Iranian Economic Review, 2024, 28(2), 555-578
DOI: 10.22059/IER.2022.89060

RESEARCH PAPER

Economic Damage and Sectors' Value-added Losses in Iran under COVID-19 Lockdown Scenarios

Seyed Reza Mirnezami[a], Sajad Rajabi[b], Ali Maleki[a,*]

a. The Research Institute for Science, Technology, and Industry Policy, Sharif University of Technology, Tehran, Iran

b. Department of Economics, Imam Sadiq University, Tehran, Iran

*Corresponding author, E-mail: a.maleki@sharif.edu

Article History: Received: 19 March 2022, Revised: 21 July 2022, Accepted: 03 August 2022
Publisher: University of Tehran Press.

Abstract

The COVID-19 disease has serious economic consequences in all countries of the world. In this paper, the impact of the pandemic on gross domestic product (GDP) and the value-added of Iranian economic sectors is simulated based on input-output analysis. The delay caused by the pandemic will not necessarily be compensated in the coming years, so it is important to understand the long-term impact of COVID-19 on the economy. Using Iran's economy input-output tables produced by Iranian authorities, it is possible to measure the economy's response to the COVID-19 shock. The nine shock scenarios are considered based on the Oxford Government Response Tracker to make the assumptions as close to reality as possible. The median scenario implies that Iran's output and GDP will decline by 2.6% and 1.7%, respectively, in 2021 and 2022. The scenarios range from the optimistic one with fewer restrictions, resulting in a 2.8% GDP decline, to the pessimistic scenario with major restrictions and barriers leading toward a GDP decrease of 7%. The huge value-added losses were in the "libraries, museums, and other cultural activities" sector, and the largest increase was in the "health care" sector.

Keywords: Coronavirus, COVID-19, GDP, Input-Output Analysis, Scenario Planning.
JEL Classification: C67, D57, O10, N35.

1. Introduction

A pandemic is the state of an epidemic that spreads across several continents (Porta, 2008); COVID-19 is the seventh pandemic in the 20th and 21st centuries. The following table provides summary information about the important pandemics.

Table 1. A Brief History of Pandemics in the Last Century

Pandemic	Year	First Case	Countries	Mortality
Asian flu (H2N2)	1957-1958	China	Almost all countries	1.1 million deaths worldwide (between 80,000 and 110,000 in the United States and about 6,000 in the United Kingdom and Wales)
Hong Kong flu (H3N2)	1968-1969	Hong Kong	Hong Kong, Vietnam, Singapore, India, Philippines, Australia, Europe, California, Japan, Africa, South America	About one million people worldwide
Swine Flu (N1H1)	April 2009	California	The United States, Mexico, Spain, and the United Kingdom had the most casualties.	Between 152,000 and 400,000 people worldwide
Severe Acute Respiratory Syndrome (SARS)	Late 2002	China	All over the world, especially in Toronto, Hong Kong, and China	About 2,258 people in China, Hong Kong, Taiwan, and Canada
Middle East Respiratory Syndrome (MERS)	2012	Saudi Arabia	Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, Netherlands, Oman; Philippines, Qatar, Korea, Thailand, Tunisia, Turkey, United Arab Emirates, UK, United States, and Yemen (80% of all patients are from Saudi Arabia)	Above 35%
Ebola virus disease (EVD)	1976-2018	Congo and Sudan		The average mortality rate is about 50% (changing from 25% to 90% depending on the severity of the disease). The first outbreak was reported in 1976 in the Democratic Republic of the Congo and Sudan. These two countries recorded 88% and 53% mortality rates, respectively, with approximately 300 deaths each year. The second wave started in West Africa in 2014 and lasted until 2016. It had the highest rate of infection and mortality since 1976, when the first case was detected. The outbreak began in Guinea with 3,800 deaths and a 67% mortality rate. Then it spread into Sierra Leone with 14,124 cases and 28%, Liberia with 10,675 cases and a 45% mortality rate. The most recent outbreak occurred in 2018-2019 in the eastern Democratic Republic of the Congo, with 54 deaths to 61% mortality rate.

Source: Research finding.

Coronavirus has gone through 5 complex waves in Iran so far. In each wave of the disease, many restrictions have been imposed on the economy, resulting in adverse shocks in various sectors. The present paper aims to investigate the harmful effects of COVID-19 disease on economic sectors to understand the extent to which each sector was affected by the adverse shocks of the epidemic. Due to the shock of the epidemic, some sectors of the economy will have a higher supply due to certain circumstances, and some other sectors will show a reverse trend. Therefore, the hypothesis of this paper is that most sectors of the economy will have a negative effect.

There is extensive literature on estimating the costs and damages of pandemics. Chou et al. (2004) evaluated the impact of SARS on the economies of some Southeast Asian countries using a multiregional computable general equilibrium model. The results of the study show that the service and manufacturing sectors contracted by 0.67% in Taiwan, 0.20% in Mainland China, and 1.56% in Hong Kong.

Zhao et al. (2004) surveyed Beijing in 2003 to assess the economic impact of SARS on sectors in China. The results showed that SARS negatively affected the Chinese economy. The tourism sector was more affected by SARS than other sectors. Domestic and overseas tourism revenues fell by 10% and 50 to 60%, respectively, compared to the previous year.

McAleer et al. (2010) analyzed the impact of avian flu on tourism in Asia using static and dynamic fixed effects panel data models. The study's results revealed that the disease affected global tourism and the tourism of the affected Asian countries. They also claimed that the average damage to Asian tourism was greater than that reported by governments.

Oba and Obukohwo (2019) investigated the macroeconomic impact of Ebola virus disease (EVD) using a neoclassical growth model. The empirical results showed that Ebola caused the economy's direct, indirect, and latent costs. The result also confirmed that the macroeconomic situation of the studied African countries was significantly affected by the Ebola virus.

In general, the economic impact of COVID-19 on the global economic downturn is inevitable. According to a study, the epidemic's impact on economic activity and energy demand was much more substantial than the 2008-2009 financial crisis (Aruga et al., 2020). Countries took various measures to combat the effects of the pandemic. After the virus was identified, Iran restricted travel, stopped air travel from China, and closed schools, stores, markets, and religious centers, among other measures. On March 25, 2020, Iran's President announced a partial lockdown for two weeks and a ban on travel between cities.

The remainder of this paper is organized as follows. Section 2 provides an overview of COVID-19, the economy, and the channels through which the

epidemic affects the economy. Section 3 explains the research methodology. Section 4 describes the results and impact of the epidemic on sectors of the Iranian economy, and finally, recommendations for policymakers are provided in Section5.

2. Literature Review

One of the most important effects of the virus is on the economic sector of the countries. As countries are economically interconnected, communicate, and receive inputs from each other, all have experienced a decline in production. Transportation restrictions, especially between countries, have reduced global economic activity. Most importantly, fear and uncertainty among consumers and businesses have led to changes in overall consumer behavior. Financial markets have also reacted to these changes, and global stock indices have fallen. Saneifar et al. (2020) argue that important markets are interconnected, and COVID-19 as a global challenge negatively affected the market.

Mckibbin and Fernando (2020) examined the impact of the coronavirus on macroeconomic conditions and financial markets under seven different scenarios using a global hybrid DSGE and CGE equilibrium model. The empirical results revealed that coronavirus significantly affected the global economy in the short run. They also asserted that COVID-19 outbreak costs could be avoided by investing more in public health systems, especially in less developed economies.

Albulescu (2020) examined the impact of the coronavirus outbreak and crude oil prices on economic policy uncertainty in the United States by applying the Autoregressive Distributed Lag (ARDL) model to daily data from January 21 to March 13, 2020. The study's results showed that increases in reported new cases at the global level and death rates did not significantly affect economic policy uncertainty, but decreasing oil prices increased uncertainty. They also found that increases in new cases and deaths associated with COVID-19 positively affected uncertainty in the United States.

Fernandes (2020) uses forecasting models to examine the impact of coronavirus on the global economy and GDP growth for 30 countries under different scenarios. The empirical results showed that countries' GDP growth would decline between 3 and 6% under the mild scenario. Under the worst scenarios, GDP is projected to decline by more than 10% to 15%. The coronavirus outbreak will affect countries whose economies depend more on the service sector, especially tourism. Countries that rely heavily on foreign trade are also expected to be more affected negatively. The findings also suggest that global GDP will shrink for each additional month of the outbreak.

Gormsen and Koijen (2020) examined the impact of coronavirus outbreaks on stock price dynamics and investor growth expectations by applying forecasting

models to the aggregate stock market and dividend futures data. The study's results showed that annual dividend growth in the US and EU was expected to decline by 9% and 14%, respectively, compared to January 1. GDP growth is also expected to decline by 2.0% and 3.1% in the US and EU, respectively. It is also noted that the March 2020 fiscal stimulus announcement positively impacts the stock market and long-term growth while not positively impacting short-term growth expectations.

Kano et al. (2021) found that the coronavirus caused severe economic damage worldwide. The authors seek solutions to this problem by considering the interrelationship between the spread of the virus and economic activities to reduce health and economic damages. Using an abstract agent-based model of the outbreak, the authors demonstrated the macroscopic dynamics that result from individuals' behaviors.

Ahani and Nilashi (2020) analyzed the role of social networking sites in corporate information sharing during the coronavirus and emphasized their significant role in information sharing and effective management of an online company. In terms of energy consumption, Mirnezami and Rajabi (2021) studied the changes in primary energy consumption in the 20 European countries with the highest GDP. The results showed that under the best scenario (rapid and full economic recovery), Russia would have the most significant decrease at 3.5%.

Kumar Singh and Yadawananda Neog (2020) tried to present the economic outlook of COVID-19 in India using some statistical figures on economic indicators. Their analysis was based on macroeconomics, travel and tourism, transportation, stock market, human capital, and trade. They declared that India might soon experience a health crisis and a sharp economic decline if the government did not set an appropriate policy framework. Based on the discussion, several policy proposals were made to address health and economic crises.

There are also some studies looking into the country-specific impact of COVID-19. Some of those economies are partially similar to Iran. Açikgöz and Günay (2020) discuss the negative effect of COVID-19 on health, security, trade, employment, agriculture, manufacturing goods production, and science policies in Turkey. For India, Dev and Sengupta (2020) suggest that government responses should be in a rules-based framework and limit the discretion to avoid long-term damage to the economy. Studying the case of the United Arab Emirates, Rehman, Shafiq, and Afzal (2021) analyze the effect of COVID-19 on the construction industry, and Ghandour and Woodford (2020) investigate its impact on the e-commerce sector. For Russia, an important consequence of COVID-19 is that domestic production declined hence unemployment among labor migrants in Russia (mainly from Central Asian countries) rose (Ryazantsev et al., 2020). Moreover, Razumovskaia et al. (2020) investigate the effectiveness of Russian

government policy in supporting small and medium firms during the pandemic and argue that tax, administrative, banking, and financial support are required.

This article uses partial analysis to show the impact of COVID-19 on business sectors and the economy as a whole. Iran's 96-part data output table was the basis of the analysis in this paper. Moreover, the impact of coronavirus cannot be analyzed in a single scenario due to its uncertainty. For example, the president of Iran announced that the third wave would be the last. However, the fourth wave also occurred afterward, so analyzing the impact in multiple scenarios and one-year intervals is necessary because of the high uncertainty. It should also be noted that some sectors of the economy, such as healthcare, have experienced a sharp increase in supply and growth. These sectors could be seriously hurt by lower supply.

In Iran, the government acted quickly to impose restrictions before taking economic action. Iran-based COVID-19 announced mitigation and revival measures of over 10% of GDP in late March 2020. In July 2020, Iran received a $50 million loan from the World Bank, which was used to finance the import of medicines and medical equipment through WHO. In November 2020, the government announced a new round of household relief measures totaling 1% of GDP in response to a renewed increase in cases (IMF, 2021).

There are some Iran-specific studies investigating COVID-19 impact on the Iran economy. Considering the interconnectedness of markets, Sakhaei et al. (2020) developed a vector autoregressive model to show that there is a 1.9% drop in Iran's GDP, which is long-lasting. In other studies, based on the input-output general equilibrium model, a 34% negative shock in labor supply is estimated by Karimi et al. (2020), and a 4% drop in Iran's GDP is anticipated by Jahangard and Kakaie (2021), and 6.5% decrease in Iran economy output is forecasted by Taherpour et al. (2021). Using system dynamic modeling, the negative effect of COVID-19 on Iran's economy is also investigated in Safaie (2021). To show the specific effect of COVID-19 on the rural economy of Iran, Rabiee and Takrosta (2021) conducted a case study showing four factors unsustainable employment, unsustainable income, increasing rural poverty, and decreasing in investment can be explained by the pandemic. In terms of governance, Shafiee Seifabadi and Bagheri DolatAbadi (2020) compare Iran and Singapore, arguing that, compared to Singapore, Iran suffered from a lack of proper planning, the rule of law, and modern governance in dealing with COVID-19.

3. Data and Methodology

3.1 Input-Output Analysis

The input-output model is one of the simulation models. The first input-output models can be traced back to 1758 when François Quesnay published his book

Economic Tables. In this book, he systematically showed the process of influencing sales and costs in an economic system graphically. However, it must be said that the beginning of the development and leap in this modeling lies in the works of Wassily Leontief. From the point of view of applied classification, the input-output table is usually used in two general areas: Economic Structure Analysis and Economic Planning. In addition, input-output tables separately identify all transactions between different sectors of the economy to regulate and present the economy's structure. In recent years, due to the increasing diversity of economic policies, globalization, environmental issues, the formation of global groupings such as the European Union, a fundamental change in information and communication technology, and the advent of the Internet, the possibilities for applying this theory and model have expanded worldwide. On the other hand, its possible applications have increased due to the possibility of combining it with other techniques and tools of economic analysis and development forecasting.

In general, input-output tables include activities, intermediate stages, and final demand and value-added. Leontief's main input-output models are derived from observed economic data in a given geographic area. This model focuses on the activities of a group of industries that produce and consume goods during each industry's production process. The data required to implement the input-output model consists of the production flows of each producer and consumer sector. These inter-industry (or inter-sector) flows are measured in monetary terms over a period of time (usually one year). The input-output model generally consists of three basic tables: the exchange table, the technical coefficients, and the immediate demand.

3.2 Disaster Impact and Input-Output Analysis

Disaster analysis is one particular subfield of multi-region input-output analysis (MRIO), which deals with the impact of shocks on the economy. A relatively new technique of hypothetical extraction (HEM) is based on evaluating hypothetical scenarios where industries cease to operate. This would develop a method that focuses on post-disaster consumption possibilities (Lenzen et al., 2020).

3.3 The Generalized Hypothetical Extraction Method

The partial hypothetical extraction method, part of the generalized hypothetical extraction method, was introduced by Dietzenbacher and Lahr (2013), pioneers in input-output modeling. As mentioned earlier, the generalized hypothetical extraction method has significant drawbacks. It assumes that α% of inputs are removed by sectors of the economy for different ones. Second, this method does not focus on the matrix of intermediate inputs in absolute terms, but the value-added vector and its changes are considered. Third, according to the partial

hypothetical extraction method, the reduction of α% of the input of a sector is unnecessary. However, it can be assumed that α% increases in sectors due to various reasons such as natural factors, development of mines and deposits, economic policies, etc. Fourth, this method does not extract supply; consequently, the interchange matrix does not decrease.

Dietzenbacher and Lahr (2013) used the partial hypothetical extraction method to analyze the effects of capacity constraints. Products produced by a sector are no longer in demand or supplied by sources outside the local economy, such as imports. When the output of x_k decreases, the inputs used in the activity of k, z_{ik} (for all i), also decrease by the same percentage. As a result, the direct demand of the economy of column k in matrix A remains unchanged. In this case, we will have (Dietzenbacher and Lahr, 2013):

$$\bar{a}_{ik} = \frac{\bar{z}_{ik}}{\bar{x}_k} = \frac{(1-\alpha) z_{ik}}{(1-\alpha) x_k} = a_{ik} \qquad i = 1.2.\ldots.n \tag{1}$$

The above equation represents the partial extraction. All elements except the diagonal element k of the last row of matrix A are reduced by α%. This is true for all j = 1, 2,..., n ($j \neq k$), and we have:

$$\bar{a}_{kj} = \frac{\bar{z}_{kj}}{\bar{x}_j} = \frac{(1-\alpha) z_{kj}}{(1-\alpha) x_j} = a_{kj} \tag{2}$$

It is found that this partial extraction involves zero to one hundred percent and is typically $0 \leq \alpha \leq 1$, and in the case $\alpha = 1$, we have $\bar{a}_{kj} = 0$ for all $j \neq k$, which is the same complete hypothetical extraction method. In the matrix symbol, we have:

$$\bar{A} = A - \alpha e_k \acute{b}_k \tag{3}$$

where e_k represents the vector whose k element is one and the other elements are zero and:

$$\acute{b}_k = (a_{k1}.a_{k2}.\ldots.a_{k.k-1}.0.a_{k.k+1}.\ldots.a_{kn}) \tag{4}$$

$$I - \bar{A} = I - A + \alpha e_k \acute{b}_k$$

Since matrix $\bar{A}$ is the sum of the s part of the previous matrix A and another matrix, the inverse of Leontief can be calculated by methods. In summary, according to an excellent study by (Henderson and Searle, 1981):

$$\bar{L} = L + \frac{\alpha L e_k \acute{b}_k L}{1 + \alpha \acute{b}_k L e_k} \tag{5}$$

After determining the inverse of Leontief matrix before and after the changes, the number of output changes can be calculated by the following equation:

$$\bar{x} - x = (\bar{L} - L) f \tag{6}$$

Final demand can be reduced by $\bar{f}_k$ due to a reduction in sectoral supply α%:

$$\bar{f}_k = (1-\alpha) f_k \quad (7)$$

Specifically, this reduction in final demand means that production also decreases by $\bar{x} - x$:

$$\bar{x} - x = (\bar{L} - L)\bar{f} \quad (8)$$

In addition, from a policy point of view, other criteria such as employment and value-added can also be considered, but this study has focused on the criterion of total value-added. The criterion of value added is of interest to economists because it can be a good criterion of economic well-being in a community. Their consumption can also determine people's wealth in a community. Their consumption is a function of their disposable income, and disposable income is also part of GDP. Since GDP is reported in the accounting system as income and expenditure, it can be used as a criterion for total value added to measure household wealth. According to Dietzenbacher and Lahr's calculations, the following results for calculating changes in total value-added, we have:

$$\overline{VA} - VA = \sum_i v_i (\bar{x}_i - x_i) = -\tilde{\lambda}_k \sum v_i l_{ik} = -\tilde{\lambda}_k \mu_k \quad (9)$$

In the above equation, tv_i stands for the value-added coefficient, which is calculated as the ratio between the value-added of the i^{th} sector and the output of the same sector. The value-added multipliers are defined as $\mu' = v'L$, where μ_i represents the impact and consequences of increasing one unit of final demand in sector *i* directly and indirectly on total value-added. Therefore, to calculate the total value added in all sectors, the equation $VA = \mu' x = \mu' Lf$ can be used.

3.4 Data and Tools

The Oxford COVID-19 Government Response Tracker (OxCGRT) was used to quantify the scenarios in this study. The index, published by the University of Oxford, measures the performance of governments around the world in responding to the SARS-CoV-2 virus. The results of these studies indicate that COVID-19 has generated a wide range of government responses to the virus. Thus, there is a need for up-to-date policy information as these responses increase and diversify over time. Governments are constantly evaluating their policy decisions in light of concerns. Therefore, there is a need to provide an indicator that can make this assessment. This index is called the Government Accountability Tracking Index and provides a common way to track government accountability to COVID-19 at all times. Tracking government response provides a systematic international initiative to understand how governments are doing throughout the outbreak. The project tracks government actions and interventions against a set of standard indicators, based on which it calculates and publishes some composite

indicators to measure the extent of these responses. The information collected is presented in 18 indicators, which are presented in Table 2.

Table 2. OxCGRT Indicators

ID	Name	Type	Targeted/General
	Containment and closure		
C1	School closing	Ordinal	Geographic
C2	Workplace closing	Ordinal	Geographic
C3	Cancel public events	Ordinal	Geographic
C4	Restrictions on gathering size	Ordinal	Geographic
C5	Close public transport	Ordinal	Geographic
C6	Stay at home requirements	Ordinal	Geographic
C7	Restrictions on internal movement	Ordinal	Geographic
C8	Restrictions on international travel	Ordinal	No
	Economic response		
E1	Income support	Ordinal	Sectoral
E2	Debt/contract relief for households	Ordinal	No
E3	Fiscal measures	Numeric	No
E4	Giving international support	Numeric	No
	Health systems		
H1	Public information campaign	Ordinal	Geographic
H2	Testing policy	Ordinal	No
H3	Contact tracing	Ordinal	No
H4	Emergency investment in healthcare	Numeric	No
H5	Investment in COVID-19 vaccines	Numeric	No
	Miscellaneous		
M1	Other responses	Text	No

Source: https://covidtracker.bsg.ox.ac.uk/

In the next step, after the observations are collected, the information is summarized in four policy indicators: the overall government response index, the severity index, the health and disease control index, and the economic support index.

Each indicator consists of a combination of indicators measuring multiple policy responses. The value of each indicator is the same continuous value recorded for it, considering that half a unit is added to the corresponding continuous value for public indicators. Finally, the scale of the indicators is changed so that the values are between zero and 100. Then, the average of the indicators below this index is calculated to measure the value of the composite index.

It should be noted that these indicators are not comprehensive and do not cover all possible policy measures but merely reflect those measured by OxCGRT, thus ignoring many essential dimensions of government response. For example, the Economic Response Index does not include support to firms or businesses and

does not consider the monetary value of total economic support. In contrast, these indicators' purpose and importance for comparing government interventions are efficient and straightforward (Hale et al., 2020).

The 80 economic sectors considered in this study are based on Table 3.

Table 3. Iran's Input-Output Sectors in 2015

Code	Sector name	Code	Sector name
S01	Agricultural	S41	Manufacture of furniture
S02	Gardening	S42	Manufacturing n. e. c. and recycling
S03	Animal Production	S43	Production, collection, and distribution of electricity
S04	Forestry	S44	Manufacture and distribution of gas
S05	Fishing	S45	Collection, purification, and distribution of water
S06	Mining of coal and lignite	S46	Dwelling constructions
S07	Extraction of crude petroleum and natural gas	S47	Other constructions
S08	Mining of iron ores	S48	Wholesale and retail trade
S09	Mining of copper	S49	Repair of motor vehicles, motorcycles, and personal and household goods
S10	Quarrying of stone, sand, and clay	S50	Short-stay accommodation
S11	Mining of other metal and nonmetal ores	S51	Restaurants
S12	Manufacture of vegetable and animal oils and fats	S52	Transport via railways
S13	Manufacture of other food products and beverages	S53	Land transport of passengers
S14	Manufacture of tobacco products	S54	Land transport of freight
S15	Manufacture of textiles	S55	Transport via pipelines
S16	Manufacture of wearing apparel; dressing and dyeing of fur	S56	Water transport
S17	Tanning and fabricating of leather; manufacture of luggage, handbags, saddlery, harness, and footwear	S57	Air transport
S18	Manufacture of wood and products of wood and cork	S58	Supporting transport services
S19	Manufacture of paper and paper products	S59	Post and telecommunications
S20	Publishing, printing, and reproduction of recorded media	S60	Banks
S21	Manufacture of coke, refined petroleum products, and nuclear fuel	S61	Other financial intermediation

Code	Sector name	Code	Sector name
S22	Manufacture of chemicals and chemical products	S62	Insurance
S23	Manufacture of rubber and plastics products	S63	Self-owned dwelling activities
S24	Manufacture of glass and glass products	S64	Renting and Leasing
S25	Manufacture of other non-metallic mineral products	S65	Renting of machinery and equipment without operator and of personal and household goods
S26	Manufacture of basic iron and steel	S66	Computer and related activities
S27	Manufacture of basic copper	S67	Research and development
S28	Manufacture of basic aluminum	S68	Other business activities
S29	Manufacture of other basic metals and casting metals	S69	Public administration
S30	Manufacture of fabricated metal products except for machinery and equipment	S70	Municipal service activities
S31	Manufacture of general-purpose machinery	S71	Social Security
S32	Manufacture of special-purpose machinery	S72	Education
S33	Manufacture of domestic appliances	S73	Health Care
S34	Manufacture of office, accounting, and computing machinery	S74	Social work activities
S35	Manufacture of electrical machinery and apparatus n. e. c	S75	Religious and political activities
S36	Manufacture of radio, television, and communication equipment and apparatus	S76	Cinema, radio, television, and other arts activities
S37	Manufacture of medical and surgical instruments	S77	News agency activities
S38	Manufacture of the optical instrument and photographic equipment and watches and clocks	S78	Library, Museum and other cultural activities
S39	Manufacture of motor vehicles, trailers, and semi-trailers	S79	Sporting and other recreational activities
S40	Manufacture of other transport equipment	S80	Other service activities

Source: Research finding, based on ISIC rev.4.

Four data or classifications are used in this modeling:

- Supply-Use table (Eora Global MRIO);
- National Accounts, (Statistical Center of Iran);

- Statistics of COVID-19 infections and deaths in Iran (Worldometer and OxCGRT);
- ISIC and CPC Classification (Classifications for economic statistics, Statistics Division, United Nations).

3.5 Scenarios

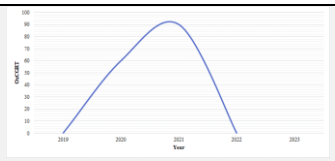
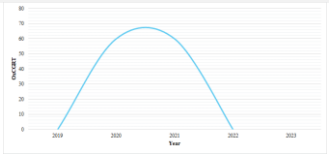
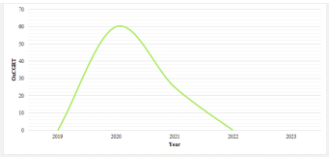
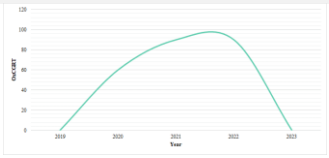
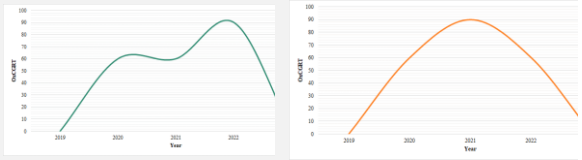
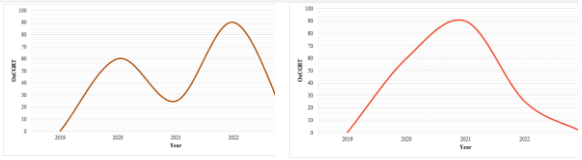
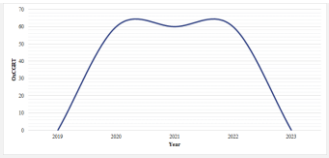
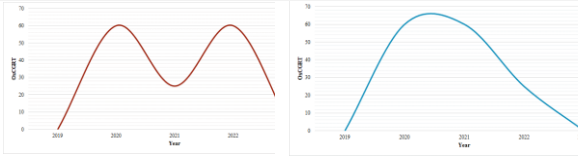
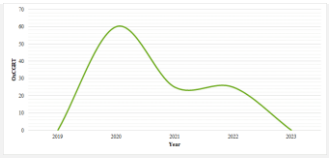
According to OxCGRT guidelines and government restrictions during 2020, the nine scenarios are shown in Table 4. As can be inferred from the explanation of the scenarios and the epidemic duration, the severity of the restrictions is also considered. The constraints are mild if the average OxCGRT index in a year is less than 35. The constraints are moderate if the average OxCGRT index in a year is between 35 and 70. If the average OxCGRT index in a year is above 70, the constraints will be severe. Our analysis will also consider scenario C3 as the most optimistic projection and scenario C4 as the most pessimistic projection.

4. Results

Table 5 shows the modeling results for Iran's base year of the pandemic (2020). As can be seen below, the damage/benefit to each sector due to COVID-19 is shown. These impacts are known both as a dollar value and as a percentage of value-added changes in each sector.

The results of Table 5 are summarized in the following table. According to it, the ten sectors that suffered the most from COVID-19 and its restrictions are "Library, museum and other cultural activities," "Restaurants," and "Air transport." The quantitative difference between "library, museum and other cultural activities" and the other sectors is significant.

Table 4. Nine Modeling Scenarios

code	Scenario	Schematic representation
C1	Two-year pandemic (Experience 2020 + Expecting a severe restriction)	
C2	Two-year pandemic (Experience 2020 + Expecting a moderate restriction)	
C3	Two-year pandemic (Experience 2020 + Expecting a mild restriction)	
C4	Three-year pandemic (Experience 2020 + Expecting two severe restrictions)	
C5	Three-year pandemic (Experience 2020 + Expecting a severe restriction + Expecting a moderate restriction)	
C6	Three-year pandemic (Experience 2020 + Expecting a severe restriction + Expecting a mild restriction)	
C7	Three-year pandemic (Experience 2020 + Expecting two moderate restrictions)	
C8	Three-year pandemic (Experience 2020 + Expecting a moderate restriction + Expecting a mild restriction)	
C9	Three-year pandemic (Experience 2020 + Expecting two mild restrictions)	

Source: Research finding.

Table 2. Value-added Lost or Gained by Each Sector in the First Year of the Pandemic (2020) in Iran

Sector	Value-added change (%)	Value-added change ($)	Sector	Value-added change (%)	Value-added change ($)
S01	-0.77%	-177,566,352	S41	-1.06%	-8,931,158
S02	-0.50%	-47,811,500	S42	-2.55%	-22,886,646
S03	-1.00%	-107,411,454	S43	-0.91%	-34,286,404
S04	-1.99%	-38,649,140	S44	-1.82%	-55,456,086
S05	-1.87%	-26,635,735	S45	-3.46%	-303,541,692
S06	-1.42%	-9,382,833	S46	-3.17%	15,622,753
S07	-0.17%	-94,056,671	S47	-3.25%	62,264,900
S08	-1.84%	-22,718,161	S48	-8.81%	-1,973,440,419
S09	-1.51%	-23,068,198	S49	-0.26%	-10,438,219
S10	-1.52%	-23,648,817	S50	-7.91%	-366,021,326
S11	-3.05%	-29,408,733	S51	-15.98%	-345,690,319
S12	-3.11%	-26,801,263	S52	-8.78%	-197,589,462
S13	-0.88%	-107,934,702	S53	-1.27%	-72,492,107
S14	-2.48%	-8,223,072	S54	-7.09%	-516,111,381
S15	-0.81%	-21,393,271	S55	-1.74%	-2,734,505
S16	-1.52%	-9,779,891	S56	-10.59%	-245,198,313
S17	-2.78%	-55,910,177	S57	-11.53%	-782,081,203
S18	-1.98%	-19,947,850	S58	-7.77%	-459,470,542
S19	-1.95%	-22,149,933	S59	-0.19%	-9,725,010
S20	-3.13%	-44,578,513	S60	-0.61%	-13,957,208
S21	-0.54%	-24,454,735	S61	-0.97%	-35,382,228
S22	-0.12%	-7,492,630	S62	-1.39%	-18,081,253
S23	-1.65%	-17,853,611	S63	-0.57%	-87,852,650
S24	-2.10%	-16,328,034	S64	-1.00%	-98,480,349
S25	-1.61%	-57,299,129	S65	-1.27%	-14,008,896
S26	-2.74%	-247,886,896	S66	0.04%	530,757
S27	-1.90%	-30,640,530	S67	-0.70%	-28,519,179
S28	-2.36%	-13,484,648	S68	-2.47%	-98,990,858
S29	-1.85%	-10,951,164	S69	1.53%	93,891,550
S30	-1.75%	-52,168,111	S70	-1.66%	-148,533,247
S31	-2.48%	-39,333,129	S71	2.02%	273,086,735
S32	-0.20%	-2,946,864	S72	1.31%	259,746,921
S33	-2.45%	-71,277,682	S73	14.55%	1,939,707,215
S34	-1.24%	-1,359,171	S74	-0.91%	-7,530,425
S35	-0.99%	-15,222,409	S75	-0.71%	-8,463,858
S36	-0.45%	-1,903,858	S76	-2.21%	-143,223,297
S37	-2.18%	-13,192,882	S77	-2.81%	-27,042,820
S38	-2.20%	-4,865,625	S78	-29.45%	-1,567,926,013
S39	-0.74%	-54,233,380	S79	-0.90%	-17,823,581
S40	-1.27%	-5,221,810	S80	2.41%	47,758,399

Source: Research finding.

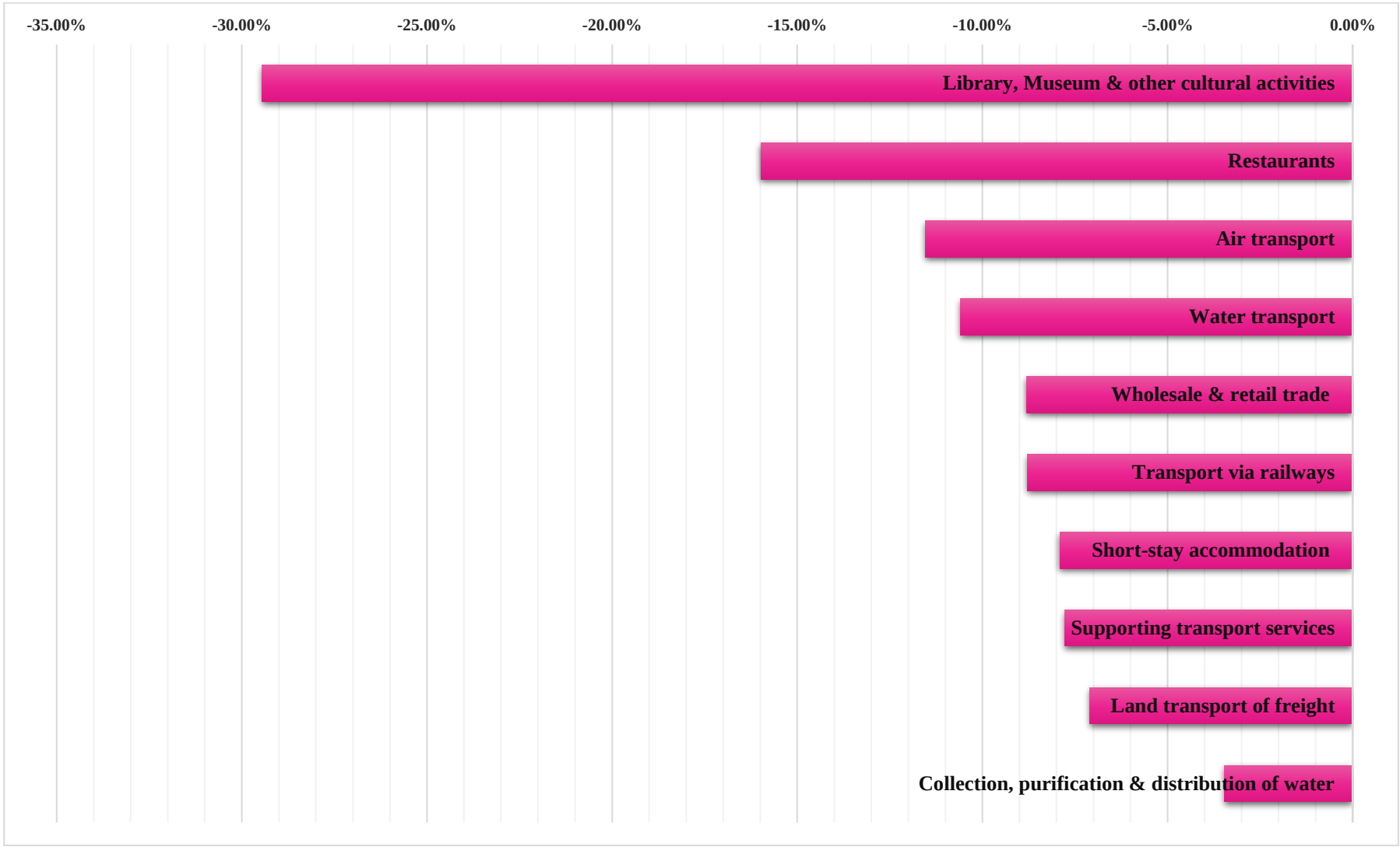


Figure 1. Top 10 Sectors with the Greatest Value-Added Loss (in Percent) in 2020

Source: Research finding.

Although most sectors of the Iranian economy have suffered from the impact of the pandemic, value-added has increased in some sectors due to increased supply and an inverse relationship with constraints, such as: "Health Care," "Other Services," and "Social Security."

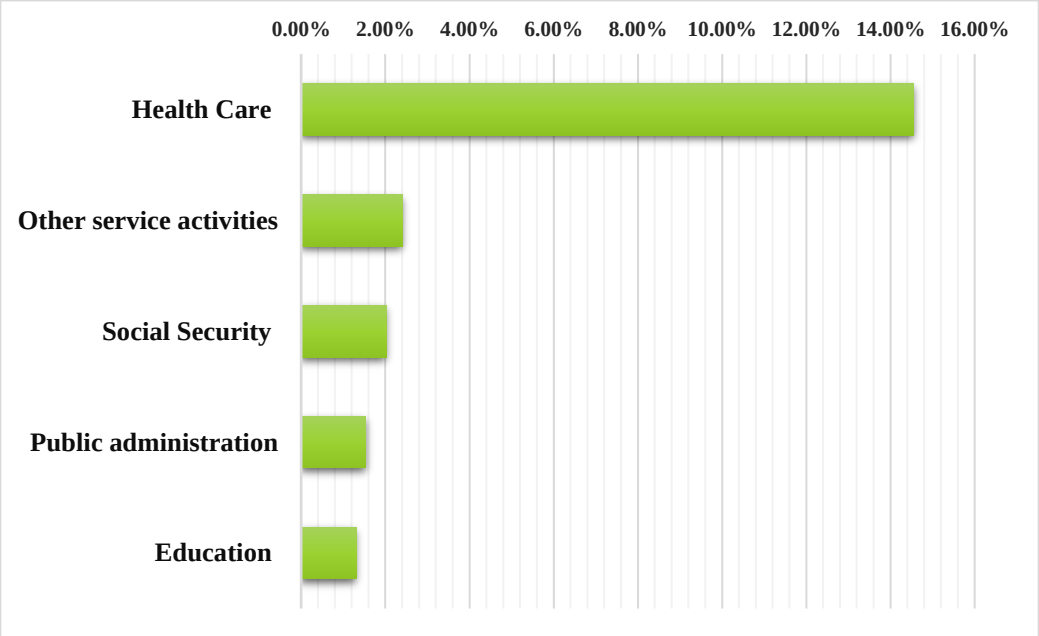


Figure 2. Five Sectors with the Positive Change in Value-Added (in Percent) in 2020
Source: Research finding.

The important thing about the pandemic is that many predictions about it were wrong. Therefore, the future situation, severity of the disease, and government restrictions are uncertain in the coming months. Therefore, this situation of uncertainty is presented in Table 4 in nine scenarios:

Table 3. Value-added Losses or Gains of Sectors under Nine Scenarios

Sector	Scenarios								
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
S01	-2.04%	-1.51%	-1.26%	-3.18%	-2.70%	-2.47%	-2.20%	-1.96%	-1.73%
S02	-1.35%	-1.00%	-0.82%	-2.11%	-1.79%	-1.63%	-1.46%	-1.29%	-1.13%
S03	-2.72%	-1.94%	-1.59%	-4.21%	-3.52%	-3.21%	-2.80%	-2.47%	-2.13%
S04	-5.11%	-3.88%	-3.28%	-7.89%	-6.79%	-6.25%	-5.64%	-5.08%	-4.51%
S05	-4.74%	-3.64%	-3.11%	-7.31%	-6.32%	-5.85%	-5.29%	-4.80%	-4.30%
S06	-3.81%	-2.81%	-2.25%	-5.93%	-5.03%	-4.52%	-4.10%	-3.57%	-3.03%
S07	-0.58%	-0.41%	-0.09%	-0.97%	-0.81%	-0.50%	-0.65%	-0.34%	-0.02%
S08	-4.73%	-3.59%	-3.03%	-7.27%	-6.26%	-5.77%	-5.21%	-4.68%	-4.15%
S09	-4.01%	-2.99%	-2.40%	-6.26%	-5.34%	-4.79%	-4.38%	-3.82%	-3.25%
S10	-4.02%	-3.02%	-2.44%	-6.26%	-5.35%	-4.82%	-4.41%	-3.86%	-3.30%
S11	-7.96%	-5.98%	-4.96%	-12.34%	-10.56%	-9.64%	-8.71%	-7.75%	-6.77%
S12	-8.08%	-6.09%	-5.17%	-12.59%	-10.78%	-9.95%	-8.90%	-8.03%	-7.15%
S13	-2.34%	-1.73%	-1.45%	-3.67%	-3.11%	-2.85%	-2.53%	-2.27%	-1.99%
S14	-6.62%	-4.89%	-4.08%	-10.41%	-8.82%	-8.07%	-7.17%	-6.40%	-5.61%
S15	-2.32%	-1.63%	-1.30%	-3.75%	-3.09%	-2.77%	-2.41%	-2.09%	-1.77%
S16	-4.05%	-3.03%	-2.53%	-6.45%	-5.47%	-5.00%	-4.48%	-4.00%	-3.51%
S17	-7.29%	-5.44%	-4.56%	-11.34%	-9.66%	-8.88%	-7.92%	-7.10%	-6.26%
S18	-5.18%	-3.89%	-3.26%	-8.06%	-6.89%	-6.32%	-5.67%	-5.08%	-4.47%
S19	-5.19%	-3.82%	-3.18%	-8.08%	-6.84%	-6.27%	-5.55%	-4.95%	-4.34%
S20	-8.24%	-6.13%	-5.13%	-12.78%	-10.88%	-9.99%	-8.90%	-7.97%	-7.02%

Sector	Scenarios								
	C1	C2	C3	C4	C5	C6	C7	C8	C9
S21	-1.57%	-1.10%	-0.87%	-2.58%	-2.12%	-1.90%	-1.66%	-1.43%	-1.20%
S22	-0.35%	-0.24%	-0.19%	-0.54%	-0.44%	-0.40%	-0.35%	-0.30%	-0.26%
S23	-4.39%	-3.29%	-2.75%	-6.98%	-5.93%	-5.43%	-4.87%	-4.35%	-3.83%
S24	-5.56%	-4.11%	-3.44%	-8.65%	-7.34%	-6.75%	-5.98%	-5.36%	-4.72%
S25	-4.21%	-3.17%	-2.67%	-6.62%	-5.65%	-5.19%	-4.66%	-4.18%	-3.70%
S26	-7.19%	-5.41%	-4.54%	-11.27%	-9.62%	-8.83%	-7.93%	-7.11%	-6.28%
S27	-5.01%	-3.77%	-3.16%	-7.95%	-6.77%	-6.19%	-5.57%	-4.98%	-4.39%
S28	-6.20%	-4.66%	-3.91%	-9.74%	-8.31%	-7.62%	-6.84%	-6.13%	-5.41%
S29	-4.81%	-3.64%	-3.07%	-7.54%	-6.45%	-5.93%	-5.34%	-4.80%	-4.25%
S30	-4.61%	-3.47%	-2.91%	-7.32%	-6.24%	-5.71%	-5.13%	-4.59%	-4.04%
S31	-6.45%	-4.87%	-4.10%	-10.07%	-8.62%	-7.92%	-7.12%	-6.39%	-5.65%
S32	-0.59%	-0.40%	-0.31%	-0.94%	-0.77%	-0.69%	-0.58%	-0.50%	-0.42%
S33	-6.35%	-4.79%	-4.05%	-9.87%	-8.46%	-7.79%	-6.99%	-6.30%	-5.59%
S34	-3.26%	-2.45%	-2.06%	-5.16%	-4.40%	-4.03%	-3.62%	-3.24%	-2.86%
S35	-2.61%	-1.95%	-1.63%	-4.09%	-3.48%	-3.19%	-2.85%	-2.55%	-2.25%
S36	-1.19%	-0.89%	-0.75%	-1.86%	-1.59%	-1.46%	-1.30%	-1.17%	-1.04%
S37	-5.80%	-4.27%	-3.56%	-9.01%	-7.64%	-7.00%	-6.21%	-5.54%	-4.85%
S38	-5.76%	-4.34%	-3.66%	-9.03%	-7.72%	-7.09%	-6.36%	-5.72%	-5.06%
S39	-1.95%	-1.48%	-1.24%	-3.13%	-2.67%	-2.44%	-2.20%	-1.97%	-1.74%
S40	-3.32%	-2.51%	-2.11%	-5.25%	-4.49%	-4.11%	-3.71%	-3.32%	-2.94%
S41	-2.79%	-2.09%	-1.75%	-4.36%	-3.72%	-3.41%	-3.06%	-2.74%	-2.41%
S42	-6.77%	-5.02%	-4.19%	-10.59%	-8.99%	-8.24%	-7.33%	-6.56%	-5.76%
S43	-2.38%	-1.79%	-1.51%	-3.71%	-3.17%	-2.92%	-2.61%	-2.35%	-2.09%

Sector	Scenarios								
	C1	C2	C3	C4	C5	C6	C7	C8	C9
S44	-4.75%	-3.58%	-3.03%	-7.42%	-6.35%	-5.85%	-5.24%	-4.72%	-4.18%
S45	-8.90%	-6.74%	-5.71%	-13.75%	-11.81%	-10.90%	-9.79%	-8.83%	-7.86%
S46	-8.21%	-6.22%	-5.27%	-12.81%	-10.99%	-10.12%	-9.11%	-8.20%	-7.28%
S47	-8.48%	-6.39%	-5.39%	-13.22%	-11.32%	-10.41%	-9.34%	-8.39%	-7.43%
S48	-23.69%	-17.74%	-15.13%	-38.54%	-32.60%	-30.00%	-26.66%	-24.05%	-21.45%
S49	-0.68%	-0.51%	-0.43%	-1.06%	-0.90%	-0.83%	-0.74%	-0.66%	-0.59%
S50	-20.58%	-15.60%	-13.32%	-32.38%	-27.74%	-25.62%	-22.98%	-20.79%	-18.57%
S51	-41.27%	-31.90%	-27.54%	-66.08%	-56.89%	-52.62%	-47.63%	-43.33%	-39.02%
S52	-22.77%	-17.59%	-15.00%	-36.53%	-31.43%	-28.90%	-26.31%	-23.75%	-21.19%
S53	-3.36%	-2.52%	-2.12%	-5.38%	-4.57%	-4.18%	-3.75%	-3.36%	-2.96%
S54	-18.62%	-14.28%	-12.11%	-30.06%	-25.75%	-23.60%	-21.43%	-19.27%	-17.11%
S55	-4.54%	-3.43%	-2.90%	-7.16%	-6.12%	-5.62%	-5.06%	-4.54%	-4.03%
S56	-26.35%	-20.53%	-17.57%	-40.16%	-35.07%	-32.47%	-29.70%	-26.97%	-24.18%
S57	-28.72%	-22.29%	-19.03%	-43.53%	-38.00%	-35.20%	-32.12%	-29.15%	-26.09%
S58	-20.10%	-15.48%	-13.16%	-31.94%	-27.50%	-25.27%	-22.99%	-20.73%	-18.46%
S59	-0.50%	-0.38%	-0.32%	-0.78%	-0.66%	-0.62%	-0.55%	-0.50%	-0.45%
S60	-1.65%	-1.24%	-1.00%	-2.65%	-2.25%	-2.02%	-1.85%	-1.61%	-1.37%
S61	-2.58%	-1.94%	-1.59%	-4.08%	-3.48%	-3.15%	-2.87%	-2.53%	-2.19%
S62	-3.49%	-2.69%	-2.30%	-5.31%	-4.62%	-4.28%	-3.89%	-3.53%	-3.16%
S63	-1.55%	-1.15%	-0.92%	-2.50%	-2.12%	-1.89%	-1.73%	-1.50%	-1.28%
S64	-2.59%	-1.95%	-1.65%	-4.04%	-3.46%	-3.18%	-2.85%	-2.57%	-2.27%

Sector	Scenarios								
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
S65	-3.32%	-2.48%	-2.10%	-5.19%	-4.42%	-4.08%	-3.63%	-3.27%	-2.90%
S66	0.40%	0.15%	0.05%	0.84%	0.56%	0.44%	0.28%	0.17%	0.06%
S67	-2.27%	-1.36%	-1.00%	-3.58%	-2.78%	-2.47%	-1.93%	-1.60%	-1.26%
S68	-6.55%	-4.97%	-4.19%	-10.57%	-9.01%	-8.24%	-7.45%	-6.67%	-5.89%
S69	3.29%	3.02%	2.81%	5.09%	4.81%	4.59%	4.53%	4.32%	4.10%
S70	-4.23%	-3.25%	-2.70%	-6.50%	-5.63%	-5.14%	-4.72%	-4.21%	-3.68%
S71	4.48%	4.00%	3.68%	6.97%	6.48%	6.15%	5.99%	5.66%	5.34%
S72	2.62%	2.58%	2.47%	4.03%	3.94%	3.82%	3.88%	3.76%	3.65%
S73	35.82%	29.33%	25.92%	57.85%	51.13%	47.60%	44.48%	40.99%	37.51%
S74	-2.34%	-1.77%	-1.49%	-3.61%	-3.10%	-2.85%	-2.57%	-2.31%	-2.05%
S75	-1.93%	-1.37%	-1.13%	-3.01%	-2.51%	-2.29%	-1.98%	-1.76%	-1.53%
S76	-5.70%	-4.29%	-3.61%	-8.78%	-7.52%	-6.93%	-6.21%	-5.58%	-4.94%
S77	-7.71%	-5.51%	-4.50%	-12.03%	-10.06%	-9.16%	-8.00%	-7.06%	-6.09%
S78	-71.46%	-56.84%	-49.30%	-98.41%	-95.56%	-88.93%	-82.09%	-75.14%	-68.03%
S79	-2.31%	-1.75%	-1.48%	-3.58%	-3.08%	-2.83%	-2.56%	-2.30%	-2.04%
S80	8.99%	7.25%	-1.28%	15.56%	13.81%	5.29%	12.07%	3.55%	-4.97%

Source: Research finding.

The ten sectors facing the largest value-added changes under the scenarios (the difference between the most optimistic and the most pessimistic scenario) are shown in the figure below.

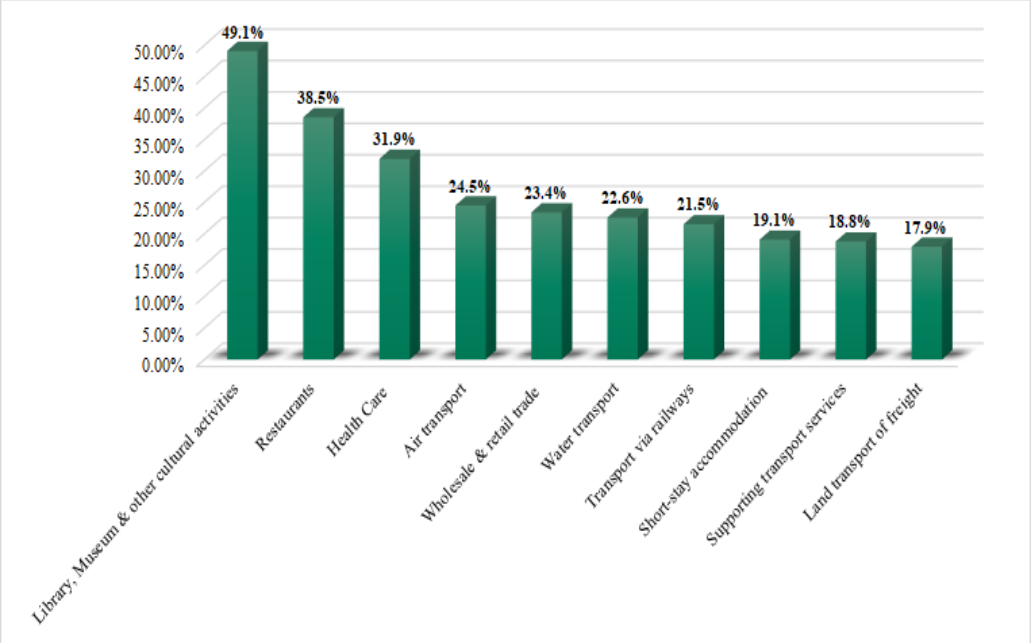


Figure 3. Difference between the Most Optimistic and the Most Pessimistic Scenario (Top 10 Sectors)
Source: Research finding.

The difference between the pessimistic and optimistic scenarios is 49.1% in "Libraries, museums, and other cultural activities," 38.5% in "Restaurants," and 31.9% in "Healthcare".

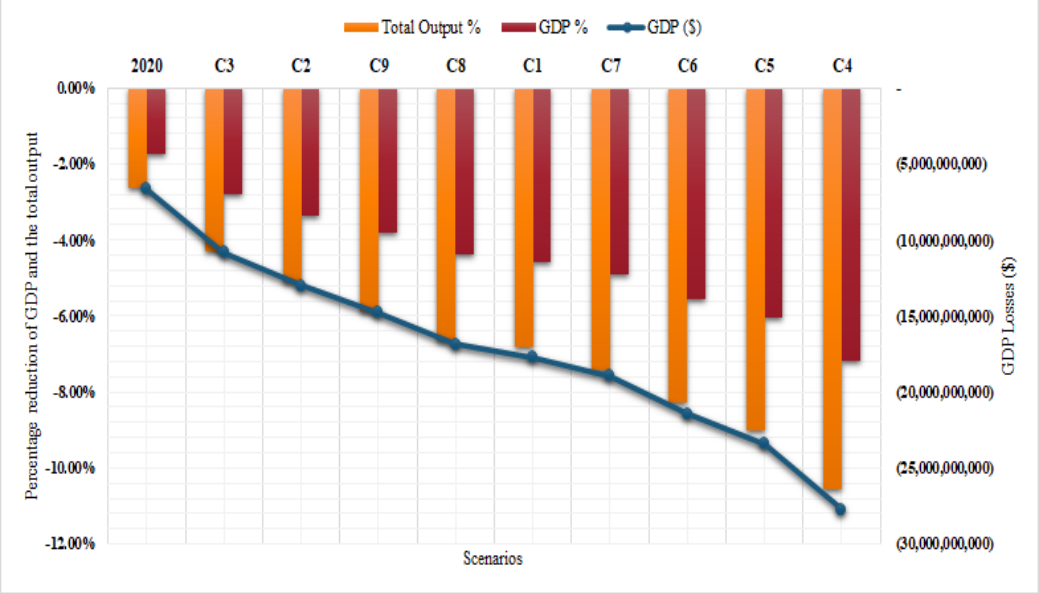


Figure 4. Percentage Changes in Total Output and GDP in 2020 And 9 Scenarios about the Future of the Pandemic in Iran
Source: Research finding.

According to the calculations in this modeling, the most optimistic future situation for the Iranian economy during COVID-19 will be in the third scenario, "Two-year pandemic (experience 2020 + expect mild restriction)". In contrast, we see the most pessimistic scenario in the fourth scenario, "Three-year pandemic (experience 2020 + expectation of two severe constraints)."

4. Discussion and Conclusion

This study considers the hypothetical shocks resulting from the COVID-19 as the plausible input for input/output modeling to show the overall impact of COVID-19 on the economy. The nine scenarios were used to examine the economic changes in Iran. Based on the results of input-output tables, the situation of value-added changes in this country under ten different scenarios of the pandemic is as follows:

– Under the conditions of the epidemic in 2020, the three sectors "library, museum and other cultural activities" with a decrease of 29.45% and "restaurants" with a decrease of 15.98% and "air transport" with a decrease of 11.53%, respectively, had the greatest damage caused by the pandemic (decrease in value-added). In contrast, the three sectors "health care," "provision of other services," and "social security" increased by 4%, and GDP decreased by 1.72%;

– Under scenario one (Two-year pandemic (Experience 2020 + Expect severe retrenchment)), the Iranian economy will experience a 4.59% decline in GDP;

– Under scenario two (Two-Year Pandemic (Experience 2020 + Expectation of Moderate Constraint)), the Iranian economy will experience a 3.37% decline in GDP;
– Under scenario three (Two-Year Pandemic (Experience 2020 + Expectation of Moderate Constraint)), the Iranian economy will record a 2.80% decline in GDP;
– Under scenario four (Three-year pandemic (Experience 2020 + Expectation of two severe constraints)), the Iranian economy will record a 7.18% decline in GDP;
– Under scenario five (Three-year pandemic (Experience 2020 + Expectation of one severe constraint + Expectation of one moderate constraint)), the Iranian economy will record a 6.06% decline in GDP.
– Under scenario six (Three-Year Pandemic (Experience 2020 + Expectation of Severe Constraint + Expectation of Moderate Constraint)), the Iranian economy will experience a 5.55% decline in GDP;
– Under scenario seven (Three-Year Pandemic (Experience 2020 + Expectation of Two Moderate Constraints)), the Iranian economy will experience a 4.90% decline in GDP;
– Under scenario eight (Three-year pandemic (Experience 2020 + Expectation of one moderate constraint + expectation of one mild constraint)), the Iranian economy will record a 4.37% decline in GDP;
– Under scenario nine (Three-year pandemic (Experience 2020 + Expectation of two mild constraints)), the Iranian economy will experience a 3.83% decline in GDP.

To better manage the COVID-19 situation in Iran, the following points are recommended:

– Implementing a generally supportive policy without considering the details may result in high costs, so the associated costs do not provide the necessary benefits. For this reason, it is recommended that Iranian government support packages for economic sectors be in three layers. The first layer includes highly vulnerable sectors such as “libraries, museums and other cultural activities,” “short-term accommodation,” and “land transportation of goods.” The second layer includes relatively vulnerable sectors such as “collection, purification, and distribution of water,” “manufacture of pig iron and steel,” and “manufacture of glass and glassware.” The third layer includes less damaged sectors such as “Manufacture of wood, wood products, and cork products,” “Rental of machinery and equipment without operators and of consumer durables,” and “Sports and other recreational activities.”
– The damage to Iranian economic sectors depends entirely on the duration of the pandemic and the severity of the disease, and its limitations, so government support packages should be flexible. More options should be considered for severe

disease progression and constraints. Among the sectors that depend on the pandemic period more than other economic sectors in Iran, we can mention "Library, museum and other cultural activities," "Short-term accommodation," and "Supportive transportation services."

– An important issue related to the post-COVID era is that some economic sectors such as "Healthcare," "Social Security," "Public Administration," and "Computer and Related Activities" have experienced an increase in value-added and supply in the COVID-19 era. This supply is expected to decline sharply in the post-COVID period. In addition, the value-added in this sector will decrease significantly. Therefore, it is necessary to meet the supply adjustment conditions with a gradual and codified plan to avoid significant shocks in these sectors in the post-COVID period.

References

Açikgöz, Ö., & Günay, A. (2020). The Early Impact of the Covid-19 Pandemic on the Global and Turkish Economy. *Turkish Journal of Medical Sciences*, *50*(9), 520-526.

Aruga, K., Islam, M., & Jannat, A. (2020). Effects of COVID-19 on Indian Energy Consumption. *Sustainability*, *12*(14), 1-16.

Dev, S. M., & Sengupta, R. (2020). COVID-19: Impact on the Indian Economy. *Indira Gandhi Institute of Development Research, Working Paper, WP-2020-013*, 1-50.

Dietzenbacher, E., & Lahr, M. L. (2013). Expanding Extractions. *Economic Systems Research*, *25*(3), 341-360.

European Statistical Office. (2020). COVID-19 and European Business. Retrieved from https://ec.europa.eu/

Ghandour, A., & Woodford, B. J. (2020). COVID-19 Impact On E-Commerce in UAE. *21st International Arab Conference on Information Technology (ACIT)* (1-8). Chicago: IEEE.

Hale, T., Petherick, A., Phillips, T., & Webster, S. (2020). Variation in Government Responses to COVID-19. *Blavatnik School of Government Working Paper*, *31*(2020-11), 1-23.

Henderson, H. V., & Searle, S. R. (1981). On Deriving the Inverse of a Sum of Matrices. *Siam Review*, *23*(1), 53-60.

International Monetary Fund. (2020). Policy Responses to Covid-19. Retrieved November 21, 2020, from https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#top

Jahangard, E., & Kakaie, J. (2021). Evaluation of COVID-19 Virus Effect on Production and Employment of Iranian Economy. *Economics Research*, *21*(80), 47-77.

Kano, T., Yasui, K., Mikami, T., Asally, M., & Ishiguro, A. (2021). An Agent-Based Model of the Interrelation between the COVID-19 Outbreak and Economic Activities. *Proceedings of the Royal Society A*, *477*(2245), 1-13.

Karimi, M., Heshmati Dayari, E., & Shahab, A. (2020). Measuring Remote Labor Index and Supply Shock of the Covid-19 Virus in Iran. *Journal of Economics and Modeling*, *11*(2), 155-180.

Lenzen, M., Li, M., Malik, A., Pomponi, F., Sun, Y. Y., Wiedmann, T., Faturay, F., Fry, J., Gallego, B., Geschke, A., Go´mez-Paredes, J., Kanemoto, K., Kenway, S., Nansai, K., Prokopenko, M., Wakiyama, T., Wang, Y., & Yousefzadeh, M. (2020). Global Socio-Economic Losses and Environmental Gains from the Coronavirus Pandemic. *PloS one*, *15*(7), 1-13.

Permeh, Z. (2019). Evaluation the Impacts of Covid19 Outbreaking on Iran's Manufacturing Sector: Application of Social Accounting Matrix. *Quarterly journal of Industrial Economic Researches*, *3*(8), 79-93.

Porta, M. (2008). *A Dictionary of Epidemiology* (Ed.). Oxford: Oxford University Press.

Mirnezami, S. R., & Rajabi, S. (2020). Changing Primary Energy Consumption Due to COVID-19: The Study 20 European Economies. *International Journal of Energy Economics and Policy*, *11*(1), 615–631.

Rabiee, H., & Takrosta, M. (2021). Investigating and Explaining the Effects of Corona on the Economy of Rural Areas, Case Study: Upper Eshkevar Village. *Political Spatial Planning*, *3*(3), 148-169.

Razumovskaia, E., Yuzvovich, L., Kniazeva, E., Klimenko, M., & Shelyakin, V. (2020). The Effectiveness of Russian Government Policy to Support Smes in the COVID-19 Pandemic. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), 1-21.

Rehman, M. S. U., Shafiq, M. T., & Afzal, M. (2021). Impact of COVID-19 on Project Performance in the UAE Construction Industry. *Journal of Engineering, Design and Technology*, *20*(1), 1-22.

Ryazantsev, S., Vazirov, Z., Khramova, M., & Smirnov, A. (2020). The Impact of the COVID-19 Pandemic on the Position of Labor Migrants from Central Asia in Russia. *Central Asia and the Caucasus, 21*(3), 58-70.

Sakhaei, E., Khorsandi, M., Mohammadi, T., Arbab, H. (2020). Investigating the Effects of Shock Caused by Covid-19 Virus on the Iran's Economy: A GVAR Approach. *Journal of Economics and Modeling*, *11*(2), 125-153.

Safaie, N. (2021). Analysis of the Effects of COVID-19 Virus on the Import, Export and Labor in Iran Using System Dynamic Approach. *Journal of Control*, *14*(5), 107-120.

Saneifar, M., Saeedi, P., Abaasi, E., & Didehkhani, H. (2020). The Complex Network of the Impact of the Coronavirus (Qovid-19) on Macroeconomic Variables and the Stock Markets Crash. *Financial Engineering and Portfolio Management*, *11*(45), 268-296.

Shafiee Seifabadi, M., & Bagheri Dolat Abadi, A. (2020). A Comparative Study of Iran and Singapore Performance in Dealing with Covid-19 and Their Future. *State Studies, 6*(22), 141-175.

Singh, M. K., & Neog, Y. (2020). Contagion Effect of COVID-19 Outbreak: Another Recipe for Disaster on Indian Economy. *Journal of Public Affairs*, *20*(4), 1-21.

Taherpoor, J., Mirzaei, H., Soheili Ahmadi, H., & Rajabi, F. (2021). Investigating the Effect of Coronavirus Outbreak on Iran's Gross Output. *Journal of Economic Modeling Research*, *11*(44), 143-190.

Wen, J., Aston, J., Liu, X., & Ying, T. (2020). Effects of Misleading Media Coverage on Public Health Crisis: A Case of the 2019 Novel Coronavirus Outbreak in China. *Anatolia*, *31*(2), 331-336.

Cite this article: Mirnezami, S. R., Rajabi, S., & Maleki, A. (2024). Economic Damage and Sectors' Value-added Losses in Iran under COVID-19 Lockdown Scenarios. *Iranian Economic Review, 28*(2), 555-578.