THE IMPACT OF COVID 19 ON THE SELECTED TURKISH FINANCIAL INDICATORS: EMPIRICAL EVIDENCE FROM TODA YAMAMOTO CAUSALITY TEST

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Extended Abstract

Humanity has suffered from COVID 19 since December 2019. A global pandemic was declared by World Health Organization on 11 March 2021 (WHO, 2019). Pandemics such as bleeding fever, cholera, SARS, MERS, and swine flu have affected humanity throughout history. During pandemic periods, the measures, panic, decline in labor power, and consumption cause economic crises. Like other pandemics, COVID 19 has negative effects on countries, businesses, and households economically (Eichenbaum, Rebelo, and Trabandt, 2020: 1).

Many studies have found a statistically significant relationship between public health variables (life expectancy, maternal mortality, etc.) and the economy (Bloom and Sachs, 1998; Robalino et al., 2002). One of the public health elements that have direct or indirect effects on economies is an infectious disease outbreak. Infectious disease outbreaks directly affect economies with their impact on the health system, medical care, and supporting services (Mckibbin and Fernando 2020: 3). In the literature, studies are analyzing economic indicators with epidemics of different dates (Chen et al., 2018; Gong, Jiang, and Lu, 2020; McKibbin and Sidorenko, 2006). Although only one and a half years old, the economic effects of COVID 19 are extensively studied in the literature. Zhang, Hu, and Ji (2020) analyze the economic impact of Covid 19 in 12 countries. Zhang, Hu, and Ji (2020) argue that pandemic increases the risk in global markets, but the uncertainty and risk in countries change according to the situation of the pandemic. Huo and Qiu (2020) analyze the consequences of COVID 19 on the stock market in China with the Cumulative abnormal returns method. According to Huo and Qiu (2020), the retail investor reacted more strongly to the lockdown news. Baker et al. (2020) argue that the consumption of households changed radically during the COVID 19 pandemic process. During the pandemic period, households' credit card, retail, and food items spending increased. Bartik et al. (2020) survey to put forward the COVID 19's economic effect on small businesses in the USA. The survey includes 5.819 participants. 43% of the participants temporarily closed their businesses. Businesses reduced their employee numbers by % 40 percent. Ludvigson, Ma, and Ng (2020) argue that production, labor market activities, and employment were affected by COVID 19 negatively in the world.

This study measures the relationship between COVID 19 case and death effect on financial indicators with the Toda Yamamoto Causality test. Some studies examine causality between COVID 19 and financial indicators. Chaouachi and Chaouachi (2020) estimate the number of COVID 19 cases effect on the Saudi Arabian stock market with the Toda Yamamoto Causality test. Empirical results reveal that there is a unidirectional causality relationship from COVID 19 case to the stock market. According to Wang and Enilov (2020), there is a granger causality from COVID 19 case numbers to stock markets in G7. Erokhin and Gao (2020) analyze the effects of COVID-19 on trade and the economy in terms of food security in 45 countries. According to empirical results, there is causality from the COVID 19 case

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to insufficient food consumption in Colombia, Latin Africa, Peru, and Turkey. Unvan (2020) investigates the causal relationship between COVID 19 and dollar, BIST 100 Index, gram gold prices, 2 years bond yields, and euro in Turkey. Unvan (2020) emphasizes that there is no causality between COVID 19 and other variables. Mele and Magazzino (2020) analyze the causality relationship between COVID 19 death numbers, economic growth, and pollution in India with the Toda Yamamato causality test. According to Mele and Magazzino (2020), there is no Granger causality between economic growth and COVID 19 death number. Saleh and Musa (2020) find that there is bi-directional causality between the exchange rate and COVID 19 case in Nigeria. Andries, Ongena, and Sprinciean (2020) show that there is a granger causality from COVID 19 case and death numbers to the 5-year sovereign Credit Default Swap (CDS) in Europe.

The causality relationship between COVID 19 and financial indicators is estimated with Toda Yamamoto's test. In the VAR analysis, the loss of information is experienced in the level values of the integrated variables that are stationary at the first difference. In the analysis developed by Toda and Yamamoto (1995), this loss of information is prevented and variables are included in the analysis with their level values (Duasa, 2007:87). Toda Yamamoto's test is suitable for integrated and co-integrated variables. Thus, integration of the series' maximum order should be estimated. Then, the vector auto-regression model's optimal lag is determined with the Schwarz Information Criterion (SIC). VAR model can be calculated thanks to k and Dmax values with seemingly unrelated regression. Lastly, the Wald test is performed on the model to test the hypothesis (Siami-Namini, 2017: 604). Toda Yamamoto model is as follows:

$$Y_t = a_1 + \sum_{i=1}^{k+Dmax} \theta_{1,i} X_{t-i} + \sum_{i=1}^{k+Dmax} \theta_{2,i} Y_{t-i} + \varepsilon_{y,t}$$

$$X_t = a_2 + \sum_{i=1}^{k+Dmax} h_{1,i} X_{t-i} + \sum_{i=1}^{k+Dmax} h_{2,i} Y_{t-i} + \varepsilon_{x,t}$$

The analysis relies on daily time series data for Turkey for the period of 11 March 2020- 31 July 2020. The period also narrows between 17 March 2020- 31 July 2020 to estimate the COVID 19 death impact. The variables are the number of COVID 19 cases (CASE), the number of COVID 19 deaths (DEATH), BIST 100 index (BIST100), 5 years credit default swap (CDS), 10 years Turkish bond yield (BONDY10), and 2 years Turkish bond yield (BONDY2). All of these data are available from the Turkish Republic Ministry of Health and Bloomberg.

CDS is insurance against credit risk. However, nowadays, CDS is an indicator that reveals the country's risk beyond an insurance process. COVID 19 is one of the important risk factors in the Turkish economy. Therefore, CDS is a useful variable to test the impact of COVID 19 on the financial indicators (Andries, Ongena, and Sprincean, 2020: 4; Kartal, 2020: 493). Stock markets are one of the indicators that reflect investor risk perception. Some studies reveal the relationship between country risk and stock markets (Fung et al., 2008; Perotti and Van Oijen, 2001). COVID 19 effect on the economy and the risk perception of investors can be examined with the stock market. In the literature, some studies show that there is a relationship between stock market performance and COVID 19 (Huo and Qiu, 2020; Liu et al. 2020). Bond yield is important data that revealing the risk perception and liquidity of the countries. Unvan (2020) uses the bond yield variable to investigate the economic consequences of COVID 19 on Turkey.

Before the Toda Yamamoto test, Philips Peron and Augmented Dickey-Fuller tests are used to estimate the series' stationarity. According to unit root tests, all variables are stationary in the first difference.

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Therefore, the Toda Yamamoto causality test is suitable to analyze the causality between variables. Besides, the prerequisite tests of the model are examined with Normality, Heteroscedasticity, Stability, and Serial Correlation tests. Then, Johansen co-integration test is applied. According to Johansen co-integration test, there is co-movement among the variables in the study. There is a co-integrating vector; thus, a long-term association is established between variables.

Table 1 and Table 2 present Toda Yamamoto test results. The optimal lag length is calculated with Schwarz Information Criteria (SIC). 1 lag length is determined for both the case impact and the death impact models.

Table 1: Toda Yamamoto test (COVID 19 Case Impact)

Dep. Variable	Independent Variable				
	CASE	BIST100	CDS	BONDY10	BONDY2
CASE	-	0,003553 (0,9525)	0,037626 (0,8462)	1,449299 (0,2286)	1,015111 (0,3137)
BIST100	0,269999 (0,6033)	-	0,429721 (0,5121)	15,55289 (0,0001)	14,94355 (0,0001)
CDS	2,008696 (0,1564)	1,395268 (0,2375)	-	5,132735 (0,0235)	3,743853 (0,0480)
BONDY10	0,001196 (0,9724)	4,911979 (0,0267)	2,187512 (0,1391)	-	2,365290 (0,1241)
BONDY2	0,649572 (0,4203)	0,443731 (0,5053)	2,057437 (0,1515)	0,133398 (0,7149)	-

The number of cases doesn't affect any financial indicator variables. There is bidirectional causality between BIST 100 and 10 years bond yield. There is a one-way causality from the bond yields (both 2 and 10 years) to CDS. Similarly, there is a causality relationship from bond yields to BIST 100. Bond yields affect BIST 100 performance.

Table 8: Toda Yamamoto Test (COVID 19 Death Impact)

Dep. Variable	Independent Variable				
	DEATH	BIST100	CDS	BONDY10	BONDY2
DEATH	-	1,764780 (0,1840)	2,891648 (0,0890)	0,078674 (0,7149)	4,335028 (0,0573)
BIST100	0,023680 (0,8777)	-	0,100700 (0,7510)	5,972094 (0,0145)	5,502051 (0,0190)
CDS	6,896844 (0,0086)	0,033513 (0,8547)	-	6,486684 (0,0109)	4,708490 (0,0300)
BONDY10	0,268708 (0,6042)	8,554247 (0,0034)	2,215009 (0,1367)	-	5,273460 (0,0217)
BONDY2	2,059819 (0,1512)	1,011040 (0,3147)	0,961555 (0,3268)	0,001959 (0,9647)	-

In Table 2, the causality relationship between the number of deaths between 17 March – 31 July and financial indicators are examined. One-way causality from the number of deaths to CDS is found as a result of the empirical result. The number of deaths affects CDS. There is bidirectional causality between BIST 100 and 10 years bond yield. There is unidirectional causality from 2 years bond yield to 10 years bond yield. Similar to the case effect, there is a one-way Granger causality relationship from 10 years bond yield and 2 years bond yield to CDS.

This study investigates the relationship between the severity of the pandemic and financial indicators. There is no granger casualty between the number of cases and any financial indicators. However, the number of deaths affects CDS. Besides, there is a one-way causality from bond yields to CDS. The increase in bond yield can be perceived as a country's liquidity problem. Besides, increased debt can increase a country's risk perception. Therefore, an increase in bond yield may affect investor perception and country risk.

The increase in the severity of the pandemic affects the country's risk of Turkey. Considering these findings, policymakers should manage the pandemic process to reduce the country's risk. However, CDS is affected by more than one indicator. The pandemic process and the measures may also cause an increase in CDS. The lockdown decision may cause a decrease in economic growth. Therefore rational policies should be established by taking into consideration a balance between the pandemic process and the economy.

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