

## IS THERE A RELATIONSHIP BETWEEN DIRECT AND INDIRECT TAX REVENUES WITH EXCHANGE RATE VOLATILITY: EVIDENCE FROM TURKEY

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### **Abstract**

*This study seeks empirical proof for this basic question: is there a relationship between direct-indirect tax revenues with exchange rate volatility? For the period of 2006:Q1-2019:Q4 in Turkey, the Toda-Yamamoto causality approach was performed to delve into the causal relationships between the exchange rate volatility determined by the moving standard deviation of the real effective exchange rate and both direct and indirect taxes. The results of the Toda-Yamamoto causality test revealed the presence of a one-way causality relationship from direct taxes to exchange rate volatility and also a one-way causality relationship from indirect taxes to exchange rate volatility. Under a causality approach framework, the paper occurred a significant empirical inference for the relationship of exchange rate volatility with both direct and indirect taxes.*

**Keywords:** Exchange rate volatility, Direct taxes, Indirect taxes, The Toda-Yamamoto causality, Turkey.

### **DOLAYLI VE DOLAYSIZ VERGİ GELİRLERİ İLE DÖVİZ KURU OYNAKLIĞI ARASINDA BİR İLİŞKİ VAR MI? TÜRKİYE ÖRNEĞİ**

### **Öz**

*Bu çalışmanın amacı dolaylı ve dolaysız vergi gelirleri ile döviz kuru oynaklığı arasında bir ilişki mevcut mudur? sorusuna ampirik kanıtlar aramaktır. Türkiye örneği için 2006:Q1-2019:Q4 döneminin dikkate alındığı ve reel efektif*

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*döviz kurunun standart sapmasının döviz kuru oynaklığı olarak kullanıldığı çalışmada, reel efektif döviz kuru oynaklığı ile hem dolaylı hemde dolaysız vergi gelirleri arasındaki nedensel ilişkiler Toda-Yamamoto yaklaşımı ile araştırılmıştır. Toda-Yamamoto nedensellik testinden elde edilen sonuçlar, hem dolaylı hem de dolaysız vergi gelirlerinden döviz kuru oynaklığına doğru tek yönlü bir nedensellik ilişkisinin varlığını ortaya koymuştur. Tüm bu bulgular ışığında çalışma nedensellik yaklaşımı çerçevesinde, döviz kuru oynaklığı ile dolaylı ve dolaysız vergi gelirleri arasındaki ilişkiye dair önemli ampirik çıkarımlar ortaya koymaktadır.*

**Anahtar Kelimeler:** *Döviz kuru oynaklığı, Dolaysız vergiler, Dolaylı vergiler, Toda-Yamamoto Nedensellik, Türkiye.*

### **Introduction**

The issue of which variables are the macroeconomic determinants of tax revenues is a significant debate in the literature on fiscal policy. The relationship between tax revenues and macroeconomic variables has been explored in most studies by using alternative combinations of macroeconomic variables. Gupta (2007) preferred to use per capita GDP, agricultural share of GDP, trade openness, and foreign aid as explanatory variables when evaluating this relationship, but Martinez-Vazquez and McNab (2000) only included per capita GDP and trade openness in their analysis. The relationship of tax revenues with income, openness and the share of agriculture in GDP was also investigated by Ghura (1998). According to Tanzi (1992), the major determinants of tax revenues were per capita wages, the share of imports, agriculture and foreign debt. More recently, a broad data collection consisting of exchange rates, industry's share of GDP, trade openness, agricultural share of GDP and foreign aid was used by Gaalya (2015). Finally, the various variables, including unemployment rate, economic growth, inflation rate and economic globalization were introduced into the study by Çalcalı and Altın (2019). The relationship of the data set of per capita GDP, agricultural, manufacturing and mining GDP shares, trade openness, foreign debt, exchange rates, unemployment rate, economic development, inflation rate, economic globalization and foreign aid with tax revenues was studied in previous studies. However, could there be another important variable that has a high potential to affect economic activity but has not been discussed in the fiscal literature until now? The debate on exchange rate volatility with total tax revenue has more recently started with Ofori et al. (2018). In Ofori et al. study, exchange rate volatility was paired with total tax revenues for the first time in the literature.

They emphasized that exchange rate volatility can be an overlooked factor determining tax revenue in the literature. The results of their study showed that exchange rate volatility, as an important determinant of tax revenue, has a deleterious effect on tax revenues for Ghana. Although the existence of a possible relationship between tax revenues and exchange rate volatility has given a start with the study of Ofori et al., exchange rate volatility has never been associated with both direct taxes and indirect taxes in the literature.

More recently, exchange rate volatility has become one of the most obtrusive and pioneering macroeconomic variables, particularly in developing countries such as Turkey. Unfortunately, the process brought along high volatility with the sudden and sharp depreciation of the Turkish lira against the DollarDollar. Ultimately, a wide spectrum of economic activity has been exposed to the uncertainty of the exchange rate. As exchange rate volatility increases, the damage caused by the high volatility on economic activity has begun to draw attention to the Turkish economy. This process became a highly controversial topic for both economic agents and policymakers. Immediately after, the relationships between exchange rate volatility and macroeconomic variables that have never been addressed have recently begun to be investigated in empirical studies. One of the closest examples of this new relationship is reported by Demirgil and Çelikkaya (2019) for domestic consumption expenditures for Turkey. Because exchange rate volatility can cause price volatility which generally induces to decrease in household consumption, since all economic transaction is closely related to taxation, in such a case, it may come to mind that indirect taxes including the value-added tax (VAT) and the special consumption tax (SCT) can be easily affected by this change. To avoid risk, firms can decrease their production or reflect the cost stemming from volatility to their prices.

Also, firms can change their investment decisions. In the given circumstances, direct taxes may easily respond to these arguments through income tax, the corporate tax. Another dimension of the event is closely related to the taxes levied on imports and exports. The relationship of exchange rate volatility with import and export is the most discussed topic in the literature. Value-added tax on imports is calculated in foreign currency and then collected in national currency. Especially as the exchange rate increases, the amount of tax collected from this item changes. As can be seen, exchange rate volatility has the potential to affect tax revenues through many channels. However, can a fiscal policy such as a cut in taxes affect the exchange rate? A cut in taxes reduces national savings, lowering the supply of dollars to be invested abroad. The lower supply causes the

equilibrium real exchange rate to rise, making the Dollar more valuable (Mankiw 2010: 140). A change in fiscal policy can cause a depreciation or an appreciation in the exchange rate. Under all these economic frameworks, the question of whether there is a relationship between direct and indirect tax revenues and exchange rate volatility has become necessary.

In the recent past, exchange rate volatility has been intensively discussed with macroeconomic variables in several studies for Turkey (Ayhan (2019), Kartal (2019), Güleç (2020), Bahmani-Oskooee and Durmaz (2020)). However, it is essential to point out that the relationship between the exchange rate volatility and total tax revenues was discussed for Turkey in Koçak (2019) for the first time, but the exchange rate volatility has never been analyzed with both direct taxes and indirect taxes for Turkey. This analysis intends to evaluate the possible causal relationship of exchange rate volatility with both direct and indirect taxes for 2006:Q1-2019:Q4 in Turkey. The study has the feature of being the first attempt to analyze the relationships between exchange rate volatility and this sort of tax revenues for the Turkish economy by using the Toda-Yamamoto Causality test.

### **1. Exchange Rate Volatility and Tax Revenues**

In developing economies, exchange rate volatility has a tremendous potential to significantly affect the entire economy through its direct and indirect channels. The transmission channels created by the volatility can harm both consumers and producers/firms as the main driver of economic uncertainty with rising risk. Primarily on the consumer side, the price instability caused by the exchange rate volatility can shift household consumption choices and trigger supply-demand imbalances under domestic demand conditions. The imbalance, thus, can cause a decrease in consumption. Ultimately, indirect taxes, particularly VAT and SCT, can be influenced by this channel with decreasing consumption. On the producer side, companies may either reduce their economic activities or reflect the cost to their prices if they want to prevent the risk caused by exchange rate volatility. Employment can be negatively affected in the event of a decrease in economic activity, and this negativity may be reflected indirect taxes by income tax. In another scenario, firms can record exchange rate losses as an expense that may affect the corporate tax revenue collected by the government.

Furthermore, there is no doubt that the volatility of the exchange rate will demonstrate its effect on investment decisions consisting of the investment value and the future profits produced by the investment. This situation may cause the postponement of both investments and direct taxes such as income tax and

corporate tax arisen from these investments. Moreover, direct taxes could also be impacted by the negative impact of postponed investments on employment. In another situation, companies record exchange rate losses as an expense, which may affect the corporate tax revenue collected by the government. The detrimental effects of exchange rate volatility on exports and imports are another important concern. The negative effect of the exchange rate volatility on foreign trade inevitably has the potential to impact indirect taxes via customs duties and VAT in imports. Tax revenues such as VAT, SCT and customs duties may decrease, especially in economies with a high dependence on imports in terms of both production and consumption, as demand for imported products decreases because of exchange rate volatility.

On the other hand, both monetary and fiscal policymakers follow different policies to achieve economic stability. In other words, monetary policies alone cannot be designed to ensure the economic stability of the economy. In this system, fiscal policies should also be a tool that should be applied simultaneously to ensure economic stability with monetary policy. Policymakers can use fiscal policies as a complementary policy of monetary policy to support economic stability, such as price stability. If fiscal policies have some degree of effectiveness in achieving this goal, then we can bespeak of a causal relationship from fiscal policy instruments such as taxes to exchange rate volatility.

## **2. Literature**

The number of studies examining the relationship between the volatility in exchange rates and tax revenues is limited. Only in a few studies, this relationship is explored. The literature on the relationships that is incomplete and ambiguous is fairly recent and restricted to only two studies. Ofori et al. (2018) were pioneers of this literature by remarking the role of exchange rate volatility on the Ghanaian government's tax revenue generation for the first time. Using annual data spanning from 1984 to 2014, they tested the existence of any short-run or long-run effects of the volatility of the exchange rate on the ratio of total tax revenues to GDP. The volatility in exchange rates is also created by the modelling process of GARCH (1,1) following Bollerslev (1990). The outcomes of the ARDL bounds test indicated that both the short-run and long-run coefficients of exchange rate volatility are negative and statistically significant. These findings of the study proved that exchange rate volatility has an impairing effect on tax revenue both in the short and long run. Another study analyzing both short and long-run effects of exchange rate volatility on tax revenues for the Turkish economy is Koçak

(2019). The study results showed that there are both short-run and long-run volatility effects on total tax revenues for the period of 2006:01-2019:12. The relationship, as seen from the literature, is quite up for discussion and empirically needs more research.

However, in both theoretical and empirical literature, there is a vast amount of studies trying to remark the main or macroeconomic determinants of tax revenues. Following Hinrich's (1965) paper, found the correlation between tax level differences and degree of openness, Lotz and Morss (1970) investigated the factors which affect tax level in developing countries. The results showed that the existence of taxable bases is more important than variations in the demand for government expenditures in the developing countries. Tanzi (1989) focused the macroeconomic determinants of taxation levels in a theoretical framework for developing countries by classifying them as statistical determinants, institutional or social determinants and tax policy determinants. However, these macroeconomic determinants involve only the relationship of the real exchange rate and tax revenues, not the real exchange rate volatility. In this time, Tanzi and Davoodi (2000) demonstrated empirically that agriculture share in GDP harms tax revenues, but per capita income has a positive effect. By utilizing Generalized Method of Moment (GMM) regression Agbeyegbe, Stotsky and WoldeMariam (2004) found that trade liberalization is weekly linked to total tax revenues. The results for currency appreciation and higher inflation indicated some lower tax revenues. In another paper for developing countries, Gupta (2007) showed that per capita GDP, agriculture in GDP, trade openness, and foreign aid significantly affect revenue performance in any economy. For the Pakistan case, The findings of Addison and Levin (2012) for 39 sub-Saharan African countries over the period 1980-2005 showed that the effect of the share of the agriculture sector on total tax revenue GDP ratio is negative and statistically significant, but openness has a statistically positive significant effect on total tax revenue GDP ratio. For another variable, per capita GDP has a positive but insignificant effect on the total tax revenue ratio. By using fixed and random effects models, Gaalya (2015) proved that exchange rates, the share of industry to GDP and especially trade openness have positive effects on tax revenue performance, while the agriculture share to GDP and foreign aid have negative effects on Uganda over the period of 1994-2012. More recently, a study for OECD countries was employed by Çalcalı and Altınır (2019) for the data of 1991-2015. The results of the Panel AMG approach indicated that unemployment and economic growth had no effects on tax revenues

in most countries, while inflation had negative and economic globalization had a positive effect.

For Turkey, there has been a limited number of papers that have empirically attempted to examine the determinants of tax revenues. Furthermore, in these studies, the relationship between exchange rate volatility and tax revenues has not been empirically tackled or examined yet. Mostly, the relationship of tax revenues with economic growth, tax rates, public expenditures and corruption was analyzed for Turkey (Yamak and Yamak, 1995; Karabulut, 2006; Durkaya and Ceylan, 2006; Mucuk and Alptekin, 2008; Temiz, 2008; Karagöz and Mutlu, 2009; Yamak and Abdioğlu, 2012; Dökmen, 2012; Erdoğan, Topçu and Ozan, 2013; Altunöz, 2017; Songur and Yüksel, 2018; Akıncı, 2019; Boğa, 2020). To determine the main factors of tax revenues, Karagöz (2013) focused on a sectorial composition for Turkey from 1970-2010. The regression analysis results proved that both agriculture and industry share GDP, external debt stock, urbanization rate and finally monetization rate affect tax revenues. Another study for Turkey's economy came from Atsan (2017) by employing multiple regression analysis for the years 1984 and 2012. His results showed that foreign trade affects tax revenues positively, while the agricultural value-added has a negative effect. Öztürk, Şaşmaz, Bayar and Odabaş (2019) investigated the effect of major economic variables on tax revenues for the case of Turkey during 1980-2017. The findings demonstrated that economic growth and urbanization have a positive effect on tax revenues but negative for unemployment, shadow economy and inflation. The relationships of tax revenues with GDP per capita, the shares of industry, the service sectors in GDP and openness on a regional scale for the period of 1990-2001 and 2004-2011 was also examined by Sağdıç (2019). The results of panel data analysis indicated that all economic variables affect tax revenues for Turkey positively, but the effect of the agriculture sector on tax revenues is only negative.

### **3. Data and Methodology**

The primary goal of this analysis is to ask whether there is any causal relationship between the volatility of the exchange rate (EXV) and both direct taxes (DT) and indirect taxes (IDT). The quarterly time series of 2006:Q1-2019:Q4 period is harnessed in the estimations for Turkey. The main reason for taking this period into consideration is that the central government budget definition has been in use instead of the consolidated budget definition since 2006. Also, since taxes are an instrument of fiscal policy, the use of a quarterly dataset may provide more opportunities to capture whether the variables react to each

other simultaneously than using an annual dataset. Each data was collected from the Central Bank of the Republic of Turkey. First, seasonally adjusted direct taxes and indirect taxes were deflated by using the consumer price index (CPI) (2003=100) to ensure real series. In the next stage, LRDT and LRIDT were achieved by performing logarithmic transformation of real direct taxes (RDT) and real indirect taxes (RIDT). The ultimate abbreviations of variables used in the analysis are as in Table 1:

**Table 1.** The Variables

Variables	Abbreviation
Real Effective Exchange Rate	LEER
Exchange Rate Volatility	EX
Real Direct Tax Revenue	LRDT
Real Indirect Tax Revenue	PRINT

To measure the exchange rate volatility (EXV), the moving standard deviation of the growth rate of the logarithmic real effective exchange rate (LREER) (2003=100) is used as follows. This methodology provides the exchange rate volatility the advantage of being stationary (Kenen and Rodrik (1986)).

$$EXV_t = \left[ \left( \frac{1}{m} \sum_{i=1}^m (LREER_{t+i-1} - LREER_{t+i-2})^2 \right)^{1/2} \right] \quad (1)$$

The Toda-Yamamoto causality, referred to as TY, the test aims to determine the causal relationships between variables without considering the integration and cointegration qualities of the variables. Therefore, the most important contribution of the TY causality test is to constitute a  $(k + d_{max})$ th order VAR model and also to specify both the optimal lag length,  $k$ , in this VAR system and maximal order,  $(d_{max})$ , of integration of the variables of this VAR model. The TY causality test with the estimation of a bivariate Augmented VAR models  $(k+d_{max})$  for both real direct taxes (LDT) (Model (1)) and real indirect taxes (LIDT) (Model (2)) with exchange rate volatility (EXV) is stated as follow:



$$LDT_t = \alpha_0 + \sum_{i=1}^k \alpha_{1i} LDT_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \alpha_{2i} LDT_{t-i} + \sum_{i=1}^k \delta_{1i} EXV_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \delta_{2i} EXV_{t-i} + \varepsilon_{2t} \quad (2)$$

$$LEXV_t = \beta_0 + \sum_{i=1}^k \beta_{1i} EXV_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \beta_{2i} EXV_{t-i} + \sum_{i=1}^k \gamma_{1i} LDT_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \gamma_{2i} LDT_{t-i} + \varepsilon_{3t}$$

and,

$$LIDT_t = \theta_0 + \sum_{i=1}^k \theta_{1i} LIDT_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \theta_{2i} LIDT_{t-i} + \sum_{i=1}^k \vartheta_{1i} EXV_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \vartheta_{2i} EXV_{t-i} + \varepsilon_{4t} \quad (4)$$

$$LEXV_t = \varphi_0 + \sum_{i=1}^k \varphi_{1i} EXV_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \varphi_{2i} EXV_{t-i} + \sum_{i=1}^k \omega_{1i} LIDT_{t-i} + \sum_{i=k+1}^{k+d_{\max}} \omega_{2i} LIDT_{t-i} + \varepsilon_{5t}$$

#### 4. Results

The summary statistics of the exchange rate volatility, real direct taxes and real indirect taxes series are presented in Table 2. The second row shows the mean of the variables. As seen in this row, the mean of the real direct taxes and real indirect taxes are realized as 11.662 and 12.341, respectively.

**Table 2.** Summary Statistics

	EX	LRDT	PRINT
<b>Mean</b>	0.0537	11.662	12.341
<b>Median</b>	0.0438	11.651	12.395
<b>Maximum</b>	0.1767	12.010	12.614
<b>Minimum</b>	0.0094	11.346	11.938
<b>Std. Dev.</b>	0.0384	0.187	0.181
<b>Skewness</b>	1.8871	0.223	-0.494
<b>Kurtosis</b>	6.5576	1.952	2.089

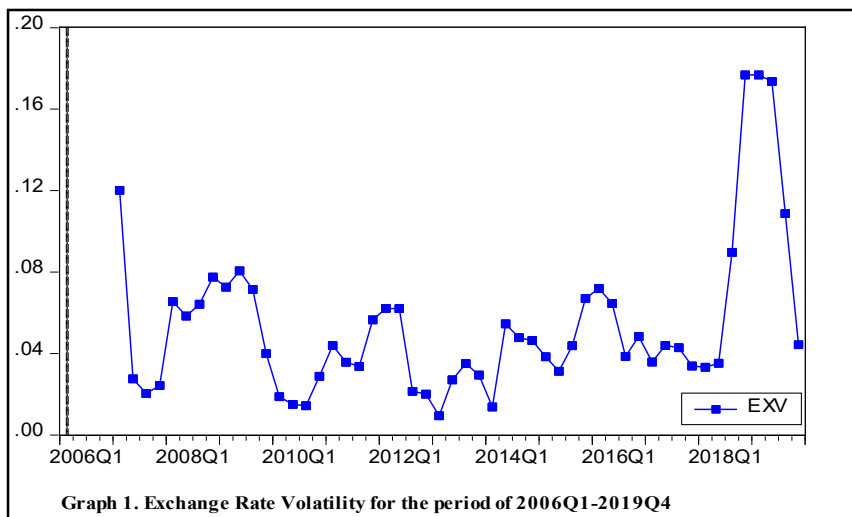
The correlation coefficients between the variables can be seen in Table 3. The values range between -0.085 and 0.830. The value of the correlation coefficient between exchange rate and real direct taxes, -0.085, indicates a

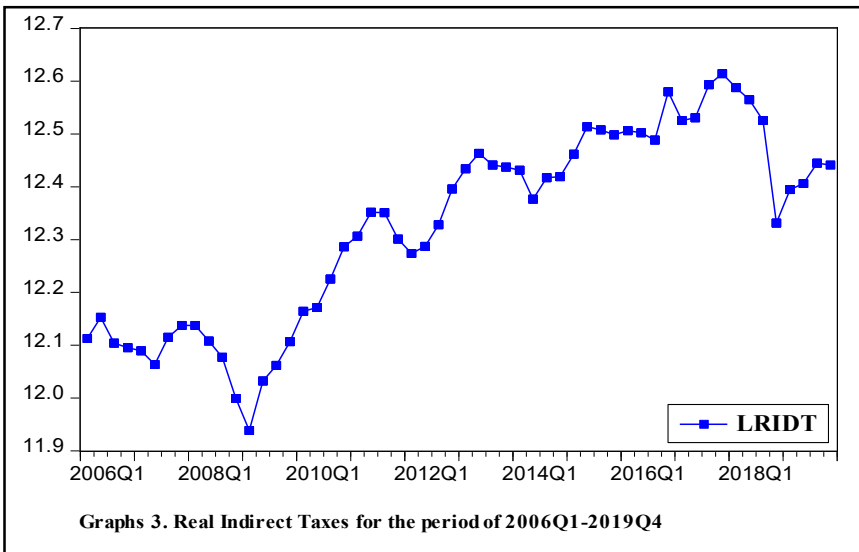
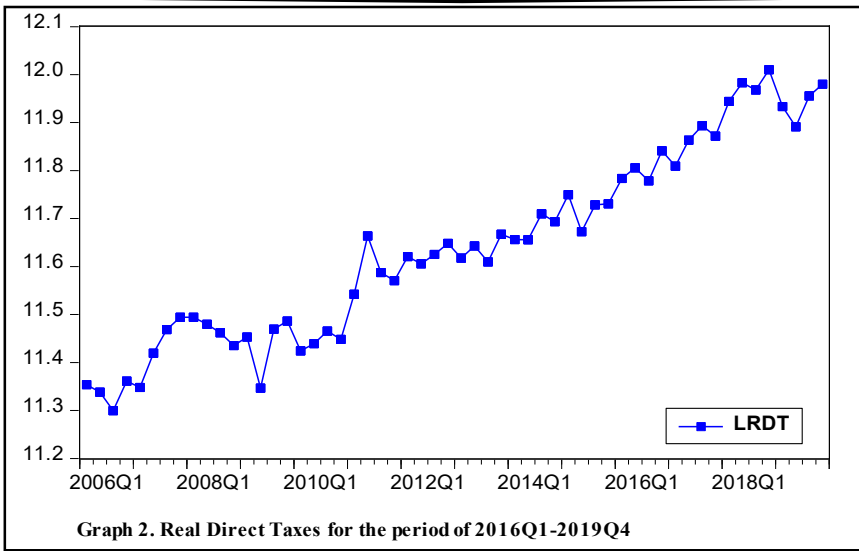
negative relationship between the variables. This lower degree of correlation coefficient also expresses the relationship between the variables because of not being equal to 0. The value of the correlation coefficient between exchange rate and real indirect taxes, 0.311, indicates a positive relationship between the variables.

**Table 3.** Correlation Matrix

	EX	LRDT	PRINT
EXY	1.000		
LRDT	-0.085	1.000	
LRIDT	0.311	0.830	1.000

When the graph of exchange rate volatility is examined as given in Graph 1, it is seen that a significant volatility in the exchange rate has occurred since 2018. As seen from Graph 2 and 3, the series of both real direct taxes and real indirect taxes exhibit an increasing trend throughout 2006:Q1-2019:Q4. Also, exchange rate volatility has shown excess volatility in Turkey between 2008:Q1-2009:Q4 and 2018:Q3-2019:Q4. The responses of both tax revenues to this volatility were downward.





Before employing the test of TY causality,  $k$  and  $D_{max}$  must be specified to constitute the model of  $VAR(k + D_{max})$ . The success of the TY causality test depends on the correct determination of  $k$  and  $D_{max}$ .

To evaluate  $D_{max}$  of the variables in the system, an array of unit root tests, including Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979), Phillips-Perron (PP) (Phillips and Perron, 1988) and Kwiatkowski, Phillips, Schmidt and

Shin test (KPSS) (1992) were used. ADF, PP and KPSS methods are traditional unit root tests that are most commonly used in practice for detecting the presence of a unit root in time series. PP unit root test focuses on controlling for the possible problem of serial correlation in the ADF test regression, using an alternative (nonparametric) approach. Also, the reason for applying KPSS unit root test is so that KPSS is suggested to eliminate a possible low power against stationary near unit root processes that occur in the ADF and PP (Katircioglu et al. (2014)). Table 4 exhibits the outcomes of ADF, PP and KPSS. These outcomes indicate that EXV is stationary in its level, but LRDT and LRIDT are stationary in their first difference. So  $d_{max}$  is identified as 1 ( $d_{max}=1$ ) for VAR Model (1) and VAR Model (2).

**Table 4.** Results of Unit Root Tests

	ADF		PP		KPSS	
	Constant	Trend	Constant	Trend	Constant	Trend
EX	-3.818***	-3.750**	-3.457***	-3.751**	0.286*	0.158***
LRDT	-0.460	-4.127***	-0.666	-4.209***	0.886	0.124**
$\Delta$ LRDT	-9.974***	-9.884***	-10.474***	-10.364***	0.036*	0.024*
LRIDT	-1.210	-1.668	-1.249	-1.944	0.768	0.137**
$\Delta$ LRIDT	-6.577***	-6.522***	-6.528***	-6.582***	0.104*	0.080*

**Note:** \*\*\*, \*\* and \* denote significance level of 1%, 5% and 10%, respectively.  $\Delta$  is the first difference operator.

Table 5 exhibits the outcomes of TY causality test. As outlined in the table, the k of Model (1) is found to be 2 ( $k=2$ ) and the k of Model (2) is chosen to be 3 ( $k=3$ ). Both models have no autocorrelation and heteroscedasticity problems.

**Table 5.** Toda-Yamamoto Causality Test Results

Model	Null Hypothesis	k	$d_{max}$	$\chi^2$ statistics	Results	LM(1)	LM(4)	White
Model (1)	EXV $\nrightarrow$ LRDT	2	1	3.848	LRDT $\rightarrow$ EXV	2.774	2.548	40.948
	LRDT $\nrightarrow$ EXV	2	1	10.911***				
	EXV $\nrightarrow$ LRIDT	3	1	2.949		3.053	4.806	48.144

Model (2)	LRIDT $\nrightarrow$ EXV	3	1	5.667**	LRIDT $\rightarrow$ EXV
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Note: \*\*\* and \*\*, denote significance at the 1%, 5% level, respectively.

The first calculated TY statistic, 3.848, which represents the null hypothesis of no-causality from EXV to LRDT is not rejected at the 10% level, but the calculated statistics for the null hypothesis of no-causality from LRDT to EXV, 10.911, is rejected at 1% level of significance. Likewise, the null hypothesis of no-causality from EXV to LRIDT is also not rejected at 10% level of significance. But the hypothesis for the causality from LRIDT to EXV is accepted at 5% level of significance with the calculated test value statistics of 5.667. In the interest of brevity, the causality test results of both Model 1 and Model 2 show that there exists a one-way causality relationship from running to both real direct and real indirect taxes to exchange rate volatility, separately.

### Concluding remarks

The relationship between total tax revenue and macroeconomic variables has been frequently discussed using empirical methods for different country groups and different periods in the literature (Hinrich (1965), Tanzi (1989), Stotsky and WoldeMariam (2004), Addison and Levin (2012), Atsan (2017), Sağdıç (2019)). This macroeconomic data set consists of per capita GDP, agricultural, manufacturing and mining GDP shares, trade openness, foreign debt, exchange rates, unemployment rate, economic development, inflation rate, economic globalization and foreign aid. However, exchange rate volatility has become a high potential variable affecting economic activities such as consumption, production, investment, import and export, especially in developing countries. As the effects of exchange rate volatility spread over a wide range of economic activities, the variable started to be analyzed with variables that it had never been discussed together before. What is even more interesting is that the realization of all these economic activities initiates a taxation process.

In the literature, the relationship of total tax revenue with exchange rate volatility has been discussed by the Ofori et al.'s paper (2018) for the first time. The remarkable thing here is that the relationship between the variables has been handled in the very recent past: 2018, for the first time. Perhaps the reason why the relationship between exchange rate volatility and tax revenues has never been discussed so far is that the restrictive effects of exchange rate volatility on economic activity are now stronger than ever before. When we went back to Ofori

et al.'s paper, the results of the study revealed that exchange rate volatility has a detrimental effect on total tax revenue. According to Ofori et al., exchange rate volatility was a very important, but especially an overlooked variable in the fiscal literature. However, both short-run and long-run effects of exchange rate volatility on tax revenues is analyzed for the Turkish economy by Koçak (2019). The results of the study showed both the short and long-run volatility effects on total tax revenue for the period of 2006:01-2019:12.

Right after these papers, the present study has drawn attention to the relationship of exchange rate volatility with direct and indirect tax revenues that had never been discussed before. Since the previous papers on the relationship are quite new and limited, this study which examines the causal relationships between the variables as a beginning aims to enlighten and extend the empirical literature. The originality of the research idea that distinguishes this study from Ofori and Koçak's studies is that it classified tax revenues as direct and indirect tax revenues. Although all variables seem to belong to the different economic policies, it is very important to determine the interaction between these variables for designing both fiscal and monetary policies. Because the results obtained at the end of this study will provide important implications for the central bank, whose aim is price stability.

This paper emphasized testing the causal relationships of exchange rate volatility with real direct taxes and real indirect taxes for the case of Turkey by implementing the Toda-Yamamoto approach to Granger causality. Quarterly time series of 2006:Q1-2019:Q4 period is used in the analysis. The proofs of the Toda-Yamamoto approach to Granger causality exhibit only the presence of a one-way causality relationship from both real direct taxes and real indirect taxes to exchange rate volatility, separately. Unlike previous analysts, Ofori et al. (2018) and Koçak (2019), the main policy output revealed from these findings is that the exchange rate volatility is not a crucial determinant of direct and indirect tax revenues for the Turkish economy. Nevertheless, the results majorly exhibited that as a fiscal policy tool, tax revenues specific to direct and indirect tax can play a key role in reducing/increasing the volatility in the exchange rate. Although all measures, such as focusing on the interest rate and encouraging foreign direct investments, intended to reduce the exchange rate volatility seem to be the priority of Turkey's economy, determining this relationship between the variables for the first time in the literature within the framework of causality analysis offers a different perspective simultaneously on both the tax revenues generation process and the exchange rate volatility. Both fiscal and monetary policymakers should

consider this relationship of exchange rate volatility and tax revenues while designing the both monetary and fiscal policies and choosing policy tools. In the study, no causality relationship from exchange rate volatility to tax revenues was determined. This finding implies that exchange rate volatility is not one of the determinants of tax revenues for Turkey. These results also indicate that the implementation of tax revenue as a fiscal policy tool can be effective in the stabilization of the exchange rate in Turkey. Moreover, these results reveal a very important empirical inferences for being the first in the literature for the relationship of exchange rate volatility with both direct and indirect taxes. Since the study is the first to examine the relationship between variables, it primarily focused on determining whether there is a causal relationship between the variables. The limitations of the study may be the focusing on the causality method and the covering the period of 2006-2019. Therefore, in the next stage, firstly, the analysis can be carried a step further by investigating the short-term and long-term dynamics between exchange rate volatility and both direct and indirect taxes. Also, the relationships between the variables can be investigated for a wider time series. Then, since the results revealed the existence of a one-way causality relationship from both direct and indirect tax revenues to exchange rate volatility, it would be appropriate to investigate the effects of tax revenues on exchange rate volatility. Lastly, examining the relationship between the variables the based on disaggregated data such as the value-added tax, the special consumption tax, customs duties, the value-added tax in imports and income tax, the corporate tax in more detail may provide policymakers with a more transparent and very important roadmap in terms of economic policies that can be implemented.

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