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AN EXAMINATION OF THE IMPACT OF EXCHANGE RATE FLUCTUATIONS ON TAX REVENUES IN IRAN FROM 1979 TO 2018

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Abstract: This research paper studies the impact of exchange rate fluctuations on tax revenues in the Iranian economy from 1979 to 2018. It is argued that taxes are a significant source of government funding and an ethical means of financing public goods and services, providing social and welfare services, and controlling economic and social activities. However, in Iran, the tax system has several challenges and has not yet reached its full potential as a source of public funding. The paper recommends identifying influential variables and recognizing the direction of their influence to increase the proportion of tax revenues to GDP. Exchange rate variations are one of the primary variables that affect tax collection, and abnormal exchange rate fluctuations reduce buying power and force exporters to either stop operations or seek more profits for greater risk. To achieve this, the paper employs unit root tests, Durbin-Watson tests, GARCH models, ARDL models, experimental model specification, and tests analysis to examine the impact of taxation in the Iranian economy.

Keywords: Exchange rate fluctuations, tax revenues, Iranian economy, unit root tests, Durbin-Watson tests, GARCH models, ARDL models.

Introduction

Taxes make up a sizable portion of the government's funding in the majority of nations. The amount of taxes as a percentage of total public revenues vary among nations and is influenced by both their economic structure and degree of development. In a strong economy, taxes are one of the primary and most ethical sources of funding (Lazgi, Amini, Shomali, & Najafi, 2008). Taxes are regarded as the most prevalent and significant source of public funding as well as one of the world's most efficient and effective instruments for implementing financial policies. With the help of taxes, the government can invest in the direction of economic prosperity, growth, and prosperity, offer a wide range of social and welfare services, and control the course of numerous economic and social activities and flows. At the international level, there are three ways to look at the function of taxes: 1) Taxes are the primary source of funding for the central government, hence their collection is required and consistent; 2) By providing public goods and services, taxes assist governments in meeting social and public demands; 3) Governments depend on tax money to maintain the security of the military forces and judicial systems and to establish justice in society (Kim, 2008). The general status of taxes and their contribution to government income is quite important in Iran. This aspect has significantly influenced scientific and experimental investigations because of how it affects the overall economy. Taxes may be seen as one of the government's significant income items when looking at Iran's economy in general and the makeup of the government's income (Jalalund, Shahiki, & Nabi, 2013).

It is crucial to look at the tax situation since it has several implications for Iran's economy from the standpoint of social and economic justice. This includes minimizing the government's reliance on oil income and implementing economic stabilization measures (Aminkhaki, 2012). Despite this, the tax system in Iran has

numerous difficulties and has not yet reached its full potential as a source of funding for the government budget because the country relied on oil income. Between 1973 and 2016, the average percentage of oil and tax income in total government receipts was around 55 and 31 percent, respectively. One measure of the contribution of taxes to funding the government budget, the percentage of tax from public budget resources, shows that between 2013 and 2016, the percentage of taxes climbed from around 31% in 2016 to 42% in 2017. This demonstrates that the structure of the Iranian economy and the combination of government budget resources are dependent on non-tax revenues, with oil sales providing a sizable portion of the budget resources while the average tax share of the total government revenues in several countries has been higher than 64% in various years (Totunchi-Melki, Mousavi Jahormi, & Mehrara, 2020). In addition to the unfortunate complications such as the country's income dependence on the export of a commodity, the high share of resources from the sale of oil and the low share of tax collections in the composition of the government's general budget resources have prevented the country's economy from being able to use taxes to implement fiscal policy more effectively. Therefore, to increase the proportion of tax revenues to GDP, the planners and policymakers of the tax system should be able to identify the most significant influential variables in this field and recognize the direction of their influence. This is because of the effective factors that increase or decrease taxes in the structure of Iran's economy (Shahson & Mousavi Shahroudi, 2011).

By fostering an unstable and uncertain situation in the area of profits from foreign exchanges, frequent swings and ongoing uncertainty in real exchange rates might result in a decline in tax collections. The performance of the nation's economy may be impacted by the actual exchange rate shift due to the variety and competing changes it causes in both local and international sectors. The process of saving and investing will often become irrational when the stability of the real exchange rate is disrupted, and the best potential allocation of resources won't be achievable. In an international system, the national currency's value will be crucial in determining the costs associated with investments, exports, and imports, as well as its effect on economic growth. Frequent exchange rate changes reduce commerce by making the economy unpredictable and limiting the flow of money by causing a decline in foreign investment and the collapse of the portfolio of financial assets. Additionally, when the real exchange rate fluctuates more frequently and with greater intensity, the cost of tradable products rises as well as the risk of having to cover unanticipated changes in the actual exchange rate (Shiri, Hosseini, & Ashtiani, 2017).

According to what was said, the major goal of the present study is to look at how exchange rate changes affect tax collections in the Iranian economy. In this regard, the impact of the economy's level of openness, the industrial production-to-GDP ratio, per capita GDP, and the inflation rate on tax revenues are all examined. There are five sections to this research. The second section of the essay provides a summary of the domestic and international research that has been done on the topic after the introduction's basic discussion of tax income. The third section introduces the study's model, methodology, data-gathering strategy, and testing. The model is estimated and examined in the fourth section, and then findings and useful recommendations are offered in the fifth section based on the estimates.

Literature review

Numerous research has been done in the area of variables that affect tax income. These studies have extensively looked at structural and institutional variables such as GDP per capita, foreign aid, foreign direct investment, inflation, real exchange rate, free trade, participation ratio in GDP, debt to GDP, corruption, and legality. Exchange rate variations are one of the primary variables affecting tax collection in the interim. The exchange rate, one of the most significant and vital economic factors, has a significant influence on how economic players behave and make decisions about how to allocate resources (Nakhjavani, 2014). Demand and supply across the whole economy are impacted by exchange rate variations or positive or negative exchange rate shocks. Positive exchange rate shocks will drive up export prices while driving up import prices, increasing local demand for products. Because abnormal exchange rate fluctuations raise the cost of imported commodities, which in turn raises inflation, there is a cause-and-effect link between abnormal exchange rate fluctuations and reduced buying power. The significant exchange rate changes force exporters to either cease operations or seek more profits in return for greater risk. The rise in profit desired by exporters and importers

will be reimbursed to purchasers through more costly sales as a result of the country's incapacity to establish global pricing; as a result, there will only be a price increase and inflation (Engle & Ng, 1993). Several studies have been undertaken in the area of examining variables impacting tax revenues and the effect of exchange rate variations on financial performance; the most significant of them are highlighted here.

In a study, Totunchi-Melki et al, assessed the variables influencing tax receipts in the Iranian economy from 2010 to 2016. They adopted the strategy of dynamic averaging models for this (TVPDMA). According to the study's findings, the factors that have the most influence on the rise of direct taxes in the Iranian economy are the economy's degree of openness, the development of the construction budget, inflation, the average tax rate, and the increase of real earnings. In addition, the most significant factors influencing the growth of indirect tax revenues are, in order, real income growth, the growth of the construction budget, inflation, the size of the black market, the exchange rate of the informal market, and the value-added ratio of the service sector to the GDP (Totunchi Melki et al., 2020). A study entitled "Investigating the Impact of Government Tax Revenues on the Prosperity of Iran's Economy for the Period of 2013-2015" was undertaken by (Fuladi, Kakai, & Khairdast, 2018), They applied the Autoregressive Distributed Lag (ARDL) in this case. The findings of this study demonstrated a correlation between the variables that were investigated. Additionally, it was confirmed that all of the model's variables had a significant and favorable relationship in the short term, with the income from import taxes having the greatest impact on economic growth. Wealth tax, income tax, and value-added tax do not, however, appear to have a substantial long-term effect on Iran's economic growth (Fuladi, Kakai, & Khairdast, 2018). In a research published in 2018, Aqiqi (2018) examined the effects of tax collections and their variations on economic development from 2019 to 2026. In this work, the modified least squares approach was used to estimate the economic-growth model. The findings suggest that as each of the three variables—population growth, openness level, and changes in national production—increases, so will economic growth. The outcomes also demonstrated that the variable representing government tax income and its variations lacks the requisite importance in this model (Aqiqi, 2018).

In 2017, Akbari et al. looked at the connection between tax collections and economic security in Iran. They employed the Winston-Price regression estimation approach and data from the 1361 to 1395 time period to achieve this. The analysis' findings show that giving economic stability leads to increased investment opportunities (particularly for the private sector) and higher tax revenues. As a consequence, it is advised that doing so will enhance both of these (Akbari, Al-Raji, & Shams-Esfandabadi, 2017). In research published in 2017, Tamizi used a Bayesian econometric methodology and the technique of moving averages (MBA) to examine the factors influencing tax receipts in Iran between the years 2010 and 2012. The findings of this study demonstrated a positive relationship between the variables of literacy rate, GDP growth, population growth, the added value of the industry sector, and government expenditures, as well as a negative relationship between the variables of the exchange rate, Gini coefficient, the added value of the agricultural sector, revenues, and added value of the oil sector. Additionally, the results showed that altering the economic structure, raising the proportion of the industry, industrializing the agricultural sector, reforming tax laws, and offering effective implementation options to lower large investors' tax evasion will all play a significant role in raising the effectiveness and efficiency of the tax system (Tamizi, 2018). To better understand the connection between exchange rates and taxes in emerging nations, Atayyeh and Taftani Eskoui performed research. They examined the relationship between exchange rate variables, GDP, population, government consumption expenditure, and government investment expenditure with tax revenues in 9 selected developing countries from 2002 to 2015 using the panel co-integration technique and the ordinary least squares (OLS) approach. According to the findings, there was a significant correlation between the aforementioned factors and tax receipts during the research (Atayyeh & Taftani Eskoui, 2016) Kwesi et al, analyzed the effect of exchange rate variations on tax revenue in research. They employed the GARCH approach and the Autoregressive Distributed Lag (ARDL) in this respect. The study's findings demonstrated that exchange rate variations have an impact on tax revenue both in the short and long term, but that the long-term impact is bigger than the short-term impact. This paper makes the recommendation that planners and policymakers step

up their exchange rate stability efforts to lessen the currency risk placed on global commerce (Kwesi Ofori, Obeng, & Armah, 2018).

Research by Tracy and Blagg examined how Kansas's income tax reductions affected job growth in the short run. Using the information on the number of workers and owners, they used a difference-in-differences (DID) technique to analyze the impact of changes to Kansas' private sector employment tax in comparison to border states. Additionally, they discovered the effects of taxes by applying the sector boundary matching method and the multi-state fixed effect model. Their findings demonstrate that two years following the tax law's enactment, revisions made to it did not result in a net rise in the number of jobs in the private sector (Turner & Blagg, 2018).

Lagat & Nyandema, investigated how changes in foreign currency rates affected the financial performance of commercial banks listed on Kenya's Nairobi Stock Exchange. Additionally, data on cases from the years 2006 to 2013 was gathered. Pearson's correlation coefficient was employed in this study to examine the correlation between the study variables. The study's findings revealed a substantial positive association between financial performance measures and exchange rates, indicating that the volatility of the exchange rate has aided in the rise in bank profitability (Lagat & Nyandema, 2016).

Using data from 261 multinational firms between the years 1984 and 2002, Lee and Sun researched the changes in the exchange rate and the operational performance of multinational corporations. The findings demonstrated that, in the majority of the examined industries, the impact of exchange rate changes on the profitability of foreign operations is not statistically significant, and in the majority of these industries, the profitability of foreign operations was less than 2% when exchange rate changes were taken into account. Additionally, the impact of currency exchange rate fluctuations on the profitability of overseas operations has been minimal for non-American multinational corporations including those in Australia, Canada, Japan, and the United Kingdom. The findings of the studies show that exchange rate changes, as one of the significant and crucial factors of the economy, have a significant influence on how economic players behave and make decisions about how to allocate resources. Changes in exchange rates can affect tax collection in both the short and long terms. Widespread exchange rate swings, which are a feature of emerging nations, make it difficult for business and production choices to be made, which has an impact on macroeconomic factors, particularly the government's revenue sources (Lee & Suh, 2012).

Methodology

The real variation of the exchange rate was determined in this study utilizing the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. The following analyses time series data using an Autoregressive Distributed Lag (ARDL) to examine how exchange rate variations affect tax receipts in the Iranian economy. The variables considered in this study include the tax revenue to GDP ratio, the inflation rate, the industrial production to GDP ratio, the GDP per capita, the degree of economic openness, and exchange rate volatility. The World Bank, the Iran Statistics Center, and the Central Bank of the Islamic Republic of Iran's economic time series database were used to compile the necessary data for the variables for the years 1979 to 2018.

Unit root test

The unit root test, in particular, is employed for this purpose. Observing a variable's time series graph is the first step in establishing its mean, however, for some variables, the mean cannot be determined from the graph alone. The unit root test, to put it simply, is a test used to determine whether a time series is normal. Being invisible means having a single root. Dicky and Fuller introduced one of the most well-known tests to determine if a series contains a unit root in 1976, and (1979). In the first-order self-explanatory process (AR(1)) shown in equation (1), the test's primary goal is to compare the null hypothesis $\emptyset=1$ (the existence of a single root and variable indeterminacy) against the hypothesis $\emptyset<1$:

$y_t = \emptyset y_{t-1} + u_t$ Equation (1)

We shall infer that the variable is mean if the null hypothesis (H 0), which rules out the presence of a unit root, is rejected. The generic model (2) presents the unit root (root = 1) or invariance, which can take one of three

forms: (1) without width from origin and trend; (2) with width from origin and trend; or (3) with width from origin and trend:

$y_t = \mu + \beta t + \emptyset y_{t-1} + u_t$ Equation (2)

The time series is considered to be a first-order self-explanatory process in the Dickey Fuller test. If the time series under examination has an order n self-explanatory process and this assumption is false, the relationship calculated for test n will not have the proper mean specification. This will result in the autocorrelation of the regression error sentences, making it impossible to utilize this test in this situation. Instead, the Augmented Dickey-Fuller test (ADF) should be applied. The Dickey-Fuller test is expanded upon in the ADF test used Δy_{t-i} for higher-order self-explanatory processes (Nofarsti, 2012).

Durbin-Watson test

When using time series analysis with an autocorrelation model, the residuals of the unit lag model or AR(1) model should be independent from one another. Durbin-Watson (DW) test is a method to detect correlation in residuals of regression model analysis. DW testing may be used to verify this. A model's parameters may not be estimated accurately if there is autocorrelation since it makes it difficult to estimate variance and standard deviation. In this manner, the DW test is efficient and helps to ensure the accuracy of the analysis findings. The Durbin-Watson test's presuppositions are as follows:

Null hypothesis: Here, there is a first-order absence of autoregression. In terms of the autocorrelation function, or ACF, this indicates that for the data (residuals), there is either no correlation between the residuals at time t and t1 or it is zero.

Counter hypothesis: Serial correlation exists between observations or residuals of unit lag in the Durbin-Watson test. As a result, even if this dependency is defined by ACF (1) 0, the correlation between the residuals of time t and t1 is opposite to zero. The model's residuals need to be average, which denotes that neither the mean nor the residuals' direction should vary over time. This is another prerequisite for time series analysis.

Generalized Autoregressive Conditional Heteroscedasticity Model (GARCH)

As previously indicated, this Generalized Autoregressive Conditional Heteroscedasticity model is used to calculate the real exchange rate variation (GARCH). Generalized Autoregressive Conditional Heteroscedasticity (ARCH) model was first presented by Engel (1982). The conditional variance may be estimated using this model, which is used to calculate uncertainty changes over time. The following equation serves as a representation of the ARCH(q) model:

$$h_t = \alpha_0 + \sum_{j=1}^{q} a_{1j} u_t^{2-j} \text{ Equation (3)}$$

Equation (3) was provided as equation (4) by Ballerslow (1986), who created the conditional variance model by including h t intermittent values:

$$ht = \alpha 0 + \sum_{j=1}^{q} a1jut2{-}j + \sum_{j=1}^{p} a2jht{-}j \text{ Equation (4)}$$

The pattern in Equation (4) is GARCH (p,q). To identify the GARCH model, the coefficients a_{1j} and a_{2j} must establish the requirement of being non-negative and the equation $\sum^{q}_{j=1} a_{1j} + \sum^{p}_{j=1} a_{2j}$ must meet the criterion of significance.

Autoregressive Distributed Lag (ARDL) model

The description of this approach is provided in this portion because the goal of the study is to examine how exchange rate variations affect tax revenues in the Iranian economy using the time series analysis method of the Autoregressive Distributed Lag (ARDL) model (Pesaran & Shin, 1995) demonstrate that if Autoregressive Distributed Lag (ARDL) model whose intervals are well described is created as a covariate vector using the least squares approach. The least squares estimator will have a normal distribution in addition to being less biased and more effective in small samples. The $ARDL(p, q_1, q_2, \dots, q_k)$ pattern may be stated in the general form as follows:

$$\emptyset(L, P)Y_t = \sum_{i=1}^{k} \beta_i(L, q_i)X_{it} + \delta' W_t + \propto_t \quad \text{Equation (5)}$$

$$Q(L, P) = 1 - \emptyset_1 L - \emptyset_2 L^2 - \cdots - \emptyset_p L^p$$

$$\beta i(L, qi) = \beta i0 + \beta i1L + \cdots + \beta iqiLqi$$

In equation (5), L is the first-order time delay operator ($LY_t = Y_{t-1}$, Y_t is the dependent variable, X_{it} is the vector of explanatory variables, k is the number of explanatory variables, (q 1,...,q i) is the number of optimal lags related to each of the explanatory variables, p is the number of optimal lags related to the dependent variable, and W_t is the vector of deterministic variables such as latitude from the origin, seasonal variables, time trends or exogenous variables with constant lags. Microfit software can be used to estimate Equation (5). This software determines the number of $(m + 1)^{k+1}$distinct regression estimates for the aforementioned equation using the ordinary least squares approach for all values of p=0,1,2,...,m and q i=0,1,2,...,k and i=1,2,...,k. All models are estimated throughout the same time ($t = m + 1, \ldots, n$), with the researcher first determining the maximum number of interruptions, or d. This indicates that the resulting model loses m degrees of freedom since m primary data were discarded during estimation. The following stage involves choosing the model's optimum intervals using one of the Akaike (AIC), Schwartz-Baysin (SBC), Hanan-Quinn (HQC), or modified coefficient of determination $\bar{R}^2$ criteria. Pesaran and Shin provide the Schwartz-Bayesian (SBC) criterion as an alternative to the aforementioned standards for the optimal model interval definition. This criterion reduces the number of lags due to the limited sample size, which reduces the number of degrees of freedom. This criterion is employed in this study to establish the ideal number of lags. The Microfit software computes the long-term coefficients and their lateral standard error while providing the diagnostic test results based on the estimated coefficients of the chosen ARDL model. It offers an error correction model (ECM) in addition to the program in question, depending on the model chosen. The variables $X_{1t},...,X_{kt}$, Y_t, and W_t are considered in terms of values with a firstorder interval and difference to extract the ECM pattern based on the ARDL pattern ARDL ($p, \hat{q}_1, \ldots, \hat{q_k}$), and the ECM pattern is obtained as follows:

$$\Delta Y_t = -\emptyset(L, P)EC_{t-1} + \sum_{i=1}^{k} \beta i0 \Delta Xit + \delta' \Delta Wt \quad \text{Equation (6)}$$

$$- \sum_{j=1}^{\hat{p}-1} \emptyset_j^* \Delta Y_{t-j} - \sum_{i=1}^{k} \sum_{j=1}^{\hat{qt}} \beta_{ij}^* \Delta X_{i,t-j} + U_t$$

To connect short-term fluctuations of variables with their long-term variations, the ECM model of equation (6) is employed. The error sentence arising from the estimation of equation (5), which is entered with a time interval, is known as the error correction sentence (EC_{t-1}). The short-term dynamic structure of the model is established by carrying out the relevant tests after estimating the aforementioned equation using the OLS technique. The parameter EC_{t-1} in the aforementioned error correction model represents the rate at which long-term equilibrium is approaching. This coefficient displays the percentage of the dependent variable Y_t's imbalance from the prior period that has been made up in the present period.

This variable is anticipated to have a negative sign and a value shift from zero to one. In general, the ARDL technique suggests the following two-stage modeling approach:

Step 1: The hypothesis that there is no auto-egression between the variables of the pattern is evaluated after first calculating the index connected to the long-term pattern using statistics related to the level of the variables. By doing this, we will be able to produce a group of variables that work well together and offer a long-term equilibrium connection.

Step 2: The long-term mean model's regression error term, also known as the error correction term, is utilized in the ECM model as an explanatory variable. The ECT coefficient displays the rate of equilibrium adjustment.

Specifying the experimental model

According to Ofori (2018), the regression model below is used in this study to examine the impact of exchange rate variations on tax collections in Iran's economy:

$$ln\left(\frac{TR}{GDP}\right)t = \beta 0 + \beta 1 lnINFt + \beta 2 lnINDt + \beta 3 lnGPCt + \beta 4 lnOPNt + \beta_5 lnEXV_t + \varepsilon_t \quad \text{Equation (7)}$$

In equation (7), TR/GDP stands for the tax revenue to GDP ratio, INF for the inflation rate, IND for the industrial output to GDP ratio, GPC for the per-capita GDP, OPN for the economy's degree of openness, and EXV for exchange rate volatility. Within the context of the ARDL approach, the regression equation (7) is expressed as follows:

$$\Delta ln\left(\frac{TR}{GDP}\right)_t = \delta_0 + \emptyset ln\left(\frac{TR}{GDP}\right)_{t-1} + \alpha_1 lnINF_{t-1} + \alpha_2 lnIND_{t-1} + \alpha 3 lnGPCt{-}1 + \alpha 4 lnOPNt{-}1 + \alpha 5 lnEXVt{-}1 + \alpha 6 lnRERt{-}1 + \sum_{i=1}^{p} \beta 1 \Delta ln\left(\frac{TR}{GDP}\right)t{-}i + \sum_{ii=1}^{p} {}_{=1}{}^{2}{}_{t-i}\ \beta\ \Delta ln(INF) + \sum \beta_3 \Delta ln(IND)_{t-i} + \sum_{i=1}^{pp} \beta_4 \Delta ln + (GPC)_{t-i} + \sum \beta_5 \Delta ln(OPN)_{t-i} + \sum_{i=1}^{p} \beta_6 \Delta ln + (EXV)_{t-i} + \sum \beta_7 \Delta ln(RER)_{t-i} + \varepsilon_t \quad \text{Equation (8)}$$

As shown, Long-term tensions are represented by $\emptyset$ and α_i and short-term tensions by β_i.

Results

In this study, time series data from the years 1979 to 2018 were utilized to examine how changes in the exchange rate affected tax collections in the Iranian economy. The time series of the examined period's GDP, tax revenue, industrial output to GDP ratio, level of economic openness, inflation rate, and real exchange rate at the base price of the year (1390) are depicted in graphs (1) through (6), respectively. It is vital to clarify that the nominal exchange rate and the ratio of the consumer price index (CPI) between Iran and the United States are used to compute the actual exchange rate. The figures show that the GDP variable initially had a steady trend and varied between 2001 and 2018. Beginning with a stable trend, the variable TR then had an increase trend from 2010 to 2017. The variables IND, OPN, and INF display varying trends across the examined time. The RER variable likewise exhibits an increasing tendency, however, since 2019, the variable's behavior has been erratic.

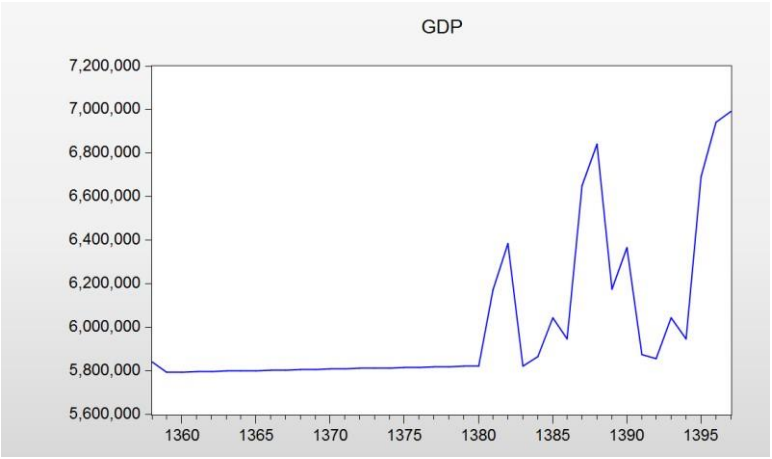

Chart 1. The trend of the gross domestic product during 1979-2018

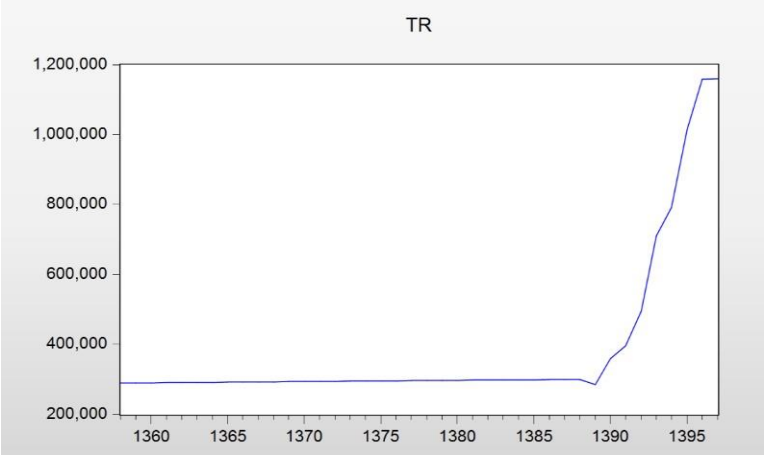

Chart 2. The trend of tax revenue during 1979-2018

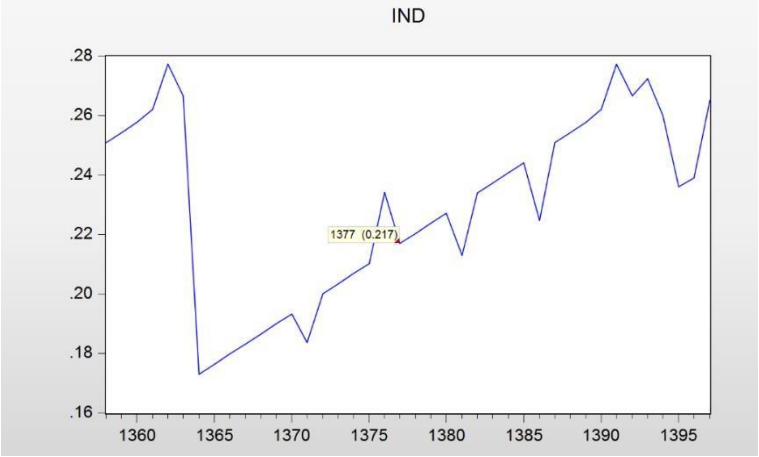

Chart 3. The trend of the ratio of industrial production to GDP during 1979-2018

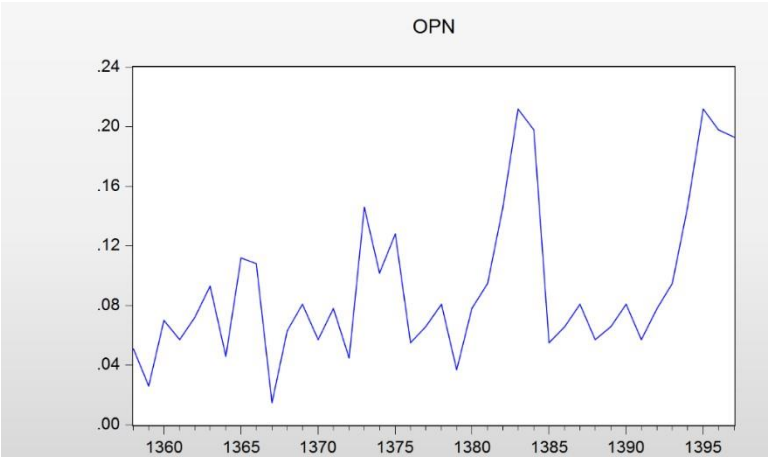

Chart 4. The trend of the degree of economic openness during 1979-2018

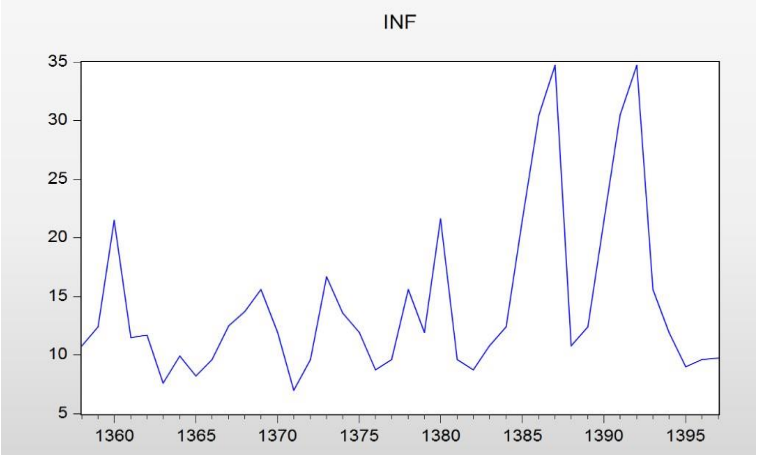

Chart 5. Inflation rate trend during 1979-2018

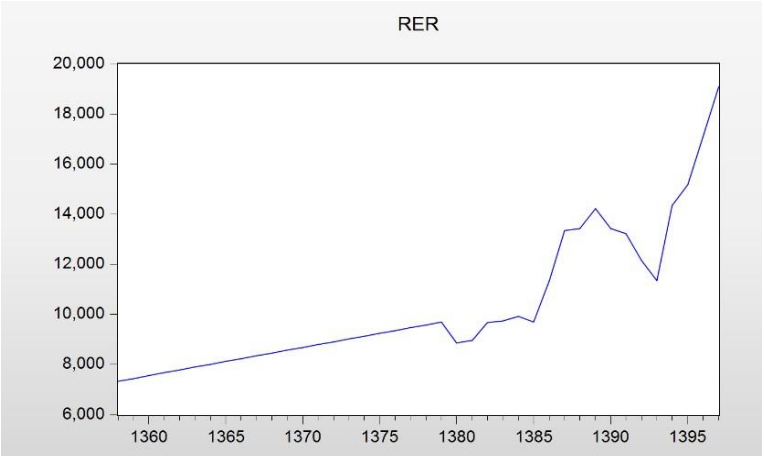

Chart 6. Real exchange rate trend during 1979-2018

Statistical features of variables

The statistical features of the analyzed variables, including kurtosis, skewness, mean, standard deviation, maximum, and minimum, are described in the table below before the research's hypotheses are put to the test. Table 1. shows that all of the data are non-normal, hence the variables needed to be transformed into a normal form using the logarithm of the variables.

Table 1. The statistical features of the studied variables

	GDP	The ratio of industrial production to GDP	Inflation rate	Degree of economic openness	Real exchange rate	tax income
Mean	5855406	0.230	14.428	0.093	10309.04	387564.7
Median	5818736	0.235	11.9	0.078	9299.49	295927.7
Maximum	6990834	0.277	34.7	0.12	19085.23	1159562
Minimum	5791904	0.173	7	0.015	7337.24	284527.9
SD	4.349475	0.031	0.235	0.052	2811.266	234317.9
Skewness	1.751059	-0.305	1.637	1.066	1.352	2.507
Kurtosis	4.720308	1.875	4.757	3.226	4.181	7.877
Jarque-Bera	25.37381	2.728	23.007	7.663	14.513	81.369
Probability	0.000003	0.256	0.00001	0.217	0.0007	0

Model implementation and tests analysis

Testing the importance of each of the employed variables is important before estimating the model that is provided. The significance was examined using the Autoregressive Dickey-Fuller (ADF) test, as described in the part above. This test's null hypothesis reveals that the variables are non-stationary. In this instance, the null hypothesis will be rejected if the probability values are less than 0.05. In this approach, Table 2. displays the results of the stationary test for the data.

Table 2. The results of the stationary test for variables using ADF

Variable name	test ADF		Result
	Statistics	Critical statistic at 5%	The variable is stationary at the level:
tax income	-5.617***	-3.610	I(0)
Degree of economic openness	-2.799**	-2.607	I(0)
Inflation rate	-4.528***	-3.615	I(0)
The ratio of industrial production to GDP	-3.328**	2.948	I(1)
GDP per capita	-6.455***	3.610	I(0)
Real exchange rate	-6.686***	3.610	I(0)
Exchange rate	-4.948***	-3.615	I(1)

As Table 2. shows, the Autoregressive Dickey-Fuller statistic (ADF) calculated for all variables, except the variables industrial production to GDP ratio (IND) and exchange rate volatility (EXV), is greater in absolute value than the critical statistic, rejecting the H_0 hypothesis or the idea that these variables have a single root. With just one difference, the ADF statistic associated with the two variables IND and EXV, which are at the unimportant level, is bigger than the crucial statistic, demonstrating the variables' significance.

Extracting the currency volatility index

The existence of conditional heterogeneity variance is assessed in this part to look at the possibility of ARCH effects. The ARCH-LM statistic was utilized for this purpose, and the results are shown in Table. The equality of variances, the null hypothesis of the test, has been rejected based on the probability level of the F statistic, hence the results indicate that there is conditional heterogeneity variance. Since the intended variance, or the variance of exchange rate swings, cannot be constant, the presence of ARCH effects is acknowledged at a confidence level of 1%.

Table 3. Results of the ARCH-LM test for the residuals of the exchange rate time series

Statistics	Probability level
F statistics	0.000
observational R^2 statistic	0.000

The relevant model may be calculated in this way. The GARCH (1,2) model was shown to perform better than other models in describing the variance of the heteroskedasticity after a review of the ARCH family models. To predict exchange rate variations, this model was utilized; the results are shown in Table 4.

Table 4. GARCH estimation for the residuals of the exchange rate time series

Variable	Coefficients	Z statistics
C	65.92	8.02
	Variance equation	
C	0.00137	0.390
RESID (-1)^2	2.007	4.001
GARCH (-1)	0.453	0.241

The model is shown in Table 4.'s findings as equation (9), and it is evident from the DW statistic that the residuals do not exhibit any correlation:

$\sigma i2^2 == 00..001378 \quad + \ DW0.453 = \sigma 2i.2{-}11 \ + 2.007 \ i2{-}1$ Equation (9) R

Model estimation by ARDL method

The ideal interval should be chosen to estimate the model. The Schwartz-Baysin criteria have been applied for this purpose. The findings of this statistic indicated that two is the ideal interval. First, the short-term ARDL coefficients were calculated with the difference in factors in mind; the results are shown in Table 5.

Table 5. Short-term coefficients of the ARDL model (1,0,0,0,0,1,1) (dependent variable: the difference in the ratio of tax revenue to GDP)

Variable	Coefficient	Standard error	T statistics
TR/GDP(-1)	0.282***	0.173	1.627
EXV	-3.63**	1.48	-2.453
GPC	1.45	8.13	0.177
IND	-0.782*	0.604	-1.294
INF	-0.002**	0.001	1.288
OPN	-0.493**	0.384	-2.455
OPN(-1)	-0.719*	0.409	1.757
RER	0.014	0.104	0.134
RER(-1)	-1.54*	1.08	-1.43
C	0.216*	0.152	1.416
S.E. of regression	0.0838	Akaike info criterion	-1.902
Sum squared resid	0.203	Schwarz criterion	-1.476
Log likelihood	47.104	Hannan-Quinn criter.	-1.749
F-statistic	1.473	Durbin-Watson stat	2.15
Prob(F-statistic)	0		

***: significance level of 1%, **: significance level of 5% and *: significance level of 10%

The findings of Table 5. indicate that the per capita gross domestic product (GPC) is not statistically significant. At 10%, there is a significant negative correlation between industrial production as a percentage of GDP (IND) and tax revenue. At 5%, the inflation rate (INF) also significantly negatively affects tax income. In both periods, there is a significant inverse relationship between tax revenue and the openness of the economy (OPN) variable. At a level of 10%, the real exchange rate variable (RER) and tax revenue have a significant negative relationship in the second period but a non-significant positive relationship in the first.

Tax income is impacted by the rise in exchange rate fluctuations (EXV) in the context of openness of trade (OPN), and because of the risk it poses, it suffers in the near term.

The long-term form and F-Bounds test are used in the following to demonstrate the presence of a long-term relationship and co-accumulation between variables. The table contains the test's findings at a significance level of 5%. For 31 to 80 observations, the computational limits of Narian (2004) are simulated and determined. The findings of Narian banks are displayed in the following table for a total of 40 variables.

Table 6. Long-term relationship test between variables

	F-statistic	Limited sample = 45	
		I(0)	I(1)
(Number of actual samples = 40)	5.190	3.15	4.43

There are two upper and lower bands on this exam. If the F-statistic is higher than the upper band, the co-accumulation connection is verified; if it is lower than the lower band, there is no co-accumulation; and if it is in the middle of these two bands, it is unclear with certainty whether there is or is not an autoregressive relationship. It is possible to extract the long-term relationship between the variables based on the acquired F statistic since its value is larger than the upper band and confirms the presence of co-accumulation vectors. The findings are shown in Table 7.

Table 7. Long-term coefficients of the ARDL model (dependent variable: ratio of tax revenue to GDP)

Variable	Coefficients	Standard error	t-statistics
EXV	0.000004**	0.00001	2.561
GPC	0.0002	0.001	0.177
IND	0.804*	0.591	1.361
INF	-0.002*	0.0017	-1.33
OPN	-0.230	0.408	-0.564
RER	-0.000002	0.000002	-0.869
C	0.222*	0.146	1.522

**: significance level of 5% and *: significance level of 10%

Findings shown in Table 7., make it evident that over the long run, there is a large direct link between exchange rate variation (EXV) and tax revenue. The computed coefficient states that a one percent increase in this variable results in a 0.000004% increase in tax income. In the long run, there is no significant relationship between GDP per capita (GPC) and tax revenue. At a level of 10 percent, there is a large direct and inverse link between the ratio of industrial output to gross domestic product (IND) and the inflation rate (INF) to tax revenue. An error correction model was calculated to see if short-term imbalances will balance out over time, and the findings are displayed in Table. The short-term model's estimated Ecm (-1) coefficient, which is statistically significant and represents the rate at which the short-term balance adjusts toward the long-term balance, is 0.79, according to the findings of Table 8.

Table 8. Coefficients of the error correction model (dependent variable: the difference in the ratio of tax revenue to GDP)

Variable	Coefficients	Standard error	t-statistics
EXV	0.0004**	0.0001	2.453
GPC	0.0002	0.001	0.271
IND	0.782**	0.604	1.294
INF	0.002*	0.001	1.288
OPN	-0.943**	0.384	-2.455
RER	0.0000001	0.000001	0.013
Ecm(-1)	-0.791***	0.173	-5.596

***: significance level of 1%, **: significance level of 5% and *: significance level of 10%

Discussion and conclusion

This study aims to investigate the impact of currency fluctuations on tax receipts in the Iranian economy. This information was gathered from the Central Bank of the Islamic Republic of Iran, the Iran Statistics Center, and the World Bank and relates to the variables of the ratio of tax revenue to GDP, inflation rate, the ratio of industrial production to GDP, GDP per capita, the degree of economic openness, and exchange rate fluctuations between 1979 and 2018. Following, the Generalized Autoregressive Conditional Heterogeneity Variance (GARCH) was used to determine the real exchange rate fluctuation, and the Autoregressive Distributed Lag (ARDL) model was used to estimate the relationships between the tax income variable and the aforementioned variables. According to the results, the actual exchange rate's short-term fluctuations have a delayed impact on tax collection. The statistical evidence demonstrates that the increase in exchange rate fluctuations when the business is open has an effect on tax revenue and due to the risk it imposes on it, it results in a decrease in tax revenue in the short term. This is significant given that the import of capital and intermediate goods is one of the primary sources of tax revenue. To put it another way, frequent volatility and ongoing ambiguity in real exchange rates might result in a decline in tax revenues by causing an ambiguous and unstable situation in terms of the benefit from global exchanges. The findings of this study are in line with those of Totunchi-Melki et al. (2016), Lagat & Nyandema (2016), Osandina et al. (2016), Isak et al. (2018), and Ataiyeh and Paitakhti Oskoiue (2017).

It may be said that if government expenditures are financed by the production of new money, it will not have any long-term influence on the real exchange rate when describing the long-term impact of exchange rate variations on tax collections. In actuality, this situation reflects the true nature of fiscal policy, which primarily focuses on the breakdown of the government's demand for tradable and non-tradable commodities. The price of non-tradable commodities rises in response to an increase in government expenditure on non-tradable items that are funded by a lump-sum tax, which also works to support the long-term real exchange rate. The findings of this study are in line with those of Kwesi et al (2018).

The results show that better steps should be taken by monetary policymakers in the short term to control exchange rate swings. For instance, the short-term interest rate can be adjusted to reflect the efficiency of the actual economy's sectors, which in turn reduces the demand for money from speculators in circumstances when the exchange rate is significantly rising. To lessen exchange rate swings, it is also essential to manage the factors (budget deficit, trade imbalance, and liquidity growth) that contribute to these changes.

To enhance tax revenues while avoiding a rise in production costs, the government can lower the inflation rate by employing workable alternatives, such as limiting a fast increase in societal liquidity and restricting the conversion of oil dollars into Rials. To connect with international organizations and lift sanctions, the government should also work to stabilize the value of the national currency and boost tax collections. By studying the commercial and economic environment of the nation and drawing on the experience of other nations, the auditing organization, the organization in charge of compiling accounting and auditinsg standards, should provide a comprehensive reporting environment, ensuring that the minimum information requirements of exchange rate fluctuations are met.

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