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The Relationship Between Financial Development and Tax Revenues in Türkiye: Hatemi-J Asymmetric Causality Analysis

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Abstract: *Financial development, defined as the growth of all elements within a financial system, can have an impact on various macroeconomic factors. Funds raised through financial development can be used to finance new investments needed for economic growth. As a result, new tax jurisdictions are created, and tax revenues increase. The aim of this study is to explore the causality relationship between financial development and tax revenues in Türkiye using up-to-date methods. Annual data on Türkiye's financial development index and tax revenue/GDP ratio for the period 1985-2021 are used. In order to determine the relationship between financial development and tax revenue, firstly, the stationarity of the series is analyzed using the two-break Narayan-Popp unit root tests that take structural breaks into account. Then, the existence of a causality relationship is analyzed using Hatemi-J asymmetric causality tests. According to the unit root test results, the series is stationary when the first difference is taken. According to the findings of the Hatemi-J test, there is no causality relationship from all shocks of financial development to all shocks of tax revenues, when the other direction of causality is analyzed, it is concluded that there is no causality relationship from all shocks in tax revenues to all shocks in financial development.*

Keywords: Financial Development, Tax Revenue, Narayan-Popp Unit Root Test, Hatemi-J Asymmetric Causality, Türkiye

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1. Introduction

While tax revenues support government expenditure, they are also an important policy instrument to support fiscal policy. In addition, taxes can be used, among other things, to stimulate economic growth. In recent years, governments have endeavored to increase tax collections to adequate levels to increase budget flexibility. According to this view, tax revenues not only fulfill various fiscal and economic objectives, but also play a vital role in the fiscal soundness of the country. Moreover, increasing tax collection is critical for reducing dependence on foreign aid, managing macroeconomic challenges, limiting borrowing and ensuring good economic growth (Terefe & Teera, 2018: 135).

Financial development is defined as the aggregation of savings obtained through the financial system, the transfer of funds to productive initiatives, the monitoring of such initiatives, risk sharing and improvements in the exchange of products and services (Svirydzenka, 2016: 4). Financial development, defined as the growth of all elements within a financial system, can have an impact on various macroeconomic factors. Funds provided through financial development can be used to finance new

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investments required for economic growth. As a result, new tax jurisdictions are created and tax revenues increase. At the same time, funds obtained through financial development can reduce the current account deficit through technical competitiveness and export growth (Karaş, 2023: 133). This notion has gained importance as a part of the globalisation process, especially since the 1980s. The globalisation process has accelerated the mobilisation of goods and services markets, increased financial activity, increased the amount of transactions and the number of investors in financial markets and affected the financial development process. The financial development process is an economic activity that has an impact on both real and financial markets. Financial trends have an impact on tax collections by affecting economic growth. This is due to the fact that financial developments will have a direct or indirect effect on tax collections by expanding the taxable base as a result of economic expansion (Şahin, 2020: 689; Sağdıç & Yıldız, 2021: 108).

In the finance literature, there are three assumptions about the relationship between financial development and economic growth. According to the supply-side theory, financial development is said to facilitate and stimulate economic growth by enabling resource allocation, capital stock and technological diffusion. The second demand-side theory claims that increasing welfare and economic growth will increase the demand for goods and services, which in turn will lead to the expansion of the financial sector. In terms of the third theory, the feedback hypothesis, financial development and economic growth are complementary and mutually influencing each other (Akçay et al., 2016: 103). These ideas attempt to articulate how financial development and economic growth interact. Increases in financial development and economic growth have a direct or indirect impact on the tax collection performance of the public sector by expanding the base of taxable economic activity (Şeyranlıoğlu, 2023: 88).

Financial development may have direct and indirect effects on tax revenues. Firstly, economic expansion increases taxable economic activity, leading to higher tax collection. Secondly, economic expansion provides social welfare benefits and leads to an increase in tax revenues and additional investments by increasing the demand for goods and services. As a result, the tax base expands and contributes directly to tax collection. Thirdly, financial development and economic growth facilitate tax monitoring and collection by preventing the spread of the informal economy and increase tax collection (Ajide & Bankefa, 2017: 16; Akçay et al., 2016: 104).

Initially, advancements in this industry can stimulate economic growth. Three theories can be articulated regarding the impact of advancements in the financial sector on economic growth. The supply-led hypothesis posits that the financial sector enhances economic growth by supplying essential money for capital accumulation and technical advancement. The demand-side theory posits that economic expansion will elevate the demand for financial services, facilitating the development of new financial institutions and frameworks. The demand-side hypothesis indicates that economic expansion stimulates financial development. The feedback hypothesis posits that financial development and economic growth exert reciprocal influences on one another (Akçay et al., 2016: 103). The hypotheses suggest a substantial correlation between financial development and economic growth. Numerous research examining the situation in Turkey have also determined that financial development enhances economic growth (Altıntaş & Ayrıçay, 2010; Güney, 2017; Pata & Ağca, 2018). An augmentation in economic growth signifies an extension of taxable economic activities and a rise in tax collections. Numerous studies have determined that economic expansion enhances tax collections (Muibi & Sinbo, 2013; Terefe & Teera, 2018).

The second explanation about the influence of financial development on tax collections posits that economic expansion fosters wealth and elevates the demand for goods and services. This circumstance facilitates the actualization of fresh investments. Economic expansion leads to heightened investments, resulting in increased tax collections. Tzougas (2013) concluded that private investments enhance tax collections. Conversely, economic growth may enhance foreign direct investment (Iamsiraroj & Doucouliagos, 2015) and consequently tax income (Sarısoy & Koç, 2010; Balıkçıoğlu et al., 2016)

The third explanation posits that both financial development and economic growth can inhibit the proliferation of the shadow economy and enhance tax collections. Financial development can immediately enhance tax collections by improving tax monitoring and collection. Entrepreneurs prefer not to disclose a

portion of their revenue to provide misleading or incomplete statements to the bank. Entrepreneurs may thus encounter elevated prices for credit access and stringent requirements for credit acquisition. A diminished degree of financial development consequently incentivizes depositors to partake in tax evasion, as the marginal benefit of such evasion is at least equivalent to its marginal cost (Bittencourt et al., 2014). In this context, informality correlates with elevated credit costs, a significant factor in the total potential cost of operating in the underground economy. As financial growth diminishes the cost of borrowing, it elevates the opportunity cost of informality (Capasso & Japalli, 2013). Analysis of the literature on this problem reveals that financial progress diminishes the informal economy (Berdiev & Saunoris, 2016; Bayar & Öztürk, 2016; Bayar & Aytemiz, 2017).

Although the increase in tax collection is a positive development for Türkiye, the factors affecting tax revenues are of critical importance for the upward trend to continue. Economic variables such as the size of the informal economy, the share and nature of foreign aid, the sectoral composition of production, the degree of openness of the country, fair income distribution, per capita income, inflation rate and economic growth rate are determinants of tax revenues. Other determinants include globalization, economic and political stability, population density, corruption, degree of institutionalization of the economic and social system, bribery, tax competition and the ratio of direct and indirect taxes to total tax revenues (Ekici, 2009: 219). For Türkiye, financial development can undoubtedly be added to these issues as a determinant of tax revenues (Akçay et al., 2016: 103; Bayar & Karamelikli, 2017: 31).

Many projects and research emphasize Türkiye 's key objectives of financial development and depth. One of the important and emerging areas of study in Türkiye is the impact of this financial development on tax collections. This study analyses the impact of financial development on tax collections for Türkiye. In this context, the financial development index of the International Monetary Fund (IMF) and the share of tax revenue in gross domestic product (GDP) are included in the models as dependent and independent variables. In the research covering a wide time period, the period 1985-2021 is considered. When the literature is analyzed, it is seen that the studies investigating the effect of financial development on tax revenues in Türkiye do not take into account structural breaks and are frequently conducted with linear models. A study that considers structural breaks using and nonlinear models to test causality between financial development and tax revenues in Türkiye has not been encountered. Therefore, it is believed that the study holds original value and is expected to contribute to the literature. In the study, whether the series contain a unit root or not is determined by the double-break unit root tests developed by Narayan-Popp (2010). In determining the causality relations between financial development and tax revenues, asymmetric causality tests developed by Hatemi-J (2012), which also take into account positive and negative shocks, are applied.

According to the results of the Narayan-Popp unit root test, it is determined that the series of FDI (Financial Development Index) and TAX (tax revenue/GDP) variables contain unit root at I(0) level, and when the series are first differenced, they become stationary at I(1) level. In the study that analyses the relationship between financial development index and tax revenues for Türkiye with asymmetric causality tests, Hatemi-J (2012) test findings indicate that there is no causality from positive disaggregated financial development to positive disaggregated tax revenues, from negative disaggregated financial development to negative disaggregated tax revenues, from positive disaggregated financial development to negative disaggregated tax revenues and from negative disaggregated financial development to positive disaggregated tax revenues at 5% significance level in the period 1985-2021. On the other hand, there is no causality from positively disaggregated tax revenues to positively disaggregated financial development, from negatively disaggregated tax revenues to negatively disaggregated financial development, from positively disaggregated tax revenues to negatively disaggregated financial development, and from negatively disaggregated tax revenues to positively disaggregated financial development.

In the second part of the study, the literature on the causality relationship between financial development and tax revenues is presented. The third section introduces the methodology, data set, variables, descriptive statistics, hypotheses and models. The fourth section presents the findings obtained. In the conclusion, evaluations are made, and policy recommendations are presented.

2. Literature

A limited number of national and international studies analyzing the relationship between financial development and tax revenues are found in the literature. In this respect, the available studies on the relationship between financial development and tax revenues are included. A country group, country and Türkiye -specific summary of the literature close to our study on the relationship between financial development and tax revenues is given.

Gilbert and Ilievski (2016) analysed the relationship between financial development indicator and tax revenues by using panel vector error correction model (panel VECM), ordinary least squares (OLS), Fizher cointegration and Pedroni panel cointegration tests for 126 countries in the period 1990-2011. They concluded that financial development has a strong positive effect on tax revenues. Nnyanzi et al. (2018) analyzed the relationship between financial development indicator and tax revenues using panel generalized method of moments (GMM) test in East African countries for the period 1990-2014. It is concluded that financial development has a significant positive impact on tax revenues. Efeoğlu (2021) analyzed the relationship between financial development indicator and tax revenues in 22 transition economy countries for the period 2004-2018 using Hurlin panel causality, Dumitrescu and Westerlund panel cointegration test. It is concluded that the causality relationship between tax revenues and financial development is bidirectional and financial development has a significant positive effect on tax revenues. Topuz (2021) analyzed the relationship between financial development index and tax revenues in 21 developing countries by using augmented mean group (AMG) estimators, common correlated effects mean group (CCE-MG) test and Durbin-Hausman test for the period 1990-2017. It is concluded that financial development has a positive and significant relationship with tax revenues in the countries subject to the study. Tsaurai (2022) analyzed the effect of financial development on tax revenues in emerging markets for the period 2005-2019 using pooled least squares, random effects, fixed effects, dynamic generalized moments methods. It is concluded that financial development has a significant positive effect on tax revenue under fixed and random effects. Yıldırım and Karadeniz (2023) analyzed the effect of financial institution development index on tax revenues in fragile five countries by using the VECM for the period 1980-2018. It is concluded that financial institution development has a positive effect on tax burden in India and South Africa, while it has a negative effect in Türkiye. Karaş (2023) analyzed the relationship between financial development and tax revenues in G-7 countries using panel asymmetric causality test, panel Fourier Granger causality test and Fourier cointegration test with data for the period 1980-2019. It is found that there is a cointegration relationship between financial development and tax revenues, there is a unidirectional causality relationship from financial development to tax revenues in Japan, the UK, and the USA, and there is a unidirectional causality relationship from tax revenues to financial development in Italy and Canada.

Taha et al. (2013) analyzed the relationship between banking-non-banking activities, one of the financial development factors, and tax revenues in Malaysia for the period 1997-2008 using VECM test and Granger causality tests. They concluded that financial development intensively affects tax revenues positively, there is a unidirectional causality relationship between financial development and tax revenues, the increase in stock market trading volumes increases tax revenues and there is no causality relationship between domestic loans to the private sector and tax revenues. Akram (2016) analyzed the relationship between total market value of stocks and number of bank branches and tax revenues in Pakistan for the period 1975-2014 using Granger causality test and Johansen cointegration test. He concluded that there is a bidirectional causality relationship between financial development and tax revenues and financial development has a significant positive effect on tax revenues. Ajide and Bankefa (2017) examined the relationship between financial system activities and tax revenue in Nigeria for the period 1981-2014 using impulse response method, variance decomposition, causality test and ARDL bounds test. As a result of the study, banking development, stock market development, banking crisis and financial inclusion variables are found to play an important role in tax revenue collections. Loganathan et al. (2017) analyzed the relationship between financial development indicators and tax revenues in Malaysia using the bootstrap causality test, parameter stability test, and Maki cointegration test in a study covering the period 1970-2015. It is concluded that there is unidirectional causality from tax revenues to financial development. Ebi (2018) analysed the

relationship between financial development indicator and tax revenues using the error correction model (ECM) test and Granger causality test in Nigeria for the period 1993-2017. According to the findings, it is concluded that financial development has a significant positive effect on tax revenues. Taha et al. (2018) analysed the relationship between financial development indicator and economic growth and tax revenues using the Brock-Dechert-Scheinkman (BDS) test, Granger causality test, Yoda-Yamamoto test, and autoregressive distributed lag- error correction model (ARDL-ECM) test, using data for the period 1970-2015 in Malaysia. It is concluded that there is an Inverted-U relationship between tax revenues and financial development. Vivien et al. (2023) analyzed the effects of financial development on tax revenue mobilization in Côte d'Ivoire for the period 1985-2020 using Granger causality test. It is concluded that there is a unidirectional relationship between financial development and tax revenue, exports and tax revenue, and there is a short and long-run cointegration relationship between financial development and exports and tax revenue.

Akçay et al. (2016) analyzed the relationship between banking-non-banking activities, one of the financial development factors, and tax revenues in Türkiye for the period 2006-2014 by using Hatemi-j cointegration, Johansen-Juselius cointegration, and VECM tests. They concluded that the banking sector is the direct cause of tax revenues in the short run, banking and non-banking financial developments are the direct causes of tax revenues in the long run and there is a causality relationship between direct tax revenues and financial development. Bayar and Karamelikli (2017) analyzed the relationship between the industrial production index, domestic credits provided to the private sector and stock market capitalization and tax revenues in Türkiye for the period 2006-2016 using the ARDL test. They concluded that there is no relationship between financial development and tax revenues when deviations in the development levels of the banking sector and stock market are not taken into account, but when deviations are taken into account, financial development positively affects tax revenues. Pata and Ela (2020) analyzed the relationship between domestic credits extended to the private sector and domestic credits extended to the private sector by banks and tax revenue in Türkiye for the period 1965-2017 using Fourier-Granger causality, dynamic ordinary least squares (DOLS), and Fourier-Shin cointegration test. They concluded that there is a long-run relationship between the two variables, financial development increases tax burden, and there is a bidirectional causality relationship from financial development to tax burden and from tax burden to financial development. Sağdıç and Yıldız (2021) analyzed the relationship between financial development, economic growth and tax revenues in Türkiye for the period 1986-2018 using Granger causality test, ARDL bounds test, and ARDL error correction model. It is found that there is a positive relationship between economic growth, financial development and tax revenues, and there is a unidirectional causality relationship from financial development and economic growth to tax revenues. Oğul (2022) analyzed the effect of financial development on tax revenues in Türkiye for the period 1980-2019 using the extended Dickey and Fuller test, lag distributed autoregressive approach, canonical cointegrated regression, dynamic least squares, and extended least squares methods. It is concluded that financial development increases tax revenues in the short and long run. Şeyranlıoğlu (2023) analyzed the effect of financial development indicators on the performance of tax revenues in Türkiye for the period 1965-2021 using Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Fourier KPSS stationarity tests, Fourier Shin cointegration test, and DOLS estimator method. It is concluded that the increase in M2 money supply and domestic loans to the private sector increases tax revenues and monetary expansion has a higher impact on tax revenues than loans to the private sector.

When the literature is analyzed, it is seen that in some studies, different variables such as loans extended to the private sector, number of banks, loans extended by banks, non-banking activities, economic growth, industrial production index, stock market transaction volume, M2 money supply are used as financial development indicators, while in some studies, the financial development index variable obtained from the IMF data bank is used. It is observed that different results are obtained in the studies due to the changes in the countries, country groups, period and analysis method. It is noteworthy that there is no causality between financial development and tax revenues in some studies, unidirectional causality in some studies, bidirectional causality in some studies and as a result, a clear consensus cannot be reached.

When the literature is analyzed, it is seen that structural breaks are not taken into account and positive and negative shocks are neglected in the studies. In this study, the causality relationship between financial development and tax revenues is analyzed by unit root test taking into account structural breaks and causality test including positive and negative shocks. In this context, the study is expected to contribute to the related literature. This study can be considered unique in terms of revealing the relationship between financial development and tax revenues. It is also thought to contribute to the discussions on financial development.

3. Data and Methods

3.1. Data and Hypotheses

This study aims to investigate the effect of financial development on tax revenues for Türkiye. Many calculation methods are used to determine financial development. However, in 2012, the International Monetary Fund (IMF) analysed this index for the first time and used a pyramid to show the dimensions of financial development. In this pyramid, financial development is organised into two categories: financial institutions and financial markets. These categories are further organised into three sub-categories: depth, accessibility and efficiency (Emin, 2019: 2209-2210; IMF, 2023). Determined using the IMF's annual financial development index, "0" represents the lowest level of financial development and "1" represents the highest level of financial development (Sahay et al., 2015: 34).

The variables in the study consist of financial development index and tax revenues/gross domestic product. Annual frequency data (37 observations) for the period 1985-2021 are used. In the IMF database, the earliest financial development index for Türkiye starts in 1985 and ends in 2021. The reason for starting the data from 1985 is that the data set of the two series is based on this date as the longest accessible time period.

The data of the series included in the analysis are obtained from two different sources. Financial development index data from the International Monetary Fund (IMF) database and tax revenues/gross domestic product data from the Organization for Economic Co-operation and Development (OECD) website.

Figure 1 presents the time series of the variables. Figure 1 shows that the financial development index (FDI) variable and the tax revenue/GDP variable, which are included in the analysis by taking their natural logarithm, have an increasing trend at their level values.

Figure 1. Time Series Graphs of Variables

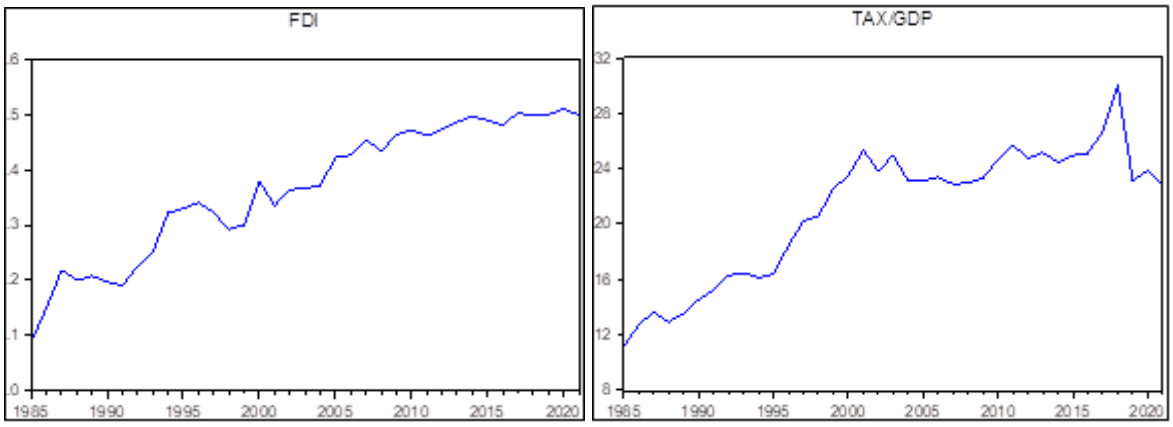

Table 1 presents the descriptive statistics of the time series. When the descriptive statistics of the series in Table 1 are analyzed, it is seen that the series with the highest deviation from the mean is the tax revenue/GDP series. In addition, according to the Jarque-Bera test at the 5% significance level, it is determined that the FDI and tax revenue/GDP series is normally distributed.

Table 1. Descriptive Statistics of the Series

Variables	FDI	Tax Revenue/GDP
Mean	0.365499	2.104414
Median	0.370496	2.308800
Maximum	0.510864	2.998300
Minimum	0.086974	1.120900
Std. Dev.	0.120542	4.796232
Skewness	-0.527024	-0.560280
Kurtosis	2.122554	2.139361
Jarque-Bera	2.899768	3.077715
(p Value)	0.234598	0.214626

The hypotheses of the research are established as given below.

H_{01}: There is not a causality relationship from positive shocks of financial development to positive shocks of tax revenues.

H_1: There is a causality relationship from positive shocks of financial development to positive shocks of tax revenues.

H_{02}: There is not a causality relationship from negative shocks of financial development to negative shocks of tax revenues.

H_2: There is a causality relationship from negative shocks of financial development to negative shocks of tax revenues.

H_{03}: There is not a causality relationship from positive shocks of financial development to negative shocks of tax revenues.

H_3: There is a causality relationship from positive shocks of financial development to negative shocks of tax revenues.

H_{04}: There is not a causality relationship from negative shocks of financial development to positive shocks of tax revenues.

H_4: There is a causality relationship from negative shocks of financial development to positive shocks of tax revenues.

H_{05}: There is not a causality relationship from positive shocks of tax revenues to positive shocks of financial development.

H_5: There is a causality relationship from positive shocks of tax revenues to positive shocks of financial development.

H_{06}: There is not a causality relationship from negative shocks of tax revenues to negative shocks of financial development.

H_6: There is a causality relationship from negative shocks of tax revenues to negative shocks of financial development.

H_{07}: There is not a causality relationship from positive shocks of tax revenues to negative shocks of financial development.

H_7: There is a causality relationship from positive shocks of tax revenues to negative shocks of financial development.

H_{08}: There is not a causality relationship from negative shocks of tax revenues to positive shocks of financial development.

H_8: There is a causality relationship from negative shocks of tax revenues to positive shocks of financial development.

3.2. Methods

In order to determine the relationship between the financial development index and tax revenues/gross domestic product variables in the study, Narayan-Pop (2010) unit root test, which analyses the degree of stationarity and also includes structural breaks, is used. Afterwards, the optimal lag lengths of the series are determined according to the Schwarz Information Criterion (SC) and the analysis continued. Hatemi-J (2012) asymmetric causality test is applied to identify a possible causality link between the financial development index series (FDI) and the tax revenue/GDP series and to determine the direction of this causality relationship, if any. Narayan-Pop unit root test and Hatemi-J asymmetric causality test are performed using Gauss-6 package programmed.

3.2.1. Narayan-Popp Unit Root Test

In his study, Perron (1989) mentions some drawbacks of ignoring breaks. The most important of these drawbacks is the probability of accepting the null hypothesis of unit root in the Dickey-Fuller test. In other words, if breaks are ignored, the series may be unit rooted even if it is not unit rooted. Popp (2008) proved that ADF type unit root tests have strong properties. Based on this, Narayan and Popp (NP, 2010) introduced the ADF type of birefringent unit root test to the literature. Traditional unit root tests are unreliable in the presence of structural breakdowns in the time series. Consequently, we will implement the Narayan–Popp Unit Root Test (Narayan & Popp, 2010, 2013). This approach can precisely identify the actual break points, enhancing the robustness of the results. In this test, breaks occur gradually, and the break time is determined endogenously according to the test strategy (Mert & Çağlar, 2023: 145). In the data preparation phase, a time series y_t is considered. y_t consists of a deterministic (d_t) and a stochastic (u_t)component.

$$y_t=d_t+u_t \quad (1)$$

$$u_t=\rho u_{t-1}+\varepsilon_t \quad (2)$$

$$\varepsilon_t=\Psi^*(L)e_t=A^*(L)^{-1}B(L)e_t \quad (3)$$

It is assumed that $\varepsilon_t \sim iid(0,\sigma_e^2)$ in equation (2) and equation (3). The p and q roots of the lag multinomials $A^*(L)$ and $B(L)$are outside the unit circle, respectively. In the NP birefringence unit root test, two different models are constructed. The first of these models is the model that considers breaks at level (Model A or M1) and the second model is the model that considers breaks at level and trend (Model C or M2). When constructing Model A and Model C, the deterministic components (d_t) differ as given in equation (4) and equation (5).

$$d_t^{M1} = a + \beta t + \Psi^*(L)\left(\theta_1 DU'_{1,t} + \theta_2 DU'_{2,t}\right) \quad (4)$$

$$d_t^{M2} = a + \beta t + \Psi^*(L)\left(\theta_1 DU'_{1,t} + \theta_2 DU'_{2,t} + \Upsilon_1 DT'_{1,t} + \Upsilon_2 DT'_{2,t}\right) \quad (5)$$

$DU'_{1,t}=1\left(1>T'_{B,i}\right)$, $DT'_{i,t}=1\left(t>T'_{B,i}\right)$, $\left(t-T'_{B,i}\right)$, ve $i=1,2$

$T'_{B,i}$ indicates the time of the break, ϑ_i indicates the magnitude of the breaks in the constant and Υ_i indicates the magnitude of the breaks in the trend. In addition, with the inclusion of $\Psi^*(L)$ in the model, the response of the series to shocks is gradual. The regression equations for Model A (level break) and Model C (level and trend break) are shown in equation (6) and equation (7), respectively.

$$y_t^{M1}=\rho y_{t-1}+a_1+\beta^* t+\vartheta_1 D\left(T_B^{'}\right)_{1,t}+\vartheta_2 D\left(T_B^{'}\right)_{2,t}+\delta_1 DU_{1,t-1}^{'}+\delta_2 DU_{2,t-1}^{'}+\sum_j^k \beta_j \Delta y_{t-j}+e_t \quad (6)$$

$$y_t^{M2} = \rho y_{t-1} + a^* + \beta^* t + \Omega_1 D(T_B')_{1,t} + \Omega_2 D(T_B')_{2,t} + \delta_1^* DU_{1,t-1}' + \delta_2^* DU_{2,t-1}' + \Upsilon_1^* DT_{1,t-1}' + \Upsilon_2^* DT_{2,t-1}' + \sum_j^k \beta_j \Delta y_{t-j} + e_t \quad (7)$$

In equations (6) and (7), while the null hypothesis ρ=1 states that the series is non-stationary, the alternative hypothesis ρ<1 states that the series is stationary, i.e. it does not have a unit root. While calculating the $\hat{\rho}$ value, the t statistic is used, and critical values are generated using Monte Carlo analyses. When deciding whether the series is stationary or not, the alternative hypothesis that the series does not contain a unit root is accepted if the obtained t statistic is greater than the critical values in absolute value (Narayan & Pop, 2010).

Consequently, the NP (2010) test performs a unit root test by considering one or two structural breaks in the series. These structural breaks usually represent sudden changes in economic or financial data series. The test provides flexibility by considering both trend and level breaks. That is, it tests for changes in the trends or levels of the series. The test usually works with long-term data and aims to examine the variability and break points of the series over time. It provides more accurate unit root detection by taking into account the effects of structural breaks. It is especially useful in econometric analyses to better understand the effects of structural changes. These features make the test an important tool in econometric and financial data analyses.

3.2.2. Hatemi-J (HJ-2012) Asymmetric Causality Test

Hatemi-J (2012) argues that people will react differently to shocks in real life. In particular, it is accepted that investors trading in financial markets are not coherent, but rather exhibit divergent characteristics. In other words, each investor in financial markets does not react in the same way when a random shock occurs. Some investors think that shocks are temporary and maintain their positions and do not avoid risk, while some investors change their positions immediately in order to avoid risk. As a result, HJ (2012) argues that the impact of shocks on the market cannot be the same and that shocks should be decomposed into negative and positive shocks. Moreover, since there is asymmetric information in financial markets, shocks should be split into negative and positive shocks. In addition, the calculation of critical values with bootstrap is another important feature of the HJ (2012) test. Another feature of the test is that even if the data set included in the analysis is not normally distributed, there is no distortion in the distribution of the test. Based on the Granger and Yoon (2002) hidden cointegration test, the HJ (2012) test is adapted to causality (Mert & Çağlar, 2023: 412). In order to reveal the causality relationship between two integrated series, assume that there are two series such as y_{1t} and y_{2t} shown in equations (8) and (9):

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i} \;\; t = 1, \dots, T \quad (8)$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i} \;\; t = 1, \dots, T \quad (9)$$

The $y_{1,0}$ in equation (8) and $y_{2,0}$ in equation (9) represent the initial values. The variables ε_{1i} and ε_{2i} are error terms and are defined as clean series. Equation (10) shows positive and negative shocks.

$$\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0), \varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0), \varepsilon_{1i}^{-} = \min(\varepsilon_{1i}, 0), \varepsilon_{2i}^{-} = \min(\varepsilon_{2i}, 0) \quad (10)$$

In addition, $\varepsilon_{1i} = \varepsilon_{1i}^{+} + \varepsilon_{1i}^{-}$and $\varepsilon_{2i} = \varepsilon_{2i}^{+} + \varepsilon_{2i}^{-}$. In the light of this information, the equations of y1t and y2t are shown in equation (11) and equation (12).

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-} \quad (11)$$

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (12)$$

The positive shocks and negative shocks of y_{1t}^{+}, y_{1t}^{-}, y_{2t}^{+} and y_{2t}^{-} variables are cumulatively shown in equation (13).

$$y_{1t}^{+} = \sum_{i=1}^{t} \varepsilon_{1i}^{+},\ y_{1t}^{-} = \sum_{i=1}^{t} \varepsilon_{1i}^{-}, y_{2t}^{+} = \sum_{i=1}^{t} \varepsilon_{2i}^{+},\ y_{2t}^{-} = \sum_{i=1}^{t} \varepsilon_{2i}^{-} \quad (13)$$

Assuming that the equation $y_t^{+} = y_{1t}^{+} + y_{2t}^{+}$is valid, the causality relationship between $y_{1t}^{+}$and y_{2t}^{+} variables is determined with the help of a VAR model with "p" lags as shown in equation (14).

$$y_t^{+} = v + A_1 y_{t-1}^{+} + \cdots + A_p y_{t-1}^{+} + u_t^{+} \quad (14)$$

In equation (14), $y_t^{+}$is the 2x1 dimensional variable vector, v is the 2x1 dimensional constant vector and u_t^{+} is the 2x1 dimensional error term vector. The string ar denotes the 2x2-dimensional set of parameters utilized for the rth order lag. Although there are many options as information criterion in the HJ (2012) test, he recommends the HJC information criterion in his study. Equation (15) defines the HJC information criterion.

$$HJC = ln\left(\left|\hat{\Omega}_j\right|\right) + j\left(\frac{n^2 lnT + 2n^2 ln\,(lnT)}{2T}\right)\ ve\ j = 0, \ldots, p \quad (15)$$

The coefficient $\left|\hat{\Omega}_j\right|$shown in Equation (15) denotes the determinant of the variance-covariance index estimation of the error terms in the VAR model with lag length j, n denotes the number of equations in the VAR model, T denotes the number of observations. The HJC information criterion is developed in HJ (2003) and simulated in HJ (2008). The HJC information criterion has shown both strong results in ARCH models and high performance when the VAR model is used for forecasting purposes. After determining the optimal number of lags, it is tested by forming the null hypothesis as "the kth element of $y_t^{+}$is not the Granger cause of the wth element of y_t^{+}". In addition, the Wald test statistic distributed by X2 is utilised. This test can also be used if the data are not normally distributed. In case the data are not normally distributed, the bootstrap simulation method is used (HJ, 2012). The steps to apply the HJ (2012) test are given below (Mert & Çağlar, 2023: 414):

Step 1: Unit root tests are applied to the series and it is determined that the degree of integration is the same (such as (X~I(0))-(Y~I(0)) or (X~I(1))-(Y~I(1)).

Step 2: The optimal lag length is determined using the VAR model.

Step 3: The code of the HJ (2012) causality test is run using the Gaussian programme.

Hatemi-J (2012) test provides a more comprehensive analysis by taking into account not only structural breaks but also positive and negative shocks. The results of the test depend on the correct identification of structural breaks and shocks. This is an important advantage for understanding short-term and long-term changes in time series data.

4. Findings

4.1. Narayan-Popp (NP-2010) Unit Root Test Results

In this study, Model-C is taken into account in order to determine the structural breaks in the financial development index series and tax revenue/GDP series in the Narayan-Popp (NP-2010) test. The NP stationarity test is applied again by taking the first differences of the variables that have unit roots in level and level. NP stationarity test findings are presented in Table 2.

Table 2. NP (2010) Unit Root Test Results with Double Break

Variables	Break at Level: Model A			Break in Level and Trend: Model C		
	Test Statistic	Break Value	Break Date	Test Statistic	Break Value	Break Date
Financial Development Index	-2.516	0.2432	1993	-3.565	0.3514	1997
		0.4054	1999		0.4324	2000
Tax Revenue/GDP	-2.618	0.2973	1995	-4.141	0.3784	1998
		0.5135	2003		0.5135	2003
ΔFinancial Development Index	-11.28	0.2432	1993	-7.957	0.2703	1994
		0.4054	1999		0.4054	1999
ΔTax Revenue/GDP	-7.654	0.2973	1995	-7.456	0.2432	1993
		0.4595	2001		0.4595	2001

Note: Critical values are obtained from NP (2010) and are -4.958, -4.316 and -3.980 for Model-A and -5.576, -4.937 and -4.596 for Model-C at 1%, 5% and 10% significance levels, respectively. The symbol "Δ" denotes the first difference of the series. The maximum lag degree for Model-A and Model-C is set as 2.

According to NP (2010) test results in Table 2, when the Model-C results are analysed, the test statistic of the FDI series takes the value of -3.565 and the test statistic of the tax revenue/GDP series takes the value of -4.141. Since -3.565>5%:-4.937 and -4.141>5%:-4.937, the null hypothesis of unit root is not rejected at 5% significance level. As a result, the financial development index series and the tax revenue/GDP series contain unit root at the level and are non-stationary. When the first differences of the series are taken, the test statistic of the FDI series takes the value of -7.957 and the test statistic of the tax revenue/GDP series takes the value of -7.456. Since -7.957<5%:-4.937 and -7.456<5%:-4.937, the null hypothesis of unit root is rejected at 5% significance level. As a result, the financial development index series and the tax revenue/GDP series do not contain unit roots and are stationary when their first differences (I(1)) are taken. When the break times of the series at (I(1)) are analyzed, it is observed that there are breaks in the FDI series in 1994 and 1999, and in the tax revenue/GDP series in 1993 and 2001. The values of 0.2703 (1994) and 0.4054 (1999) found for the break locations in the FDI series indicate that the first break is at the beginning and the second break is towards the middle. The values of 0.2432 (1993) and 0.4595 (2001) found for the break points in the tax revenue/GDP series indicate that the first break is at the beginning and the second break is towards the middle.

4.2. Hatemi-J (2012) Asymmetric Causality Test Findings

The causality relationship between the financial development index series and the tax revenue/GDP series is analyzed using asymmetric causality tests developed by HJ (2012). The causality relationship between cumulative positive (+) shocks, the causality relationship between cumulative negative (-) shocks, the causality relationship from cumulative (+) shocks to cumulative (-) shocks and the causality relationship from cumulative (-) shocks to cumulative (+) shocks are tested separately. Table 3 shows the findings of the analyses.

Table 3. HJ (2012) Asymmetric Causality Test Results

Causality Aspects	Value of Test Statistics	Bootstrap Critical Value		
		1%	5%	10%
lnFDI (+) ≠> lnTAX (+)	0.120	9.940	4.916	3.232
lnFDI (-) ≠ >lnTAX (-)	5.104	13.837	5.678	3.659***
lnFDI (+) ≠> lnTAX (-)	4.320	13.196	5.812	3.858***
lnFDI (-) ≠> lnTAX (+)	0.123	8.466	4.676	3.397
lnTAX (+) ≠ >lnFDI (+)	0.071	10.727	4.852	3.347
lnTAX (-) ≠>lnFDI (-)	0.806	11.416	5.210	3.266
lnTAX (+) ≠> lnFDI (-)	0.045	16,109	5.884	3.750
lnTAX (-) ≠>ln FDI (+)	0.052	10.425	5.010	3.053

Note: ≠ > denotes the null hypothesis of no causality. In addition, *** ** * denotes 10%, 5% and 1% significance level respectively. In the production of critical values, the bootstrap value is taken as 10.000.

Table 3 tests the null hypothesis of no causality from positive shocks of financial development to positive shocks of tax revenues (lnFDI (+) ≠> lnTAX (+)). According to these results, since the test statistic (T) value (0.12) is smaller than the bootstrap value (4.916) at 5% significance level, the null hypothesis of no causality H_0 is accepted and hypothesis H_1 is rejected. In the equation testing the null hypothesis that there is no causality from negative shocks of financial development to negative shocks of tax revenues (lnFDI (-) ≠> lnTAX (-)), since the (T) value (5.104) is smaller than the bootstrap value (5.678) at 5% significance level, the H0 hypothesis of no causality is accepted and the H_2 hypothesis is rejected. In the equation testing the null hypothesis that there is no causality from positive shocks of financial development to negative shocks of tax revenues (lnFDI (+) ≠> lnTAX (-)), since (T) value (4.32) is smaller than the bootstrap value (5.832) at 5% significance level, the H0 hypothesis of no causality is accepted and the H_3 hypothesis is rejected. In the equation testing the null hypothesis of no causality from negative shocks of financial development to positive shocks of tax revenues (lnFDI (-) ≠> lnTAX (+)), since the value of (T) (0.123) is smaller than the bootstrap value (4.676) at 5% significance level, the H_0 hypothesis of no causality is accepted and the H_4 hypothesis is rejected.

In the equation testing the null hypothesis of no causality from positive shocks of tax revenues to positive shocks of financial development (lnTAX (+) ≠> lnFDI (+)), since the value of (T) (0.071) is smaller than the bootstrap value (4.852) at 5% significance level, the null hypothesis of no causality H_0 is accepted and hypothesis H_5 is rejected. In the equation testing the null hypothesis that there is no causality from negative shocks of tax revenues to negative shocks of financial development (lnTAX (-) ≠> lnFDI (-)), since the (T) value (0.806) is smaller than the bootstrap value (5.21) at 5% significance level, the H_0 hypothesis of no causality is accepted and the H_6 hypothesis is rejected. In the equation testing the null hypothesis that there is no causality from positive shocks of tax revenues to negative shocks of financial development (lnTAX (+) ≠> lnFDI (-)), since the (T) value (0.045) is smaller than the bootstrap value (5.884) at 5% significance level, the H_0 hypothesis of no causality is accepted and the H_7 hypothesis is rejected. In the equation testing the null hypothesis of no causality from negative shocks of tax revenues to positive shocks of financial development (lnTAX (-) ≠> lnFDI (+)), since the value of (T) (0.052) is smaller than the bootstrap value (5.01) at 5% significance level, the H_0 hypothesis of no causality is accepted and the H_8 hypothesis is rejected.

While there is no causality relationship from all cumulative shocks of financial development to all cumulative shocks of tax revenues for Türkiye, when the other direction of causality is analyzed, it is found that there is no causality relationship from all cumulative shocks of tax revenues to all cumulative shocks of financial development.

5. Conclusion and Discussion

This study analyses the relationship between the financial development index calculated for Türkiye and Türkiye 's tax revenues. In this study, the asymmetric causality relationship between the parameters is investigated by using the annual data sets of FDI and TAX parameters between 1985-2021. For this purpose, firstly, in order to determine whether the time series within the scope of the study are stationary, the double-break stationarity tests are developed by Narayan-Popp, including structural breaks, are applied. Then, whether there is a causality relationship between the variables and the direction of the relationship, if any, are investigated by Hatemi-J asymmetric causality tests.

According to the results of the Narayan-Popp unit root test, it is determined that the series of FDI and TAX variables contain unit root at I(0) level, and when the series are first differenced, they become stationary at I(1) level. When the break times of the series at (I(1)) are analyzed, it is observed that there are breaks in the FDI series in 1994 and 1999, and in the tax revenue/GDP series in 1993 and 2001. In the study that analyses the relationship between financial development index and tax revenues for Türkiye with asymmetric causality tests, Hatemi-J (2012) test findings indicate that there is no causality from positive disaggregated financial development to positive disaggregated tax revenues, from negative disaggregated financial development to negative disaggregated tax revenues, from positive disaggregated financial development to negative disaggregated tax revenues and from negative disaggregated financial development to positive disaggregated tax revenues at 5% significance level in the period 1985-2021. On the other hand, there is no causality from positively disaggregated tax revenues to positively disaggregated financial development, from negatively disaggregated tax revenues to negatively disaggregated financial development, from positively disaggregated tax revenues to negatively disaggregated financial development and from negatively disaggregated tax revenues to positively disaggregated financial development.

As a result, it is determined that increases and decreases in the financial development index calculated for Türkiye do not have any asymmetric causality effect on Türkiye 's tax revenues, and increases and decreases in tax revenues do not have any asymmetric causality effect on the financial development index.

While the findings of the study are similar to the findings of Bayar and Karamelikli (2017), Yıldırım and Karadeniz (2023), they are not similar to the findings of Akçay et al. (2016), Pata and Ela (2020), Sağdıç and Yıldız (2021), Oğul (2022), and Şeyranlıoğlu (2023). The causality that emerged with traditional causality tests did not emerge with asymmetric causality tests. The fact that the authors use different tests and the variables of financial development and tax revenues in different forms may be the possible reason for the difference in the findings. Although limited in the literature, there are studies in which negative, inverted U or different findings are obtained between both variables. These findings were similarly observed in the studies conducted by Loganathan et al. (2017), Bayar et al. (2017), Taha et al. (2018), Loganathan et al. (2020).

The developing nations, which generally prioritize economic growth, necessitate significant investments to achieve this goal. Nonetheless, these governments, deficient in sufficient internal savings to finance these expenditures, often depend on foreign savings. This circumstance may intensify the economic fragility of these nations. Countries with weaker financial systems are likely to demonstrate more susceptibility. The increasing need for investment capital, alongside the financial system's inherent fragility, may necessitate these nations to introduce further incentives in capital markets. Tax incentives constitute one of the most substantial motivators. These incentives generally appear as a reduction in the income tax rates imposed on capital gains or as various exceptions and exemptions regularly enacted. Tax incentives designed to enhance the financial system may lead to a decrease in state income. It may be correct to infer from the results of this study for Türkiye that the increase or decrease in financial development does not affect tax revenues. This can be explained in terms of the elasticity of tax revenues. In the face of increasing GDP with financial development and in line with the hypothesis of low-income elasticity of the tax system, tax revenues may not increase at the same rate as GDP. This will result in a decrease in the tax burden defined as the ratio of tax revenues to GDP (Yıldırım & Karadeniz, 2023: 48). In this case, countries with high tax revenue elasticity will most likely increase their tax revenues in response to increasing GDP with increasing

financial development. In this context, the positive contribution of financial development to tax revenues will depend on tax revenue elasticity. Developing countries such as Türkiye, which contribute to the development of the financial system to a large extent through tax incentives, should compensate for the erosion in tax revenues by increasing the tax revenue elasticity.

The current econometric methodologies of the study are expected to contribute to the limited literature on the link between financial development and tax revenues. Future research can expand the literature by differentiating the econometric approach used in the models, the study period, the country or country group and the financial development variables.

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