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INTERACTIONS OF BENCHMARK INTEREST RATE, FOREIGN TRADE VOLUME, AND DOMESTIC DEBT STOCK

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ÖZET

Kamu borç stokunun sürdürülebilirliğiyle ilgili endişeler yüksek ve oynak risk primlerine neden olduğundan gelişmekte olan ekonomilerde aktarım mekanizmasının etkinliğini azaltmaktadır. Bununla birlikte, ulusal parada değerlenmeye bağlı olarak ekonomilerde faiz ve dış ticaret etkileşimi etkili olmaktadır. Bu makale bazı iktisat okulları çerçevesinde değişkenlerin faiz oranları üzerindeki etkisine ilişkin açıklamalara yer verdikten sonra Türkiye'de iç borç stoku, dış ticaret hacmi ve piyasa katılımcılarına ekonomik yapı hakkında bilgi sağlayan gösterge faizi arasındaki uzun ve kısa dönem dinamik ilişkileri belirlemeyi amaçlamaktadır.

Anahtar Kelimeler: *Gösterge faizi, kointegrasyon, Hendry modeli, etki-tepki analizi.*

ABSTRACT

Concerns about the sustainability of public debt reduce efficiency of the transmission mechanism in emerging economies owing to high and volatile risk premiums. Moreover, the interaction between the interest rate and foreign trade volume affects the economy, depending on the valuation of the national currency. This article attempts to identify the long- and short-term dynamic relationships among domestic debt stock, foreign trade volume, and benchmark interest rate in Turkey. These dynamic relationships provide information about the economic structure to market participants. This article also explains the impact of these variables on interest rates within the framework of various schools on economic thought.

Keywords: *Benchmark interest rate, cointegration, Hendry model, impulse response analysis.*

1. INTRODUCTION

Interest rate policy is defined as the intervention of monetary authorities in setting interest rates at levels that serve economic objectives. Setting interest rates that incentivize loan demand and investment is

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important for sustained economic development. Monetary authorities must attempt to keep rates at low levels to prevent stiff competition between banks, keep rising interest rates from generating risky banking practices, and stabilize the prices of government bonds. In addition, monetary authorities may apply high interest rates or indexing policies to stimulate international capital inflows when a balance of payments problem arises or to minimize inflationary pressures on savings.

There are two types of interest rates in the market: the overnight rate at which the central bank pays interest on bank balances and the benchmark interest rate that determines interest paid on treasury bonds as well as lending rates charged by banks. Overnight rate is determined by the central bank and the benchmark interest by supply and demand in the market. The benchmark is the most liquid security that provides a regular reference point for the market (Blanco,2002). In the case where there is such extreme similarity across an asset class, liquidity usually concentrates on a small number of individual cases, and these are often selected as reference points for the market as a whole. The asset class becomes very illiquid and it becomes difficult to construct reliable indices for pricing. This creates the need for an alternative reference point and opens the way for a single asset to take the role as the benchmark (Dunne, Moore, and Portes, 2007).

Effects of public borrowing on macroeconomic balances have resulted in extensive literature concerning the causes and results of borrowing. A high level of public domestic borrowing is seen as the reason for negative developments in many macroeconomic variables, primarily interest rate, inflation, and gross domestic product. Besides being important in financing public deficit, borrowing appears as a fundamental determinant of strategy and policies related to the formation and application of economic and financial policies.

With these characteristics and their direct derivative effects, borrowing affects almost all economic variables at different degrees. This article theoretically and empirically analyzes the effect of public domestic borrowing on fundamental macroeconomic variables. In many countries, the state can borrow to finance macroscale investments or public deficits. On the other hand, reasons underlying domestic borrowing are (1) repayment of existing debts, (2) incompatibility from the perspective of place and time, (3) balance of public revenues and expenses, (4) urgent financing needs emerging in extraordinary circumstances, and (4) cases in which increase in tax revenue is not possible.

There are opposing theories about how budget deficits affect interest rates. In the neoclassical model, the budget deficit taxes increase the total lifetime consumption by transferring taxes to subsequent generations. If the economy is in full employment, consumption will improve and

interest rates will increase in order to balance the capital market. As a result, a persistent fiscal deficit will exclude private capital accumulation. Regarding borrowing to finance budget deficit in a closed economy, interest rates are raised and investments are excluded. Budget deficit causes interest rates to increase and foreign funds to flow into the country. Thus, the net export rather than domestic investment is excluded in an outward economy, where there are international capital flows. Flow of capital in the domestic market causes the national currency to appreciate, specifically in an economy with a flexible exchange rate system. In the neoclassical approach, permanent and temporary budget deficits have different effects on the economy. In contrast, in the Keynesian approach, for majority of consumers and in the case of limited liquidity, permanent budget deficit effects will remain unchanged but temporary budget deficits will increase interest rates by reducing savings in the short term, the effects of excluding investments will occur in the short term.

In the Keynesian model, people tend to consume their current available income, and temporary tax reduction has a significant sudden impact on the total demand in quantity terms. If the economy has significant underemployment due to the Keynesian multiplier effect, the national income will increase. Consequently, the budget deficit will increase consumption and national income, and hence savings and capital accumulation will not be negatively affected. In the standard investment-saving/liquidity preference-money supply analysis, increase in national income increases the demand for money. If the money supply is fixed, the interest rate will increase and private investment will decrease. This indicates that reduction in national income and the balancing of the Keynesian multiplier effect are due to the crowding-out effect. On the other hand, some scholars say that financing budget deficits will not exclude private investment. The total demand increases private investment profitability due to the budget deficits and increases the investment level with certain interest rates. For this reason, budget deficits, despite the fact that they result in an increase in interest rates, can encourage total savings and investment. In other words, if the economy has underemployment but the reverse process is not applied as a monetary policy, both the nominal and real budget deficits increase to those in the case of full employment. This increase in nominal demand reflects both consumption and investment, and as a result, the crowding-out effect does not occur (Ataç et al., 2006).

In the Ricardian approach, economic agents must make consumption and savings decisions while considering their life-long income. In this case, if the budget deficit is financed by borrowing, the taxes paid during these agents' lifetime are only considered as a redistribution. Meanwhile, knowing that they will pay more taxes to close the gap in the future, the economic agents will save money instead of spending it today.

Owing to the increase in savings, the interest rate will not increase and investments will be excluded from budget deficit financing(Ataç et al., 2006).In a structure where interest rates do not change despite increased borrowing, private investments will hardly be affected. An empirical study of this issue conducted in the US concluded that federal budget deficits causing extensive borrowing do not significantly affect real investment expenditures (Bahmani-Oskooee, 1999).

Empirical studies have postulated a positive correlation between real interest rates and budget deficits in the US and certain EU countries and have determined that budget deficits are important constituents of the difference between domestic and world interest rates (Leibfritz et al., 1994). A positive relationship between public deficits and interest rates has been established by Gale and Orszag (2004), Cebula (2005), and Kinoshita (2006). Evans (1985), Darrat (1990), and Mehra (1996) claimed that the relationship was either weak or the reverse. Ardagna et al. (2004) determined that a 1% increase in the ratio of the primary deficit to the gross domestic product caused a 10% increase in long-term rates. Furthermore, increases in the quantity of public debt mean larger public deficits and higher interest rates. Friedman (2005) determined that following a 1% change in the debt ratio, interest rates increased by 2.9–5.3%. Eric and Glenn (2004) found this range to be 3.4–5.8%.

A study of OECD countries asserted that the effect of extensive public borrowing on interest rates can change with mobility of capital and that low capital mobility has a crowding-out effect at high levels (Dar and AmirKhalkhali, 2003). A positive relationship has been reported in studies of developing countries (Gupta, 1992; Kuehlwein and Samalapa, 1999). Barro and Sala-i-Martin (1990) and Cohen and Garnier (1991) determined an insignificant relationship between real expected interest rates and government debt. Laubach (2003) showed that the magnitude of the interest rate effect is important in determining the relation. Miller and Russek (1996) found that results can vary with econometric approaches. Engen and Hubbard (2005) examined the relationship by using three types of specifications and vector autoregression (VAR) analysis. They found a positive and significant relationship between federal government debt and interest rates.

Domestic borrowing also entails short- and long-run economic and political costs. Particularly regarding developing countries where economic and political costs intersect, it can be said that high costs that emerge in the mid and long terms (high interest) are acceptable, whereas political costs in the short term are not. In line with political preferences, borrowing is undertaken with irrational tools. Alongside the primary budget surplus, effective debt management is among the few tools that lighten the debt burden. To this end, it is important to act according to economic priorities

and compose borrowing to assure minimum borrowing cost. Particularly in countries where institutional structures are not fully functional, borrowing to finance off-budget expenses damages the reliability of borrowing-related foresights and the quantity of debt can exceed forecasts and imperil payment plans. Rolling a payment forward without preparation increases the current burden at a higher interest rate. When borrowing is uncontrolled or executed with questionable effectiveness, its efficiency decreases. It also may be that domestic borrowing in developing countries where national savings are inadequate also affects foreign borrowing costs, which are important for growth and development. The real interest rates that increase dependence on domestic borrowing are important instruments for speculative foreign capital flows. Accordingly, foreign resources used in more suitable conditions become more costly domestic debt. When it is used to finance public deficits in economies with inadequate savings, domestic borrowing negatively affects interest rates. As benchmark interest rates rise as borrowing increases, one reason for the high benchmark interest rates in Turkey is the government's demand for borrowing. When there are no redundant funds and saving is below investment, increasing interest rates is the only way to fund new borrowing. In this regard, interest rates increase rapidly parallel to growth in public deficits and borrowing (Sonat, 1994).

When domestic borrowing is in question, private sector borrowing will increase demand for loanable funds and interest rates, and private sector investment spending will decrease (crowding-out effect). Public deficits, which are among the most important reasons for accumulating public debt, essentially transfer taxes to succeeding generations and increase total life-long consumption. Under the assumption of a full employment economy, increased consumption will decrease savings and interest rates will increase to bring capital markets into equilibrium. In such a case, public deficits will exclude private capital accumulation. In addition, the characteristics of public financing requirements and the depth of financial markets are important in shaping the effect of public borrowing on interest rates. In economic structures with financial market depth, public borrowing increases foreign capital flows, translates some domestic debt into foreign debt, and reduces pressure on interest rates.

Several studies have addressed factors determining the effect of public borrowing on interest rates in Turkey. Examining the period 1988–1998, Berument and Malatyali (1999) found that nominal interest rates increase in response to inflation risk and that there is an inverse relationship between the term of borrowing and interest rates. Emir et al. (2005) researched how events in Turkey and abroad affect daily interest rates and found that events specific to Turkey have greater effects on interest rates. İnal (2006) investigated the effect of overnight central bank rates on long-term interest rates and showed that they are sensitive to unexpected changes

and not anticipated changes in the monetary policy. Nonetheless, the extent of sensitivity is proportional to the maturity of debt securities.

Borrowing to finance budget deficits increases interest rates. In this case, while the foreign capital inflows and exchange rate depreciate, the national currency becomes valuable. With the appreciation in the national currency, domestic goods become expensive relative to foreign goods, and this situation increases trade deficits. The objectives of foreign trade are to source goods and services that are unavailable or costly in domestic markets, transfer goods and services abundant in domestic markets to foreign markets, and enhance wealth. A foreign trade deficit, however, is regarded as unfavorable because it shows that a country lacks savings to repay its debts and suggests a trend of greater deficits and borrowing. Consequently, these variables have increasing effects on differences in interest rates.

Foreign exchange is not itself a variable in our model, but its omission has no effect on interest rates. By changing the quantity of loanable funds and returns on alternative investments, foreign exchange affects interest rates. These effects appear in capital inflows and interbank rates. In other words, within the context of the loanable funds theory, an increase in foreign exchange means a decrease in foreign capital flows and overnight interbank rates. The interaction of the interest rate and foreign trade is very effective for the appreciation of the national money .The effect of monetary depreciation on foreign trade largely depends upon the elasticity of supply and demand for export and import goods. Therefore, disorder of foreign trade influences all economic activities. The interaction of the interest rate due to capital flows negatively affects foreign trade flow in developing countries. These speculative capital flows, which reduce export, cause macroeconomic imbalances. These, in turn, cause external deficit problems. As a result of the appreciation of the exchange rate, the export sector cannot compete with the import sector and thus has to decrease production (Karacan, 2010).

The foreign exchange rate affects foreign competition, composition of spending, and consumption and savings realized through current deficits over time; hence, it affects consumers and producers. Rose (1991) showed that significant changes in exchange rates do not impact the foreign trade balance in developed countries. Demeulemeester and Rochat (1995) revealed a two-way relationship between exchange rates and trade balance. Zhang (1996) determined that the effect of exchange rate changes on the foreign trade balance is strong but indirect. Frait and Komarek (2001) stated that the development of the equilibrium exchange rate is based on trade rates; total efficiency increase in sectors that may or may not be subject to foreign trade, savings, and investments; composition of government spending; and foreign capital inflows. Arize, Malindretos, and Kasibhatla (2003) concluded that exchange rate variability has no significant effect on

the cash flow of exports in the short and long terms. Narayan (2004) found a causality between exchange rates and the foreign trade balance. Egert and Zumaquero (2005) showed that exchange rate variability in the cash flows of exports, especially in the industry sector, have a negative impact.

Foreign trade is considered one of the most important underpinnings of sustainable development in Turkey. Öztürk and Acaravcı (2002) and Saatçioğlu and Karaca (2004) showed that exchange rate uncertainty negatively affects exports. Zengin (2001) found that foreign trade prices directly affect the real exchange rate, which in turn directly affects the import price index (one of the items of foreign trade), and through this index, indirectly affects the export price index. Yamak and Korkmaz (2005) showed that the relationship between foreign trade balance and exchange rate changes is not in the long term but in the short term and that the relationship among exchange rate changes, real exchange rates, and the foreign trade balance is mainly determined by trade in capital goods. Barışık and Demircioğlu (2006) revealed a strong relationship between the exchange rates on imports and those on exports. Coşkun and Taylan (2009) showed that there is no significant relationship between exchange rate changes and volume of imports and exports.

Based on this framework, Section 2 reviews previous literature that investigated short- and long-term relationships between economic indicators. Section 3 discusses the relationship among foreign trade volume, domestic debt stock, and the benchmark interest rate in Turkey using cointegration and VAR. The section also presents the results of the analysis. Section 4 presents and discusses the findings and conclusions.

2. ECONOMETRIC METHODOLOGY

Economic theory is based on assumptions of stationarity. Applying standard inference in econometric models requires stationary variables. When an economic series is not stationary, spurious forecasts and other situations emerge. Unit root tests are used to test stationarity. This study employs the augmented Dickey–Fuller (ADF) test to control stationarity in a time series. The Dickey–Fuller equation addresses autocorrelation in the series by lagging difference terms to illuminate the effects of shocks (Dickey and Fuller, 1981).

Cointegration permits analysis of a time series that is not linear itself but whose combinations are stationary. Cointegration analysis, which explores long-term relationships between variables integrated at the same level, forestalls potential losses of information and solutions caused by subtractions performed on nonstationary variables to render them stationary (Granger, 1981). Engle and Granger (1987) developed a method to discover existing long-term relationships between two time series and allow directly forecasting existence of equilibrium relationships proposed by economic

theory. Compared to the coefficients obtained from regression equations constructed after the two series are made stationary, coefficients obtained from common integration regression converge faster to the actual parameters. The fact that the Engle–Granger method does not reflect short-term developments is a disadvantage. Error correction models are used to handle short- and long-term changes together. In general, their use is one way to understand whether a system in disequilibrium will attain equilibrium in time. If the system reaches equilibrium, these models help in providing preliminary information about how long it will take to do so.

When seeking more than one cointegration relationship, the Johansen test should be used. Because the method originates from VAR, it captures more than one cointegration relationship. Johansen and Juselius (1990) developed the theory, provided necessary tables, and issued forecasts with maximum probabilities. The method is used for the same difference in stationary time series as that in the Engle–Granger method and considers short-term dynamic relationships and lagged values of variables. It permits forecasting combinations of all common integration relationships that can exist between variable sets (Johansen, 1988). Models prepared to support an idea might not provide accurate information about real economic situations and interactions. An important alternative to obviate deficiencies in traditional econometric methods is Hendry modeling (Darnell and Evans, 1990). Its objective is to transit from a wide-ranging general model containing all variables envisioned by theory with their lagged values to the narrowest possible model that harmonizes with the dataset and satisfies specified criteria. In this model, when specifying the number of lags, one should not pay excessive attention to decreased degrees of freedom. On the other hand, it requires going back long enough to explain dynamic economic processes.

In the modeling process, particularly because of the variables included, a model that overlaps with equilibrium relationships proposed by economic theory is formulated. The model is re-parameterized to the extent possible using variables orthogonal to each other that have an explanatory power and can be interpreted from an economic perspective. To determine the limitations of the model eventually chosen, the error terms and model's forecasting power are analyzed (Pagan, 1987). If the model derived from the equation is consistent with even one theory, explanatory variables used in the model are at least weakly external. In cases where the model forecasts different periods, the parameters are the same for each period and the error terms are random. This indicates the most appropriate model has been reached (Hendry and Richard, 1982).

Although regression analysis is related to dependence relationships between variables, this dependence does not always demonstrate causality (Granger, 1969). The average error terms calculated from the forecasting

equation should be zero, the variance should be small, and the errors should be independent. If there is a time-dependent lagged relationship between two variables, causality should be statistically determined. Because Granger causality demonstrates a lagged relationship between variables, causality tests between variables are based on time series data. For the Granger causality test to be applied, the series should be stationary. Significant statistical relationships between variables obtained from models employing spurious regressions involving nonstationary variables show a simultaneous correlation rather than causality.

When Sims (1980) discovered VAR models as an alternative to simultaneous equation models, their use in economic analysis increased. Nonetheless, existence of long-term time series observed with greater frequency has created a need for models concentrating on dynamic structures of variables. The externality assumption of variables in simultaneous equation models is criticized because it is not supported by either temporary or completely developed theories. In VAR models, all observed variables are usually treated as internal. Each variable is forecasted by its own lagged values and lagged values of other variables. Second, in VAR models, theory is important only in selecting variables. Therefore, the model's parameters are not formed by structural interpretations. For this reason, no guarantee can be given that the results of applied forecasts will accord with theory. In case of deficiencies in the model, corrections are made until the appropriate model is identified. After these corrections, the model is used for forecasting, determining causality, or structural analysis (Lütkepohl, 2007). However, when the selected degree of the model is greater than it should be, variance in forecasts of parameters turns out to be large. On the other hand, when the selected degree is smaller, forecast of parameters becomes consistent. In both cases, results from the model are unreliable.

To analyze interactions between the series X_t and Y_t, moving average demonstration is used. Then, ϕ_i coefficients are used to generalize the effects of jumps of the series ε_{xt} and ε_{yt} over movements of X_t and Y_t. The decomposition of error variance in forecasts helps express movements of a series with respect to a variable's individual changes counter to changes in other variables. Another probable method for defining residuals is Cholesky decomposition. It requires the series Y_t to be dependent on changes in the error variance of forecasts that are one period ahead. Consequently, if the correlation coefficient is statistically different from zero, variance decomposition can be obtained.

2.1. Data

Within the scope of this article, the relationships among domestic debt stock, foreign trade volume, and the benchmark interest rate are

analyzed using monthly data from 2006:01 to 2012:05. The interest rate offered on the most recently issued treasury security in this period is taken as the benchmark interest rate. Foreign trade data were analyzed after being converted to Turkish Lira using the monthly average exchange rate. The data used in this article are taken from the Central Bank of Turkey and the Ministry of Development of the Republic of Turkey. The model is established with 77 observations. To stabilize the variance and purify small fluctuations, the logarithmic value of the series is used in this article. Owing to the fact that the period includes some financial crises, the series are examined for structural breaks and seasonal fluctuations. Exchange rates are not included in the model as a separate variable. Instead they are reflected in the analysis as a factor affecting the benchmark interest rate through the foreign trade volume.

3. RELATIONSHIPS AMONG BENCHMARK INTEREST RATE, FOREIGN TRADE VOLUME, AND DOMESTIC DEBT STOCK

A single bond is most likely to emerge as a benchmark when there is an asset with significant sensitivity to systematic variability and insignificant idiosyncratic variability. As a focus for market-wide price discovery, the benchmark improves as a reference point because it leads to what happens elsewhere in the market (Dunne, Moore and Portes, 2007). This article analyzes what factors might explain Turkey's benchmark interest rate. In economics, factors determining the interest rate include supply and demand for funds, changes in money supply, monetary policies, and market liquidity and reliability. A determinant of Turkey's benchmark status is the high trading volume in the respective secondary markets (Migiakis and Georgoutsos, 2009).

In this study, by constructing a supply–demand model according to the loanable funds theory, a modern interest rate theory, we determine factors affecting the benchmark bond interest rate (benchmark interest rate). According to the model, demand and supply of debt securities can be expressed as foreign and domestic demand for domestic government debts, real money supply, real stock of government debt securities, and the treasury's real borrowing needs. On the demand side of the theory, an increase in the economy's disposable income spurs an increase in domestic savings, part of which is directed toward bills and bonds—that is, greater demand for government debt. An increase in the interest rate for borrowing increases demand for these securities and positively affects total demand. In contrast, an increase in the short-term rate shifts funds to short-term instruments and reduces the attractiveness of long-term debt. On the supply side, however, rising interest rates depress prices of securities supplied to the market and decrease the quantity of securities supplied. Accordingly,

benchmark bond rates should increase with the budget deficit and short-term real interest rates, whereas they are expected to decrease with foreign capital flows and money supply. In addition, exchange rates alter the amount of loanable funds and returns on alternative instruments and affect interest rates. These effects are visible in foreign capital inflows, trade volumes, and interbank money market rates.

To determine whether a statistically significant relationship between two time series is real, it is necessary to apply a unit root test and to determine stationarity in the series. If both series turn out to be stationary (integrated) at the same level, the relationship and regression is "real," and these series are said to be cointegrated. In other words, for the regression to be real, the series should be cointegrated (possess the same degree of stationary). This article employs the ADF test to analyze whether the data contain unit roots. To test stationarity using the ADF test, we employ a process without constants, with constants, and with a trend. Accordingly, if the series becomes stationary in a process with a trend, this value is predicated on not following the other processes. If the series does not become stationary, a test with a constant is performed. If stationarity is not attained, a test without constants is performed, and at the end of this process, the value that makes the series stationary is predicated on. In determining the optimal number of lags of dependent variables that would not cause autocorrelation in the unit root in the ADF test, Akaike's Information Criterion (AIC) is used.

Table 3.1: ADF unit root test results

Level Stationary	BIR	DDS	TV
Constant (exists) / Trend (exists)	−4,1756	−4,1756	−4,1756
	−1,7624	1,094	−2,0582
Constant (exists) Trend (does not exist)	−3,5847	−3,5847	−3,5857
	−0,8570	3,2059	−1,8850
Constant (does not exist) Trend (does not exist)	−2,6173	−2,6185	−2,6173
	−0,6020	2,2980	−0,9853
First-Order Difference Stationary	−3,5888	−3,5885	−3,5885
	−6,1873	−4,2078	−7,2273

The ADF test has been tested at 1% significance with a constant and trend, with a constant and without a trend, and without a constant and trend. The results in Table 3.1 indicate that the absolute values of the ADF test statistics for level values of all series are smaller than the absolute MacKinnon critical value. Therefore, the hypothesis that the series contains

a unit root is accepted. These results show that all the series are not stationary at their levels. When differences of the series are considered, it has been concluded that all series are stationary. Since all series are integrated to the same degree in the following stages, cointegration and causality between the series can be analyzed.

In determining cointegration between series, this article invokes the two-stage Engle–Granger and Johansen cointegration tests. The Engle–Granger method is based on a simple analysis. Accordingly, after the model is forecasted using least squares, it examines the stationarity of this regression by excluding the error term. If the error terms obtained from cointegration regressions are stationary, a long-term relationship is said to exist between the two variables. Because these regressions do not give reliable results for relationships involving more than two variables, the cointegration between the benchmark interest rate and domestic debt stock is first analyzed, followed by the cointegration between the benchmark rate and trade volume. To test the equations with domestic debt stock and trade volume, whose coefficients are significant in explaining the cointegration of the benchmark interest rate with trade volume, the residuals of the equations are applied to the ADF unit root test. The ADF test statistics show that the variables are cointegrated at the 5% confidence level (Table 3.2).

The cointegration hypothesis was tested and according to the ADF test statistics, cointegration exists at the 5% level. The existence of cointegration is sought when long-term relationships among the benchmark interest rate, domestic debt stock, and trade volume are analyzed together. The number of lags in the error correction model that accords with the AIC was found to be one, and the error correction model was forecasted as one lagged. When an external shock is delivered to this system, which as a whole is in equilibrium, the equilibrium is disrupted in the short term but system dynamics facilitates a return to equilibrium in the long term. This economic system disposes of 30% of the disequilibrium in each term.

Long-run convergence to the equilibrium of linear combinations of a group of variables (in theory dependent on each other) is possible if and only if these combinations are cointegrated. While the Engle–Granger method assumes that in such a variable vector there exists only one cointegrated vector, the Johansen test does not bring along such a restriction, and it tests multiple cointegration structures and presents maximum likelihood estimators of related cointegrated vectors. In contrast to the Engle–Granger method, the Johansen method is set off from VAR because it captures more than one cointegration relationship. Therefore, the Johansen method is also called the multiple cointegration test. In constructing a VAR model, the AIC states that the appropriate number of

lags is two. The results of the Johansen test are applied to the number of lags after the decision is identified (Table 3.3).

Table 3.2: Long-term relationships among the benchmark interest rate, domestic debt stock, and trade volume

Benchmark Interest Rate—Long-Term Relationship with Domestic Debt Stock				
Variable	Coefficient	Std. Error	t-Statistics	Prob.
DDS	−0.000118	1.95E-05	−6.060155	0.0000
Constant	48.66518	5.233158	9.299390	0.0000
Benchmark Interest Rate—Long-Term Relationship with Domestic Debt Stock (ADF Test)				
			t-Statistics	Prob.
ADF test statistics			−3.161481	0.0292
Test critical values	1% level		−3.588509	
	5% level		−2.929734	
	10% level		−2.603064	
Benchmark Interest Rate—Long-Term Relationship with Trade Volume				
Variable	Coefficient	Std. Error	t-Statistics	Prob.
TV	−0.001092	0,000421	−2.595497	0.0128
Constant	14.22206	1.205368	11.79893	0.0000
Benchmark Interest Rate—Long-Term Relationship with Trade Volume (ADF Test)				
			t-Statstics	Prob.
ADF test statistics			−2.035941	0.0412
Test critical values	1% level		−2.618579	
	5% level		−1.948495	
	10% level		−1.612135	

Table 3.3: Johansen's cointegration test results

Series: BIR DDS TV				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	Critical Value (5%)	Prob.
None*	0.414317	32.64089	24.27596	0.0035
At most 1	0.197375	9.636871	12.32090	0.1352
At most 2	0.004237	0.182586	4.129906	0.7233
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max. Eigen Statistics	Critical Value (5%)	Prob.
None*	0.414317	23.00402	17.79730	0.0075
At most 1	0.197375	9.454285	11.22480	0.1008
At most 2	0.004237	0.182586	4.129906	0.7233

Table 3.3 shows that the cointegration results based on Johansen's (1988) maximum likelihood method overlap with the results from the Engle–Granger cointegration test. According to the results in Table 3.3, the absence hypothesis ($r \leq 1$), which claims there is no cointegration, is rejected at the 99% confidence level for all variables. The fact that there is one cointegration relationship in the model was determined by both the path test and the maximum eigenvalue test. The long-term equilibrium equation obtained using the normalized cointegration vector is written as follows:

$$BIR_t = 0{,}000147\, DDS_t + 0{,}005178\, TV_t \quad (3.1)$$

The findings are consistent with the results obtained by Gupta (1992) and Kuehlwein and Samalapa (1999) in their studies for developing countries. Having obtained a long-term model, Hendry's general-to-specific modeling method was used to forecast short-term equilibrium. In the Hendry approach, a general model is first constructed that involves all variables related to the economic equilibrium relationship (theoretical model) and limits the process to the minimum possible dynamic. According to the AIC, the appropriate number of lags is two. The model is constructed with two-period lags and is called unrestricted.

Table 3.4: Forecast of unrestricted regression model coefficients

Variable	Coefficient	Std. Error	t-Statistics	Prob.
TV	0.000123	0.000368	0.335888	0.7390
DSS	−4.78E-05	9.01E-05	−0.531138	0.5987
BIR(−1)	0.702840	0.166102	4.231382	0.0002
TV(−1)	0.000112	0.000426	0.263904	0.7934
DDS(−1)	6.31E-05	0.000133	0.475043	0.6377
BIR(−2)	−0.033017	0.153011	−0.215779	0.8304
TV(−2)	−0.000627	0.000366	−1.714535	0.0953
DDS(−2)	−6.99E-05	9.48E-05	−0.737169	0.4659
Adjusted R-squared	0.819851	*Schwarz criterion*		4.299568

Table 3.4 shows the forecasts of unrestricted regression model coefficients. The model is re-parameterized to the extent possible using parameters orthogonal to each other that can be interpreted from the perspective of a long-term equilibrium. By simplifying, we find the smallest short-term model consistent with the dataset. This approach ends by testing the model's error terms and forecast power and making comparisons with competing models through rounded and unrounded tests.

Table 3.5: Forecast of restricted regression model coefficients

Variable	Coefficient	Std. Error	t-Statistics	Prob.
BIR(−1)	0.696302	0.089059	7.818445	0.0000
DDS(−1)	−4.80E-05	1.64E-05	−2.923202	0.0057
TV(−2)	−0.000439	0.000210	−2.083980	0.0436
Adjusted R-squared	0.847121	*Schwarz criterion*	3.911264	

According to the Ramsey Regression Equation Specification Error Test (RESET), Autoregressive Conditional Heteroskedasticity (ARCH), and Breusch–Godfrey serial correlation LM test results, the special model presents no statistical and econometric problems. Coefficients related to restricted regression equations appear in Table 3.5. We find that the restriction imposed while switching from the general to specific models is valid. The obtained model is written as

$$BIR_t = 0{,}696302BIR_{t-1} - 0{,}000048\,DDS_{t-1} - 0{,}000439TV_{t-2} \quad (3.2)$$

In associating the benchmark interest rate with domestic debt stock and trade volume, we must first determine which variable causes the other. Further, before the causality analysis, we should determine the appropriate number of lags. Data input is from the external to internal variables. According to the AIC, two lags are appropriate. To confirm that the benchmark interest rate is forecasted with the domestic debt stock and trade volume, the Granger causality test, shown in Table 3.6, is used. The test finds that domestic debt stock and trade volume cause the benchmark interest rate, and domestic debt stock causes trade volume.

Table 3.6: Granger causality test[2]

Null Hypothesis	F-Statistics	Probability
DDS does not Granger-Cause BIR	5.59640	0.00730
BIR does not Granger-Cause DDS	0.84348	0.43791
TV does not Granger-Cause BIR	3.09383	0.05661
BIR does not Granger-Cause TV	0.30325	0.74014
TV does not Granger-Cause DDS	1.45133	0.24663
DDS does not Granger-Cause TV	3.22756	0.05045

According to Table 3.6, causality flows from the domestic debt stock to the benchmark interest rate and trade volume and is realized from trade volume to the benchmark interest rate. Before undertaking VAR, we determine which lag to use in forming the most appropriate VAR model

[2] In order to test Granger causality, variables need to be covariance stationary and stochastic. Therefore, causality test was carried out after adjusting the variables.

under the AIC. After determining the most appropriate lag value and VAR model, we perform autocorrelation and heteroscedasticity tests to check whether it is the best model; we find that the optimum number of lags is three. The impulse-response functions are analyzed to assess the term effects of a positive one-standard-deviation shock on the variables in question on the basis of the forecasted VAR model.

Figure 1: Response to Cholesky One S.D. Innovations ± 2 S.E.

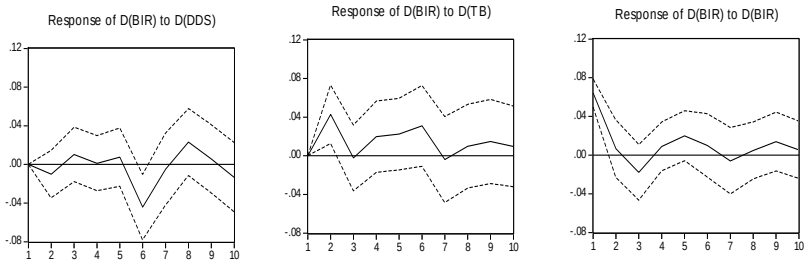

Figure 1 shows that a positive shock to the domestic debt stock demonstrated a decrease in the interest rate in the sixth period. However, over the long term, the interest rate persisted around an average. Confronting a one-standard-deviation shock in trade volume, the interest rate increased in the second period and acquired a positive value. It displayed a sudden decrease in the third and seventh period and ascended from negative to zero in the periods shown in Table 3.7.

Table 3.7: Impulse response to Cholesky One S.D. Innovations

Per.	D(TV)	D(DDS)	D(BIR)	Per.	D(TV)	D(DDS)	D(BIR)
1	0.000	0.000	0.060	6	0.031	-0.044	0.010
2	0.043	-0.010	0.007	7	-0.004	-0.005	-0.006
3	-0.002	0.010	-0.018	8	0.010	0.023	0.005
4	0.020	0.001	0.009	9	0.015	0.006	0.014
5	0.022	0.008	0.020	10	0.010	-0.013	0.005

To determine to what extent changes in domestic debt stock and trade volume affect the benchmark interest rate, a variance decomposition function is analyzed. Table 3.8 shows that the long-term effect of trade volume on the benchmark interest rate increased.

Table 3.8: Variance decomposition of the benchmark interest rate, domestic debt, and trade volume

	D(TV)			D(DDS)		
Per	D(TV)	D(DDS)	D(BIR)	D(TV)	D(DDS)	D(BIR)
1	6.51	0.36	93.13	11.10	88.90	0.00
2	30.28	2.25	67.47	26.55	72.52	0.93
3	28.37	4.09	67.54	31.95	63.72	4.33
4	30.49	3.82	65.69	35.88	60.02	4.10
5	30.27	3.81	65.92	37.43	58.28	4.29
6	28.80	21.35	49.85	39.14	55.64	5.22
7	28.65	21.38	49.97	39.87	54.85	5.28
8	27.64	24.57	47.79	43.78	50.36	5.86
9	27.57	23.85	48.58	44.41	49.82	5.77
10	27.41	24.82	47.77	44.34	49.68	5.98

	D(BIR)						
Per	D(TV)	D(DDS)	D(BIR)	Per	D(TV)	D(DDS)	D(BIR)
1	100	0.00	0.00	6	93.92	4.38	1.70
2	99.82	0.03	0.15	7	92.68	5.53	1.79
3	99.71	0.10	0.19	8	92.11	5.95	1.94
4	96.32	2.94	0.74	9	91.58	6.30	2.12
5	94.43	4.10	1.47	10	90.78	7.14	2.08

Although the effect on domestic debt stock increases in the long term, it does not significantly affect the benchmark interest rate. The important effect of trade volume on the benchmark interest rate is determined in the second period. Nonetheless, the effect on interest itself is high in the first period but decreases as the periods extend. On the other hand, effects of the trade volume on domestic debt stock increase over time and are at a significant level, but the benchmark interest rate does not significantly affect domestic debt stock. Likewise, while the domestic debt stock and benchmark interest rate have no significant effect on trade volume, effects on itself show significant increases in each period.

4. CONCLUSION

In this article, the effect of financial policies on benchmark interest rate developments in Turkey is analyzed by studying the relationship among the monthly domestic debt stock, trade volume, and the monthly average benchmark interest rate for the period 2006:01–2012:05. Public borrowing

caused by expansionist financial policies dominates the list of factors causing an increase in interest rates. Gaining control over public debt is the primary solution to this situation. From an economic perspective, the objectives of foreign trade are to source goods and services that are unavailable or prohibitively priced in the domestic market, transfer to foreign markets the goods and services that are domestically abundant, and elevate the level of wealth in the country. A growing foreign trade deficit shows that a country is not saving sufficiently to repay its debt and is immersed in a trend of further borrowing. Such growing deficit is therefore regarded as unfavorable. Consequently, these variables have the effect of increasing differences in interest rates.

Cointegration analysis was used to show that it is possible to form long-term relationships, while the general-to-specific modeling method and the VAR model were used to determine the dynamic, short-term interactions among variables. Moreover, the effects of the positive shock to domestic debt stock and to trade volume on the benchmark interest rate were analyzed. In this article, we found that the benchmark interest rate, foreign trade volume, and domestic debt stock move together in the long term owing to cointegration, and an increase in domestic debt stock and foreign trade volume causes an increase in the benchmark interest rate. In the short-term equilibrium model formed by using the general-to-specific model, benchmark interest rate changes are found to be directly proportional to the benchmark interest rate, inversely proportional to the domestic debt stock, each with a one-period lag, and inversely proportional to the foreign trade volume with a two-period lag.

Causality is examined by testing the significance of lagged differences of variables and the joint significance of the error correction term and lagged variables in the vector error correction (VEC) equation. The causality analysis concludes that while there is a strong one-way causality from domestic debt stock to the benchmark interest rate and trade volume, causality flows from foreign trade volume to the benchmark interest rate. To determine the term effects of a positive one-standard-deviation shock and to what extent changes in variables affect the benchmark interest rate, impulse response and variance decomposition functions were analyzed. Nonetheless, because changes in foreign trade volume generally stem from the shocks themselves, the shock acts externally.

To reveal the relationship among the benchmark interest rate, domestic debt stock, and foreign trade volume in Turkey, current and projected measures of variables can be used in further studies, as in Engen and Hubbard (2005). The effectiveness of the monetary transmission mechanism in Turkey is increased by the applied monetary and fiscal policies. Monetary policy makers and financial market participants try to

estimate the reaction of interest rate with monetary policy instruments in granting investment decisions and determining the risk management strategies. While monetary policy makers have the ability to directly influence short-term interest rates, they have no control over the long-term interest rates that affect the cost of borrowing and the real economic activities of the country. Transition of the effects of monetary policy from short-term interest rates to long-term interest rates occurs in security markets. Adding factors such as the real money supply, price level, the Istanbul Stock Exchange (ISE) National 100 Index, the industrial production index capacity utilization rate, and taxes to the model used in this article will enable an analysis of the interaction between the benchmark interest rate and economic indicators.

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