The Relationship Between Real Exchange Rate, Interest Rate And Current Account Deficit in the Context of Financial Crises: The Case of Turkey¹

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ABSTRACT

Keywords:

Financial Crisis, Exchange Rate, Interest Rate, Current Account Deficit, Causality Analysis.

Beginning after the Second World War, with the acceleration of the international financial integration process in the 1990s, the concept of financial crisis emerged with the integration of national and international financial markets. Domestic and foreign financial liberalization initiatives, which are carried out by ignoring the tendency of liberalization and opening up in developed and developing countries and macroeconomic instability, cause financial crises. The instability in the financial markets, which affects the country's economy and companies with its microeconomic dimension, in terms of macroeconomic indicators (exchange rate, interest rate, etc.) of unexpected events in the economy leads to instability in international financial markets and financial and real crises. In this study it is aimed to examine with Nazlioglu et al. (2016) Fourier Toda-Yamamoto causality analysis and Enders and Jones (2016) Fourier Granger causality analysis for the period 1990-2019 of Turkey within the framework of financial crises, the relationship between the current account deficit/GDP as an indicator of low-frequency banking crisis as an indicator of financial crises, the indicator of high-frequency banking crises and the real exchange rate, which is the buying and selling value of foreign currencies, and an indicator of the value of national currency in financial markets and the interest rate. In line with the findings of the Nazlioglu et al. (2016) Fourier Toda-Yamamoto causality analysis and Enders and Jones (2016) Fourier Granger causality analyzes, it was found that there is a one-way causality relationship from interest rates to exchange rates, from interest rates to current account deficit, and from exchange rates to current account deficit.

Keywords: Financial Crises, Exchange Rate, Interest Rate, Current Account Deficit, Causality Analysis.

Finansal Krizler Bağlamında Reel Döviz Kuru, Faiz Oranı ve Cari Açık İlişkisi: Türkiye Örneği

ÖZET

Anahtar Kelimeler: Finansal Kriz, Döviz Kuru, Faiz Oranı, Cari Açık, Nedensellik Analizi. İkinci Dünya Savaşı sonrasında başlayarak 1990'lı yıllarda ülkelerarası finansal entegrasyon sürecinin hız kazanmasıyla ulusal ve uluslararası finansal piyasaların entegrasyonu ile birlikte finansal kriz kavramı da ortaya çıkmıştır. Gelişmiş ve gelişmekte olan ülkelerde liberalizasyon ve dışa açılma eğiliminin görülmesi ve makroekonomik istikrarasızlıklar göz ardı edilerek sürdürülen iç ve dış finansal liberalizasyon girişimleri finansal krizlere neden olmaktadır. Ekonomide beklenmedik bir şekilde görülen olayların makroekonomik göstergeler (döviz kuru, faiz oranı vb.) açısından ülke ekonomisini ve mikroekonomik boyutuyla firmaları etkileyen finansal piyasalarda meydana gelen istikrarasızlık uluslararası finansal piyasalarda istikrarsızlıklara ve finansal ve reel krizlere yol açmaktadır. Bu çalışmada 1990-2019 dönemi için finansal krizler çerçevesinde krizlerin bir göstergesi olarak düşük frekanslı bankacılık krizi göstergesi olarak cari işlemler açığı/GSYH ve yüksek frekanslı bankacılık krizleri göstergesi ve yabancı paraların alım ve satım değeri olan reel döviz kuru ile ulusal paranın finans piyasalarındaki değerinin göstergesi olarak faiz oranı ilişkisinin Nazlıoğlu vd. (2016) Fourier Toda-Yamamoto ve Enders ve Jones (2016) Fourier Granger nedensellik analizleri bulguları doğrultusunda, faiz oranından döviz kuruna, faiz oranından cari açığa ve döviz kurundan cari açığa doğru tek yönlü nedensellik ilişkisi olduğu bulunmuştur.

Anahtar Kelimeler: Finansal Kriz, Döviz Kuru, Faiz Oranı, Cari Açık, Nedensellik İlişkisi.

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INTRODUCTION

As Sánchez (2005) stated, exchange rate and interest rate variables have a determining role on macroeconomic variables such as inflation, growth, imports and exports. The relationship between interest rate and exchange rate operates through three channels in the theoretical framework. The first channel, in case of high domestic interest rates, increases the demand for domestic financial assets, resulting in an increase in the foreign exchange supply and an appreciation of the domestic currency. The functioning of the second channel, on the other hand, has the effect of decreasing the profit share by increasing the interest burden of companies and banks with increasing interest rates. This process, which also affects the cash flow, increases the debt burden of companies and banks and creates problems in repayment of loans. Failure to repay the loans negatively affects the balance sheets of banks and causes a depreciation of the country's currency. In the third channel, the operating mechanism leads to inflationary expectations due to the increase in interest rates and causes a decrease in the purchasing power of the country's currency (Karacan, 2010: 72, 73).

Although the determinants of the current account deficit in developed and developing countries are different, there are many economic variables such as real exchange rate, growth, energy prices, interest rates, investments, public sector borrowing level, foreign direct investments, and budget deficits among the determinants of the current account deficit (Çiftci, 2014: 130).

Fofack (2005) is expressed that the country causes an increase in the foreign currency equivalent of the goods subject to export. It results in a negative impact on the country's competition in export products and an increase in the current account deficit. When the exchange rate increases, the current account deficit also increases (Baş and Kara, 2019: 20).

As stated by Blanchard and Milesi-Ferretti (2012), the current account deficit in developing countries causes macroeconomic vulnerabilities and constitutes an obstacle to the growth processes of countries. According to the Intertemporal Approach to explain the current account deficit problem, it is considered as the difference between the savings and investments of the private sector. The current account deficit is affected by many macroeconomic variables such as savings and investment gap, expected income growth, interest rate, public expenditures and exchange rate. According to Salvatore (2006), the increase in real interest rates and the appreciation of the national currency also cause the current account balance to deteriorate. Under the Marshall-Lerner condition, an increase in the real exchange rate will cause the goods subject to export to become cheaper in terms of foreign currency, which will increase exports and cause the goods subject to import to become more expensive in terms of national currency and the current account deficit will decrease. The decrease in the exchange rate will adversely affect the international competitiveness of the country and cause the sustainability of the current account balance and the current account deficit to deteriorate (Benli and Tonus, 2019: 438, 445-448).

Mishkin (1996) explains financial crises as the deterioration in financial markets as a result of the loss of effectiveness of financial markets and funds in efficient investment areas as a result of adverse selection and moral hazard problems being carried forward within the framework of information theory. Mishkin (2001) causes financial crises as a result of deterioration in financial sector balance sheets, increase in interest rates, increase in economic uncertainty, deterioration of balance sheets of non-financial companies due to changes in asset prices. According to Mishkin (2001) financial crises, the deterioration in non-financial balance sheets are followed by monetary crises, and in the third stage, it leads to a financial crisis as a result of the deterioration in financial and non-financial balance sheets as a result of the monetary crisis (Delice, 2003: 57, 58, 62).

The leading indicators of financial crises are classified by Reinhart (2002) as low-frequency and high-frequency indicators, in two groups as currency crises and banking crises. While high frequency currency crisis indicators constitute real exchange rate, banking crisis, stock prices, exports and M2/International reserves, high frequency banking crisis indicators include real exchange rate, stock prices, M2 multiplier, production (GDP) and exports. Low-frequency currency crisis indicators are current account deficit/GDP and current account deficit/investments ratio. Low-frequency banking crisis indicators are short-term capital inflows, capital inflows/GDP, current account deficit/GDP ratio (Ural, 2003: 11, 13).

Krugman explains currency crises with first generation (Canonical Crisis Models), second generation (Self-Reaffirming Crisis Models) and third generation crisis models. Paul Krugman and later Flood and Garber developed Krugman's crisis model in 1984. Crises are mostly explained by the negativities experienced in macroeconomic indicators. According to the first generation crisis model, it was observed that financial crises emerged as a result of the increase in budget deficits. In order to close the budget deficits, governments also played a role in the expansion of the money supply by printing money. In this case, the fixed exchange rate policy deteriorates and investors from abroad tend to take their capital out of the country, and citizens residing in the country also tend towards foreign exchange. The central bank responds to the increasing demand for foreign exchange by issuing foreign currency to the market, which causes a decrease in foreign exchange reserves and speculative changes cause crises. The effect of first generation crisis models on commodity markets was analyzed by Salant and Henderson by analyzing governments' policies and pricing in gold markets. Provided that it is valid under the same conditions, speculators will hold these goods on the grounds that a good will provide higher returns than other goods and that the price of the goods they hold will provide higher returns compared to other goods. However, since the prices are determined by the governments, the speculators will not want to keep their assets in their hands, since they will not be able to earn much money. In this case, the government will have a surplus of goods. In the absence of a stabilization policy, prices will rise above the prices set by governments. In this case, speculators who predict that prices will rise will start to buy the goods. If governments do not control prices, stocks will run out. According to the second generation models, it is stated that speculative attacks on the currencies of the countries will lead to economic crises in cases where the monetary and fiscal policies of the countries are in consistency, that is, when the economic indicators are not negative. One of the reasons for the second generation crisis models is that the governments want to apply a fixed exchange rate and the expectation that the fixed exchange rate system will be costly and will increase, causes the idea that the implementation of the fixed exchange rate will not be sustainable. Second generation crisis models are seen as bank crisis or currency crisis. Currency crises are often caused by the failure of fixed exchange rates. Third generation crisis models, problems in the financial and banking sectors are examined. The explanation of the reasons for the spread of crises among countries for the solution of these problems is explained on the basis of Krugman's (1998) "Government's Moral Risk Approach" and Sach's (1998a and 1998b)'s "Financial Attack Approach" theses. Third generation crisis models are sectoral growth models in which capital inflows and outflows are free and there is full capital mobility. According to this model, governments directly or indirectly give guarantees to banks that do not impose tight budgetary restrictions and provide guarantees for company securities (Durmus, 2010).

First Generation Crisis Model	Second Generation Crises Model			
* Crises are inevitable.	* Crises are contagious.			
* Crises are predictable.	* Crises are unpredictable.			
* Expectations accelerate the crisis.	* Expectations are self-fulfilling and lead to			
* Implemented policies lead to deterioration	crises.			
of macroeconomic indicators.	*Governments make choices against			
* Deterioration in macroeconomic indicators	macroeconomic policies.			
causes crises.	*Deterioration in macroeconomic indicators			
	accelerates the self-feeding crisis process.			

Table 1. First and	l Second	Generation	Financial	Crisis Models
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Source: Durmuş, 2010: 37.

The CBRT (Central Bank of the Turkish Republic) has the option of raising the policy rate to reduce the current account deficit and can use monetary policy tools. In case of an increase in the policy rate, it causes an appreciation of TL and an increase in the current account deficit. In addition, the increase in the policy rate causes a contraction in the loan demand. Since domestic demand is dependent on imports, it causes a decrease in imports and causes the current account deficit to narrow. In addition to the policy rate, the CBRT also uses alternative policy tools, the reserve requirement ratios are a tool for reducing the credit volume, while the

interest rate corridor is among the tools for reducing short-term capital inflows and credit expansion (Esen et al., 2012: 216, 217).

Literature Review

When a detailed literature review is made, it is seen that the relationship between real exchange rate, interest rate and current account deficit is mostly included in studies that deal with the variables as binary in the literature. In this study, it is aimed to contribute to the literature by considering the real exchange rate, interest rate and current account deficit variables together, examining - 1990-2019 period - a current period range and examining them with current econometric time series analysis for Turkey.

Considering the studies examining the relationship between exchange rate and current account deficit, Henry and Longmore (2003) analyzed the causality analysis for the period of 1990-2001 in Jamaica in their study and it was concluded that the effective exchange rate was not the cause of the current account deficit.

Gervais et al. (2016) discussed the relationship between exchange rate and current account deficit for 22 developing countries for the period 1975-2008, and it was concluded that there is a long-term negative relationship between real exchange rate and current account deficit for the analyzed period. Mu and Ye (2013), in their study examining 95 developing countries for the 1971-2004 period, concluded that there is a relationship between the fixed exchange rate regime and the current account deficit, but the fixed exchange rate regime prevents the current account deficit balance. In the study of Çiftci (2014), in which he dealt with the current account deficit problem in Turkey for the period 2001-2012, it was concluded that there is a long-term relationship between the current account deficit and the real exchange rate.

Looking at the studies that analyzed the relationship between interest rates and exchange rates for the first time, Frankel (1979), Feldstein (1986), Furman and Stiglitz (1998) stated that there is a significant relationship between these two variables. However, the studies conducted by Hooper and Morton (1982), Woo (1985), Goldfajn and Baig (1998) in the same years concluded that there was no relationship between the variables (Celik ve Kunç, 2020: 130).

In the studies in the literature examining the exchange rate and interest rate relationship, Westerlund (2006) examined the data of 14 OECD countries for the period 1980:01-1999:12 with panel cointegration analysis and it was concluded that the Fisher hypothesis was valid. In the study of Sever and Mızrak (2007), in which Turkey analyzed the period 1987:01-2006:06 with the VAR model, it was concluded that the effect of the change in the exchange rate on the interest rate is high. Gottschalk-Moore (2001) studied Poland for the period 1992:01-1998:08 with the VAR model and it was found that there is a strong relationship between exchange rate and interest rate variables, and the change in interest rates has positive effects on the exchange rate (Okur, 2017).

In line with the studies in the literature among the studies, Peker and Hotunoğlu (2009), Özmen (2004) and Baydur (2007) examining the relationship between interest rate and current account deficit, it is argued that an increase in interest rates will increase the current account deficit. In the study of Özatay (2006), it is stated that high real interest rates cause current account deficit in Turkey. Calderon, Chong, and Loayza (2002) also state that an increase in real interest rates will increase the current account deficit. Esen et al. (2012), on the other hand, it was stated that the increase in the policy rate will cause a decrease in the current account deficit through the credit channel (Esen et al., 2012: 224).

Econometric Analysis

In this study, in the context of financial crises, considering the low and high financial crisis indicators, the relationship between current account deficit, real exchange rate and interest rate for the period 1990-2019 for Turkey ADF unit root test, as well as Nazlıoğlu et al. (2016) Fourier Toda-Yamamoto and Enders and Jones (2016) Fourier Granger causality analysis. The exchange rate indicator used in the study is 'official exchange rate (LCU per US\$, period average)', the interest rate variable is 'deposit interest rate (%)' and the current account balance variable is 'current account balance (% of GDP) is taken. Econometric analyzes of the study were performed using the Eviews 10.0, Stata 12.0 ve Gauss 10.0 econometric programs. The data used in the study were taken from "data.worldbank.org" databases.

Variables	ADF Unit Root Test Results			
	I(0)	I(1)		
Cad	-3.244 (0.027)**	-		
Interest	-0.650 (0.843)	-7.744 (0.000)**		
Exc	2.578 (0.898)	-6.872 (0.000)**		

Table 2: ADF (1981) Birim Kök Testi

Note: ***, **, * denote significance at 1%, 5% and 10% significance levels, respectively. Exc: Exchange Rate, Interest: Interest Rate, Cad: Current Account Deficit.

As seen in Table 2, while the current account deficit variable is stationary at the 5% significance level, the interest rates and exchange rate variables are not stationary at the level, and when the first order differences of the series are taken, it is seen that the series become stationary at the 5% significance level.

Nazlioglu et. al. (2016) Fourier Toda-Yamamoto Causality Test

Granger causality test based Fourier Toda Yamamoto test, Nazlioglu et al. (2016) was developed by. The basis of the Fourier Toda Yamamoto test is the Granger causality approach developed by Toda and Yamamoto (1995). In this approach, it is aimed to estimate the VAR (p+d) model. In the model, "p" represents the lag length and "d" represents the maximum degree of cointegration of the variables. Nazlioglu et al. (2016) contributed to the literature Fourier Toda Yamamoto causality analysis, the Toda Yamamoto approach models the undulating refractions with the Fourier method. The model of the test is expressed as in equation 1 (Caglar and Kubar, 2017: 107, 109):

$$y_{t} = \alpha_{0}(t) + \beta_{1}y_{t-1} + \dots + \beta_{p} + dy_{t} - (p+d) + \varepsilon_{t}$$
(1)

The constant term parameter $\alpha_0(t)$ in the equation is time dependent and represents a structural change in y_t . Equation 2 is obtained by using the Fourier approach in order to capture the fluctuating structural changes based on the assumption that the breaking time, number and form are unknown (Caglar and Kubar, 2017: 109):

$$\alpha(t) = \alpha_0 + \sum_{k=1}^n \gamma_{1k} \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^n \gamma_{2k} \cos\left(\frac{2\pi kt}{T}\right)$$
(2)

In Equation 2, "n" represents the frequency number, γ_{1k} ve γ_{2k} frequency width and location. Becker et al. As (2006) states, if "n" is large, it is likely to be related to stochastic parameters and causes the degree of freedom to decrease, causing an over-fitting problem. In single fourier functions, break points are filled with deterministic components, regardless of break time, number and form. Nazlioglu et al. (2016) uses a single fourier frequency to define α (t) as in equation 3 (Caglar and Kubar, 2017: 110):

$$\alpha(t) = \alpha_0 + \gamma_{1k} \sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2k} \cos\left(\frac{2\pi kt}{T}\right)$$
(3)

In Equation 3, k represents the frequency. Equation 8 is obtained by substituting equation 7 in equation 5.

$$\gamma_t = \alpha_0 + \gamma_{1k} \sin\left(\frac{2\pi kt}{T}\right) + \gamma_{2k} \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 y_{t-1} + \dots + \beta_{p+d} y_t - (p+d) + \varepsilon_t \tag{4}$$

In Equation 4, the null hypothesis, which states that there is no Granger causality test, is tested. In addition, hypotheses are tested with wald statistics. Lutkepohl (2005) recommends using F statistics instead of Wald statistics. The Fourier causality test of the properties of the F distribution is stronger than the Granger causality test χ^2 distribution. Nazlioglu et al. (2016) stated in the Granger causality analysis literature that bootstrap critical values are produced in order to increase the power of the test in small samples. In addition, unit root and cointegration properties are made robust with this method. Nazlioglu et al. (2016), the bootstrap distribution of

the F statistic developed by Efron (1979) is used in the Fourier Toda Yamamoto approach (Caglar and Kubar, 2017: 110).

Causality Direction	Wald stat.	Asimptotik p-value	Bootstrap p value	р	k
Interest to Exc	10.443	0.015	0.060*	2	3
Exc to Interest	3.808	0.283	0.355	2	3
Interest to Cad	9.480	0.024	0.072*	2	3
Cad to Interest	6.067	0.108	0.188	2	3
Exc to Cad	3.906	0.048	0.061*	2	3
Cad to Exc	1.817	0.403	0.425	2	3
Note: Optimal delay and Fourier frequency lengths were determined by AIC with a maximum of 3. Bootstrap					

Table 3. Nazlioglu et. al. (2016) Fourier Toda-Yamamoto Causality Test

Table 3 indicated that the results of the Fourier Toda-Yamamoto causality test. According to the causality test findings, it was found that there is a one-way causality relationship from interest rates to exchange rate, from interest rates to current account deficit, and from exchange rate to current account deficit. Since it is a causality test that takes into account structural breaks, the fact that there is a causal relationship according to the Fourier Toda-Yamamoto test, this test once again emphasizes the importance of structural breaks in the causality relationship.

Enders and Jones (2016) Fourier Granger Causality Test

Structural breaks are ignored in Granger causality analyzes performed with the VAR (vector autoregressive model) model. In the Enders and Jones (2016) test, Gallant (1981)'s fourier functions were included in the VAR and they developed the Fourier-Granger causality analysis, which takes into account the structural breaks without knowing the date and number. Fourier trigonometric functions added to VAR are shown as expressed in equation 5 (Pata and Ela, 2020: 181, 182):

$$y_{t} = \beta_{0} + \gamma_{1k} \sin(\frac{2\pi kt}{T}) + \gamma_{2k} \cos(\frac{2\pi kt}{T}) + \vartheta_{1} y_{t-1} + \dots + \vartheta_{u} y_{t-u}$$
(5)

Causality Direction	Wald Stat.	Asimptotik p-value	Bootstrap p-value	р	k
Interest to Exc	13.109	0.000	0.005**	2	3
Exc to Interest	2.194	0.139	0.148	2	3
Interest to Cad	5.844	0.054	0.076*	2	3
Cad to Interest	4.500	0.105	0.131	2	3
Exc to Cad	3.332	0.068	0.069*	2	3
Cad to Exc	0.134	0.714	0.716	2	3
Note: Optimal delay and Fourier frequency lengths were determined by AIC with a maximum of 3. Bootstrap					
repetition count is 1000. k is the optimal frequency, p is the optimal lag-length.					

Table 4. Enders and Jones (2016) Fourier Granger Causality Test

In order to analyze the causality relationship between the variables, both Nazlioğlu et al. (2016) and Fourier Granger causality analyzes developed by Enders and Jones (2016). In line with the findings of the causality analyzes obtained from table 3 and table 4, according to the results of both causality tests, it was found that there is a one-way causality relationship from interest rates to exchange rates, from interest rates to current account deficit, and from exchange rates to current account deficit at the 5% significance level.

RESULT

As of the 1990s, the concept of financial crisis emerges with the effect of the financial integration of countries with each other due to the acceleration of the globalization process. The concept of financial crisis is a process

that affects companies with its microeconomic dimension as well as macroeconomic indicators such as exchange rate and interest rate. The unstable environment seen in financial markets also causes financial and real crisis environment.

As a result of not taking macroeconomic instabilities into account and not taking precautions due to the effect of opening up and liberalization processes of developed and developing countries, it leads to internal and external financial crises. Macroeconomic instabilities cause financial markets to become more fragile and cause economic crises.

In the last quarter of the 20th century, many crises have been seen in the world due to globalization, advances in information and technology. These crises affect the least developed and developing countries the most.

Changes in macroeconomic indicators such as interest rates and exchange rates in developed and developing countries affect the financial and real sector as a determinant of investment decisions as well as a sustainable and stable development economy. The relationship between the exchange rate, which is an important determinant of the current account deficit, and the increase in the real effective exchange rate is expressed as the appreciation of the national currency. If the current account deficit does not have a sustainable structure, it brings with it financial instability, foreign payment difficulties and financial crises.

In this study, the low and high indicators of financial crises and the period 1990-2019 are discussed for Turkey. In the study, the relationship between current account deficit, real exchange rate and interest rate was tested by ADF unit root test and Nazlıoğlu et al. (2016) Fourier Toda-Yamamoto and Enders and Jones (2016) Fourier Granger causality analyzes and econometric analysis were implemented.

According to the findings of both causality analysis tests, a one-way causality relationship was found from interest rates to exchange rates and current account deficit, and there was also a unidirectional causality relationship from exchange rates to current account deficit. The causality relationship from the interest rate to the exchange rate coincides with the analysis findings of the studies of Celik and Kunc (2020), Uslu (2018). When the relationship between exchange rate and current account deficit is examined, there is a causal relationship from exchange rate to current account deficit, exchange rate is the cause of the current account deficit, it coincides with the analysis findings of Henry and Longmore (2003) and Erbaykal (2007)'s studies.

In line with the analysis findings of our study, it is seen that there is a causality relationship from interest rates to exchange rates and from exchange rates to current account deficit for Turkey in line with two different mechanisms. According to the first mechanism, interest rates affect the exchange rate indirectly, and the exchange rate indirectly affects the current account deficit. According to the second mechanism, interest rates also directly affect the current account deficit.

Considering the importance of interest rates as they affect both the current account deficit and the exchange rate, as expressed by Özatay (2011), the importance of raising the policy rate or using the monetary policy by supporting it with other different monetary policy tools is expressed between the two policies that the CBRT will follow in order to reduce the current account deficit. However, the increase in the policy rate has an increasing effect on the current account deficit by causing an increase in foreign resource inflows through the exchange rate channel and an appreciation of the TL. In addition, the increase in the policy rate causes a contraction in loan demand and domestic demand. Turkey is an import-based country in terms of meeting domestic demand, an increase in policy interest will cause a decrease in imports due to the contraction in domestic demand and cause a decrease in the current account deficit. Since it is thought that if the first option is implemented by the CBRT, it will have an increasing effect on the current account deficit with the effect of the exchange rate channel, choosing the second option and using the policy rate hike supported by different monetary policy tools will provide more effective results in reducing the current account deficit.

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