

Testing the Relative Purchasing Power Parity in Türkiye: Comparing the Headline and Core Inflation

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Abstract

After the official abandon of the Bretton Woods Agreements in the 1973, flexible foreign rates were adopted and exchange markets were allowed fluctuate freely. Thus, the question of how to resolve the value of exchange rates came to the agenda. The first theory that came to mind was Purchasing Power Parity. The notion of PPP embraces the idea that flexible foreign exchange rates adjust themselves right away according to inflation rates. Therefore, PPP asserts that the currency of the higher inflation country should be depreciated by the inflation difference. This paper examines the validity of the relative purchasing power parity (PPP) for Türkiye with its major trading partners: the USA, the UK and Euro area. To do so, simple linear regression models is employed to quarterly data over the period 2002–2023. The empirical findings illustrate that PPP is invalid for major partner currencies (\$, £, €) since exchange rate movements and inflation differentials are not identical. However, when the headline inflation is used instead of core inflation, findings show that variations in exchange rates become more tied to inflation rates. Nevertheless, results also emphasize that Turkish Lira depreciation can be attributed other factors than inflation.

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INTRODUCTION

The price of the exchange rate gives investors an idea about many issues. For example, the performance of economy, whether the currency is accepted in world trade or the country's financial risk are first topics that come to mind (Nyambuu and Tapiero, 2018: 197). One of the variables most closely related to the exchange rate is inflation. When inflation starts to rise in a country, its impact on exchange rates is immediately felt. Firstly, the country's export demand decreases due to higher prices, which reduces the demand for the local currency. Secondly, since foreign goods will become relatively cheaper, the demand for foreign currency increases. Respectively, the reduced demand for local goods and increased demand for foreign goods simultaneously place downward pressure on the value of local currency and causing the depreciation of exchange rate (Madura and Fox, 2023: 265).

The first theory that relates exchange markets and consumer inflation is purchasing power parity (PPP). Simply put, PPP defined by Gustav Cassel, is an empirical proposition which defends the movements of exchange rates are driven by the inflation differential of two countries. PPP emerged because of how exchange rates should be determined after World War I. Because the value of pre-war exchange rates was determined by the amount of gold reserves that countries had. However, after the war, the possibility of governments attempting to rebuild their countries by printing money made it impossible to maintain the gold standard (Rogoff, 1996). PPP has two types of applications. One is Absolute PPP which defends that the exchange rate should be equal to the ratio of price levels. The other is Relative PPP which claims the inflation differential across the countries is underlying factor to determine the currency rate (Solnik and McLeavey, 2014: 83).

Many authors have listed several leading factor why purchasing power parity is invalid. To summarize, Rogoff (2007) points the volatility differential of price indices and exchange rates as causes of deviations from PPP. According to his findings, variations in commodity prices are markedly smaller than exchange rates. In another study, Rogoff (1996) suggested that value-added taxes also lead to deviation. Yoon and Jei (2019) cited downward rigidity of wage as the reason why the PPP is invalid. According to Solnik and McLeavey (2014:65, 78) rents, labor costs and sticky in good prices causes the departures from PPP especially in the short run. Similarly, Miles and Scott (2008:500) argued that transportation costs, border effects and market pricing invalidate the law of one price. Melvin and Norrbin (2017:135) noted that the consumers live in different countries choose different of basket goods. Thus, preparing the price index of each country

with different weighted consumption patterns and nontraded goods causes deviations to occur. Despite shortcomings, the reason why PPP is still worth researching is that foreign exchange rates sooner or later revert to their fundamental values (Solnik and McLeavey, 2014: 90).

This study investigates validity of Relative PPP hypothesis for Türkiye from 2002:Q1 to 2023:Q4 using OLS regression. This paper differs from existing literature on two fronts. While headline inflation rates are used in many studies (Telatar and Kazdagli, 1998; Doganlar, 1999; Yazgan, 2003; Alba and Park, 2005; Yıldırım, 2017; Özmen and Gökcan, 2004;) on Türkiye to determine purchasing power parity, this study use non-food, non-energy CPI. In addition, the general tendency in literature (Koncak and Güriş (2022), Coşkun (2020), Doğanlar et al. (2020), Doğanlar et al. (2021), Erdoğan (2021), Uğur and Alper (2023)) conducted for Türkiye is to test absolute PPP based on movements of the real exchange rate.

Apart from existing literature, this study tests Relative PPP by taking into account the inflation differences between the two countries. The parts of the study are classified in this fashion. Second section includes the literature review. Section 3 is devoted to overview of monetary policy and inflation in Türkiye. Fourth section expresses the data with model. Section 5 discusses the empirical findings. Finally, last part is the conclusion and contains some policy recommendation.

LITERATURE REVIEW

Considering that purchasing power parity has such a long history, it is not surprising that the literature is full of mixed findings. While early studies of Gailliot (1970), Officer (1978), Rush and Husted (1985) and Kim (1990) empirically supported the PPP hypothesis in general, conversely papers of Adler and Lehmann (1983), Abuaf and Jorion (1990) and Patel (1990) did not support for long run PPP. When we look at studies conducted with cointegration techniques, Varamini and Lisachuk (1998), Salchizadeh and Taylor (1999) and Arize, Malindretos and Nam confirmed the validation of PPP respectively for Ukraine emerging countries and Africa countries. However, the studies of Chocholatá (2009) and Baharumshah and Ariff (1997), Jacobo, and Sosvilla-Rivero (2021) that failed to backing purchasing power parity in cases of Slovakia, Asian countries and Argentina respectively, applying similar techniques. The studies of Zhou (1997), Haug and Basher (2011) have given partial support to the PPP hypothesis and stated that PPP is valid in the weak form. Again, many studies drawing attention to

the nonlinear nexus exchange rates and have tested PPP using nonlinear time series models. For example, Bozoklu and Kutlu (2012), Su and Chang (2011), Baum et al. (2001) and the findings of Su et al.(2002) encourages purchasing power parity. However, using similar techniques, Tiwari and Shahbaz, (2014) rejected the PPP hypothesis for India. Studies conducted for euro area, OECD, ASEAN-5, G7 and 159 international countries respectively by Koedijk et al. (2004), Kalyoncu and Kalyoncu (2008), Munir and Kok (2015), Kargbo, (2009) and Vo and Vo (2023) found support for PPP. Considering the studies conducted based on Türkiye, it is clearly seen that PPP is a controversial issue because many paper presented mixed findings. Koncak and Güriş (2022), Doğanlar et al.(2020), Doğanlar et al.(2021) and Uğur and Alper (2023) confirmed PPP's validity for Türkiye, whereas Azazi et al.(2023), Erdoğan (2021) and Coşkun (2020) concluded that PPP is not valid.

OVERVIEW OF MONETARY POLICY AND INFLATION IN TÜRKİYE

Türkiye allowed the exchange rates to float freely after 2001 crisis and again as of the same year The Central Bank of Türkiye adopted inflation targeting model. While the fixed exchange rate regime was applied in Türkiye until 1980, roughly crawling peg exchange rate and managed float regime was adopted between the episodes 1980-2001 (Leigh and Rossi, 2002). Particularly, between 1980 and 1989, the aim of exchange rate policy was to support export-led growth strategy. In later periods, the nominal value of the Turkish Lira was depreciated by the central bank in line with inflation expectations (Kandil et al., 2007).

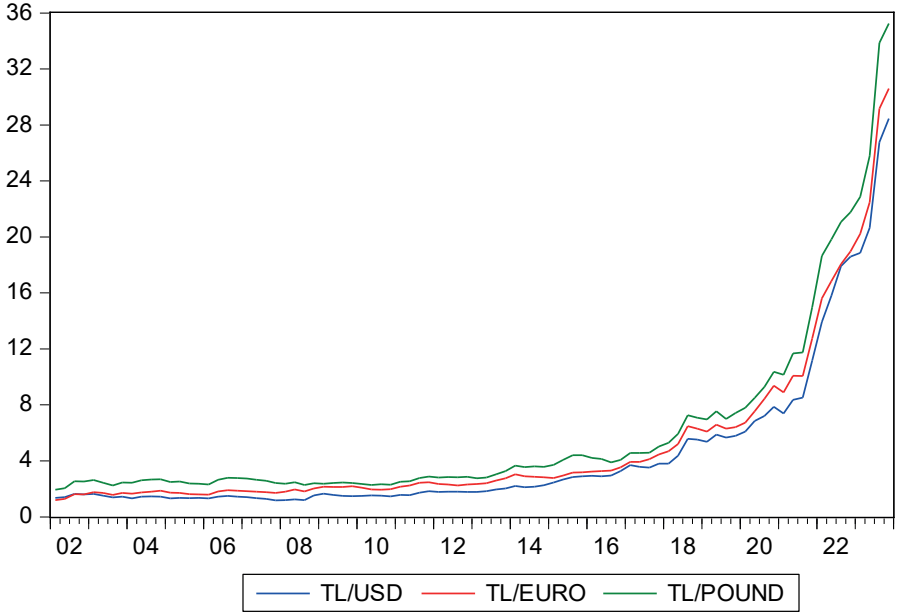


Figure 1. Value of TL against major currencies

Source: CBRT Department of Statistics

Overall, figure 1 shows that after remaining stable, the TL depreciated strongly relative to other currencies since the mid of 2019. During the 2002-2012 episodes, no abrupt movement was observed in exchange rates due to price stability. As of 2023, it seems that major currencies reached all-time high record against TL.

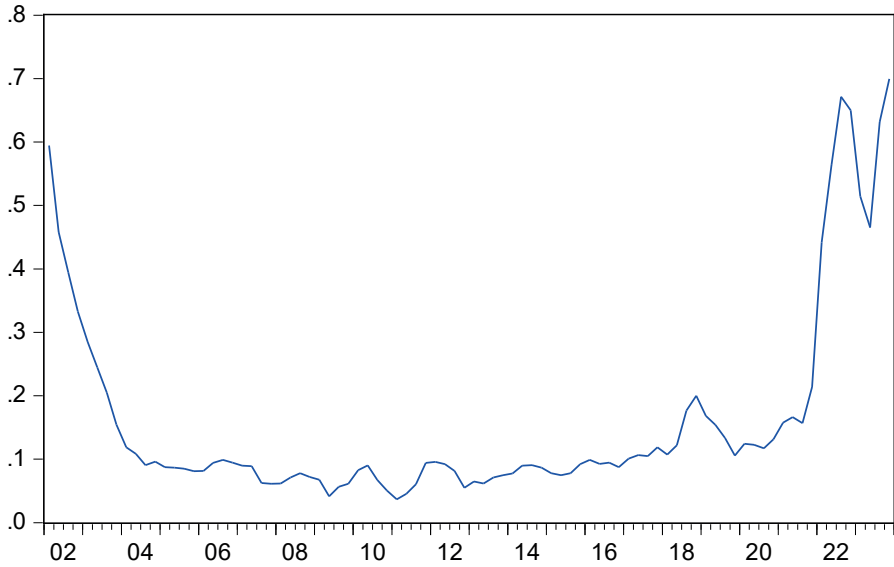


Figure 2. Türkiye inflation rate between 2002Q1-2023Q4, %

Source: CBRT Department of Statistics

Türkiye has suffered from stubborn inflation for years. Inflation rates reached very high levels in 2002 and 2021. In fact, inflation declined markedly from 60 percent in 2002 to 10 percent in 2004 within two years and before climbing back to 20 percent in 2021, stayed moderate levels from 2004 to 2012. The inflation targeting regime worked reasonably well during the period 2004-2012. Nevertheless, covering the period 2002-2023, inflation averaged about %16 quarterly, meaning that price stability has not yet been achieved. According to Cecchetti and Schoenholtz (2017), the causes of the inflation may be attributed highly to mistakes in monetary policy. However, the failed fiscal policy as a result of politicians spending more than necessary by relying on the central bank's ability to print money is also shown another reason. In some articles from the Turkish economic literature, the causes of inflation are attributed to other issue. For example, Demiralp and Demiralp (2019) stated that declining central bank of Türkiye independence result in weakening inflation targeting regime. In similar vein, Gürkaynak et al., (2023) emphasized that the central bank's early interest rate cut decisions are the main reason for the recent jump in inflation. Lastly, Yilmazkuday (2022) concluded by using VAR models that economic drivers of Turkish inflation are oil price fluctuation and US dollar rate.

DATA AND EMPIRICAL MODEL

Data

The dataset consists of quarterly observations which covers the period from 2002 Q1 to 2023:Q4 (totally 88 quarters) for Türkiye and its three major partners Euro Area, the UK, and the USA. The reason why it was started in 2002 is that the value of the Turkish Lira has been determined by market forces since that year. The inflation data set includes both headline consumer inflation and Core inflation (non-food non-energy consumer inflation) is obtained from the OECD Statistics database. The nominal exchange rates are derived from data system of The Central Bank of Türkiye.

Econometric Methodology

The paper benefited from the following ordinary least squares (OLS) regression model similar to the methods used in studies of Mishkin (1984) and Nyambuu and Tapiero (2018):

$$\% \Delta S_t = \alpha + \beta (\pi_t^{TUR} + \pi_t^F) + \varepsilon_t \quad (1)$$

Where $\% \Delta S_t$ is a percentage change in spot exchange; π_t^{TUR} and π_t^F are percentage changes in inflation of Türkiye and foreign countries, respectively and finally ε_t is a residual term distributed with constant variance, uncorrelated with one another and expected mean value is zero. Whereas the α parameter stands for intercept and is the expected depreciation or appreciation of currency, the β parameter demonstrates the effect of inflation differentials on currencies. If the relative version of PPP holds, β must be equal to 1.

FINDINGS

Summary statistics

Table 1 illustrates the descriptive statistics of the bilateral of inflation differentials and exchange rates between Türkiye and the USA, Euro zone and the UK. The p-values of the Jarque–Bera (JB) tests clearly indicate that all series have non-normal distribution. Both the means (expected value) and standard deviations (risk) of exchange rates are very close to each other. Because international foreign exchange markets do not allow arbitrage, when TL depreciates, it loses equally value against all currencies. The same is almost valid for inflation differences. Whereas the means of inflation differences ranges between 0.13 to 0.14, standard deviations varies between 0.15 and 0.16. However, it should be emphasized that core inflation differentials fluctuate relatively higher than headline inflation. A glance at

table reports positive skewness for all of inflation differentials and exchange rates. In terms of exchange rates, the findings denote the depreciations of TL outweigh the appreciations against major currencies. The kurtosis values of inflation differentials supports the the prevalence of fat tail distributions with more outliers. This fact is a result of sudden jumps in inflation in Türkiye.

Table 1. Summary statistics of inflation differentials and exchange rates

	TR-USA			TR-EURO			TR-UK		
	ID ^h	ID ^c	%ΔS	ID ^h	ID ^c	%ΔS	ID ^h	ID ^c	%ΔS
Mean	0.13	0.14	0.03	0.14	0.14	0.03	0.14	0.14	0.03
Std. Dev	0.15	0.16	0.07	0.15	0.16	0.07	0.15	0.16	0.07
Skewness	2.11	2.24	1.02	2.09	2.22	0.89	2.06	2.21	0.98
Kurtosis	6.33	7.02	4.17	6.29	6.97	3.97	6.13	6.96	4.23
JB [Prob]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Correlation*	0.33	0.34		0.37	0.36		0.35	0.33	

Source: Author's computation

ID^h: headline inflation differential, ID^c: headline inflation differential, %ΔS: spot exchange rate return

* Correlation with exchange rate

Unit Root Results

Table 2. Phillips-Perron unit root tests results

	Level			First difference of log level		
	constant	constant with trend	None	constant	constant with trend	None
TL/USD	22.93	17.25	10.11	-7.28***	-8.95***	-6.39***
TL/EURO	22.90	37.84	9.92	-7.62***	-8.42***	-6.46***
TL/POUND	29.89	24.03	11.11	-7.39***	-8.33***	-6.47***
Headline						
$\pi^{TR} - \pi^{USA}$	-1.22	-2.01	-0.77	-5.45***	-5.91***	-5.51***
$\pi^{TR} - \pi^{EURO}$	-1.23	-2.13	-0.75	-5.41***	-5.89***	-5.47***
$\pi^{TR} - \pi^{UK}$	-1.36	-2.17	-0.90	-5.42***	-5.92***	-5.48***
Core						
$\pi^{TR} - \pi^{USA}$	-2.70*	-3.58**	-2.03**	-6.27***	-7.01***	-6.24***
$\pi^{TR} - \pi^{EURO}$	-2.54*	-3.53**	-1.74**	-6.14***	-6.87***	-6.16***

$\pi^{TR} - \pi^{UK}$	-2.65*	-3.55**	-1.90**	-6.18***	-6.94***	-6.20***
critical values						
1% level	-3.50	-4.06	-2.59	-3.50	-4.06	-2.59
5% level	-2.89	-3.46	-1.94	-2.89	-3.46	-1.94
10% level	-2.58	-3.15	-1.61	-2.85	-3.15	-1.61

Source: Author's computation

For checking the stationary of variables, the Phillips-Perron (1988) unit root test was preferred constant, constant with trend and as well as none. Table 2 revealed that all series appear to be non-stationary in level forms except the core inflation differentials. However, when log-first differences of each variable were used, non- stationarity was rejected in all the cases.

Regression results

Table 3. OLS Regression results of relative PPP

	With Headline inflation			With Core Inflation		
	USA	EURO	UK	USA	EURO	UK
α	0.03***	0.03***	0.03***	0.03***	0.03***	0.03***
β	0.79***	0.50**	0.56**	0.50***	0.29**	0.32*
R^2	0.21	0.10	0.12	0.15	0.05	0.07
LM [1]	0.29	0.11	0.07	0.15	0.08	0.04
ARCH [1]	0.87	0.47	0.82	0.71	0.36	0.49
F-Stat.	23.90	10.27	12.29	0.13	5.33	6.47
F-Prob.	0.00	0.00	0.00	0.00	0.00	0.01

Source: Author's computation

*Significant at: 1%***; 5%**; 10%**

Without exception, table 3 demonstrates positive β coefficients that are less than 1. In other words, econometric results are consistent with idea that inflation differentials have a statistically significant influence on exchange rates. Since beta coefficients are in the range of 0.32 to 0.76, table presents little empirical evidence in favor of PPP. Turning to the β coefficients in table, one percent increase in headline inflation differentials leads to depreciates TL by 0.79, 0.50 and 0.56 percent, against the USA dollar, the Euro and the pound, respectively. On the other hand, taking core inflation rate into consideration, the effect of inflation differences on the exchange rate weakens significantly. In the case of core inflation, a one percent expansion

between inflation differences causes the Turkish lira to lose value by 0.50, 0.29 and 0.32 percent, against the currencies of USA, Eurozone, and UK, respectively. Overall, findings indicate that PPP does not valid because the exchange rate movements and inflation differentials are not identical. The facts that the coefficients are not equal to 1 confirm the inflation differences are not fully reflected in the exchange rate. In addition, the headline inflation data offer more support for relative PPP than core inflation.

Of course, the failure of validation of PPP does not imply that the exchange rate cannot achieve in reflecting inflation differentials. For example if Turkish inflation is higher than U.S. inflation, the Turkish lira will depreciate relative to the dollar but the depreciation is not be one-to-one, but will be half of the inflation differences. For this reason, changes in exchange rates tied to differences in inflation rates, even if there is a weak linkage.

In terms of R^2 , all three countries have low value, indicating that models fit the data poorly. The R^2 of models vary from the 0.05 to 0.21, implying that inflation differentials with optimistic forecast, explain less than 20% in the variations of exchange rate movements. This means that the remaining 80% of foreign exchange movements can be attributed factors other than inflation. Finally, table 3 shows that both LM and ARCH probability values indicate no any remaining serial correlation and heteroscedasticity of the error term.

CONCLUSION

Turkish Lira is free floating and fully determined by non-government market forces that reflect economic performance and future expectations at each point in time. Also, Lira have been fluctuating according to supply and demand freely especially after 2002. The findings of the study indicate that the price of exchange rate is not as simple as presumed by PPP. Nevertheless, it is worth stressing that TL will depreciate against major currencies quite markedly depending on the type of price index. Therefore the currency of Türkiye with higher inflation tends to weaken over time against the US dollar, the Euro and the British pound. Moreover, since the depreciation of the TL is not offset by the inflation difference precisely, Türkiye will be less competitive in the international market. To sum up, widening inflation differential feeds the depreciation of the TL. The monetary authorities should have to close the gap by implementing tightening monetary policy.

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