

# The effect of inflation on the budget deficit in Türkiye: Evidence from cointegration test with multiple structural breaks

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## Abstract

In determining the relationship between the budget deficit and inflation in literature, the effect of the budget deficit on inflation has been widely focused on. Although the impact of inflation on the budget deficit is highly significant, there has been a lack of sufficient research on this matter. There are two different views put forward on this issue. The first of these is the Tanzi effect; argues that an increase in inflation will cause a real decrease in tax revenues and therefore the budget deficit will increase. The opposing view is known as the Patinkin effect and suggests that the budget deficit will decrease because inflation will reduce real public expenditures. In this study, the effect of inflation on the budget deficit was investigated for the period 1960-2022 in Türkiye. Considering that the data period may contain many structural breaks, Carrion-i-Silvestre unit root test and Maki cointegration test were used. The years 1995, 2002, 2007, 2011 and 2018 were determined as the break dates. According to the results, the inflation rate has an increasing effect on the budget deficit in the period when there is no break. The overall result did not change when the effect of breaks was included. With these findings, it can be said that the Tanzi effect is more dominant in Türkiye.

**Keywords:** Inflation, Budget Deficit, Türkiye, Tanzi Effect, Patinkin Effect.

**JEL codes:** C22, H62, E31

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## 1. INTRODUCTION

The two most important policies are implemented to ensure price and financial stability in an economy. These are monetary policy carried out by central banks and fiscal policy carried out by governments. Inflation, which defines a constant increase in the general level of prices, is generally the most basic element that creates price instability in countries. Fiscal policy basically has two important policy tools. The first of these is public revenues, most of which consist of tax revenues, and the other is public expenditures. In this respect, fiscal policies aim to ensure price stability together with monetary policy by using these tools. (Yaraşır Tülümce et al., 2021).

The budget balance, which shows the balance of income and expenditure, is extremely important in the fiscal policy functionality. Budget deficit, as a chronic problem, is generally more common in developing countries. It is accepted that a country may have a certain level of budget deficit. For example, one of the conditions set by the European Union for participation in the monetary union in the Maastricht Treaty is that the share of budget deficits in gross domestic product (GDP) should not exceed 3%. High budget deficits create an expansionary fiscal policy effect, ultimately causing inflation. In addition, high budget deficits may necessitate an increase in public debt to finance the deficit. In this case, high public debt can make monetary policy dysfunctional (Favero and Giavazzi, 2004).

Therefore, the effect of budget deficits, which is an important indicator for an economy, on the inflation rate is a very important research topic. However, it has been observed that there is not enough research on the effect of inflation, which is the subject of this study, on budget deficits. Nevertheless, it should be noted that public revenues and expenditures, which constitute the basis for calculating the budget deficit, are susceptible to the impact of inflation due to their monetary nature. From this point of view, Tanzi (1978) stated in his study that an increase in inflation reduces real tax revenues. He attributed the realization of this cause-effect relationship to

two reasons: the delay in tax collection and the flexibility of tax revenue to changes in national income. Since these two reasons are expected to be valid, especially in developing countries, inflation will reduce real tax revenues. Therefore, a real decrease in tax revenues will increase the budget deficit. This view of Tanzi (1978) has been defined as the Tanzi effect in the literature and it has been argued that inflation increases the budget deficit (Abdioğlu and Terzi, 2009).

Regarding the effect of inflation on the budget deficit, Patinkin (1993) argues that inflation can be used as a financing tool for the budget deficit (Karadeniz, 2022). According to Patinkin (1993), high inflation will reduce real public expenditures and thus the budget deficit will be improved to some extent. In this way, the view that inflation reduces the budget deficit over the real value of public expenditures is known as the Patinkin effect in the literature. (Yaraşır Tülümce et al., 2021).

Given the aforementioned, the aim of this study is to investigate the effect of inflation on the budget deficit on the basis of the Tanzi effect and the Patinkin effect. It takes into account the tax revenues of the Tanzi effect and the public expenditures of the Patinkin effect. However, both views constitute the theoretical basis of this study, as they are approaches that ultimately concern the budget deficit. The fact that not enough studies have been conducted on the effect of inflation on the budget deficit in Türkiye makes the findings of this study valuable for the literature. In addition, since the data period of this study covers a relatively long period (1960-2022), the fact that techniques allowing multiple (five breaks) structural breaks were not used in previous studies can be considered as another contribution of this study to the literature.

In the following sections of the study, the empirical literature review on the subject will be summarized and the data and method will be introduced. Then, econometric analysis findings will be included, and the study will be completed with the conclusion part.

## 2. LITERATURE REVIEW

Past studies on the determination of the relationship between budget deficits and inflation rate generally have consistent findings. A few studies have found no relationship between the budget deficit and the inflation rate. Hondroyiannis and Papapetrou (1997) and Georganopolus and Tsamis (2011) did not find any relationship between the budget deficit and the inflation rate for Greece for the 1957-1993 and 1980-2009 periods, respectively. A similar result was reached by Tiwari et al. (2015), who used data from 9 European countries covering the period 1990-2013. In Türkiye specifically, Akçay et al. (2001) for the 1970-2000 period, Altıntaş et al. (2008) for the 1992-2006 period, Özmen and Koçak (2012) for the 1994-2011 period and Kaya and Öz (2016) for the 1980-2014 period could not detect a relationship between the budget deficit and the inflation rate.

However, in contrast to these results, a few studies have determined a positive and negative relationship between the budget deficit and the inflation rate. Egeli (1999) found negative relationships between budget deficit and inflation rate for 23 developing countries. The findings of the study conducted by Catao and Terrones (2005) for 107 developed and developing countries indicate that there is a positive relationship between the budget deficit and the inflation rate. Similarly, Zonuzi et al. (2010) determined the positive relationship result for Iran. It would not be correct to make an inference about the direction of the relationship between variables based on the findings of these few studies. However, it should be taken into consideration that the findings differ.

Studies examining the causality relationship between variables mostly point to a bidirectional causality relationship. In the context of Türkiye, Özgün (2000), Günaydın (2001, 2004), Barışık and Kesikoğlu (2006), Koyuncu (2014), İpek and Akar (2016), and Ceyhan and Yıldız (2017) studies determined the bidirectional causality relationship between budget deficit and inflation. Oktayer (2010), Bayrak and Kanca (2013), Doğru (2014) and Bayır and Güvenoğlu (2020) found a one-way causality relationship from budget

deficits to the inflation rate. In addition, when we look at the studies that analyze coefficient estimation, it is seen that they mostly focus on the effect of budget deficits on the inflation rate. The results of these studies provide clear evidence. According to these findings, budget deficits are inflationary. In other words, increasing budget deficits increases the inflation rate. The inference in question, as obtained from various country examples by Narayan et al. (2006), Devapriya and Ichihashi (2012), Isaq and Mohsin (2015), Nguyen (2015), and Arjomand et al. (2016), has been reached through studies conducted within the scope of Türkiye by Metin (1995, 1998), Akçay et al. (1996), Günaydın (2004), Oktayer (2010), Bayrak and Kanca (2013), Bedir and Tural (2014), İpek and Akar (2016), Öruç (2016), Alper (2018), Maraş and Dumrul (2019), and Erdil Şahin (2019). Contrary to the aforementioned studies, no study has been found that concludes that increasing the budget deficit reduces the inflation rate.

It can be said that there are relatively few studies examining the effect of the inflation rate on the budget deficit, which is the subject of this study. It has been observed that even in many studies examining the Tanzi effect and the Patinkin effect, the effect of the budget deficit on the inflation rate was investigated. At this point, it can be said that models have not been established within the framework of an econometrically correct cause-effect relationship to investigate the Tanzi effect and the Patinkin effect. However, the econometric model to be designed to examine the effects of Tanzi and Patinkin should focus on the effect of the inflation rate on budget deficits. When the limited number of studies conducted in this regard are compiled, Jalil et al. (2014) for Pakistan, Brima and Mansaray-Pearce (2015) and Bangura et al. (2016) for Sierra Leone, and Yaraşır-Tülümce et al. (2021) for 16 European countries have determined that an increase in the inflation rate leads to an increase in the budget deficit.

In studies conducted on the example of Türkiye, Abdioğlu and Terzi (2009) in their study covering the period of 1975-2005 have found that an increase in the inflation rate leads to a decrease in

the budget deficit, while Dağ and Kızılkaya (2019) for the period of 1960-2016 have determined that an increase in the inflation rate leads to an increase in the budget deficit. Karadeniz (2022), who reached a similar conclusion, approached the issue from a different perspective and determined that the effect of inflation on the budget deficit has a quadratic structure. Looking at the findings of the study, it was seen that the increase in the inflation rate increased the budget deficit up to a certain point and then decreased it. It has been determined that this turning point coincides with the inflation rate of approximately 74%. Additionally, Karadeniz (2022) carried out an analysis with two structural breaks in this study.

As a result, although there are different findings in the literature regarding the relationship between the inflation rate and the budget deficit, it can be said as a general conclusion that an increase in the inflation rate increases the budget deficit.

### 3. DATA AND METHOD

For the analysis of the study, data covering the years 1960-2022 for Türkiye were used. Data on the budget deficit was obtained from the Ministry of Treasury and Finance. It is proportioned to GDP taken from the World Bank data system in order to eliminate the price effect. Data on the inflation rate, the other variable of the study, was obtained from the World Bank data system and calculated as the annual percentage change of the consumer price index (CPI). Summary statistics for the series are presented in Table 1.

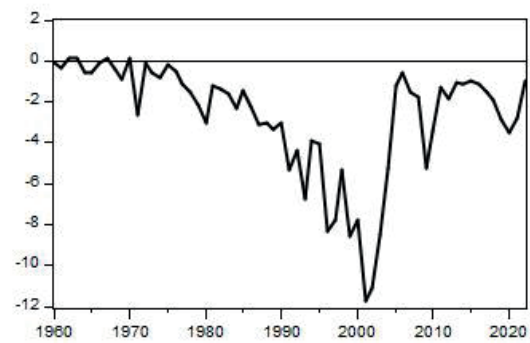
**Table 1.** Summary statistics

	BD	INF
Mean	-2.71	32.10
Std. Dev.	2.80	28.80
Maximum	0.18	105.22
Minimum	-11.74	1.12
Observation	63	63

When examining summary statistics, it becomes evident that the average budget deficit over a period of 63 years stands at approximately 2.7%. In the Maastricht Criteria, where the necessary conditions for the monetary union of the European Union are determined, this value is requested not to exceed 3%. In this respect, it can

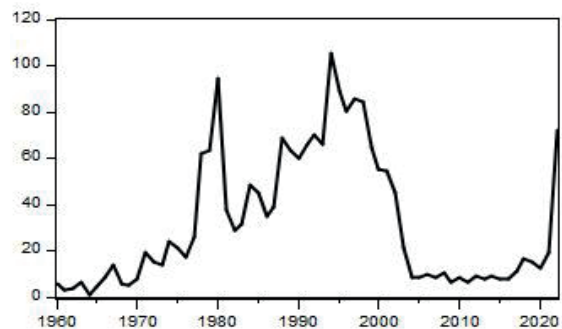
be said that Türkiye's budget deficit average is at a good level. However, the fact that the 63-year average inflation rate is approximately 32% is an important statistic showing the inflation problem that has become a chronic problem in Türkiye. In particular, the standard deviation value of 28.8% is clear evidence of price instability in Türkiye. This variability can be seen from the difference between the maximum and minimum values of the inflation rate.

The course of the budget deficit and inflation over time is seen in Graph 1 and Graph 2, respectively.



**Graph 1.** Budget deficit (Share in GDP, %)

When the graph of the budget deficit is examined, it is understood that the budget did not give a deficit, albeit for a short time, between the years 1960-1970, but there was a constant budget deficit after 1970. In particular, the budget deficit, which reached its peak in 2001, reached its highest level with 11.7%. However, it is seen that a significant recovery was achieved in the following period.



**Graph 2.** Inflation rate (annual, %)

Looking at the graph of the inflation rate, it is seen that there are rapid increases and decreases, except for the period of price stability between 2004 and 2016. Although the inflation rate



reached a significant peak of 94% in 1980, it is understood that it reached its highest value in the 63-year period, 105%, in 1994. In addition, a significant increase in the inflation is noteworthy in the period from 2021 to the present.

The use of a 63-year-old data set in the study brings to mind structural breaks. Because there have been different economic, political and social crises since 1960. For this reason, it was deemed appropriate to use the Maki (2012) cointegration test for the analysis. Following Burgaç Çil and Dülger (2017), Maki (2012) cointegration test equations were defined as follows.

**Model 0: Level Shift**

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \beta x_t + u_t \tag{1}$$

**Model 1: Level Shift (with Trend)**

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \gamma t + \beta x_t + u_t \tag{2}$$

**Model 2: Regime Shifts**

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \beta x_t + \sum_{i=1}^k \beta_i x_i D_{i,t} + u_t \tag{3}$$

**Model 3: Trend and Regime Shifts**

$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \gamma t + \sum_{i=1}^k \gamma_i t D_{i,t} + \beta x_t + \sum_{i=1}^k \beta_i x_i D_{i,t} + u_t \tag{4}$$

Here, the dummy variables represented by  $D_i$  ( $i=1, 2, \dots, k$ ) depict the structural breaks being referred to. Dummy variables take the value 1 for after the break date and 0 for other cases. In the cointegration test procedure, structural breaks are determined endogenously. In this process, the determination of multiple structural break dates is based on Bai and Perron (1988), and the stationary test of the residuals is based on Kapetanios (2005) (Maki, 2012). Additionally, in the Maki (2012) cointegration test, all series must be stationary to the first order.

Maki (2012) cointegration test has become more valuable because the previous tests with

structural breaks allowed one or two breaks. Maki (2012) presented critical values to be used for test equations up to 5 breaks. The null hypothesis of the test is that there is no cointegration under structural breaks.

**4. RESULTS**

Before the cointegration test, the stationarity levels of the series must be determined. For this reason, instead of using traditional unit root tests that ignore structural breaks, it was deemed appropriate to use the unit root test that takes structural breaks into consideration. For this purpose, the unit root test by Carrion-i-Silvestre et al. (2009), which endogenously determines the break dates and allows for five structural breaks, has been employed. Structural break periods can be determined through dynamic programming algorithms defined by Bai and Perron (2003) and Perron and Qu (2006). Furthermore, in the test utilizing the quasi-GLS method proposed by Elliott et al. (1996), five different test statistics based on M-tests, as introduced by Stock (1999), are computed (Carrion-i-Silvestre et al., 2009).

**Table 2.** The Results of Carrion-i-Silvestre (2009) Unit Root Test with Multiple Structural Breaks

Test Stat.	BD	INF	$\Delta$ BD	$\Delta$ INF
$P_T$	16.24 [9.49]	21.71 [9.00]	3.05* [5.54]	4.20* [5.54]
$MP_T$	16.33 [9.49]	20.50 [9.00]	3.15* [5.54]	4.31* [5.54]
$MZ_\alpha$	-27.42 [-46.33]	-20.88 [-46.20]	-30.16* [-17.33]	-30.18* [-17.33]
MSB	0.13 [0.10]	0.15 [0.10]	0.13* [0.17]	0.12* [0.17]
$MZ_T$	-3.68 [-4.79]	-3.18 [-4.81]	-3.86* [-2.90]	-3.66* [-2.90]
Breaks Dates	1970 1976 1995 2002 2008	1973 1980 1993 2002 2016	-	-

**Note:** Values in square brackets are critical values for the 5% significance level obtained using bootstrap with 1000 iterations. (\*) indicates stationarity at the 5% significance level.

The result evaluation of the test is different from traditional unit root tests. If the test statistical value reached as a result of the test is less than the critical value, the series is stationary with structural breaks. Otherwise, the series is not stationary. The results of the Carrion-i-Silvestre unit root test applied to the level and first

differences of inflation and budget deficit are shown in Table 2.

According to the unit root test results, both series are not stationary at level with structural breaks. However, both series are stationary in first differences. In this case, the existence of a cointegration relationship between the series can be tested. For this purpose, Maki (2012) approach, which is a cointegration test with multiple structural breaks, was used. The cointegration test results of Model 0, Model 1, Model 2 and Model 3, respectively, shown in Equations (1), (2), (3) and (4) are presented in Table 3.

According to the Maki (2012) test results, there is a cointegration relationship with five structural breaks between the series at the 5% significance level in all models. Based on this result, it has been determined that the inflation rate is an important factor affecting the budget deficit in the long run.

**Table 3.** Maki (2012) Multiple Structural Break Cointegration Test Results

Dependent Variable: BD	Model 0	Model 1	Model 2	Model 3
Test Stat.	-6.86	-8.15	-6.67	-8.79
Critical Value (5%)	-5.43	-5.70	-6.36	-7.41
Breaks Dates	1983 1987 1992 1995 2004	1989 1995 1999 2003 2010	1990 1999 2008 2013 2019	1995 2002 2007 2011 2018

It is seen that each model forming the test equations takes into account different break dates. However, in the process of estimating the long-run coefficients, it was thought that it would be more accurate to consider the results of the model with the minimum value of residuals sum of squares from these four different models. For this purpose, the fully modified least squares (FMOLS) method developed by Hansen and Phillips (1990) was used to estimate long-run coefficients. Residuals sum of squares values obtained as a result of FMOLS estimations of all models are shown in Table 4.

**Table 4.** Residuals Sum of Squares of Maki (2012) Cointegration Test Models

Model 0	Model 1	Model 2	Model 3
89.76	66.73	91.10	49.12

Based on these results, the long-run coefficients over Model 3 were estimated with the FMOLS method, taking into account the breaks dates specified in Table 3. FMOLS estimation results are presented in Table 5. When examining long-run coefficient estimates, in periods without structural breaks, it is observed that when the inflation rate increases by one percentage points, the budget deficit increases by 0.02 percentage points (negative coefficient estimated). It can be said that it is a very low effect in terms of effect size. It should also be noted that although the sign of the slope coefficient is negative, this result means that the budget deficit increases even more. Therefore, the pass-through from the inflation rate to the budget deficit is positive. Considering the structural breaks, although the effect may vary in some periods, the positive effect is generally valid.

**Table 5.** Long-Run Coefficient Estimates

Variables	Coefficient	Std. Error
INF	-0.02*	0.01
D <sub>1995</sub>	-29.97	24.65
D <sub>2002</sub>	-26.00	32.26
D <sub>2007</sub>	-8.13	37.50
D <sub>2011</sub>	57.91*	34.05
D <sub>2018</sub>	5.50	48.44
D <sub>1995</sub> *INF	0.16**	0.07
D <sub>2002</sub> *INF	-0.39***	0.14
D <sub>2007</sub> *INF	1.06**	0.40
D <sub>2011</sub> *INF	-0.95**	0.43
D <sub>2018</sub> *INF	0.18	0.19
D <sub>1995</sub> *trend	0.39	0.52
D <sub>2002</sub> * trend	0.92	0.68
D <sub>2007</sub> * trend	-0.13	0.74
D <sub>2011</sub> * trend	-0.99	0.65
D <sub>2018</sub> * trend	-0.16	0.83
Trend	-0.09**	0.03
Constant	0.58	0.37

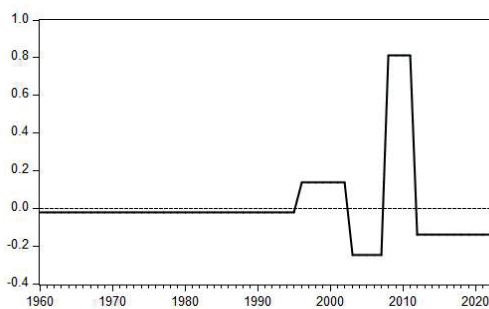
Note: (\*), (\*\*) and (\*\*\*) indicate significance at the 10%, 5% and 1% significance level, respectively. Standard errors are robust based on the Newey-West approximation.

According to the estimation results, it is seen that there were breaks for Türkiye in 1995, 2002, 2007, 2011 and 2018. These dates are important dates for the Turkish economy. It has been

determined that there were structural breaks due to significant social and economic events such as the economic and political crisis in 1994 known as the "April 5 Decisions," the implementation of important financial and fiscal rules following the 2001 financial and banking crisis, the adoption of inflation targeting regime starting from 2002, the global crisis triggered by the housing market collapse in the United States in 2007, the 2010 European debt crisis, and the currency attacks in 2018 following the political disagreement between the United States and Türkiye.

The impact of the inflation rate on the budget deficit can be calculated based on the coefficient estimates of regime variables according to the break dates. For example, the slope coefficient, which is (-0.02), increases to (0.16) after the 1995 break date, decreases to (-0.39) after 2002, increases to (1.06) after 2007, and decreases to (-0.95) after the 2011 break date. The coefficient of the regime variable for 2018 was not taken into account because it was not statistically significant.

The coefficient estimates of regime variables suggest that the inflation rate affects the budget deficit with varying magnitudes and directions when considering the structural breaks. To make this clearer, the slope coefficient estimates have been calculated for each year, excluding the insignificant effect in 2018, based on the coefficient estimates of regime variables and presented in Graph 3.



**Graph 3.** The Effect of Inflation Rate on Budget Deficit Under Structural Breaks

As can be seen from the graph, although the inflation rate had a mildly increasing effect on the budget deficit until 1995, it had a decreasing effect between 1996 and 2002, and then increased

it again between 2003 and 2007. During the period from 2008 to 2011, there is a significant reduction in the inflation rate's impact on the budget deficit. During this period, one percentage point increase in the inflation rate leads to a 0.8 percentage point reduction in the budget deficit. However, when looking at the period from 2012 onwards, it can be seen that inflation has once again started to have an increasing effect on the budget deficit. In the current phase, which also reflects contemporary influences, one percentage point increase in the inflation rate is found to increase the budget deficit by 0.14 percentage points. In a general assessment, except for two exceptional periods, the inflation rate positively influences the budget deficit. Therefore, it can be stated that if the inflation rate decreases, the budget deficit will also decrease. With this result, it can be emphasized that the Tanzi effect dominates in Türkiye, considering only the budget deficit.

## 5. CONCLUSION

The role of fiscal policy in ensuring price stability is as important as monetary policy. The primary instruments of fiscal policy include taxes and government expenditures. While the literature often examines the impact of fiscal policy instruments on inflation, it's worth noting that inflation can also affect these policy tools. Tanzi (1978), advocating the view that inflation reduces real tax revenues, has argued that this would lead to an increase in the budget deficit. However, Patinkin (1993), based on the perspective that inflation reduces real government spending, has contended that this would result in a decrease in the budget deficit. Determining which of these views, known as the Tanzi effect and the Patinkin effect, is applicable in Türkiye has been the aim of this study.

The study utilized data spanning the period from 1960 to 2022 to examine the impact of inflation on the budget deficit. The motivation behind this study was the lack of a sufficient number of studies on the effect of inflation on the budget deficit. Additionally, the chosen data period covers a time in Türkiye marked by diverse economic, political, and societal events. Therefore, it is highly likely that structural breaks

occurred in the inflation and budget deficit series. As a result, Carrion-i-Silvestre et al. (2009) structural break unit root test and Maki (2012) structural break cointegration test were selected as the analytical techniques for this study. The unit root test determined that both series were stationary in first differences. Consequently, the Maki (2012) cointegration test was applied, revealing that inflation has a long-run impact on the budget deficit.

The long-run coefficients were obtained using the FMOLS method. According to the obtained coefficient estimates, inflation positively influences the budget deficit. To put it more explicitly, one percentage point increase in the inflation rate increases budget deficits by 0.02 percentage points. When considering the break dates based on the coefficient estimates of regime variables, the overall result has not changed significantly. Therefore, only the periods between 1996-2002 and 2008-2011 have seen inflation rates having a reducing effect on the budget deficit. In all other periods, the inflation rate has played a role in increasing the budget deficit.

The results obtained suggest that the Tanzi effect is more predominant in Türkiye. Additionally, it should be noted that while the inflation rate has a positive impact on increasing the budget deficit, a decrease in inflation can also lead to a reduction in the budget deficit. It is believed that this study will shed light on authorities responsible for maintaining price stability and researchers interested in the subject. Moreover, it will contribute to the literature, which currently lacks sufficient research on the impact of inflation on the budget deficit. Furthermore, the study's reliance on multiple (five-break) structural break analyses, in line with a long data period, can be considered another valuable contribution to the literature.

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