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Abstract

Purpose: The main objective of this research was to detect whether Turkish Statistical Institute (TURKSTAT) started to understate inflation figures as alleged after it stopped announcing detailed item prices in the inflation basket.

Methodology: The study started with a simple Before-After analysis and then expanded to an application of the more comprehensive Difference-in-Differences (DiD) method. Inflation figures announced by ITO (İstanbul Chamber of Commerce) and ENAG (Inflation Research Group) were used as control group in DiD analysis. The study used monthly Consumer Price Index (CPI) data between November 2021 and January 2023. Data has been collected from the webpage of TURKSTAT, ITO and ENAG.

Findings: The fact that the price details in the inflation basket were not disclosed did not have a statistically significant effect on the difference between TURKSTAT figures and ITO and ENAG figures. Therefore, we could not reach a finding that supports the views and criticisms that TURKSTAT may understate inflation by not publishing the basket details.

Recommendation: Although it has been shown that covering up the price details in the inflation basket does not have a statistically significant dropping effect on TURKSTAT figures compared to ITO and ENAG figures, disclosing price details to the public, as in previous years, may increase transparency and trust in the institution.

Keywords: *Inflation, Inflation Basket, CPI, Data Manipulation, Official Statistics, Difference-In-Differences.*

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1.0 INTRODUCTION

Unfortunately, Türkiye is one of the countries in the world that is not unfamiliar with inflation and has had to live with it. We have been facing the inflation problem, which has been seen even in developed countries recently, for many years.

The first thing that comes to mind about inflation is the rise in prices for commonly used goods and services in our daily lives. Nevertheless, inflation entails more than just the increase of specific prices; it denotes a consistent rise in the overall price level. Put differently, it is not classified as inflation if only a few goods experience continuous price increases or if all goods encounter a one-time price increases (Kibritçioğlu, 2002). To illustrate, if the monthly inflation rate stands at 1 percent, it means that the general price level has risen by 1 percent in that particular month when compared to the preceding month. Inflation can also be understood as a decline in the purchasing power of money relative to the value of goods and services in the overall economy (Dharma et al. 2020).

1.1 Harms of Inflation

Inflation has many harms on individuals and societies. Hence, governments prioritize achieving price stability as their primary objective. Price stability entails maintaining a low inflation rate that individuals can disregard when making decisions regarding investments, consumption, and savings (Castelnuovo et al., 2003). The main troubles induced by inflation are as follows:

The most important negative effect of inflation is that it creates uncertainty in the markets, which in turn impairs the decision-making processes of individuals and companies. Price perceptions of individuals and firms become blurred due to high inflation (Golob, 1994). In an environment of high inflation, the price of everything increases constantly and disproportionately, making it difficult to understand what is cheap and what is expensive. Due to high inflation, relative price changes cannot be easily distinguished, and necessary and sufficient information cannot be provided to make sound decisions (Ball and Romer, 1993).

The uncertainty created by the inflationary environment increases the concerns of individuals and companies about the future and causes them to avoid long-term decisions (Temel Nalın, 2013). If the course of the economy over the next five to ten years cannot be approximated, such long-term considerations are delayed or not carried out at all. This negatively affects employment, development and welfare of the country. Due to prolonged periods of high inflation, individuals develop a tendency to rely on past experiences rather than future projections when making decisions. Consequently, their anticipation of price increases creates a cycle where inflation reinforces itself, hindering its decline.

The uncertainty due to inflation causes the investor to demand an extra return in order to secure himself and protect himself from risk, thus increasing real interest rates. This, in turn, increases borrowing costs, constraining the producer's credit demands and preventing investment (TCMB, 2004). High inflation also negatively affects the efficiency of investments. Inflationary environment causes individuals and firms to direct their savings to unproductive areas such as foreign currency, gold and real estate in order to protect them from inflation (Temel Nalın, 2013). The presence of high inflation creates challenges for financial markets in making accurate future predictions, thereby diminishing the efficiency of the credit market and limiting the availability of credit. As a result, both consumers and producers face obstacles in accessing loans, particularly those with longer-term durations.

High inflation also hinders the efficient functioning of the labor market. An environment where price stability cannot be achieved causes the labor market to be unstable, increase layoffs and decrease employment (Dritsaki and Dritsaki, 2012). With the uncertainty it creates, the

inflationary environment weakens the country's ability to compete with other countries and has a distorting effect on the foreign trade balance. In addition, it causes foreign capital coming to the country to be predominantly short-term and increases the fragility in the economy. As a result, long-term direct investments that will support growth and employment do not come to the country (Asiamah et al. 2019).

Inflation harms the low-income segment of the society more and increases poverty. In an inflationary environment, individuals who have the means to save can benefit from higher real interest rates. However, this situation contributes to a gradual deterioration in income distribution, as the low-income segment of society lacks the same opportunity to take advantage of these benefits (Law and Soon, 2020).

1.2 Measurement and Calculation of Inflation

Precise measurement of inflation is of great importance (Guðnason, 2005). We can explain the importance of the accuracy in the measurement of inflation with the help of a metaphor: For example, in order for a person with a health problem such as high cholesterol to be able to overcome or reduce this problem, her cholesterol level must be measured correctly. In cases where the test kit used does not measure correctly, it will not be possible to take the necessary precautions to eliminate the health problem. Likewise, in order to reduce inflation and take measures against its negative effects listed above, the increases in price levels must first be accurately measured.

In order to calculate inflation, a basket containing certain goods or services must first be created. Depending on the purpose for which inflation information will be used, the goods or services included in the basket will vary. The most popular indicator of inflation used in the world is the consumer price index, or CPI for short. CPI is an index calculated over the price increases in basic consumption products used by the public. The CPI is calculated over a basket that includes durable consumer goods such as refrigerators and televisions, perishable products such as bread, tomatoes, and goods and services such as education, transportation, housing costs, etc.

Calculation of inflation in Türkiye is carried out officially by the Turkish Statistical Institute (TURKSTAT). TURKSTAT updates the weights of the products in the basket in December every year. While the weight of the products that are used more is increased, the weight of the products that are less used is reduced. In 2022, to calculate the CPI, namely TUFE in Turkish, TURKSTAT has compiled more than 500,000 prices each month for 409 items and 904 item types from 27.000 workplaces and 4.000 residences (rents) in all 81 provinces and 225 districts.[1]

1.3 Statement of the Problem

Until May 2022, TURKSTAT had been announcing the prices of the items and item types used in the CPI calculation in detail on a monthly basis, some of which can be seen in the Table 1. However, in May 2022, it stopped announcing the prices used in the calculation and instead started to publish the price index of 290 expenditure groups. The termination of the announcement of the monthly price levels of the items in the inflation basket was the subject of criticism on the grounds that it removed the transparency. Some claimed that since item prices are not disclosed to the public and can no longer be seen, TURKSTAT may show inflation

[1] https://www.aa.com.tr/tr/ekonomi/tuik-enflasyon-sepetindeki-urunleri-ve-agirliklarini-guncelledi/2492872

lower than it is, and this will further reduce confidence in the inflation figures announced by TURKSTAT. [2]

In this study, the validity of this claim will be investigated empirically. To put it more clearly, it will be examined whether TURKSTAT started to manipulate and understate inflation figures as alleged after it stopped announcing detailed item prices. We follow a pedagogical approach while reaching this goal. In other words, the analysis methods that can be used when seeking an answer to the question of whether TURKSTAT has begun to understate inflation figures, will be developed step by step, from simple to complex. We consider May 2022, when TURKSTAT stopped explaining detailed item prices, as the turning point in which the policy change was made. Then, the inflation figures after this turning point will be compared with the inflation figures before it.

Table 1: A Part of Items and Average Prices of TURSTAT CPI Basket

Tüketici fiyat endeksi (2003=100) madde sepeti ve ortalama fiyatlar (Türkiye) Consumer price index (2003=100) item basket and average prices (Turkey)										
			TL	TL	TL	TL	TL	TL	TL	TL
			2021	2021	2021	2021	2022	2022	2022	2022
Kod		Madde adları	Eylül	Ekim	Kasım	Aralık	Ocak	Şubat	Mart	Nisan
Code		Item name	September	October	November	December	January	February	March	April
0111101	Pirinç	Rice	13.0078	12.8113	13.0396	14.8318	14.8289	15.1403	15.1767	16.5981
0111201	Buğday Unu	Wheat flour	5.4669	5.8428	6.6307	9.5536	8.9233	9.1900	9.5583	10.3459
0111208	Bebek Sütü (Toz Karışım)	Baby food	151.3812	151.5265	157.4898	166.8686	160.9100	161.5983	157.4953	155.4234
0111209	Bulgur	Boiled and pounded wheat	6.5743	6.9804	7.3841	8.9300	10.1402	10.8659	10.5602	10.7178
0111301	Ekmek	Bread	8.2790	8.4959	9.0969	10.7633	11.3447	11.7953	12.7932	13.7356
0111401	Bisküvi	Biscuit	16.9074	17.0624	18.5557	21.9986	27.7764	32.8292	33.6195	34.3655
0111402	Kraker	Cracker	15.2323	15.2853	16.7961	20.9389	29.0799	32.6233	32.0221	32.9568
0111404	Gofret	Wafer	35.6233	37.5015	41.3048	47.6634	57.4480	64.7584	63.7353	64.5431
0111405	Pasta	Cream-cake and patisserie	63.9103	65.3686	68.5170	76.2448	79.2260	82.0784	87.7666	94.0891
0111408	Kek	Cake	24.7014	25.5261	26.2085	28.9452	42.3181	49.1889	49.4520	53.4115
0111411	Baklava	Dessert	65.0194	66.4896	70.1474	79.5389	83.9016	88.2705	94.5609	102.3532
0111415	Ekmek Hamuru (Yufka)	Thin dough	11.5308	11.9642	12.9580	16.5308	18.5792	19.5658	20.3425	21.7332
0111501	Makarna	Macaroni	6.7998	7.4692	7.8062	9.2484	10.5988	10.9530	11.2831	11.5907
0111502	Şehriye	Wermicelli	6.7362	7.4195	7.7336	9.2101	10.0369	10.1861	10.5658	11.0445
0111602	Tahıl Gevreği	Cereal	26.7159	27.3459	27.5385	29.6327	32.8879	35.7656	35.6011	39.6393
0112201	Dana Eti	Veal	65.1153	65.6117	68.3084	79.5849	80.2239	85.0795	97.3522	111.5343
0112401	Kuzu Eti	Lamb	71.6164	71.5010	73.0709	83.6930	91.2928	91.8639	105.5935	120.4315
0112501	Tavuk Eti	Poultry	19.1360	19.4249	21.5999	26.9654	29.0125	28.4595	32.6942	41.5212
0112602	Sakatat	Offal	58.4928	59.1183	64.1606	72.9410	80.0085	84.0977	89.4831	96.3896
0112701	Sucuk	Garlic-flavored sausage	96.5938	96.5283	103.7896	119.9349	114.3463	113.8004	122.6919	140.4911
0112702	Sosis	Sausage	57.2156	57.7372	61.8414	70.0851	74.3052	78.9500	81.8886	92.9197
0112703	Salam	Salami	49.2379	50.0324	54.1082	62.6425	71.8449	74.9136	77.2603	90.0718

2.0 LITERATURE REVIEW

The government's aim to provide both their citizens and the international community with optimistic economic statistics such as strong economic growth, minimal unemployment and low inflation rates. In many cases, government agencies have exclusive access to the data needed to calculate these statistics. In that light, it can be said that governments may have enough incentives to manipulate these figures in their favor (Aragão and Linsi, 2020).

In recent years, the issue of manipulating statistics has sparked considerable controversies in both academic literature and policy discussions. A sizable body of the articles has focused on examining and addressing this problem. Most of them have identified consistent patterns of data manipulation by governments across various economic statistics.

Before moving on to these empirical studies on the subject, it would be appropriate to refer to Aragão and Linsi (2020), which systematically classifies data manipulation practices by government agencies. Aragão and Linsi (2020) focuses on three recent popular manipulation cases from Argentina, Brazil and Greece and suggests that governments may manipulate statistical numbers in four different ways: Governments may simply force statistical agencies to announce politically more convenient figures instead of the correct ones which are known by the most. This type of manipulation is called as the outright manipulation of statistics, or type 1-manipulation. In addition, governments may seek to manipulate statistics by presenting politically advantageous figures in cases where the actual numbers are uncertain or unknown.

[2] https://tr.euronews.com/2022/06/03/enflasyon-tuik-in-madde-sepetini-yay-nlamay-b-rakmas-seffafl-k-tart-smalar-n-alevlendirdi

(type2). Or, they may adopt statistical methodologies that yield more convenient figures (type 3). And lastly, they may use indirect means that lead to more advantageous (methodologically correct) figures (type 4).

Most of the studies in the literature have witnessed the manipulation of official economic statistics by governments. Some of them are as follows:

The estimation of data manipulation has posed methodological challenges for researchers. Some authors have employed Benford's law (e.g. Adam and Tsarsitalidou, 2022) to detect anomalies in the distribution of certain numbers. Recently, the analysis of satellite data has provided new possibilities, enabling the approximation of "true" GDP or economic growth through satellite imagery (e.g. Ghosh et al., 2010; Martinez, 2022). These approaches offer alternative methods for assessing and approximating the extent of data manipulation.

Frey et al. (2022) examined the scope and drivers of data manipulation, taking into account institutional factors. Their findings indicate that economic openness tends to reduce manipulation, whereas decentralization tends to increase it. Political openness is associated with lower manipulation in countries that under-report GDP but higher manipulation in countries that over-report GDP. However, no significant effects were observed for press freedom and the independence of statistical offices.

Electoral cycles have been identified as an additional factor that compels governments to manipulate official data. In a recent study using nightlight satellite data, Martinez (2022) shows that the more authoritarian a state is, the more it tends to inflate its GDP growth rates just before elections. Moreover, times of crisis, characterized by low economic growth rates, provide strong incentives for governments to manipulate data (e.g. Alt et al., 2014; Wallace, 2016). These findings suggest that electoral considerations and economic downturns can influence the propensity for data manipulation.

Manipulation of economic data is not limited to non-democratic regimes (Frey et al., 2022). Countries like Argentina and Greece have frequently faced suspicions of falsifying official statistics. Coremberg (2014) replicated Argentina's GDP data and discovered that the reported figures were overstated, raising doubts about the country's claim of having the highest growth rates in South America. Similarly, Greece has been found to manipulate economic data, particularly during the period of 2008-2009 financial crisis (Rauch et al., 2011). These instances highlight that data manipulation can occur even within democratic contexts.

To the best our knowledge, there is no study specific to Türkiye on whether official economic statistics are manipulated or not. However, allegations of the manipulation in the inflation figures are increasingly being voiced both in the press and in the public.[3] TURKSTAT's ceasing to announce the prices of the items in the inflation basket to the public has increased the concerns and accusations about the manipulation. Therefore, our study will provide insights into the validity of the claims regarding the manipulation of inflation statistics.

3.0 FINDINGS AND ANALYSIS

3.1 Simple Before-After Analysis

In order to see whether TURKSTAT has under-announced inflation figures since May 2022, one might suggest comparing the average inflation figures before this turning point with the average inflation figures after. This type of analysis is called "before-after analysis" or "pre-

[3] According to The Economist (2022), "in late June a group of researchers [ENAG (Inflation Research Group)] put inflation in Türkiye at 160%, double the official rate of 79%. A survey showed that seven out of ten Turks believed that group's figures rather than the government's."

post comparison analysis". It is clear that before-after analysis would be a naive one and would yield erroneous results in our case. Because, in the before-after analysis, we compare the outcome of the same variable (group) before and after a change in the relevant factor such as a policy change. This analysis assumes that if the change had never existed, the outcome of the group members would have been exactly the same as their situation before the change. In other words, it assumes that all the observed difference, if any, between the outcomes in the group before and after the change is attributed to the change in the relevant factor. However, the actual impact of the change may be larger or smaller than the observed difference. Thus, simple before-after analysis can lead to bias in predicting the effect of a change in a factor (Çelen, 2022). However, if we are sure that all the difference observed between the results in the group before and after the change is due to the change itself, the simple before-after analysis will yield reliable results (Estrada et al. 2019). It is clear that this is not the case in our study. To be more specific for our case, there may indeed be a difference between the averages before and after May 2022, completely independent of the policy change of TURKSTAT in May 2022. With such a simple average comparison, it would not be possible to argue that the reason for this difference is that TURKSTAT no longer discloses detailed item prices. However, since this kind of simple before-after analysis is the basis of the Difference-in-Differences (DiD) Method, which we will utilize in the next section, we will begin our analysis with this premature method even if it gives erroneous results.

We used monthly CPI data between November 2021 and January 2023. Descriptive statistics for the variables we used in our empirical study are presented in Table 2. We collected the data from the webpage of TURKSTAT, ITO (İstanbul Chamber of Commerce) and ENAG (Inflation Research Group).

Table 2: Descriptive Statistics

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
CPI	Consumer Price Index (monthly inflation)	45	6.44	3.92	1.18	19.35
post	Dummy variable indicating that inflation data for the relevant month belongs to post-May 2022 period	45	0.6	0.5	0	1
treated	Dummy variable to show TURKSTAT's inflation data	45	0.33	0.48	0	1

We compared the CPI averages in the framework of before-after analysis with the help of a simple regression model. For this, it is sufficient to use the variable *CPI* as the dependent variable and the dummy variable *post* as the independent variable. The specification of this simple model as follows:

$$CPI_t = \alpha + \beta post_t + \varepsilon_t \quad (1)$$

Taking conditional expectations for different periods (pre-May 2022 period, post-May 2022 period), we get the following:

$$E[CPI_t | post_t = 0] = \alpha \quad (2)$$

$$E[CPI_t | post_t = 1] = \alpha + \beta \quad (3)$$

In this specification, the constant term (α) gives the average inflation rate for the period before May 2022. The average of the inflation rates announced after May 2002 is equal to the $\alpha + \beta$.

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Therefore, the effect of the policy change made in May 2022 on the announced inflation rates seems to be β. however, as explained above, the comparison of averages with such a simple regression is flawed from the very beginning. Because in such a simple regression, all the changes observed between the periods before and after May 2022 are directly attributed to the dummy variable *post*. However, the changes in inflation rates in the period after May 2022 may have many reasons other than the policy change of TURKSTAT. Although it is not possible to detect these reasons with such a simple and faulty model, it is useful to start from it as it forms the basis of the DiD method.

Having determined the regression model in this way, we can now present its result in the Table-3 below:

Table 3: Estimation Results of Before-After Analysis

Source	SS	df	MS		
Model	69.2566944	1	69.2566944	Number of obs	= 15
Residual	100.256039	13	7.71200299	F(1, 13)	= 8.98
				Prob > F	= 0.0103
Total	169.512733	14	12.1080524	R-squared	= 0.4086
				Adj R-squared	= 0.3631
				Root MSE	= 2.777

cpi	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
post	-4.386111	1.463634	-3.00	0.010	-7.548099	-1.224123
_cons	7.618333	1.133726	6.72	0.000	5.169068	10.0676

The constant term α is found to be 7.62 and it is equal to the inflation average before May 2022. The coefficient β coefficient is found as -4.39 and it is statistically significant. Therefore, the average inflation fell to 3.23 (7.62-4.39) after May 2022. However, it should be emphasized once again that it is not possible with this model specification to attribute this decrease in the inflation rate to the change in the data announcement policy of TURKSTAT. In the post-May 2022 period, such a decrease in inflation may indeed have occurred, regardless of the data disclosure policy of TURKSTAT. This initial model does not provide us with this distinction. In the following section, we will make this initial model more realistic and develop it into the DiD model.

2.3 Difference-in-Differences Method

In the previous section, with a simple before-after analysis, we examined whether the inflation figures announced by TURKSTAT decreased after it stopped announcing item prices in May 2022. We found that there was a statistically significant decrease in the inflation figures announced after May 2022. However, it is not possible to attribute this decrease to the policy change of TURKSTAT in May 2022. The actual impact of TURKSTAT's policy change, if any, may be larger or smaller than the observed difference. Therefore, simple before-after analysis may introduce bias in estimating the effect of policy change of TURKSTAT.

Difference-in-Differences (DiD) is one of the most popular methods in the social sciences for estimating causal effects in non-experimental settings (Roth et al. 2023). It eliminates the bias of the before-after analysis by introducing one more comparison. DiD compares the before-and-after changes in outcomes of a group affected by the relevant change/event with the before-and-after changes of another group that is not affected by it. In this section, we apply the DiD methodology to obtain an unbiased estimation of how inflation figures were affected, if any, by the policy change of TURKSTAT in May 2022.

In our study, the change/event whose causal effect we want to estimate is that in May 2022, TURKSTAT stopped releasing item prices in detail, which is called the *treatment* in literature. The group that is affected by the treatment (stopping announcement of detailed figures here) is known as the *treatment group*, which corresponds to the CPI figures announced by TURKSTAT in our study. The group that is similar features with the treatment group, but not affected by treatment is called *control group* (or *comparison group*).

We have two alternatives to use as a control group to compare with the official inflation figures announced by TURKSTAT. The first is the Living Wage Index, published by the ITO (İstanbul Chamber of Commerce) to measure the retail price changes in the province of İstanbul.[4] The second alternative is the Consumer Price Index, published by a group of economists called ENAG (Inflation Research Group).[5]

We see that those who criticize TURKSTAT's termination of data disclosure especially compare the inflation figures of TURKSTAT and those of ENAG. ENAG offers alternatives to the official inflation statics of the TURKSTAT by extracting approximately 250,000 price data from online and offline sources.[6] In ENAG inflation basket, there are 339 of 418 items in the TURKSTAT basket. This is equal to 81% of the total item rate, and 80% of the item weight. The remaining 79 items are excluded from the scope due to the intermittent behavior affecting inflation, or because controlled products make up the majority. In order to make a one-to-one comparison with the TURKSTAT inflation rate, the monthly price changes of these remaining 79 products are taken from TURKSTAT, and presented as a weighted inflation rate.[7]

The selection of control group in DiD applications is critical. Because, the validity of DiD relies on assumptions about the comparability of treatment and control groups. The control group should satisfy one important condition: The treatment should only affect the treatment group and not the control group (Maier-Rigaud and Sudaric, 2019). We can easily claim that the inflation data announced by ITO and ENAG meet this condition. Because, the fact that TURKSTAT stops announcing detailed item prices as of May 2022 may only affect the inflation figures announced by TURKSTAT. Such a policy change cannot be expected to have an impact on the inflation figures of ITO and ENAG. For this reason, the inflation figures announced by ITO and ENAG will be used safely as a control group in our study.

In the DiD methodology, *the first difference* is the difference in the before-and-after sales in the treatment group (TURKSTAT's inflation figures). It is worth noting that the first difference we calculate in this way is nothing more than the above-mentioned premature before-after analysis. In DiD method, we introduce *the second difference* to measure the before-and-after change in outcomes for a different control group (ITO's and ENAG's inflation figures, separately). If we reduce the first difference by the second difference, we can "clean" the effects on the treatment group. In other words, DiD approach eliminates the above-mentioned bias of the simple before-after analysis.

Or alternatively, *the first difference* can be defined as the difference in the "before" period between groups, and *the second difference* as the difference in the "after" period between groups. Then, subtracting the first difference from the second difference, we can "clean" the effects on the "after" period. While making use of the first method in the theoretical

[4] https://bilgibankasi.ito.org.tr/tr/istatistik-verileri/istanbul-ucretler-gecinme/genel-indeksin-degisim-oranlari/aylik-degisim?year=95
[5] https://enagrup.org/?hl=en
[6] In other countries, there are initiatives that produce alternative statistical data to official statistics like ENAG. The best known for the alternative inflation statistics is shadowstats.com in the USA.
[7] https://enagrup.org/?p=metodoloji&hl=en

explanations in this section, we used the alternative interpretation in Tables 4 and 5 below, where our results are presented.

We can now consider the specification of DiD model:

$$CPI_t = \alpha + \beta post_t + \gamma treated_t + \delta post_t treated_t + \varepsilon_t \quad (4)$$

Taking conditional expectations for different periods (pre-May 2022 period; post-May 2022 period) and group (TURKSTAT data; ITO or ENAG data), we get the following:

$$E[CPI_t | post_t = 0, treated_t = 0] = \alpha \quad (5)$$

$$E[CPI_t | post_t = 1, treated_t = 0] = \alpha + \beta \quad (6)$$

$$E[CPI_t | post_t = 0, treated_t = 1] = \alpha + \gamma \quad (7)$$

$$E[CPI_t | post_t = 1, treated_t = 1] = \alpha + \beta + \gamma + \delta \quad (8)$$

Now, we compute the difference-in-differences by first calculating the before-and-after difference in the TURKSTAT data (treatment group), then calculating it for the ITO or ENAG (control group), and finally subtracting the latter from the former. As seen, the casual effect of the policy change of the TURKSTAT on its inflation announcements is captured by δ, the coefficient of interaction variable between *post* and *treated* variables.

$$\text{DiD effect} = \left[E[CPI_t | post_t = 1, treated_t = 1] - E[CPI_t | post_t = 0, treated_t = 1]\right]$$

$$- \left[E[CPI_t | post_t = 1, treated_t = 0] - E[CPI_t | post_t = 0, treated_t = 0]\right]$$

$$\text{DiD effect} = [(\alpha + \beta + \gamma + \delta) - (\alpha + \gamma)] - [(\alpha + \beta) - (\alpha)]$$

$$\text{DiD effect} = \delta$$

The DiD estimation results when ITO and ENAG are used as control groups are reported separately in Tablo-4 and Table-5.

As a result of comparing the inflation figures of TURKSTAT and ITO, our findings in Table 4 are as follows: In the period before TURKSTAT stopped disclosing the details of the inflation basket, TURKSTAT announced lower inflation compared to ITO and the difference was 0.753. However, this difference was not statistically significant.

In the period when basket details are not disclosed, TURKSTAT continues to announce lower inflation than ITO: Although the difference between the inflation figures of these two groups has increased to 1.018, this difference is still not statistically significant.

Thus, with the basket details not being disclosed, the difference between TURKSTAT and ITO figures increased approximately by 0.264 (1.018-0.753): TURKSTAT started to announce lower inflation figures compared to ITO and the gap widened. However, this difference is not statistically significant at all.

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Table 4: Estimation Results of DiD Analysis when ITO Figures are Used as Control Group

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: **30**

	Before	After	
Control:	**6**	**9**	15
Treated:	**6**	**9**	15
	12	18	

Outcome var.	**cpi**	S. Err.	|t|	P>|t|
Before				
Control	**8.372**			
Treated	**7.618**			
Diff (T-C)	**-0.753**	**1.556**	**-0.48**	**0.632**
After				
Control	**4.250**			
Treated	**3.232**			
Diff (T-C)	**-1.018**	**1.271**	**0.80**	**0.430**
Diff-in-Diff	**-0.264**	**2.009**	**0.13**	**0.896**

R-square: **0.42**

* Means and Standard Errors are estimated by linear regression

**Inference: *** p<0.01; ** p<0.05; * p<0.1

According to the Table 5, the findings we obtained as a result of the comparison of the inflation figures of TURKSTAT and ENAG within the framework of DiD are as follows: In the period before TURKSTAT stopped publicizing the details of the inflation basket, TURKSTAT announced lower inflation compared to ENAG. The difference was 4,187 and this difference was statistically significant.

In the period when basket details are not disclosed, TURKSTAT continued to announce lower inflation than ENAG: Although the difference between the announced inflation figures has decreased to 2.970, this difference is still statistically significant.

Therefore, with the details of the basket not disclosed, the difference between the inflation figures of TURKSTAT and ENAG decreased by 1.217 (4.187-2.970). However, this decrease is not statistically significant. Although if it is not statistically significant, ENAG announced relatively lower inflation figures compared to TURKSTAT in the new period, when the basket details were not disclosed, and thus the gap between the figures of the two institutions began to close.

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Table 5: Estimation Results of DiD Analysis when ENAG Figures are Used as Control Group

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: **30**

	Before	After	
Control:	**6**	**9**	15
Treated:	**6**	**9**	15
	12	18	

Outcome var.	**cpi**	S. Err.	|t|	P>|t|
Before				
Control	**11.805**			
Treated	**7.618**			
Diff (T-C)	**-4.187**	**1.781**	**-2.35**	**0.027****
After				
Control	**6.202**			
Treated	**3.232**			
Diff (T-C)	**-2.970**	**1.454**	**2.04**	**0.051***
Diff-in-Diff	**1.217**	**2.299**	**0.53**	**0.601**

R-square: **0.52**

* Means and Standard Errors are estimated by linear regression

**Inference: *** p<0.01; ** p<0.05; * p<0.1

4.0 CONCLUSION AND RECOMMENDATION

One of the stages that must be overcome on the way to fight inflation is to measure it correctly. We cannot expect to fight an inflation that cannot be measured accurately. In addition, since the incomes of some of the citizens are mostly indexed to inflation figures, inflation directly affects the welfare of these people.

TURKSTAT, which is responsible for calculating the official inflation statistics in Türkiye, had been disclosing detailed information about the prices of goods or services included in the inflation basket for many years. As of May 2022, the institution changed this policy and stopped disclosing detailed price information. This policy change has been severely criticized on the grounds that it would reduce transparency and serve to understate the inflation figures by TURKSTAT.

In this study, we examined whether this policy change in May 2022 served TURKSTAT to understate the inflation figures. For this purpose, the inflation figures of TURKSTAT were compared with those of ITO and ENAG, which produce alternative statistics, with the help of the DiD method. We come to the following conclusions:

TURKSTAT announced lower inflation figures than both ITO and ENAG in all periods examined. However, as it should be, when we do a statistical analysis, the inflation figures announced by TURKSTAT are not different from those of ITO in both periods we examined. In ENAG, on the other hand, the situation is the opposite: TURKSTAT inflation figures are significantly lower than ENAG's in both periods when the details of the inflation basket are disclosed and not.

The conclusion concerning the main motivation of our study is as follows: Not disclosing the details of the basket do not have a statistically significant effect on the difference between the figures of TURKSTAT and the figures of ITO and ENAG. Therefore, we could not reach a finding that supports the opinion and criticism that TURKSTAT can understate the inflation by

not releasing the basket details. More interestingly, when statistical significance was neglected for a moment, our study witnessed an unexpected result: In the new period, after the basket details were discontinued, TURKSTAT started to announce higher figures than ENAG compared to the previous period, and thus the gap started to close. Therefore, alternative ENAG inflation figures, which are frequently used to criticize TURKSTAT's policy of non-disclosure, do not seem to serve this purpose.

Although we demonstrated that covering up the price details in the inflation basket does not have a statistically significant impact on TURKSTAT figures when compared to ITO and ENAG figures, making price details public, as done in previous years, could enhance transparency and foster trust in the institution.

REFERENCES

Adam, A., & Tsarsitalidou, S. (2022). Data misreporting during the COVID19 crisis: The role of political institutions. *Economics Letters, 213*, 110348.

Alt, J., Lassen, D. D., & Wehner, J. (2014). It isn't just about Greece: domestic politics, transparency and fiscal gimmickry in Europe. *British Journal of Political Science*, *44*(4), 707-716.

Aragão, R., & Linsi, L. (2020). Many shades of wrong: what governments do when they manipulate statistics. *Review of International Political Economy. 29*, 1, 88–113.

Asiamah, M., Ofori, D., & Afful, J. (2019). Analysis of the determinants of foreign direct investment in Ghana. *Journal of Asian Business and Economic Studies*, *26*(1), 56-75.

Ball, L.M., & Romer, D.H. (1993). Inflation and the informativeness of prices. NBER Working Paper Series, no: 4267.

Castelnuovo, E., Nicoletti Altimari, S., & Rodriguez-Palenzuela, D. (2003). Definition of price stability, range and point inflation targets: The anchoring of long-term inflation expectations.. European Central Bank Working Paper Series, no:273.

Coremberg, A. (2014). Measuring Argentina's GDP Growth. *World Economics 15* (1), 1–32.

Çelen A. (2022). Is home advantage lost when football matches are played behind closed doors wWithout spectators? Evidence from top European football leagues in the Covid-19 Era. *International Sports Studies*, *44*(1), 67-81.

Dharma, F., Shabrina, S., Noviana, A., Tahir, M., Hendrastuty, N., & Wahyono, W. (2020). Prediction of Indonesian inflation rate using regression model based on genetic algorithms. *Journal Online Informatika*, *5*(1), 45-52.

Dritsaki, C., & Dritsaki, M. (2012). Inflation, unemployment and the NAIRU in Greece. *Procedia Economics and Finance*, *1*, 118-127.

Estrada, E., Ferrer, E., & Pardo, A. (2019). Statistics for evaluating pre-post change: Relation between change in the distribution center and change in the individual scores. *Frontiers in psychology*, *9*, 2696.

Frey, B. S., Moser, L., & Bieri, S. (2022). When do governments manipulate official statistics? An empirical analysis. https://ssrn.com/abstract=4244682.

Ghosh, T., Powell, R.L., Elvidge, C.D., Baugh, K.E., Sutton, P.C., and Anderson, S. (2010). Shedding light on the global distribution of economic activity. *The Open Geography Journal, 3* (1), 147–160.

Golob, J. E. (1994). Does inflation uncertainty increase with inflation?. Economic Review-Federal Reserve Bank of Kansas City, 79, 27-27.

Guðnason, R. (2005). How do we measure inflation?. Statistics Iceland.

Kibritçioğlu, A. (2002). "Causes of inflation in Turkey: A literature survey with special reference to theories of inflation". in: Inflation and Disinflation in Turkey, ed. by Kibritçioğlu, A., L. Rittenberg, and F. Selçuk, Aldershot: Ashgate, 43-76.

Law, C. H., & Soon, S. V. (2020). The impact of inflation on income inequality: the role of institutional quality. *Applied Economics Letters*, *27*(21), 1735-1738.

Maier-Rigaud, F. P., & Sudaric, S. (2019). The difference-in-differences approach in the estimation of cartel damage. *CPI Antitrust Chronicle*, *3*(1).

Martinez, L.R. (2022). How much should we trust the dictator's GDP growth estimates?. *Journal of Political Economy*, *130*(10), 2731-2769.

Rauch, B., Göttsche, M., Engel, S., & Brähler, G. (2011). Fact and fiction in EU-governmental economic data. *German Economic Review*, *12*(3), 243-255.

Roth, J., Sant'Anna, P. H., Bilinski, A., & Poe, J. (2023). What's trending in difference-in-differences? A synthesis of the recent econometrics literature. *Journal of Econometrics*. arXiv preprint arXiv:2201.01194

TCMB (2004), Enflasyon, https://www.tcmb.gov.tr/wps/wcm/connect/b62e1fb7-ebc1-4922-99dc-b3ba23320b9f/enflasyon.pdf?MOD=AJPERES&CACHEID=ROO

Temel Nalın, H. (2013). Determinants of household saving and portfolio choice behaviour in Turkey. *Acta Oeconomica*, *63*(3), 309-331.

The Economist (2022). Turkey grapples with triple-digit inflation. https://www.economist.com/europe/2022/07/14/turkey-grappleswith-triple-digit-inflation

Wallace, J.L. (2016). Juking the stats? Authoritarian information problems in China. *British Journal of Political Science 46* (1), 11–29.