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AN ESSAY ON INFLATION HYSTERESIS IN TURKEY

Abstract

In today's world, where globalization is increasing rapidly, the epidemic process is experienced, international supply chains are disrupted, and geographical tensions are escalating; the frequency and severity of socioeconomic and political shocks are increasing day by day. In this process, the effects and temporality of shocks are very important for countries to evaluate current opportunities and threats. From an economic point of view, in the most general sense, the permanent effect of shocks on the series and the inability to return to the past equilibrium state after the shock are handled at the center of the concept of "hysteresis". Although hysteresis studies are extensively studied on unemployment series in the literature, it is possible to question macroeconomic variables such as economic growth and inflation by modeling from here. Accordingly, within the scope of this study, the temporality of shocks in monthly price indices data in Turkey is investigated with ADF, PP, and Zivot-Andrews unit root tests. According to the empirical results, it has been determined that the hysteresis hypothesis is valid with structural breaks in most of the consumer and producer price indices and so that the series cannot return to their previous equilibrium states after the shocks. Structural break dates, on the other hand, indicate that political processes and tensions on a national and international scale can cause permanent inflationary effects. From this point of view, it is concluded that the authorities should act as proactively as possible to intervene directly/indirectly in the face of stochastic inflationary shocks and developments.

Keywords: Macrodynamics, Hysteresis in Price Indices, Sticky Inflation

TÜRKİYE'DE ENFLASYON HİSTERİSİ ÜZERİNE BİR DENEME

Özet

Küreselleşmenin hızla arttığı, salgın sürecinin yaşandığı, uluslararası tedarik zincirlerinde aksamaların oluştuğu ve coğrafi gerilimlerin tırmandığı günümüzde sosyoekonomik ve politik şokların frekansı ve şiddeti her geçen gün artmaktadır. Bu şokların etkilerinin ne olacağı ve özellikle de geçiciliği ülkelerin halihazırdaki fırsat ve tehditleri değerlendirebilmeleri açısından oldukça önemlidir. İktisadi açıdan bakıldığında en genel anlamıyla şokların seriler üzerinde kalıcı etkide bulunması ve şok sonrası eski dengeye gelememe durumu "histeri" kavramı merkezinde ele alınmaktadır. Histeri çalışmaları her ne kadar literatürde yoğun olarak işsizlik serileri üzerinde yapılsa da buradan modellenerek döviz kurları ve enflasyon gibi makroekonomik değişkenler üzerinde de sorgulanması mümkündür. Bu çalışma kapsamında Türkiye'de aylık enflasyon verilerindeki şokların geçiciliği ADF, PP ve Zivot-Andrews testleriyle araştırılmaktadır. Ampirik sonuçlara göre, tüketici ve üretici fiyat endekslerinin büyük bir kısmında histeri hipotezinin yapısal kırılmalarla birlikte geçerli olduğu, şok sonrası serilerin önceki denge düzeylerine dönemedikleri tespit edilmiştir. Yapısal kırılma tarihleri ise ulusal ve uluslararası ölçekteki politik süreçlerin ve gerilimlerin kalıcı enflasyonist etkilere neden olabildiğini işaret etmektedir. Buradan hareketle yetkililerin stokastik enflasyonist gelişmeler karşısında doğrudan/dolaylı olarak müdahale edebilmek üzere olabildiğince proaktif hareket etmeleri gerektiği sonucuna ulaşılmaktadır.

Anahtar Kelimler: Makrodinamikler, Fiyat Endekslerinde Histeri, Yapışkan Enflasyon

1. INTRODUCTION

It is a highly controversial issue whether socioeconomic and political developments act in a balance. On the one hand, the random point of view is accepted, on the other hand, the harmony-centered view in which all developments repeat each other, and the balance is preserved over time is accepted (Ersoy, 2015: 13-17). From an economic point of view, it is seen that this approach, which is accepted as a general balancer and comes even from Ancient Greek philosophers. This view had started to find an economic response with the Physiocratic thought and has been adopted by great minds such as A. Smith and D. Ricardo, the founders of modern economics. Accordingly, a general understanding of balance is valid in all-natural events and so it is accepted that this balance can be observed in economics in the absence of governmental intervention (Haftacı, 2014: 11-14). The "Rely on the market" phrase was quite popular, however, with the Great Depression of 1929, it was accepted that these assumptions were relatively shaken, and the "what is the long term" question became the center of discussions. Keynes and his outstanding intervention-based ideas are considered very important in depression times. However, the types, sizes, and styles of these interventions were not clear enough, so the effectiveness of interventions began to be questioned and discussed. Here, discussions centered on whether which series will self-equilibrate come to the fore.

Considering these discussions in Turkey, it is possible to predict that the results will be quite complex. Because, due to its geostrategic location, it is a country that is culturally between east and west, and economically between north-south countries. In addition, its young and dynamic population, complex political functioning, and unique historical background can cause frequent socio-political and economic shocks and crises in Turkey. From an economic point of view, these shocks can change over time, especially inflation, employment, exchange rate and current account deficit.

The developments in inflation after 1980 can be examined in terms of index and percentage from chart 1 below. Looking at the percentage changes on the left vertical axis and shown with bar graphs, it is seen that the Turkish economy entered a period of high inflation after 1980, when free market-centered open policies were adopted, fluctuated at very high rates, especially in the 1990s, and even inflation rates exceeding 104% were experienced in 1995. After the turbulent 90s, Turkey experienced economic crisis in 2000 and 2001, and went to IMF and then implemented IMF-centered economic programs. The main purpose of these programs was to reduce high inflation and to ensure economic stability. With the high interest policy implemented in the early 2000s, the capital flows were increased, and exchange rates declined very much. In August 2008, the Dollar/TL rate decreased to the level of 1.16. With the effect of the falling exchange rate, a serious decrease was observed in inflation and the annual inflation rate decreased to 6.3% in 2009.

Looking at the index value, it is striking that the price increases are continuous and even the slope changes over time. This situation shapes the suspicions that inflation, which is one of the macroeconomic variables that gives the most comprehensive set of information about the health of the economic functioning, cannot come into balance on its own. To investigate this suspicion, the persistence of shocks in inflation data is examined within the scope of the study. In this direction, the following section discusses the macrodynamics and hysteresis hypothesis, then introduces the applied methodology and presents the findings. In the evaluation and conclusion part, the findings are discussed within the scope of current developments and possible expectations.

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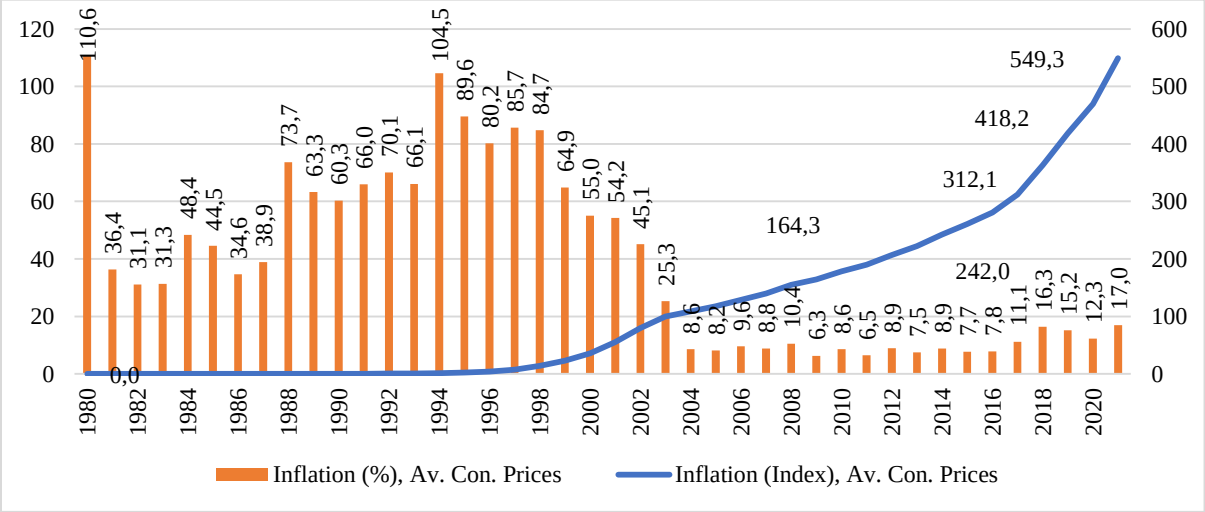
Chart 1: Development of Inflation Series of Turkey, 1980-2021 (2021est)



Source: International Monetary Fund – World Economic Outlook Database

2. MACRODYNAMICS AND THE HYSTERESIS HYPOTHESIS

"History matters" pattern is one of the key concepts of the economic process which has dynamic and quite complicated characteristics. Path dependency term is framing this dynamic process into a concept of equilibrium (Dutt, 2009: 118). Here the "what exactly is path dependency?" question is coming out. In a dynamic process, if earlier states affect the latter ones, it calls path dependency (Setterfield, 2009: 37-40). But there can be alternative equilibrium positions routes and shocks can convey the path into another state. Reversibility to the past equilibrium opens the hysteresis debate. If it is irreversible, there is a permanent effect of shock on the series, here the hysteresis hypothesis becomes valid (Arestis and Sawyer, 2009: 5).

The hysteresis hypothesis can be valid in all static macroeconomic variables such as economic growth and inflation rates which can be evaluated as path dependent and unit root approaches are used to identify 'hysteresis' macrodynamic analysis (Setterfield, 2009: 37-40). The most common hysteresis studies are focused on the unemployment hysteresis hypothesis which states that permanent effects of the temporary economic shocks on unemployment rates (Røed, 1997). Unemployment hysteresis has largely been studied during crisis such as 1970s and 2008 financial crisis and discussed deeply especially in macroeconomic policy debates (Jump and Levine, 2021: 2; Çınar et al., 2014: 30; Kahyaoğlu et al., 2016: 105; Baysal Kar, 2019: 279).

Blanchard and Summers (1986), who worked on the failure of unemployment rates to return to the previous equilibrium level after the economic crisis in Europe, published a pioneering study on unemployment hysteresis (Røed, 1996: 590). Afterwards, the discussions on the characteristics of unemployment data in the face of shocks, three basic approaches come to the fore as the natural rate hypothesis, the unemployment hysteresis hypothesis, and the structuralist approach (Özcan, 2012: 96). The hysteresis hypothesis states that shocks will have permanent effects, the natural rate hypothesis adopted by Phelps (1967) and Friedman (1968) states that post-shock unemployment rates will converge to the NAIRU level. And the structuralist approach proposed by Phelps (1994) states that the permanence of the effect of shocks may be confused due to structural breaks which can be caused by institutional reasons and endogenous dynamics, and therefore unit root tests with structural breaks should be performed (Öztürk, 2020: 4886).

With the increase in globalization, it is seen that socioeconomic and political shocks can spread to countries instantly. The reflection type and permanence of these stochastic shocks may vary according to the internal characteristics of the economies. Although hysteresis studies mostly focus on unemployment rates in the relevant literature, as Setterfield (2009) stated, this approach can be used for macroeconomic data to understand macrodynamics processes. Here, considering the persistence of shocks in terms of inflation, as the New Keynesian model indicates, issues such as price stickiness, market clearance problems and coordination failure may find a place to be debated (Mankiw - Econlib.org). In this situation where sticky inflation probability will be triggered, it opens the door for the authorities to intervene the economy within the scope of monetary and fiscal policies.

In its simplest form, inflation, which expresses the constant increase in the general level of prices, is a threat to all economies, especially to imperfect competition markets. Considered together with its unpredictable consequences, it can give significant legitimacy to public interventions. Understanding the dynamics and examining the developments in inflation data, which has various types such as supply, cost, price and expectation inflation, is important for understanding and comprehending economic activity. However, it should be noted that fluctuations in inflation rates and especially hysteresis research are not encountered in the relevant literature.

3. DATA AND METHODOLOGY

Within the scope of the study, series are analyzed firstly with traditional unit root tests as Augmented Dickey-Fuller (1979) and Phillips-Perron (1988). And then Zivot-Andrews (1992) unit root test with endogenous structural break, has used to understand whether the hysteresis hypothesis is valid for price indices.

3.1. Price Indices and Inflation Data

In this study, which was conducted to investigate the inflation dynamics, two separate data sets from the Turkstat database are used. The first of these is the group consisting of consumer price indices. In the second group, there are sub-headings related to producer price indices. Details are in the table.

Table 1: Variables, Definitions and Coverage

Variable	Definition	Coverage
CPI	Consumer Price Index (Headline Inflation)	2003M02-2021M11
CPI-A	CPI excluding seasonal products	2003M02-2021M11
CPI-B	CPI excluding unprocessed food, energy, alcoholic beverages, tobacco and gold	2003M02-2021M11
CPI-C	CPI excluding energy, food and non-alcoholic beverages, alcoholic beverages, tobacco and gold	2003M02-2021M11
CPI-D	CPI excluding unprocessed food, alcoholic beverages and tobacco	2003M02-2021M11
CPI-E	CPI excluding alcoholic beverages and tobacco	2003M02-2021M11
CPI-F	CPI excluding administered and directed prices	2003M02-2021M11
DPPI	Domestic producer price index and rate of change	2010M02-2021M11
NDPPI	Non-domestic producer price index and rate of change,	2010M02-2021M11
PPIAP	Producer price index of agricultural products	2010M02-2021M11
SPPI	Services producer price index and rate of change	2017M02-2021M10
Data obtained from Turkstat		

3.2. Zivot – Andrews (1992) Unit Root Test with Single Endogenous Structural Break

Zivot - Andrews (1992) investigates the existence of unit roots through three models, based on the idea that the stationarity of economic data can be affected by endogenous structural breaks. They

developed a unit root test that detects structural breaks, in this perspective models set as Model A level (DU), Model B trend (DT) and Model C level + trend ($DU + DT$).

Model C equation becomes $y_t = \mu + \alpha y_{t-1} + \beta t + \theta_1 DU(\varphi) + \theta_2 DT(\varphi) + \sum_{i=1}^{k} d_i \Delta y_{t-j} + e_t$

and $\varphi = T_B / T$ equation gives the break date. Here, α the statistical data of the observation with the lowest value of the parameter are compared with the critical values, and if the absolute value is small, the null hypothesis that there is a unit root with a structural break in the series cannot be rejected (Yılancı, 2009: 327-328).

4. EMPIRICAL RESULTS

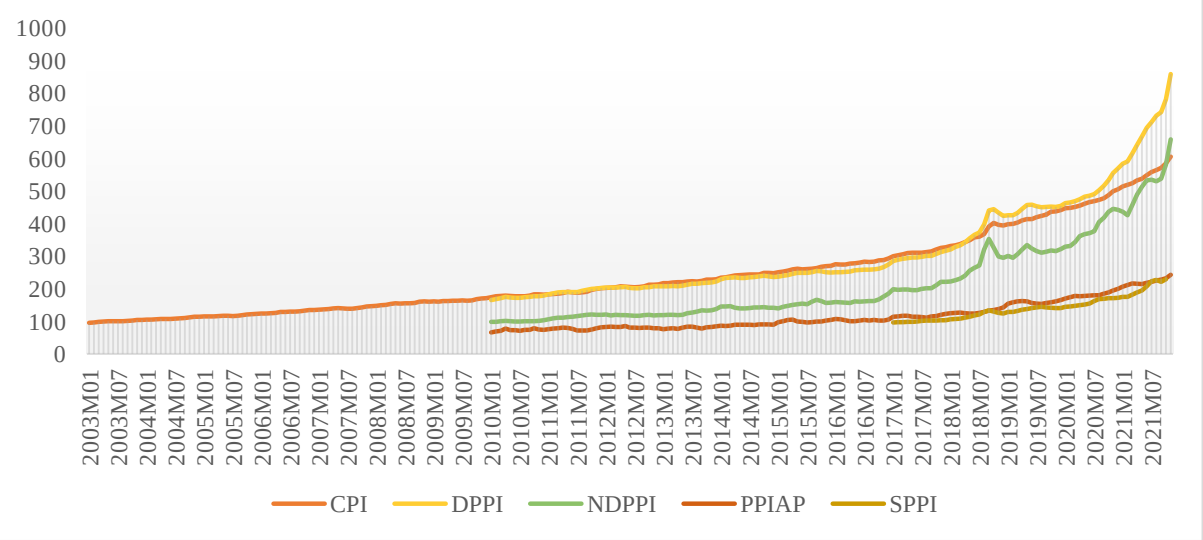
The results of the analyzes on inflation developments are as follows. According to descriptive statistics, data on CPI and its subheadings start in February 2003 and consist of 226 observations. Producer price indices such as DPPI, NDPPI, PPIAP starting from February 2010 have 142 observations, and SPPI starting from 2017 has 57 observations.

Table 2: Descriptive Statistics

	Mean	Median	Max.	Min.	Std. D.	Skewness	Kurtosis	Obs.
CPI	0.83	0.74	6.30	-1.44	0.88	1.26	9.06	226
CPI-A	0.85	0.74	6.14	-1.53	0.71	2.33	17.13	226
CPI-B	0.77	0.69	6.70	-1.48	0.86	1.63	12.11	226
CPI-C	0.74	0.63	6.76	-1.87	0.97	1.13	8.37	226
CPI-D	0.79	0.69	6.64	-1.45	0.83	1.87	13.20	226
CPI-E	0.81	0.71	6.61	-1.52	0.91	1.30	9.53	226
CPI-F	0.83	0.72	6.99	-2.01	1.02	1.06	8.22	226
DPPI	1.18	0.88	10.88	-2.53	1.78	2.29	12.34	142
NDPPI	1.40	0.85	18.16	-8.44	3.17	1.42	9.49	142
PPIAP	0.96	0.97	9.31	-6.28	2.70	0.11	4.18	142
SPPI	1.55	1.33	7.82	-3.26	2.16	0.52	4.13	57
Obtained with Eviews 10.0								

When the development of the series is examined, it is seen that the curves increase steadily over time. Here, in the autumn of 2021, when exchange rate and inflation shocks were experienced, it is striking that the DPPI and NDPPI series reached a very high acceleration.

Chart 2: Development of Consumer and Producer Price Indices, Monthly - 2003-2021



Source: Turkstat

In addition, it is observed that the trend in PPI became unstable after the exchange rate shock experienced in 2018 and fluctuated in parallel with global uncertainties and disruptions in supply chains, especially during the COVID19 pandemic process.

When the fluctuations in the series are analyzed seasonally (Annex 1), considering the monthly distributions of the consumer price index data, which is the first of these, it is seen that the CPI in Turkey is fluctuating, and although it is low in the summer months, it reaches the highest values especially in September and October. The effects of the shocks experienced in the last two years can also be read on monthly basis through the deviations in the series.

When the seasonal fluctuation graphs in the sub-headings of consumer inflation are examined (Annex 3), the effect of the exchange rate shock experienced in 2018 can be seen in the data for September and the effect of the exchange rate shock experienced in 2021 can be seen in the data for November. It can be concluded here that CPI-A is the most stable type of inflation and CPI-C is the most unstable series. Looking at the seasonal changes in the indices for changes in producer prices (Annex 2), it is seen that DPPI and NDPPI data move relatively stable, whereas PPIAP and SPPI data -naturally- fluctuate.

The results of ADF and PP unit root tests, which are traditional unit root tests, are presented in the table. According to the results, the hysteresis hypothesis is valid for the CPI-B and CPI-C series, while the natural rate hypothesis is valid for the others.

Table 3: Augmented Dickey - Fuller and Phillips - Perron Unit Root Test Results

		With Constant		With Constant & Trend			With Constant		With Constant & Trend	
		At Level					At First Difference			
		t-Statistic	Prob.	t-Statistic	Prob.		t-Statistic	Prob.	t-Statistic	Prob.
UNIT ROOT TEST TABLE (ADF)	CPI	-5.68	0.00	-8.84	0.00	d(CPI)	-9.71	0.00	-9.76	0.00
	CPI-A	-8.82	0.00	-9.03	0.00	d(CPI-A)	-11.76	0.00	-11.77	0.00
	CPI-B	-1.54	0.51*	-5.34	0.00	d(CPI-B)	-9.81	0.00	-9.91	0.00
	CPI-C	-1.78	0.39*	-3.04	0.12	d(CPI-C)	-11.09	0.00	-11.17	0.00
	CPI-D	-4.29	0.00	-5.06	0.00	d(CPI-D)	-9.56	0.00	-9.62	0.00
	CPI-E	-5.41	0.00	-11.29	0.00	d(CPI-E)	-13.32	0.00	-13.31	0.00
	CPI-F	-11.06	0.00	-11.75	0.00	d(CPI-F)	-14.02	0.00	-14.01	0.00
	DPPI	-5.32	0.00	-6.43	0.00	d(DPPI)	-8.27	0.00	-8.36	0.00
	NDPPI	-8.22	0.00	-8.88	0.00	d(NDPPI)	-9.10	0.00	-9.08	0.00
	PPIAP	-9.89	0.00	-10.03	0.00	d(PPIAP)	-9.46	0.00	-9.42	0.00
	SPPI	-5.20	0.00	-5.51	0.00	d(SPPI)	-5.23	0.00	-5.16	0.00
UNIT ROOT TEST TABLE (PP)	CPI	-10.40	0.00	-10.64	0.00	d(CPI)	-43.95	0.00	-46.56	0.00
	CPI-A	-8.95	0.00	-9.14	0.00	d(CPI-A)	-37.06	0.00	-51.66	0.00
	CPI-B	-9.28	0.00	-8.83	0.00	d(CPI-B)	-22.86	0.00	-23.19	0.00
	CPI-C	-9.61	0.00	-8.63	0.00	d(CPI-C)	-23.84	0.00	-24.03	0.00
	CPI-D	-8.94	0.00	-8.59	0.00	d(CPI-D)	-26.93	0.00	-27.76	0.00
	CPI-E	-10.14	0.00	-10.36	0.00	d(CPI-E)	-39.58	0.00	-41.44	0.00
	CPI-F	-10.29	0.00	-10.21	0.00	d(CPI-F)	-38.25	0.00	-41.98	0.00
	DPPI	-5.00	0.00	-5.27	0.00	d(DPPI)	-13.84	0.00	-14.50	0.00
	NDPPI	-6.31	0.00	-6.48	0.00	d(NDPPI)	-19.60	0.00	-20.18	0.00
	PPIAP	-9.79	0.00	-11.32	0.00	d(PPIAP)	-56.36	0.00	-63.03	0.00
	SPPI	-4.63	0.00	-4.61	0.00	d(SPPI)	-22.42	0.00	-21.81	0.00

Obtained with Eviews 10.0

According to the results of Zivot-Andrews test Model A and Model C, only the CPI-A, NDPPI and PPIAP series are stationary and the other series are non-stationary. Those comes to stationary at the first difference, and this shows that shocks have permanent effects on these series and so the hysteresis hypothesis is valid for these.

Table 4: Zivot-Andrews (ZA) Unit Root Test Results

var	Model A (t-stat)	Model A Breakpoint	Model C (t-stat)	Model C Breakpoint
CPI	-4.261601	2017M10	-4.422002	2016M12
CPI-A	-7.530848*	2018M01	-7.688649*	2016M12
CPI-B	-4.260077	2008M11	-4.228607	2008M11
CPI-C	-4.035012	2007M07	-4.112433	2009M02
CPI-D	-4.251686	2008M11	-4.251251	2008M11
CPI-E	-4.075100	2017M10	-4.172219	2016M12
CPI-F	-4.052491	2017M10	-4.186419	2016M12
DPPI	-2.364384	2020M03	-3.680675	2019M06
NDPPI	-9.121236*	2018M10	-9.711973*	2018M10
PPIAP	-7.029961*	2012M06	-7.070737*	2013M05
SPPI	-3.110311	2019M06	-3.095743	2019M08

ZA test critical values for Model A %1 and %5 is -5.34 and -4.93| for Model C %1 and %5 is -5.57 and -5.08.
Obtained with Eviews 10.0

5. EVALUATION AND CONCLUSION

With globalization, the interaction between geographies, cultures, economies, and societies is increasing. This interaction process has positive and negative aspects. Especially when considered from an economic point of view, the effects, and shocks, which can be considered as negative effects, can be quite critical for economies. In recent years, the COVID19 pandemic, the deterioration of supply chains, shocks in food and commodity supply and similar developments cause high inflationary effects in countries. Especially in recent months -with the effect and/or contribution of expansionary economic policies made during the epidemic- inflation has been on the rise in almost every country and the temporariness of the increases in prices has been discussing. Though, it is seen that academic studies on the permanence and temporariness of shocks have been done very little.

Whether the economic shocks are temporary or not is discussed in the center of the concept of hysteresis from an economic point of view. Briefly, hysteresis can be considered as a deviation from the "history matters" pattern and/or as a level change in path dependency. Although it is generally used for unemployment data, the hysteresis approach, which can also be used to analyze macrodynamics of economy, has been questioned for Turkey's inflation data within the scope of this study. The analysis made with ADF, PP, and ZA unit root tests; shows that the natural rate hypothesis approach is valid for the CPI-A, NDPPI, and PPIAP series, and the hysteresis hypothesis is valid for the others. The validity of the natural rate approach can be read like the market clearance for the dynamic process is valid. The hysteresis approach, on the other hand, highlights the concepts of stickiness and coordination failures, as suggested by the new Keynesian approach, in which case there may be direct and indirect interventions by the authorities for the reshaping of the effectiveness of the price mechanism. Unit root test results from ZA test shows that shocks have permanent effects on most series so government interventions may/should come to the fore. In addition, over the clusters on the structural break dates; It can be interpreted that the 2008 global financial crisis, the coup attempt, and elections in 2016-2017, and the uncertainties experienced in the following period affect prices.

In conclusion, the temporality of the shocks in inflation, which is critical for the healthy continuation of economic activities, is very important in terms of the legitimacy, direction, scope, and effectiveness of public interventions. The results of the study on the Turkish economy, that a country which has a memory of high and chronic inflation problems, show

that the shocks in the consumer and producer price indices are prone to have permanent effects. Therefore, the authorities in Turkey should firstly keep the distance between political tensions and economic activity, secondly, be proactive against possible shocks (that may occur on both the production and consumption fronts) and thirdly, be vigilant to quickly intervene markets directly and/or indirectly.

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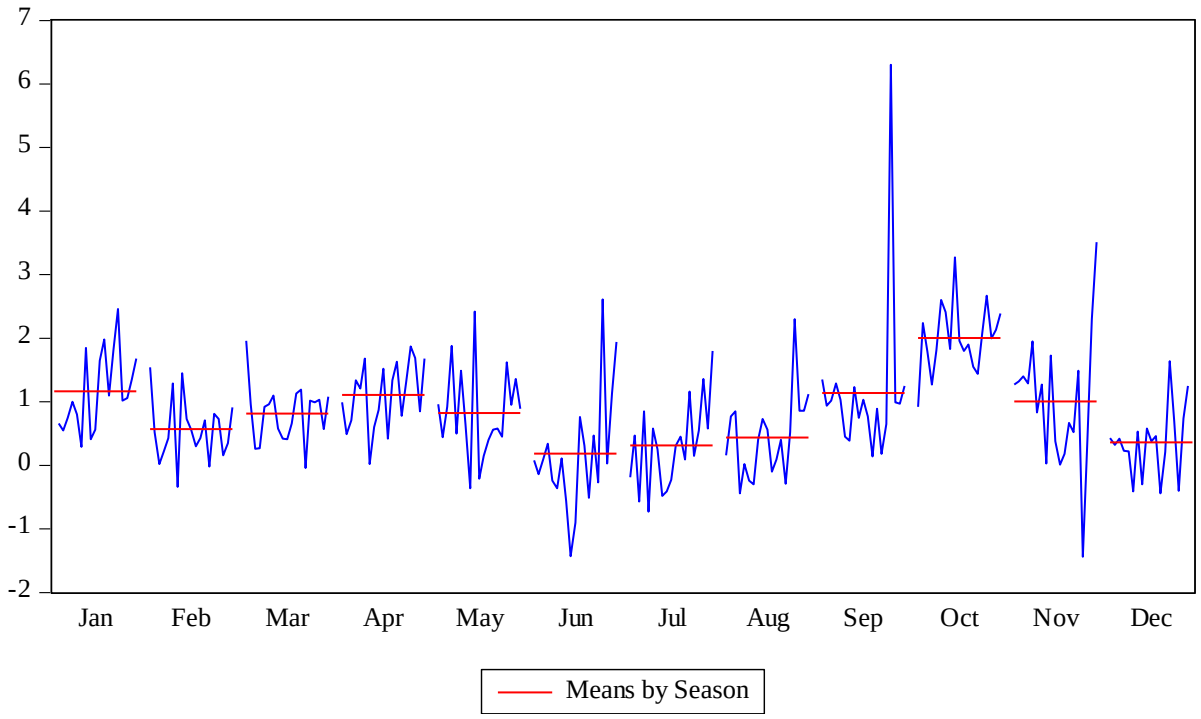
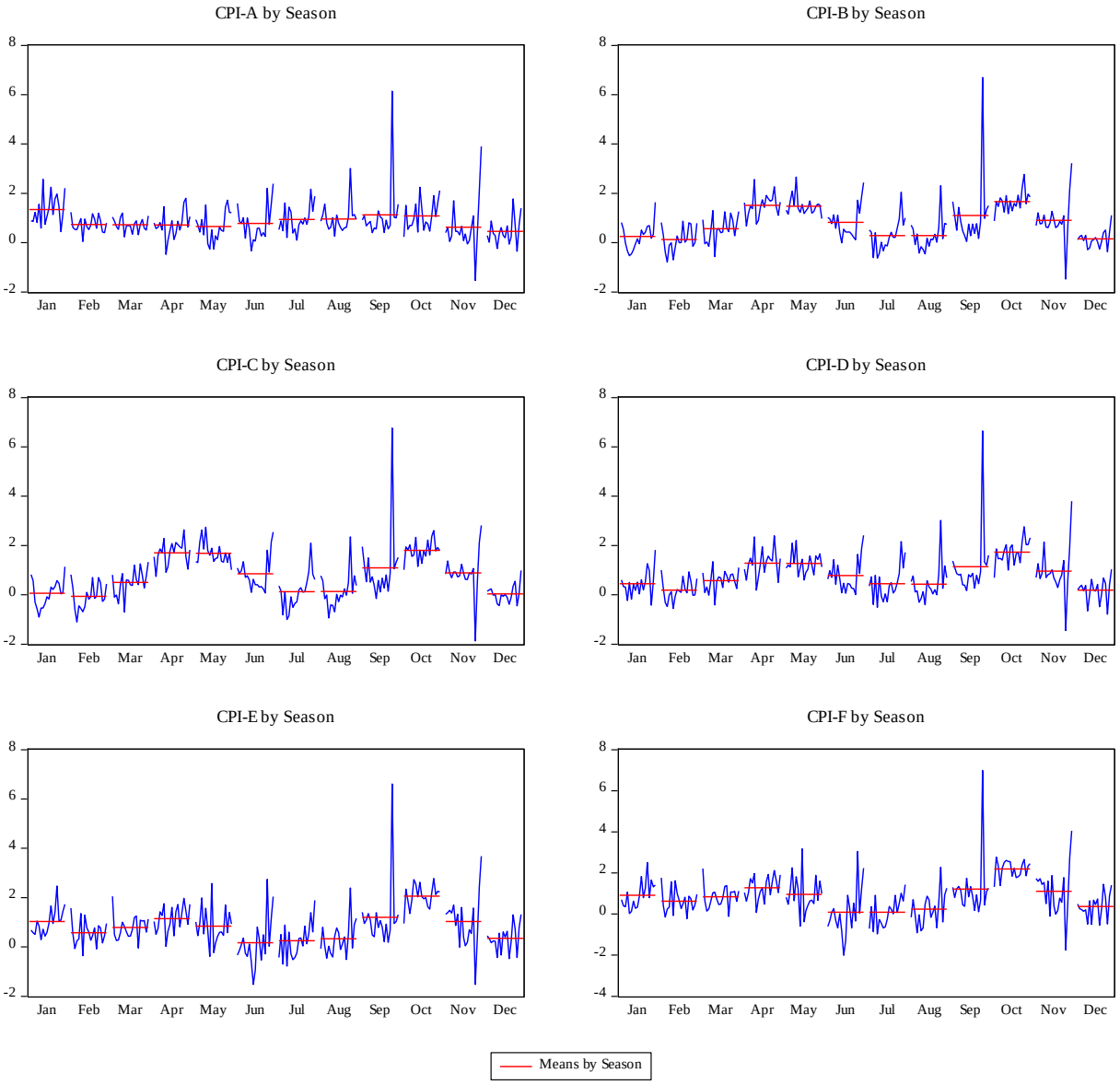
Annex 1

CPI by Season



Annex 2

Annex 3


CPI-A by Season
CPI-B by Season
CPI-C by Season
CPI-D by Season
CPI-E by Season
CPI-F by Season
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Means by Season