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Investigation of the Relationship Between Misery Index and Some Macroeconomic Factors in Türkiye: Hacker and Hatemi-J (2006) Causality Test

Türkiye'de Sefalet Endeksi ile Bazı Makroekonomik Faktörler Arasındaki İlişkinin İncelenmesi: Hacker ve Hatemi-J (2006) Nedensellik Testi

İrfan Ersin [a,*]

[a] Assist. Prof. Dr., Istanbul Medipol University, Vocational School of Social Sciences, Banking and Insurance Program, Istanbul/Türkiye
ORCID: 0000-0002-7407-3654

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ÖZ

Sefalet endeksi, enflasyon oranı ve işsizlik oranı toplamlarından oluşmaktadır. Bu indeks Arthur Okun tarafından 1970 yılında kullanılmış, ekonomik refah göstergesi olarak dikkate alınmıştır. Sefalet endeksi, ekonomik politika yapıcılar için önemli bir göstergedir. Yüksek bir sefalet endeksi, ekonominin halkın refahı üzerindeki olumsuz etkilerini yansıtır ve bu durum, politika değişikliklerinin gerekli olduğunu gösterir. Bu endeks, tarihsel olarak özellikle ekonomik kriz ve ekonomik daralma dönemlerinde politika yapıcılar ve ekonomistler için önemli bir rehber olmuştur. Bu çalışmanın amacı Türkiye'de sefalet endeksiyle bazı makroekonomik değişkenler arasındaki ilişkiyi incelemektir. Çalışmada yöntem olarak Hacker and Hatemi-J (2006) Nedensellik testlerinden yararlanılmış ve 2020-2022 dönemi aylık olarak ele alınmıştır. Analiz sonuçlarına göre, yurtiçi kredi hacmi, nominal döviz kuru ve mevduat faiz oranlarından sefalet endeksine nedensellik tespit edilmiştir. Sefalet endeksinin azaltılmasında TCMB'nin para politika uygulamalarında hassas olması gerekliliği önerilmiştir.

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ABSTRACT

The misery index consists of the sum of the inflation rate and the unemployment rate. This index was used by Arthur Okun in 1970 and was taken into account as an indicator of economic welfare. The misery index is an important indicator for economic policy makers. A high misery index reflects the negative effects of the economy on the well-being of the population, indicating that policy changes are necessary. This index has historically been an important guide for policymakers and economists, especially during periods of economic crisis and economic contraction. The aim of this study is to examine the relationship between the misery index and some macroeconomic variables in Türkiye. In the study, Hacker and Hatemi-J (2006) Causality test was used as a method, and the 2020–2022 period was discussed monthly. According to the analysis results, causality was determined from domestic credit volume, nominal exchange rate and deposit interest rates to the misery index. It has been suggested that the CBRT should be sensitive in its monetary policy practices in reducing the misery index.

1. Introduction

Macroeconomic variables are essential indicators in ensuring the economic development of a country. In addition, since these variables are interdependent, it is possible to say that a change in one variable affects the other variable more or less (Agu et al., 2022; Mensi et al., 2023). Unemployment and inflation are macroeconomic variables given priority by developed and developing countries. When unemployment occurs in a country, this situation causes a decrease in production economically, while social divorce, suicide, etc., may have negative consequences (Azzollini, 2023; Antipova, 2021; Hashimoto et al., 2023). Likewise, increases in the general level of prices can have negative

* *Sorumlu yazar/Corresponding author*.
e-posta: *iersin@medipol.edu.tr*

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economic and social consequences (Silva and de Araújo). In this context, the adverse effects of these two variables on welfare attracted the attention of the American scientist Artur Okun who revelead the misery index, which expresses the sum of inflation and unemployment. The problem of unemployment and inflation, which broke out in the USA with the effect of the oil crisis in the 1970s, was defined by Okun as the "discomfort index," and then Ronald Reagan used it as an index of misery. A high Misery index indicates a high level of economic difficulty, while a low one indicates a lower level of economic difficulty (Janseen, 1971; Cohen et al., 2014; Cakici & Zaremba, 2023). The misery index is just one of many economic indicators that can be used to measure economic well-being. The fact that two important macroeconomic variables, such as inflation and unemployment, have a significant share in economic decline shows that the misery index is a substantial variable. The misery index can sometimes be the "Economic Discontent Index" (Tunand Akdağ, 2023).

Unemployment and inflation have become a global problem during and after the Covid-19. Inflation, which showed a severe rise, especially after the Covid-19, has been among the critical primary problems of developed and developing countries (Bobeica and Hartwig, 2023; Hancock and Mora, 2023; Naveed et al., 2023). Therefore, the “misery index” has become one of the global economic agendas. Central banks of developed and developing countries applied expansionary monetary policies during the Covid-19 period; although these policies were not reflected in inflation during the Covid-19 period, they caused significant increases in inflation in the post-Covid-19 period (Ramos-Francia and García-Verdú, 2022; Petersen and Ruholes, 2022; Armantier et al., 2021). While commercial restrictions caused a decrease in production during the Covid-19 period, unemployment increased, and after the Covid-19, the rise in demands and costs led to an increase in inflation (Armantier et al., 2021; Bianchi et al., 2023; Hagen et al., 2022; Yamacli and Yamacli, 2023; Liv et al., 2023). As a result, the increase in unemployment and inflation brought the “misery index” issue to the fore.

Some economists argue that the misery index, which is the sum of unemployment and inflation, cannot adequately represent economic discomfort (Cohen et al., 2014; Akçayır, 2022). Although it has been criticized, it is possible to say that the misery index provides important information to policymakers today. Today, macroeconomic variables have the power to affect each other within themselves. Because a deterioration in one variable can reflect negatively on other macroeconomic variables (Pogoy et al., 2016; Obayori, 2020). Thus, policymakers and practitioners will follow other macroeconomic variables more carefully in terms of their impact on the misery index.

One of the important macroeconomic issues that affect unemployment and inflation is interest. Especially after Covid 19 in Turkey, the CBRT followed a fixed and decreasing policy in the policy rate contrary to market expectations (CBRT, 2020) and, this situation led to inflationary pressure in Turkey (Ülger Danacı, 2022). Although some economists argue that this pressure is based on different reasons and that the low-interest policy is not related to inflation, some economists have emphasized that the interest rate policy is an important reason for inflationary developments in the country (Eğilmez, 2021; Kuzucu, 2022). It is possible to say that the country's balance of payments and foreign trade policy are affected by the high inflation experienced in Turkey in recent years (Fodor and Onuk, 2023). The worthless money, cheap export, and expensive import policy that China had applied before was also tried to be implemented by Turkey, and a high exchange rate and low-interest policy was adopted. With the increase in the exchange rate, the costs of Turkey, which is dependent on imports in intermediate and energy goods, have increased and this has triggered inflation (Gemici et al., 2023; Azzam et al, 2023; Akçayır, 2022). Whether the exchange rate affects the post-Covid 19 misery index has revealed the need for empirical testing.

Another crucial macroeconomic variable, the stock market, also holds significance in terms of inflation and unemployment. In the context of representing real markets, the question of whether the increase in the stock market value can reduce unemployment and how this situation affects the misery index is a key concern (Özer, 2019; Boduk, 2022). The industrial production index, another active issue in real markets, is closely tied to Turkey's economic growth. An increase in the industrial production index has a positive impact on employment. The government's provision of short-time working allowances during the Covid 19 period helped prevent a surge in unemployment (Bayar et al., 2023). Therefore, testing the contribution of the industrial production index to the misery index is as crucial as examining other macroeconomic variables.

This study makes significant contributions to the literature. The first contribution is to examine the relationship between the misery index and macroeconomic variables in Turkey during and after COVID-19 and inform policymakers of the analysis results. The second contribution is handling some macroeconomic variables affecting inflation and unemployment, which are chronic and structural problems in Turkey, with the Hacker and Hatemi-J (2006) causality test. The bootstrap method Hacker and Hatemi-J's (2006) causality test, especially in a sample of less than 50, gives highly reliable results, and the examination of this test on the misery index makes a significant contribution. Finally, it is a contribution that the results obtained in the study are compared in future studies and affect the analysis and evaluations. In light of these factors, the primary goal of the research has been to investigate the correlation between the Turkish misery index and a few chosen macroeconomic variables.

This study has some limitations as well as some contributions. The first limitation of our research is the

handling of data as of 2020, which is the COVID-19 period. The misery index is analyzed during this period. The results related to the effect of macroeconomic variables on the misery index can only be interpreted for this period. Another limitation of the study is the inclusion of selected macroeconomic indicators in the model. While macroeconomic factors were preferred, the literature was considered, and other factors were left to the researchers. The rest of this study is organized as follows: In the introduction, the theoretical information and purpose of the study are given. In the second part, the literature review was made. In the third section, the method and model are explained. The findings were evaluated in the fourth part, and the conclusion and evaluation were made in the last part.

2. Literature Review

Studies examining the effects of macroeconomic variables on the misery index have generally been carried out in recent years. Ülgen and Özer (2020), who dealt with the relationship between the poverty index and the current account deficit in Turkey, used the Fourier Shin Cointegration test, considering the quarter periods between 2000 and 2018. According to the analysis results, a one-unit increase in the current account deficit led to a decrease of 5.11 units in Okun's misery index and 11.73 units in Barro-Hanke's misery index.

On the other hand, Göksu and Mere (2022) examined the relationship between growth, insurance, and misery index in Turkey using the ARDL Bounds test and causality test, and they found a long-term relationship between misery index and growth. In addition, causality was found in the growth to misery index. Tunçay (2021) dealt with the relationship between non-performing loan rates and the misery index and applied the VAR analysis for 2002-2020. The results obtained indicate that there is a relationship between the non-performing loan rates and the misery index.

Akçayır (2022) examined the relationship between loan interest rates and the misery index in Turkey for the 2005-2020 quarter periods using the Maki (2012) Structural Break Cointegration Test. According to the results of the analysis, when the Turkish lira depreciates by 1 unit, the misery index rises by approximately 0.89 points. In contrast, the misery index rises by approximately 0.10 points when the loan interest rates increase by 1 point. Şentürk and Akbaş (2014) considered the misery index variables separately and analyzed the relationship between the industrial production index, unemployment, and inflation using the Bootstrap causality method. The results show that the industrial production index causality affects inflation and unemployment. Tatlı and Barak (2019) examined the relationship between the misery index and social indicators by using the panel causality test over 26 regions in Turkey. The findings show that there is causality from the misery index to suicide and divorce variables in some regions. In a similar study, Akpınar et al. (2013) performed misery index and social discontent calculations for 2007-2010 using the principal component analysis technique on 26 regions in Turkey. As a result of the said study, TRC3 (Mardin, Batman, Şırnak, Siirt), TRB2 (Van, Muş, Bitlis, Hakkari), and TRC2 (Şanlıurfa, Diyarbakır) regions were identified as the regions with the highest level of economic and social discontent. Çondur (2016), who used the data compilation and evaluation technique and conducted a similar study, stated that social discontent indicators are negative when inflation and unemployment rates are high in Turkey.

The Barro Misery Index, which is expressed as the developed version of the Okun misery index, has been included in some studies for Turkey. In Ünal's (2020) study, the effects of FDI and real exchange rate shocks on the Barro misery index were examined using the SVAR method. The study examining the 1985-2017 period determined that FDI and real exchange rate shocks negatively affected the Barro misery index. In the analysis of Çoban and Emin Benli (2022) on BRICS countries, VAR Analysis and Granger Causality Test were used, and the period of 2007-2020 was examined. The findings specific to Turkey are on a negative relationship between the Barro Misery Index and the foreign trade balance and a positive relationship with the exchange rate. The causality test results also show causality from the exchange rate to the Barro misery index. Büyüksarıkulak and Suluk (2022) created the misery indices for Brazil, India, Indonesia, South Africa, and Turkey from 2010-2021. These calculations stated that the best performance in terms of the misery index was in Indonesia, and the worst was in Turkey and South Africa.

When the international studies on the misery index are examined, it is understood that the analyses are handled at the regional level. Acar and Topdağ (2022), in their panel regression approach for 34 OECD countries, found that the misery index positively affected health expenditures for 2001-2019. Yeten et al. (2022) stated in a literature study on the OECD that the Okun and Barro misery indices gave different results across the country. In the study of Çağlayan Akay and Oskonbaeva (2020) for 16 transition countries, the Panel ARDL Bounds Test was used, and it found that the misery index negatively affected economic growth. Karacan (2020) evaluated the data for Indonesia, Iran, and Saudi Arabia, and it was found that economic growth was only effective on inflation rates in terms of the welfare level of the people and did not have any effect on unemployment rates. Sánchez López (2022) used the VAR model in their analysis for Mexico and observed that the depreciation of the national currency had a positive effect on the misery index in the 2000-2020 period. Finally, Wang et al. (2019) analyzed the period 1989-2017 using the ARDL Bounds Test in their study for Pakistan. In the analysis results, a long-term relationship was found between the misery index and the GDP. Núñez and Morales-Alonso (2024) examined the effects of the economic freedom index and misery index on entrepreneurship for the Covid-19 period using artificial neural networks for 30 countries. In the study using data from the 2017-2020 period, it was concluded that a high misery index reduces entrepreneurship.

When the literature is evaluated in general, it is observed that there are few studies examining the effect of macroeconomic variables on misery. It is also noteworthy that studies on the misery index have been intense recently. The impact of high inflation rates experienced in Turkey in the post-COVID-19 period and in recent years on the misery index has brought up the issue of how this index is affected by other macroeconomic variables. In this context, the study's novelty is to reveal which macroeconomic variables are affected by the post-Covid 19 misery index. In this respect, the study contributes to the literature.

3. Dataset and Method

This study examines the macroeconomic variables affecting the misery index in Turkey during COVID-19 and its aftermath and discusses the period between January 2020 and December 2022. The names and definitions of the variables included in the analysis of this study are given in Table 1. The dependent variable misery index used in the analysis in Table 1 consists of the sum of unemployment and inflation rates. The graph of the index created by the author was examined, and the logarithm of the related variable was taken due to a geometric structure. In addition, since the data on the misery index is monthly, Census X-12 has been subjected to seasonality analysis. Data on the misery index were obtained from TUIK. The exchange rate variable, one of the independent variables, was obtained from the CBRT, and the nominal exchange rate was used. The industrial production index, another independent variable, was obtained from TUIK and subjected to seasonality analysis of Census X-12 by taking its logarithm.

On the other hand, the domestic loan volume variable was obtained from the CBRT and converted into real terms by taking into account the CPI (2003=100) index. The logarithm of the realized domestic loan volume was taken, and the Census X-12 was subjected to seasonality analysis. The Census X-12 seasonality test was applied for the BIST 100 index, one of the independent variables, and the logarithm of the related variable was taken. Finally, deposit-weighted average interest rates were obtained from the CBRT and included in the analysis.

Table 1: Variables Definition

Variable Name	Definition	Source
MIS	It is the sum of the unemployment rate and the inflation rate	TUIK*
EXC	Nominal Exchange Rate, Dollar ($)	TCMB†
IND	Industrial production index	TUIK
LCRED	Domestic credit volume	TCMB
STOCK	BIST100 index	TCMB
INT	deposit-weighted average interest (flow)	TCMB

Note: *Turkish Statistical Institute, †Central Bank of Türkiye Republic

Graphs related to the variables analyzed in the study are shown in Appendix 1. When the graphs above are examined, it is understood that the cyclical effects are reflected in the macroeconomic variables during COVID-19 and after. Summary statistics for the variables are given in Table 2. According to Table 2, the maximum value was realized in the highest misery index and the minimum in the lowest exchange rate variable. The Jarque-Bera test shows that the variables except the industrial production index variable are typically distributed at the 5% significance level. When the skewness values are examined, it is understood that the MIS, EXC, and STOCK series are skewed to the right, and the others are skewed to the left. When the Kurtosis results with kurtosis values are examined, it is observed that the Kurtosis is positive for all variables, and the normal distribution is sharp.

Table 2: Descriptive Statistics

Desc. Stat.	MIS	EXC	IND	INT	STOCK	LCRED
Mean	46.44194	10.80087	131.7788	14.46158	7.436479	20.28409
Median	30.31500	8.501441	134.8189	15.98750	7.291144	20.30244
Maximum	95.41000	18.65376	148.2818	18.04000	8.507524	20.42273
Minimum	23.74000	5.923493	79.34207	7.344000	6.778027	20.15209
Std. Dev.	26.92651	4.465302	15.02020	3.618025	0.455064	0.062750
Skewness	0.815223	0.690732	-1.646371	-0.869208	0.915851	-0.061899
Kurtosis	1.897857	1.856615	5.972110	2.156697	2.917455	2.282321
Jarque-Bera	5.809611	4.823657	29.51339	5.599877	5.042916	0.795585
Probability	0.054759	0.089651	0.000000	0.060814	0.080342	0.671802

In creating econometric models, it is crucial to test the stationarity of the time series data to establish an appropriate methodology (Işık, 2010). In the study, first, the stationarity of the variables will be examined with Augmented Dickey-Fuller (ADF) and Structural BreakAugmented Dickey-Fuller (ADF) unit root tests. Then, analyses will be carried out using the ARDL model and Hacker and Hatemi-J (2006) Causality Test (Yiğit and Canöz, 2021).

3.1. Hacker and Hatemi-J (2006) Causality Test

The causality test, developed by Hacker and Hatemi-J (2006), is a statistical method used to examine causal relationships. This test uses an econometric method, the Granger causality test, to determine the causal relationship

between variables. Hacker and Hatemi-J (2006) apply the bootstrap Granger causality test and the Toda-Yamamoto causality test (1995) to determine causality between variables. Still, critical values are obtained by bootstrap Monte Carlo simulation, taking the risk of errors not being normally distributed. On the other hand, Hacker and Hatemi-J (2006) suggested that the results are more robust by following the Toda-Yamamoto causality procedure and using the bootstrap approach to determine the critical values. Critical values are obtained with the bootstrap approach, although the errors are not normally distributed, thus minimizing the problem of "having a normal distribution of errors" (Canöz and Erdoğdu, 2019; Keskin and Kara, 2021).

The Toda-Yamamoto causality analysis is based on the VAR model with increased latency. The VAR(p) model is shown in equation 1 (Amiri and Ventelou, 2012).

$$Yt = \vartheta + A_1 Y_{t-1} + \ldots\ldots\ldots + A_p Y_{t-p} + \varepsilon_t \quad (1)$$

In Equation 1, $\vartheta, Y_t \; ve \; \varepsilon$ represent the n-dimensional variable vector, A parameter vector, and p represents the optimal lag length. Toda and Yamamoto (1995) suggest the VAR model in equation 2 for causality analysis among integrated variables (Dritsaki, 2017).

$$Y_t = \hat{\theta} + \hat{A}_1 Y_{t-1} + \ldots + \hat{A}_p Y_{t-p} + \ldots + \hat{A}_{p+d} Y_{t-p-d} + \hat{\varepsilon}_t \quad (2)$$

The thinning marks on the variables in Equation 2 represent the least squares estimator. In this equation, while the p data expresses the lag numbers determined before, the d_{max} data also expresses the maximum integration degree of the variables. While the null hypothesis of Toda-Yamamoto causality analysis is based on the absence of a causal relationship between the variables, the alternative hypothesis advocates the existence of a causal relationship between the variables (Toda and Yamamoto, 1995).

An important contribution of Hacker and Hatemi-J (2006) in the Toda-Yamamoto causality testing process is that variables with a small sample lead to stronger test results through the boostrap distribution. According to Hacker and Hatemi-J (2006), the use of the X^2 distribution in small samples weakens the test performance. Hacker and Hatemi-J (2006) obtain critical values with Monte Carlo simulation. In addition, delay values are calculated by Hacker and Hatemi-J (2006). Based on the information criteria, the HJC criterion was taken into account for the optimal lag length (Hacker and Hatemi-J, 2006).

4. Findings

4.1. Unit Root Test Results

The Augmented Dickey-Fuller (ADF) unit root test is a statistical test used to determine whether a time series has a unit root. A unit root is a characteristic of a time series where the series is non-stationary and has a mean that is not constant over time. Non-stationary time series are problematic in statistical analysis because they can produce spurious regression results, leading to incorrect conclusions (Caner and Hansen, 2001).

The ADF test is a popular test for unit root because it allows for autocorrelation in the errors and serial correlation in the time series data. The test is based on a regression model that includes the dependent variable's lagged values and the dependent variable's lagged differences. The null hypothesis of the ADF test is that a unit root is present in the time series data, while the alternative hypothesis is that the time series is stationary. The test statistic is based on the estimated coefficient of the lagged difference of the dependent variable. If the coefficient is negative and statistically significant, there is evidence against the null hypothesis of a unit root and in favor of the alternative hypothesis of stationarity (Paparoditis and Politis, 2018).

The ADF test also includes a critical value table that allows the researcher to determine the significance level at which the null hypothesis can be rejected. The ADF test has several advantages over other unit root tests, including its ability to handle time series with serial correlation and its flexibility for different lag structures. However, the ADF test also has some Boundsations, including its sensitivity to the choice of lag length and the assumption of no structural breaks in the time series data (Phillips and Xiao, 1998).

Table 3: ADF Unit Root Test

Variable Name	Trend &Intercept	**Level**		**1st difference**	
		t istatistic	**p value**	**t istatistic**	**p value**
dmis	Intercept	-0.202310	0.9290	-3.259298**	0.0250
	Trend &Intercept	-1.665551	0.7452	-	-
exc	Intercept	0.842182	0.9934	-4.114222*	0.0029
	Trend &Intercept	-1.367653	0.8530	-	-
lind	Intercept	-1.639049	0.4526	-5.981405*	0.0000
	Trend &Intercept	-2.720286	0.2351	-	-
lcred	Intercept	-1.971962	0.2972	-6.198534*	0.0000
	Trend &Intercept	-3.035002	0.1376	-	-
stock	Intercept	2.256201	0.9999	-5.736147*	0.0000
	Trend &Intercept	-0.740274	0.9617	-	-
int	Intercept	-3.1797**	0.0320	-2.368521	0.1582
	Trend &Intercept	-1.279833	0.8755	-	-

Note: *, ** and *** represent 1%, 5% and 10% significance level, respectively.

When the ADF test results are examined in Table 3, it is understood that the INT variable is stationary at the level, and the other variables are stationary with a first-degree difference. Because some macroeconomic variables included in the analysis during the study period had broken, this study also considered structural breaks in unit root tests.

The ADF unit root test with structural break is a statistical test that combines the ADF test with detecting structural breaks in the time series data. According to the conventional understanding of the unit root theory, current shocks only have a short-term impact on the series' long-term movement. The most significant implication of the unit root hypothesis, which Nelson and Plosser (1982) first proposed, is that random shocks have long-lasting effects on the macroeconomic long-run level; in other words, fluctuations are not temporary (Glynn et al., 2007).

Perron (1989) introduced a significant controversy, disputing the conventional understanding of ADF tests and the unit root hypothesis. He claimed that the typical ADF tests are biased against rejecting the null hypothesis when there is a structural break. According to Perron, most macroeconomic series do not exhibit a unit root; rather, persistence only results from significant and infrequent shocks, and the economy resumes its deterministic pattern following minor but frequent shocks. "Most macroeconomic time series are not characterized by the presence of a unit root," claims Perron. In fact, fluctuations are stationary when centered on a deterministic trend function. Perron employs a modified DickeyFuller (DF) unit root test with dummy variables to account for one exogenous structural break that is known to have occurred. The trend function's breakpoint is fixed (exogenous) and picked without consideration of the data. The unit root tests proposed by Perron (1989) permit a break both under the null and alternative hypotheses.

The structural single-break ADF test results are given in Table 4. Considering the relevant results, it is understood that the STOCK and MIS variables are stationary at the first difference, while the other variables are stationary at the level. It is understood that the breaking periods are mostly in the 11th month of 2021. The most important reason for the break in this month is estimated to be the transition of inflation rates in Turkey to a high inflation period of 21% starting in the 11th month (TCMB, 2024). Based on the results of both unit root tests, the INT variable was included in the model at level, while the other variables were included in the model with a first-degree difference. These findings provide valuable insights into the behavior of the variables under study.

Table 4: Structural Single Break ADF Unit Root Test Results

Variable Name	Trend &Intercept	Level			1st difference		
		t statistic	p value	Break Date	t statistic	p value	Break Date
dmis	Intercept	-4.154898	0.1102	2021M11	-4.853139**	0.0150	2022M11
	Trend &Intercept	-4.530881	0.1210	2021M11	-	-	-
exc	Intercept	-5.229296*	< 0.01	2021M11	-7.185218*	< 0.01	2021M12
	Trend &Intercept	-4.827755**	0.0549	2021M11	-	-	-
lind	Intercept	-5.898213*	< 0.01	2020M04	-7.399750*	< 0.01	2020M06
	Trend &Intercept	-4.985839**	0.0346	2020M04	-	-	-
lcred	Intercept	-5.181112*	< 0.01	2021M11	-7.352749*	< 0.01	2021M11
	Trend &Intercept	-5.064827**	0.0273	2021M11	-	-	-
stock	Intercept	-0.213939	> 0.99	2022M01	-7.090850*	< 0.01	2022M02
	Trend &Intercept	-2.885104	0.9407	2022M07	-	-	-
int	Intercept	-5.762163*	< 0.01	2020M12	-5.629708*	< 0.01	2021M01
	Trend &Intercept	-6.651969*	< 0.01	2020M12	-	-	-

Note: *, ** and *** represent 1%, 5% and 10% significance level, respectively.

4.2. Hacker and Hatemi-J (2006) Causality Test Results

Hacker and Hatemi-J (2006) causality test results are given in Table 5. According to the relevant results, the variables in which WALD Statistics values are above critical values and the causal relationship to the misery index is determined are domestic credit volume (1% sig.), deposit interest rates (5% sig.) and exchange rates (10% sig.). That is, it is understood that these variables in question are the Granger cause of the misery index. In addition, causality was determined from the misery index to the domestic loan volume, deposit rates, exchange rates and stock market.

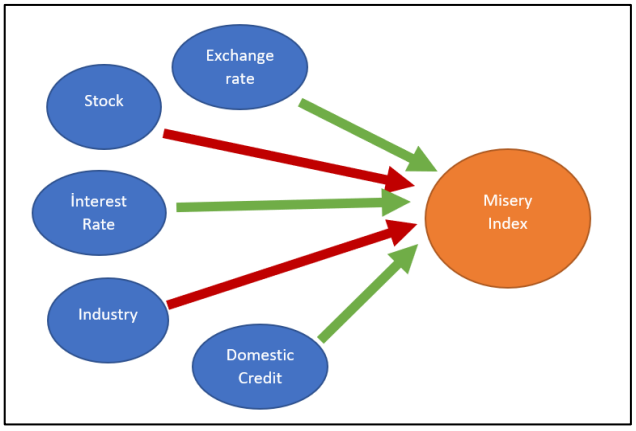
If we show Hacker and Hatemi-J (2006) causality test results with the help of figure, causality relationships are presented in Figure 1.

Table 5: Hacker and Hatemi-J (2006) Causality Test Results

Hypotheses	WALD İstatistik	Kritik Değer (%1)	Kritik Değer (%5)	Kritik Değer (%10)	Lag+Add. Lag
IND is the Granger Cause of MIS	0.185	13.113	7.643	5.580	2+1
MIS is the Granger Cause of IND	5.326	19.874	9.638	6.795	2+1
CRED is the Granger Cause of MIS	27.197*	11.682	7.111	5.261	2+1
MIS is the Granger Cause of CRED	2.673*	0.171	0.004	0.001	2+1
INT is the Granger Cause of MIS	11.188**	12.986	8.036	5.847	2+1
MIS is the Granger Cause of INT	22.518*	16.163	9.516	6.948	2+1
EXC is the Granger Cause of MIS	6.013***	11.736	6.933	5.182	2+1
MIS is the Granger Cause of EXC	44.685*	9.290	4.101	2.646	2+1
STOCK is the Granger Cause of MIS	3.175	11.793	7.127	5.345	2+1
MIS is the Granger Cause of STOCK	40.129*	12.414	7.817	5.739	2+1

Note: *, ** and *** represent 1%, 5% and 10% significance level, respectively

Figure 1: Causality Results



When we compare the results we obtained in our study with the literature, the result of Tunçay (2021) that the non-performing loan rates affect the misery index is similar to our findings. The findings of this study differ with the positive relationship between Akçayır's (2022) loan interest rates and the misery index. Akçayır's (2022) use of loan interest rates and the use of weighted average deposit rates in this study can be shown as the reason for this difference. Finally, it can be stated that our findings are similar to the result of Ünal (2020), that the exchange rate positively affects the Barro index.

5. Conclusion

The Misery Index is the sum of a country's inflation and unemployment rates. This index is based on the assumption that unemployment and inflation negatively affect citizens' well-being. First popularized in the United States in the 1970s, this index was used by Arthur Okun. Misery Index use has become widespread worldwide, and many countries have started to use this index to measure their economic situation. The index has been criticized due to the combined calculation of inflation and unemployment rates. For example, high inflation rates may result from policies implemented to reduce unemployment; therefore, the combination of the two factors may sometimes give inaccurate results. However, the Misery Index is still used in many countries to indicate economic prosperity. However, today, many different economic indicators are used alongside other indices.

Covid 19, an epidemic disease, has negatively affected the global economy. Disruptions in supply chains due to the occurrence of restrictions have led to economic contraction in many countries, and this has led to an increase in unemployment. In addition, implementing loose monetary policies to revive the shrinking economies has led to inflationary pressures in the post-COVID-19 period. In this framework, this study aimed to examine Turkey, where inflation and unemployment experienced significant fluctuations and aimed to examine the relationship between the Misery index and some macroeconomic variables in Turkey. In this direction, the 2020-2022 period was considered monthly in the study, and Hacker and Hatemi J's (2006) causality test was applied. According to the analysis results, causality was determined from the nominal exchange rate, deposit interest rates, and domestic loan volume of the Misery index. The study's results supported Tunçay's (2021) and Ünal (2020) findings in the literature.

Turkey has had important policies during the Covid-19 period. Despite the decrease in production during the Covid-19 period restrictions, Turkey made partial salary payments to the workers called "short-time working allowance" to protect the producer and prevent unemployment. While this policy reduced the costs for employers, it also prevented the increase in unemployment. In addition, the government's ban on laying off workers during the Covid-19 period was among the important steps that prevented the increase in unemployment during the Covid-19 period. With the lifting of the ban after the Covid-19, there has been a decrease in unemployment. The most important development that negatively affected Turkey's post-Covid-19 Misery index was the rapid increase in inflation rates. The loose monetary policy preferences of the Central Bank of the Republic of Turkey and applying the low-interest policy in policy rates, except for certain periods, led to significant increases in total demand.

Moreover, the significant increases in the money supply are also effective in the inflationary process in Turkey. In addition, it can be said that the exchange rate increases, and the positive effect of these exchange rate increases on exports, increasing growth and decreasing unemployment; on the other hand, it can be said that it affects the cost-based inflationary pressure. While this process increased the Misery index under inflationary pressure, the decrease in unemployment had a decreasing effect on the Misery index. However, the fact that the rapid increase in the inflationary process was higher than the decrease in unemployment allowed the Misery index to be high. In addition, due to the causal relationship between deposit interest rates and the Misery index, the weight of high inflation in the Misery index is felt.

The increase in domestic credit volume can increase production. Since the increase in production reduces unemployment, a credit policy considering price stability is likely appropriate in Turkey. The cheap credit policy that can be offered to producers will not only increase production but also reduce unemployment. CBRT's tightening monetary policy, especially to ensure price stability, will positively affect the misery index. In this context, it is clear that appropriate fiscal and monetary policies will have a reducing effect on the misery index. In addition, considering that the exchange rate activity negatively affects the Misery index, it is important to make the right foreign exchange policies. In this study, examining other macroeconomic factors affecting the Misery index for a similar period is presented as a suggestion to researchers.

References

Agu, S. C., Onu, F. U., Ezemagu, U. K., & Oden, D. (2022). Predicting gross domestic product to macroeconomic indicators. *Intelligent Systems with Applications*, *14*, 200082.

Akay, E. Ç., & Oskonbaeva, Z. (2020). İktisadi Büyüme ve Sefalet Endeksi Arasındaki İlişki: Geçiş Ülkeleri Örneği The Relationship between Economic Growth and Misery Index: Evidence from Transition Countries. *On Eurasian Economies*, *130*.

Akçayir, Ö. (2022). Döviz Kurlarının ve Kredi Faiz Oranlarının Okun Sefalet Endeksi Üzerindeki Etkileri. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, *18*(2), 595-617.

Akpınar, R., Taşcı, K., & Özsan, M. E. (2013). Hoşnutsuzluk Endeksine Göre Türkiye'de Bölgesel Farklılık. *International Journal Of Eurasia Social Sciences*, *2013*(10), 59-70.

Ali, W., Abdullah, A., & Azam, M. (2017). Re-visiting the environmental Kuznets curve hypothesis for Malaysia: fresh evidence from ARDL Bounds testing approach. *Renewable and sustainable energy reviews*, *77*, 990-1000.

Amiri, A., & Ventelou, B. (2012). Granger causality between total expenditure on health and GDP in OECD: Evidence from the Toda–Yamamoto approach. *Economics letters*, *116*(3), 541-544.

Armantier, O., Koşar, G., Pomerantz, R., Skandalis, D., Smith, K., Topa, G., & Van der Klaauw, W. (2021). How economic crises affect inflation beliefs: Evidence from the Covid-19 Covid-19. *Journal of Economic Behavior & Organization*, *189*, 443-469.

Azzam I., El-Masry A.A. & Yamani E. (2023). Foreign exchange market efficiency during COVID-19 Covid-19, *International Review of Economics and Finance* (86).

Azzollini, L. (2023). Scar effects of unemployment on generalised social trust: The joint impact of individual and contextual unemployment across Europe. *Social Science Research*, *109*, 102787.

Bahmani-Oskooee, M., Halicioglu, F., & Karamelikli, H. (2023). Singapore's Trade in Financial and Insurance Services and the Role of the Exchange Rate: An Asymmetric Analysis. *The International Trade Journal*, 1-13.

Bayar, A. A., Günçavdı, Ö., & Levent, H. (2022). Evaluating the impacts of the COVID-19 Covid-19 on unemployment, income distribution and poverty in Turkey. *Economic Systems*, 101046.

Bianchi, F., Bianchi, G., & Song, D. (2023). The long-term impact of the COVID-19 unemployment shock on life expectancy and mortality rates. *Journal of Economic Dynamics and Control*, *146*, 104581.

Bobeica, E., & Hartwig, B. (2023). The COVID-19 shock and challenges for inflation modelling. *International journal of forecasting*, *39*(1), 519-539.

Boduk, S. (2022). *Seçilmiş endeks ve değişkenlerle dış ticaret analizi: Türkiye örneği* (Master's thesis, Necmettin Erbakan Üniversitesi Sosyal Bilimler Enstitüsü).

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society: Series B (Methodological)*, *37*(2), 149-163.

Büyüksarıkulak, A. M. & Suluk, S. (2022). The Mısery Index: An Evaluatıon On Fragıle Fıve Countrıes . *Abant Sosyal Bilimler Dergisi* , 22 (3) , 1108-1123

Caner, M., & Hansen, B. E. (2001). Threshold autoregression with a unit root. *Econometrica*, *69*(6), 1555-1596.

Cohen, I. K., Ferretti, F., & McIntosh, B. (2014). Decomposing the misery index: A dynamic approach. *Cogent Economics & Finance*, *2*(1), 991089.

Çondur, F. (2016). Türkiye'de Hoşnutsuzluk Endeksi Parametrelerinin Gelişimi. Ataturk University Journal of

Economics & Administrative Sciences, 30(5).

Dritsaki, C. (2017). Toda-Yamamoto causality test between inflation and nominal interest rates: evidence from three countries of Europe. *International Journal of Economics and Financial Issues*, *7*(6), 120.

Eğilmez, M. (2021). 'Faiz Sebep, Enflasyon Sonuçtur Teorisi'nin Bilmem Kaçıncı Kez Çöküşü. *Kendime Yazılar, Erişim Tarihi*, *8*.

Fodor, A., & Onuk, C. (2023). Turkish Currency Crunch: Examining Behavior Across Investor Types. *Journal of International Financial Markets, Institutions and Money*, 101760.

Glynn, J., Perera, N., & Verma, R. (2007). Unit root tests and structural breaks: A survey with applications.

Göksu, S. & Mere, M. (2022). İktisadi hoşnutsuzluk endeksi ve ekonomik büyüme sigortacılık sektörü üzerinde etkili mi? *Journal of Social and Humanities Sciences Research*, 9(82), 680-689.

Hacker, R. S., & Hatemi-J, A. (2006). Tests for causality between integrated variables using asymptotic and bootstrap distributions: theory and application. *Applied Economics*, *38*(13), 1489-1500.

Hagen, D., Lai, A. Y., & Goldmann, E. (2022). State-level unemployment and negative emotions throughout the Covid-19 Covid-19 in the United States. *Preventive Medicine*, *164*, 107239.

Hancock, M. E., & Mora, J. (2023). The Impact of COVID-19 on Chinese trade and production: An empirical analysis of processing trade with Japan and the US. *Journal of Asian Economics*, 101596.

Hashimoto, K. I., Ono, Y., & Schlegl, M. (2023). Structural unemployment, underemployment, and secular stagnation. *Journal of Economic Theory*, 105641.

Işık, M. & Çetenak, Ö. Ö. (2019). İktisadi Hoşnutsuzluk Endeksi Makroekonomik Performansın Ölçülmesinde Başarılı Bir Gösterge midir?: Türkiye ve BRICS Ülkeleri Üzerine Bir Değerlendirme. *Uluslararası Ekonomik Araştırmalar Dergisi*, *4*(4), 37-50.

Janseen, R. F. (1971). Appraisal of current trends in business and finance. *The Wall Street Journal*, *4*.

Karacan, R. (2020). Ekonomik Büyüme Refah Düzeyini Artırır mı? Hoşnutsuzluk Endeksi Yaklaşımı ile Test Edilmesi: Endonezya, İran ve Suudi Arabistan Örneği. *JOEEP: Journal of Emerging Economies and Policy*, *5*(1), 17-22.

Keskin, A., & Kara, B. (2021). The Relationship Between Trade Openness, Foreign Trade Tax Revenues and GDP in Turkey: ARDL Bounds Test Approach for 1993-2019 Period. *Turkish Studies-Economics, Finance, Politics*, *16*(4), 1297-1315.

Kuzucu, S. (2022). Türkiye Cumhuriyet Merkez Bankası'nın Covıd-19 Pandemisine Karşı Para Politikasının Bir Değerlendirmesi. *Doğuş Üniversitesi Dergisi*, *23*(COVID-19 ÖZEL SAYISI), 265-279.

Li, T., Barwick, P. J., Deng, Y., Huang, X., & Li, S. (2023). The COVID-19 Covid-19 and unemployment: Evidence from mobile phone data from China. *Journal of Urban Economics*, *135*, 103543.

Mensi, W., Rehman, M. U., Hammoudeh, S., Vo, X. V., & Kim, W. J. (2023). How macroeconomic factors drive the linkages between inflation and oil markets in global economies? A multiscale analysis. *International Economics*, *173*, 212-232.

Naveed, H. M., HongXing, Y., Memon, B. A., Ali, S., Alhussam, M. I., & Sohu, J. M. (2023). Artificial neural network (ANN)-based estimation of the influence of COVID-19 Covid-19 on dynamic and emerging financial markets. *Technological Forecasting and Social Change*, *190*, 122470.

Nazir, M. I., Nazir, M. R., Hashmi, S. H., & Ali, Z. (2018). Environmental Kuznets Curve hypothesis for Pakistan: Empirical evidence form ARDL Bounds testing and causality approach. *International journal of green energy*, *15*(14-15), 947-957.

Núñez, Y. M., & Morales-Alonso, G. (2024). Longitudinal study of necessity-and opportunity-based entrepreneurship upon COVID lockdowns-The importance of misery and economic freedom indexes. *Technological Forecasting and Social Change*, 200, 123079.

Obayorı, J. B. (2020). Government Expenditure and Economic Discomfort in Nigeria: An ARDL Approach. *Finance & Economics Review*, *2*(2), 1-12.

Özer, M. O. (2019). Gelişmekte olan ülkelerde iktisadi hoşnutsuzluk endeksi ile cari açık arasındaki ilişki.

Paparoditis, E., & Politis, D. N. (2018). The asymptotic size and power of the augmented Dickey–Fuller test for a unit root. *Econometric Reviews*, *37*(9), 955-973.

Perron, P. (1989). The great crash, the oil price shock, and the unit root hypothesis. *Econometrica: journal of the Econometric Society*, 1361-1401.

Petersen, L., & Rholes, R. (2022). Macroeconomic expectations, central bank communication, and background uncertainty: A COVID-19 laboratory experiment. *Journal of Economic Dynamics and Control*, *143*, 104460.

Phillips, P. C., & Xiao, Z. (1998). A primer on unit root testing. *Journal of Economic Surveys*, *12*(5), 423-470.

Pogoy, A. M., Balo, V. T., Plaisent, M., & Bernard, P. (2016). Global implication of fractals on misery index across countries. *International Journal of Global Business*, *9*(1), 30.

Ramos-Francia, M., & García-Verdú, S. (2022). Central bank response to COVID-19. *Latin American Journal of Central Banking*, *3*(3), 100065.

Sánchez López, F. (2022). Measuring the effect of the misery index on international tourist departures: Empirical evidence from Mexico. *Economies*, *10*(4), 81.

Silva, P. H. N., & de Araújo, J. M. (2023). Inflation, perception of economic uncertainty and COVID-19: Evidence from Central Bank communication. *Central Bank Review*, 100108.

Şanlı, O. (2022). Döviz Kuru Dalgalanmalarının Enflasyona Etkisi: Türkiye Örneği. *Sosyal Bilimler Arastirmalari Dergisi*, *12*(3).

Şentürk, M., & Akbaş, Y. E. (2014). İşsizlik-Enflasyon ve Ekonomik Büyüme Arasındaki Karşılıklı İlişkinin Değerlendirilmesi: Türkiye Örneği. *Journal of Yasar University*, *9*(34), 5820-5832.

Tatlı, H., & Barak, D. (2019). The Determınatıon Of Causal Relatıonshıp Between Economıc Dıscontent Index And Dıvorce And Suıcıde Numbers: Empırıcal Evıdence For Level 2 Regıons In Turkey. 5th International Regional Development Conference (IRDC'2019), 26-28 September 2019, Malatya / TURKEY

TCMB (2020). Koronavirüsün Ekonomik ve Finansal Etkilerine Karşı Alınan Tedbirler. https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Duyurular/Koronavirus#:~:text=Bu%20kapsamda%2C%2017%20Mart%202020,%259%2C75%20seviyesine%20getirilmi%C5%9Ftir Acces Date: 04.04.2023

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of econometrics*, *66*(1-2), 225-250.

Tuğçe, A., & Derya, T. (2022). OECD Ülkelerinde Sefalet Endeksi ve Ekonomik Kalkınma Ekseninde Sağlık Harcamalarının Belirleyicileri: Toplamsal Olmayan Sabit Etkili Panel Kantil Regresyon Yaklaşımı. *Sosyal Siyaset Konferansları Dergisi*, (82), 267-286.

TCMB (2024). Fiyat Endeksi (Tüketici Fiyatları) (2003=100). https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Istatistikler/Enflasyon+Verileri/Tuketici+Fiyatlari Acces Date: 11.06.2024

Tunali, H., & Akdag, N. (2022). İktisadi Hoşnutsuzluğun Gelir Dağılımı Üzerindeki Etkisi: Seçili Kırılgan Ekonomiler Örneği. *PressAcademia Procedia*, *16*(1), 174-178.

Tunçay, C. M. (2021). Hoşnutsuzluk Endeksi ve Takipteki Kredi Oranları İlişkisi: Türkiye Ekonomisi Üzerine Ampirik Bir Analiz. *Politik Ekonomik Kuram*, *5*(2), 241-251.

Ülgen, G., & Özer, M. O. (2020). İktisadi Hoşnutsuzluk Endeksi ile Cari Açık Arasındaki İlişkinin Ampirik Analizi: Türkiye Örneği. *Akademik İncelemeler Dergisi*, *15*(1), 83-112.

Ülger Danacı, Ö. (2022). TCMB'nin Covid-19 Salgını Sürecinde Uyguladığı Para Politikalarının Değerlendirilmesi. *Maliye Finans Yazilari*, (118).

Ünal, A. E. (2020). Doğrudan Yabancı Yatırımların Barro Sefalet Endeksine Etkisi: Türkiye İçin Svar Analizi. *Akademik Araştırmalar ve Çalışmalar Dergisi (AKAD)*, *12*(22), 45-55.

Wang, N., Haroon Shah, M., Ali, K., Abbas, S., & Ullah, S. (2019). Financial structure, misery index, and economic growth: Time series empirics from Pakistan. *Journal of Risk and Financial Management*, *12*(2), 100.

Yamacli, D. S., & Yamacli, S. (2023). Estimation of the unemployment rate in Turkey: A comparison of the ARIMA and machine learning models including Covid-19 Covid-19 periods. *Heliyon*, e12796.

Yetişen, S., Türkoğlu, M., & Duran, G. (2022). Ekonomik Kalkınma ve İşbirliği Örgütü Üyelerinin Hoşnutsuzluk İndeksi Kapsamında Değerlendirilmesi (2008-2021). *Economics Literature*, *4*(2), 43-56.