

The effects of PPI and CPI in prediction of interest rate value

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Abstract

Interest, which is as old as the history of humanity, is at the center of life today in parallel with the developments in technology and communication. Predicting the future values of interest, which is very important in every field from state administration to individual investments and expenditures, is very important for individuals/companies/states to continue their activities in a stable manner. In pioneering studies, it has been emphasized that the main components of interest are real interest and future inflation expectations. Over time, the effects of goods, money, and international markets on the formation of interest have been analyzed theoretically and empirically. The effects of Central Banks on monetary policies and their long-term reflections have been the aim of many studies in recent history. The fact that the expected inflation in interest studies does not reflect the truth for many times has prevented the right results from being found. For this reason, it is seen that the realized CPI is generally used in estimating the interest rate. In addition, when countries are examined, it is seen that there are significant differences between CPI and PPI. The aim of this study is to empirically investigate which of the CPI and PPI values realized in estimating the interest rate should be used and to what extent.

Keywords: Interest Rate, CPI, PPI, Panel GMM.

JEL codes: E43, E47, C33

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1. INTRODUCTION

The history of interest, which expresses the economic return or cost of using or lending a resource, dates to ancient times. It has emerged and evolved in different ways according to the needs of civilizations. It was considered a moral crime and banned until the Renaissance and Enlightenment period. Globalization and financial liberalization activities in the world economy in the last 50 years have highlighted the role and functioning of interest. Today, interest is at the center of our lives, including applications for blockchain, fintech, and future markets. In addition to the establishment of macroeconomic models, interest is also one of the basic concepts in the creation of the micro foundations of macroeconomics (Mishkin, 2012, p.459). At the core of financial decisions is the desire to maximize the income of individuals who invest. The main comparison and control point of investment decisions is interest rate (Fabozzi and Peterson, 2003, p.27).

Interest rate is one of the important factors in the formation of the value of exchange rates. In futures or spot markets, since the interest rate differences between countries create arbitrage opportunities, the changes in exchange rates continue until this arbitrage opportunity disappears. Today, due to the developments in communication and technology, this type of arbitrage opportunity is very limited as the markets react very quickly to these imbalances and maintain the balances. Increases in exchange rates, on the other hand, trigger inflation because of foreign trade on the economy. As stated below, one of the most important components of interest is inflation. Therefore, increases in exchange rates increase inflation and interest rates. In other words, there is an interaction between exchange rate, interest, and inflation. Any developments in exchange rate, interest, or inflation force others to change. For this reason, macroeconomic policies must include all three variables at the same time.

There is no optimal value for the interest rate that reflects the underlying macroeconomic conditions. The value of interest rates should be to ensure long-term growth, price stability and

the resilience of financial markets (Executive Office of the President of the United States, 2015). For interest rates to be realistic, capital markets must have sufficient technological and legal infrastructure. Macroeconomic stability is the key to keeping interest rates stable and low.

In this study, it is aimed to determine the macroeconomic variables that affect interest rates. First, important studies on the determination of interest rates will be presented. Then, empirical studies to test the theoretical framework studies will be summarized. After specifying the basic features of the econometric method to be used, the results of the econometric study of 12 countries including the variables covering the period will be stated.

2. PIONEERING STUDIES ON THE DETERMINATION OF INTEREST RATES

Determining the future interest rate is very important in a very wide area, from taking any investment decision to bond markets. In this context, many studies have been carried out on the modeling of future interest rates. Handa (2009) emphasized that the traditional classical economists' full employment savings and investment, Keynesian economists' money supply and demand, modern classics money and bond supply and demand without being affected by inflation and post Keynesian economists' monetary policies affect real interest rates. Spahija (2016), on the other hand, examined the meaning and definition of the concept of interest, the independent variables affecting it, the hypotheses, and the proposed policies from four perspectives: Austrian School, Neo-Classical Theory, Theory of Liquidity and Theory of Loan.

The mathematical representation of interest was created with the book "Theory of Interest" written by Irving Fisher, one of the founders of monetary economy, in 1936. Fisher mathematically explained many concepts such as nominal interest following inflation, the concept of real interest, the opportunity cost of money. He showed the relationship between nominal interest, real interest, and inflation in equation (1). In equation (1), i is r is real interest, nominal

interest, and π^* is inflation (Fisher, 1936, p.173).

$$r = i - \pi^* \quad (1)$$

Again, the relationship between money supply and inflation is shown by Fisher in equation (2). In equation (2), M represents the money supply, V represents the velocity of money, and PY represents the nominal GNP (Pressman, 1999, p.94).

$$M * V = P * Y \quad (2)$$

When equations (1) and (2) are considered together, the increase in money supply increases prices, and the increase in prices increases interest rates, which is called the Fisher effect (Mankiw a, 2003, p.90).

With the IS-LM model, which is one of the foundations of modern macroeconomics, the interaction of output in commodity markets and supply and demand with interest in money markets is presented mathematically and graphically. The IS-LM model, which was designed by Keynes for the closed economy, was adapted to open economies by Mundell-Fleming (Snowdon & Vane, 2005, p.123).

In money markets, supply consists of savings and demand consists of households and individuals' borrowing needs for consumption and investment. Interest rate ensures that supply and demand in money markets come into balance (Mankiw, 2003, p.278). IS-LM curves, which show the equilibrium state of goods and money markets in the macro economy, are also modeled with the help of real interest and real output (Hubbard & O'Brien, 2012, p. 357).

Mathematical representations of IS and LM curves are presented below.

$$Y = C(Y - \bar{T}) + I(r) + \bar{G} \quad (3)$$

$$\left(\frac{M}{P}\right) = L(r, Y) \quad (4)$$

As can be seen from equations (3) and (4), interest rates affect both investments and money markets. In other words, the rise in interest rates has a contractionary effect on investments, decreases expenditures on durable consumer goods, decreases the value of bonds

held by households, and indirectly decreases consumption expenditures due to the income effect (Engen & Hubbard 2005). One of the most basic tools for the growth of countries is investment. Since investment is a function of interest, interest policies are extremely effective in the growth of countries. An increase in interest rates causes a decrease in investments.

Whelan (2020), on the other hand, obtained the interest equation specified in equation (5) by combining the Philips curve showing the relationship between inflation and unemployment, the IS curve showing the relationship between output and interest, and the Monetary Policy Rule.

$$i_t = r^* + \pi^* + \beta_\pi(\pi_t - \pi^*) + \beta_y(y_t - y^*) \quad (5)$$

In the modeling of nominal interest in equation (5), the deviations in the natural value of inflation π^* and the natural value of national income y^* are included in the Fisher model specified in equation (1). Doepke et al. (1999) stated, many studies have been conducted on directing monetary policies according to the rules. It is preferred in terms of credibility and performance that monetary policy makers conduct monetary policy in accordance with these rules. Taylor (1993) has demonstrated how simple, algebraic formulations of such rules would play a role in a world where policy makers cannot and should not be followed mechanically.

Hördahl et al. (2006), on the other hand, modeled the short-term interest in equation (6) by including the Taylor-type short-term interest rate reaction function of the monetary authority in equation (5) by including expectations. In the equation, η_t represents the monetary policy shock.

$$i_t = (1 - \rho)(\beta(E_t[\pi_{t+1}] - \pi_t^*) + \gamma y_t) + \rho i_{t-1} + \eta_t \quad (6)$$

Patterson and Lygnerud (1999) emphasized that while short-term interest rates are determined by the transmission mechanisms of the rates announced by Central Banks, long-term interest rates are created by the markets. They stated that short-term interest rates, inflation expectations, expectations regarding the real economy (such as growth), international markets, exchange rate,

public sector borrowing rate and price/return rates of other assets and growth/demand are affected by the interaction of interest.

Based on modern monetary policies, economic activities are controlled with the help of interest. Interest is directed by Central Banks with the method also called Taylor rule. According to this rule, central banks minimize the movements in the inflation target and lack of production with the help of their policies. Central Banks with the help of policy interest; affect output/inflation/expectations through interest, asset, credit, and foreign exchange channels. The specified Money Transfer Mechanism is carried out by the Central Banks in accordance with the monetary policy rules (Égert and MacDonald, 2008).

When the balance sheet of the Central Bank is analyzed, its assets include gold, foreign currency and government debts, and its liabilities include the money released to the market and the Central Bank's deposit. Since the central bank is the sole authority in the release of the money supply, it increases the money supply by buying bonds from the market, and decreases the money supply by selling bonds to the market. The central bank fulfills its function of influencing the market by changing the money supply, the amount of foreign currency or debt. The Central Bank uses open market operations to satisfy its monetary policy objectives, to ensure that short-term interest rates in the financial market are formed around the policy rate, and to regulate liquidity. It is not preferred to change the money supply directly, especially considering that it exerts inflationary pressure.

Individuals can react heterogeneously to developments in monetary policies due to reasons such as the failures and imperfections in the functioning of the market stated by the new monetarists and the stickiness in wages and prices emphasized by the new Keynesians. In this case, although the expected reactions are received in short-term interest rates, heterogeneous results occur in the long-term structure of the interest rate. The fact that the same interest rate has different effects on the economy in different countries and/or time periods is also due to heterogeneous changes in

the long-term structure of the interest rate. Hur (2006) investigated the effects of changes in US monetary policies on bond markets with the help of impulse response function. He put the change in money markets into the model with M1. He found that the changes in M1 affect all the interests in the bond markets, but the severity of the effect is different, in other words, the returns do not change linearly by differentiation.

In monetary modeling of exchange rate, stable money demand function, balance in money markets, unsecured interest parity and Purchasing Power Parity are used. In other words, there is a significant relationship between the interest rate and the exchange rate. Equilibrium in international markets is provided by the unsecured interest parity and is shown in equation (7) (Heijdra, 2003, p 298).

$$r_t = r_t^* + e^e \quad (7)$$

In equation (7), $e \equiv \ln E$ and $e^e \equiv de^e/dt \equiv \dot{E}^e$. As can be understood from equation (7), when the interest rate of one country changes, if the interest of other countries does not change, the exchange rate must change to provide the balance. With the help of uncovered interest arbitrage, countries intervene by changing the interest rate according to the developments in the exchange rate. Therefore, the correct calculation of the formation of interest plays an extremely important role in the formation of international monetary policies of countries.

Especially those of the developing countries that apply the fixed exchange rate regime have a serious dependence on the interest rates of the developed countries. A change in the exchange rate results in the developing country changing the interest rates and, in this case, it affects the GNP of the developing country. In their study, Giovanni and Shambaugh found that a 1 point increase in the interest rates of developed countries caused a decrease between 0.1-0.2 in the GNP of developing countries that implement the fixed exchange rate regime (Giovanni and Shambaugh, 2006).

Both developed and developing countries may experience extreme decreases in the value of financial assets due to financial crises caused

by the defense of the fixed exchange rate system, problems in the banking system, and the inability to rollover the debt stock. These crisis situations require quick action due to its self-feeding, uneven distribution of information to individuals, long duration with multiple balances and very costly to society. Some of the most important instruments of governments in crises are monetary and interest rate policies.

When the empirical and theoretical studies are examined, it is seen that the interest rate is affected by inflation. However, in the literature review, no study could be found on which or at what rate both producer and consumer inflation should be used. Since both inflation rates move differently over time, this issue is very important in interest rate estimations.

3. PIONEERING STUDIES ON THE DETERMINATION OF INTEREST RATES

Some studies on interest modeling and its components are presented Table-1.

When the empirical studies mentioned Table-1 are examined, it is seen that the relationship between inflation and interest rate has not been directly tested. In addition, when the literature review was examined, no study could be found on which of the CPI and PPI should be used in the estimation of interest rates.

4. ECONOMETRIC MODELS TO BE USED

The time series will be used to understand the changes in interest rates over time and to predict their future trends. Data from 12 countries will be included in the model with the Panel data method, as it contains more observations and provides statistically more reliable and higher degree of precision. A time series is said to be stationary if its mean and autocovariance do not change over time. Since the data to be used in the study is a time series, first, it is necessary to test its stationarity. Panel unit root test is performed by Levin, Lin and Chu (2002) with the help of the following equation.

$$\Delta y_{it} = \delta y_{it-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it} \quad m = 1,2,3. \quad (8)$$

In the least squares method, basic assumptions such as the normal distribution of error terms, the absence of variance and autocorrelation problems between the error terms, and the absence of multicollinearity between the independent variables should be provided. In cases where this assumption cannot be met, traditional methods do not give correct results. Since some of these assumptions could not be satisfied in our study, the Generalized Method of Moments (GMM) method was used. The GMM method is suitable for working with very different data structures such as linear and non-linear models, cross-sectional data, panel data and time series, and parameter estimates are obtained by matching a certain number of theoretical moments with observed moments, and then model validation and hypothesis tests are performed on these estimates.

$$E(Z_i' u_i) = E(Z_i'(y_i - X_i \beta)) = 0$$

$$\hat{\beta} = (X' Z \widehat{W} Z' X)^{-1} (X' Z \widehat{W} Z' Y) \quad (9)$$

In the equation, Z_i' is a $G * L$ matrix with observable instrumental variables. If the number of instrumental variables (L) is greater than the unknown (K), a more general class of estimators is obtained by using a weighting matrix (W) in quadratic form (Wooldridge, 2002, p.190).

5. MODELING OF INTEREST RATE MOVEMENTS

Modeling of interest rate, which has a very important role in every moment of life both in the world and in Türkiye, is of vital importance in making economic decisions. Econometric study will be done with the help of equation (1). Panel GMM method was used with the 1995-2021 data of 12 countries (USA, England, Japan, Australia, Canada, Chile, India, South Korea, Singapore, South Africa, Brazil, and Mexico)¹ whose data can be accessed.

In the study, the deposit interest rates of banks (LENDINGINTERERESTRATE) were taken as the dependent variable. The independent variables are Consumer Price Index (CPI),

Producer Price Index (PPI) and Real Interest Rate (RIR). Actual values are used because there is not enough and accurate data on inflation expectations. The difference of this study from other studies is that PPI is included in the study as well as CPI. First, unit root tests were carried

out with the help of equation (8) to investigate the stationarity of the series, and the results regarding the stationarity of the series are in Table-2.

Table 1. Some Studies on Interest Modeling And Its Components

Number	Writer	Dependent/Independent Variables	Methods	Conclusion
1	Aksoy and León-Ledesma (2005)	UK and US Treasury Bond interest rate, logarithm of GNP	Unit Root Testing, VAR and Cointegration	There is no long-term relationship between interest and production.
2	Beechey et al. (2008)	Short and long-term interest rates for 10 countries	Unit Root Testing, Cointegration	Nominal interest rates are stable in 10 countries, but cointegration is valid in some countries but does not give the same result for all 10 countries.
3	Kılıcı (2019)	Central Bank interest rates and inflation data for Turkey for the years 2005-2017	Unit Root and Fourier Granger tests	The fact that the Central Bank interest rates affect inflation and there is a cause-and-effect relationship.
4	Browne and Manasse (1989)	Data from the USA, England, France, Germany, Italy, and Canada for the years 1971-1989 on interest rates and inflation between 3 months and 10 years	Linear and two-stage linear regression	Short-term interest rates (monthly-2 years) can be used for inflation expectations.
5	Chakraborty (2012)	India's 2006-2011 public deficit and interest data	Unit Root Testing and Asymmetric YES	The increase in the public deficit did not increase the interest rates.
6	Leuvensteijn et al. (2008)	Bank rates (deposit and loan) and Bond indicators of 8 EU countries for the period 1994-2004	Unit root testing, Cointegration and Error Correction Method	Increasing competition in banking reduces the gap between interest rates and increases social benefit.
7	Molefe and Mah (2020)	Budget deficit, GNP, inflation and interest rates of the BRICS countries for the years 1995-2019	Panel unit root, panel cointegration and panel vector error correction model	In the long run, the budget deficit increases the interest rates and creates a crowding out effect.
8	Bauer et al. (2014)	Inflation GNP growth with the bond yields of 10 countries covering the years 1990-2009	Gaussian dynamic term structure model	Presence of a forward premium model in long-term interest rates in developed countries
9	Rudebusch et al. (2007)	Between 1962 and 2005, 10-year and 3-month treasury bonds of the USA, and the growth of GNP	VAR	The finding that changes in the interest premium term have a significant correlation with future GDP growth has not been captured by macroeconomic models.
10	Sun (1992)	Between 1971-1986 US bond rates and CPI	MLE	The assumption of neutrality of money is not consistent.
11	King and Kurmann (2002)	US short-term and long-term interest rates between 1951-2001	VAR and cointegration	It was seen that the assumption of neutrality of money was not consistent and the expectations theory was rejected, and since short-term interest rates are determined by the CBT according to the interest and output gap, this interaction is important in determining the long-term interest rate.
12	Fama (1990)	TÜFE Bond interest rates from 1 to 5 years for the years 1952-1988 in the USA, CPI	Regression	That the real yield of inflation and bond interest rates move in opposite directions in the short run, but they move in the same direction in the long run.

Table 2. Unit Root Tests of Variables

	Levin, Lin & Chu t Sta.	Prob.
LENDINGINTERESTRATE	-2,2870	0,0111
CPI	-10,5505	0,0000
PPI	-8,2189	0,0000
RIR	-2,2255	0,0130

Null Hypothesis: Series have a unit root

In the study, Broadmoney/GDP (BROADMONEY), real interest (RER) and annual growth of GDP (GDPGROWTHANNUAL) are used as instrument variables.

Since the assumptions of the least squares method, such as the normal distribution of error terms, could not be satisfied, Panel GMM was used with the help of equation (9) and the results are presented in Table-3.

Table 3. Panel GMM Results

Variable	Coefficient	t-Statistic	Prob.
CPI	0,5144	3,2417	0,0014(*)
PPI	101,8927	2,5132	0,0127(*)
RIR	0,8632	5,5095	0,0000(*)

Dependent Variable: LENDINGINTERESTRATE

(*)The coefficients are significant at the level of $\alpha=0.01$

The explanatory power of the study was found to be 0.95. When the results are analyzed, it is seen that the main variable affecting the bank rates is the Producer Price Index, while the effect of the consumer price index and real interest rates is relatively limited. The probability of the J test for the suitability of the instrument set was found to be 0.52, and the suitability of the instrument set is provided. The skewness of the error terms was found to be 0.22 and the kurtosis was 3.5, the Jarque-Bera test was 4.59 and the probability was 0.10. According to these results, it is seen that the error term is normally distributed.

6. CONCLUSIONS AND FURTHER RESEARCH

Interest, which has existed throughout the history of humanity, has been prohibited by religious provisions due to its negative effects. Since the enlightenment era, its use has become widespread in parallel with the economic, political, and technological developments in the world. Over time, with the establishment of institutional structures such as banking, it settled on a legal basis.

Estimating the future value of the interest rate, which is one of the most important determinants of many economic decisions such as investment, production and consumption for households, companies, government, and other countries, is of vital importance today. In addition, the reflection of the monetary policies of the state on the economy is extremely important for policy makers, households, entrepreneurs and other countries. Even a very small policy change regarding the interest rates of the Central Banks of the USA and EU developed countries has great effects in the world.

One of the focal points of today is the creation of projections for the future by modeling the interest rate. Therefore, many studies have been done to understand and model the interest rate. Theoretical and empirical studies have emphasized that interest includes expected inflation and risk premium. In the literature search, no adequate study could be found on which inflation rate or at what rate should be used due to the differences in the movements of CPI and PPI. In this study, it was aimed to determine their relative weights by including CPI and PPI in the same model.

The data of 12 countries whose data can be accessed, and the interest rate are modeled with Panel data. Although the correct result was determined by the least squares method after the stationarity test of the time series, the Panel GMM method was used because the assumptions about the model were not satisfied. Bank deposit rates are the dependent variable, and the independent variables are CPI, real interest and PPI, and the explanatory value of the model is 0.95. Although CPI and real interest have a significant effect on the formation of interest rates, the effect of PPI is relatively much more important.

According to the results obtained, it is considered that it would be appropriate for policy makers to attach importance to PPI in determining interest rates and in their efforts to keep interest rates low. It does not seem possible to expect a stable structure in interest rates without finding a solution to the problems experienced in the PPI within the country and throughout the world. As a result, it is considered that a permanent

decrease in the interest rate will only be possible by reducing the inflation and the real interest rate, which includes the uncertainty/risk premium.

Sufficient data could not be obtained for some developed countries, especially EU countries, and many developing countries. The establishment of the EU and the ECM and the joint publication of the data of these countries prevent the collection of long-term data on a country basis. This situation limits the number of countries to be included in the model. Since countries' studies on expected inflation differ and there is not enough data, actual inflation was used instead of expected inflation in the study. The effect of the policy rates of the Central Banks on the deposit rates could not be included in the study due to the lack of data.

In order to obtain more precise results, the number of countries included in the study should be increased. Due to the insufficient level of publicly available data, obtaining additional data from institutions may further increase the sensitivity of the study. Since countries' studies on expected inflation differ, sometimes healthy results are not obtained and there is not enough data, the results can be confirmed by conducting an econometric study on a country basis. Deposit rates are affected by short-term interest rates, primarily Central Bank rates, for reasons such as risk, return, supply/demand. In this context, due to the problems of accessing comprehensive data on the term structure of interest rates, examining the term structure of interest rates covering a limited number of countries will help to better understand interest rates.

Endnote

¹Data are from the World Bank and International Financial Statistics (IFS).

REFERENCES

- HEIJDR A. B. J., (2003), *Foundations of Modern Macroeconomics*, Second Edition, Oxford University Press.
- AKSOY Y. & LEÓN-LEDESMA M. A., (2005), Interest Rates and Output In The Long-Run, European Central Bank, Working Paper Series No 434, [online] Available at: <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp434.pdf>, [Accessed in November 2021].
- BAUER M. D., RUDEBUSCH G. D., & WU J. C., (2014), Term Premia and Inflation Uncertainty: Empirical Evidence from an International Panel Dataset: Comment, *American Economic Review*, Number 104(1): 323–337.
- BEECHEY M., HJALMARSSON E. & ÖSTERHOLM P., (2008), Testing the expectations hypothesis when interest rates are near integrated, *International Finance Discussion Papers* No 953, [online] Available at: <https://www.federalreserve.gov/pubs/ifdp/2008/953/ifdp953.htm> [Accessed in June 2022.]
- BROWNE F. & MANASSE P., (1989), The Information Content of the Term Structure of Interest Rates: Theory and Evidence, OECD Economics Department Working Papers 69, [online] Available at: <https://www.oecd-ilibrary.org/docserver/748671027822>
- CHAKRABORTY L. S., (2012), Interest Rate Determination in India: Empirical Evidence on Fiscal Deficit – Interest Rate Linkages and Financial Crowding Out, December 2012, Levy Economics Institute, Working Paper No. 744, [online] Available at: http://www.levyinstitute.org/pubs/wp_744.pdf, [Accessed in October 2018].
- Di GIOVANNI J. & SHAMBAUGH J. C., 2006, The Impact of Foreign Interest Rates on the Economy: The Role of the Exchange Rate Regime, IMF Working Paper, [online] Available at: file:///C:/Users/user/Downloads/_wp0637.pdf, [Accessed in May 2018], p. 23.
- DOEPKE M., LEHNERT A. & SELLGREN A. W., (1999), *Macroeconomics*, [online] Available at: <https://faculty.wcas.northwestern.edu/mdo738/book.htm>, [Accessed in August 2022]
- ÉGERT B. & MacDONALD R., (2008), Monetary Transmission Mechanism In Central And Eastern Europe: Surveying The Surveyable , Economics Department Working Papers No. 654, [online] Available at: <https://www.oecdlibrary.org/docserver/230605773237.pdf?expires=1635863416&id=id&accname=guest&checksum=37500F2121C3E591881FC51D161D0041>, [Accessed in December 2019], p.6.

- ENGEN E. M. & GLENN H. H., (2005), Federal Government Debt and Interest Rates, *NBER Macroeconomics Annual* 2004, Volume 19, [online] Available at: <http://www.nber.org/books/gert05-1>, p.1. [Accessed in May 2022]
- Executive Office of the President of the United States, (2015), Long-Term Interest Rates: A Survey, p. 40, [online] Available at: <https://vdocuments.site/long-term-interest-rates-a-survey-decline-in-long-term-interest-rates-over-the.html?page=1>, [Accessed in April 2021]
- FABOZZI F. J. & PETERSON P. P., 2003, Financial Management and Analysis, 2nd Ed.
- FAMA E. F., (1990), Term-Structure Forecasts Of Interest Rates, Inflation, & Real Returns, *Journal of Monetary Economics* 25, 60, 59-76.
- FISHER I., (1936), *The Theory of Interest*, The Macmillan Company, 173, [online] Available at <http://oll.libertyfund.org/Home3/EBook.php?recordID=0219>: [Accessed in April 2020]
- HANDA J., (2009), *Monetary Economics*, 2nd Edition, Routledge Press,
- HÖRDAHL P., TRISTANI O. and VESTIN D, 2004, Joint Econometric Model of Macroeconomic and Term Structure Dynamics, Working Paper Series, NO. 405 /, [online] Available at: <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp405.pdf>, p. 12, [Accessed in March 2022]
- HUBBARD G., O'BRIEN A., RAFFERTY M. & KONIECZNY J., (2012), *Macroeconomics*, Pearson Canada Press.
- HUR S. K., (2006), Money Growth and Interest Rates, NBER Working Paper Series Number 11102, [online] Available at: http://www.nber.org/books/ito_06-1, [Accessed in January 2021], s.36.
- KILCI E. N., (2019), Analysis of the Relationship Between Inflation and Central Bank Interest Rates in Turkey: Fourier Approach, *International Journal of Economic and Administrative Studies*, Number 22, 135 – 146.
- KING R. G. & KURMANN A., (2002), Expectations and the Term Structure of Interest Rates: Evidence and Implications, *Federal Reserve Bank of Richmond Economic Quarterly* Volume 88/4 Fall 2002, 49-95, [online] Available at: https://www.richmondfed.org/~media/richmondfedorg/publications/research/economic_quarterly/2002/fall/pdf/king.pdf, [Accessed in December 2021].
- LEVIN A., LIN C. F., & CHU C., (2002). "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties," *Journal of Econometrics*, 108, 5, 1–24.
- MAIER R. & PATERNOSTER D., (2013), Implications of the Low Interest Rate Environment for the Real Economy, [online] Available at: <http://www.stefancollignon.de/PDF/EP-Feb2013-draft.pdf>, [Accessed in September 2019], 10
- MANKIW N.G., (2003a), *Macroeconomics*, 5th ed., Worth Publishers Press.
- (2003b), *Principles of Macroeconomics*, 3rd Ed., Cengage Learning Australia Press.
- MISHKIN F. S., (2012), *Macroeconomics Policy and Practice*, Pearson Education Inc.
- MOLEFE E. K. and MAH G., (2020), Fiscal Deficits and Interest Rates In Brics Economies: Testing The Keynesian-Ricardian Opposition, *Journal of Life Economics*, 7(2), 2020, 177-188, [online] Available at: <https://journals.gen.tr/index.php/jlecon/article/view/1063/748>, [Accessed in February 2020].
- PATTERSON B. & LYGNERUD K., (1999), The Determination of Interest Rates, *European Parliament Working Paper* ECON 116 EN 11-1999, [online] Available at: https://www.europarl.europa.eu/workingpapers/econ/116/116_en.htm, [Accessed in January 2019]
- PRESSMAN S., (1999), *Fifty Major Economists*, Routledge Press.
- RUDEBUSCH G. D., SACK B. P., & SWANSON E. T., (2007), Macroeconomic Implications of Changes in the Term Premium, *Federal Reserve Bank of St. Louis Review*, 262, 241,270, [online] Available at: https://glennrudebusch.com/wp-content/uploads/2007_FRBSL-Rev_Rudebusch-Sack-Swanson_Macroeconomic-Implications-of-Changes-in-the-Term-Premium.pdf, [Accessed in August 2020].
- SNOWDON B. & VANE H. R., (2005), *Modern Macroeconomics Its Origins, Development and Current State*, Edward Elgar Pub.
- SPAHIJA F., (2016), Analysis of The Main Theories of Interest Rates, *International Journal of Economics, Commerce and Management*, IV(6), June 2016, 643-658
- SUN T.S., (1992), Real and Nominal Interest Rates: A Discrete-Time Model and Its Continuous- Time Limit, *The Review of Financial Studies*, 5(4), 607, 581-611.
- TAYLOR J.B., (1993), Discretion versus policy rules in practice, *Carnegie-Rochester Conference Series on Public Policy* 39, 213, 195-214.
- Van LEUVENSTEIJN M., SØRENSEN C. K., BIKKER J. A. & van RIXTEL A., 2008, Impact of Bank Competition on the Interest Rate Pass-through in the Euro Area, the Banco de España Working Paper No 0828, [online] Available at: <https://www.bde.es/f/webbde/>

SES/Secciones/Publicaciones/PublicacionesSeriadas/
DocumentosTrabajo /08/Fic/dt0828e.pdf, [Accessed in
February 2020].

WHELAN K, (2020), Advanced Macroeconomics
Notes, University College Dublin, [online] Available
at: [https://www.karlwhelan.com/Macro2/Whelan-
Lecture-Notes.pdf](https://www.karlwhelan.com/Macro2/Whelan-Lecture-Notes.pdf) s.35, [Accessed in June 2020]

WOOLDRIDGE J. M., (2002), *Econometric Analysis of
Cross Section and Panel Data*, The MIT Press.