

YIELD SPREAD

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**The Information in the Yield
Spread for the Recession in
the Case of Pakistan**

**Hafsa Hina
Henna Ahsan
Hania Afzal**

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Pakistan Institute of Development Economics
Islamabad, Pakistan

E-mail: publications@pide.org.pk

Website: <http://www.pide.org.pk>

Fax: +92-51-9248065

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Hafsa Hina

Pakistan Institute of Development Economics, Islamabad.

Henna Ahsan

Pakistan Institute of Development Economics, Islamabad.

and

Hania Afzal

Pakistan Institute of Development Economics, Islamabad.

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ABSTRACT

Yield spread is positively linked with future economic expansion to a certain extent, and it has been observed that an inverted yield curve is an indication of recession. The primary purpose of this study is to investigate the effect of yield spread (calculated as the difference between the weighted average rates of return on 5-year deposits and the 3-month rates of return) on the economic activity of Pakistan while incorporating other macroeconomic factors as well.

To measure recession and expansion probabilities Hamilton's (1989) Markov switching model has been used. After that, the impact of yield spread on recession is analysed by applying the ARDL bounds testing approach, based on 40 years of data ranging from 1980 to 2020. The result shows that the yield spread is positively associated with the probability of a recession. Therefore, whenever there is an increase in yield spread, we expect a recession rather than economic growth. In contrast, the control variables like migration and foreign direct investment reduce the chance of a recession in an economy. Moreover, price level increases the probability of a recession in the country.

JEL Classifications: B23, E3, E4.

Keywords: Yield Spread, Recession, ARDL, Pakistan.

1. INTRODUCTION

A recession is defined as a period of a country's declining economic performance, which may last for several months, as explained by the National Bureau of Economic Research (NBER). Businesses witness their revenues decreasing during a recession, which may compel many to halt hiring new workers and lay off the rest. Many enterprises may completely get out of the business, adding more numbers to total jobs lost. This ultimately causes the unemployment rate to rise in the area. This general economic unease and large numbers of unemployed may lead more consumers to save.

It is not always possible to predict recessions; if it was, human beings would plan better to handle them or to altogether avoid them. However, a few warning signs can help economists to predict that a recession is on its way. It has been often stated that an inverted yield curve is an essential indicator of a recession. When short-term interest rates are greater than the long-term interest rates, market views suggest that the long-term performance is depressing. Similarly, long-term fixed-income yields will continue to decrease, while a positively sloped yield curve usually leads to an increase in economic growth. Kessel (1965) was the first to notice an association between the interest rate and business cycles.

Research on the predictive ability of yield curves has gotten very popular, particularly in developed countries. The reason for according considerable importance is due to its scope in forecasting both in nominal and actual macroeconomic variables (Chinn & Kucko, 2015). That includes predicting future interest rates (Fama, 1975), consumption (Harvey, 1988), employment (Bernanke, 1990), inflation rates (Alessandri & Mumtaz, 2014 and Gomez-Biscarri, 2009), business cycle fluctuations and economic growth (Gilchrist & Zakrajsek, 2012; Abdymomunov, 2013; Nakaota & Fukuta, 2013). Yield spread is considered necessary as an indicator of inflation and economic growth is well well-known and a wide range of research supports this notion (Stock and Watson, 2003). Extensive research of its predictive power in terms of spreading for forthcoming activity had been conducted in the 1990s as a natural reaction. Moreover, past research provides strong evidence for forecasting the yield spread for a country's economic activity.

However, the latest research in the area shows that the association between the yield spread and economic growth is not consistent as has been assumed in previous studies. Haubrich & Dombrosky (1996) concluded that the projecting power of the term spread for economic activity has weakened since mid-1980's. As Estrella et al. (2000) suggested that instability in this relationship in the contexts of Germany and the United States of America (USA). Similarly, Zulkhibri & Rani (2016) and Maya (2020) purported that yield spread provides less information about inflation and future economic output for short spans and the use of yield expansion in monetary analysis beyond predictable indicators are somewhat inadequate. Moreover, Siklos (2000) suggested that the interest spread is negatively related to the future economic expansion in New Zealand for shorter periods.

Because of such a situation, it is pertinent to analyse the role of yield spread for realising as a predictor of economic growth for developing countries like Pakistan, as governments do not announce the explicit target of economic growth, so the role of interest rate spread has remained in ambiguity. That is why it is essential to analyse the role of interest spread in economic activity, but such literature is very limited in developing countries. In the case of Pakistan, Hussain and Mahmood (2017) have suggested the effect of yield spread on inflation and economic expansion. They calculated the yield spread as the difference between yield on 10-year bond and 3-month T-bills in the secondary market. The results suggest that yield expansion is a good indicator of economic expansion in Pakistan, specifically for periods exceeding six months up to two years.

However, until now, no research is available that could analyse the spread of the yield curve on economic cycles. Therefore, this paper aims to examine the impact of yield spread on economic recession while incorporating other macroeconomic factors as well, besides keeping insight into economic and social parameters. This paper's first objective is to measure the business cycle of economic growth. To measure recession and expansion probabilities Hamilton's (1989) Markov switching model has been used. In the second stage, the impact of yield spread on recession is analysed by incorporating other macroeconomic variables involving migrant workers, foreign direct investment, and general price level based on data from 1980 to 2020 using the Auto Regressive Distributed Lag Model (ARDL) approach. Our result suggested that the yield spread is positively associated with the probability of recession, opposing the general theory of yield curve, where an increase in the spread is the indicator of economic stability. This study does not support a priori expectation of the yield curve. However, this result is very similar to Zulkhibri & Rani, 2016 and Maya, 2020). Accordingly, yield spread contains little confirmation of the direction of the overall economy. In comparison, the control variables like migration and foreign direct investment reduce the chance of a recession. Moreover, price level increases the probability of a recession in the country.

The rest of the paper is organised as follows: Section 2 provides the empirical and theoretical framework and related literature on the predictive power of the yield spread. While data, methodology, and econometric model are discussed in section 3. Section 4 discusses the yield curve trend, economic cycles, and empirical results. The last section provides the conclusion of the study.

2. EMPIRICAL AND THEORETICAL BACKGROUND

Sufficient studies and literature on forecasting techniques of future economic output with asset prices are available. To predict future economic growth, an exhaustive analysis is also carried out for interest rates, particularly for term spreads. Because of economic instability in the 1970s and early 1980s, the intention has focused on forecasting leading indicators of output growth built on monetary aggregates. The term frequently used in literature is the difference between long span, i.e., ten-year government bills rate, and short period, i.e., three-month treasury bill rate. Sometimes an overnight rate subtracted from the long bond rate, such as the Federal Funds rate in the US is also used. As such, there is no standard method for estimating future output. In most models, sample estimates are applied, whereas in a few cases, some researchers design out-of-sample forecasts.

The relationship between the yield spread and real economic output fundamentally reflects financial market participants' expectations regarding future economic growth. As a starting point, the relation between terms spread and real economic activity may be considered a theoretical relationship between macro-economic activity and real interest rates, for example, through investment and consumption. A simple optimising consumption model can be used to derive a theoretical model to establish an association between future consumption and real-term structure.

Research skill in forecasting in terms of the spread of economic growth was started by (Stock & Watson, 1989; Estrella & Hardouvelis, 1991; and Chen, 1991). Many researchers find a significant positive relationship between yield expansion and economic growth of the economy. The confirmation of such conclusions has further been made by (Bomhoff, 1994; Davis & Fagan, 1997; and Hamilton & Kim, 2000). Most of these studies conclude that the term spread has substantial predictive power for economic growth, especially over a short period, and view the inverted yield curve as an indicator of awaiting economic recession. Similarly, when short-term interest rate surpasses the long-term rate, market dynamics suggest that the long-run economic outlook will be poor and the yields offered by long-term fixed income will continue to decrease and may cause a recession in an economy.

Later research has focused on exploring the association between term spread and real economic output is stable across time and does this holds up across the country. Haubrich & Dombrosky (1996) concluded that the predictive power of the yield expansion for economic growth was curtailed after the 1980s. Similarly, Estrella et al. (2000) suggested that there is instability in this relationship between the yield spread and economic growth for Germany and the USA. However, Siklos (2000) has presented some reverse findings which show that yield spread has adverse and significant effects on the future economic growth in New Zealand for the period 1985 to 1997. He suggested this negative effect on future economic growth at the short horizon because during this period government emphasised an inflation targeting policy.

The above-detailed literature leads us to some conclusions. It has been observed that the term expansion can be used as a predictor of economic growth, especially over a short time. However, the relationship does not hold stable results across countries, across periods, and in different monetary policy regimes. Further, the term's predictive power seems to have declined during the last decade. Moreover, limited empirical work supports the results found in Siklos (2000), where yield spread has a negative relationship with economic growth.

3. METHODOLOGY AND DATA

3.1. Economic Model

This study follows the theoretical model of Estrella and Hardouvelis (1991) to analyse the impact of yield spread on the economic recession. The regression model has the following general form:

$$R_t = \alpha_0 + \alpha_1 spread_t + \sum_{i=1}^N \beta_i X_{it} + \varepsilon_t \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

Where R_t is the probability of recession, $spread_t$ is the measure of the slope of the yield curve, and X_{it} is a vector of control variables – migrant workers (M_t), trade openness (TO_t), foreign direct investment (FDI_t), price level (P_t) and wage rate - included in the regression.

As migration from one country to another increased the remittances that lead not only to improved living standards and decreases the depth and severity of poverty but also boosted the foreign exchange reserves. This, in turn, can potentially affect other macroeconomic variables such as reducing the fiscal deficit and increasing the output (Carling, 2005). Similarly, trade openness enhances the output growth of the economy by providing easy access to goods and services, increasing the total factor productivity through efficient diffusion of technology and knowledge transfer and attaining competency in the allocation of resources (Barro & Sala-i-Martin, 1997; Freund & Bolaky, 2008).

Foreign investment impacts economic growth in many ways, such as by increasing business efficiency, stimulating the economic growth and business in a country, and increasing the quality and diversity of local manufacturers that is the receiver of capital. Moreover, FDI enhances knowledge and technology spillover and trains the local labour to overcome the future challenges related to production and economic growth (Gory & Greenway, 2004; Bauer, 1991; Easterly, 2006). Moreover, empirical studies suggest that inflation is negatively related to economic activity. For example, Barro (1997) says that high prices reduce the level of investment, which adversely affects output growth and causes a recession in an economy. Similarly, a rise in wage rate may promote economic growth if productivity is shifted toward more highly-skilled labour, possibly by inducing additional training for low-skilled workers with an increase in wages. Whereas reducing the wage rate reduces labour productivity, which causes a recession in an economy (Lavoie & Stockhammer, 2013 and Xu et al, 2015).

3.2. Econometric Methodology

The econometric methodology has been framed into two parts. The first is to measure the business cycles, the date of the recession and expansion, and probabilities. Then modelling the probabilities of recession with yield spread and macroeconomic variables that have the potential predictive power for recession.

3.2.2. Recession Probabilities by Markov Switching Method

The recession and expansion probabilities will be calculated by following Hamilton's (1989) Markov switching model. It captures the nonlinearity of the process as the process is based on discrete shifts in mean between high-growth model and low-growth states, and is commonly used for the business cycle dating process.

The first-order autoregressive two-state Markov regime-switching model where only the mean change is expressed as:

$$y_t = \alpha_{s_t} + \sum_{l=1}^p \beta_l y_{t-l} + \varepsilon_t$$

Where dependent variable y_t depends on the autoregressive $AR(p)$ process, unobserved discrete variable s_t such that $s_t = 1$ if a high-growth state and $s_t = 2$ for low-growth states and normally distributed residuals in each regime $\varepsilon_t \sim (0, \sigma_{s_t}^2)$.

s_t follows a first-order Markov chain with the following transition matrix:

$$\mathbb{P} = \begin{bmatrix} p_{11}=P[s_t=1|s_{t-1}=1] & p_{12}=P[s_t=2|s_{t-1}=1] \\ p_{21}=P[s_t=1|s_{t-1}=2] & p_{22}=P[s_t=2|s_{t-1}=2] \end{bmatrix}$$

where p_{ij} ($i, j = 1, 2$) denote the transition probabilities of $s_t = j$ given that $s_{t-1} = i$. Clearly, the transition probabilities satisfy $p_{i1} + p_{i2} = 1$. The maximum likelihood estimator (MLE) is used to estimate the parameters of the Markov switching autoregressive (MS-AR) model.

3.1.3. Auto-Regressive Distributed Lag (ARDL) Model and Bound Test

It is expected that the set of regressors is a mixture of I (0) and I (1). Therefore, the regression model (1) will be estimated by the ARDL bound testing approach by Pesaran *et al.* (2001) to analyse the long-run co-integration relationship among the probabilities of recession and its determinants.

The mathematical representation of the ARDL model is given below.

$$\begin{aligned} \Delta R_t = & \alpha + \sum_{i=1}^l \beta_{1i} \Delta y_{t-i} + \sum_{i=0}^l \beta_{2i} \Delta spread_{t-i} + \sum_{i=0}^l \beta_{3i} \Delta m_{1t-i} \\ & + \sum_{i=0}^l \beta_{4i} \Delta to_{t-i} + \sum_{i=0}^l \beta_{5i} \Delta fdi_{t-i} + \sum_{i=0}^l \beta_{6i} \Delta un_{t-i} \\ & + \sum_{i=0}^l \beta_{7i} \Delta p_{t-i} + \delta_1 y_{t-1} + \delta_2 spread_{t-1} + \delta_3 m_{t-1} \\ & + \delta_4 to_{t-1} + \delta_5 fdi_{t-1} + \delta_6 UN_{4t-1} + \delta_7 p_{t-1} + \varepsilon_t \quad \dots \quad \dots \quad (2) \end{aligned}$$

The bound test investigates the existence of long-run cointegration under the null hypothesis that the coefficients of the lagged variables are equal to zero, i.e., $H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0$ it means there exists no long-run relationship among the variables. Whereas the alternative hypothesis for cointegrating relationships is $H_A: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq \delta_7 \neq 0$. According to Pesaran, et al. (2001), if the F-test statistics exceed the upper bound I(1) critical value, the null hypothesis is rejected, and there is evidence of the long-run relationship. Alternatively, the null hypothesis cannot be rejected by statistics below the lower bound I(0) critical value. However, if statistics lies between the bound, then the results are inconclusive.

3.3. Data Description

The empirical analysis is carried out on the annual data from 1980 to 2020. A detailed explanation of data and data sources is mentioned in Table 1.

Table 1

Description of Variables

Symbol	Variables	Description/ Measure	Source
Dependent Variable			
R_t	Recession	The probability of recession is calculated by applying Markov Switching regime technique proposed by Hamilton (1989) on real GDP growth for calculating the probabilities of recession and expansion.	The data on real GDP growth is taken from SBP
Independent Variables			
$spread_t$	Yield Spread	It is the difference between the weighted average rates of return on 5-year deposits and the 3-month rates of return. ¹	SBP
M_t	Migrant workers	Number of migrant workers	Bureau of Emigration & Overseas Employment
TO_t	Trade openness	Trade openness is the ratio of the sum of imports and exports to GDP.	SBP
FDI_t	FDI	FDI is the type of investment in which the people or organisation of one country invested in the company or property of other countries.	SBP
P_t	General price level resumed	The consumer price index is used as a measure of the general price of goods and services based on 2005=100.	SBP
W_i	Wage Level	Average of daily wages of construction works in 6 major cities of Pakistan including Islamabad, Karachi, Lahore, Peshawar and Quetta.	Pakistan Economics Survey

¹ In literature yield spread is calculated as a difference between yield on 10-year bond and 3-month T-bills in the secondary market. But Government of Pakistan started the auctions of Pakistan Investment Bonds (PIBs) from December 2000. Due to lack of data we measured the yield spread as a difference between the weighted average rates of return on 5-year deposits and the 3-month rates of return.

Based on the smoothed probabilities for expansion and recessions, eight business cycles in Pakistan have been identified in Table 3.

Table 3

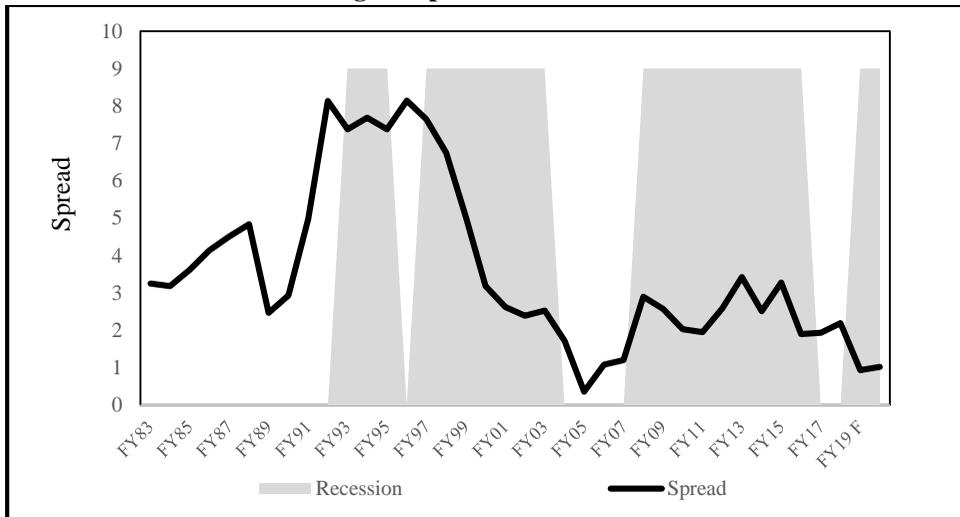
Business Cycle Dating from Markov Switching

Business Cycle	Recession	Expansion
First Cycle: 1951-1954	1951-1953	1954
Second Cycle: 1955-1970	1955-1961	1962-1970
Third Cycle: 1971-1974	1971-1972	1973-1974
Fourth Cycle: 1975-1992	1975-1977	1978-1992
Fifth Cycle: 1993-1996	1993-1995	1996
Sixth Cycle: 1997-2007	1997-2003	2004-2007
Eight Cycle: 2008-2018	2008-2016	2017-2018
Ninth Cycle: 2019-	2019-2021	-

4.2. Spread vs Recession

An increase in the spread is associated with expansion, and a decrease in the spread is linked with a recession in the near future. Therefore, the slope of the yield curve becomes negative before the recession. In Figure 2 for spread vs recession, we have noted only a single negative spread before the 1994 to 2006 recession.

Fig. 2. Spread vs Recession



4.3. Continuous Model of Recession

4.3.1. Unit Root Test

To estimate the continuous regression to model the recession with the yield spread by ARDL Bound test approach, it is essential to confirm the absence of non-stationary variables at the second difference i.e., $I(2)$. Otherwise, in the presence of $I(2)$, variable F

statistics provided by Pesaran et al. (2001) are no more applicable. The results of the Augmented Dickey-Fuller (ADF) test are given in Table 4. According to the ADF unit root test, all variables are integrated into order one.

Table 4
Unit Root Test

Variables	At level				At first Difference				Conclusion
	t_{cal}	t_{tab}	c, t	lag	t_{cal}	t_{tab}	c, t	Lag	
R_t	-1.86 (0.35)	-2.94	C	0	-5.64 (0.00)	-1.95	-	0	1(1)
$spread_t$	-0.91 (0.32)	-1.95	-	0	-5.36 (0.00)	-1.95	-	0	1(1)
$m_t = \ln M_t$	-1.33 (0.61)	-2.94	C	0	-5.04 (0.00)	-1.95	-	0	1(1)
$to_t = \ln TO_t$	-2.18 (0.22)	-2.94	C	0	-6.71 (0.00)	-1.95	-	0	1(1)
$fdi_t = \ln FDI_t$	-2.31 (0.38)	-3.52	c,t	0	-7.37 (0.00)	-2.93	c	0	1(1)
$p_t = \ln P_t$	-0.29 (0.97)	-2.94	C	6	-5.71 (0.00)	-2.94	c	5	1(1)
$w_t = \ln W_t$	-2.36 (0.40)	-3.52	C, t	0	-6.00 (0.00)	-2.94	c	0	1(1)

4.3.2. ARDL Bounds Tests for Cointegration

To analyse the long-run relationships and short-run dynamic interactions among the variables of interest (recession probabilities, spread, migrant workers, trade openness, foreign direct investment, unemployment rate, and general price level), we apply the ARDL cointegration technique. We start with the general model, which contains a maximum of two lags for each variable. By testing down and dropping insignificant terms, the selected model for ARDL is (2, 1, 2, 0, 2, 1, 0). With this specification, there is no evidence of autocorrelation ($\chi^{2(1)} = 1.83$ with prob. 0.175), no ARCH effect ($\chi^{2(1)} = 0.52$ with prob. 0.471), and residuals are normally distributed (Jarque-Bera 6.19 with prob. 0.05) at a 5 per cent level of significance. From the Bound test results reported in Table 5, it is clear that there is a long-run relationship between the variables as its F-statistic (5.54) is higher than the upper-bound critical value (3.28) at the 5 percent level of significance. This suggests that we reject the null hypothesis of no cointegration between the variables.

Table 5
Bound Test Results

	F-Statistic	Decision
$F_R(R_t spread_t, m_t, to_t, fdi_t, p_t, w_t)$	5.54	Cointegration
Lower-bound critical value at 5%	2.27	
Upper-bound critical value at 5%	3.28	

Critical values are taken from Pesaran et al. (2001), Table CI(ii) Case II.

The long-run results obtained from ARDL (2, 1, 2, 0, 2, 1, 0) by normalising on R_t are presented in Table 6. The estimated coefficients of the long-run relationship are significant for spread, migrant workers, foreign direct investment, and general price level but insignificant for trade openness and wages. Spread is positively associated with the probability of recession² (we also confirmed the effect of spread on the recession by estimating the discrete model of recession, see appendix for details), This result opposes the general theory of yield curve where an increase in a spread is the indicator of economic stability. However, this result is very similar to (Zulkhibri and Rani, 2016; Maya, 2020). Accordingly, yield spread contains little confirmation of the direction of the overall economy. In our case an increase in the spread is the indicator of recession, therefore, whenever there is an increase in spread, we would expect the recession rather than growth in the economy. It also highlights that savings from deposits are not used for investment purposes and motivates us to bring the one possible explanation of the positive association between spread and recession: the high level of government debt borrowing³ to finance the budget deficit.

Table 6

Long Run Coefficients Using the ARDL Approach

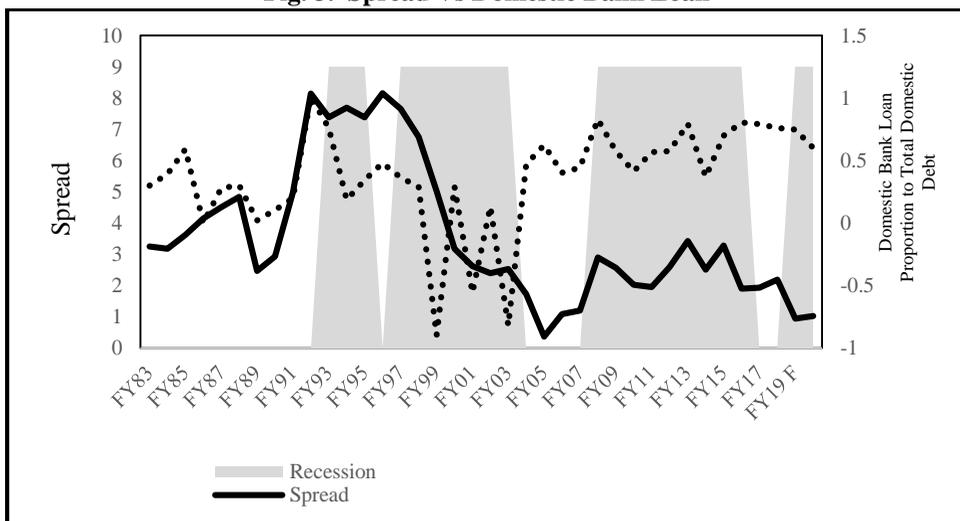
Variables	Coefficient	t-stat	Prob.
$spread_t$	0.07	4.20***	0.001
m_t	-0.22	-1.76*	0.090
to_t	-0.70	-1.55	0.134
fdi_t	-0.17	-2.43**	0.023
p_t	1.09	2.63***	0.015
w_t	-0.26	-0.71	0.483
C	3.69	1.93*	0.066

Although deficit financing is necessary in a recession, it has long-term consequences such as reducing the spending on investment. Consequently, public debt from the domestic market crowds out the private sector and may decrease the future potential output of the economy. Banks also prefer to lend/ invest their money to the government, which is risk-free, making it difficult for private businesses to get a loan. It is also evident from Figure 3, that domestic debt from the bank increases with the increase in the spread, which is alarming and indicates the institutional problems.

The government pays a markup on the domestic debt. Therefore, a hike in interest rates boosts the markup payments on short-term and early maturity long-term debts. To meet these responsibilities, the government will have to raise taxes and remove subsidies, resulting in a rise in price levels rather than a decrease (Rahman, 2021).

² Perhaps this may be due to different measure of spread, see footnote 1.

³ Government domestic debt is usually borrowed from domestic banks and financial institutions by selling short-term and long-term government securities, such as treasury bills.

Fig. 3. Spread Vs Domestic Bank Loan

Moreover, the control variable like migration has a positive role in increasing the economic growth and hence reducing the recession in a country, our results are consistent with studies of (Ratha, et al. 2010; Gupta, et al. 2007; Anyanwu & Erhijakpor, 2010). Regarding the impact of trade openness, it has a negative sign with the probability of recession but is statistically insignificant. That supports the study of Kim (2011) that although trade openness is favourable to output growth in low-inflation countries, it seems to have an insignificant effect on output in high-inflation countries.

The inflow of foreign capital is one of the main components of economic growth acceleration. Our results are also consistent with economic theory as FDI has negative and significantly reduces the recession of the economy and the magnitude of the coefficient is 0.17. This result is consistent with endogenous theory (Romer, 1986) and the innovation-based growth model (Grossman and Helpman, 1994). So the Pakistan economy is boosted by FDI spillover.

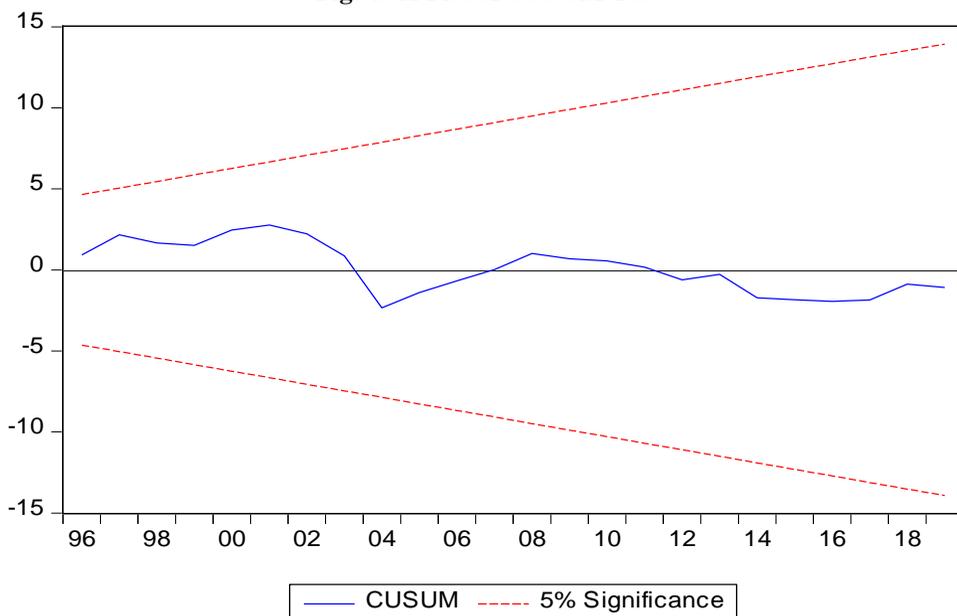
Similarly, our results show that an increase in the price level causes a recession in an economy, and the coefficient's magnitude is 1.09. Our result supports the studies of (Fischer, 1993 & Barro, 1997) that inflation affects economic growth by reducing investment and productivity of the economy. Moreover, an increase in price level reduces the purchasing power of the people; they are forced to stretch their paychecks which, of course, has limits. Wages have a negative relationship with recession, but it is statistically insignificant. A wage-led strategy is a worthwhile economic policy for worldwide economic growth. An increase in the wage rate has a favourable impact beyond aggregate demand and economic activity. Moreover, an increase in wages also positively affects the growth rate by enhancing labour productivity.

Short-run dynamic parameters of the continuous recession model are estimated through the Error Correction Model (ECM), which is related to the long-run estimates. The ECM regression is presented in Table 7. It can be seen from the results again migrant workers, foreign direct investment, and general price level are the true determinant of recession in the short run rather than the spread.

Table 7

<i>Error Correction Model</i>			
Variables	Coefficient	t-stat	Prob.
ΔR_{t-1}	0.36	3.11***	0.005
$\Delta spread_t$	-0.01	-0.20	0.844
Δm_t	0.01	0.06	0.951
Δm_{t-1}	0.27	2.85***	0.009
Δfdi_t	-0.11	-2.25**	0.034
Δfdi_{t-1}	-0.11	-2.09**	0.047
Δp_t	2.99	7.51***	0.001
ECM_{t-1}	-0.71	-7.57***	0.001
F-statistic (Prob)	16.57 (0.00)		
Ramsey RESER Test	3.37 (0.08)		

Fig. 4. A Plot of CUSUM Test



5. CONCLUSION

The study aimed to analyse the impact of yield spread on Pakistan's economic recession. As empirical studies generally confirm, this attribute of yield spread on economic activity is mainly done for developed economies with minimal emphasis on developing countries. Therefore, to analyse the impact of yield spread on Pakistan's economic cycles, the data was taken from 1980 to 2020, and the ARDL approach was used in consideration of the different order of integration among the variables. Moreover, the Error Correction Model was used to determine whether there is a relationship between the yield spread and economic cycles in the long and short run.

Previous literature shows that an inverted yield curve serves as an indicator of the recession and an upward-sloping yield curve leads the economic expansion, and this notion is widely accepted. However, after the 1980s concerns have been shown by some researchers including Estrella (1997) and Smets & Tsatsaronis (1997) regarding the stability between the yield spread and future economic activity.

Our results show that yield spread has a significantly positive relationship with the economic recession, that contradicts the findings of (Estrella & Mishkin, 1997; Stock & Watson, 1989). However, our results are consistent and empirically support the results of (Siklos, 2000). His results suggest that interest rate spread has a negative and significant effect on economic growth in a short time in the case of New Zealand during the period that emphasised inflation targeting. Therefore, it can be said that the relationship between the yield spread and future economic activity of a region is likely to depend on the nature of prevailing monetary policy, along with the responsiveness of the monetary authority to inflation and output. It can be concluded that term spread is likely to predict output growth well when the monetary regime is more responsive to output than inflation targeting and relatively persistent inflation (Wheelock & Wohar, 2009).

Moreover, a government financing its deficit budget, borrows loans from banks which causes yield spread to increase. However, this debt financing by the government has negative consequences in the long term because private investors are crowded out due to new high-interest rates imposed by the banks. So, this scenario ultimately leads to recession in an economy. The result of control variables like promoting migration, foreign direct investment, trade openness, and enhancing wage rate helps to reduce recession while increasing the price level leads to the recession for the economy.

APPENDIX

Discrete Model of recession

In binary time series analysis, the dependent variable $R_t = 1, 2, \dots, T$, is a time series of the realisation of the corresponding stochastic process that only takes on values one and zero. In recession forecasting, the value of an observable binary recession indicator depends on the state of the economy in the following way

$$R_t = \begin{cases} 1 & \text{if the economy is in recession state at time } t \\ 0 & \text{if the economy is in expansionary state at time } t \end{cases}$$

The unobservable variable R_t is related to the yield curve according to the following regression:

$$R_t = \alpha_0 + \alpha_1 \text{spread}_t + \sum_{i=1}^N \beta_i X_{it} + \varepsilon_t$$

The conditional probability of a recession at time t is

$$P(R_t \geq 0 | \text{spread}_t, X_{it}, \alpha, \beta) = \Phi[\alpha_0 + \alpha_1 \text{spread}_t + \sum_{i=1}^N \beta_i X_{it}]$$

where Φ is the cumulative distribution function of the standard normal distribution.

The results of the discrete model of recession are as follow

Dependent Variable: Recession					
Variable	Coefficient	Std. Error	z-Statistic	Prob.	
SPREAD	0.532782	0.182842	2.913894	0.0036	
LNMIG	0.742429	0.957212	0.775616	0.4380	
LNT0	-10.68383	4.727030	-2.260157	0.0238	
LNFDI	0.355744	0.486956	0.730547	0.4651	
LNCPI	-0.155260	1.404805	-0.110520	0.9120	
C	23.14350	14.18679	1.631341	0.1028	
McFadden R-squared	0.520617	Mean dependent var		0.487805	
S.D. dependent var	0.506061	S.E. of regression		0.351878	
Akaike info criterion	0.956963	Sum squared resid		4.333629	
Schwarz criterion	1.207730	Log likelihood		-13.61775	
Hannan-Quinn criter.	1.048279	Deviance		27.23550	
Restr. deviance	56.81368	Restr. log likelihood		-28.40684	
LR statistic	29.57818	Avg. log likelihood		-0.332140	
Prob(LR statistic)	0.000018				
Obs with Dep=0	21	Total obs		41	
Obs with Dep=1	20				

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Pakistan Institute of Development Economics

Post Box No. 1091, Islamabad, Pakistan

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