



ASSESSING ECONOMIC ACTIVITIES BY USING TERM SPREADS

Sheik Ahmad Ryman Bissessur^{a*} and Noor-Ul-Hacq Sookia^b

^aDepartment of Finance and Accounting, Faculty of Law and Management, University of Mauritius, Réduit, Mauritius (Email: a786_sheik@yahoo.com)

^bDepartment of Mathematics, Faculty of Science, University of Mauritius, Réduit, Mauritius (Email: sookian@uom.ac.mu)

ABSTRACT

Both linear and non-linear models have been used in literature in developed countries to assess the forecasting power of the term spread on output. When it comes to developing economies, however, a gap in research exists. As such, the main objective of this research work is to assess the predicting capacity of the variable term spread on economic growth in the context of a developing country, namely, Mauritius. In this regard, an extended production function is designed that includes major relevant macroeconomic variables such as Spread, Investment, Human Capital, Openness to Trade, Foreign Direct Investment, and Inflation. Following the test of stationarity, where a mixture of $I(0)$ and $I(1)$ variables are obtained but no $I(2)$, the autoregressive distributed lag (ARDL) model is chosen for regression purposes. We found that the spread variable has a positive impact on economic growth though being weakly significant and very low. A major limitation when dealing with Treasury Bills in Mauritius is the lack of data on medium to long-term securities, hence, restricting the longest term security use to the 1-year Treasury Bills. This research can be viewed as a pioneering work in assessing term spread on economic activity in developing economies.

JEL Classification: C22, E29, G12

Keywords: Treasury bills rates, Extended production function, Economic growth, Autoregressive Distributed Lag (ARDL) Regression model, Developing country

Submitted: 01/02/2022 Accepted: 09/10/2022 Published: 28/12/2023

*Corresponding author: a786_sheik@yahoo.com

1. INTRODUCTION

Term spreads have been viewed as a major indicator of economic growth. Professionals as well as academics agree that a recession can be detected with an inverted yield curve whereas an upward-sloping yield curve announces economic expansion. A popular field of study in recent decades is the relationship between the interest rate term structure and economic activity. In fact, focus on studying correlation between business cycles and interest rates dates long back as observed by Kessel (1965). Some researchers have also based their studies on the potential capacity of term spreads in signalling. These included Estrella and Hardouvelis (1991), Estrella and Mishkin (1998), Bernard and Gerlach (1998), Wright (2006). Ludvigson and Ng (2009), Joslin, Priebsch and Singleton (2010), Rudebusch and Swanson (2012), and more recently, Leboeuf and Pinnington (2017), Gilchrist and Mojon (2017), Bedock and Stevanović (2017), Campbell, Pflueger and Viceira (2020) found empirical evidence on the impact of bond premia shifts on economic growth. Ang, Piazzesi and Wei (2006), Rudebusch, Sack and Swanson (2007) found that the motivational factor to study the forecasting power of the term spread was mainly influenced by forward-looking behavior of market participants who expected central bank reactions.

In the event of anticipated recession, the central bank would deliberately decrease the interest rates to respond to disinflationary pressures and GDP contractions. Consequently, the short-term rates became higher than the long-term rates, creating a negative spread. Estrella, Rodrigues and Schich (2003), Stock and Watson (2003), Giacomini and Rossi (2006) found evidence that parameter uncertainties and settings have reduced the power of term structure in forecasting future economic growth, since the mid-1980s. They also noticed, however, that after the mid-1960s, the yield curve forecasted every recession apart from one case where a recession had not followed a yield curve inversion. Based on these findings, we suggest that term spread is an important economic growth indicator. In this paper, the main objective is to assess the predictive capacity of the variable term spread on economic growth. Given that term spread is not structurally related to economic growth, investigators, especially policy makers, have to judiciously assess the term structure movement; it is crucial for decision makers to make correct predictions of the economy future state.

This paper is divided into five sections, including this introduction. The second section covers the estimation. The third part

describes the methodology and the data used. The fourth section presents the empirical findings. Finally, the fifth section provides some concluding remarks.

2. ESTIMATION

Several studies using different types of data and methodologies had examined to what extent the term spread can forecast economic growth. Initial reports concentrated on the United States Post-World War II. More recent studies, however, have assessed the term spread impact on economic growth from other countries' perspective and over a different time period. These studies demonstrated the desire to understand the output growth and term spread relationship and also to determine why and how term spread could forecast economic growth.

The empirical assessment on the forecasting power of the term spread on economic growth was more common using linear estimation models. Equation (1) illustrates an example of such model.

$$(1) \quad \Delta G_t = \alpha + \beta Spread + \gamma(Lag)\Delta G_{t-1} + \varepsilon_t$$

Where

ΔG_t = Output growth rate (e.g., real GDP)

Spread = Difference between long-term and short-term Treasury securities' yields

$\gamma(Lag)$ = Lagged polynomial up to four periods (current and three lags, assuming quarterly data)

ε_t = Error term

2.1 EVIDENCE 1: MULTIVARIATE LINEAR METHODS

Numerous studies empirically examined the forecasting power of the term spread in models that also contained other explanatory/independent factors. Furthermore, several studies also found that the term spread had a positive impact on economic growth. A few examples of research that supported the term spread as a powerful variable are Estrella and Hardouvelis (1991), Plosser and Rouwenhorst (1994), Estrella and Mishkin (1998), Hamilton and Kim (2002), Feroli (2004) and Aguilar-Argaez et al. (2020). They found the term spread had positive and significant forecasting power for GDP growth, even when the model included other independent variables such as a measure of monetary policy or short-term interest

rate. The resulting outcome proved that impact of term spread on economic growth could not have been explained solely by monetary policy, Stock and Watson (2003), however, showed that having other macroeconomic variables in the model did not improve the forecasting power of the spread over output growth.

Focusing their study on Germany and the United States, Estrella, Rodrigues and Schich (2003) looked for breakpoints that were unknown in the forecasting relationship that linked output growth to term spread. Despite finding that in general the output growth and term spread relationship was significant for both countries one year ahead, a break was identified in September 1983 when using one-year future predicting models for the United States. For the United States, however, no breaks in the longer period forecasting models were found, and for Germany also no breaks were detected for both short and long period estimation models.

Using forecast breakdown tests that they developed in 2006, Giacomini and Rossi (2009) assessed the predictive performance of the term spread on real GDP growth. Giacomini and Rossi (2006) argued that economic growth models could be viewed as a series of predictability. Specifically, forecast breakdowns were found to be empirically significant during the periods 1974 to 1976 and 1979 to 1987, using a one-year forecast horizon. Improved output growth stability and the use of other macroeconomic variables have been described as the main reasons to explain the term spread having a less powerful impact on output growth since the mid-1980s.

2.2 EVIDENCE 2: NON-LINEAR METHODS

Based on existing literature, most researchers have studied the forecasting power of the term spread on output growth using linear models. The terms spread capacity and power to forecast real GDP growth, however, has varied over time such that even non-linear models have been offered as alternative solutions. Studies have already made use of non-linear models and data on Canada and United States. Furthermore, non-linear models are being more extensively used by researchers; for instance, Galbraith and Tkacz (2000) empirically found the presence of a threshold effect between output growth and term spread for Canada and the United States which was, however, not noticed in the other major developed countries. Precisely, Galbraith and Tkacz (2000) found that the term spread had a strong and statistically significant impact on conditional expectations of output growth. It was however noted that the

forecasting impact a rise in term spread had on output growth was reduced when the term spread increased above a certain limit. Plakandaras et al. (2017) also used a non-linear approach in their quest to estimate the US inflation rate by looking at the informational content of the term spread.

Neural network models were adopted by Shaaf (2000) and Tkacz (2001) to cater for non-linearity in the output growth-term spread relationship. Both researchers found that this type of non-linear model generated smaller forecast errors as compared to linear models. Venetis, Paya, and Peel (2003) used transition models classified as non-linear that could cater for both parameters that are time-varying as well as having non-linear behaviors, to estimate the term spread forecasting power on output growth and also checked stability of the relationship between economic growth and term spread. Focusing their studies on Canada, United Kingdom and the United States, Venetis et al. (2003) observed that the output growth and term spread relationship was more robust when a certain positive threshold level was not exceeded by the past values of the term spread. Duarte, Venetis, and Paya (2005) applied both non-linear as well as linear regression models to assess the forecasting power of the term spread on output growth for the Euro area countries. They argued that both the non-linear and linear forecasting models produced positive results over a period of four quarters and they added that the variables term spread turned out to be strong indicators of future recessions and economic growth in the Euro zone. The authors, however, found signs of instability in the linear models whereas there was significant evidence of non-linearities with regard to lagged output growth and time. Furthermore, the non-linear forecasting model they adopted performed better than the linear model for predicting output growth one year in the future.

3. METHODOLOGY & DATA

3.1 METHODOLOGY

Solow (1956) had introduced the neoclassical growth model which remained as the pioneer in the classical economic growth theories. The model depended on basic assumptions such as; reducing marginal capital productivity, technical advancements, sustained returns to scale, and inter-changeability between labor and capital. With the neoclassical model, the ratio of investment or savings was seen as a major factor of economic growth in the short-term whereas

technological progress, although a key factor in the long-run, was regarded as unrelated and in isolation with respect to other economic determinants and as such remained under explored in the model.

More recent works, especially those agreeing on constant and increasing returns to capital, have reviewed the technology contribution in the economic model, since it has been portrayed as a key factor in long-run economic growth. These economic growth theories, endogenous in nature, claimed the addition of any new variable, for instance innovation and knowledge, would entail having a self-maintained economic growth. Based on pivotal studies by Romer (1986) and Lucas (1988), three important sources of growth had been identified: public infrastructure (Barro, 1990), new knowledge (Grossman and Helpman, 1991; Romer, 1990), and innovation (Aghion and Howitt, 1992). Consequently, the role of policies in ensuring long-term economic growth became an extremely important and vital one.

The extended production function used in this paper for regression purposes is as follows:

$$(2) \quad GDP_t = a_0 + a_1 Spread_t + a_2 INV_t + a_3 HC_t + a_4 OPEN_t + a_5 FDI_t + a_6 INF_t + \varepsilon_t$$

where

GDP_t = Economic growth at time t

$Spread_t$ = Spread between the 3-months and 1-year T Bills rates

INV_t = Investment rate at time t

HC_t = Human Capital at time t

$OPEN_t$ = Openness at time t

FDI_t = Foreign Direct Investment at time t

INF_t = Inflation at time t

a_0 = Intercept

$a_{1...6}$ = Slope Coefficients

ε = Error Term

Term Spread (Spread) has been empirically examined by a number of researchers. Several studies found that the term spread had positive impact on economic growth, for example, Estrella and Hardouvelis (1991), Plosser and Rouwenhorst (1994), Estrella and Mishkin (1998), Hamilton and Kim (2002), Feroli (2004) and Leboeuf and Pinnington (2017), Gilchrist and Mojon (2017), Bedock and Stevanović (2017), Campbell et al. (2020). They found the term spread had positive and significant forecasting power for GDP growth,

even when the model included other independent variables such as a measure of monetary policy or short-term interest rate. The resulting outcome proved that the impact of term spread on economic growth could not have been explained solely by monetary policy. However, Stock and Watson (2003) showed that having other variables in the model did not improve the forecasting power of the spread over output growth.

Investment (INV) has been regarded by both endogenous growth and neoclassical models as a major factor of economic growth. In the neoclassical model, investment impacts on the transitional period whereas it is claimed that the effects are more permanent in the endogenous growth models. The different theories have given so much importance to investment such that numerous studies have empirically assessed its relationship and impact on economic growth (Onifade et al., 2020a; Podrecca and Carmeci, 2001; Sala-i-Martin, 1997; Easterly and Levine, 1997; Barro and Sala-i-Martin, 1995; Auerbach, Hassett and Oliner, 1994; Levine and Renelt, 1992; Mankiw, Romer and Weil, 1992; Kormendi and Meguire, 1985). However, findings have had mixed outcomes.

Human capital (HC) is a variable that finds its importance in the endogenous model as well as the neoclassical growth model. The endogenous growth model sees human capital as a primary source of growth whereas in the neoclassical model, it represents one of the major extensions. Given that human capital is commonly and widely interpreted as the gaining of knowledge and skills through training and education, most of the studies have used education-related proxies as substitutes for human capital, for instance school-enrolment rates. Several studies have found positive and significant relationships between economic growth and human capital (Hanushek and Kimko, 2000; Intisar et al., 2020; Brunetti, Kisunko and Weder, 1998; Barro and Sala-i-Martin, 1995; Mankiw, Romer and Weil, 1992; Barro, 1990). Other researchers, however, have criticized the positive findings and questioned the claim that human capital is a key factor of economic growth. These studies include Krueger and Lindahl (2001), Pritchett (2001), Levine and Renelt (1992), Benhabib and Spiegel (1994), and Topel (1999).

Another frequently used key determinant of growth performance in economic growth literature is openness to trade (OPEN). The positive relationship between openness to trade and economic growth has strong theoretical backing. Different channels through which openness impacts growth have been identified and these are knowledge transmission and technology transfer, increasing

scale economies, exposure to competition and exploitation of comparative advantage. The ratio of exports to GDP has been frequently used to capture openness. Some authors, however, have calculated openness as the sum of exports and imports. On one hand, numerous studies have claimed that fast growing economies, that is, those with higher per capita GDP, were those countries that were more opened to capital flows and trade (Intisar et al., 2020; Dollar and Kraay, 2004; Edwards, 1998; Sachs and Warner, 1995, Dollar, 1992). On the other hand, other researchers have questioned the reliability and validity of these findings, particularly on measurement and methodological basis (Vamvakidis, 2002; Rodriguez and Rodrik, 2001; Levine and Renelt, 1992).

Foreign Direct Investment (FDI) has of late provided a very strong and important international link to local economic activity and it has also been viewed as a major source of technology transfer as well as economic growth. Several endogenous growth models have catered for the FDI impacts on the economy. Various studies have found a positive empirical relationship between FDI and economic growth (Gherghina, Simionescu and Hudea, 2019; Lensink and Morrissey, 2006; Hermes and Lensink, 2000; Borensztein, De Gregorio and Lee, 1998). A study in Latin America by Alvarado, Iñiguez and Ponce (2017), however, found that FDI did not have a statistically significant effect on economic growth.

Inflation (INF) is another commonly used variable in assessing economic growth. Policy makers normally claimed that the long-run economic performance had been negatively impacted by inflation (Clark, 2001; Valdovinos, 2003; Madurapperuma, 2016; Tien, 2021). Fischer and Modigliani (1978) argued that workers and firms, in general, invested in productive resources to tackle inflation. Furthermore, they added that efficiency was decreased by uncertainties in inflation by reducing demand for long-term contracts and causing a rise in relative prices variability. Weak performance of households and businesses could be attributed to a high and volatile inflation rate. Fischer (1993) carried out both panel and cross-sectional regressions and found that inflation had adverse effect on growth. Levine and Renelt (1992) pointed out that lower inflation countries were normally the ones having higher economic growth. As opposed to the vast majority of studies that claimed that inflation and economic growth were negatively related, Sala-i-Martin (1997) found a positive but yet an insignificant association between inflation and growth. Other researchers who found a positive relationship between inflation and economic growth are Rapach (2003), Mallik and

Chowdhury (2005), Benhabib and Spiegel (2009), Coibion, Gorodnichenko and Ropele (2018).

Before moving to the regression tests on the production function, all variables in the proposed model were tested for unit roots by using the Augmented Dickey Fuller (ADF) test which was followed by the optimal lag determination to remove serial correlation. At the 5% significance level, the ADF test results demonstrated that at level form, there was a mixture of stationary and non-stationary variables and that after taking the first difference, those non-stationary variables became stationary. Given that the chosen model had a mix of both I(0) and I(1) variables but none were I(2); hence, the decision is to opt for the autoregressive distributed lag (ARDL) bounds testing approach.

3.2 DATA

The sample period is based on monthly data spanning from April 2008 to March 2020 (144 monthly records). Data have been collected from various sources, namely; Treasury Bills rates from the Bank of Mauritius¹, Gross Domestic Product, Openness to Trade, Human Capital and Foreign Direct Investment from Statistics Mauritius and Investments from World Bank Database. This analysis was conducted up to March 2020 that is prior to the outbreak of COVID-19 in Mauritius so as to ensure that the empirical findings do not suffer from any unwanted distortions that may have arisen due to pandemic effect on the financial markets and the economy at large.

4. EMPIRICAL RESULTS & DISCUSSION

The results of ADF unit roots test are presented in Table 1.

TABLE 1
Unit Root Test Results

Variable	Level Form		First Difference	
	P-value	Decision	P-value	Decision
GDP	0.5937	Non-Stationary	0.0000	Stationary
Spread	0.0001	Stationary		
INF	0.0418	Stationary		

TABLE 1 (continued)

Variable	Level Form		First Difference	
	P-value	Decision	P-value	Decision
HC	0.3136	Non-Stationary	0.0000	Stationary
Open	0.8677	Non-Stationary	0.0000	Stationary
FDI	0.7493	Non-Stationary	0.0000	Stationary
INV	0.8641	Non-Stationary	0.0000	Stationary

Source: Author's conceptualization

Note: Considering a 5% significance level, the null hypothesis (H_0), that is the variable has unit root or likewise it is non-stationary, is not accepted when the p-value is less than 0.05.

Equation (2) is thus formulated as follows:

$$\begin{aligned}
 (3) \quad \Delta GDP_t = & \alpha_o + \sum_{i=1}^n \alpha_{1i} \Delta GDP_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta Spread_{t-i} \\
 & + \sum_{i=0}^n \alpha_{3i} \Delta INV_{t-i} + \sum_{i=0}^n \alpha_{4i} \Delta HC_{t-i} \\
 & + \sum_{i=0}^n \alpha_{5i} \Delta OPEN_{t-i} + \sum_{i=0}^n \alpha_{6i} \Delta FDI_{t-i} \\
 & + \sum_{i=0}^n \alpha_{7i} \Delta INF_{t-i} + \beta_1 GDP_{t-1} + \beta_2 Spread_{t-1} \\
 & + \beta_3 INV_{t-1} + \beta_4 HC_{t-1} + \beta_5 OPEN_{t-1} \\
 & + \beta_6 FDI_{t-1} + \beta_7 INF_{t-1} + e_t
 \end{aligned}$$

where

Δ denotes the first difference operator

α_o is the drift component

e_t is the usual white noise residual

The left-hand side of the model represents economic activity captured by GDP. On the right-hand side, the expressions ($\beta_1 \dots \beta_7$) capture the long-run relationship whereas the short-run dynamics of the model is represented by the other expressions with the summation sign ($\alpha_1 \dots \alpha_7$).

Given that the model on the whole has only 1 lag and the lowest value Akaike Info Criterion (AIC) at -9.15 and Schwarz

information criterion (SIC) at -8.79, the model with only one lag has been chosen as the best model. It also captures the long run relationship among the variables. Table 2 summarizes the results for determining the number of lags for each variable. The final model is best fitted with 1 lag for all the variables.

TABLE 2
Lag Determination

Variable	Optimal Lag	AIC/SIC
GDP	1	AIC: -9.40
Spread	1	AIC: 0.38
INV	1	AIC: 1.82
HC	1	AIC: -8.66
OPEN	1	AIC: -7.27
FDI	1	AIC: 0.92
INF	1	AIC: -6.76

Source: Author's conceptualization

Note: Test to determine the optimal number of lags using the Akaike Info Criterion (AIC) and Schwarz Criterion (SIC). The chosen number of lags is the one with the lowest AIC/SIC value.

The bound testing procedure as described by Pesaran et al. (2001) has been employed:

$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$
i.e., there is no cointegration among the variables.

$H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$
i.e., there is cointegration among the variables.

Table 3 summarizes the results of the cointegration tests generated as per the principles of the bounds test. The computed F -statistics from the Wald test is found to be below the lower bound and is furthermore statistically significant at the 10% confidence interval. Therefore, the null hypotheses of no cointegration meaning that there is no long-run relationship among the variables included in the proposed model for Mauritius cannot be rejected. Consequently, an ARDL short-run model is estimated after ensuring that it is stable and free of serial correlation. With a p -value of 0.1434, it can be concluded that the model with 1 lag has no serial correlation.

TABLE 3
ARDL Bounds F-Test for Cointegration

$$H_0: GDP(-1) = Spread(-1) = INV(-1) = HC(-1) = OPEN(-1) = FDI(-1) = INF(-1) = 0$$

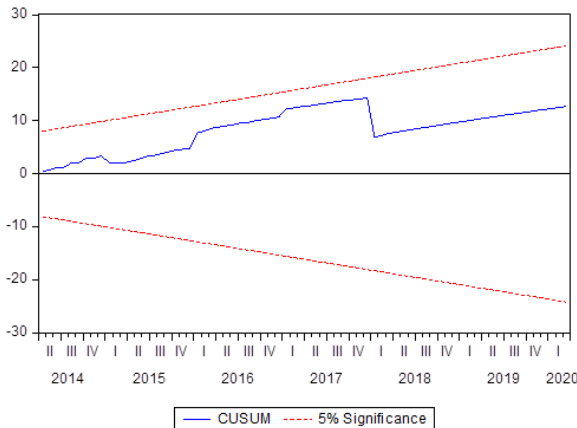
Model	F-Statistics	
GDP = f(Spread, INV, HC, OPEN, FDI, INF)	1.82*	
Pesaran et al. (2001)	k =6, n=117	
Critical Values	Lower Bound	Upper Bound
1%	3.15	4.43
5%	2.45	3.61
10%	2.12	3.23

Source: Author’s conceptualization

Note: Pesaran at al. (2001) provides the critical value bounds with model used being unrestricted intercept and no trend. The lower and upper bounds are denoted by I(0) and I(1) respectively. Whenever the computed F-statistic exceeds I(1), that is the upper bound, a long-run relationship is said to exist among the variables. ***, **, * denote statistical significance level at 1% , 5% and 10% respectively.

The stability test is performed as per the CUSUM test developed by Brown, Durbin and Evans (1975). Given that the model lies within the 5% significance level line, it can be concluded that the proposed model with 1 lag is a stable one as shown in Figure 1.

FIGURE 1
CUSUM Test



Source: Author’s conceptualization

Analysis of outcomes of the regression, as shown in Table 4, demonstrates that 1 unit increase in spread, investments, human capital, trade openness and foreign direct investment on average caused the gross domestic product to increase by 0.002, 0.0007, 0.26, 0.04 and 0.0013 respectively. On average with a 1 unit increase in inflation, the gross domestic product decreased by 0.17. The signs of the estimated short-run coefficients were corroborated by theories. The main highlight of this research was that even though the coefficient on the spread variable was found to be positive, it remained weakly significant and very low at 0.002. This could be explained from the fact that the local financial market has been facing excess liquidity situation. The country's main commercial banks have had a relatively low loan to deposit ratio, for example MCB (the main commercial bank in Mauritius) reported a loan to deposit ratio of 0.73 for the financial year ended June 2019. Hence, commercial banks found themselves in need to invest excess deposits in securities and mainly Central Bank issued Treasury Bills and Notes. This could possibly explain why the impact of the term spread on economic activity remained very low. Also, the margin obtained from securities investment would likely be offset by the cost of capital such that the net gain would be nearly equal to zero. Investment in Treasury Bills and Notes may be viewed as good cash management by the financial institutions, especially local banks. This in turn may boost up investment which then may positively affect national economic growth. The adjusted R^2 obtained from the regressions was nearly 60%, showing an adequate goodness of fit ratio. The error correction term (ECT) which represents the adjustment speed of the short-term model towards the long run equilibrium is very low at 11%. However, it is insignificant which further justifies that the model does not have a long-term relationship. Similar research in developed countries have had mixed results. On one hand, a minimal to no impact of term spread on economic growth was noted (Dotsey, 1998; Hamilton and Kim, 2002; Venetis, Paya and Peel, 2003) and on the other hand, significant impact was registered (Nakaota, 2005; Duarte, Venetis and Paya, 2005).

TABLE 4
Regression Results

Dependent Variable: D(GDP)			
Variable	Coefficient	Std. Error	t-Statistic
C	0.2194***	0.0373	5.8747
D(GDP(-1))	0.0068*	0.1892	0.0358
D(SPREAD(-1))	0.0020*	0.0010	2.0932
D(INV(-1))	0.0007***	0.0002	3.3434
D(HC(-1))	0.2603***	0.0532	4.8964
D(OPEN(-1))	0.0404*	0.0206	1.9570
D(FDI(-1))	0.0013**	0.0005	2.4245
D(INF(-1))	-0.1655***	0.0165	-10.0037
ECT(-1)	-0.1101	0.0693	-1.5893

Source: Author's conceptualization

Note: ***, **, * denote statistical significance level at 1%, 5% and 10% respectively

5. CONCLUSION

Increasing interest has been shown in assessing whether the spread between long-term and short-term Treasury Bills has an impact on economic growth. Studies, however, have been made mainly on developed markets. To bridge that gap, this study has adapted that literature in the context of a developing country, namely, Mauritius. Moreover, given the context of excess liquidity prevailing in the country, commercial banks have no other choice than to invest in risk-free Treasury Bills issued by the Bank of Mauritius. The variable spread has been added in an extended production function and the results have been quite reassuring. Use of an ARDL model found that the variable spread had a positive impact on economic growth though being weakly significant and very low. Furthermore, the production function did not have any long-run relationship. This was an expected result as Mauritius is a country whose economy has been and is still largely dependent on external factors, such as exchange rates. The country's vision and objectives remain primarily focused for the short to medium term. Any fluctuation in the international market will likely have impact on the domestic economic activity. As for the variable spread, its usefulness in depicting economic growth is appreciable. Future research can further consolidate the importance of the variable spread on economic growth and in various developing markets. Nevertheless, a major limitation has been encountered while

conducting this research. There is a lack of data on medium to long-term securities and the longest maturity that is readily available is in fact the 1-year Treasury Bills rates.

ENDNOTES

1. Data from the Bank of Mauritius can be accessed through www.bom.mu

REFERENCES

- Aghion, P., and P. Howitt. "A Model of Growth through Creative Destruction." *Econometrica* 60, no. 2 (1992): 323-51.
- Aguilar-Argaez, A., M. Diego-Fernández, R. Elizondo and J. Roldán-Peña. "Term Premium Dynamics and its Determinants: The Mexican Case." Banco de México, Working Papers no. 18 (2020).
- Alvarado, R., M. Iñiguez and P. Ponce. "Foreign Direct Investment and Economic Growth in Latin America." *Econ. Anal. Policy* no. 56 (2017): 176-87.
- Ang, A., M. Piazzesi and M. Wei. "What Does the Yield Curve Tell Us about GDP Growth?" *Journal of Econometrics* 131, no. (1/2) (2006): 359-403.
- Auerbach, A., K. Hassett and S. Oliner. "Reassessing the Social Returns to Equipment Investment." *Quarterly Journal of Economics* 109 (1994): 789-802.
- Barro, R. "Government Spending in a Simple Model of Endogenous Growth". *Journal of Political Economy* 98 (1990): 103-25.
- _____. and X. Sala-i-Martin "Economic Growth." New York: McGraw-Hill (1995).
- Bedock, N. and D. Stevanović. "An Empirical Study of Credit Shock Transmission in a Small Open Economy." *Canadian Journal of Economics/Revue canadienne d'économique* 50 (2017): 541-70.
- Benhabib, J. and M. Spiegel. "The Role of Human Capital in Economic Development: Evidence from Aggregate Cross-Country Data". *Journal of Monetary Economics* 34 (1994): 143-73.
- _____. "Moderate Inflation and the Deflation-Depression Link." *Journal of Money, Credit and Banking* 41, no. 4 (2009): 787-98.

- Bernard, H. and S. Gerlach. "Does the Term Structure Predict Recessions? The International Evidence." *International Journal of Finance and Economics* 3, no. 3 (1998): 195-215.
- Borensztein, E., J. De Gregorio and J. Lee. "How does Foreign Direct Investment affect Economic Growth?" *Journal of International Economics* no. 45 (1998): 115-35.
- Brown, R.L., J. Durbin and J.M. Evans. "Techniques for Testing the Constancy of Regression Relations Over Time." *Journal of the Royal Statistical Society* 37 (1975): 149-92.
- Brunetti, A., G. Kisunko and B. Weder. "Credibility of Rules and Economic Growth: Evidence from a Worldwide Survey of the Private Sector." *The World Bank Economic Review* 12, no. 3 (1998): 353-84.
- Campbell, J.Y., C. Pflueger and L.M. Viceira. "Macroeconomic Drivers of Bond and Equity Risks." *Journal of Political Economy* 128 (2020): 3148-185.
- Clark, T.E. "Comparing Measures of Core Inflation." *Federal Reserve Bank of Kansas City Economic Review* 86 no. 2 (2001) (Second Quarter): 5-31.
- Coibion, O., Y. Gorodnichenko and T. Ropele. "Inflation Expectations and Firm Decisions: New Causal Evidence." *Cambridge: National Bureau of Economic Research* no. 25412 (2018).
- Dollar, D. "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1976-1985." *Economic Development and Cultural Change* 40, no. 3 (1992): 523-44.
- _____. and A. Kraay. A "Trade, Growth and Poverty" *The Economic Journal* 114, no. 493 (2004): 22-45.
- Dotsey, M. "The Predictive Content of the Interest Rate Yield Spread for Future Economic Growth." *Federal Reserve Bank of Richmond Economic Quarterly* 84, no. 3 (1998): 31-51.
- Duarte, A., I.A. Venetis and I. Paya. "Predicting Real Growth and the Probability of Recession in the Euro Area Using the Yield Spread." *International Journal of Forecasting* 21, no. 2 (2005): 262-77.
- Easterly, W. and R. Levine. "Africa's Growth Tragedy: Policies and Ethnic Divisions." *Quarterly Journal of Economics* 112, no. 4 (1997): 1203-50.
- Edwards, S. "Openness, Productivity and Growth: What Do We Really Know?" *Economic Journal* 108 (1998): 383-98.

- Estrella, A. and G.A. Hardouvelis. "The Term Structure as a Predictor of Real Economic Activity." *Journal of Finance* 46 (1991): 555-76.
- _____. and F.S. Mishkin "Predicting U.S. Recessions: Financial Variables as Leading Indicators." *Review of Economics and Statistics* 80, no. 1 (1998): 45-61.
- Estrella, A., A.P. Rodrigues and S. Schich. "How Stable is the Predictive Power of the Yield Curve? Evidence from Germany and the United States." *Review of Economics and Statistics* 85, no. 3 (2003): 629-44.
- Feroli, M. "Monetary Policy and the Information Content of the Yield Spread." *Topics in Macroeconomics* 4, no. 1 (2004): 1-17.
- Fischer, S. "The Role of Macroeconomic Factors in Growth." *Journal of Monetary Economics* 32 (1993): 485-512.
- _____. and F. Modigliani. "Towards an Understanding of the Real Effects and Costs of Inflation." *Weltwirtschaftliches Archiv* no. 114 (1978): 810-32.
- Galbraith, J.W. and G. Tkacz. "Testing for Asymmetry in the Link between the Yield Spread and Output in the G-7 Countries." *Journal of International Money and Finance* 19 no. 5 (2000): 657-72.
- Gherghina, S.C., L.N. Simionescu and O.S. Hudea. "Exploring Foreign Direct Investment – Economic Growth Nexus – Empirical Evidence from Central and Eastern European Countries." *Sustainability* no. 11 (2019): 5421.
- Giacomini, R. and B. Rossi. "How Stable Is the Forecasting Performance of the Yield Curve for Output Growth?" *Oxford Bulletin of Economics and Statistics* 68, no. 1 (2006): 783-95.
- Gilchrist, S. and B. Mojon. "Credit Risk in the Euro Area." *The Economic Journal* 128, no. 608 (2017): 118-58.
- Grossman, G. and E. Helpman. "Innovation and Growth in the Global Economy." *Cambridge, Mass, MIT Press* (1991).
- Hamilton, J.D. and D.H. Kim. "A Re-examination of the Predictability of the Yield Spread for Real Economic Activity." *Journal of Money, Credit and Banking* 34, no. 2 (2002): 340-60.
- Hanushek, E. and D. Kimko. "Schooling, Labor-Force Quality, and the Growth of Nations." *American Economic Review* 90 (2000): 1184-208.
- Hermes, N. and R. Lensink. "Foreign Direct Investment, Financial Development, and Economic Growth." *Journal of Development Studies* 40, no. 1 (2000): 142-63.

- Intisar, R.A., M.R.Yaseen, R. Kousar, M. Usman and M.S.A. Makhdam. "Impact of Trade Openness and Human Capital on Economic Growth: A Comparative Investigation of Asian Countries." *Sustainability* 12 no. 7 (2020): 1–19.
- Joslin, S., M. Priebsch and K. Singleton. "Risk Premiums in Dynamic Term Structure Models with Unspanned Macro Risks." Working Paper, *Graduate School of Business, Stanford University* (2010).
- Kessel, R.A. "The Cyclical Behavior of the Term Structure of Interest Rates." *NBER Occasional paper* no. 91 (1965).
- Kormendi, R. and P. Meguire. "Macroeconomic Determinants of Growth: Cross-Country Evidence." *Journal of Monetary Economics* 16 no. 4 (1985): 141-63.
- Krueger, A. and M. Lindhal. "Education for Growth: Why and For Whom?" *Journal of Economic Literature* 39, no. 4 (2001): 1101-36.
- Leboeuf, M. and J. Pinnington. "What Explains the Recent Increase in Corporate Bond Spreads?" Bank of Canada Staff Analytical Note (2017). <https://www.bankofcanada.ca/wp-content/uploads/2017/03/san2017-2.pdf>
- Lensink, W. and O. Morrissey. "Foreign Direct Investment: Flows, Volatility and the Impact on Growth." *Review of International Economics* 14, no. 3 (2006): 478-93.
- Levine, R. and D. Renelt. "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review* 82, no. 4 (1992): 942-63.
- Lucas, R. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22 (1988): 3-42.
- Ludvigson, S.C. and S. Ng. "Macro factors in Bond Risk Premia." *Review of Financial Studies* 22 (2009): 5027-067.
- Madurapperuma, W. "Impact of Inflation on Economic Growth in Sri Lanka." *Journal of World Economic Research* 5 (2016): 1-7.
- Mallik, G. and R.M. Chowdhury. "Inflation and Economic Growth: Evidence from South Asian Countries." *Asian Pacific Development Journal* 8 (2005): 123-35.
- Mankiw, N., D. Romer and D. Weil. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107, no. 2 (1992): 407-37.
- Nakaota, H. "The Term Structure of Interest Rates in Japan: The Predictability of Economic Activity." *Japan and the World Economy* 17, no. 3 (2005): 311-26.

- Onifade, S.T., S. Çevik, S. Erdoğan, S. Asongu and F.V. Bekun. “An Empirical Retrospect of the Impacts of Government Expenditures on Economic Growth: New Evidence from the Nigerian Economy.” *Journal of Economic Structures* 9, no. 1 (2020): 1-13.
- Pesaran, M.H., Y. Shin and R.J. Smith. “Bounds Testing Approaches to the Analysis of Level Relationships.” *Journal of Applied Econometrics* 16 (2001): 289-326.
- Plakandaras, V., P. Gogas, T. Papadimitriou and R.Gupta. “The Informational Content of the Term Spread in Forecasting the US Inflation Rate: A Nonlinear Approach.” *Journal of Forecasting* 36, no. 2 (2017): 109-21.
- Plosser, C.I. and K.G. Rouwenhorst. “International Term Structures and Real Economic Growth.” *Journal of Monetary Economics* 33, no. 1 (1994): 133-55.
- Podrecca, E. and G. Carmeci. “Fixed Investment and Economic Growth: New Results on Causality.” *Applied Economics* 33 (2001): 177-82.
- Pritchett, L. “Where Has All the Education Gone?” *World Bank Economic Review* 15 (2001): 367-91.
- Rapach D.E. “International Evidence on the Long-Run Impact of Inflation.” *Journal of Money, Credit, and Banking* 35, no. 1 (2003): 23-48.
- Rodriguez, F. and D. Rodrik. “Trade Policy and Economic Growth: a Skeptic’s Guide to the Cross-national Evidence.” *NBER Macro-economics Annual 2000* no.15 (2001): 261-325.
- Romer, P. “Increasing Returns and Long-Run Growth.” *Journal of Political Economy* 94, no. 2 (1986): 1002-037.
- _____. “Endogenous Technological Change.” *Journal of Political Economy* 98 no. 5 (1990): 71-102.
- Rudebusch, G. and E. Swanson. “The Bond Premium in a DSGE Model with Long-Run Real and Nominal Risks.” *American Economic Journal: Macroeconomics* 4 (2012): 105-143.
- _____, B. Sack and E. Swanson. “Macroeconomic Implications of Changes in the Term Premium, Review.” *Federal Reserve Bank of St. Louis* (2007): 241-70.
- Sala-i-Martin, X. “I Just Ran Two Million Regressions.” *American Economic Review, Papers and Proceedings* 87, no. 2 (1997): 178-83.
- Sachs, J., and A. Warner. “Economic Reform and the Process of Global Integration.” *Brooking Papers on Economic Activity* no. 1 (1995): 1-118. Brookings Institution Press.

- Shaaf, M. "Predicting Recessions Using the Yield Curve: An Artificial Intelligence and Econometric Comparison." *Eastern Economic Journal* 26, no. 2 (2000): 171-90.
- Solow, R. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70 (1956): 65-94.
- Stock, J.H. and M.W. Watson. "Forecasting Output and Inflation: The Role of Asset Prices." *Journal of Economic Literature* 41, no. 3 (2003): 788-829.
- Tien, N.H. "Relationship between Inflation and Economic Growth in Vietnam." *Turkish Journal of Computer and Mathematics Education* 12, no. 14 (2021): 5134-39.
- Topel, R. "Labor Markets and Economic Growth." in *Handbook of Labor Economics*, ed. By Ashenfelter O, Amsterdam DC, Elsevier, (1999): 2943-84.
- Tkacz, G. "Neural Network Forecasting of Canadian GDP Growth." *International Journal of Forecasting* 17 no. 1 (2001): 57-69.
- Valdovinos C.G.F. "Inflation and economic growth in the long run." *Economics Letters* 80, no. 2 (2003): 167-73.
- Vamvakidis, A. "How Robust is the Growth-Openness Connection? Historical Evidence." *Journal of Economic Growth* 7 (2002): 57-80.
- Venetis, I.A., I. Paya and D.A. Peel. "Re-Examination of the Predictability of Economic Activity Using the Yield Spread: A Nonlinear Approach." *International Review of Economics and Finance* 12, no. 2 (2003): 187-207.
- Wright, J.H. "The Yield Curve and Predicting Recessions. Finance and Economics Discussion Series No. 2006-07, Federal Reserve Board of Governors, www.federalreserve.gov/pubs/feds/2006/200607/200607pap.pdf. (2006)

APPENDIX 1

List of Abbreviations

Abbreviation	Meaning
ADF	Augmented Dickey Fuller
AIC	Akaike Info Criterion
ARDL	Autoregressive Distributed Lag
BoM	Bank of Mauritius
ECT	Error Correction Term
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
HC	Human Capital
INF	Inflation
INV	Investment
MCB	Mauritius Commercial Bank
OPEN	Openness to Trade
SIC	Schwarz Criterion
T Bills	Treasury Bills