Box 5.1

A Comparative Analysis of the Slope of the Yield Curve

The yield curve is basically a tool that graphically displays returns at different maturities of a debt instrument of the same type in terms of risk, liquidity and taxation. Yield curves contain important information for policy makers as well as being used as indicators for various market pricing. In particular, the slope of a yield curve and its change over time provide central banks with important hints on monetary policy stance, interest rate expectations, and the course of a number of macro-variables such as inflation and growth. This box, after giving a brief introduction of the yield curve and its dynamics, explores how interpretations of the position and slope of yield curves differ across developed and developing countries.

Slope of Yield Curve and Economic Cycle

The yield curve shows how interest rates differ in short, medium and long terms. The slope of the yield curve indicates the direction of this differentiation, in other words, the higher the maturity, the higher or lower the returns. There are two main reasons why short and long-term interest rates are often different. The first one is the expectations regarding the short-term interest rate and the second is the term premium.

The effect of the expectations on the yield curve is due to the investor's option of investing in different maturities. For example, an investor who wants to make use of their money for a period of two years may either invest in a two-year bond or invest in a one-year bond and re-invest the amount accrued a year later in a new one-year bond. As the return of the two-year bond is already known before the investment action, there is no uncertainty about how much it will yield. However, investing in one-year maturity bonds carries some uncertainty since the return of the one-year bond is not known at the beginning of the second year. Therefore, the investor has to use the one-year (i.e. short-term) interest rate expectation to calculate the expected return. The *expectations hypothesis* in the economic theory states that the returns of these two different investment options should be equal. If the two-year bond yields a higher (lower) return than does the sum of the estimated annual returns from one-year bonds, then the investors prefer investing in the two (one)- year assets, resulting in the convergence of total returns of the two investment options. Under this hypothesis, the long-term interest rate will be a function of the short-term interest rate and short-term interest rate expectation, and the difference of the short and long-term interest rates (slope of the yield curve) will also reflect the short-term interest rate expectations.

At this point, inflation expectations should also be taken into account. As the yield curve consists of nominal returns, interest rate expectations also reflect inflation expectations. Therefore, differentiation of inflation expectations at different maturities may affect the slope of the yield curve. Especially in developed countries, medium and long-term inflation expectations are well-anchored and are close to the official inflation target. Although inflation expectations may deviate from the target in the short term, such deviations are but minor thanks to the policy response. Therefore, inflation expectations have similar implications on yields of all maturities and do not affect the slope of the yield curve. However, this mechanism may be different for developing countries as discussed below.

On the other hand, the slope of the yield curve may not only be related to interest rate expectations, the term premium mentioned above may also be effective. The term premium is an additional return that investors demand for investing in the long rather than the short term. Due to the fact that taking positions in longer-term investments is often risker, the term premium is expected to be positive in theory. The size of the term premium, which may vary over time depending on the relative demand conditions of the bond, is affected by factors such as the risk sensitivity of investors and the level of development of the markets.

In summary, the slope of the yield curve is determined by the term premium and interest rate expectations. If the term premium is positive, the yield curve will be positively sloped if there is no sufficiently high negative effect from short-term interest rate expectations. However, from time to time, the yield curve may become flatter or may be inverted. In such a case, short-term interest rates should be expected to decline beyond the positive term premium.

The fact that long-term interest rates contain some information about the short-term interest rate expectations makes the slope of the yield curve an indicator that needs to be closely monitored by central banks. The flattened or inverted (negatively sloped) yield curve may indicate that short-term interest rates will drop in the future and hence economic activity may slow down and inflation will decline. Being a handy tool in estimating the economic cycles and inflation, the yield curve is also seen as an indicator of the tightness of the monetary policy stance. Accordingly, a positively sloped yield curve as an indication of the maturity indicates that the monetary policy stance is neutral or loose, whereas a flat or inverted yield curve implies a tight monetary policy stance.

Developed Countries

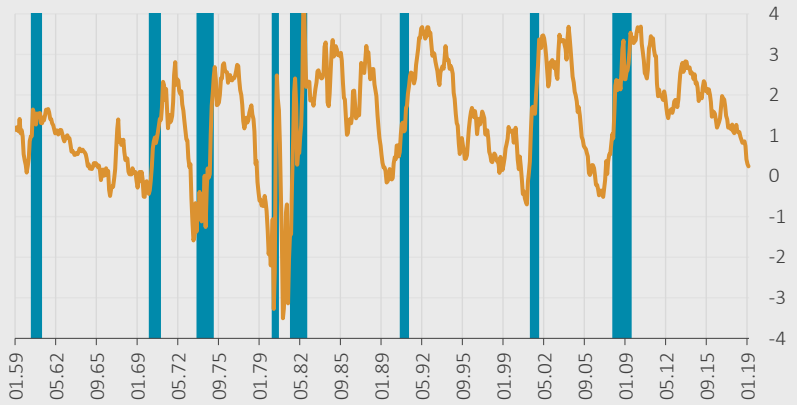
There are a number of empirical studies in the academic literature, linking the inverted yield curve to the economic recession (see Mishkin, 1990; Estrella and Hardouvelis, 1991). The underlying reason for this finding is that the slope of the yield curve is related to the monetary policy stance. Monetary tightening results in short-term interest rates in excess of the long-term ones. In turn, higher short-term interest rates contribute to slowing the economy down (Bernanke and Blinder, 1992). On the other hand, in the event that a central bank does not implement any monetary tightening, but financial market participants foresee an economic recession, the expectation that the central bank will try to stimulate the economy by lowering interest rates in the future may also cause long-term interest rates to decline compared to short-term interest rates. Studies for the US economy confirm the inverse relationship between the slope of the yield curve and economic activity. These studies reveal that the slope measured in terms of the yield difference between Treasury bonds with 10-year and 3-month maturities gives signals about an economic deceleration four to six quarters in advance. The yield curve has successfully predicted every recession (National Bureau of Economic Research (NBER) definition) that took place in the US since 1950 except for the false signal in 1967 (Chart 1). This relationship for the US economy was found to be valid for some other developed economies (for Germany, Canada and the UK see Estrella and Mishkin, 1997, and Bernard and Gerlach, 1998).

Recent Developments in the US Yield Curve and Debates on Economic Recession

The US economy has been steadily growing for some time, and the normalization of monetary policy is ongoing. The inversion of the US yield curve has recently caused debates on the possibility of an economic recession in the near future (Chart 2). However, some analysts argue that a low and even negative term spread will not result in an economic recession today,

contrary to the historical experience. As a factor supporting this argument, it is asserted that a decline in long-term interest rates may reflect expectations of a decline not only in short-term interest rates, but also in term premium (Bauer and Rudebusch, 2016). Considering that the central banks of developed countries continue their accommodative monetary policy, the term premium is expected to maintain its current low levels. Additionally, considering that the natural policy interest rate may have decreased (Williams, 2017), it is also argued that low long-term interest rates indicate new normal levels for interest rates rather than a recession in the economy.

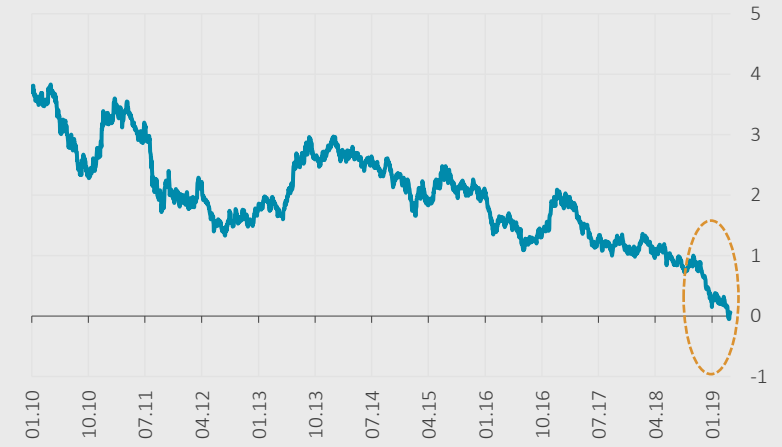
Chart 1: US Yield Curve and Recession Periods* (Spread Between 10 Year Maturity and 3 Month Maturity Treasury Bonds, Monthly Averages ,%)



Source: New York Fed.
* Shaded areas indicate recession periods determined by NBER.

Moreover, the US monetary policy implementation in the post-crisis period has been highly effective on the term premium. Both the impact of asset purchase programs on long-term interest rates, and fading of uncertainties over future policy steps thanks to the forward guidance led to a decline in the term premium. There are also studies with findings that the term premium declined significantly and even turned to negative in some periods. [1] In this context, the inverted yield curve may reflect not only the short-term interest expectations but also the negative term premium, albeit partially.

Chart 2: Slope of the US Treasury Yield Curve (Spread Between 10 Year Maturity and 3 Month Maturity Treasury Bonds, %)



Source: FRED.

[1] Studies based on Adrian et al. (2013), Hördahl and Tristani (2014), Kim and Wright (2005) indicate that negative term premium has been observed recently.

Developing Countries

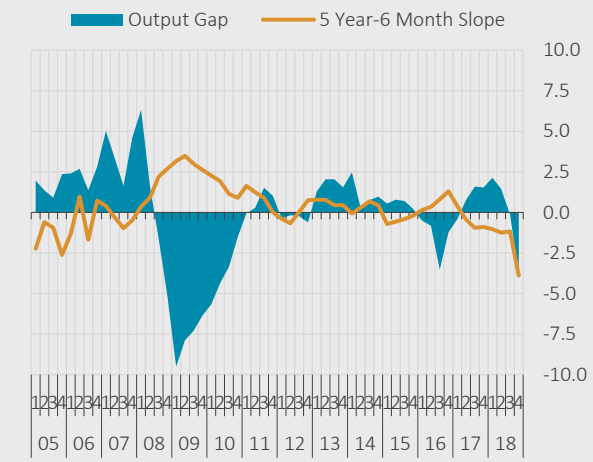
The relationship between the slope of the yield curve and economic activity for some developed countries, the US in particular, has not been clearly established for developing countries. As a possible explanation, some studies argue that developing countries' bond markets have less liquidity than those of developed countries. For the yield curve to give reliable signals about economic activity, there should exist a bond market with sufficient liquidity and long maturities. Additionally, in developing countries, particularly the mid to long end of the yield curve is said to be affected by global financial conditions. For example, Chen et al. (2005) conclude in their studies on five particular developing Asian counties that the US bond market developments rather than domestic bond markets provide sounder indications for economic growth.

In addition, since the risk premium and inflation are more volatile in developing countries than developed ones, tight monetary policy practices in these countries may affect economic activity positively. A tight monetary policy stance for a limited time may lead to an inverted yield curve by lowering the exchange rate and inflation expectations without implying a slowdown in economic activity, as external variables (such as exchange rates, import prices) can be effective in the course of inflation in small open economies where expectations are not fully anchored. The tightening of the monetary policy stance leads to an increase in short-term rates, and may lead to a decline in future inflation expectations and a decrease in long-term interest rates if the action is regarded as credible. Empirical studies for developing countries also support this relationship. Moreno (2008) found that inflation expectations and risk premium in developing countries were lower and more stable compared to the past, which contributed to the decline in long-term returns. The analysis by Barroso et al. (2014) shows that there is an inverse relationship between short-term interest rates and slope of the yield curve. Both studies suggest that foreign interest rates or term spreads have a statistically significant impact on local long-term interest rates.

Additionally, as a result of the tight monetary policy stance in developing countries, short-term interest rates that are higher than long-term rates, together with favorable risk premium conditions, may accelerate economic activity by attracting capital inflows.

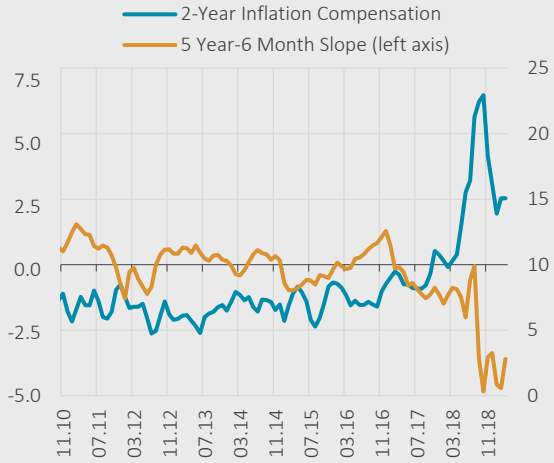
An analysis of the course of economic activity and the slope of the yield curve for Turkey reveals concurrence of an inverted yield curve with the times when the economy is growing above potential, in particular (Chart 3). By contrast, particularly in the wake of 2018 Q2 and Q3 marked by soaring inflation expectations, the slope of the yield curve became even more negative and inflation expectations declined rapidly in response to , the CBRT's monetary tightening measures (Chart 4).

Chart 3: Yield Curve Slope and Output Gap for Turkey (Quarterly Averages, %)



Source: Bloomberg, CBRT.

Chart 4: Yield Curve Slope and Inflation Compensation for Turkey (Monthly Averages, %)



Source: Bloomberg.

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