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## International Review of Economics and Finance

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# Yield curve interactions with the macroeconomic factors during global financial crisis among Asian markets

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## ARTICLE INFO

### JEL Classification:

G12  
G15  
G010  
C58  
G2

### Keywords:

Yield curve  
Economic activity  
Macroeconomic factors  
Dynamic Nelson Siegel model  
Sovereign bond markets  
Monetary policy

## ABSTRACT

This study examines the interaction between the yield curve movements and the macro economic factors among the nine Asian sovereign bond markets. The yield curve and macro-economic variables were jointly modelled in the dynamic Nelson Siegel model framework and are fitted in the vector auto regressive (VAR) process in a state space framework. The results indicate the existence of a bi-directional relationship between the yield curve and macro factors in the Asian economies. The study found that both the policy rate and the inflation rate influence the short end of the yield curve, reflecting an effective management of the monetary policy. While output growth strongly leads the long term rates in the region, steepening of the yield curve causes increase in inflation. The depreciation of exchange rates led to increase the level factor in emerging economies and the increase in slope factor appreciated the exchange rates in developed Asian markets.

## 1. Introduction

Central banks set the short term interest rates on the basis of the expected future path of the economy, which in turn affects the long term rates (Orphanides & Wei, 2012). The goal of any central bank is to affect the long term rates in order to boost growth in the economy which would be achieved by affecting the yield curve. On the other hand, there is also an indirect feedback effect from long term rates to the macro economic factors (Nimark, 2008). The movement in the term structure signals the shift in the macro factors, inducing the central bank to alter the short term rates. Thus there exists complementary relationship between the yield curve and the state of the economy. This study aims to analyse the interactions between the yield curve and economic factors across nine Asian economies.

Literature on macro economy and yield curve has concentrated on the slope of the yield curve as the significant predictor of economic activity (Estrella & Hardouvelis, 1991), and the stance of the monetary policy (Evans & Marshall, 1998). Mishkin (1990) provided evidence that long term rates contain information about the future expected inflation. Alternatively, some recent studies jointly modelled the term structure with macro-economic factors in two different approaches. Ang and Piazzesi (2003) used an arbitrage free model, and Diebold, Rudebusch, and Aruoba (2006) used the Dynamic Nelson Siegel model. Both these models distilled the yield curve

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<http://dx.doi.org/10.1016/j.iref.2017.08.006>

Received 26 April 2017; Received in revised form 16 August 2017; Accepted 16 August 2017

Available online xxxx

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into a set of latent factors and modelled macro factors jointly with yield curve factors. The advantage is that these models allow the capturing of the bidirectional relationship between the yield curve and macro factors, and they help to assess the time varying relationships.

The 1997 Asian Currency crisis brought an increased awareness and urgency in developing an efficient bond market to reduce external borrowings from other countries and to channelize the domestic savings to their long term investment needs in the region. Since then, various measures were taken to develop the bond markets. Globalisation of emerging markets coupled with domestic economic growth increased the capital inflows into these economies. The sudden rise in the capital flows increased challenges in the macro-economic management in the region (Pradhan et al., 2011). Given the significant growth in bond markets and capitals inflows in the region, it was necessary to examine how the bond markets respond to the macroeconomic surprises in the region.

This study has examined the interactions between the yield curve and the macroeconomic factors of Asian economies such as Japan, Hong Kong, Singapore Malaysia, Korea, India, China, Indonesia and Philippines for the period of January 2003 to December 2013. The zero coupon yields of Asian economies and macro factors were considered at monthly frequency from January 2003 to December 2013. The macro economic factors considered were monetary policy rate, inflation, output growth and exchange rate. The yield curve and macro-economic variables were modelled jointly in the Dynamic Nelson Siegel model frame work as in Diebold et al. (2006) and were fitted in a vector auto regressive (VAR) process in a state space framework.

The results of this study reflect the feedback effect between the yield curve and macroeconomic factors in the nine Asian economies. The term structure factors exhibited significant persistence among all the Asian economies. Increase in the policy and inflation rates affects the slope of the term structure while the output growth strongly leads the long term factor of the yield curve. The depreciation of exchange rates led to increase in the level factor in emerging economies, and increase in slope factor led to the appreciation of the exchange rates, confirming the uncovered interest rate parity.

The contribution of the study is three fold. Prior studies that examined the relationship between macro factors and yield curve were conducted mostly on developed economies, especially the US and some industrialized economies (Afonso & Martins, 2012). The literature on Asian economies is thin. In the literature on emerging economies, Mehl (2009) used the slope of the yield curve to predict inflation and economic activity. This paper contributes to literature by investigating the interactions between macro factors and the yield curve at various maturity spectrums among the Asian economies.

Second, though there is a large body of literature about the information content of the term structure, the focus was on the predictive ability of term spread to forecast macro-economic factors (Nimark, 2008). This paper on the other hand, focuses on how the shift in the term structure alters the macro factors, and how the shift in macro factors affects the term structure movements in Asia. The countries considered for this study demonstrated varied characteristics. While Korea (2001), Philippines (2002) and Indonesia (2005) adopted inflation targeting policies, Japan fought deflation in a lower interest rate environment. Singapore and Hong Kong strove for exchange rate stability, while the Indian and Chinese bond markets operated in a regulated market environment.

Third, the period of the study starting from January 2003 to December 2013 was the crucial time in the development of Asian bond markets. This period also covers the economic drifts and turns caused by the 2007–2008 global financial crisis. The emerging markets received strong capital flows into the local currency bond market at the onset of the crisis, which led to volatility in asset prices and was quite a challenge to regulators in terms of macroeconomic management.

The rest of the paper is organised as follows: Section 2 presents stylized facts about Asian bond markets; Section 3 presents the theoretical background of yield curve and macro factors; Section 4 presents the model, Section 5 describes the data and presents the results, and Section 6 summarizes and concludes.

## 2. Stylized facts about Asian bond markets

The local currency bond market in Asia has developed rapidly in the past decade due to the increased financial openness in the region post the Asian Financial Crisis. In the year 2000, the total size of the Asian local currency Government bond market was USD 493 billion; by 2013, it had increased to USD 4560 billion (excluding Japan)<sup>1</sup> (source: Asian Bond online) indicating the rapid development of the bond market in the region.

Table 1 presents the comparative size of the local currency bond market denominated in USD billions for the years 2000 and 2013. In the Government bond market segment, the Japanese bond market is the largest in the region followed by China and South Korea. In the corporate bond market segment, China stands the largest among the Asian economies, followed by South Korea and Japan. India stands as the fourth largest bond market in the region. The development and growth of the bond market after the Asian financial crisis has been phenomenal in all the countries in the region.

The Asian countries considered in the study shared a regional resemblance, but exhibited heterogeneous monetary policy objectives. Japan was fighting deflation in a low interest rate environment, and was using various unconventional measures such as purchases of long term bonds, real estate funds and exchange traded funds to influence the economy. Emerging economies such as Korea, Indonesia, and Philippines were adopting inflation targeting regimes and used monetary policy rates to influence the inflation and the economy. Singapore was one major economy that used the exchange rate to manage inflation, as their economy is import driven. Moreover, their interest rates are largely determined by the US rates and investors' expectations of currency movements. (Source: Bloomberg report). Hong Kong adopted a linked exchange rate system with US dollars to maintain currency stability. Their exchange stability was maintained through the automatic interest rate mechanism (Source: Hong Kong Monetary Authority). The Indian economy effectively used

<sup>1</sup> The end of period exchange rate are taken from Bloomberg.

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