Expert Systems with Applications 36 (2009) 7129–7134

Contents lists available at ScienceDirect

Expert Systems with Applications

journal homepage: www.elsevier.com/locate/eswa

An analysis of the yield spread as a predictor of inflation in Brazil: Evidence from a wavelets approach

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ARTICLE INFO

Keywords:
Interest rates
Forecasts
Multiresolution analysis
Wavelets
Yield spread
Term structure of interest rates

ABSTRACT

In the present paper we apply multiresolution decomposition in order to test if the Brazilian yield spread has informational content in the prediction of inflation. Additionally, we investigate the effect of the implementation of inflation targeting regime over this relation. The results suggest that the predictive power of the spread varies across time patterns. Inasmuch, the results indicate that the implementation of the inflation target regime was a *sine qua non* condition for a substantial increase in the predictive power of inflation. Overall, results suggest that wavelets transformations may be very useful in the building of forecasts of important financial variables.

1. Introduction

A large body of empirical evidence suggests that the yield curve is a significant predictor of inflation (Berk & Van Bergeijk, 2000, 2001; Estrella, 2005; Mishkin, 1990a, 1990b, 1991; Schich, 1999).[1] This evidence is important for financial regulators, practitioners, portfolio and risk managers as it may help in the development of forecasting models. Nonetheless, most research has applied linear regressions to study this relationship. Recent research in econometrics and statistics has shown that wavelets may be employed to unveil such relationships and empirical results have been favorable to the use of such methods in the analysis of economic phenomena.[2] This paper contributes to the literature by employing such recent wavelets techniques to the analysis of inflation forecasts for the Brazilian economy.[3]

Estrella (2005) developed an analytical model that shows that the yield curve should help predict output and inflation under most circumstances. However, the usefulness of the yield curve as a predictor depends on the monetary policy framework under place. If monetary policy reacts to deviations of inflation from the target, then the predictive relationship would depend on the magnitudes of the reaction parameters.

It is not clear whether the yield curve contains relevant information that can be helpful in forecasting inflation for emerging markets. Many emerging markets have had structural changes in monetary policy in recent years, adopting inflation targeting (IT) frameworks. An important question is whether the adoption of such regimes has provoked any changes in the predictive power of the yield curve. This is an important issue that deserves special attention.

Recent literature has shown that emerging countries adopting IT regimes have experienced greater drops in inflation and in growth volatility if compared to non-targeters (Goncalves and Salles (2008)), and therefore that the adoption of IT regimes imply in concrete welfare gains. Furthermore, inflation uncertainty has been shown to have negative and significant effects on growth (Grier and Grier (2006)). Therefore, an important issue is whether with the implementation of an IT regime inflation predictability increases (inflation uncertainty decreases).[4]

The Brazilian case seems to be an interesting case study as it has implemented an IT framework for monetary policy in the mid 1999s. With the implementation of the IT the main concern of monetary policy was to deliver an inflation target. Brazil also let the currency float in the IT regime and employs short-term interest rates as the main instrument of monetary policy.

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[1] It has been shown that it is also a predictor of future short-term interest rates. See for example Musti and D'Ecclesia (2008) that present such evidence for the Italian and the European market.

[2] See Gallegati (2007), Guo, Sun, Li, and Wang (2008), Li and Kuo (2009) and Tang, Tang, and Sheng (2009).

[3] A variety of papers have suggested important nonlinearities in interest rates, which implies that transforming the data prior to testing whether economic relationships hold maybe worthwhile (see Kim and Noh (1997) and Kyong and Han (2000)).

[4] An interesting issue is whether central bank independence would alter inflation dynamics as well. Otero and Ramirez (2006) study the Colombian case and show that disequilibria in goods and monetary markets were found to have a smaller effect on inflation after the Central Bank independence was granted.

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doi:10.1016/j.eswa.2008.08.073

The main contribution of this paper is that it shows that with the adoption of the IT framework in Brazil the yield curve seems to increase its forecasting power for the evolution of future inflation employing a wavelets approach. Inasmuch, the results indicate that the implementation of the IT regime was a *sine qua non* condition for a substantial increase in the predictive power of inflation. This result is in line with the reasoning of Estrella (2005) and sheds some light on why the predictive power may change from country to country and within samples. It seems to depend on the monetary policy framework under place. Furthermore, the paper employs a novel methodology (wavelets) and shows that the predictive power of the yield spread varies across time patterns.

The remainder of the paper is structured as follows. Section 2 introduces an overview of the literature. Section 3 describes the methodology while Section 4 discusses the empirical results. Finally, a summary of important findings and key issues is offered in Section 5.

2. Brief literature review

The use of interest rates and their term structure as a predictor of inflation is an issue of relevance for the literature, and it has been widely studied. In a seminal paper, Fama (1975) investigates the informational content of short-term interest rates as a predictor of inflation.[5] He concludes that it is not possible to reject the hypothesis that the short-term rates reflect the path followed by inflation.

Mishkin (1990a) concludes that the term spread is not significant in a big part of the OECD countries. The only countries where the spread is significant are UK, France and Germany. Kozicki (1997) indicates that the yield spread helps predict inflation, but the results are less strong than those for the GPD, while Schich (1999) testing the predictive power of the term spread for the G-7 countries, concludes that the spread can be useful in the case of the USA, Germany, Canada and UK, while for France, Italy and Japan the spread is not statistically significant. Additionally, Schich (1999) also concludes that the significance varies not only across countries, but also over the time.

Bernanke (1990) and Estrella and Mishkin (1997) find evidence that the predictability of the term spread is strictly related to the stance of monetary policy, and the latter also suggest that the term spread could be a useful tool for the European Central Bank. Estrella (2005) also confirms this influence of monetary policy over the yield spread, but he reports that in most cases other information beyond the yield spread can be useful in forecasting industrial production and inflation.

Estrella and Hardouvelis (1991) firstly find that the term structure can help predict production growth, and secondly they test if there is information in the yield spread that is beyond the influence of monetary policy. After adding a variable representing monetary policy, they conclude that the spread remains statistically significant, indicating that the correlation between term spread and economic activity is not totally due to the monetary policy.

Testing the ability of the yield spread to predict real economic activity in 11 industrial countries,[6] Bonser and Morley (1997) find that the yield spread is a good predictor for the majority of the countries, specially for US, Canada and Germany, while for Japan and Switzerland the term spread possesses a weak predictive content.

Kozicki (1997) analyzes the same industrial countries (with the exception of the Netherlands) and reports that the maximal contribution of the spread to predict GDP growth is at a horizon of four-quarters. Testing for the ability of the term spread to predict inflation, the paper suggests that the spread helps predict inflation, but the results for inflation are less strong than those for real growth.

Davis and Fagan (1997) evaluate the information content of the yield curve and find a poor out-of-sample forecasting performance and parameter instability, which suggests the need for caution in using spread variables for forecasting in EU countries.

In the case of Brazil a complex structure in the inflation process may arise, which implies that the use of more general methodologies such as wavelets may add some insights on the inflation process it self (see for example Şahin, Ülengin, and Ülengin (2006) that employ a Bayesian causal maps (BCMs) to analyze the complex structure of inflation in Turkey).

The overall conclusion is that the information content of the yield curve depends on a variety of factors such as country under examination, monetary policy framework and sample. Furthermore, it is not clear whether this information content in the yield curve is present in emerging markets. The focus of this paper is to analyze this issue for the Brazilian economy using a wavelets methodology.

3. Methodology

Basically, wavelet is a mathematical filter that allows dividing a given function into different frequency components. Wavelets are scaled and translated copies of a specific function, called mother wavelet. The great advantage of a wavelet in relation to a Fourier transform is the possibility to analyze non-stationary functions, which are very common in finance and economics, given the continuous presence of abrupt changes and volatility.

This methodology has recently received great acceptance in the financial literature. McCarthy, DiSario, Saraoglu, and Li (2006), applying such methodology, investigate the presence of long-term memory for US government debt securities, finding that there is statistically significant long-range dependence in changes of interest rates for most of the investigated securities, while Kim and In (2006) study the relationship between industry returns and inflation using wavelets analysis, and they find evidence that the correlation between these variables does not decrease as the time horizon increases, and the effects of industry over inflation vary from industry to industry.[7] Gallegati (2008) studies the relationship between stock market returns and economic activity and shows that the former tend to lead the level of economic activity, but only at lowest frequencies.

Zagaglia (2006) tested for the predictive power of the term spread for the US using a wavelets approach. His results report a heterogeneous relation across time scales. Additionally, he found that, for some time scales, a negative slope in the yield curve is related to a positive GDP growth, in contrast to the existing literature.[8]

For a wavelets multiresolution analysis, a few conditions must be satisfied: let $L^2(R)$ denote the space of square-integrable functions. Now consider a sequence of closed subspaces $\{W_k\}_{k=n}^{\infty}$ (relative to the detail spaces of the series) and V_n (relative to the approximation of the series) of $L^2(R)$, such that $V_n \subset V_{n+1}$ and $\cap_n V_n = \{0\}$, and $\cup_n V_n = L^2(R)$, which indicates that all integrable functions should be included at the highest resolution.[9] Moreover, we say that V_n is a multiresolution if it satisfies the following conditions:

[5] Studies about the term structure can be found in: Fama (1984), Mankiw and Miron (1986), Fama and Bliss (1987), Edmister and Madan (1993), Ang, Piazzesi, and Wei (2006) and Anderson and Vahid (2001).

[6] The countries analyzed are: Australia, Canada, France Germany, Italy, Japan, Netherlands, Sweden, Switzerland, UK and US.

[7] See also DiSario, Saraoglu, McCarthy, and Li (2008) and Esteban-Bravo and Vidal-Sanz (2007).

[8] Laukaitis (2008) employ wavelet bases for smoothing data in the continuous time stochastic process forecasting process.

[9] See Ramsey and Lampart (1998), Crowley (2005) and Esteban-Bravo and Vidal-Sanz (2007).