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The Low Frequency Effect of Macroeconomic News on Colombian Government Bond Yields*

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Abstract

We study the effect of macroeconomic announcements surprises on Colombian treasury bond spot rates in the medium term. For this, we employ a two-step regression approach proposed by Altavilla, Giannone and Modugno (2017), which takes into account the high frequency response to these surprises while filtering out the noise in the estimation of its medium to long term effect. We found that the share of variation of one day Colombian treasury bond spot rates changes explained by these surprises lies below 10%. Moreover, Colombian macroeconomic announcement surprises other than the nominal exchange rate depreciation do not seem to significantly affect spot rate changes, although important ones have big (but not significant) effect. Furthermore, the explanatory power of macroeconomic news surprises increases substantially at longer horizons, i.e. monthly and quarterly changes, reaching 34% for the latter. These results arise from the fact that spot rate changes show a delayed effect to shocks. This is mostly due to the features of the shocks contained in the error and the persistence of macroeconomic news surprises effect's. Our results are robust to the appetite for risk of international investors measure employed in the model.

Keywords: Macroeconomic announcements, News, Low frequency analysis, Treasury bonds spot rates.

JEL: E43, E44, E47, G14.

*First draft for comments. Please do not circulate.

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El Efecto de Baja Frecuencia de los Anuncios Macroeconómicos en las Tasas de los Bonos Gubernamentales Colombianos[1]

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Resumen

Estudiamos el efecto de mediano a largo plazo de las sorpresas en los anuncios de cifras macroeconómicas sobre las tasas cero cupón de los títulos denominados en pesos de la Tesorería Nacional, TES. Empleamos regresión en dos etapas propuesta por Altavilla, Giannone and Modugno (2017), la cual tiene en cuenta las respuestas de alta frecuencia a las sorpresas, que filtra el ruido en la estimación de los efectos en el mediano plazo. Encontramos que el porcentaje de las variaciones de los cambios de alta frecuencia de las tasas spot explicadas por las sorpresas es inferior al 10%. Adicionalmente, las sorpresas macroeconómicas colombianas, excepto la depreciación nominal, no afectan significativamente los cambios de las tasas cero cupón, aunque algunas sorpresas importantes tienen un efecto grande (pero no significativo). Además, el poder explicativo de las sorpresas se incrementa substancialmente para horizontes más largos, i.e. cambios mensuales y trimestrales, alcanzando un 34% para el último. Estos resultados reflejan el hecho de que las tasas spot responden con retraso a los choques, lo cual está asociado a las características de los choques en el error y la persistencia del efecto de las sorpresas. Nuestros resultados son robustos a la medida del apetito por riesgo de los inversionistas internacionales empleada en el modelo.

Palabras Clave: Anuncios de cifras macroeconómicas, Noticias, Análisis de baja frecuencia, Tasa de los bonos de tesorería.
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1 Introduction

Monitoring financial markets is crucial for monetary authorities and financial regulators as it informs about the market reaction to policy changes as well as to macroeconomic (external and internal) shocks. For instance, central bankers asses the financial structure and the way the financial system alters the monetary transmission mechanisms to design its monetary policies, Ellingsen and Söderström (2003). In a similar way, the rise of the recent financial crises underscored the role of unconventional monetary policies when traditional monetary transmissions channels are obstructed. More specifically, forward guidance, quantitative easing and targeted asset purchases have been implemented in some developed economies to influence long term bond yields and thus stimulate economic activity, Cecchetti and Schoenholtz (2017) and Gilchrist, Yue, and Zakrajšek (2016). Furthermore, globalisation, technology innovation and law changes brought new challenges to the traditional structure of regulation and supervision. Finally, analysing bond market drivers has also gained greater relevance in the macro-prudential policy scope, as it reveals market spillovers and contagion, Beirne and Fratzscher (2013).

In this paper we estimate the medium to long-term response of the local bonds market to the surprises contained in macroeconomic data releases. For this, we employ a two-step methodology proposed by Altavilla, Giannone, and Modugno (2017). In the first step, we estimate a high frequency reaction function of daily (i.e high frequency) bond spot rates changes to macroeconomic data surprises. To reflect the fact that Colombia is an emerging small open economy, we include also (a) US macroeconomic announcements, (b) measures of the appetite for risk of international investors, (c) local bonds market liquidity measures, and (d) the variation of the nominal exchange. In the second step, a low frequency analysis is performed, which filters out the short-term noise. This is achieved by accumulating daily bond yield changes as well as the effect of daily news surprises over different time spans. Following Altavilla et al. (2017) we also employ the methodology in J. H. Cochrane (1988) and J. Cochrane and Sbordone (1988a) to calculate the persistence of the effect of macroeconomic news surprises on spot rate changes.

We conclude that macroeconomic data releases have a significant impact on daily Colombian bond rates changes, explaining between 5% and 7% of the daily spot rates variation. However, local macroeconomic releases have a limited or non-significant effect at high frequencies. In fact, the nominal exchange rate depreciation is the sole local indicator significantly influencing daily bond rate changes. The limited high frequency influence of local macro events is consistent with findings for emerging bond markets such as Brazil, China, Korea, Malaysia, Mexico, Poland, South Africa, Thailand, Turkey and Venezuela, and the importance of exchange rate shocks is reported by Rincón-Torres, Rojas-Silva, and Julio-Romń (2021) in Colombia.

Over longer horizons, that is monthly or quarterly, the explanatory power of the unanticipated news component reaches 34% of spot rate variability, reflecting that shocks have an immediate and permanent effect on spot rate changes. These findings are coherent with those of Altavilla et al. (2017) who found a slow absorption of macroeconomic news surprises.

The remaining of the paper is organised as follows. Section 2 contains the literature review. The third comprises the data and empirical approach. Section 4 presents the results, and in the last we conclude.

2 Literature Review

The impact of macroeconomic surprises on the dynamics of financial assets markets has been widely studied in high frequencies (intra-day or daily) for both, advanced and emerging markets. Most of the results reflect that news surprises have a significant impact on assets' prices, although they have limited explanatory power over the short-term. For instance, Gürkaynak, Sack, and Swanson (2005), Faust, Rogers, Wang, and Wright (2007) and Andersen, Bollerslev, Diebold, and Vega (2007) report that surprises are economically important and have a statistically significant impact on daily bond yields changes in developed economies. But the impact is limited, that is surprises explain about 10% of the daily fluctuations, in emerging markets. Nonetheless, Altavilla et al. (2017) reports that macroeconomic surprises explain a significant fraction of the low-frequency fluctuations of bond yields. More than one third of the quarterly movement in bond yields is driven by the unexpected component of macroeconomic releases.

Caporale, Spagnolo, and Spagnolo (2018), in turn, estimated a bi-variate VAR-GARCH(1,1) model for determining the effects of positive and negative news on yield spreads between the German Bund and 10-year sovereign bonds issued by 8 European countries for the period spanning Apr-1999 to Mar-2014. The model included the VIX index, the macroeconomic event surprises and a classification of news headlines. The results showed that: i) on average the number of positive news is bigger than the negative ones (except in Belgium), ii) since the 2008 crisis: negative news releases have become more frequent in all countries (except Belgium and the Netherlands), and news headlines reflected that sovereign bonds have been perceived as much riskier because of weak macroeconomic fundamentals, iv) negative news have a positive and significant effect on bonds spreads in all countries but Italy before September 2008, markets respond more to negative news and their reaction has increased during the 2008 financial crisis, v) news volatility has a significant impact on yield spreads volatility, and the effect is more pronounced in the case of negative news, and their reaction has increased during the financial crisis, vi) the conditional correlations between yield spreads and negative news are significant and positive, and their increase during the financial crisis indicates a higher sensitivity of yield spreads to negative releases. Caporale et al. (2018) conclude the linkages between real sector news and financial markets have clearly become stronger in the euro area during the financial crisis, which should be considered in the EU-wide macro-prudential regulations.

For emerging markets Andritzky, Bannister, and Tamirisa (2007), Banerjee and Pradhan (2021), and Nowak, Andritzky, Jobst, and Tamirisa (2011) report that macroeconomic news announcements have a significant influence on financial markets, but the direction and magnitude of the effect is generally ambiguous and depends on the degree of uncertainty in the market and the surprise content of the announcements. Given the imperfect nature of the emerging market bond asset class with relatively scarce information, the asymmetry of access to information between creditors and debtors and the prevalence of default, it is widely expected that macroeconomic events explain the widening or narrowing of spreads, Andritzky et al. (2007).

According to Andritzky et al. (2007), global bond spreads respond to rating actions and changes in global interest rates rather than domestic data and policy announcements. All announcements affect market volatility, although the direction of the volatility effects is ambiguous: data and policy announcements reduce uncertainty and stabilise the trading environment, while rating actions cause greater volatility. Additionally, the results showed the impact of announcements is lower for countries with more transparent policies and higher credit ratings, and during crisis periods, rating actions become less important, and investors focus more on simple and timely indicators. They estimated OLS regressions for all countries, a GARCH(1,1) to improve efficiency and to examine the effect of announcements on the volatility of the daily change in spreads for individual countries, and a panel regression using the Generalised Method of Moments to examine the common impact of announcements on emerging bond markets as an asset class. In a later work, Nowak et al. (2011) estimated the response of the conditional returns and volatility of external bonds to macroeconomic surprises in Brazil, Mexico, Russia, and Turkey, using a two-step weighted least-squares and also determined the ARCH structure of the volatility, revealing the lag lengths for the emerging markets bonds are much larger than for the US Treasury note, which suggests a more pronounced interdependence of the emerging market bonds, possibly mirroring a longer volatility. They found that i) the process of information absorption in emerging markets tends to be more drawn-out than in mature bond markets, ii) the effects on volatility were more pronounced and longer lasting than those on prices, and iii) global and regional macroeconomic news is at least as important as local news for both price and volatility dynamics.

Similarly, Banerjee and Pradhan (2021) encountered for the Indian market: i) both returns, and conditional volatility respond swiftly to surprises in most local macroeconomic news, ii) the impact on volatility is more pronounced than on returns, and iii) there is an asymmetric impact implying that negative news has a stronger market reaction over positive news. The authors emphasised that given the evidence of the sensitivity of news announcements impacting return and volatility in the benchmark bond, The Government, the Central Bank ought to plan strategically the news announcements, to stabilise the bond yields, thereby facilitating orderly bidding in the dealers' weekly primary auctions.

3 Data and Empirical Approach

3.1 Data

The data set under analysis contains daily records of three different types of data; Colombian financial markets, international investors' risk appetite measures, and Colombian and US macroeconomic data releases and expectations. The variables contained in the data set may be found in Table A.2, whose first column exhibits the data type, the symbol it might be identified with in equations in the second, while the third contains a mnemonic that may be found in tables and Figures. The last column is a label describing the variable itself.

3.1.1 Colombian Financial Markets Data

The Colombian government treasuries issued in local currency, TES-COP, spot curve is estimated by Bolsa de Valores de Colombia, BVC, the colombian stock exchange, employing Nelson and Siegel (1987)'s parameterization. For this, BVC gathers TES-COP spot secondary market trade prices and volumes from the spot trading platforms in this country, SEN and Master Trader[6]. The spot curve is estimated on a daily basis and coefficient estimates are released for market purposes.

The continuously compounded spot rate at day t and maturity m was calculated from the estimated daily coefficients, $\hat{\beta}_0$, $\hat{\beta}_1$, $\hat{\beta}_2$ and $\hat{\tau}$, through the equation

$$y_t^m = \hat{\beta}_0 + \hat{\beta}_1 \frac{1 - e^{-m/\hat{\tau}}}{m/\hat{\tau}} + \hat{\beta}_2 \left(\frac{1 - e^{-m/\hat{\tau}}}{m/\hat{\tau}} - e^{-m/\hat{\tau}} \right) \tag{1}$$

for any maturity of m years. See Nelson and Siegel (1987) and Svensson (1994, eq. 3.2).

The discretely compounded spot rate, Y_t^m is calculated from the continuously compounded one through

$$Y_t^m = 100 \times \left(e^{y_t^m/100} - 1 \right)$$

[6]SEN is Banco de la República's, the Colombian central bank, trading platform where only market makers are allowed to trade and interact with the central bank. Master Trader is BVC's secondary spot market where all agents are allowed to trade.

for any maturity of m years.

We include the estimated spot rates at maturities of 2, 5, and 10 years, Y_t^k for $k = 2, 5, 10$, which are also identified by the mnemonic *S2*, *S5* and *S10*, respectively. We also include the daily number of TES-COP trades at the SEN trading platform, *N-OPER*, and their corresponding market volume, *VOL*. Finally, we include the Colombian FOREX spot official COP/USD depreciation rate, *Deprec*[7].

Figure 1 shows the evolution of these spot rates across the time. The dynamics of these rates show the expected parallel, slope and butterfly movements of the spot curve. From Jan-2014 to Mar-2015, a parallel upward trend is observed. At the peak, a sudden spot curve flattening happens followed by a parallel downward trend until Jul-2016, when the curve slopes suddenly back. Since that date until Jun-2018 the spot curve slope increases slowly following a slight downward trend. On Jun-2018 a sudden flattening occurs followed by a flat trend until Apr-2019, when a sudden spike with a strong flattening ensues. After the spike, the spot curve follows a downward trend accompanied by an increasing slope. Butterfly movements, however, are slight and not easily detected with three maturities only.

3.1.2 Global Investors' Risk Appetite

The appetite for risk of international investors is thought to be one of the most important determinants of asset price movements in emerging and developing markets such as Colombia. As a matter of fact, the high spreads these governments and firms have to pay to offset their creditworthiness creates an important incentive for international investors to diversify their portfolios. When expected TES-COP returns offset risk, inflows of funds to these countries arise and local currency as well ass financial investments appreciate. However, when risk offsets their expected returns, portfolio re-balancing movements create outflows of funds from these countries having the opposite effect. Thus, the appetite for risk of international investors seems to be a key determinant of treasury bond prices, at least on crises times.

Following ECB (2007), we include a set of risk appetite measures apart from the well known 10 year BAA corporate yield spread with respect to the 10 year fixed rate US treasury bond, *SpreadBAA* and the global and Colombian Emerging Markets Bond Indexes, *EMBIG* and *EMBIC*. These are newer measures such as the Standard and Poor's index options expected volatility, *VIX*, and its European counterpart, the EURO STOXX 50 options volatility, *V2X*, and the Merrill Lynch Option Volatility Estimate, *MOVE*.

The dynamics of these measures may be found in Figure 2. These indicators show

[7] COP/USD depreciation is calculated from the *Tasa Representativa de Mercado*, the official COP/USD exchange rate in Colombia

a similar dynamics among them, especially at crisis periods such as the Apr-2019 event. Furthermore, these indicators seem to share some features with the dynamics of spot rates. More specifically, they share the bump that occurred between Jan-2014 and May-2016, as well as a smaller one around 2017 and 2018. Moreover, they display the same spike at Apr-2019. We explore this relationship further in Figure 3 where the scatter plots between each risk appetite measure, x-axis, and the spot rates, y-axis, are drawn. Traditional risk appetite measures such as *EMBIG*, *EMBIC* and *SpreadBAA* suggest a constant slope linear regression with and intercept shift. For newer risk appetite measures, a linear relationship with both a slope and intercept shifts seem to arise. These figures show that there is a clear relationship between the spot rates and the appetite for risk of international investors.

3.1.3 Macroeconomic data Releases, Expectations and Surprises

US and Colombian macroeconomic data releases, $A_{i,t}$, and expectations, $E_{i,t}$, come from Bloomberg's World Economic Calendar, mostly. Announcement times were gathered from Bloomberg News feed when available, and otherwise from Reuters'. Agents expectations regarding these macroeconomic data releases, in turn, were retrieved from Bloomberg News.

Time stamped standardised macroeconomic announcement surprises, $S_{i,t}$, were calculated from data releases and expectations as in Andersen, Bollerslev, Diebold, and Vega (2003, pp. 42) as follows,

$$S_{i,t} = \frac{A_{i,t} - E_{i,t}}{\hat{\sigma}_i} \tag{2}$$

where $i = 1, 2, \ldots, n$ identifies the macroeconomic indicator, t is release date, and $\hat{\sigma}_i$ is the sample standard deviation of the un-standardised surprise, $A_{i,t} - E_{i,t}$, [8].

It is worth emphasizing at this point that the mnemonic for the standardized surprises in Equation (2) equals the mnemonic in Table A.1 adding the suffix *-SS*.

Finally, the time marks of aftermarket data releases were shifted to the next trading day since Colombia's financial markets run Monday through Friday from 8:00 AM to 1:00 PM, except on national holidays.

3.2 Empirical Approach

We follow the methodology proposed by Altavilla et al. (2017) with some modification. These authors propose a two-step approach; a high frequency analysis accompanied by a

[8] According to Andersen et al. (2003) "This standardization affects neither the statistical significance of the estimated response coefficients nor the fit of the regressions compared to the results based on the "raw" surprises, because $\hat{\sigma}_i$ is constant for any indicator [i]".

low frequency one, in which short term noise is filtered out. This process disentangles the low frequency effects of interest.

3.2.1 High Frequency Analysis

Altavilla et al. (2017) estimate a high frequency reaction function of daily spot rates changes on macroeconomic data surprises, which we modify as follows. In addition to the standardised Colombian and US macroeconomic data release surprises, $S_{i,t}$, for $i = 1, 2, \ldots, 33$, we include a measure of the appetite for risk of international investors, $R^{j}_{j,t}$ for $j = 1, 2, \ldots, 6$, from the list in Table A.1. We also capture the effect of liquidity risk through our TES-COP liquidity measures; the number of daily trades, N_t and traded volume, V_t. Finally, we account for the relationship between the COP/USD FOREX market and TES-COP markets found in Rincón-Torres, Rojas-Silva, and Julio-Román (2021) by including the direct effect of the nominal exchange rate variation, $\Delta\chi_t$ on the spot rates. Thus, we estimate the following equation

$$\Delta Y_t^{\tau} = \beta_0 + \sum_{i=1}^{33} \beta_i^{\tau} S_{i,t} + \gamma R_{j,t} + \delta_1 N_t + \delta_2 V_t + \alpha \Delta\chi_t + \varepsilon_t^{\tau} \tag{3}$$

for each maturity $\tau = 2, 5, 10$ years, and risk appetite measure $j = 1, 2, \ldots, 6$, where Greek letters are unknown parameter coefficients, and the unobserved error ε_t^{τ} is a zero mean conditionally heteroscedastic term.

As a result, Equation (3) accounts for the effect of liquidity risk, the appetite for risk of international investors and exchange rate variations, in addition to standardised macroeconomic releases surprises, thus reflecting the fact that Colombia is an emerging small open economy.

Equation (3) is estimated by Ordinary Least Squares, OLS, with robust standard errors. This estimate allows us to correct the erroneous standard error estimate in OLS due to error heteroscedasticity without the cost of specifying its exact form. For this, the only requirement to meet is to have a big sample. See Andrews (1991), Hamilton (1994) and Hayashi (2000).

3.2.2 Low Frequency Analysis

The second step in Altavilla et al. (2017) consists of accumulating the estimated responses along longer time horizons than one day. For this, let $N_t^{1,\tau} = \widehat{\Delta^1 Y_t^{\tau}}$ be fitted value at t from Equation (3), where the superscript 1 day indicates the horizon the response is estimated at.

In addition, let us notice that the spot change at a longer horizon h is

$$\Delta^h Y_t^\tau = Y_t^\tau - Y_{t-h}^\tau = \sum_{j=0}^{h-1} \Delta^1 Y_{t-j}^h \tag{4}$$

In a similar way, let us define the cumulative response of the daily spot change as follows

$$N_t^{h,\tau} = \sum_{j=0}^{h-1} N_{t-j}^{1,\tau} \tag{5}$$

where the horizon h correspond to either one month or one quarter, i.e. 22 and 66 market days, respectively. It can be easily seen that the procedure embodied by Equations (4) and (5) filters out high frequency noise "while retaining fluctuations with frequencies lower than h days", Altavilla et al. (2017, pp 34).

The second step model explains the variation of the spot rates with maturity τ years at a horizon of h days, $\Delta^h Y_t^\tau$, for $h = 22, 66$, in terms of the cumulative estimated response in Equation (5) as follows

$$\Delta^h Y_t^\tau = \gamma^{h,\tau} N_t^{h,\tau} + \nu_t^{h,\tau} \tag{6}$$

where $\gamma^{h,\tau}$ is the cumulative effect of news and controls on the spot rate with maturity τ at each horizon $h = 22, 66$ days. It is also easily noticed that this procedure ensures the orthogonality condition between the cumulative news and error terms. Furthermore, whenever γ is "bigger(smaller) than one, indicates a delayed (reversal of the) effect" on the spot rates, Altavilla et al. (2017, pp 35).

Equation (6) controls for many of the factors affecting the TES-COP spot rates. However, the flow of information available to traders include other factors such as political, social and corporate Colombian news as well as other international news, which are left to the error term. The flow of information also includes Colombian fiscal news, which we capture, at least partially, through its effect on the nominal exchange rate. Notwithstanding, Equation (6) has a causal character according to Altavilla et al. (2017, footnote 7 pp 36).

3.2.3 The Relative Persistence of Macroeconomic News Surprises and Residual Shocks

In order to disentangle the persistence of macroeconomic news surprises compared to the shocks left out in the error term, Altavilla et al. (2017, pp. 36) calculate a measure of aggregate shock persistence proposed by J. H. Cochrane (1988) and J. Cochrane and Sbordone (1988b). These authors put forward a measure of the persistence of a time series

X_t through the behaviour of $\frac{1}{h}V[X_t - X_{t-h}]$ along h. Whenever all shocks are incorporated to X_t "immediately and permanently", the series has a unit root, and thus $\frac{1}{h}V[X_t - X_{t-h}]$ "is constant with respect to h". Otherwise, when the effect of shocks reverse, this figure slopes downward, and when the effect of these shocks is delayed, it slopes upward.

To gauge these trends more precisely, it is worth noticing that

$$R^2_{h,\tau} = \frac{\frac{1}{h}V\left[\widehat{\Delta^h Y^\tau_t}\right]}{\frac{1}{h}V\left[\widehat{\Delta^h Y^\tau_t}\right] + \frac{1}{h}V\left[\Delta^h Y^\tau_t - \widehat{\Delta^h Y^\tau_t}\right]} \tag{7}$$

from where the change in the explanatory power of macroeconomic news surprises depends on the "relative persistence of two orthogonal components; the macro-news-related (the fit) and non-macro-news-related (the residual)". Altavilla et al. (2017, pp. 36).

4 Results

We present the results in three subsections. The first contains the estimation of Equation (3), thus emphasising on the short run reaction of the spot rates. The second encompass the estimation of Equation (6), while the third deals with the persistence results.

4.1 High Frequency Results

Estimation results from Equation (3) may be found in Tables A.3-A.7, where different measures of appetite for risk are employed. These results are consistent among the different estimations with respect to the effect of US macroeconomic data release surprises such as the policy rate, *US-PRUB-SS*, housing starts, *US-HS-SS*, and the ADP national employment report, *US-ADP-SS*.

Moreover, the results are fairly consistent, five out of six times are significant, for US budget statements, *US-BS-SS* and the nominal COP/USD exchange rate depreciation, *Deprec* (for the 10 year spot rate only).

Furthermore, the results tend to be consistent, i.e. significant four out of six times, for US jobless claims, *US-JC-SS*. In the same way, three out of six times the US consumer credit surprise is significantly different from zero. Colombian macroeconomic data release surprises appear significantly only once for exports, *C-EXP-SS*, at the two year maturity spot rate regression.

Colombian macroeconomic data releases surprises appear non-significant mostly. However, the coefficient size of important ones such as the policy rate, *C-PR-SS*, and manufacturing production, *C-MP-SS* are consistently bigger than other Colombian surprises. Furthermore, the effect of nominal depreciation on the 2 and 5 year spot rates changes have the same size as that of the 10 year spot rate, in spite of the fact that only the latter is significant.

We conclude that macroeconomic announcement surprises do affect high frequency (daily) TES-COP spot rate changes. These rates respond to US macroeconomic surprises and nominal COP/USD exchange rate depreciation, and surprisingly do not seem to respond to Colombian macroeconomic data release surprises and liquidity factors. However, important Colombian macroeconomic announcements such as the policy rate and manufacturing production display consistently big (but not significant) coefficients. The same happens to the coefficients associated to nominal local currency depreciation for the 2 and 5 year maturity spot rates.

4.2 Low Frequency Estimates

Estimation results for Equation (6) may be found in Tables A.9-A.14. These tables consistently show that macroeconomic news surprises explain a very small part of daily spot rate variations at all maturities, ranging between 5 and 7% as the R^2 estimates in the first row of each table demonstrates.

In addition, these tables show that the explanatory power of macroeconomic news surprises tends to increase with the spot rate change horizon. In fact, the R^2 in the second row, i.e. the spot change at all maturities over a month, are higher than those for one day spot rate changes for every risk appetite measure but *VIX*, which show a slight non-significant decline. Moreover, the share of the monthly change of the five year maturity spot rate variance explained by macroeconomic news surprises reach a maximum of 25% when the risk appetite measure employed is the 10 year *BAA* corporate bond spread.

This trend is confirmed unanimously for all risk appetite measures and spot rate maturities. Indeed, the share of quarterly spot changes variance explained by macroeconomic news surprises in the third row range between 15% and a substantial 34%. Finally, these tables also reveal that the explanatory power of macroeconomic surprises decreases with the maturity of the spot rate, especially for quarterly spot rate changes.

These results are consistent with the fit achieved by Equation (6), which is shown in Figures 5-10. The panels in the first row show that daily spot changes have a poor fit. However, the fit tends to improve as the change horizon increases to one month (22 days), middle row panels, and one quarter (66 days), third row panels. It is also noticeable the poor fit exhibited in the middle panels, i.e. monthly spot changes, at every maturity when the appetite for risk indicator employed was *VIX*, Figure 7. It is also remarkable the comparatively good fit reached when the appetite for risk measure employed is the corporate 10 year BAAA spread in Figure 8, which corresponds to noteworthy R^2's of 34%, 34% and 32% for 2, 5 and 10 year spot maturities, respectively, which may be found in Table A.12.

Our previous results are similar both in trends and values to Altavilla et al. (2017, T. 3, pp 26). Although their explanation power of macroeconomic news surprises for daily changes is higher, between 6% and 9%. Furthermore, our results show similar R^2's for monthly and quarterly spot changes at all maturities, i.e. 2, 5 and 10 years, respectively. More interestingly, our results share their downward explanation power trend within each spot change horizon, i.e. with the spot maturity. In our case this downward trend is not clear when the appetite for risk measure is either the 10 year corporate BAA spread and EMBIC, only, as can be deduced from Figure 11.

Finally, Tables A.9-A.14 also reveal that shocks have a delayed effect on spot changes, except when the appetite for risk measure is VIX for the monthly change of the spot rate of 2 year maturity. As a matter of fact, when the regression includes any other risk appetite measure γ is significantly greater than one, which according to Altavilla et al. (2017, pp. 35) means that the effect of macroeconomic news surprises is delayed. However, when VIX is included in the regression, Table A.11, the γ parameter for the monthly change of the two year spot rate is significantly smaller than one, which means that the effect of macroeconomic news reversed during the horizon. However, for the monthly change of 5 and 10 years spot rates γ is not significantly different than one. As a result, the explanatory power of macroeconomic news surprises increase with the horizon of the change, i.e. one day, one month and one quarter, and tends to fall with the maturity of the spot rate.

4.3 The Relative Persistence of Macroeconomic News Surprises and Residual Shocks

Figures 12-17 show the evolution along the maturity of the spot rates, i.e. two, five and ten years, of $\frac{1}{h}V\left[\Delta^h Y_t^\tau\right]$, $\frac{1}{h}V\left[\widehat{\Delta^h Y_t^\tau}\right]$, $\frac{1}{h}V\left[\Delta^h Y_t^\tau - \widehat{\Delta^h Y_t^\tau}\right]$, that is $\dfrac{1}{h}$ the variance of the spot rate change, the fit and the residuals, respectively. These figures show unanimously (for all the alternative risk appetite measures) that the effect of shocks to the monthly change of the spot rates tend to be delayed up to maturities of ten years. The fact that this behavior is similar between spot rates and residuals leads to macroeconomic news surprises to have an immediate and persistent effect, i.e. a flat $\frac{1}{h}V\left[\widehat{\Delta^h Y_t^\tau}\right]$.

As a result, the delayed effect of shocks on spot rates has to do with the delayed effect of residual shocks, which is consistent with macroeconomic news surprises shocks having an immediate and permanent effect.

5 Conclusion

Macroeconomic news surprises, especially those related to US data releases, affect TES-COP high frequency spot yield changes. More specifically, the US policy rate, housing starts and the ADP national employment report are significantly consistent among the alternative risk appetite measures and spot rate maturities. Other data releases such as US budget statements and jobless claims fairly consistently affect spot rate changes significantly. The only Colombian indicator that significantly affect spot rate changes is the nominal exchange rate depreciation for the daily change of the 10 year spot rate. These macroeconomic news surprises account for between 5% and 7% of high frequency (one day) spot change variability at all horizons. These results are coherent with those of Andritzky et al. (2007), but are at odds with those of Nowak et al. (2011), who encountered the same importance of international and local news when explaining price and volatility dynamics.

However, other Colombian macroeconomic news surprises such as the policy rate as well as manufacture production show comparatively big effect, albeit not significant on daily spot rate changes.

On longer horizons, one month and one quarter, the explanatory power of macroeconomic news surprises increases and may reach a substantial share of 34% of spot change variability. These shocks have an immediate and permanent effect on spot rate changes, which is consistent with spot rate changes and residual shocks having an equally delayed effect. These findings are coherent with those of Altavilla et al. (2017), who found a slow absorption of the macroeconomic news surprises, in the same direction of Nowak et al. (2011), who concludes that the information absorption in emerging markets is more prolonged than in developed economies. The high frequency analyses of Nowak et al. (2011) and Banerjee and Pradhan (2021) linked the longer persistence of the impact in emerging bond markets to the higher heterogeneity in investors' views compared to those of mature markets.

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Appendices

A Tables

Table A.1: Data and its Source

Source	Symbol	Mnemonic	Label
Colombian Financial Markets	Y_t^k	Sk	TES-COP Spot rate (percent per year) at a maturity of k years
	N_t	N-OPER	TES-COP Number of spot trades in the day
	V_t	VOL	TES-COP Traded volume in the day
	$\Delta\chi_t$	Deprec	FOREX Spot trade official COP/USD exchange rate
Risk Appetite Measures	$R_{1,t}$	MOVE	Merrill Lynch Option Volatility Estimate
	$R_{2,t}$	V2X	EURO STOXX 50 Options volatility
	$R_{3,t}$	VIX	SPX index options expected volatility
	$R_{4,t}$	SpreadBAA	Corporate BAA 10 year yield spread on 10 year treasury
	$R_{5,t}$	EMBIG	Emerging Markets Bond Index Global
	$R_{6,t}$	EMBIC	Emerging Markets Bond Index Colombia
Colombian Macroeconomic Data Releases	$A_{1,t}$	C-UNE	Urban Jobless Rate
	$A_{2,t}$	C-CPIM	CPI MoM
	$A_{3,t}$	C-EXP	Exports FOB
	$A_{4,t}$	C-PR	Policy rate
	$A_{5,t}$	C-MP	Manufacturing Production
	$A_{6,t}$	C-RS	Retail Sales
	$A_{7,t}$	C-GDP	GDP NSA YoY
	$A_{8,t}$	C-IMP	Imports
	$A_{9,t}$	C-TB	Trade Balance
US Macroeconomic Data Releases	$A_{10,t}$	US-GDP	GDP
	$A_{11,t}$	US-BI	Business Inventories
	$A_{12,t}$	US-CS	Construction Spending MoM
	$A_{13,t}$	US-ISM	ISM Manufacturing
	$A_{14,t}$	US-LR	US Leading Index
	$A_{15,t}$	US-NHS	New Home Sales
	$A_{16,t}$	US-PMI	Chicago PMI
	$A_{17,t}$	US-TB	Trade Balance
	$A_{18,t}$	US-CBCC	Conf. Board Consumer Confidence
	$A_{19,t}$	US-UNE	Jobless Rate
	$A_{20,t}$	US-CC	Consumer Credit
	$A_{21,t}$	US-PRUB	FOMC Rate UB
	$A_{22,t}$	US-BS	Budget Statement
	$A_{23,t}$	US-RS	Retail Sales
	$A_{24,t}$	US-HS	Housing Starts MoM
	$A_{25,t}$	US-NP	Nonfarm Payrolls
	$A_{26,t}$	US-ADP	ADP National Employment Report
	$A_{27,t}$	US-JC	Jobless Claims
	$A_{28,t}$	US-CPIM	CPI MoM
	$A_{29,t}$	US-PPI	PPI YoY
	$A_{30,t}$	US-DG	Durable Goods
	$A_{31,t}$	US-FO	Factory Orders
	$A_{32,t}$	US-IP	Industrial Production
	$A_{33,t}$	US-PS	Personal Spending

Source Authors' compilation

Table A.2: Data set Under Analysis

Símbolo	Nombre	Fuente
$\Delta q_t = \Delta \left(\ln(P_t^F) - \ln(P_t^{NFR}) \right)$	Cambio de los Precios Relativos	DANE[b]
N_t	Oceanic Niño Index ONI	NOAA[c]
$I_t(l)$	Indicador de Intensidad ONI	
E_t	Tasa de Cambio COP/USD Nominal	BR[d]
P_t^O	Precio Internacional del Petróleo	USD/Barril EIA[e]
R_t	Tasa de Cambio Real	BR[d]

Source: Authors' Compilation

Table A.3: High Frequency Model Estimation Based on Standardised Surprises Employing MOVE

Regressor	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
(Intercept)	-0.01	-0.01	0.00
C-UNE-SS	0.00	0.00	0.00
C-CPIM-SS	0.00	-0.01	-0.01
C-EXP-SS	-0.01	-0.01	-0.01
C-PR-SS	-0.02	-0.01	-0.01
C-MP-SS	-0.02	-0.02	-0.01
C-RS-SS	0.00	0.01	0.01
C-GDP-SS	-0.01	-0.01	-0.01
C-IMP-SS	0.00	0.00	0.00
C-TB-SS	0.01	0.01	0.01
US-GDP-SS	-0.01	-0.01	-0.01
US-BI-SS	0.00	0.00	0.00
US-CS-SS	0.01	0.01	0.00
US-ISM-SS	0.01	0.01	0.00
US-LR-SS	0.01	0.00	0.00
US-NHS-SS	0.01	0.01	0.01
US-PMI-SS	-0.02	-0.02	-0.03
US-TB-SS	0.00	0.00	0.00
US-CBCC-SS	-0.01	-0.02	-0.02
US-UNE-SS	0.00	0.01	0.02
US-CC-SS	0.01	0.00	0.00
US-PRUB-SS	**-0.01**	**-0.02**	**-0.02**
US-BS-SS	**0.01**	**0.01**	**0.01**
US-RS-SS	0.00	0.00	-0.01
US-HS-SS	**-0.02**	**-0.02**	**-0.02**
US-NP-SS	0.00	0.01	0.02
US-ADP-SS	**-0.01**	**-0.01**	**-0.01**
US-JC-SS	0.00	-0.01	**-0.01**
US-CPIM-SS	-0.01	-0.01	0.00
US-PPI-SS	0.00	-0.01	-0.01
US-DG-SS	0.01	0.02	0.02
US-FO-SS	0.00	0.00	-0.01
US-IP-SS	-0.01	-0.01	-0.01
US-PS-SS	0.01	0.01	0.01
Deprec	0.02	0.02	**0.02**
N-OPER	0.00	0.00	0.00
VOL	0.00	0.00	0.00
DMOVE	0.00	0.00	0.00

Source: Authors' calculation

Table A.4: High Frequency Model Estimation Based on Standardised Surprises Employing V2X

Regressor	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
(Intercept)	-0.01	-0.01	0.00
C-UNE-SS	0.00	0.00	0.00
C-CPIM-SS	-0.01	-0.01	-0.01
C-EXP-SS	-0.01	-0.01	-0.01
C-PR-SS	-0.02	-0.01	-0.01
C-MP-SS	-0.02	-0.02	-0.01
C-RS-SS	0.00	0.01	0.01
C-GDP-SS	-0.01	-0.01	-0.01
C-IMP-SS	0.00	0.00	0.00
C-TB-SS	0.01	0.01	0.01
US-GDP-SS	0.00	-0.01	-0.01
US-BI-SS	0.00	0.00	0.00
US-CS-SS	0.01	0.01	0.01
US-ISM-SS	0.01	0.01	0.00
US-LR-SS	0.01	0.00	0.01
US-NHS-SS	0.01	0.01	0.01
US-PMI-SS	-0.02	-0.03	-0.03
US-TB-SS	0.00	0.00	0.00
US-CBCC-SS	-0.01	-0.02	-0.02
US-UNE-SS	0.00	0.00	0.02
US-CC-SS	**0.01**	0.01	0.00
US-PRUB-SS	**-0.02**	**-0.02**	**-0.02**
US-BS-SS	**0.01**	**0.02**	**0.02**
US-RS-SS	0.00	-0.01	-0.01
US-HS-SS	**-0.02**	**-0.02**	**-0.02**
US-NP-SS	0.00	0.01	0.02
US-ADP-SS	**-0.01**	**-0.01**	**-0.02**
US-JC-SS	0.00	0.00	**-0.01**
US-CPIM-SS	-0.01	-0.01	-0.01
US-PPI-SS	0.00	-0.01	-0.01
US-DG-SS	0.01	0.02	0.02
US-FO-SS	0.00	0.00	-0.01
US-IP-SS	-0.01	-0.02	-0.02
US-PS-SS	0.01	0.01	0.00
Deprec	0.02	0.02	**0.02**
N-OPER	0.00	0.00	0.00
VOL	0.00	0.00	0.00
DV2X	0.00	0.00	0.00

Source: Authors' calculation

Table A.5: High Frequency Model Estimation Based on Standardised Surprises Employing VIX

Regressor	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
(Intercept)	-0.01	-0.01	0.00
C-UNE-SS	0.00	0.00	0.00
C-CPIM-SS	0.00	-0.01	-0.01
C-EXP-SS	**-0.02**	-0.02	-0.01
C-PR-SS	-0.02	-0.01	-0.01
C-MP-SS	-0.02	-0.01	-0.01
C-RS-SS	0.00	0.01	0.01
C-GDP-SS	-0.01	-0.02	-0.01
C-IMP-SS	0.00	0.00	0.00
C-TB-SS	0.01	0.01	0.01
US-GDP-SS	0.00	-0.01	-0.01
US-BI-SS	0.00	0.00	0.00
US-CS-SS	0.01	0.01	0.01
US-ISM-SS	**0.01**	0.01	0.00
US-LR-SS	0.01	0.00	0.01
US-NHS-SS	0.01	0.01	0.01
US-PMI-SS	-0.01	-0.02	-0.03
US-TB-SS	0.00	0.00	0.00
US-CBCC-SS	-0.01	-0.02	-0.02
US-UNE-SS	0.00	0.01	0.02
US-CC-SS	**0.01**	0.01	0.00
US-PRUB-SS	**-0.01**	**-0.02**	**-0.02**
US-BS-SS	0.01	0.01	0.01
US-RS-SS	0.00	-0.01	-0.01
US-HS-SS	**-0.02**	**-0.02**	**-0.02**
US-NP-SS	0.01	0.01	0.02
US-ADP-SS	**-0.01**	**-0.01**	**-0.02**
US-JC-SS	0.00	0.00	**-0.01**
US-CPIM-SS	-0.01	-0.01	0.00
US-PPI-SS	0.00	0.00	0.00
US-DG-SS	0.01	0.02	0.02
US-FO-SS	0.00	0.00	-0.01
US-IP-SS	-0.01	-0.01	-0.02
US-PS-SS	0.01	0.01	0.01
Deprec	0.02	0.02	**0.02**
N-OPER	0.00	0.00	0.00
VOL	0.00	0.00	0.00
DVIX	0.00	0.00	0.00

Source: Authors' calculation

Table A.6: High Frequency Model Estimation Based on Standardised Surprises Employing SpreadBAA

Regressor	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
(Intercept)	-0.01	-0.01	0.00
C-UNE-SS	0.00	0.00	0.00
C-CPIM-SS	0.00	-0.01	-0.01
C-EXP-SS	-0.01	-0.01	-0.01
C-PR-SS	-0.02	-0.01	-0.01
C-MP-SS	-0.02	-0.01	-0.01
C-RS-SS	0.00	0.01	0.01
C-GDP-SS	-0.01	-0.01	-0.01
C-IMP-SS	0.00	0.00	0.00
C-TB-SS	0.01	0.01	0.01
US-GDP-SS	-0.01	-0.01	-0.01
US-BI-SS	0.00	0.00	0.00
US-CS-SS	0.01	0.01	0.01
US-ISM-SS	0.01	0.01	0.00
US-LR-SS	0.01	0.00	0.00
US-NHS-SS	0.01	0.01	0.01
US-PMI-SS	-0.02	-0.02	-0.03
US-TB-SS	0.00	0.00	0.00
US-CBCC-SS	-0.01	-0.02	-0.02
US-UNE-SS	0.00	0.00	0.01
US-CC-SS	**0.01**	0.01	0.00
US-PRUB-SS	**-0.02**	**-0.02**	**-0.02**
US-BS-SS	**0.01**	**0.02**	**0.02**
US-RS-SS	0.00	-0.01	-0.01
US-HS-SS	**-0.02**	**-0.02**	**-0.02**
US-NP-SS	0.00	0.00	0.01
US-ADP-SS	**-0.01**	**-0.01**	**-0.02**
US-JC-SS	0.00	-0.01	**-0.01**
US-CPIM-SS	-0.01	-0.01	-0.01
US-PPI-SS	-0.01	-0.01	-0.01
US-DG-SS	0.01	0.02	0.02
US-FO-SS	0.00	0.00	-0.01
US-IP-SS	-0.01	-0.01	-0.01
US-PS-SS	0.01	0.01	0.00
Deprec	0.02	0.02	0.02
N-OPER	0.00	0.00	0.00
VOL	0.00	0.00	0.00
DSpreadBAA	0.08	0.21	0.28

Source: Authors' calculation

Table A.7: High Frequency Model Estimation Based on Standardised Surprises Employing EMBIG

Regressor	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
(Intercept)	-0.01	-0.01	0.00
C-UNE-SS	0.00	0.00	0.00
C-CPIM-SS	-0.01	-0.01	-0.01
C-EXP-SS	-0.01	-0.01	-0.01
C-PR-SS	-0.02	-0.01	-0.01
C-MP-SS	-0.02	-0.02	-0.01
C-RS-SS	0.00	0.01	0.01
C-GDP-SS	-0.01	-0.01	-0.01
C-IMP-SS	0.00	0.00	0.00
C-TB-SS	0.01	0.01	0.01
US-GDP-SS	0.00	-0.01	-0.01
US-BI-SS	0.00	0.00	0.00
US-CS-SS	0.01	0.01	0.00
US-ISM-SS	0.01	0.01	0.00
US-LR-SS	0.01	0.00	0.00
US-NHS-SS	0.01	0.01	0.01
US-PMI-SS	-0.02	-0.02	-0.03
US-TB-SS	0.00	0.00	0.00
US-CBCC-SS	-0.01	-0.02	-0.02
US-UNE-SS	0.00	0.00	0.01
US-CC-SS	**0.01**	0.01	0.00
US-PRUB-SS	**-0.02**	**-0.02**	**-0.02**
US-BS-SS	0.01	**0.02**	**0.02**
US-RS-SS	0.00	0.00	-0.01
US-HS-SS	**-0.02**	**-0.02**	**-0.02**
US-NP-SS	0.01	0.01	0.02
US-ADP-SS	0.00	**-0.01**	**-0.02**
US-JC-SS	0.00	0.00	**-0.01**
US-CPIM-SS	-0.01	-0.01	0.00
US-PPI-SS	0.00	-0.01	-0.01
US-DG-SS	0.01	0.02	0.02
US-FO-SS	0.00	0.00	-0.01
US-IP-SS	-0.01	-0.01	-0.02
US-PS-SS	0.00	0.01	0.01
Deprec	0.02	0.02	**0.02**
N-OPER	0.00	0.00	0.00
VOL	0.00	0.00	0.00
DEMBIG	0.00	0.00	0.00

Source: Authors' calculation

Table A.8: High Frequency Model Estimation Based on Standardised Surprises Employing EMBIC

Regressor	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
(Intercept)	-0.01	-0.01	0.00
C-UNE-SS	0.00	0.00	0.00
C-CPIM-SS	-0.01	-0.01	-0.01
C-EXP-SS	-0.01	-0.01	-0.01
C-PR-SS	-0.02	-0.01	-0.01
C-MP-SS	-0.02	-0.02	-0.01
C-RS-SS	0.00	0.01	0.01
C-GDP-SS	-0.01	-0.01	-0.01
C-IMP-SS	0.00	0.00	0.00
C-TB-SS	0.01	0.01	0.01
US-GDP-SS	0.00	-0.01	-0.01
US-BI-SS	0.00	0.00	0.00
US-CS-SS	0.01	0.01	0.00
US-ISM-SS	0.01	0.01	0.00
US-LR-SS	0.01	0.00	0.00
US-NHS-SS	0.01	0.01	0.01
US-PMI-SS	-0.02	-0.02	-0.03
US-TB-SS	0.00	0.00	0.00
US-CBCC-SS	-0.01	-0.02	-0.02
US-UNE-SS	0.00	0.00	0.02
US-CC-SS	**0.01**	0.01	0.00
US-PRUB-SS	**-0.02**	**-0.02**	**-0.02**
US-BS-SS	0.01	**0.02**	**0.02**
US-RS-SS	0.00	-0.01	-0.01
US-HS-SS	**-0.02**	**-0.02**	**-0.02**
US-NP-SS	0.00	0.01	0.02
US-ADP-SS	**-0.01**	**-0.01**	**-0.02**
US-JC-SS	0.00	0.00	**-0.01**
US-CPIM-SS	-0.01	-0.01	0.00
US-PPI-SS	0.00	-0.01	-0.01
US-DG-SS	0.01	0.02	0.02
US-FO-SS	0.00	0.00	-0.01
US-IP-SS	-0.01	-0.02	-0.02
US-PS-SS	0.01	0.01	0.01
Deprec	0.02	0.02	**0.02**
N-OPER	0.00	0.00	0.00
VOL	0.00	0.00	0.00
DEMBIC	0.00	0.00	0.00

Source: Authors' calculation

Table A.9: Macroeconomic Surprises Effect on TES-COP Spot Rates Employing MOVE

Statistic	**Horizon**	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
R^2 High Freq. Regr.	1	0.06	0.06	0.06
R^2 High Freq. Regr.	22	0.20	0.18	0.13
R^2 High Freq. Regr.	66	0.34	0.28	0.22
$\hat{\gamma}$ Low Freq. Regr.	22	1.54	1.54	1.46
SE		(0.10)	(0.11)	(0.13)
$\hat{\gamma}$ Low Freq. Regr.	66	1.72	1.49	1.39
SE		(0.08)	(0.08)	(0.07)

[a] *Source:* Authors' calculations
[b] Standard error in parenthesis
[c] R^2 and $\hat{\gamma}$ from Equation (6)

Table A.10: Macroeconomic Surprises Effect on TES-COP Spot Rates Employing V2X

Statistic	**Horizon**	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
R^2 High Freq. Regr.	1	0.05	0.05	0.05
R^2 High Freq. Regr.	22	0.15	0.16	0.13
R^2 High Freq. Regr.	66	0.30	0.27	0.21
$\hat{\gamma}$ Low Freq. Regr.	22	1.35	1.48	1.46
SE		(0.08)	(0.10)	(0.13)
$\hat{\gamma}$ Low Freq. Regr.	66	1.68	1.47	1.38
SE		(0.08)	(0.08)	(0.07)

[a] *Source:* Authors' calculations
[b] Standard error in parenthesis
[c] R^2 and $\hat{\gamma}$ from Equation (6)

Table A.11: Macroeconomic Surprises Effect on TES-COP Spot Rates Employing VIX

Statistic	**Horizon**	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
R^2 High Freq. Regr.	1	0.07	0.06	0.05
R^2 High Freq. Regr.	22	0.05	0.05	0.04
R^2 High Freq. Regr.	66	0.23	0.19	0.15
$\hat{\gamma}$ Low Freq. Regr.	22	0.81	0.89	0.90
SE		(0.10)	(0.11)	(0.14)
$\hat{\gamma}$ Low Freq. Regr.	66	1.56	1.34	1.26
SE		(0.09)	(0.09)	(0.08)

[a] *Source:* Authors' calculations
[b] Standard error in parenthesis
[c] R^2 and $\hat{\gamma}$ from Equation (6)

Table A.12: Macroeconomic Surprises Effect on TES-COP Spot Rates Employing SpreadBAA

Statistic	**Horizon**	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
R^2 High Freq. Regr.	1	0.06	0.06	0.06
R^2 High Freq. Regr.	22	0.21	0.25	0.23
R^2 High Freq. Regr.	66	0.34	0.34	0.32
$\hat{\gamma}$ Low Freq. Regr.	22	1.50	1.57	1.55
SE		(0.10)	(0.12)	(0.14)
$\hat{\gamma}$ Low Freq. Regr.	66	1.65	1.41	1.35
SE		(0.08)	(0.06)	(0.06)

[a] *Source:* Authors' calculations
[b] Standard error in parenthesis
[c] R^2 and $\hat{\gamma}$ from Equation (6)

Table A.13: Macroeconomic Surprises Effect on TES-COP Spot Rates Employing EMBIG

Statistic	**Horizon**	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
R^2 High Freq. Regr.	1	0.06	0.05	0.05
R^2 High Freq. Regr.	22	0.09	0.11	0.13
R^2 High Freq. Regr.	66	0.27	0.24	0.22
$\hat{\gamma}$ Low Freq. Regr.	22	1.08	1.28	1.40
SE		(0.09)	(0.09)	(0.14)
$\hat{\gamma}$ Low Freq. Regr.	66	1.61	1.43	1.38
SE		(0.09)	(0.08)	(0.07)

[a] *Source:* Authors' calculations
[b] Standard error in parenthesis
[c] R^2 and $\hat{\gamma}$ from Equation (6)

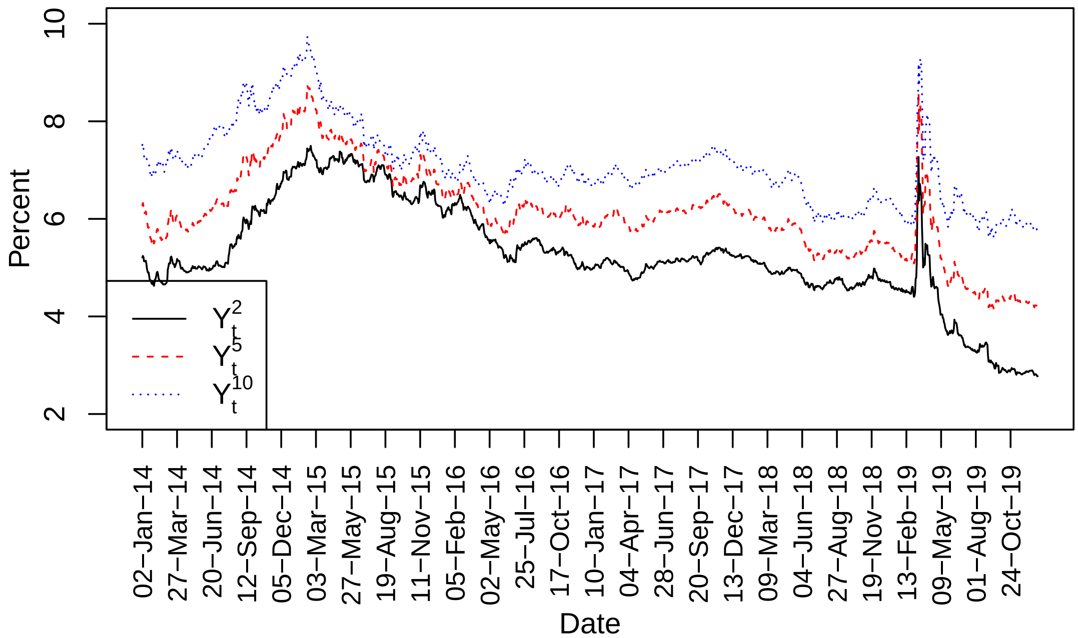
Table A.14: Macroeconomic Surprises Effect on TES-COP Spot Rates Employing EMBIC

Statistic	**Horizon**	ΔY_t^2	ΔY_t^5	ΔY_t^{10}
R^2 High Freq. Regr.	1	0.06	0.05	0.06
R^2 High Freq. Regr.	22	0.12	0.19	0.22
R^2 High Freq. Regr.	66	0.29	0.29	0.32
$\hat{\gamma}$ Low Freq. Regr.	22	1.26	1.54	1.64
SE		(0.08)	(0.11)	(0.14)
$\hat{\gamma}$ Low Freq. Regr.	66	1.67	1.50	1.49
SE		(0.09)	(0.07)	(0.06)

[a] *Source:* Authors' calculations
[b] Standard error in parenthesis
[c] R^2 and $\hat{\gamma}$ from Equation (6)

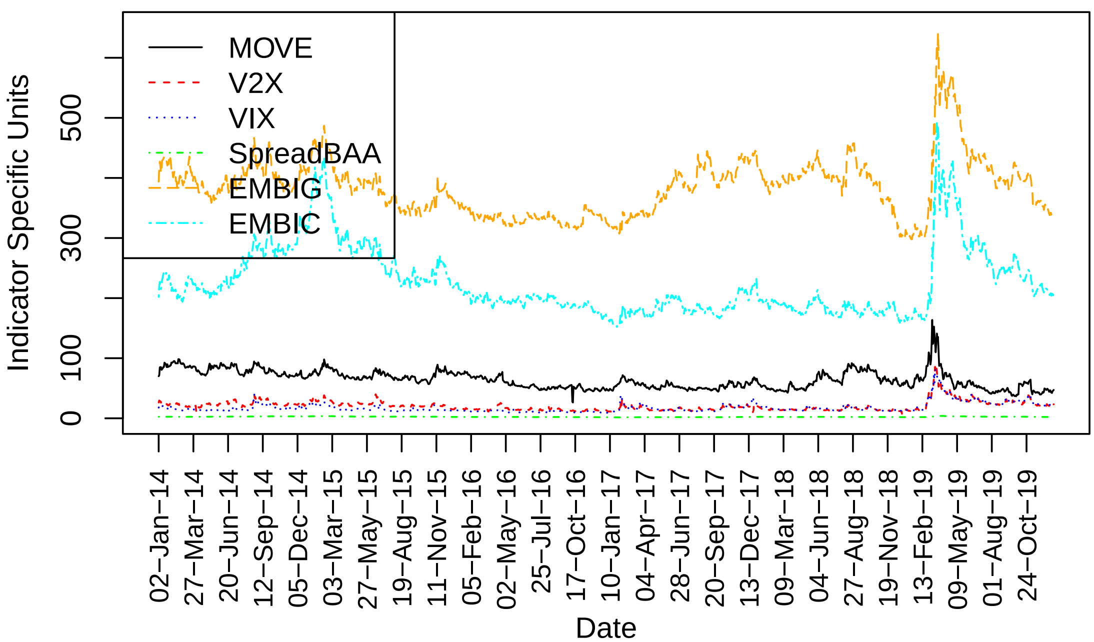
B Figures

Figure 1: TES-COP Spot Rates at 2, 5 and 10 Years



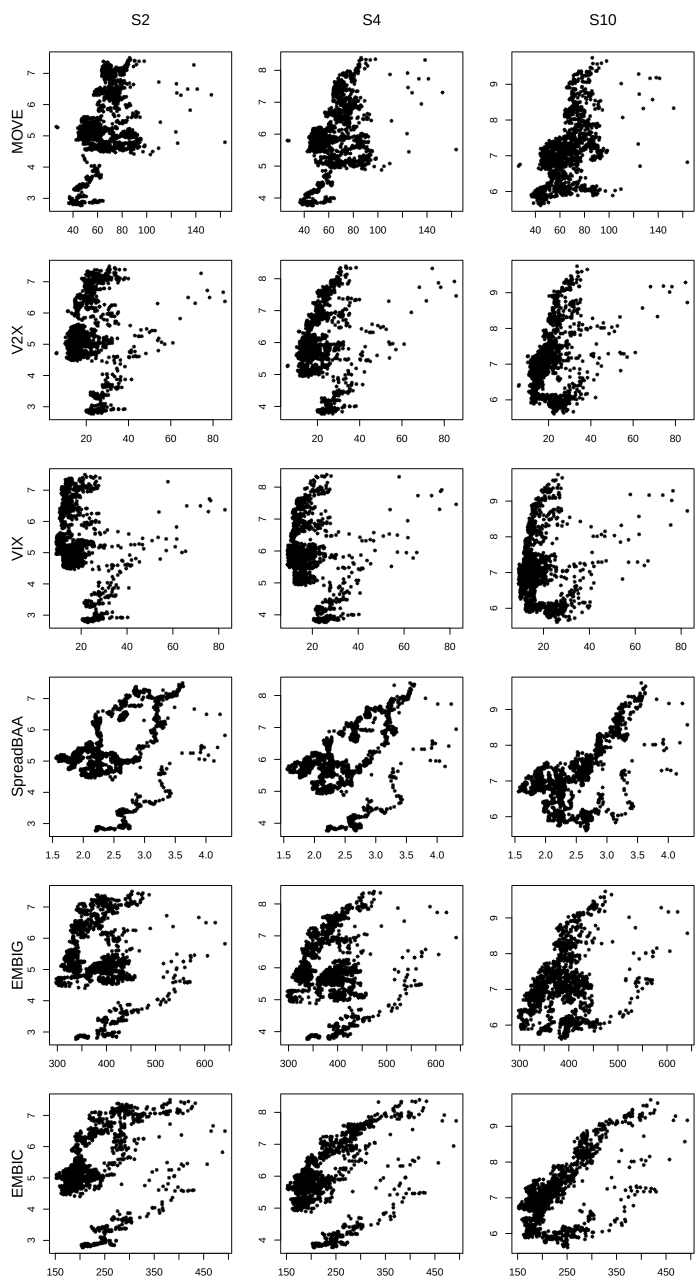
Source: Authors' calculations

Figure 2: Financial Investors Risk Appetite Measures



Source: Authors' calculations

Figure 3: Relationship Between TES-COP Spot Rates and Risk Appetite Measures

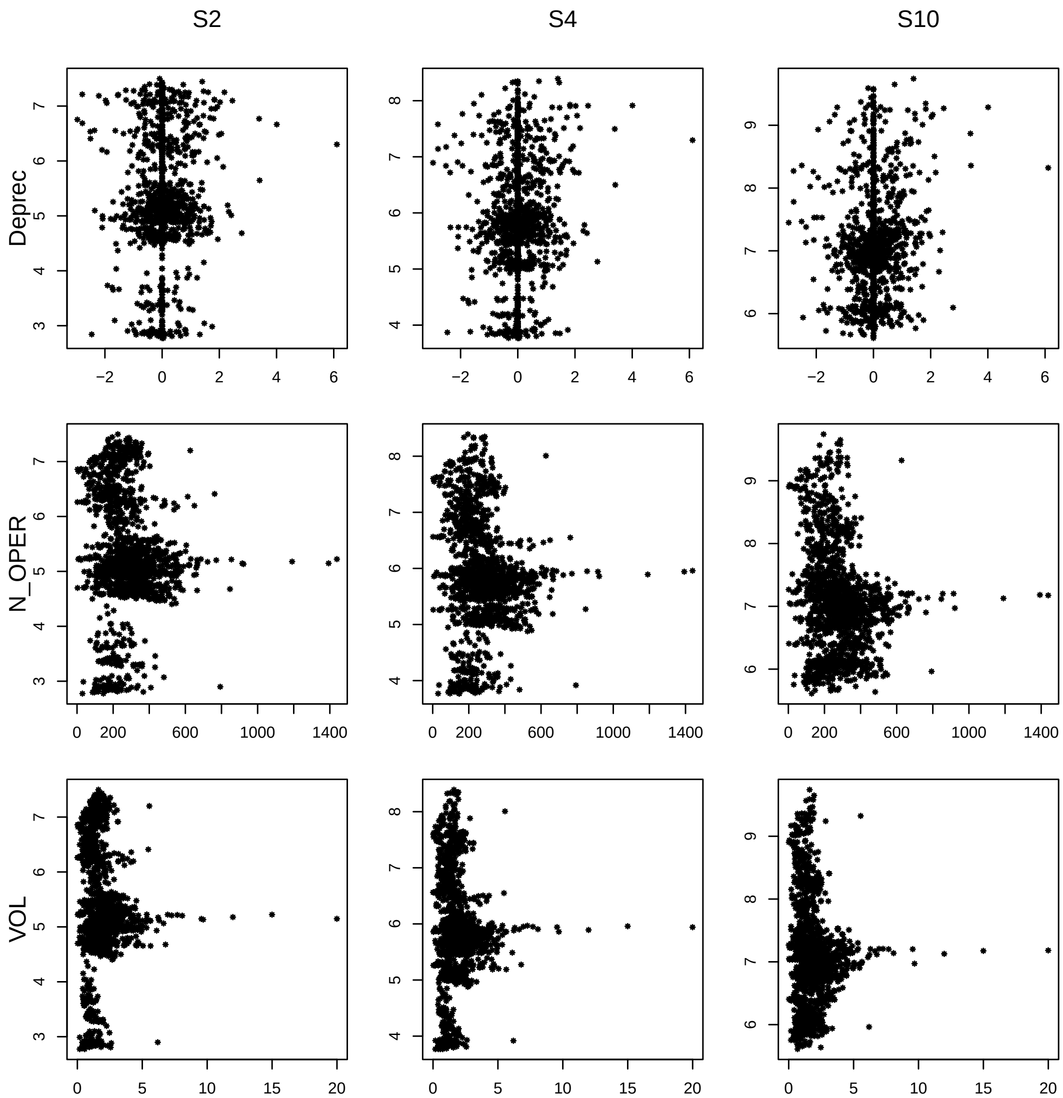


Source: Authors' calculations

Left labels indicate x-axis variables

Top labels indicate y-axis variables

Figure 4: Relationship of Spot Rates with Liquidity Measures and Nominal Exchange Rate Depreciation

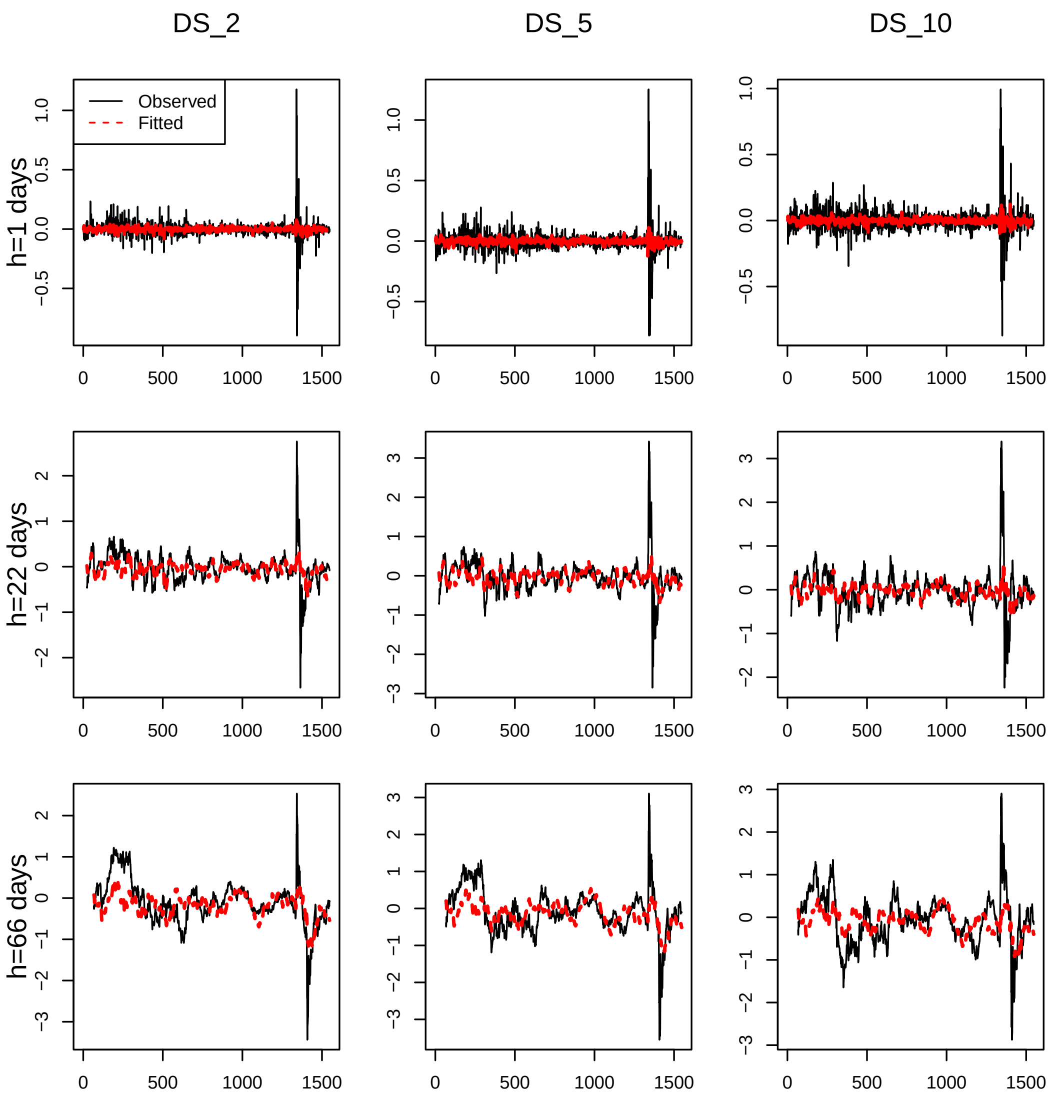


Source: Authors' calculations

Left labels indicate x-axis variables

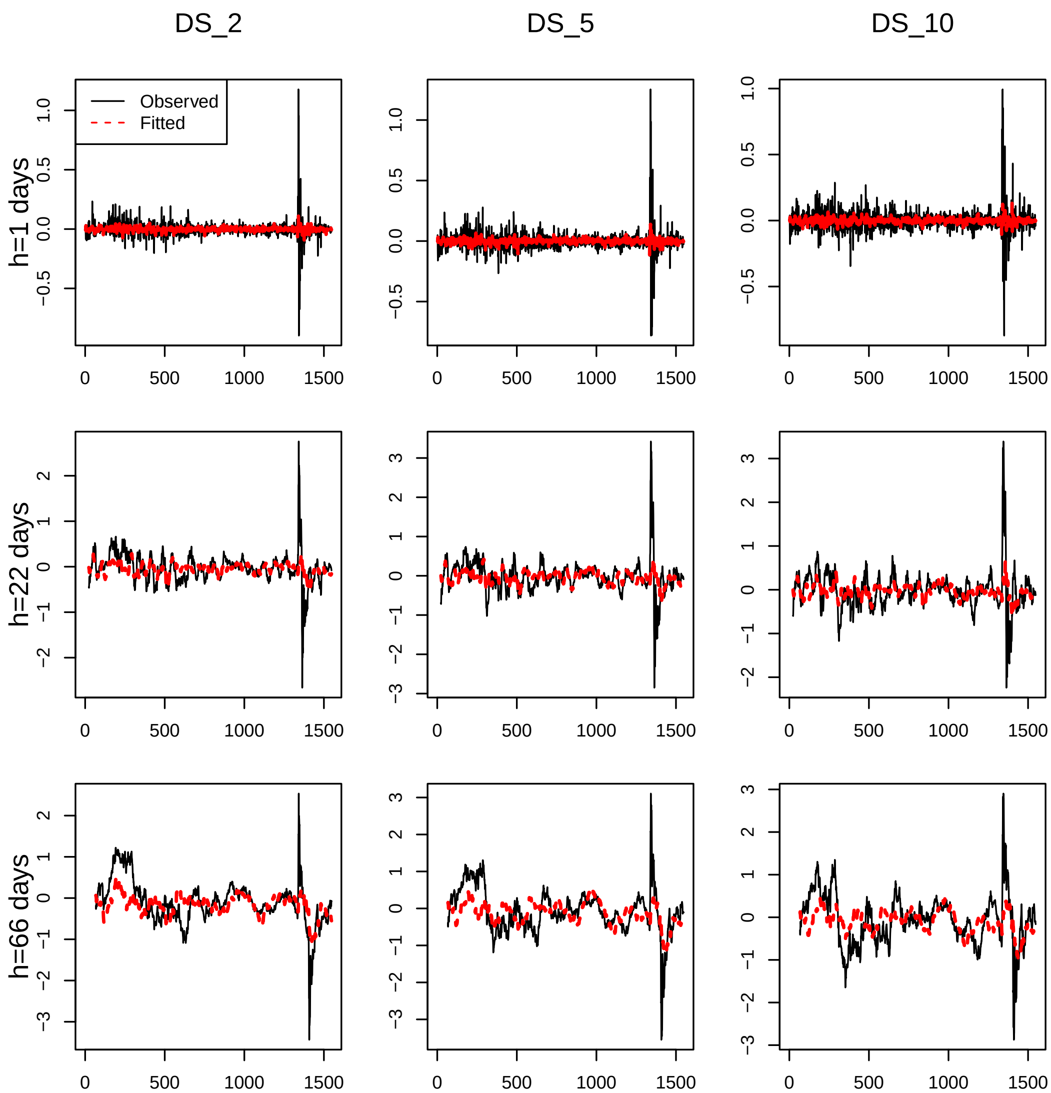
Top labels indicate y-axis variables

Figure 5: Daily, Monthly and Quarterly Cumulative Spot Rates and their Fit Employing MOVE



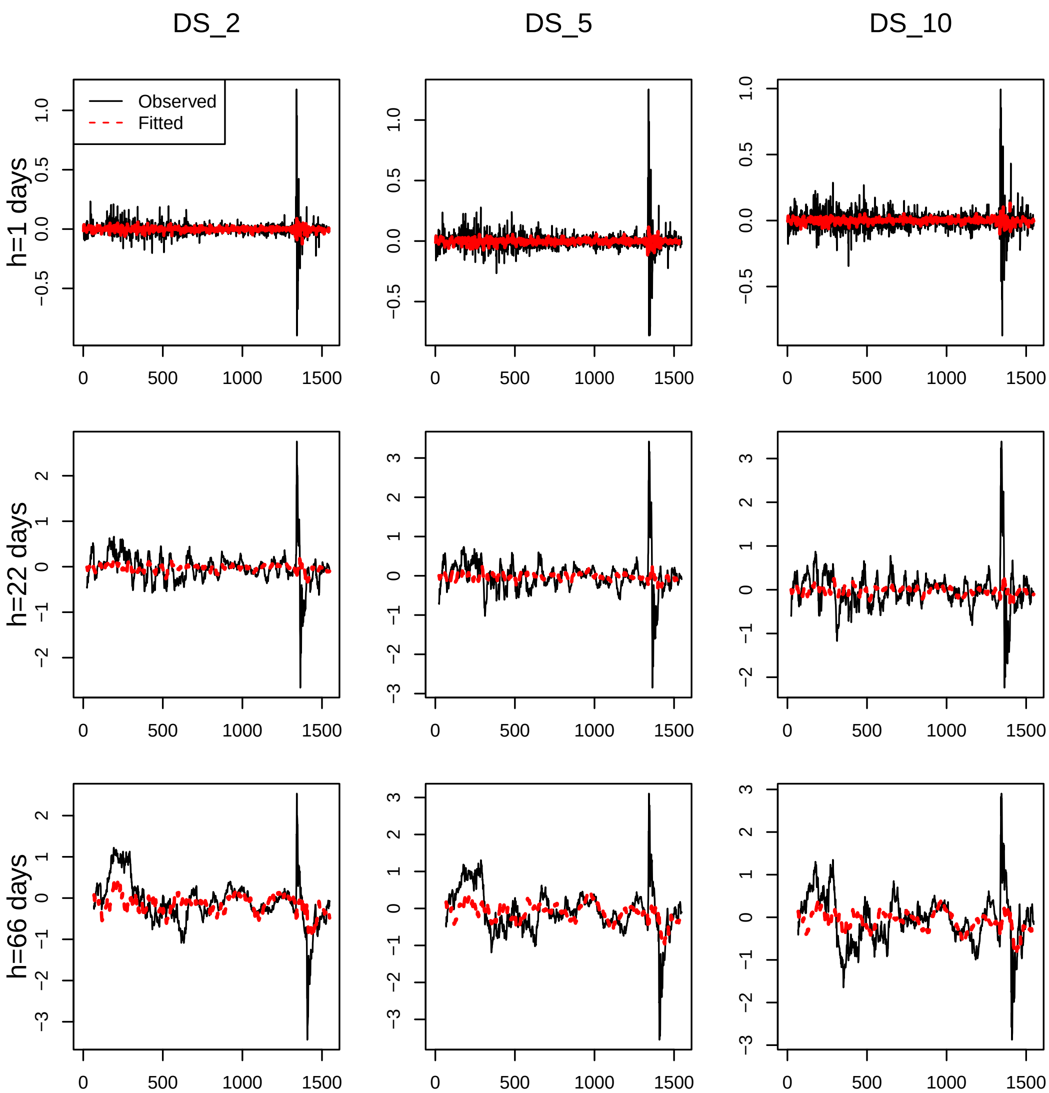
Source: Authors' calculation

Figure 6: Daily, Monthly and Quarterly Cumulative Spot Rates and their Fit Employing V2X



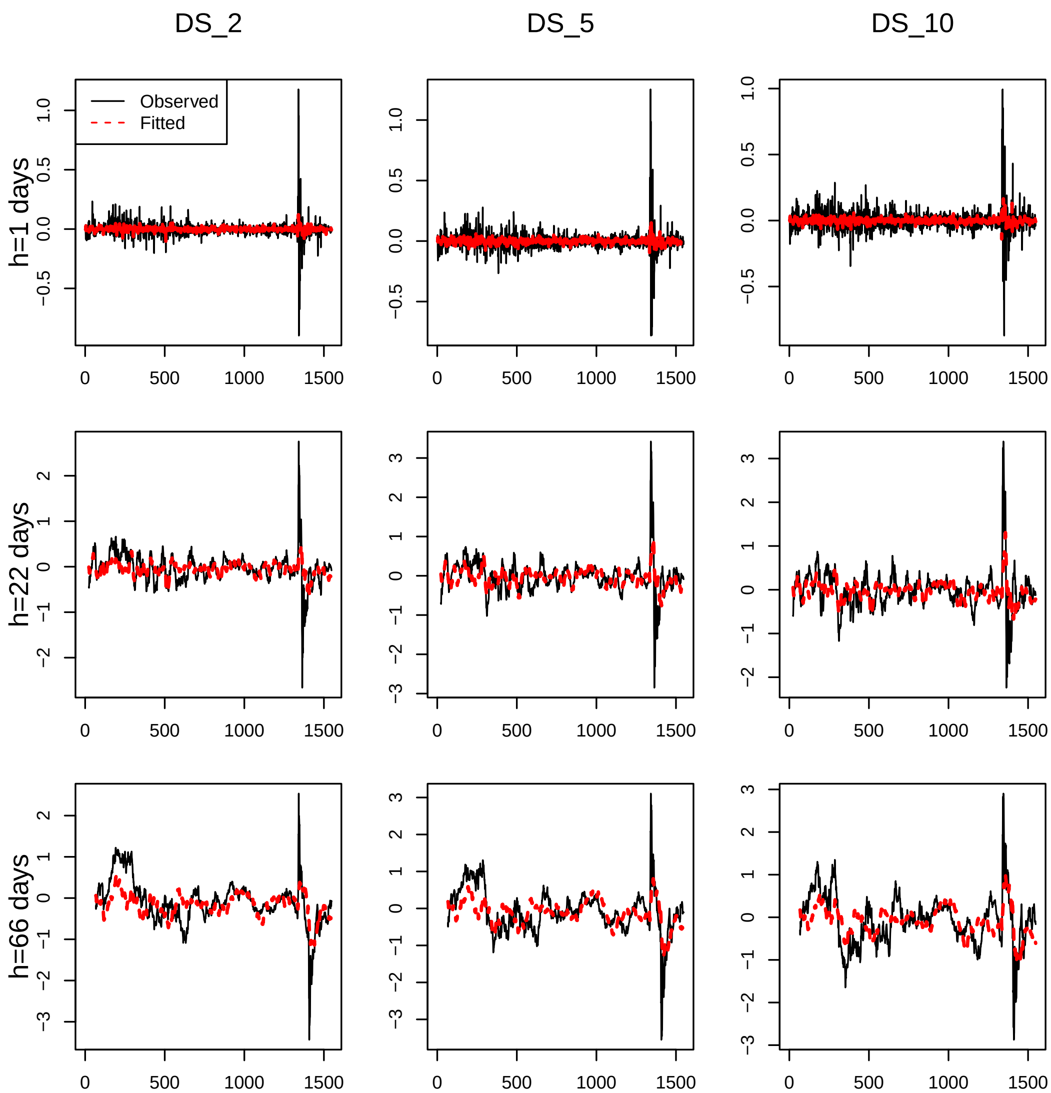
Source: Authors' calculation

Figure 7: Daily, Monthly and Quarterly Cumulative Spot Rates and their Fit Employing VIX



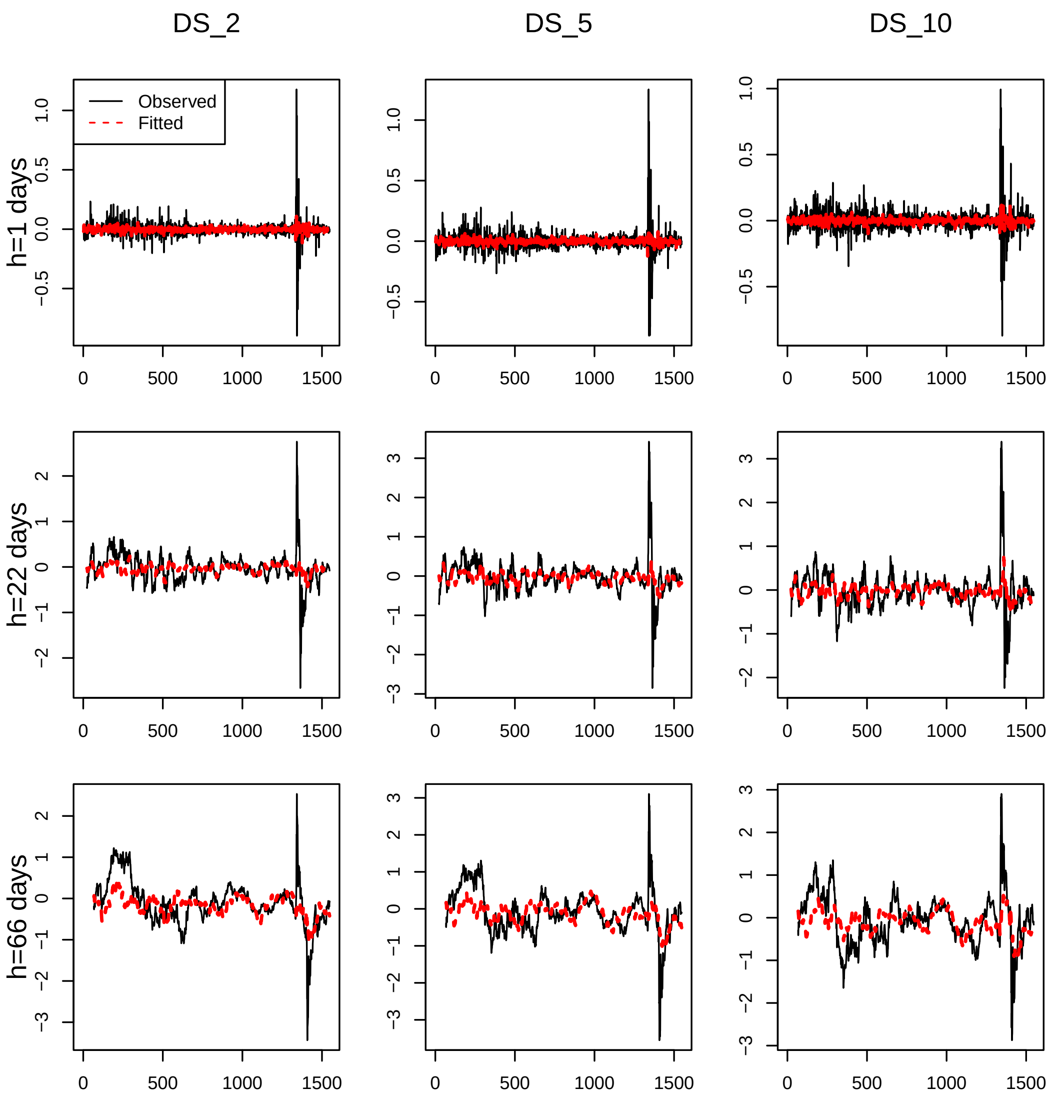
Source: Authors' calculation

Figure 8: Daily, Monthly and Quarterly Cumulative Spot Rates and their Fit Employing SpreadBAA



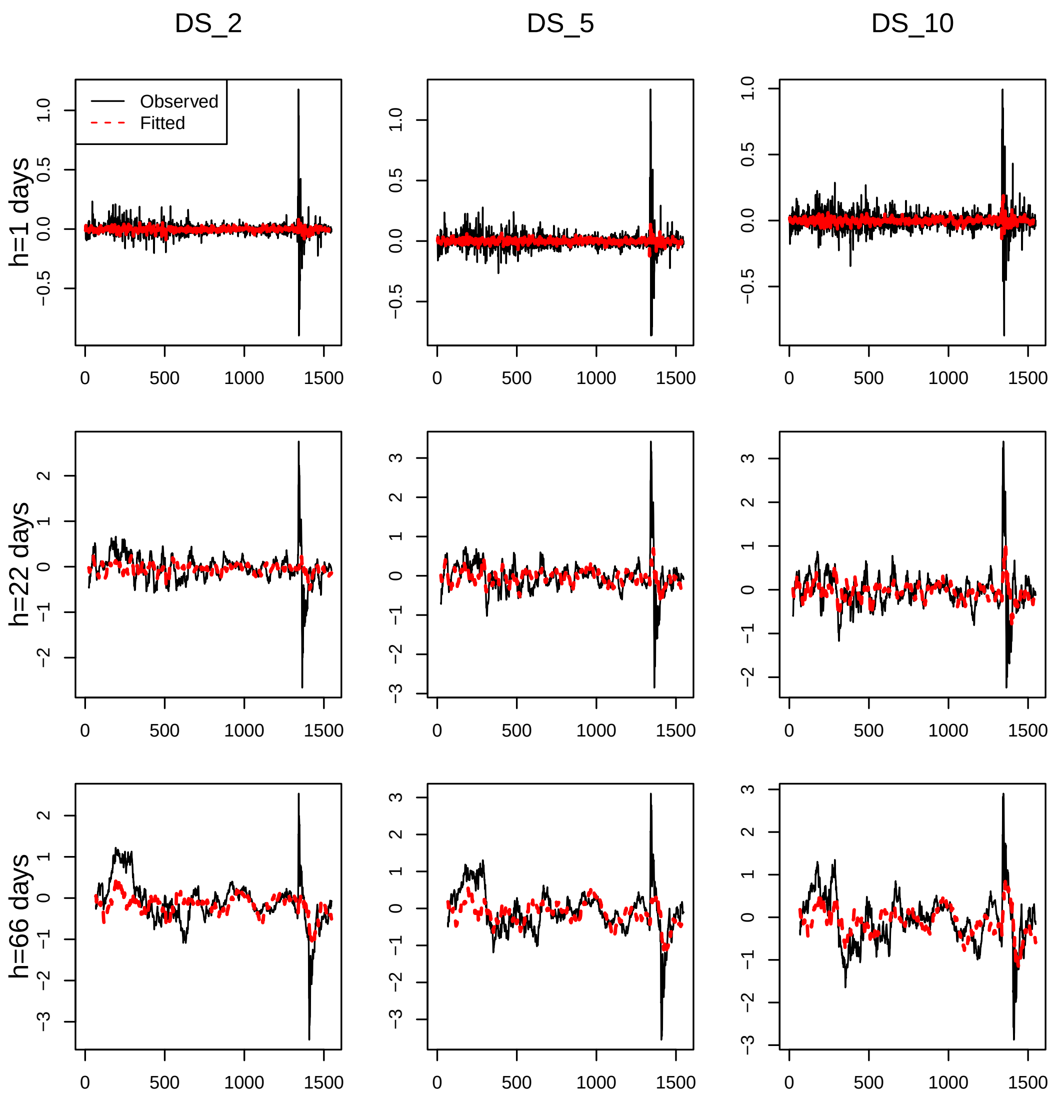
Source: Authors' calculation

Figure 9: Daily, Monthly and Quarterly Cumulative Spot Rates and their Fit Employing EMBIG



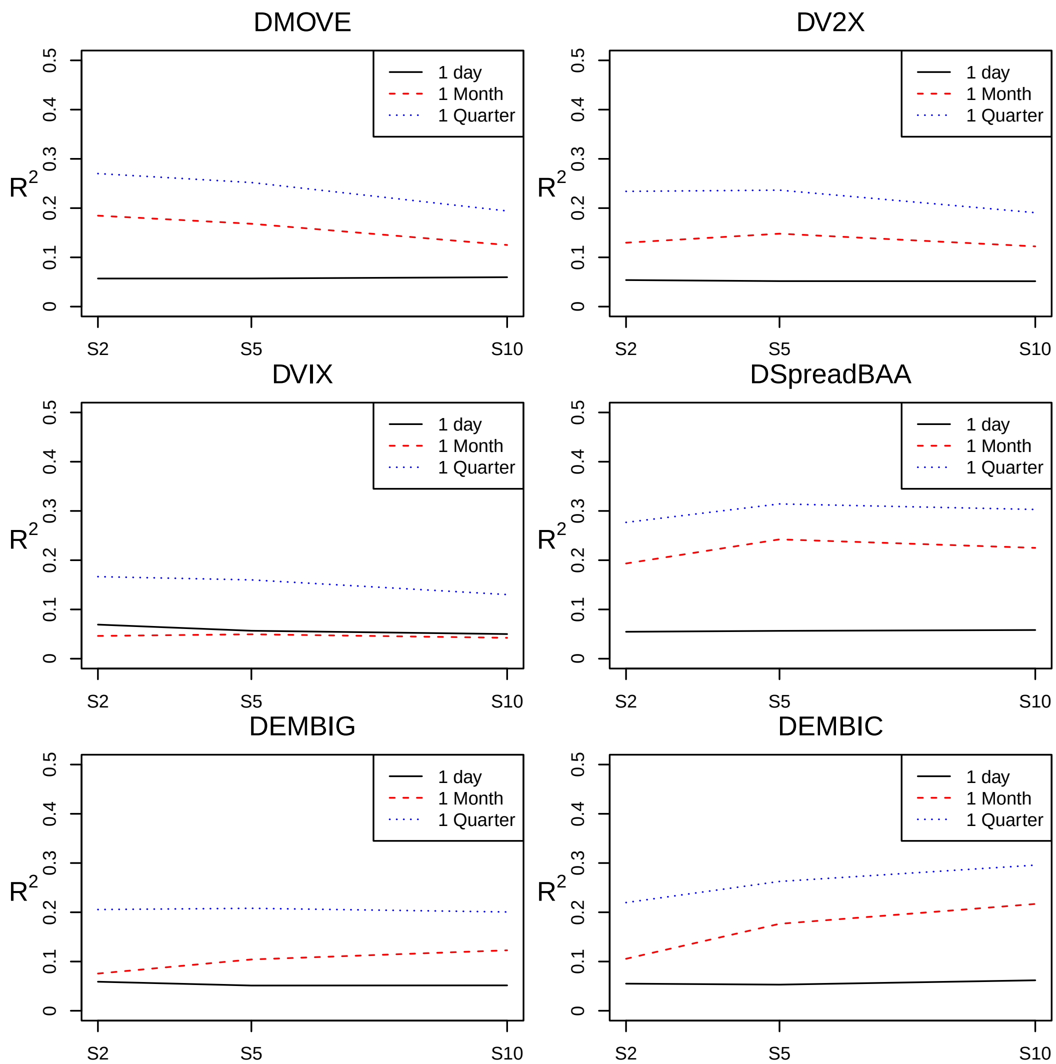
Source: Authors' calculation

Figure 10: Daily, Monthly and Quarterly Cumulative Spot Rates and their Fit Employing EMBIC



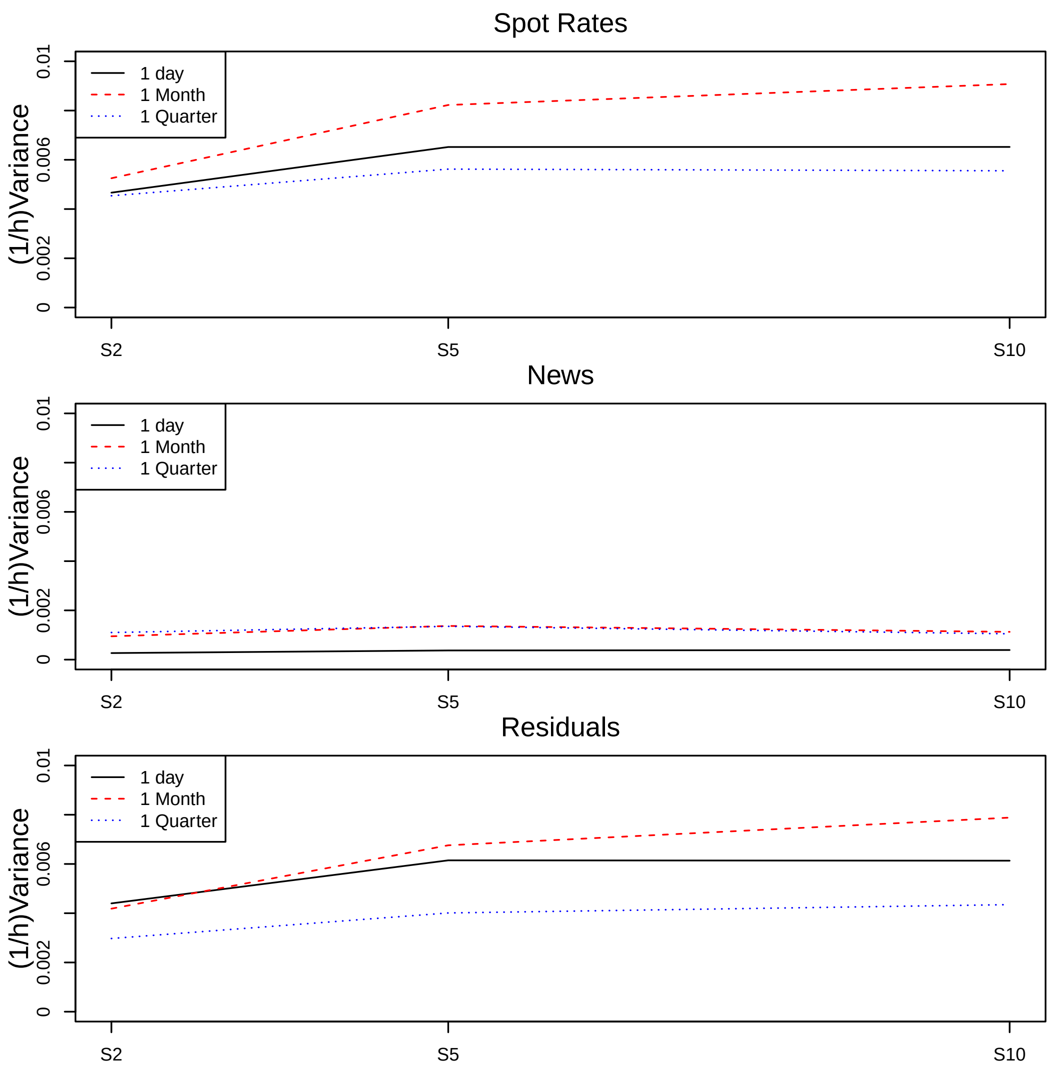
Source: Authors' calculation

Figure 11: Measures of Fit for Daily, Monthly and Quarterly Spot Rate Changes for Each Risk Appetite measure



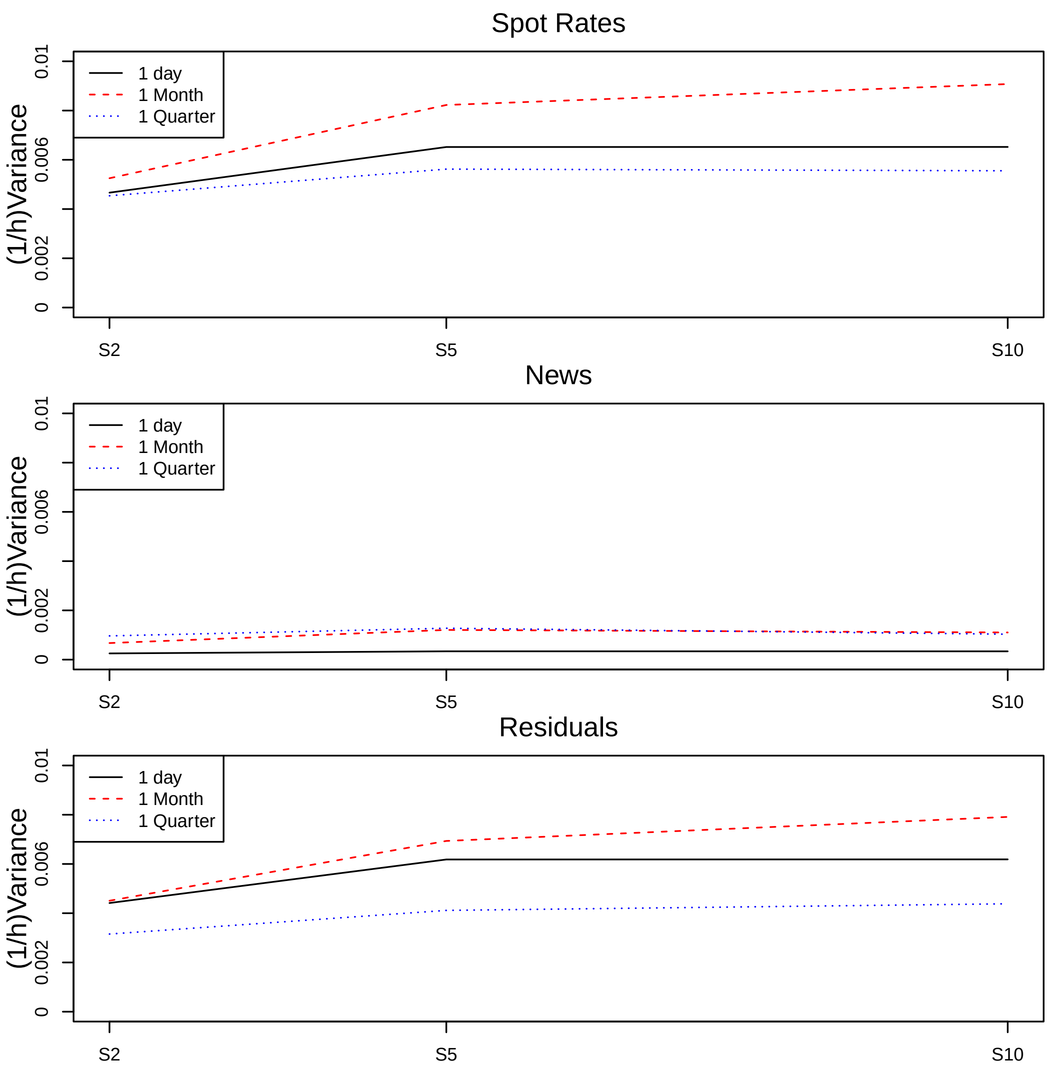
Source: Authors' calculation

Figure 12: $1/h$ Analysis of Variance for MOVE



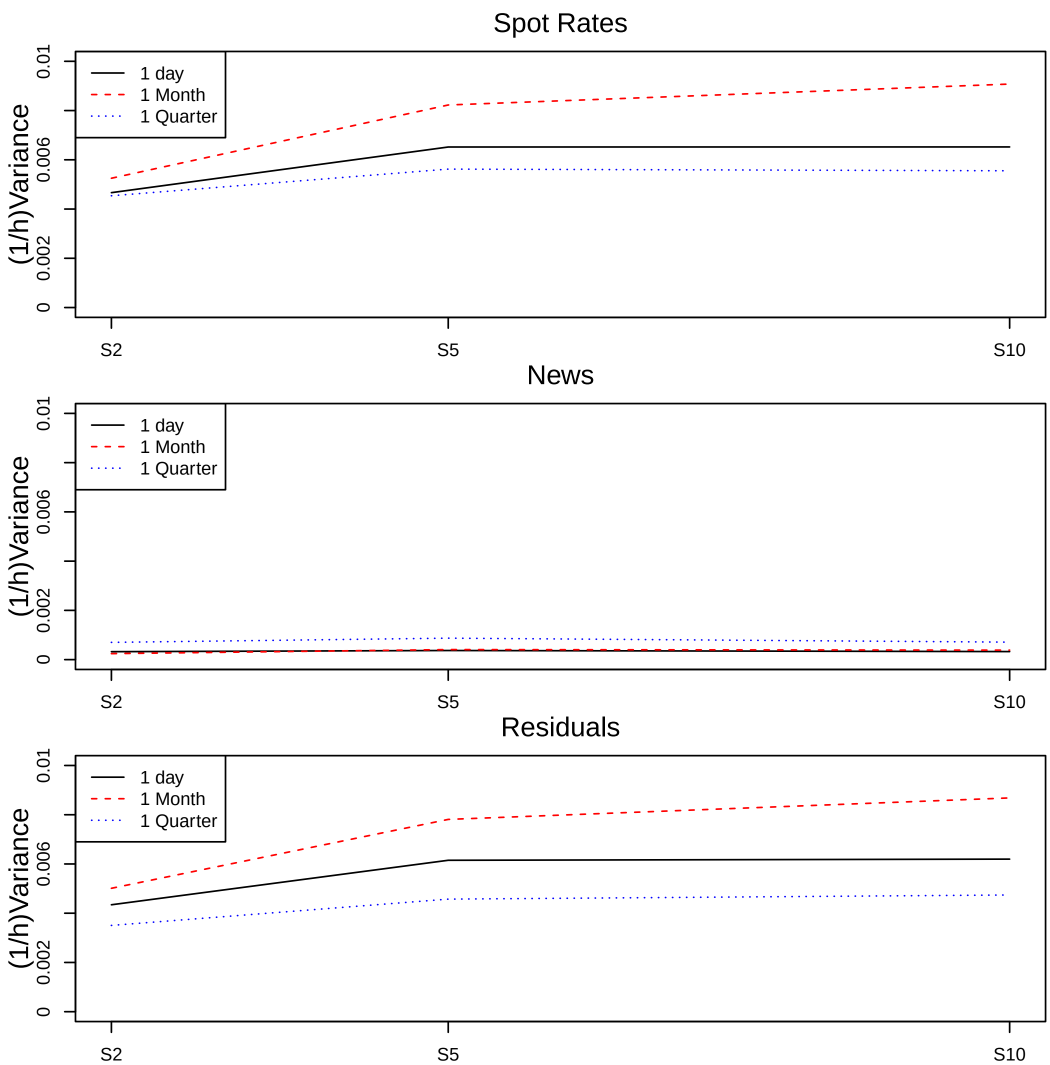
Source: Authors' calculation

Figure 13: $1/h$ Analysis of Variance for V2X



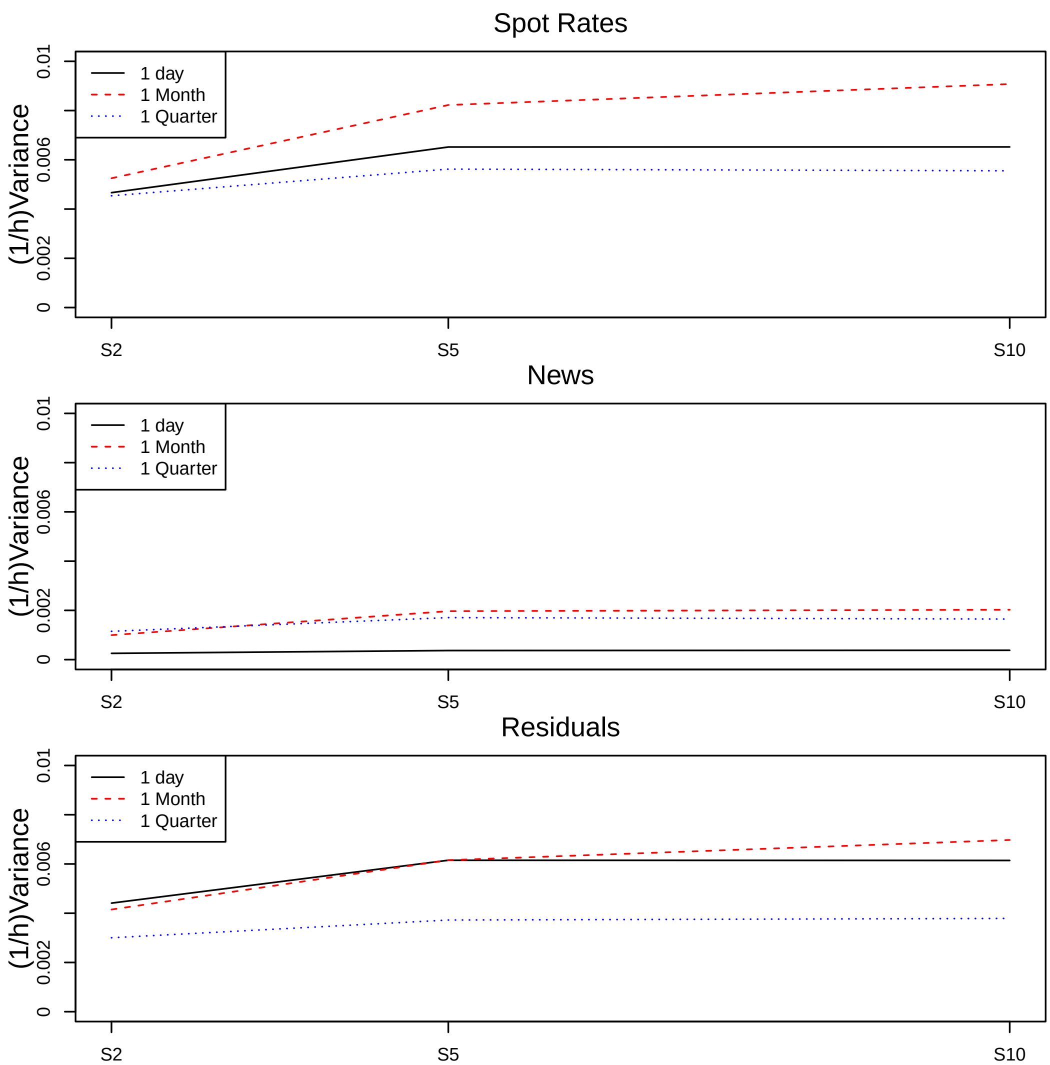
Source: Authors' calculation

Figure 14: $1/h$ Analysis of Variance for VIX



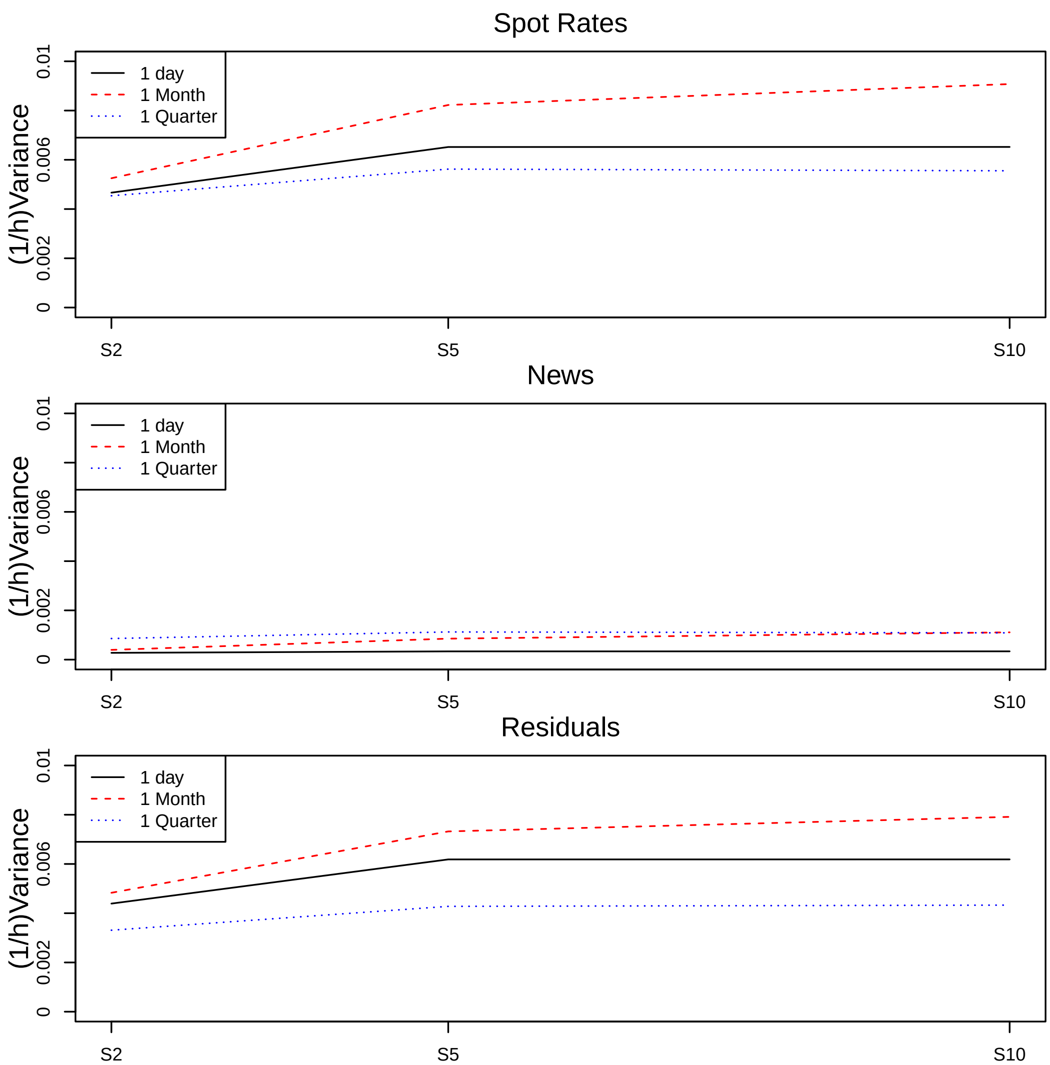
Source: Authors' calculation

Figure 15: $1/h$ Analysis of Variance for SpreadBAA



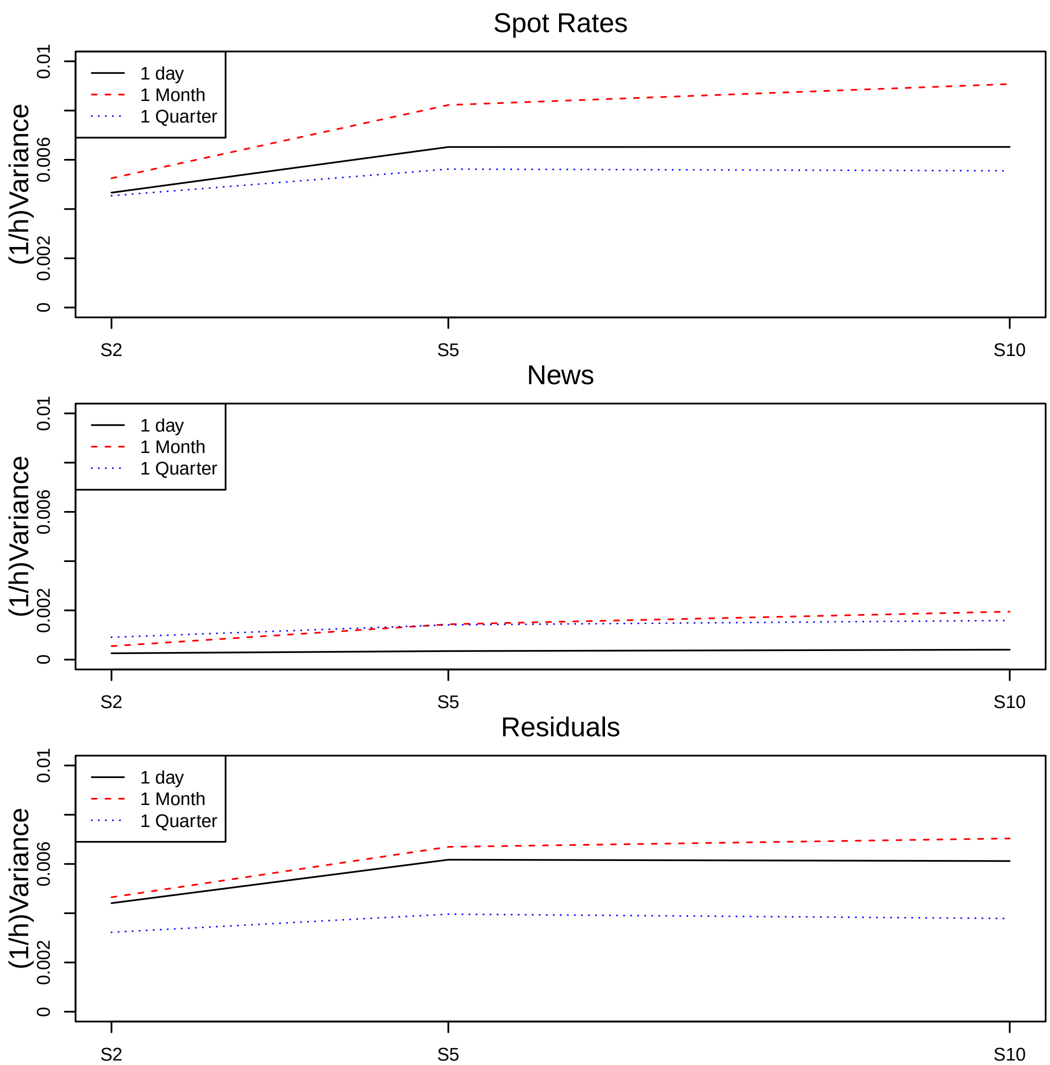
Source: Authors' calculation

Figure 16: $1/h$ Analysis of Variance for EMBIG



Source: Authors' calculation

Figure 17: $1/h$ Analysis of Variance for EMBIC



Source: Authors' calculation