The Behaviour of Trading Volume : Evidence from Money Market Instruments

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Abstract

This paper analyzed the impact of macro and non-macroeconomic factors on the trading volume of the certificate of deposits and commercial paper with regard to India during the monthly period from April 2012 – March 2018 using the quantile regression approach. The results revealed that gross domestic product rate, Consumer Price Index, Economic Policy Uncertainty Index, the Volatility Index, and the Nifty index had a negligible impact on the trading volume of corporate bonds. However, interest rates and exchange rates did not influence the trading volume of corporate bonds. In the other context, gross domestic product rate, Consumer Price Index, interest rates, the Volatility Index, and movements in the Nifty index showed a negligible impact on the trading volume of commercial paper. However, the variations in the trading volume of commercial papers were not explained by exchange rates and Economic Policy Uncertainty Index.

Keywords : macroeconomic factors, non-macroeconomic factors, trading volume, commercial papers, certificate of deposits, quantile regression, India

JEL Classification : C31, F16, G11, G12

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Capital, money, and foreign exchange sub-markets are the components of a country's financial system. In daily business activity, short-term funding plays a crucial role to fill the mismatch in operational financing requirements. The source of short term funds is the money market with maturity period from overnight to 1 year (Singh & Raja, 2014). The Indian money market has been experiencing speedy changes in recent times because of the deregulation procedure started by the Reserve Bank of India and the Government of India. Commercial paper (CP) and certificate deposit (CD) are the important money market instruments in the hands of companies and banks, respectively to raise short-term finance. Companies issue CP instead of seeking bank loans to reduce the cost of short-term financing (Nippani & Pennathur, 2004). On the other hand, the CD provides banks an opportunity to tap additional sources of funds by offering attractive rates of interest (Murdeshwar, 1970). From the investor's perspective, CP provides many advantages such as low-toned endangerment because of issuance from premier rated companies and modest reinvestment risk. Investors show interest in CP as it passes higher yields in comparison with other short-term investing sources such as treasury bills or CD (Rao & Pillai, 2011). On the other hand, the returns on CDs are better than a savings account.

Many studies in stock market research have shown the importance of trading volume to identify the trend of the market. Few of them include : Chari, Panda, and Korivi (2017) ; Cook and Watson (2017) ; Gebka and Wohar

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(2013) ; Wang, Qian, and Wang (2018). Joshipura and Janakiramanan (2015) detected that trading volume had no significant impact on Nifty. Similarly, the trading volume of CD and CP can also help investors in identifying momentum and confirm a trend. Investors must have a good knowledge of several vital factors, namely, interest rate, maturity date, and credit ratings of CD and CP before they place money. However, investors should be aware of some other risk factors. Even though CD and CP are usually released for the short term, the risk created by macroeconomic and financial factors cannot be ignored to earn good returns.

In this context, this paper examines how the macroeconomic and non-macroeconomic factors influence the behaviour of the trading volume of certificate deposit (TVCD) and trading volume of commercial paper (TVCP) in India by applying the quantile regression (QR) approach given by Koenker and Bassett (1978). QR allows quantifying the heterogeneous effects of covariates through conditional quantiles of the dependent variables that are TVCD and TVCP, and furnishes a comprehensive picture of the whole distribution of the outcome. To study the impact on the trading activity of CD and CP, the gross domestic product (GDP) rate, Consumer Price Index (CPI), interest rates (IR), exchange rate (ER), Economic Policy Uncertainty Index (EPUI) for India, Volatility Index (VIX), and Nifty index are included as explanatory variables.

Thus, the effort contributed by this paper in bringing about results to the literature currently in existence may be the following : First, this paper examines whether the behaviour of TVCD and TVCP are symmetric or asymmetric. Second, this area is an unexplored area of research, and as far as I know, this study might be the first use of the QR method to analyze the effects of macroeconomic and non-macroeconomic factors on TVCD and TVCP.

Review of Relevant Literature

This section reviews a few previous studies concerning CD and CP. Research on money market instruments is widely done in developed countries. Murdeshwar (1970) took an overview of a new monetary instrument, that is, negotiable CD and stated that this new instrument would give one more avenue for savings, and CD would provide an opportunity to banks to be an additional source of funds. Schadrack (1970) studied the demand and supply in commercial market papers. Knez, Litterman, and Scheinkman (1994) measured elements that depict returns on the money market ; 86% and 90% of the total fluctuations in most money market returns were explained by three-factor and four factors models. Cuthbertson, Hayes, and Nitzsche (1996) studied the behaviour of CD rates in the UK. Lackman, Carlson, and Varick (2004) worked on forecasting of commercial papers rate. Nippani and Pennathur (2004) examined the alteration in commercial paper's daily rates. Wednesday showed a uniform and significant negative return in comparison with other weekdays.

A wide range of studies is done in the Indian context at different periods and under various conditions on the factors influencing money market instruments. Bhatt and Virmani (2005) detected that short-term money markets (up to 3 months) were interconnected with the US. Ghosh and Pradhan (2008) detected that call rate, incremental bank credit, the issue amount, and cut-off yield of 364-day T-bills were the significant factors to affect the weighted average discount rate. Rao and Pillai (2011) carried out a comparison between India and America to study the impact of the financial crisis on the returns of commercial papers. They observed that the US outstanding commercial paper market decreased, and the Indian market increased considerably. Kaur (2014) showed that money, government securities, and foreign exchange markets were highly liquid, while money and government securities markets were less volatile. Singh and Raja (2014) studied the changing structure of the CP market. They found that credit rating, liquidity, and short-term interest rates influenced CP market activity. In other context, Faniband (In Press) affirmed the impact of macro and non-macroeconomic factors on the Indian government bonds.

Jha, Bhattacharya, and Bhattacharya (2019) noticed that addition in Google search queries (Google search volume) was connected to an increase in stock liquidity and trading activity. Dangi and Kohli (2018) generated investors' archetypes based on biases and heuristics. These archetypes of investors were found to be Stereotypical, Nervous, Imitator, Naïve, Cautious, and Passive investors. Isidore and Christie (2018) measured eight behavioral biases and interrelation among them. Raghuram and Erickson (2017) used the Fama – French three-factor model for the asset pricing behavior in India and detected a structural break in November 2001.

Liu (2018) appraised critical developments that happened in the Chinese negotiable CD in recent times. The results showed that CD affected the relationship between the lending rate and the policy rate. In the other context, Nowman (2002) applied Gaussian estimation methodology to estimate a range of one-factor short-term interest rate models on Gensaki interest rates and Japanese CD. The relationship between the level of rates and the volatility of rates was found to be low. Covitz, Liang, and Suarez (2009) observed that significant compression in asset-backed commercial paper (ABCP) came out due to appraising and examining runs on ABCP programs. Kacperczyk and Schnabl (2013) examined the risk pickings behavior of money market funds throughout the economic recession of 2007–2010 and confirmed that money market funds lacked safety. Carlson and Wheelock (2018) revealed that safe short-term assets, particularly Treasury bills, influenced the volume and price of negotiable CDs and Euro dollars issued.

Previous studies confirmed the impact of macroeconomic, non-macroeconomic, industry, and company specific factors on the stock market (see Al-Tarawneh & Al-Assaf, 2018 ; Bhanumurthy, Singh, & Aggarwal, 2019 ; Chellaswamy, Natchimuthu, & Faniband, 2020 ; Da Fonseca, 2016 ; Faniband & Marulkar, 2020 ; Jothi & Suresh, 2016 ; Okuyan, 2013 ; Winarto, Sule, & Ariawati, 2017).

Previous studies have focused more on the relationship between macroeconomic factors and stock returns. Trading volume is an important element which should be considered for trading decision. Past research work has ignored exploring the dependence between the trading volume of money market instruments and its determinants. Very few studies have analyzed the impact of macro and non-macroeconomic factors on the trading volume of CD and CP using QR methodology with regard to India. Therefore, this paper fills these gaps in this research and extends the literature.

Methodology

The QR was proposed by Koenker and Bassett (1978). An extension of linear regression is QR. Linearity, independence, normality, homoscedasticity are the conditions to use linear regression. QR is used when the above conditions are not met. Regular linear regression considers the least squares to calculate the conditional mean. In contrast, the conditional median of the target is estimated by QR. QR is not limited just to find the median, but any quantile can be calculated for a particular value in the features variables. In this context, a better result of the impact of macroeconomic and non-macroeconomic factors on the trading volume of CD and CP with a quantile ranging from 0.1 – 0.9 can be achieved.

The QR model of Koenker and Bassett (1978) can be written as :

$$y_i = x'_i \beta_\theta + \mu_{\theta i} \text{ with } Q_\theta(y_t | x_t) = x'_t \beta_\theta \qquad (1)$$

where, x'_t indicates a vector of regressors, β_θ denotes the vector of parameters to be estimated, and $\mu_{\theta i}$ represents a vector of residuals. $Q_\theta(y_t | x_t)$ denotes the θth conditional quantile of y_i given x'_i.

The estimation of β_θ is based on the following optimization problem :

$\beta_\theta = \underset{\beta}{\text{argmin}}$

$$\left\{ \underset{t: yt > x't\beta}{\Sigma} \theta | y_i - x'_i \beta | + = \underset{t: yt > x't\beta}{\Sigma} (1 - \theta) \, y_i - x'_i \beta | \right\} \qquad (2)$$

The optimization problem can be figured out by applying a linear programming representation via the simplex algorithm or the generalized method of moments framework (Brooks, 2014). The median regression is received by placing $\theta = 0.5$. Other quantiles of the conditional distribution can be found through variations of setting θ. In this paper, the bootstrap method given by Buchinsky (1995) is applied to hold approximations of the standard errors for the coefficients in quantile regression. Moreover, it is effective for a comparatively small sample size.

Data and Variables

This paper empirically examines how the trading volume of CD and CP is influenced by macroeconomic and non-macroeconomic factors over the monthly period from April 2012 – March 2018. The selection of this period is based on the availability of data. The macroeconomic factors include : (a) gross domestic product growth rate ; (b) Consumer Price Index ; (c) interest rate (less than 24 hours : Call money/interbank rate); and (d) exchange rate stated in U.S. dollars to Indian rupees. Non-macroeconomic factors are : (a) the Indian Economic Policy Uncertainty Index ; (b) India Volatility Index ; and (c) Nifty index. The trading volume data of CD and CP were captured from the *Factbook 2018* published by The Clearing Corporation of India Limited. The FRED database was used to obtain the data of CPI, IR, and ER. The GDP rate data were taken from the website of investing.com. The data of Indian Economic Policy Uncertainty Index were gathered from the website of economic policy uncertainty. India VIX data were collected from the website of investing.com. Nifty Index data were pulled in from the website of the National Stock Exchange.

These factors are selected based on their relevance to the behaviour of TVCD (trading volume of CD) and TVCP (trading volume of CP). One of the key factors of the economic trend of any economy is GDP rate. Further, the real liabilities and default risk may be increased due to unexpectedly low inflation and vice versa. CPI shows the extent of inflation or deflation. The next important element of macroeconomic factors is the interest rate. Reinvestment and credit risks are affected because of the expected change in inflation and investors' risk appetite in rising interest rate scenario and vice versa. Moreover, the exports and imports from a company are influenced by depreciation and appreciation in the exchange rate and exports, and consequently, repayment of loans to banks. The Indian EPUI is made using seven Indian newspapers. This factor is now widely used as a risk indicator to know the investment profitability and business environment in a country. The Indian market's volatility is captured in India VIX from the investor's perception. This index is based on a methodology similar to that followed by the Chicago Board Options Exchange. The various segments of the financial markets are interlinked in an economy. Therefore, the movements in the VIX and Nifty are likely to influence TVCD and TVCP. In these contexts, it is expected to have the influence of macroeconomic and financial factors on the trading volume behaviour of CD and CP.

Empirical Analysis and Results

Table 2 and Table 3 illustrate the results of quantile estimated coefficients for GDP, CPI, IR, ER, EPUI, VIX, and Nifty for the 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, and 0.9 quantiles. The changes in the quantile regression coefficients for the trading volume behaviour of CD and CP are also shown in the QR graph. The prefix *'X'* indicates explanatory variable.

Descriptive Statistics of the Variables

The statistical properties are shown in Table 1. The mean value of CD, CP, GDP, EPUI, and VIX is more than the median. Thus, these variables appear to be skewed to the right. However, the median values of CPI, IR, ER, and Nifty index is more than their mean values. Kurtosis values for all the explanatory variables (except CD, EPUI, and VIX) are less than the reference value of normal distribution that is equal to 3. It shows that there are lighter tails than the normal distribution. The Jarque – Bera (JB) test results indicate that all the variables (except CP) are not normally distributed.

Eventually, unit root in the variables is tested using the conventional Augmented Dickey and Fuller (ADF) and Phillips & Perron (PP) statistics and the stationarity property employs the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test. CD, CP, CPI, EPUI, and VIX have no unit root. In contrast, GDP and the Nifty index have a unit root. Therefore, these variables are included in the first differences and confirm the stationarity.

Table 1. Descriptive Statistics and Unit Root Tests

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	JB	ADF	PP	KPSS Stationary
									Unit root		
CD	114223.600	108901.500	272573.000	45657.000	50716.570	1.039	3.972	15.779***	−0.769	−4.490***	0.858
CP	72500.000	68200.000	150000.000	24100.000	28300.000	0.541	2.551	4.115	−1.175	−3.551***	1.075
GDP	6.076	5.900	7.900	4.400	1.141	0.032	1.501	6.756***	−1.340	−1.306	0.663
CPI	97.375	97.545	110.169	78.419	9.282	−0.407	2.006	4.953***	−3.392***	−2.116	1.114
IR	8.024	8.375	10.250	6.250	1.109	−0.343	1.751	6.091***	−0.226	−0.278	1.017
ER	62.137	63.208	68.240	51.690	4.479	−0.725	2.414	7.341***	−2.368	−2.302	0.923
EPUI	99.346	84.691	283.689	32.884	48.410	1.203	5.130	30.994***	−3.404***	−3.049**	1.009
VIX	16.397	15.970	30.593	10.860	3.761	1.604	6.126	60.182***	−4.724***	−4.676***	0.514
Nifty	7697.241	7959.575	11027.700	4924.250	1592.658	0.023	2.007	2.966***	−0.816	−0.771	1.020

Note. CD indicates certificates of deposit, *CP* denotes commercial paper, *GDP* refers to gross domestic product, *CPI* shows Consumer Price Index, *IR* is interest rate, *ER* is exchange rate, *EPUI* indicates Economic Policy Uncertainty Index, *VIX* is Volatility Index.

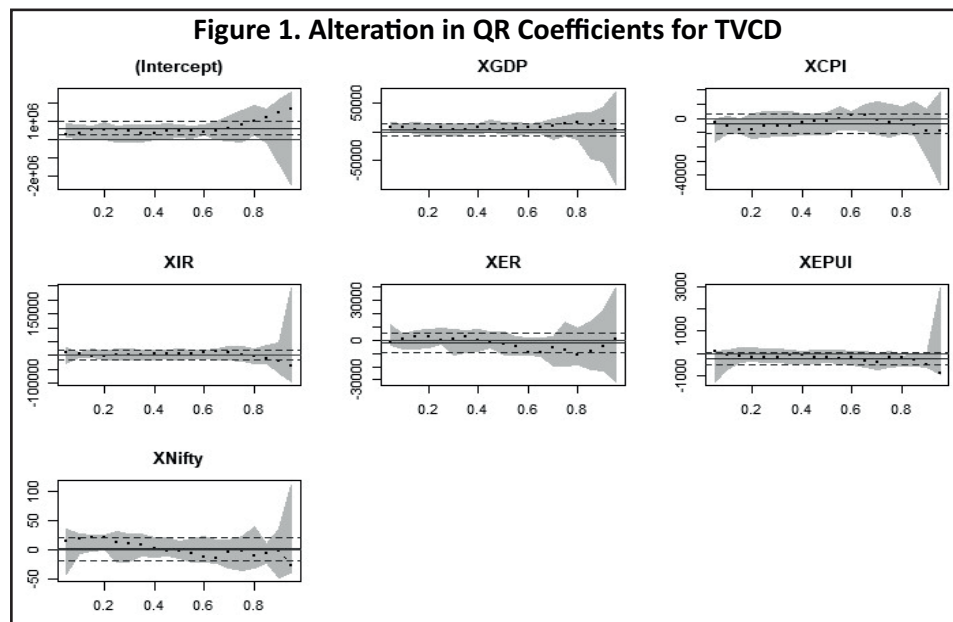** $p < 0.05$ and *** $p < 0.01$.

Analysis of Determinants of TVCD

The results of the impact of macro and non-macroeconomic factors on the trading volume of CD are shown in Table 2 and Figure 1. An insignificant dependence structure with the GDP is brought out for each quantile excluding 0.1. Further, the inflation rate, as represented by CPI, has a statistically significant and positive impact only for the lower quantiles. But the impact is absent for the intermediate and upper quantiles. This confirms the presence of an asymmetric dependence structure (that is the lower tail dependence and the upper tail independence). It is worth noting that IR and ER have no impact across the quantiles. With regard to EPUI, it has a negligible impact for the median quantile. Moreover, TVCD is affected positively by VIX only for the 0.1 quantile. The structure of dependence concerning changes in the Nifty index is asymmetric. Nifty has a significant and positive impact.

Table 2. Empirical Results for TVCD Determinants

	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
α	494630.1***	644069.2***	438446.3**	340884.6	507733.8**	495046.6	577334.3*	1008755*	1213646**
	(0.000)	(0.000)	(0.022)	(0.171)	(0.051)	(0.109)	(0.095)	(0.059)	(0.034)
GDP	7224.816***	5781.675	3761.857	5764.409	3073.218	7331.194	9271.488	14918.22	26654.9
	(0.003)	(0.242)	(0.486)	(0.419)	(0.677)	(0.406)	(0.349)	(0.327)	(0.103)
CPI	−5875.748***	−7966.612**	−5384.687	−2349.434	−1789.997	1034.445	−3011.576	−1197.416	−4143.307
	(0.000)	(0.018)	(0.141)	(0.624)	(0.718)	(0.861)	(0.650)	(0.906)	(0.704)
IR	−4276.689	−6554.493	3379.522	8907.97	2791.214	6853.679	2757.946	−4150.829	−6086.001
	(0.291)	(0.441)	(0.717)	(0.470)	(0.827)	(0.652)	(0.871)	(0.874)	(0.704)
ER	−415.0952	1055.789	905.6918	−1885.774	−3985.385	−8137.905	−4079.664	−11980.4	−12784.13
	(0.803)	(0.763)	(0.813)	(0.710)	(0.448)	(0.196)	(0.561)	(0.268)	(0.269)
EPUI	−51.50623	−148.4047	−193.6235	−187.7506	−311.6351*	−297.5191	−252.035	−185.6256	−424.8039
	(0.384)	(0.235)	(0.158)	(0.298)	(0.098)	(0.184)	(0.313)	(0.628)	(0.301)
VIX	1864.11***	1323.841	646.9041	809.985	1447.768	2237.295	2596.202	1240.552	3909.066
	(0.004)	(0.316)	(0.654)	(0.671)	(0.464)	(0.343)	(0.326)	(0.759)	(0.368)
Nifty	18.50375***	20.46843**	10.16796	.2399725	−1.699532	−10.18009	−.1114013	−7.682228	1.14804
	(0.000)	(0.032)	(0.325)	(0.986)	(0.904)	(0.546)	(0.995)	(0.791)	(0.970)

Note. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

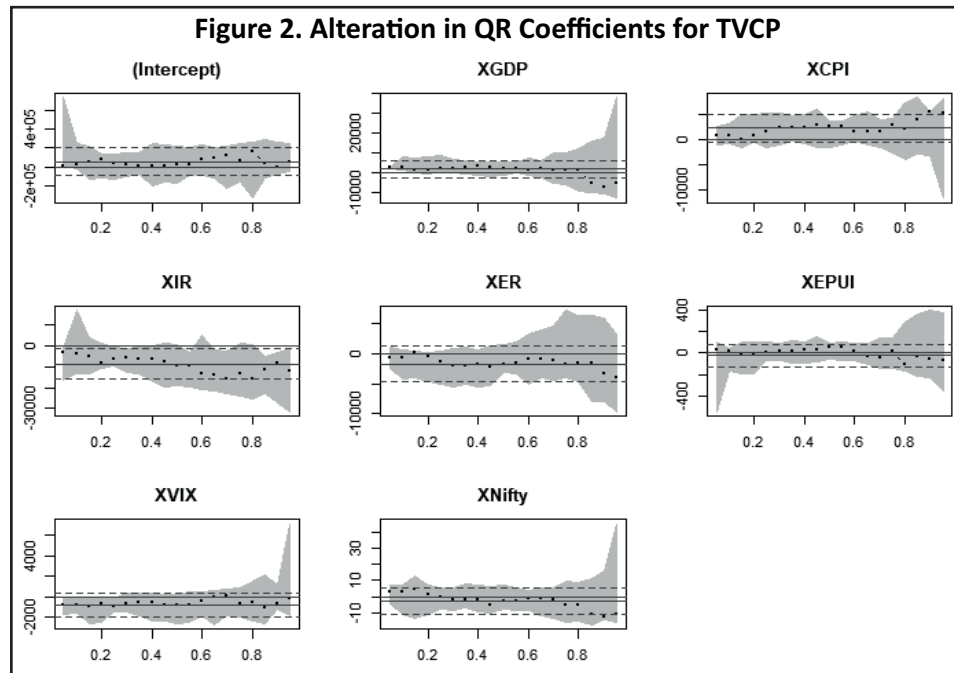### Figure 1. Alteration in QR Coefficients for TVCD

Analysis of Determinants of TVCP

Table 3 and Figure 2 show the results concerning TVCP. GDP has a negligible impact at the tail of the distribution. However, GDP has no impact for the 0.2, 0.3, intermediate quantiles, 0.7, and 0.8 quantiles. The impact of inflation is not ascertained for the lower and intermediate quantiles, except 0.9. In the case of IR, the quantile

Table 3. Empirical Results for TVCP Determinants

	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
α	113846.4*	73934.42***	18788.21	9173.583	15663.23	77230	115572.5	163855.5	−1761.487
	(0.051)	(0.369)	(0.871)	(0.932)	(0.892)	(0.573)	(0.457)	(0.236)	(0.989)
GDP	2723.255*	1740.858	1942.683	3202.893	2385.522	1645.018	1472.776	1464.489	−7075.132*
	(0.073)	(0.462)	0.559)	(0.304)	(0.472)	(0.677)	(0.741)	(0.712)	(0.062)
CPI	689.009	742.8764	2246.093	2341.047	2712.538	1594.102	1710.578	2018.754	5499.306**
	(0.495)	(0.641)	(0.317)	(0.264)	(0.226)	(0.548)	(0.569)	(0.450)	(0.032)
IR	−4015.409	−8553.754**	−5564.62	−6397.037	−9697.555*	−13121.11*	−16095.42**	−16122.03**	−8327.113
	(0.124)	(0.039)	(0.334)	(0.235)	(0.093)	(0.070)	(0.040)	(0.021)	(0.200)
ER	−588.4809	−472.2209	−1927.486	−1869.977	−1841.29	−800.8407	−1058.219	−1495.4875	−3437.419
	(0.581)	(0.779)	(0.415)	(0.398)	(0.435)	(0.775)	(0.739)	(0.596)	(0.199)
EPUI	21.42716	−13.76841	22.41312	23.43534	55.36848	−15.90436	−44.77571	−107.3403	−55.9328
	(0.572)	(0.818)	(0.789)	(0.765)	(0.508)	(0.873)	(0.691)	(0.286)	(0.554)
VIX	−796.9293**	−711.6047	−637.031	−594.5198	−810.6232	−491.1819	79.94874	−559.0792	−744.4889
	(0.050)	(0.262)	(0.474)	(0.474)	(0.361)	(0.641)	(0.947)	(0.598)	(0.457)
Nifty	2.957723	1.837963	−1.826351	−2.100309	−2.842149	−.759294	−1.840565	−5.2877347	−12.6041*
	(0.304)	(0.684)	(0.774)	(0.723)	(0.653)	(0.920)	(0.829)	(0.486)	(0.081)

Note. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Figure 2. Alteration in QR Coefficients for TVCP

estimated coefficients for 0.2, 0.5, 0.6, 0.7, and 0.8 show a negative impact. However, ER and EPUI have no impact across the quantiles. VIX has a significant and negative influence only for the first quantile. Further, the negative impact of the Nifty index is found only for the end quantile. However, the impact is not visible for the lower and intermediate quantiles.

Conclusion and Research Implications

This paper analyzes the impact of macroeconomic and financial factors on TVCD and TVCB across different quantiles of the trading volume distributions. CD and CP give additional avenue of investments besides other small savings instruments for the investors. Trading volume and macroeconomic behavioral relationship analyses have become important in today's volatile and uncertain scenarios characterized by interlinkages of the Indian economy with the global economy. This topic is of great importance for the money market participants to take the financial decision of investing in money market instruments. Investors operating in the money market carefully watch what happens in the Indian economy. Therefore, there is a need to study the dependence structure between macroeconomic, non-macroeconomic factors, and trading volume of CD and CP.

The quantile dependence results indicate that GDP, CPI, EPUI, VIX, and Nifty index have a negligible impact on TVCD. On the other hand, IR and ER have no impact on TVCD. Further, with regard to TVCP, there is a negligible impact of GDP, CPI, IR, VIX, and movements in the Nifty index on TVCP. However, the variations in TVCP are not influenced by ER and EPUI.

This research has come out with several significant implications for investors from money market segments to take trading decisions. In truth, money market participants should be cognizant of the relationship between money market instruments and macroeconomic as well as non-macroeconomic factors. QR analysis reveals that TVCD is less sensitive to GDP, CPI, EPUI, VIX, and Nifty index. Therefore, if investors want to understand the momentum in CD with the help of trading volume and minimize the risk created by these factors, they should take investment decisions carefully because the impact of these factors varies across the quantiles. Similarly, investment in CP should be made carefully using GDP, CPI, IR, VIX, and Nifty because TVCP is less sensitive to these factors. In other contexts, the variations in TVCB are not explained by IR and ER. Further, TVCP is not sensitive to ER and EPUI. Therefore, investors should avoid investing in CB and CP using these factors.

Limitations of the Study and Scope of Future Research

The major limitation of this study is that the results gathered from such studies are not stable and may become different in some particular way with changes in time. It is important to note that this paper is one of the novel attempts to address the impact of macroeconomic and non-macroeconomic factors on the behaviour of TVCD and TVCP using QR methodology. However, this study can be further extended with other macroeconomic and financial factors. The next possible line of extension is to take the trading volume of other money market instruments. Another scope for future research is to make a comparative study between developed nations and India. Similarly, comparison with other emerging economies can also be a line of research.

Author's Contribution

The conception or design of the work, collection of data, analysis and interpretation, drafting, and the critical revision of the article were done by Mr. Muhammadriyaj Faniband.

Conflict of Interest

The author certifies that he has no affiliation with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter, or materials discussed in this manuscript.

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