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Government Regulation Effect On The Volatility Of Top Trading Cryptocurrencies

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GOVERNMENT REGULATION EFFECT ON THE VOLATILITY OF TOP TRADING CRYPTOCURRENCIES

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DEDICATION

This thesis is dedicated to my parents Lorraine and Fernand who have supported

and encouraged me to pursue this journey

along with my sister Jamie who

has taught me to never

give up on your

dreams

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ABSTRACT

I study whether news and the sentiment of the news regarding cryptocurrency regulation affects the volatility of Bitcoin, Binance, and Ethereum, measured as the standard deviation of the 1st difference of the log of the price with a right sided overlapping window of 7 days. I utilise a modified dynamic causal model with Newey-West heteroskedastic autocorrelation standard errors to estimate both the impact and cumulative effects that regulation news has on the three cryptocurrencies included in the study. My results show the volatility of all three cryptocurrencies react most strongly to negative regulatory news, with Binance being affected the most with an increase of 16.329% after 9 periods following an event, followed by Ethereum with an increase of 8.240% and Bitcoin with an increase of 8.180%. Positive news is also found to affect the volatilities; however, it is a much smaller effect and is only significant for Bitcoin, which experienced an increase of 4.597% in volatility 9 periods following an event. The results are robust to controlling potential omitted variable bias including the volatility of the S&P500 index, consumer confidence, inflation, and federal funds rates.

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CHAPTER I

INTRODUCTION

Cryptocurrency being a relatively new development in financial and economic markets has created a lot of media attention and willing investors. The lack of government backing along with no interest or dividends raises questions as to what factors contribute to its pricing, volatility, liquidity, and reliability as a means of exchange. I believe that understanding what factors may be responsible for the erratic volatility seen in crypto markets is imperative to weigh the risk of such an investment. The anonymity and decentralization aspects that attract individuals also concern governments as they cannot target these coins with standard monetary policies. It is hypothesized that government regulatory events increase the volatility of Bitcoin, Ethereum, and Binance. I investigate whether news with positive regulatory events and news with negative regulatory events effect these volatilities and I find that both yield statistically significant results. Negative regulatory news has a greater effect than positive regulatory news across all cryptocurrencies studied, and this effect varies for each cryptocurrency with Binance being affected the most. A positive regulatory event on Bitcoin causes its volatility to increase by 4.6% after 9 days.

Negative regulatory news has an effect of 8.789% when positive news is included or 8.180% without positive news both with a significance level of 1%. The effect of positive news on Binance is insignificant and is estimated at 4.626% when negative news is included or 2.898% without negative news. The effect of negative news is significant at the 1% level with a 16.986% cumulative effect when positive news is included and 16.3295% without positive news. The effect of positive news on Ethereum is insignificant and is estimated at 3.896% when negative news is included or 3.050% without negative news. The effect of negative news is significant at the 5% level with an 8.724% cumulative effect when positive news is included and 8.240% in Model 8 without positive news.

1.1 Literature Review

Most research conducted regarding cryptocurrency has been in price formation and similarities to other financial assets. In the process of attempting to define the type of asset that cryptocurrency falls under, Baur (2018) determines that Bitcoin cannot be considered a currency. Through his research he proves that new information is largely responsible for price movement and speculates that the excess volatility in the market may be due to the volatile information about Bitcoin. The use and regulation surrounding cryptocurrencies is still a relatively new concept, and unpredictable changes will continue to be made potentially affecting the volatility in the market.

Bystrom (2018) looks at the relationship between volatility in the Bitcoin market and volatility in other traditional markets and if it can be explained by internet searches or general risk in the financial system. Correlations and OLS regressions show a positive

link between changes in Bitcoin Volatility and the USD trade-weighted currency index volatility, but the largest finding was the link with Bitcoin-related Google searches.

Bouri and Hagfors (2017) use a bivariate DCC model with various stock indices to determine if cryptocurrency, specifically Bitcoin, is a suitable investment. The data found that overall, it is an effective diversifier that very rarely displays haven or hedge properties. Understanding the reason for individuals to buy, trade, or invest in cryptocurrency is important because the returns are determined mainly by the buyers and sellers. Thus, regulatory events and news announcements can alter the perception of cryptocurrency viability and potentially affect the market as a whole.

Baker (2016) explains the development of a new index of EPU based on newspaper coverage frequency and finds that with firm-level data "policy uncertainty is associated with greater stock price volatility and reduced investment and employment in policy sensitive sectors". They found there is a strong relationship between the measure of EPU and other measures of economic and policy uncertainty and political slant does not distort the EPU index. This concept of uncertainty regarding policies, is relevant to this research as cryptocurrency is a relatively new financial asset and policies will continue to change.

Bouri and Dyhrberg (2017) find that prior to the cryptocurrency crash in 2013, positive shocks increased the conditional volatility more than negative shocks. Volatility is highest pre-crash and lowest post-crash where they find that the safe-haven effect from the pre-crash period is no longer observed. This paper shows how large events like the crash of 2013 can affect volatility in the long term as well as the short term. Government

regulation may have a similar effect such as government bans on cryptocurrency mining, however it is expected that negative shocks will be more impactful.

Prior research studying regulation news and its effect on cryptocurrency includes Auer (2020) who find that regulatory actions and news regarding potential regulatory actions can have a strong intraday impact on cryptocurrency markets in terms of valuations and transaction volumes. Their classification breaks regulatory news into three categories: events related to general bans, money laundering and terrorism, and restricting interoperability of cryptocurrencies with regulated markets. They find that national regulation spills over into foreign markets despite the decentralized aspect of cryptocurrencies, and as a result I will be using regulatory news from all countries in my analysis.

Lyocsa (2020) continues this research by expanding news to include macroeconomic news announcements and hacking of exchanges. They find that the volatility of bitcoin is strongly influenced by hacking news, and news about bitcoin regulation. They find very little evidence that macroeconomic variables have an impact on bitcoin volatility, but they find a link exists between an increase in volatility and positive investor sentiment from Google searches.

In this paper, the approach will emphasize the effect that positive and negative regulatory news has on the volatility of cryptocurrencies, specifically Bitcoin, Binance, and Ethereum over time.

CHAPTER II

CRYPTOCURRENCY BACKGROUND

2.1 Bitcoin

Satoshi Nakamoto introduced the concept of an electronic payment system that is based on cryptographic proof that would allow for transactions to occur without a third party involved. This is accomplished through the Blockchain, where transactions are broadcasted to nodes then collected into blocks that will be validated before being accepted into the Blockchain. The first transaction in a block starts a new coin owned by the creator of the block, which acts as an incentive for miners to run nodes and simultaneously adds coins into the circulation without any issuer (Nakamoto 2022). Transactions on the blockchain are visible to the public however the information provided keeps these transactions completely anonymous. Bitcoin is thus the electronic currency used for transactions on the Blockchain.

2.2 Ethereum

The Ethereum Blockchain allows for peer-to-peer transactions similar to Bitcoin, however the blockchain functions as a platform for applications called "smart contracts". These smart contracts are lines of code that will be automatically executed given the proper inputs, like a vending machine. These applications are able to operate with other

systems such as Compound which can be interacted with through their website, program, or integrated into exchanges such as Binance (Gulley 2021). Like Bitcoin, transactions cost a fee, "gas", and this fee is given to nodes along with block rewards each time a new block of transactions is added to the blockchain. The Ethereum Blockchain allows for transactions using other coins such as Bitcoin, but most are in the native coin Ether (which will be notated as "Ethereum" in this analysis).

2.3 Binance

Binance, which stands for Binary finance, is the world's largest crypto exchange that supports cross-platform trading in currencies such as Bitcoin, Ethereum, Tether, Binance, and many more. Binance announced their token coin Binance Coin with a limit of 200MM, and previously used 20% of their profits every quarter to buy back their currency and burn it until 100,000 BNB remains ("Binance Whitepaper." 2022). This has been replaced with BNB Auto-Burn that offers more predictability to the quarterly burns adjusted to price.

Binance initially ran on the Ethereum Blockchain when launched in 2017 but has since transitioned to the native coin of the Binance Chain. The Binance DEX was built on top of the Binance chain which allows participants to send and receive BNB, issue new tokens on the blockchain that can be sent, received, burned, minted, frozen, or unfrozen along with proposing trading pairs and selling/buying orders that have been proposed (Binance 2018). When launched in 2020, the Binance DEX was able to handle trading volumes as efficiently as the previous centralized exchange it operated. The Binance Chain is unique as it has a one-second block time unlike the 10-minute block time on the

Bitcoin blockchain or 20 seconds on the Ethereum blockchain ("Binance Chain: Blockchain for Exchanging the World." 2019).

CHAPTER III

DATA AND METHODOLOGY

3.1 Data

The data used in this paper covers the time period between November 2017 to January 2022 and is sampled on a daily frequency. The Bitcoin, Ethereum, and Binance price data is obtained through Yahoo finance via the quantmod package in R. The overlapping volatilities are calculated as the standard deviation of the 1st difference of the log of the price with a right sided window of 7 days. Regulatory events are coded as two separate variables. One dummy variable for positive regulatory news which takes a value of 1 when a positive event occurs such as legalizing crypto trading in a country, and 0 otherwise. Negative regulatory news also takes a value of 1 when a negative event occurs such as banning all cryptocurrencies in a country and takes 0 otherwise.

I expect regulatory events that negatively affect cryptocurrencies such as restrictions on use or bans to be significant and positive in the short run. Since Cryptocurrencies have no government backing and cannot be controlled by monetary policies, bans on use would directly impact users and investors who influence the trading volume and price thus affecting the volatility of the coin.

News Articles

Regulating cryptocurrencies is similar to regulating other financial assets. Governments may want to eliminate the risk of fraud or money laundering, protect citizens from risky investments, or to ensure stability with full control of the monetary supply.

To study the sentiment of the regulation I classify negative news as any regulation that bans, discourages, declares an illegal status, fines, suspends, or increases taxation excessively, on a single cryptocurrency, all cryptocurrencies, sales or trading of cryptocurrencies, or cryptocurrency accounts. Positive news is classified as any regulation that declares legality, supports, allows the use of, or reverses prior bans on a single cryptocurrency, all cryptocurrencies, sales or trading of cryptocurrencies, or cryptocurrency accounts along with any announcements of governments creating their own cryptocurrency.

I used Google Search to find articles that contained keywords "cryptocurrency" (or "Bitcoin" or "Binance", or "Ethereum") and "regulation" (or "ban" or "law"). These were manually checked, and only articles that were related to regulation or potential regulation being discussed by authorities were included in the database. To ensure that the dates of the events recorded in the database are accurate and not lagged, I first search for the official government document or released statement and record this official date, second if the official document cannot be found I refer to the article to see if it states the date of the announcement, and finally if no date is mentioned I record the date of the earliest documented article on the subject. Table 7 in the appendix provides

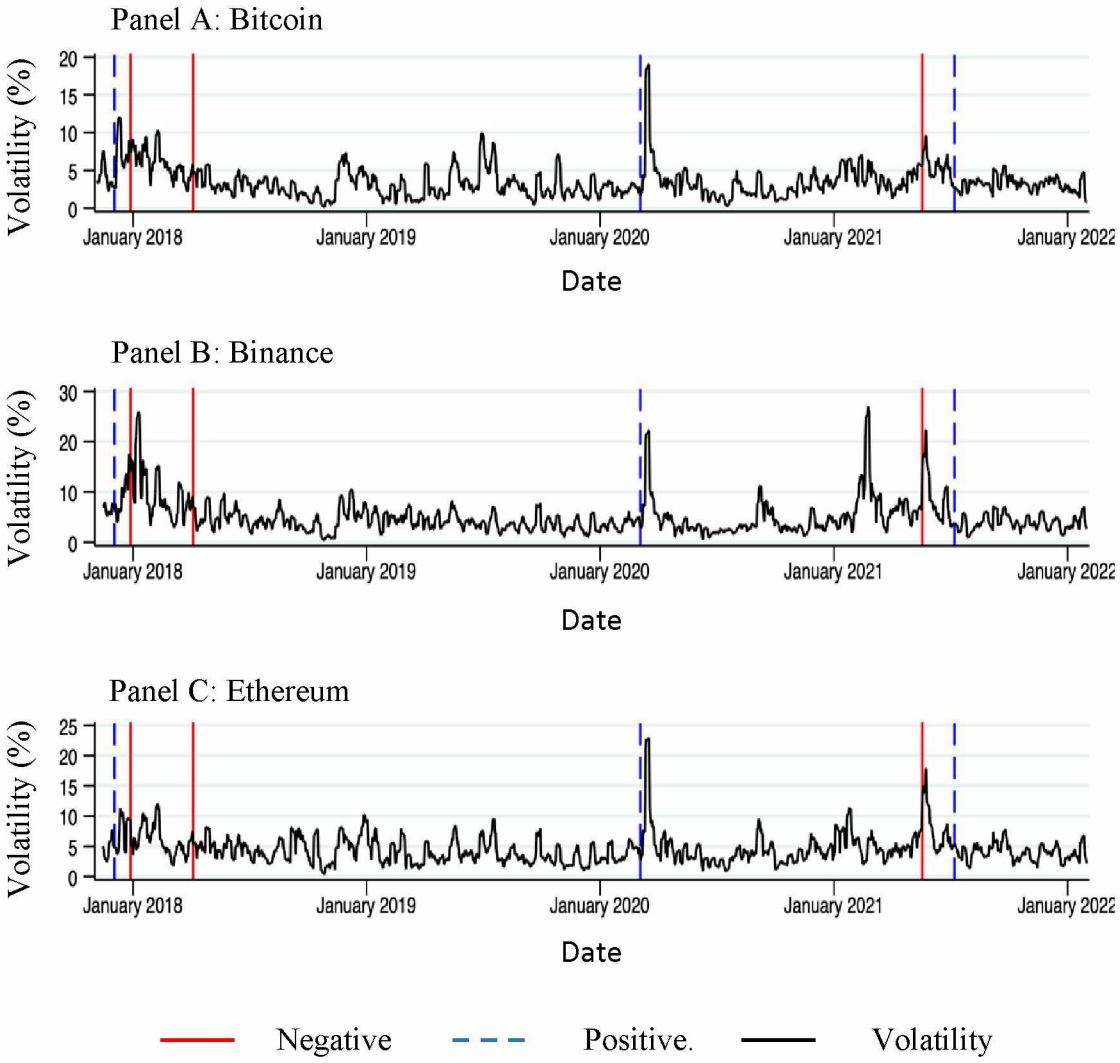
descriptions of each regulatory event included in the study, the date that is listed and the sentiment of the event.

In total I identify 62 regulatory news events between November 6th 2017 to January 30th 2020, 33 of these are labelled as positive regulatory events and 29 as negative regulatory events. For each news event the date discussed by the journalist or government authority is recorded. The first dummy variable represents positive news and will take the value of 1 if an event occurs, 0 otherwise. The second dummy variable represents negative news, and it also takes the value of 1 if an event occurs, 0 otherwise.

Figure 1 depicts three positive events and three negative regulatory events on separate graphs of Bitcoin, Binance, and Ethereum volatility. The negative events, dictated by a solid vertical line, include Russia increasing their strict regulation on cryptocurrency mining (2017-12-28), India's central bank announcing a ban on the sale or purchase of cryptocurrency (2018-04-05), and China banning all cryptocurrencies (2021-05-19). The positive events, dictated by a dashed vertical line, include Venezuela announcing their own oil backed cryptocurrency (2017-12-03), India reversing the prior ban on cryptocurrency (2020-03-04), and El Salvador declaring Bitcoin as legal tender (2021-06-08).

Figure 2 contains the histograms for the volatilities of Bitcoin, Binance, and Ethereum. The data for all three variables is positively skewed. Binance has the most extreme values for the three cryptocurrencies, while Bitcoin has the smallest maximum volatility. All three cryptocurrencies however have high volatility, much more volatile than traditional financial assets which is consistent with the literature.

Figure 1: Regulatory News on Volatility of Cryptocurrencies



Note: The values on the y axis correspond to the overlapping volatility calculated as the standard deviation of the 1st difference of the log of the price with a right sided window of 7 days. Red vertical lines represent specified negative regulatory events, and dashed blue vertical lines represent specified positive regulatory events.

Figure 2: Histograms of Cryptocurrency Volatility

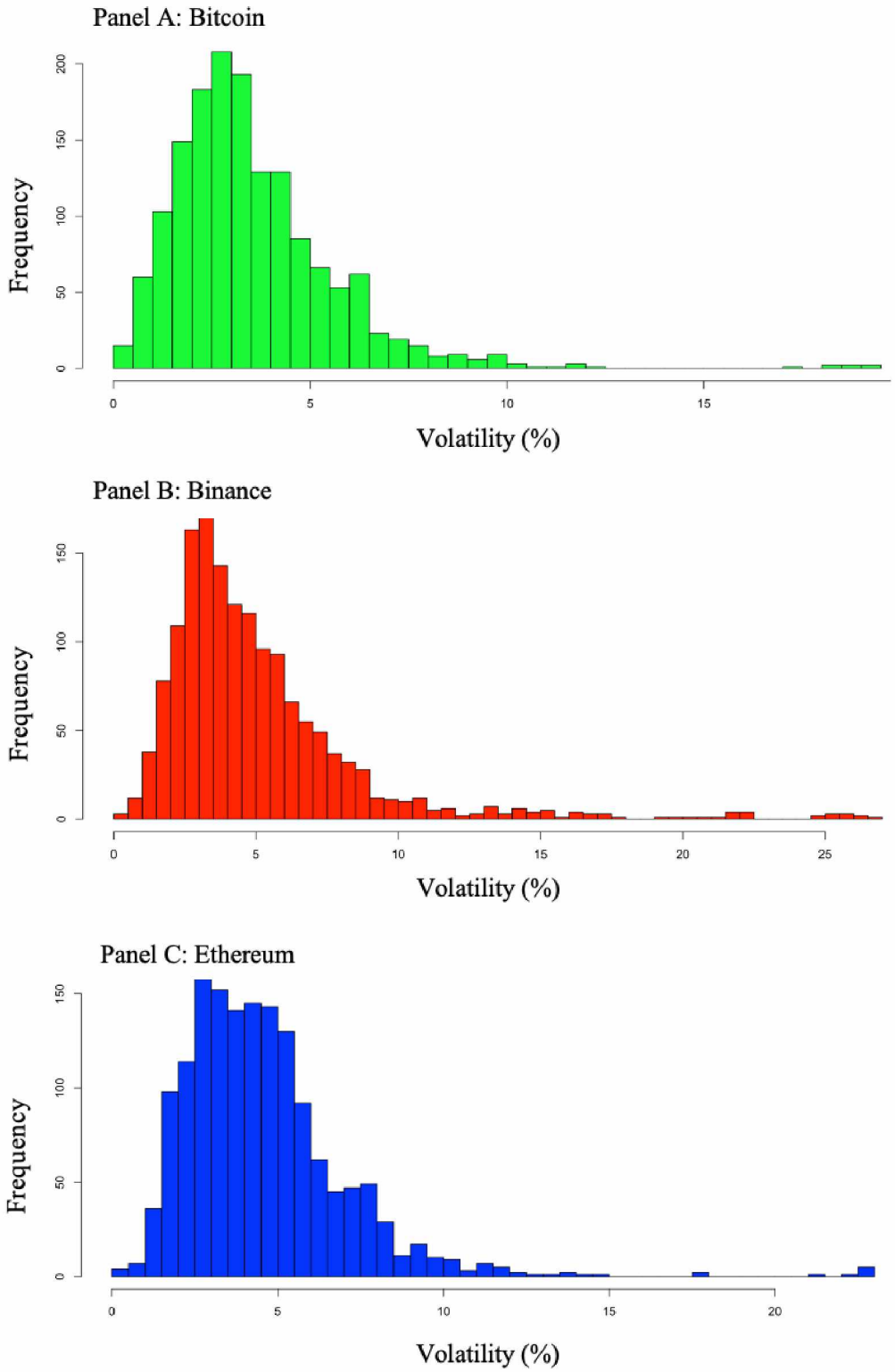


Table 1 displays sample summary statistics for the entire sample. The volatility of Bitcoin noted as "VBTC", volatility of Binance noted as "VBNB" and volatility of Ethereum noted as "VETH" are calculated as the standard deviation of the 1st difference of the log of the price with a rolling right sided window of 7 days. Variables "good" and "bad" are dummy variables for positive and negative regulatory news taking the value of 1 if an event occurs and 0 otherwise.

Table 1: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
1. VBTC	1540	3.534	2.128	0.200	19.028
2. VBNB	1540	5.056	3.559	0.469	26.988
3. VETH	1540	4.576	2.506	0.392	22.909
4. good	1540	0.021	0.145	0.000	1.000
5. bad	1540	0.019	0.136	0.000	1.000

Table 2 is the correlation matrix for the sample data. The variables representing the volatilities of Bitcoin, Binance, and Ethereum are positively correlated at the 5% level. The correlation coefficients between the volatility variables and the regulatory news dummy variables are close to zero and are not statistically significant.

Table 2: Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4
1. VBTC	3.53	2.13				
2. VBNB	5.06	3.56	.63** [.60, .66]			
3. VETH	4.58	2.51	.78** [.76, .80]	.63** [.60, .66]		
4. good	0.02	0.14	.01 [-.04, .06]	.02 [-.03, .07]	-.01 [-.06, .04]	
5. bad	0.02	0.14	.05 [-.00, .10]	.04 [-.01, .09]	.03 [-.02, .08]	-.02 [-.07, .03]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). *, ** indicate statistical significance at 5% and 1% level, respectively.

3.2 Econometric Modeling

I will be using a dynamic causal model regressing overlapping volatility with lagged regulation news dummy variables and heteroskedastic autocorrelation standard errors. The lag length is chosen by $m= 0.75\ T^{1/3}$, T being the sample size. I have also estimated a modified dynamic causal model regressions overlapping volatility with the difference between lagged regulation dummies to obtain the correct heteroskedastic standard errors for the cumulative multipliers. The following models are run for Bitcoin, Binance and Ethereum with a lag length of 9 as chosen by

$$VBTC_t = \beta_0 + \beta_1 good_t + \beta_2 bad_t + \beta_3 good_{t-1} + \beta_4 bad_{t-1} + \beta_5 good_{t-2} + \beta_6 bad_{t-2} + \ldots + \beta_m good_{t-m-1} + \beta_{m+1} bad_{t-m} + X_t + \varepsilon_t \quad (1)$$

$$VBTC_t = \beta_0 + \beta_1 bad_t + \beta_2 bad_{t-1} + \beta_3 bad_{t-2} + \ldots + \beta_m bad_{t-m-1} + X_t + \varepsilon_t \quad (2)$$

$$VBTC_t = \beta_0 + \beta_1 good_t + \beta_2 good_{t-1} + \beta_3 good_{t-2} + \ldots + \beta_m good_{t-m-1} + X_t + \varepsilon_t \quad (3)$$

$$VBTC_t = \delta_0 + \delta_1 \Delta good_t + \delta_2 \Delta bad_t + \delta_3 \Delta good_{t-1} + \delta_4 \Delta bad_{t-1} + \delta_5 \Delta good_{t-2} + \delta_6 \Delta bad_{t-2} + \ldots + \delta_r \Delta good_{t-r+1} + \delta_r \Delta bad_{t-r+1} + \delta_{r+1} good_{t-r} + \delta_{r+1} bad_{t-r} + X_t + u_t \quad (4)$$

$$VBTC_t = \delta_0 + \delta_1 \Delta bad_t + \delta_2 \Delta bad_{t-1} + \delta_3 \Delta bad_{t-2} + \cdots + \delta_r \Delta bad_{t-r+1} + \delta_{r+1} bad_{t-r} + X_t + u_t \quad (5)$$

$$VBTC_t = \delta_0 + \delta_1 \Delta good_t + \delta_2 \Delta good_{t-1} + \delta_3 \Delta good_{t-2} + \ldots + \delta_r \Delta good_{t-r+1} + \delta_{r+1} good_{t-r} + X_t + u_t \quad (6)$$

Models 1, 2, and 3 are used to estimate the causal effect of regulatory news on the volatility of the cryptocurrencies studies. Models 4, 5, and 6 are modifications of the dynamic casual model that allow the computation of the cumulative multipliers and their respective heteroskedastic autocorrelation standard errors.

To ensure the results of the estimated model hold under endogeneity assumptions and possibility of Omitted Variable Bias I have included multiple variables as controls as described in Table 3 and below.

Forward Looking

The first included being the Consumer Confidence Index obtained from OECD data. The CCI is a leading indicator that was included in Lyocsa (2020) to control for macroeconomic variable influence and can be used to provide an indication of future consumption and saving based on economic sentiment. If values are less than 100 individuals expect worsened economic conditions and predict and increase in savings, while values greater than 100 predict an increase in spending due to the positive economic outlook. I include this variable as volatile investments during a recession could potentially worsen a recession which may influence policymakers to enact new laws to discourage cryptocurrency investment. Therefore, a lower CCI could result in stricter (negative) regulation which could cause investors to panic increasing the volatility of cryptocurrencies causing an upward bias in the model.

Second, I include the Composite Leading Indicator obtained from OECD data as well. The patterns in the CLI are likely to be followed by the business cycle approximately 6-9 months following a turn in the estimation. The average for the CLI is around 100, and values below 100 would suggest future contraction while values above 100 would suggest future expansion. Since the CLI can provide early signals of turning points in business cycles, this metric can be used as a proxy for the effect business cycles may have on the volatility of cryptocurrency. I include this variable as a downturn could potentially influence policymakers to enact stricter (negative) regulation which could cause investors to panic increasing the volatility of cryptocurrencies.

Table 3
An Overview of Macroeconomic Variables

Variable	Definition
Real Economy	
Federal Funds Effective Rate (DFF)	The federal funds rate is the central interest rate in the U.S. financial market
10-Year Breakeven Inflation Rate (IN)	A measure for expected inflation from 10-Year Treasury Constant Maturity Securities and implies what individuals expect inflation to be in the next 10 years.
Market Capitalization	
S&P 500 Volatility (VSP)	Volatility of the S&P 500 index calculated as the standard deviation of the 1st difference of the log of the price with a rolling right sided window of 7 days to keep consistency with other calculated volatilities
Moody's Seasoned Aaa Corporate Bond Yield (CBY)	Measure based on bonds Aaa rated (highest quality rating) with maturities 20 years and above.
Prices	
Consumer Price Index (CPI)	The Consumer Price Index for All Urban Consumers represents a basket of goods where a percent change measures inflation between any two time periods.
Forward Looking	
Consumer Confidence Index (CCI)	Provides an indication of future household consumption and savings based on sentiment about the general economy.
Composite Leading Indicator (CLI)	Provides early signals of turning points in business cycles by showing short term economic movements in qualitative terms.

Prices

Next, I include the Consumer Price Index obtained from the FRED database. The CPI represents a basket of goods where a percent change measures inflation between any two time periods. The CPI was included in Lyocsa (2020) to control for macroeconomic variable influence, and I include this variable as an increase in prices can suggest a lower purchasing power which may influence policymakers in altering monetary policy to enact stricter (negative) regulation while simultaneously reducing the volatility of cryptocurrencies.

Market Capitalization

Next, I include the Volatility of the S&P 500 (VSP) obtained from the Yahoo finance via quantmod package. The S&P 500 measures the value of the 500 largest corporation's stocks by market capitalization. I include this variable as an increase in the volatility of the S&P500 suggests an increase in the volatility of cryptocurrency markets and may influence policymakers to introduce stricter (a potential downward bias in the model.

Next, I include the Moody's Seasoned Aaa Corporate Bond Yield obtained from the FRED database. Previous research finds that measures of business conditions help predict stock returns in a variety of datasets, therefore corporate bond yield can be expected to predict volatility (Green 2000). I include this variable as higher bond yields increase the discount rate that investors use to calculate the present value of future cash flows which results in lower prices for tech valuations such as cryptocurrency. This could increase the volatility of cryptocurrencies as investors begin to panic sell while increasing regulation to reduce the impulse trading.

Real Economy

Next, I include the Federal Funds Effective Rate obtained from the FRED database. Previous research finds that measures of business conditions help predict stock returns in a variety of datasets, therefore corporate bond yield can be expected to predict volatility (Green 2000). I include this variable as an increase in rates would result in tightened liquidity that should increase the volatility of cryptocurrencies while higher rates may cause an increase in stricter regulation to reduce the impulse trading.

Finally, I include the 10-Year Breakeven Inflation Rate (IN) obtained from the FRED database. I include this variable as an increase in inflation can suggest a lower purchasing power which may influence policymakers to alter monetary policy and enact more negative regulation while simultaneously reducing the volatility of cryptocurrencies with less individuals investing in cryptocurrencies causing a potential bias in the model.

Table 5 presents the regression results from the dynamic causal model with Newey-West heteroskedastic autocorrelation standard errors including the mentioned control variables.

CHAPTER IV

REGRESSION RESULTS

4.1 Models Without Control Variables

In Table 4, I present the regression results from the dynamic causal model with Newey-West heteroskedastic autocorrelation standard errors. There are three main columns representing each dependent variable, volatility of Bitcoin, Binance, and Ethereum. For each dependent variable there are three different models, one including 9 lags of both the positive regulatory news and negative regulatory news, one including only the 9 lags for negative regulatory news, and one including only the 9 lags for positive regulatory news.

I notice that the coefficients with respect to lags 5, 6, 7, 8, 9 of bad news are statistically significant in all specifications. The sign of the negative news coefficients is always positive with varying statistical significance across models and dependent variables but always have a stronger effect than positive news coefficients. Coefficients for negative news from Models 1, 4, and 7 are very close to the coefficients in Models 2, 5, and 8, this same pattern is seen in coefficients for positive news in Models 1,4, and 7 to Models 3, 6, and 9 suggesting independence.

For Bitcoin volatility in Model 1, good news has a total cumulative effect of 4.895% over 9 lags and bad news has a cumulative effect of 10.393% over 9 lags. Model 2 shows that bad news has a cumulative effect of 9.907% over 9 lags, and Model 3 shows that good news has a cumulative effect of 4.122% over 9 lags.

For Binance volatility in Model 4, good news has a total cumulative effect of 4.895% over 9 lags and bad news has a cumulative effect of 22.301% over 9 lags. Model 5 shows that bad news has a cumulative effect of 18.462% over 9 lags, and Model 6 shows that good news has a cumulative effect of 3.205% over 9 lags.

For Ethereum volatility in Model 7, good news has a total cumulative effect of 3.286% over 9 lags and bad news has a cumulative effect of 10.614% over 9 lags. Model 8 shows that bad news has a cumulative effect of 10.269% over 9 lags, and Model 9 shows that good news has a cumulative effect of 2.467% over 9 lags.

Table 4: Regression Results

	Dependent Variable: VBTC (%)			Dependent Variable: VBNB (%)			Dependent Variable: VETH (%)		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
$good_t$	-0.035		-0.049	0.318		0.354	-0.434		-0.426
	(-0.111)		(-0.143)	(0.518)		(0.518)	(-1.275)		(-1.121)
bad_t	0.917**	0.974**		0.625	0.678		0.667	0.775	
	(2.185)	(2.299)		(0.832)	(0.881)		(1.228)	(1.420)	
$good_{t-1}$	0.224		0.195	0.306		0.365	-0.233		-0.229
	(0.650)		(0.546)	(0.491)		(0.547)	(-0.699)		(-0.651)
bad_{t-1}	0.734	0.748		0.677	0.681		0.496	0.555	
	(1.569)	(1.582)		(0.892)	(0.885)		(0.930)	(1.052)	
$good_{t-2}$	0.253		0.204	0.288		0.347	0.131		0.116
	(0.789)		(0.642)	(0.559)		(0.668)	(0.407)		(0.336)
bad_{t-2}	1.002**	0.966**		1.348*	1.298*		0.870	0.862	
	(2.069)	(2.022)		(1.688)	(1.667)		(1.551)	(1.579)	
$good_{t-3}$	0.634*		0.524*	0.536		0.401	0.399		0.310
	(1.913)		(1.665)	(1.095)		(0.864)	(1.232)		(0.919)
bad_{t-3}	1.019**	0.938*		1.911*	1.834*		0.897	0.860	
	(1.993)	(1.850)		(1.883)	(1.841)		(1.448)	(1.403)	
$good_{t-4}$	0.559*		0.454	0.319		0.109	0.356		0.243
	(1.736)		(1.409)	(0.750)		(0.261)	(1.227)		(0.793)
bad_{t-4}	1.141**	1.049*		2.216**	2.129*		1.162*	1.114	
	(2.046)	(1.892)		(1.966)	(1.925)		(1.649)	(1.566)	
$good_{t-5}$	0.568*		0.403	0.437		0.057	0.356		0.181
	(1.714)		(1.214)	(1.084)		(0.140)	(1.192)		(0.591)
bad_{t-5}	1.338**	1.241**		2.691**	2.615**		1.366*	1.270*	
	(2.478)	(2.324)		(2.194)	(2.137)		(1.901)	(1.775)	
$good_{t-6}$	0.583		0.425	0.518		0.166	0.367		0.204
	(1.495)		(1.084)	(1.001)		(0.314)	(1.093)		(0.600)
bad_{t-6}	1.340***	1.241**		3.061**	2.982**		1.362**	1.249**	
	(2.688)	(2.534)		(2.557)	(2.488)		(2.183)	(2.040)	
$good_{t-7}$	0.816*		0.712	0.937		0.639	0.904*		0.780
	(1.659)		(1.397)	(1.423)		(0.992)	(1.662)		(1.425)
bad_{t-7}	1.070**	0.976**		3.455***	3.394***		1.465***	1.344**	
	(2.465)	(2.281)		(2.776)	(2.681)		(2.588)	(2.452)	
$good_{t-8}$	0.632		0.571	0.738		0.474	0.844		0.752
	(1.195)		(1.036)	(1.132)		(0.731)	(1.362)		(1.188)
bad_{t-8}	0.944**	0.907**		3.364***	3.329***		1.367**	1.302**	
	(2.131)	(2.051)		(2.629)	(2.580)		(2.263)	(2.214)	
$good_{t-9}$	0.661		0.634	0.498		0.293	0.596		0.536
	(1.212)		(1.136)	(0.730)		(0.434)	(0.953)		(0.847)
bad_{t-9}	0.888**	0.867**		2.953**	2.916**		0.962**	0.938**	
	(2.383)	(2.276)		(2.411)	(2.361)		(2.036)	(2.005)	
Intercept	3.230***	3.344***	3.439***	4.534***	4.648***	4.982***	4.317***	4.394***	4.531***
	(13.028)	(12.508)	(13.597)	(11.078)	(11.532)	(10.179)	(15.650)	(14.870)	(15.867)
R^2	0.055	0.041	0.010	0.086	0.081	0.002	0.042	0.033	0.007
Adj. R^2	0.043	0.035	0.004	0.073	0.075	-0.004	0.029	0.026	0.000
Num. obs.	1531	1531	1531	1531	1531	1531	1531	1531	1531

Note: The significance level of the coefficient is indicated by * (10%), ** (5%) and *** (1%).

4.2 MODELS WITH CONTROL VARIABLES

Models regressing non-overlapping weekly volatility on news regulatory events can be found in Tables 7-9 in the Appendix. If positive news occurred within the week the dummy variable took the value of 1 and 0 otherwise, and similarly for negative news events. This resulted in a sample size of 221, and these regressions utilized OLS standard errors. Table 9 shows equations 1,2 and 3, without control variables, table 9 includes control variables, and table 10 utilizes equations 4,5, and 6.

Table 5 presents the regression results from the dynamic causal model with Newey-West heteroskedastic autocorrelation standard errors including control variables. The three models present for each dependent variable correspond to equations 1, 2 and 3 in section 3.2. Figures 3-5 illustrate the impact effect over the 9 days following regulatory news events.

Table 5: Regression Results

	Dependent Variable: VBTC (%)			Dependent Variable: VBNB (%)			Dependent Variable: VETH (%)		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
$good_t$	0.006		-0.031	0.430		0.433	-0.446		-0.458
	(0.022)		(-0.114)	(0.647)		(0.610)	(-1.518)		(-1.446)
bad_t	0.873***	0.932***		0.319	0.365		0.584	0.721	
	(2.769)	(2.790)		(0.438)	(0.483)		(1.338)	(1.542)	
CCI	1.177***	1.214***	1.219***	1.158***	1.182***	1.247***	0.989***	1.022***	1.034***
	(5.400)	(5.230)	(5.160)	(3.157)	(3.145)	(2.998)	(3.434)	(3.415)	(3.340)
VSP	71.341**	70.576**	74.822**	78.167*	78.383*	86.604*	96.569**	96.337**	100.321***
	(2.305)	(2.191)	(2.382)	(1.813)	(1.777)	(1.952)	(2.542)	(2.456)	(2.598)
CLI	0.024	0.028	0.035	0.156	0.157	0.178	0.038	0.041	0.049
	(0.330)	(0.367)	(0.440)	(1.402)	(1.409)	(1.469)	(0.440)	(0.456)	(0.543)
IN	-1.152	-1.308	-1.158	2.229	2.129	2.170	0.193	0.065	0.177
	(-1.051)	(-1.125)	(-1.011)	(1.084)	(1.012)	(1.014)	(0.140)	(0.045)	(0.126)
CBY	1.157	0.942	0.713	4.950*	4.720*	3.995	1.674	1.505	1.224
	(0.923)	(0.734)	(0.553)	(1.790)	(1.675)	(1.372)	(0.986)	(0.873)	(0.713)
DFF	-0.071	-0.113	-0.249	-0.173	-0.217	-0.528	-0.035	-0.067	-0.212
	(-0.280)	(-0.436)	(-0.939)	(-0.578)	(-0.705)	(-1.465)	(-0.135)	(-0.259)	(-0.826)
CPI	0.025	0.026	0.020	-0.108*	-0.108*	-0.118**	-0.006	-0.005	-0.011
	(0.778)	(0.757)	(0.587)	(-1.927)	(-1.904)	(-2.012)	(-0.162)	(-0.134)	(-0.290)
$good_{t-1}$	0.124		0.062	0.595		0.617	-0.087		-0.117
	(0.364)		(0.168)	(0.862)		(0.813)	(-0.249)		(-0.302)
bad_{t-1}	0.893**	0.916**		0.690	0.663		0.396	0.487	
	(2.107)	(2.064)		(0.897)	(0.840)		(0.718)	(0.884)	
$good_{t-2}$	0.354		0.261	0.344		0.385	0.069		0.046
	(1.010)		(0.766)	(0.668)		(0.634)	(0.186)		(0.114)
bad_{t-2}	0.836**	0.740*		1.267	1.166		1.043	0.996	
	(2.163)	(1.956)		(1.160)	(1.071)		(1.322)	(1.278)	
$good_{t-3}$	1.048***		0.885***	0.500		0.296	0.353		0.230
	(3.280)		(3.004)	(1.029)		(0.573)	(0.924)		(0.579)
bad_{t-3}	0.553*	0.420		1.159	1.022		0.289	0.200	
	(1.776)	(1.316)		(1.531)	(1.396)		(0.707)	(0.491)	
$good_{t-4}$	1.079**		1.011**	0.316		0.231	0.775*		0.752
	(2.315)		(2.125)	(0.485)		(0.372)	(1.654)		(1.555)
bad_{t-4}	1.000*	0.913		0.832	0.735		0.541	0.512	
	(1.752)	(1.511)		(1.423)	(1.266)		(1.015)	(0.871)	
$good_{t-5}$	0.656		0.527	0.336		0.032	0.501		0.351
	(1.558)		(1.194)	(0.752)		(0.069)	(1.342)		(0.938)
bad_{t-5}	1.354**	1.222*		2.134*	2.027*		1.473*	1.334*	
	(2.123)	(1.912)		(1.937)	(1.860)		(1.845)	(1.672)	
$good_{t-6}$	0.285		0.098	0.007		-0.344	0.220		0.040
	(0.907)		(0.318)	(0.016)		(-0.770)	(0.680)		(0.125)
bad_{t-6}	1.318***	1.167***		2.803***	2.701***		1.387***	1.237**	
	(3.335)	(2.927)		(2.844)	(2.755)		(2.671)	(2.422)	
$good_{t-7}$	0.689		0.549	1.129		0.773	0.884		0.732
	(1.470)		(1.153)	(1.629)		(1.151)	(1.483)		(1.245)
bad_{t-7}	0.932**	0.799**		3.109***	3.035***		1.151**	0.985**	
	(2.338)	(1.983)		(2.893)	(2.744)		(2.290)	(1.975)	
$good_{t-8}$	0.810*		0.768	0.680		0.389	1.191*		1.081*
	(1.689)		(1.518)	(1.094)		(0.615)	(1.955)		(1.756)
bad_{t-8}	0.720*	0.651		2.804**	2.764**		1.035*	0.925	
	(1.651)	(1.459)		(2.040)	(1.977)		(1.707)	(1.562)	
$good_{t-9}$	0.471		0.467	0.288		0.084	0.435		0.392
	(0.877)		(0.832)	(0.418)		(0.117)	(0.691)		(0.606)
bad_{t-9}	0.309	0.418		1.870*	1.850*		0.825	0.841	
	(0.677)	(0.916)		(1.734)	(1.755)		(1.363)	(1.389)	
Intercept	-123.445***	-126.901***	-126.341***	-109.996**	-111.792**	-116.326**	-100.303***	-103.535***	-103.487***
	(-4.508)	(-4.350)	(-4.349)	(-2.567)	(-2.536)	(-2.476)	(-2.866)	(-2.829)	(-2.802)
R^2	0.285	0.267	0.253	0.280	0.274	0.229	0.253	0.240	0.229
Adj. R^2	0.266	0.255	0.240	0.260	0.262	0.216	0.233	0.227	0.216
Num. obs.	1044	1044	1044	1044	1044	1044	1044	1044	1044

Note: The significance level of the coefficient is indicated by * (10%), ** (5%) and *** (1%).

4.2.1 Impact Causal Effect

Impact Effect Bitcoin

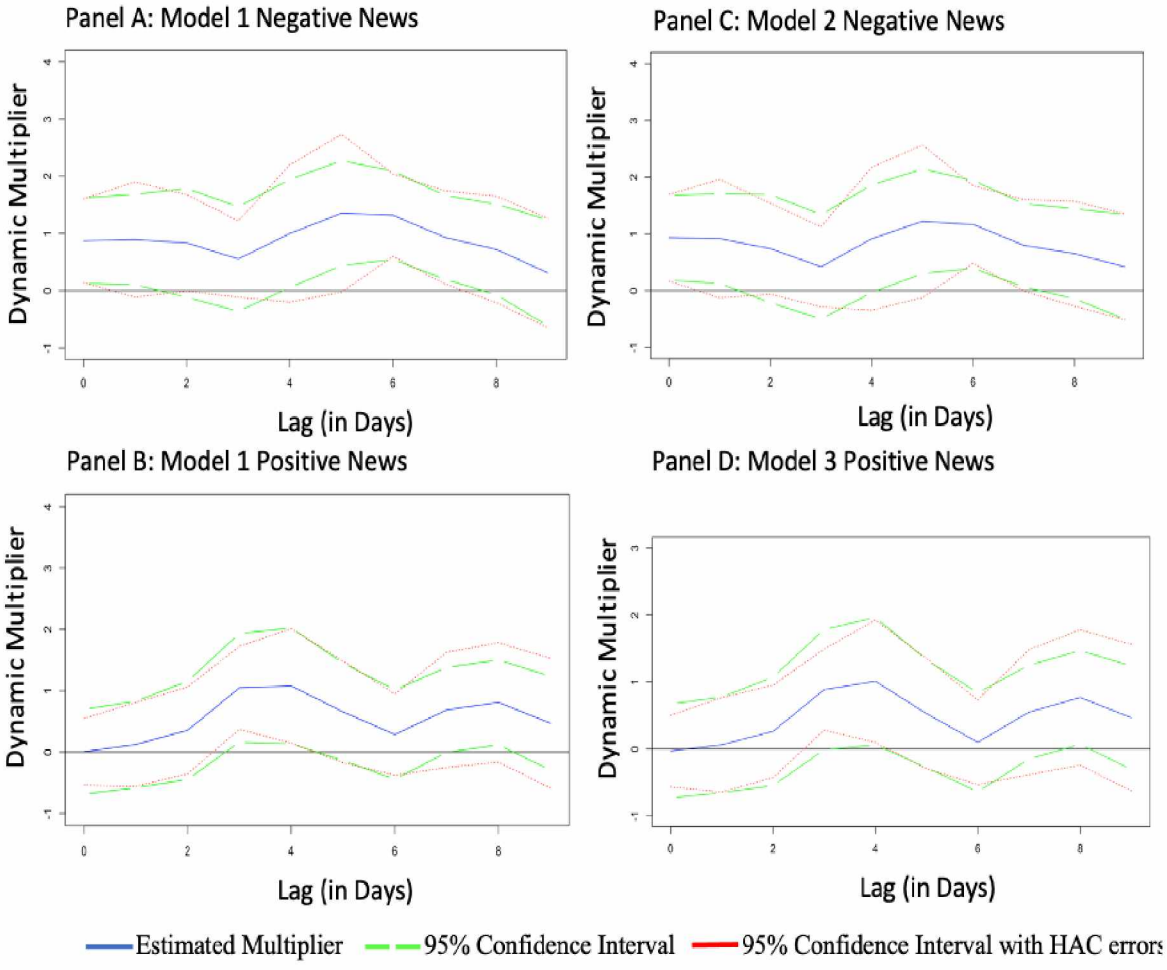
The impact effect for Bitcoin volatility in Model 1 for good news in the same period is an increase of 0.006%, the impact of good news one period after is 0.124%, the impact of good news two periods after is 0.354%, the impact of good news three periods after is 1.048%, the impact of good news four periods after is 1.079%, the impact of good news five periods after is 0.656%, the impact of good news six periods after is 0.285%, the impact of good news seven periods after is 0.689%, the impact of good news eight periods after is 0.810%, the impact of good news nine periods after is 0.471%.

The impact effect for Bitcoin volatility in Model 1 for bad news in the same period is an increase of 0.873%, the impact of bad news one period after is 0.893%, the impact of bad news two periods after is 0.836%, the impact of bad news three periods after is 0.553%, the impact of bad news four periods after is 1.000%, the impact of bad news five periods after is 1.354%, the impact of bad news six periods after is 1.318%, the impact of bad news seven periods after is 0.932%, the impact of bad news eight periods after is 0.720%, the impact of bad news nine periods after is 0.309%.

The impact effect for Bitcoin volatility in Model 2 for bad news in the same period is an increase of 0.932%, the impact of bad news one period after is 0.916%, the impact of bad news two periods after is 0.740%, the impact of bad news three periods after is 0.420%, the impact of bad news four periods after is 0.913%, the impact of bad news five periods after is 1.222%, the impact of bad news six periods after is 1.167%, the impact of bad news seven periods after is 0.799%, the impact of bad news eight periods after is 0.651%, the impact of bad news nine periods after is 0.418%.

The impact effect for Bitcoin volatility in Model 3 for good news in the same period is an increase of -0.031%, the impact of good news one period after is 0.062%, the impact of good news two periods after is 0.261%, the impact of good news three periods after is 0.885%, the impact of good news four periods after is 1.011%, the impact of good news five periods after is 0.527%, the impact of good news six periods after is 0.098%, the impact of good news seven periods after is 0.549%, the impact of good news eight periods after is 0.768%, the impact of good news nine periods after is 0.467%.

Figure 3: Impact Effect of Regulatory News on Bitcoin



Impact Effect Binance

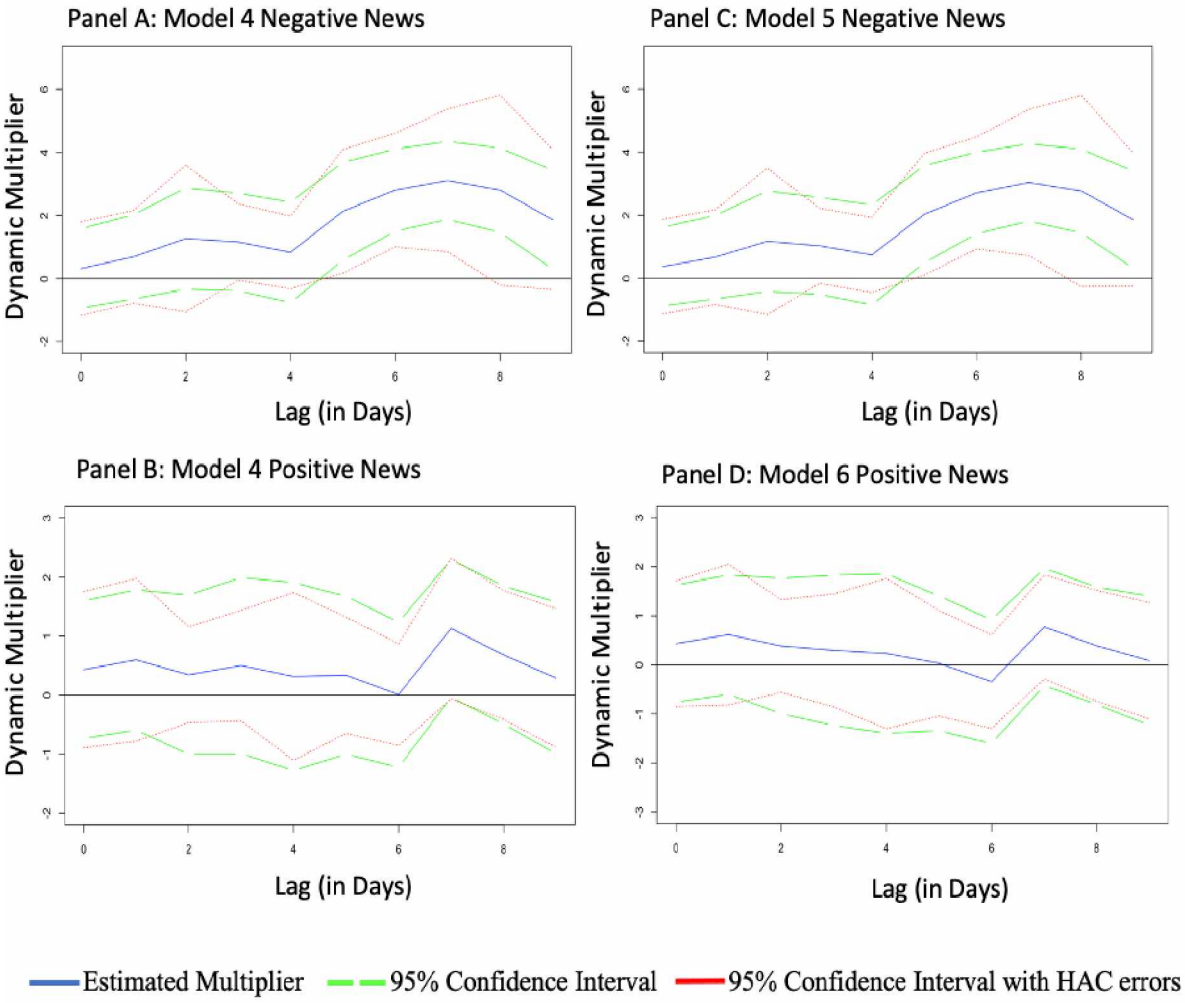
The impact effect for Binance volatility in Model 4 for good news in the same period is an increase of 0.430%, the impact of good news one period after is 0.595%, the impact of good news two periods after is 0.344%, the impact of good news three periods after is 0.500%, the impact of good news four periods after is 0.316%, the impact of good news five periods after is 0.366%, the impact of good news six periods after is 0.007%, the impact of good news seven periods after is 1.129%, the impact of good news eight periods after is 0.680%, the impact of good news nine periods after is 0.288%.

The impact effect for Binance volatility in Model 4 for bad news in the same period is an increase of 0.319%, the impact of bad news one period after is 0.690%, the impact of bad news two periods after is 1.267%, the impact of bad news three periods after is 1.159%, the impact of bad news four periods after is 0.832%, the impact of bad news five periods after is 2.134%, the impact of bad news six periods after is 2.803%, the impact of bad news seven periods after is 3.109%, the impact of bad news eight periods after is 2.804%, the impact of bad news nine periods after is 1.870%.

The impact effect for Binance volatility in Model 5 for bad news in the same period is an increase of 0.365%, the impact of bad news one period after is 0.663%, the impact of bad news two periods after is 1.166%, the impact of bad news three periods after is 1.022%, the impact of bad news four periods after is 0.735%, the impact of bad news five periods after is 2.027%, the impact of bad news six periods after is 2.701%, the impact of bad news seven periods after is 3.035%, the impact of bad news eight periods after is 2.764%, the impact of bad news nine periods after is 1.850%.

The impact effect for Binance volatility in Model 6 for good news in the same period is an increase of 0.433%, the impact of good news one period after is 0.617%, the impact of good news two periods after is 0.385%, the impact of good news three periods after is 0.296%, the impact of good news four periods after is 0.231%, the impact of good news five periods after is 0.032%, the impact of good news six periods after is -0.344%, the impact of good news seven periods after is 0.733%, the impact of good news eight periods after is 0.389%, the impact of good news nine periods after is 0.84%.

Figure 4: Impact Effect of Regulatory News on Binance



Impact Effect Ethereum

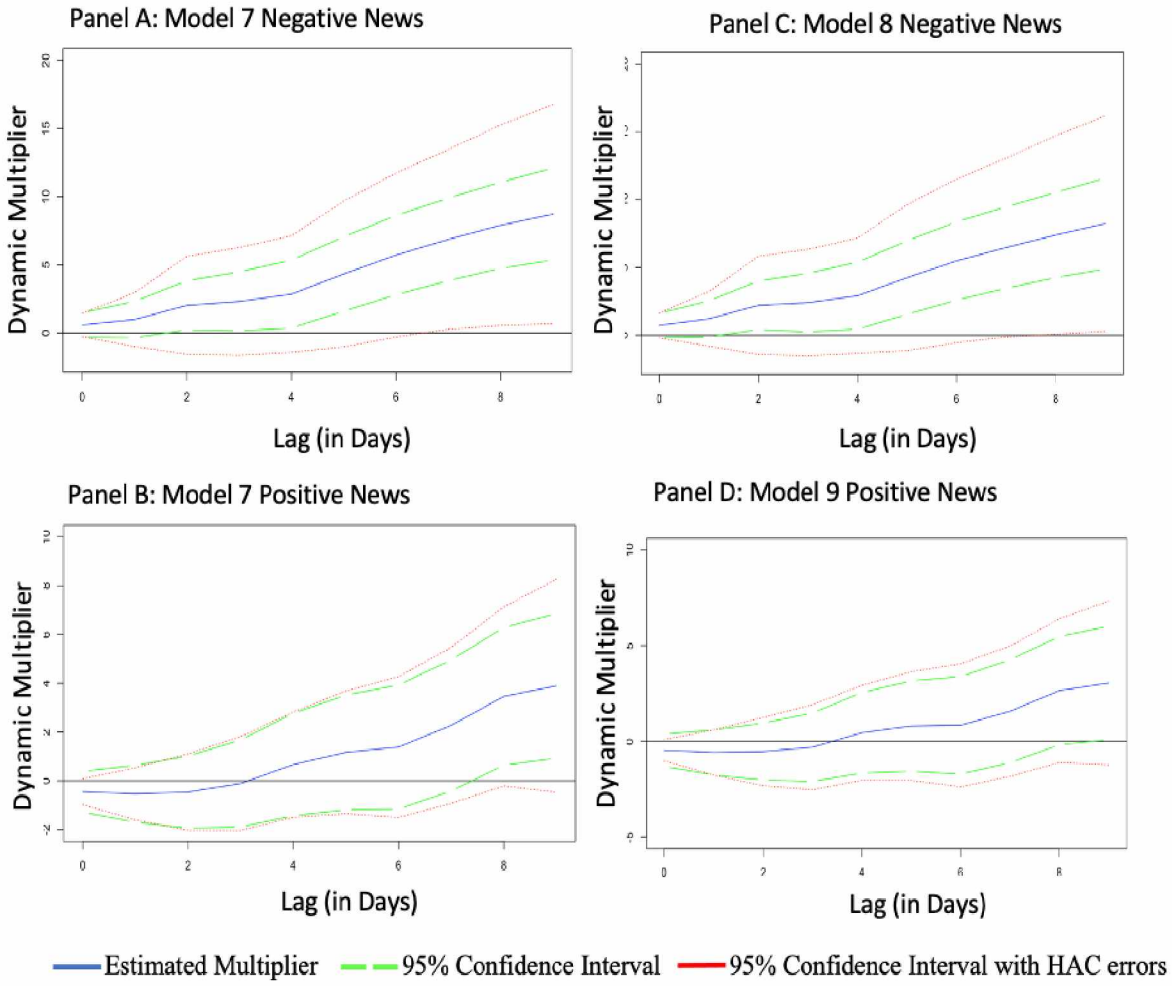
The impact effect for Ethereum volatility in Model 7 for good news in the same period is an increase of -0.446%, the impact of good news one period after is -0.087%, the impact of good news two periods after is 0.069%, the impact of good news three periods after is 0.353%, the impact of good news four periods after is 0.775%, the impact of good news five periods after is 0.501%, the impact of good news six periods after is 0.220%, the impact of good news seven periods after is 0.884%, the impact of good news eight periods after is 1.191%, the impact of good news nine periods after is 0.435%.

The impact effect for Ethereum volatility in Model 7 for bad news in the same period is an increase of 0.584%, the impact of bad news one period after is 0.396%, the impact of bad news two periods after is 1.043%, the impact of bad news three periods after is 0.289%, the impact of bad news four periods after is 0.541%, the impact of bad news five periods after is 1.473%, the impact of bad news six periods after is 1.387%, the impact of bad news seven periods after is 1.151%, the impact of bad news eight periods after is 1.035%, the impact of bad news nine periods after is 0.825%.

The impact effect for Ethereum volatility in Model 8 for bad news in the same period is an increase of 0.721%, the impact of bad news one period after is 0.487%, the impact of bad news two periods after is 0.996%, the impact of bad news three periods after is 0.200%, the impact of bad news four periods after is 0.512%, the impact of bad news five periods after is 1.334%, the impact of bad news six periods after is 1.237%, the impact of bad news seven periods after is 0.985%, the impact of bad news eight periods after is 0.924%, the impact of bad news nine periods after is 0.841%.

The impact effect for Ethereum volatility in Model 9 for good news in the same period is an increase of -0.458%, the impact of good news one period after is -0.117%, the impact of good news two periods after is 0.046%, the impact of good news three periods after is 0.230%, the impact of good news four periods after is 0.752%, the impact of good news five periods after is 0.351%, the impact of good news six periods after is 0.040%, the impact of good news seven periods after is 0.732%, the impact of good news eight periods after is 1.081%, the impact of good news nine periods after is 0.392%.

Figure 5: Impact Effect of Regulatory News on Ethereum



The largest and most significant effect for Model 1 and Model 3 occurs around the 3rd and 4th periods after positive regulation news. For Model 1 and Model 2 the largest and most significant effect occurs around the 5th and 6th periods after negative regulation news. Although the magnitude of the effect is larger for negative news, positive news has the largest effect on the volatility of Bitcoin on average 2 days before the largest impact caused by negative news.

The largest effect for Model 4 occurs around the 7th and 8th periods after positive regulation news and negative regulation news. Similarly, the largest effect for Model 5 occurs around the 7th and 8th for negative regulation news while Model 6 the largest effect occurs one period after and 7 periods after positive news is announced. For both Model 4 and Model 5 the largest impact effect on Binance for negative news occurs on the 7th day following the announcement, while Model 4 and 6 shows the largest impact for positive news similarly occurring on the 7th day.

The largest and most significant effect for Model 7 and Model 9 occurs around the 7th and 8th period after positive regulation news. For Model 7 and Model 8 the largest and most significant effect occurs around the 5th and 6th periods after negative regulation news. Therefore, negative news not only impacts the volatility of Ethereum at a larger magnitude, but its largest impact effect takes effect before the largest impact effect for positive regulatory news.

4.2.2 CUMULATIVE EFFECTS

The following table, Table 6, expands on the conclusions of Table 5 by using Equations 4, 5, and 6 described previously as modifications of the dynamic casual model.

Table 6: Regression Results

	Dependent Variable: VBTC (%)			Dependent Variable: VBNB (%)			Dependent Variable: VETH (%)		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
$\Delta good_t$	0.006		-0.031	0.430		0.433	-0.446		-0.458
	(0.022)		(-0.114)	(0.647)		(0.610)	(-1.518)		(-1.446)
Δbad_t	0.873***	0.932***		0.319	0.365		0.584	0.721	
	(2.769)	(2.790)		(0.438)	(0.483)		(1.338)	(1.542)	
CCI	1.177***	1.214***	1.219***	1.158***	1.182***	1.247***	0.989***	1.022***	1.034***
	(5.400)	(5.230)	(5.160)	(3.157)	(3.145)	(2.998)	(3.434)	(3.415)	(3.340)
VSP	71.341**	70.576**	74.822**	78.167*	78.383*	86.604*	96.569**	96.337**	100.321***
	(2.305)	(2.191)	(2.382)	(1.813)	(1.777)	(1.952)	(2.542)	(2.456)	(2.598)
CLI	0.024	0.028	0.035	0.156	0.157	0.178	0.038	0.041	0.049
	(0.330)	(0.367)	(0.440)	(1.402)	(1.409)	(1.469)	(0.440)	(0.456)	(0.543)
IN	-1.152	-1.308	-1.158	2.229	2.129	2.170	0.193	0.065	0.177
	(-1.051)	(-1.125)	(-1.011)	(1.084)	(1.012)	(1.014)	(0.140)	(0.045)	(0.126)
CBY	1.157	0.942	0.713	4.950*	4.720*	3.995	1.674	1.505	1.224
	(0.923)	(0.734)	(0.553)	(1.790)	(1.675)	(1.372)	(0.986)	(0.873)	(0.713)
DFF	-0.071	-0.113	-0.249	-0.173	-0.217	-0.528	-0.035	-0.067	-0.212
	(-0.280)	(-0.436)	(-0.939)	(-0.578)	(-0.705)	(-1.465)	(-0.135)	(-0.259)	(-0.826)
CPI	0.025	0.026	0.020	-0.108*	-0.108*	-0.118**	-0.006	-0.005	-0.011
	(0.778)	(0.757)	(0.587)	(-1.927)	(-1.904)	(-2.012)	(-0.162)	(-0.134)	(-0.290)
$\Delta good_{t-1}$	0.130		0.030	1.026		1.051	-0.533		-0.575
	(0.233)		(0.051)	(0.801)		(0.756)	(-0.897)		(-0.872)
Δbad_{t-1}	1.766**	1.849**		1.009	1.028		0.980	1.208	
	(2.559)	(2.539)		(0.706)	(0.698)		(1.035)	(1.239)	
$\Delta good_{t-2}$	0.484		0.292	1.370		1.436	-0.463		-0.529
	(0.642)		(0.368)	(0.813)		(0.762)	(-0.552)		(-0.559)
Δbad_{t-2}	2.603***	2.589***		2.276	2.194		2.023	2.204	
	(2.710)	(2.609)		(0.988)	(0.934)		(1.238)	(1.323)	
$\Delta good_{t-3}$	1.532*		1.177	1.870		1.732	-0.110		-0.299
	(1.777)		(1.349)	(0.996)		(0.845)	(-0.104)		(-0.252)
Δbad_{t-3}	3.156***	3.009***		3.434	3.216		2.312	2.405	
	(2.962)	(2.765)		(1.307)	(1.219)		(1.305)	(1.351)	
$\Delta good_{t-4}$	2.610**		2.187**	2.185		1.963	0.664		0.452
	(2.329)		(1.997)	(1.085)		(0.918)	(0.525)		(0.327)
Δbad_{t-4}	4.156***	3.922***		4.267	3.952		2.853	2.917	
	(2.907)	(2.637)		(1.533)	(1.417)		(1.536)	(1.553)	
$\Delta good_{t-5}$	3.267**		2.715**	2.521		1.995	1.166		0.804
	(2.352)		(2.005)	(1.128)		(0.877)	(0.793)		(0.507)
Δbad_{t-5}	5.510***	5.145***		6.400*	5.978*		4.326*	4.251*	
	(2.955)	(2.674)		(1.801)	(1.679)		(1.827)	(1.764)	
$\Delta good_{t-6}$	3.552**		2.813*	2.528		1.651	1.386		0.844
	(2.293)		(1.888)	(1.014)		(0.665)	(0.848)		(0.484)
Δbad_{t-6}	6.828***	6.311***		9.203**	8.680**		5.713**	5.488**	
	(3.321)	(3.017)		(2.248)	(2.139)		(2.110)	(2.000)	
$\Delta good_{t-7}$	4.241**		3.362**	3.658		2.425	2.270		1.576
	(2.530)		(2.086)	(1.275)		(0.869)	(1.223)		(0.813)
Δbad_{t-7}	7.760***	7.111***		12.312***	11.714**		6.864**	6.473**	
	(3.491)	(3.169)		(2.628)	(2.537)		(2.315)	(2.158)	
$\Delta good_{t-8}$	5.051***		4.130**	4.337		2.814	3.461		2.657
	(2.619)		(2.192)	(1.361)		(0.918)	(1.625)		(1.214)
Δbad_{t-8}	8.480***	7.762***		15.117***	14.479***		7.899**	7.399**	
	(3.572)	(3.257)		(2.704)	(2.634)		(2.370)	(2.198)	
$good_{t-9}$	5.522**		4.597**	4.626		2.898	3.896		3.050
	(2.478)		(2.084)	(1.314)		(0.863)	(1.592)		(1.233)
bad_{t-9}	8.789***	8.180***		16.986***	16.329***		8.724**	8.240**	
	(3.504)	(3.226)		(2.786)	(2.734)		(2.396)	(2.255)	
Intercept	-123.445***	-126.901***	-126.341***	-109.996**	-111.792**	-116.326**	-100.303***	-103.535***	-103.487***
	(-4.508)	(-4.350)	(-4.349)	(-2.567)	(-2.536)	(-2.476)	(-2.866)	(-2.829)	(-2.802)
R^2	0.285	0.267	0.253	0.280	0.274	0.229	0.253	0.240	0.229
Adj. R^2	0.266	0.255	0.240	0.260	0.262	0.216	0.233	0.227	0.216
Num. obs.	1044	1044	1044	1044	1044	1044	1044	1044	1044

Note: The significance level of the coefficient is indicated by * (10%), ** (5%) and *** (1%).

Binance Volatility is the most affected by negative regulatory news in the sample, and Bitcoin volatility is the most affected by positive regulatory out of all three cryptocurrencies. For all three coins it remains true that negative regulatory news has a greater effect than positive regulatory news on their volatilities. The following figures 3-8 visualizes these cumulative effects for each model in Table 6 with both standard 95% confidence intervals and 95% confidence intervals with heteroskedastic autocorrelation standard errors.

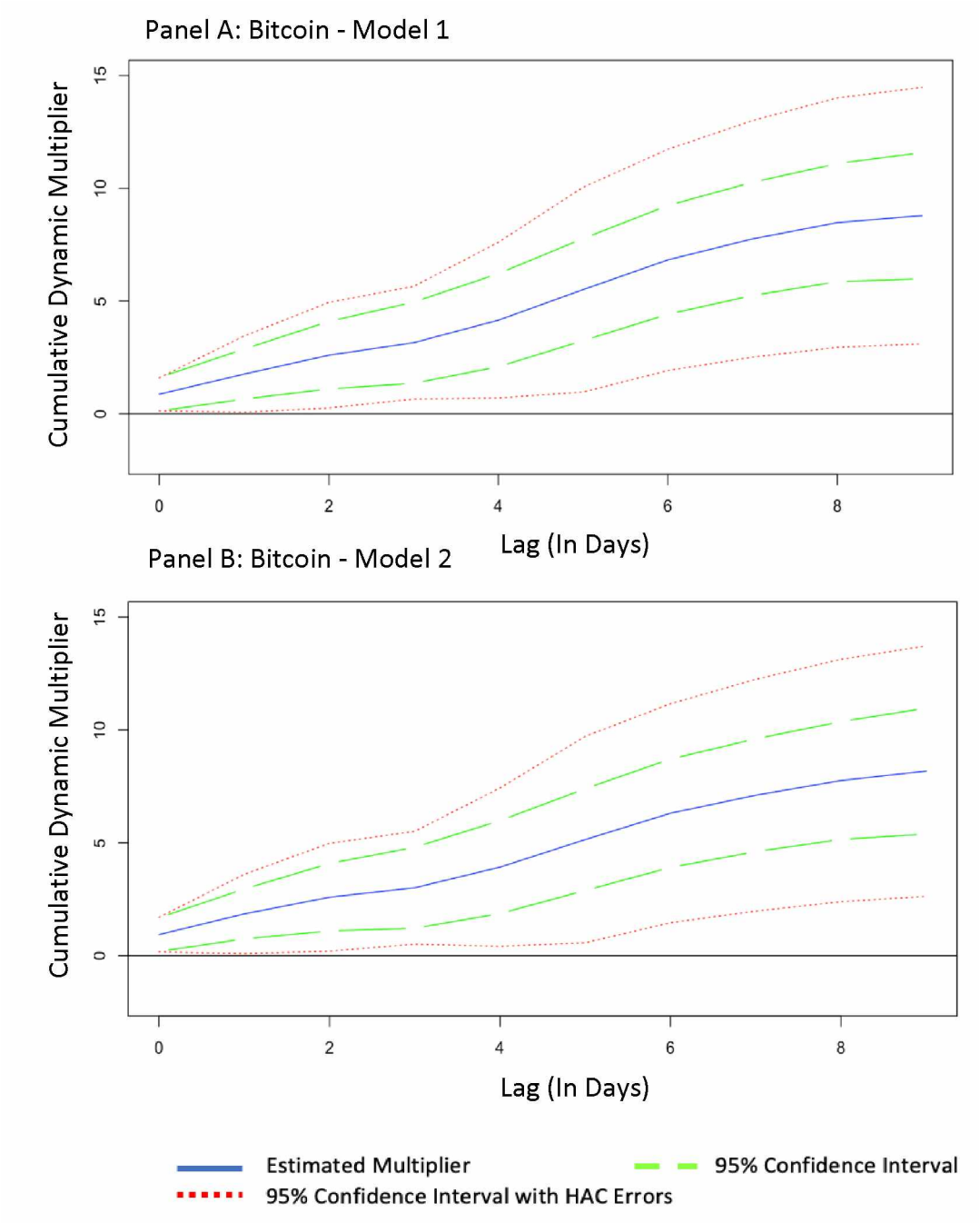
Cumulative effects in table 6 differ slightly from the cumulative effects calculated based off table 5. Model 1 for Bitcoin shows good news with a 4.895% in table 5 while table 6 shows a 5.522% effect and the effect for bad news decreasing from 10.393% to 8.789%. Model 2 in table 6 also shows a decreased value for the effect of negative news from 9.907% to 8.180%. Model 3 in table 6 also shows an increased value for the effect of positive news from 4.122% to 4.597%.

Model 4 for Binance shows good news with a 4.895% effect in table 5 while table 6 shows a 4.626% effect and the effect for bad news decreasing from 22.301% to 16.986%. Model 5 in table 6 also shows a decreased value for the effect of negative news from 18.462% to 16.329%. Model 6 in table 6 shows a decreased value for the effect of positive news from 3.205% to 2.898%.

Model 7 for Ethereum shows good news with a 3.286% in table 5 while table 6 shows a 3.896% effect and the effect for bad news decreasing from 10.614% to 8.724%. Model 8 in table 6 also shows a decreased value for the effect of negative news from 10.269% to 8.240%. Model 9 in table 6 also shows an increased value for the effect of positive news from 2.467% to 3.050%.

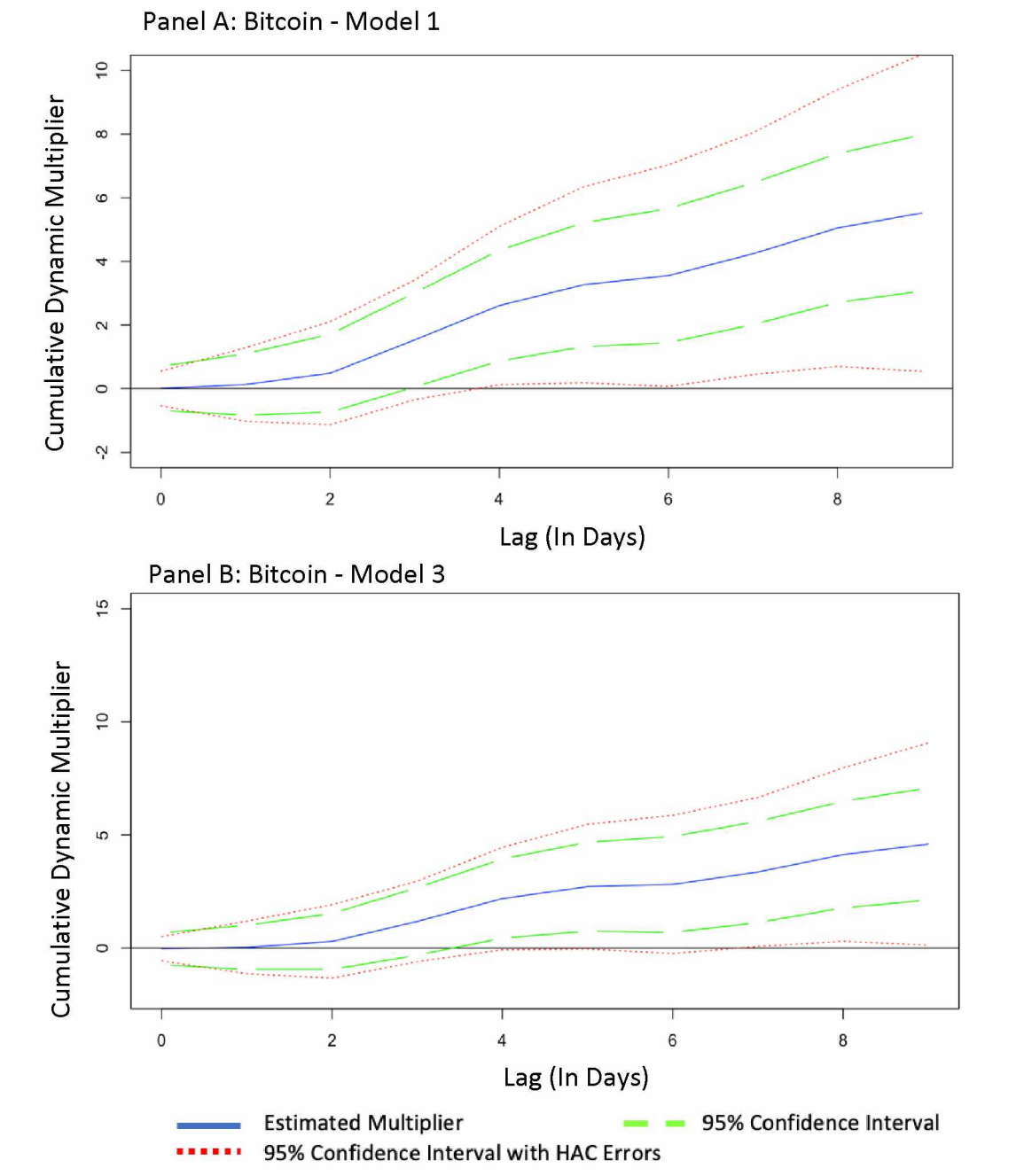
Bad news in Model 1 has a cumulative effect of 8.789% over 9 lags that is statistically significant at the 1% level. Model 2 shows that bad news has a cumulative effect of 8.180% over 9 lags that is statistically significant at the 1% level. Figure 3 below illustrates the similarity between the two models tested.

Figure 6: Cumulative Dynamic Effect of Negative Regulatory News on Bitcoin



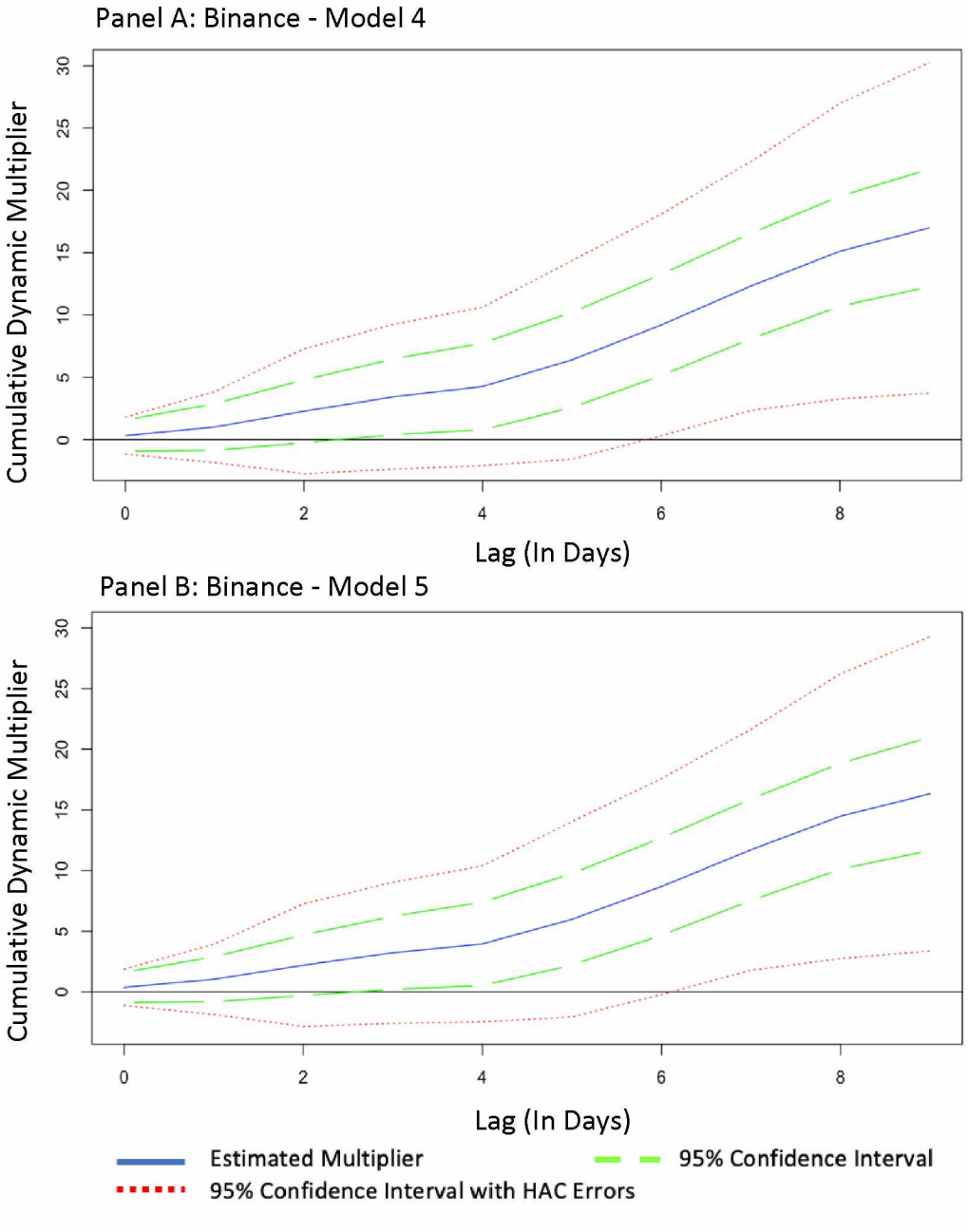
For Bitcoin volatility in Model 1, good news has a total cumulative effect of 5.522% over 9 lags that is statistically significant at the 5% level. Model 3 shows that good news has a cumulative effect of 4.597% over 9 lags that is statistically significant at the 5% level. Figure 4 below illustrates the cumulative effects in both models.

Figure 7: Cumulative Dynamic Effect of Positive Regulatory News on Bitcoin



Negative news in Model 4 has a cumulative effect of 16.986% over 9 lags that is statistically significant at the 1% level. Model 5 shows that bad news has a cumulative effect of 16.329% over 9 lags that is statistically significant at the 1% level. Figure 5 below illustrates the similarities between the models and the respective confidence intervals.

Figure 8: Cumulative Dynamic Effect of Negative Regulatory News on Binance



For Binance volatility in Model 4, positive news is shown below in Figure 6 to have a total cumulative effect of 4.626% over 9 lags that is not statistically significant. Model 6 shows that good news has a cumulative effect of 2.898% over 9 lags which is not statistically significant.

Figure 9: Cumulative Dynamic Effect of Positive Regulatory News on Binance

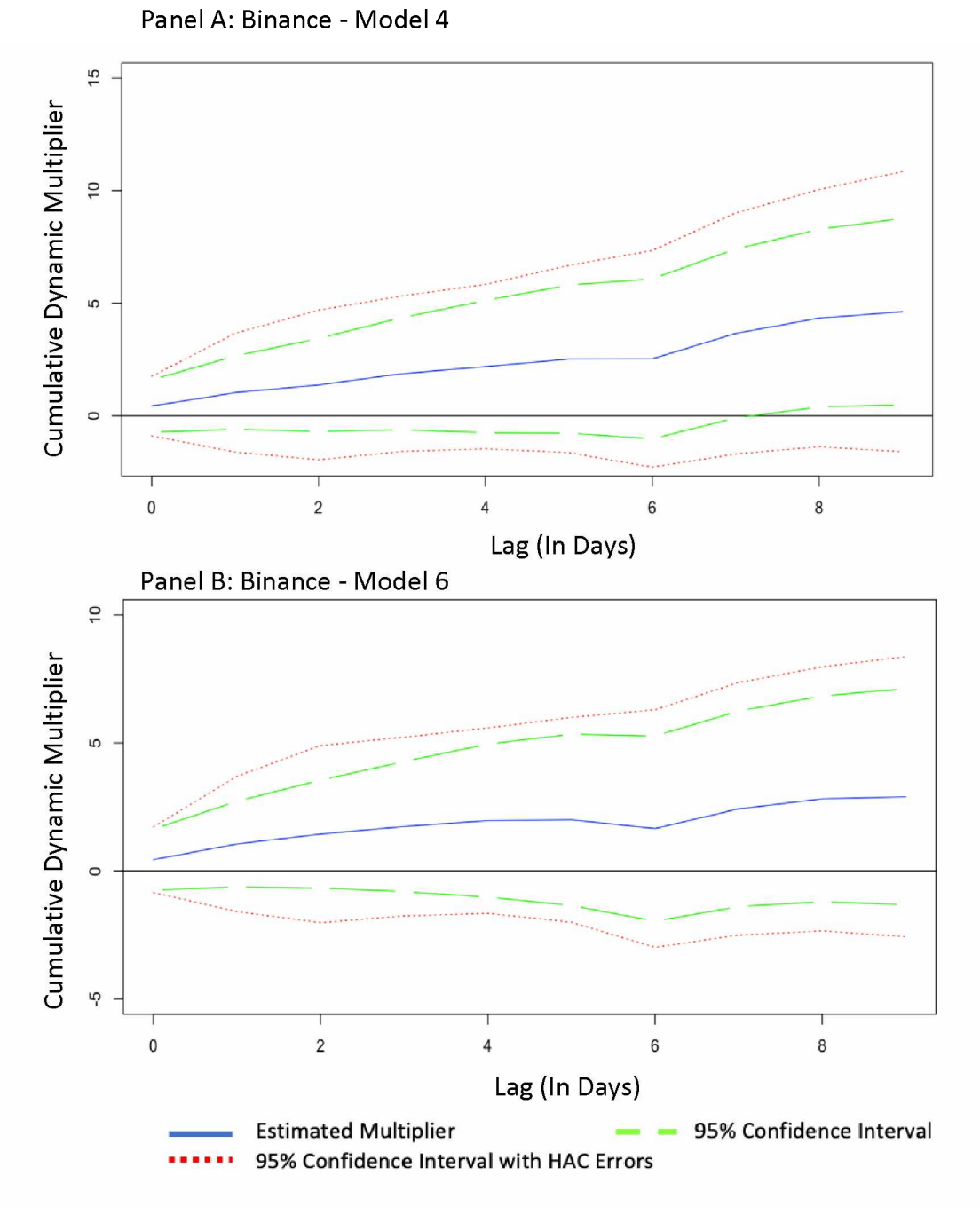
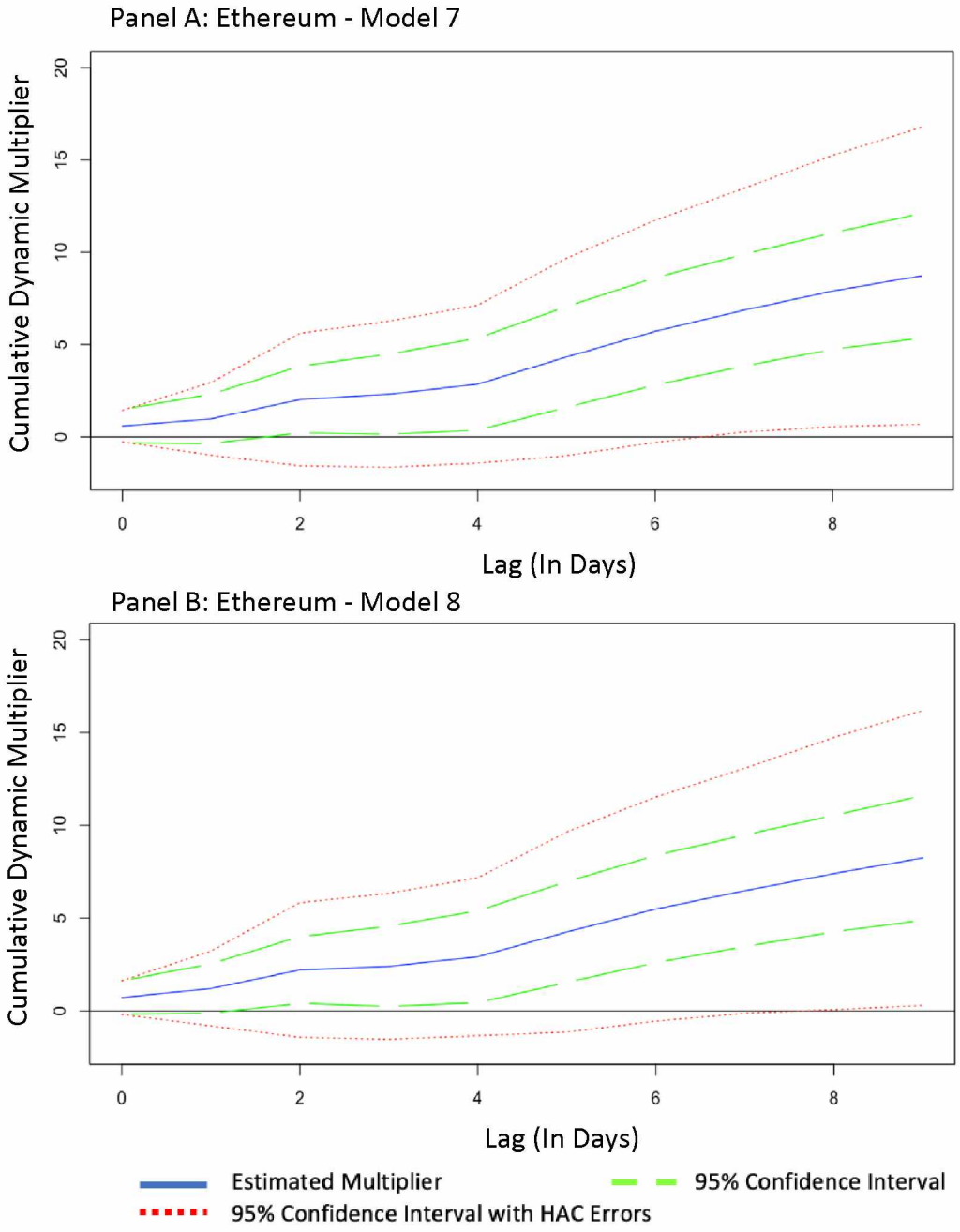


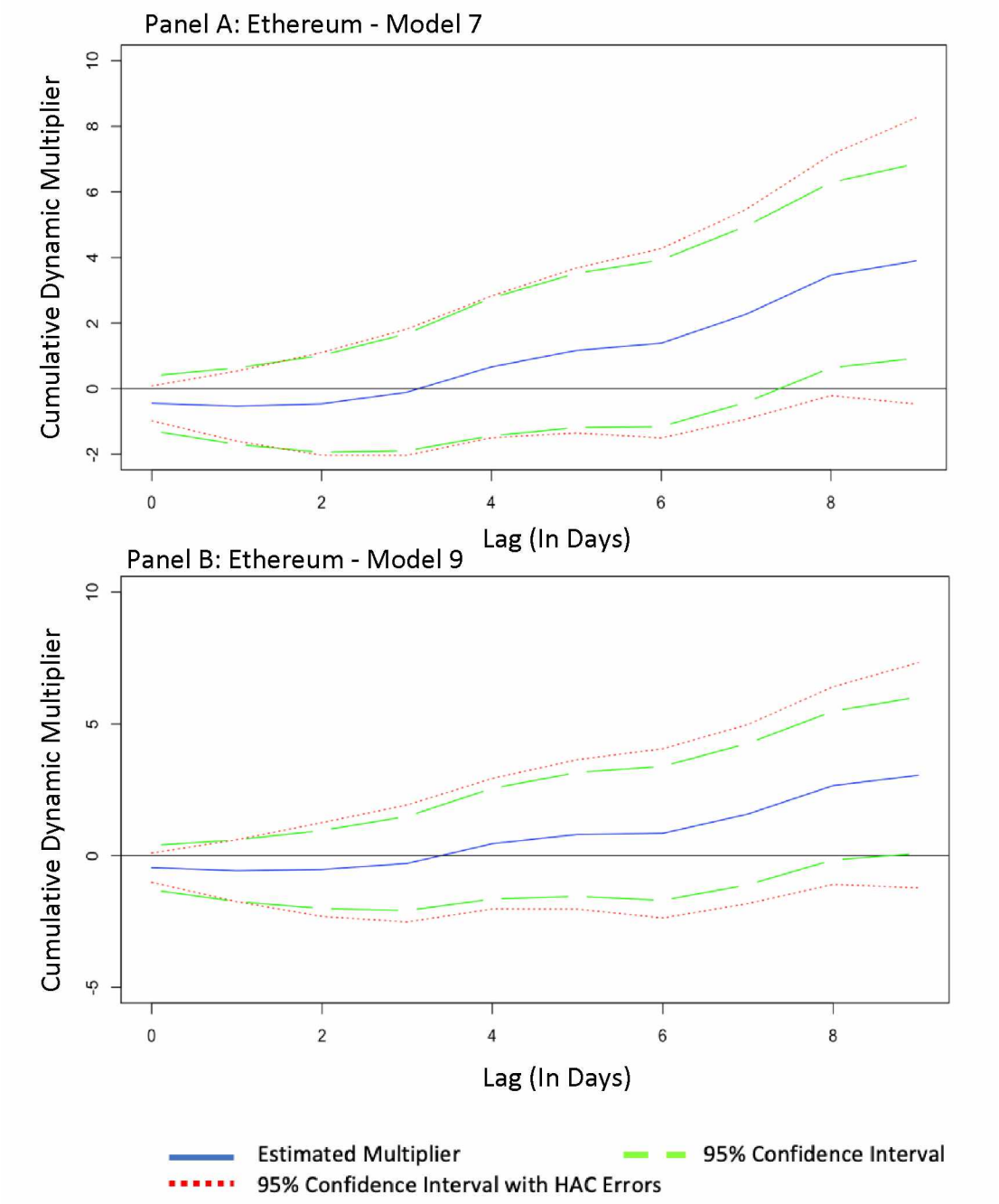
Figure 7 below show that negative news has a cumulative effect of 8.724% over 9 lags that is statistically significant at the 5% level, and that Model 8 shows a similar effect for bad news with a cumulative effect of 8.240% over 9 lags that is statistically significant at the 5% level.

Figure 10: Cumulative Dynamic Effect of Negative Regulatory News on Ethereum



For Ethereum volatility in Model 7, good news has a total cumulative effect of 3.896% over 9 lags which is not statistically significant. Model 9 shows that good news has a cumulative effect of 3.050% over 9 lags which is not statistically significant. Both effects are illustrated in Figure 8 below.

Figure 11: Cumulative Dynamic Effect of Positive Regulatory News on Ethereum



CHAPTER V

CONCLUDING REMARKS

In this paper, I study the volatility of Bitcoin, Binance, and Ethereum and whether they are influenced by news about regulation, the sentiment of the news, and several macroeconomic variables. I use the standard deviation of the 1st difference of the log of the price with a right sided overlapping window of 7 days for the measure of volatility. I utilise a modified dynamic causal model with Newey-West heteroskedastic autocorrelation standard errors to estimate both the impact and cumulative effects that regulation news has on the three cryptocurrencies included in the study. My first key finding is that all three cryptocurrencies react most strongly to negative regulatory news, with positive news having a much smaller and less significant effect. This effect is particularly strong for Binance with Ethereum being affected the least.

Next, in order to control for external factors that may affect the volatility cryptocurrency volatility other than regulatory news I included macroeconomic variables that correspond to market capitalization, pricing, forward looking indicators, and the general economy. I find that the volatility of the cryptocurrencies studied respond to the volatility of the S&P 500 index similar to other financial assets. The forward

indicator, the consumer confidence index yielded a response from all three cryptocurrencies which remains consistent with Lyocsa (2020) who finds that Bitcoin is connected to the overall economy via the forward-looking component. All other macroeconomic variables included do not influence the volatility, except corporate bond yields and consumer price index displaying a week connection to Binance volatility.

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APPENDIX

Table 7: Regulatory News Events

Date	Sentiment	Event
2017-11-21	NEGATIVE	Morocco exchange office issued a public statement in which it declared that transactions via virtual currencies constitute an infringement of the exchange regulations
2017-12-03	POSITIVE	Venezuela Announced Oil Backed Crypto
2017-12-07	NEGATIVE	Bank Indonesia, the country's central bank, issued a regulation banning the use of cryptocurrencies including bitcoin as payment tools
2017-12-21	NEGATIVE	Morocco says bitcoin is not a currency but a "financial asset
2017-12-28	NEGATIVE	The Russian Finance Ministry continued its strict regulatory posturing by suggesting a taxation on cryptocurrency mining ventures
2018-01-02	NEGATIVE	Egypt declares transactions in bitcoin as haram (prohibited under Islamic law)
2018-01-09	POSITIVE	Singapore says the laws don't make any distinction with fiat currency or crypto
2018-01-18	POSITIVE	Switzerland wants to be crypto capital and they set up an ISO working group to increase legality
2018-01-25	NEGATIVE	Canada Central Bank says cryptocurrency isn't legal tender
2018-01-30	NEGATIVE	South Korea bans anonymous cryptocurrency trading accounts
2018-02-13	POSITIVE	Dubai gold trader Regal RA DMCC became the first company in the Middle East to get a license to trade cryptocurrencies
2018-02-20	POSITIVE	Vargas confirmed that the highly controversial Petro cryptocurrency, initiated by President Nicolas Maduro, would go ahead with a presale February 20.
2018-02-27	NEGATIVE	Bank Negara Malaysia has issued a policy document reiterates cryptocurrency is illegal.
2018-03-09	POSITIVE	The Law that Regulates the Financial Technology Institutions (the "Fintech Law") was published in the Federal Official Gazette and became effective on the day following its publication.
2018-03-19	NEGATIVE	The National Bank of Slovakia has published its opinion regarding issuing and trading with virtual currency saying: "this activity is not regulated and supervised by the National Bank of Slovakia".
2018-04-05	NEGATIVE	India's central bank has announced a ban on the sale or purchase of cryptocurrency.

2018-06-19	NEGATIVE	Cambodia makes statement that those who participate in cryptocurrency-related activities without obtaining a license from competent authorities would be subject to penalties in accordance with applicable laws
2018-07-04	POSITIVE	Malta's parliament passed three bills into law, establishing a regulatory framework for blockchain, cryptocurrency, and Distributed Ledger Technology.
2018-08-02	POSITIVE	In the Philippines, the Securities and Exchange Commission will consider all tokens issued in ICOs as securities.
2018-09-02	POSITIVE	Uzbekistan issues a decree legalizing crypto trading also making it tax-free.
2018-11-07	POSITIVE	Taiwan revised its Money Laundering Control Act (MLCA) to allow the government to regulate virtual currency platforms and trading businesses as "financial institutions".
2018-11-15	POSITIVE	The Central Bank of Trinidad and Tobago issued a statement that it was willing to work with companies that provided Fintech and virtual currencies.
2019-01-14	POSITIVE	The Parliament of Singapore passed the Payment Services Act, bringing cryptocurrency dealing or exchange services under the supervision of the Monetary Authority of Singapore (MAS).
2019-01-28	POSITIVE	The Central Bank of Iran reverses a previous ban, but still imposing restrictions on the use of the digital currency inside the Islamic Republic.
2019-02-14	POSITIVE	Securities issued on blockchains in Luxembourg now have the same legal status as traditional securities.
2019-04-11	POSITIVE	The PACTE draft Bill was adopted at its final reading in the French National Assembly.
2019-05-01	POSITIVE	Finland's Financial Supervisory Authority (FIN-FSA) officially began regulating the crypto currency sector.
2019-10-26	POSITIVE	China's cryptography law is aimed at "facilitating the development of the cryptography business and ensuring the security of cyberspace and information".
2019-11-29	POSITIVE	The German Parliament passed a bill which amends an existing anti-money laundering directive to allow German banks to both sell and store cryptocurrencies.
2019-12-30	POSITIVE	The International Monetary Fund (IMF) is providing the Philippines with technical assistance regarding crypto assets.
2020-01-22	POSITIVE	The Mexican National Banking and Securities Commission (CNBV) issued its first license to a cryptocurrency market, to operate as a financial technology institution under the new law.
2020-03-04	POSITIVE	India reverses previous ban on cryptocurrencies
2020-05-21	POSITIVE	Albania passed a new law to regulate cryptocurrency activities.

2020-06-01	NEGATIVE	France enacted new crypto regulations that impact not only French companies, but also international crypto firms seeking to operate in France.
2020-06-10	NEGATIVE	In the UK, The FCA has published final rules banning the sale of derivatives and exchange traded notes (ETNs) that reference certain types of crypto assets
2020-07-31	POSITIVE	Vladimir Putin signed the new cryptocurrency law stating these assets can be sold, purchased, exchanged, and pledged
2020-10-20	POSITIVE	The Bahamas' digital currency "the Sand Dollar" launched
2020-12-02	POSITIVE	Ukrainian parliament adopts bill on virtual assets in the first reading
2020-12-26	NEGATIVE	The Qatar Financial Centre Regulatory Authority (QFCRA) declared that all virtual asset services are banned
2020-12-31	POSITIVE	The National Bank of Kyrgyzstan has published draft legislation that would legally define cryptocurrency and how it may be used in the Central Asian nation.
2021-01-29	NEGATIVE	India introduces a bill to ban all cryptocurrency except a state-backed digital currency issued by the Reserve Bank of India
2021-02-05	NEGATIVE	The Central Bank of Nigeria issued a circular informing financial institutions that dealing in cryptocurrency or facilitating payment for same remains prohibited and would attract a stiff penalty.
2021-03-31	POSITIVE	The Eastern Caribbean Central Bank launched DCash, an electronic version of the Eastern Caribbean dollar
2021-04-16	NEGATIVE	The Central Bank of the Republic of Turkey issued a regulation banning the use of cryptocurrencies
2021-05-11	POSITIVE	Hungary's Minister of Finance announced the country's government would halve capital gains tax on cryptocurrency earnings
2021-05-19	NEGATIVE	China issues a stricter ban on cryptocurrencies
2021-05-26	NEGATIVE	Iran has announced a four-month ban on the energy-consuming mining of cryptocurrencies
2021-06-08	POSITIVE	Bitcoin was made legal tender in El Salvador through the "Bitcoin Law"
2021-06-18	NEGATIVE	The Financial Services Agency (FSA) issued the warning Friday that Binance is not registered to do business in Japan.
2021-07-01	NEGATIVE	Taiwan's new AML regulations, including Hsu's amendment for virtual assets, come into effect
2021-09-01	NEGATIVE	A new proposal from the Financial Administration of the Republic of Slovenia which wants to increase regulation of crypto
2021-09-06	POSITIVE	Securities and Commodities Authority signs agreement with Dubai World Trade Centre Authority to support trading of crypto assets

2021-09-07	POSITIVE	El Salvador "Bitcoin Law" took affect
2021-09-08	POSITIVE	The Ukrainian Parliament passed a law that legalized and regulated bitcoin in the country
2021-09-17	NEGATIVE	Announcement that all exchanges operating in South Korea must obtain licenses from financial and Internet regulators which shut down most exchanges
2021-10-31	NEGATIVE	Poland's new AML laws are in effect
2021-11-11	NEGATIVE	Indonesian Ulema Council issued haram fatwa against use of cryptocurrencies as currency
2021-11-15	NEGATIVE	Laos has issued new regulations to govern cryptocurrency mining operations and trading platforms in the country.
2021-12-28	NEGATIVE	Iran is banning authorized crypto mining in the country until March 6
2022-01-04	NEGATIVE	Kosovo's government introduced a ban on cryptocurrency mining
2022-01-19	POSITIVE	Lao central bank has issued licenses authorizing two companies to trade in cryptocurrencies.
2022-01-27	NEGATIVE	Nepal bans crypto

Table 8: Regression Results

	Dependent Variable: VBTC (%)			Dependent Variable: VBNB (%)			Dependent Variable: VETH (%)		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
$good_t$	0.662***		0.790***	0.928***		0.967***	0.728***		0.663***
	(0.189)		(0.185)	(0.282)		(0.274)	(0.227)		(0.221)
bad_t	-0.121	-0.024		0.663**	0.665**		0.420*	0.410*	
	(0.210)	(0.204)		(0.312)	(0.304)		(0.252)	(0.245)	
$good_{t-1}$	0.783***		0.622***	0.883***		0.791***	0.872***		0.707***
	(0.191)		(0.184)	(0.284)		(0.272)	(0.229)		(0.220)
bad_{t-1}	0.439**	0.322		1.138***	1.212***		0.768***	0.582**	
	(0.214)	(0.208)		(0.318)	(0.311)		(0.257)	(0.250)	
$good_{t-2}$	0.327*		0.263	0.822***		0.836***	0.205		0.304
	(0.187)		(0.182)	(0.278)		(0.269)	(0.224)		(0.217)
bad_{t-2}	0.624***	0.587***		1.099***	1.238***		0.106	0.080	
	(0.214)	(0.208)		(0.318)	(0.311)		(0.257)	(0.250)	
$good_{t-3}$	0.241		0.481***	1.255***		1.693***	0.354		0.529**
	(0.190)		(0.185)	(0.283)		(0.273)	(0.228)		(0.221)
bad_{t-3}	0.092	0.256		-0.055	0.043		0.443*	0.524**	
	(0.213)	(0.206)		(0.316)	(0.308)		(0.255)	(0.247)	
$good_{t-4}$	-0.466**		-0.220	-0.046		0.350	-0.956***		-0.614***
	(0.186)		(0.182)	(0.277)		(0.270)	(0.224)		(0.218)
bad_{t-4}	0.043	0.120		-0.503	-0.113		-0.318	-0.052	
	(0.213)	(0.208)		(0.317)	(0.311)		(0.256)	(0.250)	
$good_{t-5}$	-0.009		0.064	0.706**		0.656**	-0.150		-0.098
	(0.191)		(0.186)	(0.284)		(0.275)	(0.229)		(0.222)
bad_{t-5}	0.676***	0.585***		0.224	0.474		0.445*	0.507**	
	(0.211)	(0.205)		(0.315)	(0.306)		(0.254)	(0.246)	
$good_{t-6}$	-0.490***		-0.443**	1.074***		0.903***	0.184		0.046
	(0.187)		(0.182)	(0.279)		(0.269)	(0.225)		(0.218)
bad_{t-6}	0.752***	0.802***		0.690**	0.576*		0.600**	0.487**	
	(0.211)	(0.205)		(0.314)	(0.306)		(0.253)	(0.246)	
$good_{t-7}$	0.687***		0.769***	1.059***		1.095***	0.943***		0.869***
	(0.188)		(0.182)	(0.279)		(0.269)	(0.225)		(0.217)
bad_{t-7}	0.255	-0.146		-0.450	-0.739**		0.539**	0.086	
	(0.209)	(0.203)		(0.311)	(0.303)		(0.251)	(0.244)	
$good_{t-8}$	-0.306*		-0.173	-0.021		0.029	-0.367*		-0.104
	(0.185)		(0.179)	(0.275)		(0.265)	(0.222)		(0.214)
bad_{t-8}	-0.107	0.071		-0.380	-0.016		-0.974***	-0.630**	
	(0.211)	(0.204)		(0.314)	(0.305)		(0.253)	(0.245)	
$good_{t-9}$	-0.435**		-0.199	0.336		0.375	-0.290		-0.140
	(0.187)		(0.183)	(0.278)		(0.270)	(0.225)		(0.218)
bad_{t-9}	-0.525**	-0.326		0.093	0.083		-0.534**	-0.294	
	(0.206)	(0.201)		(0.306)	(0.300)		(0.247)	(0.241)	
Intercept	3.003***	3.126***	3.135***	3.481***	4.367***	3.694***	4.079***	4.268***	4.174***
	(0.113)	(0.081)	(0.112)	(0.168)	(0.121)	(0.165)	(0.136)	(0.097)	(0.133)
R^2	0.120	0.058	0.060	0.133	0.064	0.085	0.099	0.037	0.048
Adj. R^2	0.102	0.048	0.051	0.115	0.055	0.076	0.081	0.027	0.039
Num. obs.	1013	1013	1013	1013	1013	1013	1013	1013	1013

Note: The significance level of the coefficient is indicated by * (10%), ** (5%) and *** (1%).

Table 9: Regression Results

	Dependent Variable: VBTC (%)			Dependent Variable: VBNB (%)			Dependent Variable: VETH (%)		
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
$good_t$	0.766***		0.809***	1.027***		1.017***	0.758***		0.636***
	(0.171)		(0.168)	(0.258)		(0.252)	(0.209)		(0.206)
bad_t	0.021	0.040		0.661**	0.670**		0.506**	0.407*	
	(0.192)	(0.189)		(0.290)	(0.282)		(0.235)	(0.230)	
CCI	0.859***	0.968***	1.004***	0.672***	0.753***	0.722***	0.829***	0.922***	0.852***
	(0.122)	(0.127)	(0.122)	(0.184)	(0.189)	(0.183)	(0.149)	(0.155)	(0.150)
VSP	0.712***	0.651***	0.793***	0.713***	0.793***	0.742***	0.992***	0.922***	0.958***
	(0.087)	(0.089)	(0.086)	(0.131)	(0.133)	(0.130)	(0.106)	(0.109)	(0.106)
CLI	-0.071*	-0.057	-0.041	0.067	0.084	0.039	-0.002	-0.002	-0.021
	(0.041)	(0.043)	(0.041)	(0.062)	(0.063)	(0.062)	(0.050)	(0.052)	(0.051)
IN	0.338	-0.324	-0.220	3.819***	3.474***	3.771***	0.701	0.166	0.618
	(0.468)	(0.479)	(0.469)	(0.705)	(0.713)	(0.705)	(0.572)	(0.583)	(0.574)
CBY	2.177***	1.626***	1.068*	5.847***	4.930***	5.354***	1.050	0.600	0.966
	(0.577)	(0.595)	(0.547)	(0.870)	(0.885)	(0.821)	(0.705)	(0.724)	(0.670)
DFF	0.253**	0.140	-0.027	0.134	-0.006	0.011	-0.077	-0.164	-0.104
	(0.118)	(0.122)	(0.105)	(0.177)	(0.181)	(0.158)	(0.144)	(0.148)	(0.129)
CPI	0.028*	0.037**	0.034**	-0.086***	-0.106***	-0.076***	-0.008	0.002	-0.001
	(0.015)	(0.015)	(0.015)	(0.022)	(0.022)	(0.022)	(0.018)	(0.018)	(0.018)
$good_{t-1}$	0.731***		0.489***	0.926***		0.733***	0.770***		0.552***
	(0.173)		(0.167)	(0.261)		(0.250)	(0.212)		(0.204)
bad_{t-1}	0.475**	0.321*		1.163***	1.173***		0.708***	0.469**	
	(0.194)	(0.193)		(0.293)	(0.286)		(0.238)	(0.234)	
$good_{t-2}$	0.170		0.067	0.614**		0.620**	-0.044		0.063
	(0.171)		(0.166)	(0.258)		(0.249)	(0.209)		(0.203)
bad_{t-2}	0.537***	0.505***		0.944***	1.104***		-0.111	-0.137	
	(0.195)	(0.194)		(0.294)	(0.288)		(0.238)	(0.236)	
$good_{t-3}$	0.146		0.328*	1.067***		1.492***	0.166		0.313
	(0.172)		(0.167)	(0.260)		(0.252)	(0.211)		(0.205)
bad_{t-3}	0.019	0.179		-0.220	-0.083		0.281	0.349	
	(0.193)	(0.190)		(0.290)	(0.283)		(0.235)	(0.232)	
$good_{t-4}$	-0.588***		-0.375**	-0.217		0.165	-1.174***		-0.839***
	(0.169)		(0.165)	(0.255)		(0.248)	(0.206)		(0.202)
bad_{t-4}	-0.052	-0.050		-0.719**	-0.414		-0.556**	-0.366	
	(0.195)	(0.194)		(0.293)	(0.288)		(0.238)	(0.236)	
$good_{t-5}$	-0.073		-0.025	0.537**		0.478*	-0.289		-0.249
	(0.172)		(0.167)	(0.260)		(0.251)	(0.211)		(0.205)
bad_{t-5}	0.592***	0.407**		-0.021	0.048		0.169	0.134	
	(0.194)	(0.192)		(0.293)	(0.285)		(0.237)	(0.233)	
$good_{t-6}$	-0.577***		-0.608***	0.962***		0.691***	0.033		-0.200
	(0.170)		(0.165)	(0.256)		(0.248)	(0.208)		(0.202)
bad_{t-6}	0.781***	0.749***		0.527*	0.256		0.457*	0.263	
	(0.192)	(0.190)		(0.290)	(0.283)		(0.235)	(0.232)	
$good_{t-7}$	0.573***		0.572***	0.918***		0.830***	0.769***		0.597***
	(0.169)		(0.165)	(0.256)		(0.247)	(0.207)		(0.202)
bad_{t-7}	0.400**	-0.074		-0.463	-0.878***		0.560**	0.043	
	(0.190)	(0.187)		(0.286)	(0.278)		(0.232)	(0.228)	
$good_{t-8}$	-0.578***		-0.450***	-0.396		-0.378	-0.700***		-0.455**
	(0.167)		(0.162)	(0.252)		(0.244)	(0.204)		(0.199)
bad_{t-8}	-0.126	0.084		-0.588**	-0.216		-1.145***	-0.760***	
	(0.191)	(0.188)		(0.288)	(0.280)		(0.234)	(0.229)	
$good_{t-9}$	-0.652***		-0.382**	-0.032		0.018	-0.553***		-0.394*
	(0.170)		(0.165)	(0.256)		(0.247)	(0.207)		(0.202)
bad_{t-9}	-0.539***	-0.347*		-0.190	-0.186		-0.737***	-0.483**	
	(0.188)	(0.187)		(0.283)	(0.278)		(0.229)	(0.227)	
Intercept	-87.504***	-99.873***	-103.550***	-63.402***	-65.406***	-67.339***	-79.847***	-90.019***	-81.726***
	(13.631)	(14.112)	(13.591)	(20.554)	(20.989)	(20.412)	(16.663)	(17.179)	(16.639)
R^2	0.304	0.229	0.259	0.294	0.240	0.255	0.261	0.189	0.211
Adj. R^2	0.284	0.216	0.246	0.275	0.227	0.242	0.241	0.175	0.198
Num. obs.	1013	1013	1013	1013	1013	1013	1013	1013	1013

Note: The significance level of the coefficient is indicated by * (10%), ** (5%) and *** (1%).

Table 10: Regression Results

	Dependent Variable: VBTC (%)			Dependent Variable: VBNB (%)			Dependent Variable: VETH (%)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$\Delta good_t$	0.766***		0.809***	1.027***		1.017***	0.758***		0.636***
	(0.171)		(0.168)	(0.258)		(0.252)	(0.209)		(0.206)
Δbad_t	0.021	0.040		0.661**	0.670**		0.506**	0.407*	
	(0.192)	(0.189)		(0.290)	(0.282)		(0.235)	(0.230)	
CCI	0.859***	0.968***	1.004***	0.672***	0.753***	0.722***	0.829***	0.922***	0.852***
	(0.122)	(0.127)	(0.122)	(0.184)	(0.189)	(0.183)	(0.149)	(0.155)	(0.150)
VSP	0.712***	0.651***	0.793***	0.713***	0.793***	0.742***	0.992***	0.922***	0.958***
	(0.087)	(0.089)	(0.086)	(0.131)	(0.133)	(0.130)	(0.106)	(0.109)	(0.106)
CLI	-0.071*	-0.057	-0.041	0.067	0.084	0.039	-0.002	-0.002	-0.021
	(0.041)	(0.043)	(0.041)	(0.062)	(0.063)	(0.062)	(0.050)	(0.052)	(0.051)
IN	0.338	-0.324	-0.220	3.819***	3.474***	3.771***	0.701	0.166	0.618
	(0.468)	(0.479)	(0.469)	(0.705)	(0.713)	(0.705)	(0.572)	(0.583)	(0.574)
CBY	2.177***	1.626***	1.068*	5.847***	4.930***	5.354***	1.050	0.600	0.966
	(0.577)	(0.595)	(0.547)	(0.870)	(0.885)	(0.821)	(0.705)	(0.724)	(0.670)
DFF	0.253**	0.140	-0.027	0.134	-0.006	0.011	-0.077	-0.164	-0.104
	(0.118)	(0.122)	(0.105)	(0.177)	(0.181)	(0.158)	(0.144)	(0.148)	(0.129)
CPI	0.028*	0.037**	0.034**	-0.086***	-0.106***	-0.076***	-0.008	0.002	-0.001
	(0.015)	(0.015)	(0.015)	(0.022)	(0.022)	(0.022)	(0.018)	(0.018)	(0.018)
$\Delta good_{t-1}$	1.498***		1.298***	1.953***		1.751***	1.528***		1.188***
	(0.245)		(0.244)	(0.370)		(0.366)	(0.300)		(0.298)
Δbad_{t-1}	0.497*	0.360		1.824***	1.843***		1.214***	0.877***	
	(0.254)	(0.252)		(0.383)	(0.375)		(0.311)	(0.307)	
$\Delta good_{t-2}$	1.667***		1.364***	2.567***		2.371***	1.484***		1.251***
	(0.303)		(0.303)	(0.457)		(0.455)	(0.370)		(0.371)
Δbad_{t-2}	1.034***	0.865***		2.768***	2.947***		1.103***	0.740**	
	(0.306)	(0.309)		(0.462)	(0.460)		(0.374)	(0.376)	
$\Delta good_{t-3}$	1.814***		1.692***	3.634***		3.863***	1.650***		1.564***
	(0.356)		(0.359)	(0.536)		(0.538)	(0.435)		(0.439)
Δbad_{t-3}	1.053***	1.044***		2.548***	2.864***		1.384***	1.089***	
	(0.340)	(0.346)		(0.512)	(0.515)		(0.415)	(0.422)	
$\Delta good_{t-4}$	1.226***		1.317***	3.417***		4.028***	0.476		0.725
	(0.402)		(0.404)	(0.605)		(0.607)	(0.491)		(0.495)
Δbad_{t-4}	1.001***	0.994**		1.829***	2.450***		0.828*	0.722	
	(0.384)	(0.392)		(0.579)	(0.584)		(0.469)	(0.478)	
$\Delta good_{t-5}$	1.153***		1.292***	3.954***		4.506***	0.187		0.477
	(0.445)		(0.447)	(0.672)		(0.671)	(0.545)		(0.547)
Δbad_{t-5}	1.593***	1.402***		1.808***	2.499***		0.998**	0.857*	
	(0.411)	(0.420)		(0.619)	(0.624)		(0.502)	(0.511)	
$\Delta good_{t-6}$	0.576		0.684	4.916***		5.197***	0.220		0.276
	(0.490)		(0.492)	(0.738)		(0.738)	(0.598)		(0.602)
Δbad_{t-6}	2.375***	2.150***		2.335***	2.755***		1.455***	1.119**	
	(0.441)	(0.449)		(0.665)	(0.668)		(0.539)	(0.547)	
$\Delta good_{t-7}$	1.149**		1.256**	5.833***		6.026***	0.989		0.873
	(0.537)		(0.539)	(0.810)		(0.809)	(0.656)		(0.659)
Δbad_{t-7}	2.775***	2.077***		1.872***	1.877***		2.015***	1.162**	
	(0.460)	(0.468)		(0.693)	(0.696)		(0.562)	(0.569)	
$\Delta good_{t-8}$	0.571		0.806	5.438***		5.649***	0.288		0.418
	(0.578)		(0.583)	(0.871)		(0.875)	(0.706)		(0.713)
Δbad_{t-8}	2.649***	2.161***		1.284*	1.661**		0.870	0.402	
	(0.477)	(0.487)		(0.719)	(0.724)		(0.583)	(0.593)	
$good_{t-9}$	-0.081		0.423	5.405***		5.667***	-0.265		0.024
	(0.618)		(0.623)	(0.931)		(0.936)	(0.755)		(0.763)
bad_{t-9}	2.110***	1.815***		1.094	1.475**		0.133	-0.081	
	(0.486)	(0.502)		(0.733)	(0.746)		(0.594)	(0.611)	
Intercept	-87.504***	-99.873***	-103.550***	-63.402***	-65.406***	-67.339***	-79.847***	-90.019***	-81.726***
	(13.631)	(14.112)	(13.591)	(20.554)	(20.989)	(20.412)	(16.663)	(17.179)	(16.639)
R^2	0.304	0.229	0.259	0.294	0.240	0.255	0.261	0.189	0.211
Adj. R^2	0.284	0.216	0.246	0.275	0.227	0.242	0.241	0.175	0.198
Num. obs.	1013	1013	1013	1013	1013	1013	1013	1013	1013

Note: The significance level of the coefficient is indicated by * (10%), ** (5%) and *** (1%).