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WHAT ARE THE DRIVERS OF STOCK PRICES? TIME SERIES EVIDENCE FROM THE US

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Abstract *The objective of this article is to analyse the drivers of stock prices in the US. Monthly time series data from May 1999 to August 2020 are used. The empirical results show that there exists a long-run cointegrating relationship between the variables under consideration. In the long run, the exchange rate, Index of Industrial Production (IIP), money supply and the Treasury bill rate (TBR) are positively related to stock prices, while the consumer price index (CPI) is negatively related to stock prices. The vector error correction model results suggest that there is a unidirectional Granger causality running from the CPI to stock prices. In addition, there are four feedback relationships that run between the exchange rate and stock prices; the money supply and stock prices; the IIP and stock prices; and the TBR and stock prices. These findings may have important implications for decision-making by national policymakers.*

Keywords: *Time Series, Dow Jones Index, Stock Prices, Granger Causality, Vector Error Correction Model*

JEL Classification: *F41, C22, C32s*

INTRODUCTION

The worldwide virus pandemic that began in early 2020 has impacted many aspects of normal functioning societies—socially, politically and economically. In March 2020, the US experienced a dramatic decline in the stock markets as never before. The Dow Jones Industrial Average (DJIA) fell over 3,500 points in one week. Between March 6 and March 23, the DJIA fell from 25,865 to 19,028. Subsequently, the US stock markets have also experienced a phenomenal recovery. At the end of 2020, the DJIA finished at 30,606—nearly 1,800 points higher than where it began the year.

In 2007, Ratanapakorn and Sharma did a notable study of six macroeconomic variables and the US stock market using cointegration and unit root tests on 25 years of data from 1975 through 1999. There have been several similar studies into stock prices and economic indicators in a range of countries. Wongbangpo and Sharma (2002) studied the five Southeast Asian ASEAN countries. Similarly, Abugri (2008) studied four Latin American countries, Wickremasinghe (2011) studied Sri Lanka, Dasgupta (2014) studied the BRIC countries, Devkota and Panta (2018) studied Nepal, Ramkelawon et al. (2015) studied Maritus and Upadhyaya et al. (2018) studied India.

Although there have been studies performed on identifying macroeconomic predictors of stock market prices, we believe that what occurred in 2020, combined with the other rises and falls experienced in the past 20 years, provides a good opportunity to further investigate these. This study uses similar methods to those of Ratanapakorn and Sharma (2007) as we examine the period beginning in 1999 through 2020. As shown in Figure 1, the time series plots of the DJIA show that the recent 20 years had more variability than the previous 25 years. It includes the tech bubble decline in the early 2000s, the 2008 crash, and the precipitous fall during the start of the pandemic infections in the US in 2020. There are other substantial differences in some of the macroeconomic factors. For example, during the most recent 20 year period, the US Federal Reserve's monetary policies used low interest rates in hopes of stimulating a recessed economy. A low prime borrowing rate likely affected the short-term US Treasury note rates, an indicator often used in similar studies, e.g., Wickremasinghe (2011), Abugri (2008) and Wongbangpo and Sharma (2002). Additionally, the US Federal Reserve (FED) also aggressively increased the money supply, referring to it as quantitative easing (QE), during that time period as part of their effort to further stimulate a sagging economy.

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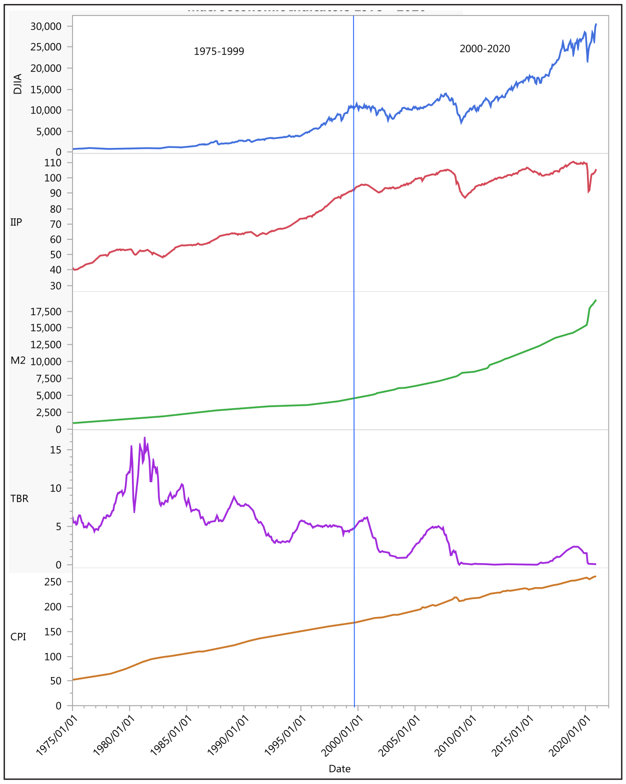

Fig. 1: Microeconomic Indicators 1975-2020

Here we employ an autoregressive model using five factors we believe predict the overall prices in the US stock market. We study the potential for long-term and short-term effects. The five factors are: (1) the relative strength of the US dollar (USD) as measured by its exchange rate; (2) the short-term interest rate; (3) the relative consumer prices; (4) the US money supply and (5) the national production output. Diverging from many past studies, we utilise the M2 money supply due to its likelihood to have a short-term economic impact as hoped for by the FED's QE program employed during the past decade. We also uniquely adopt an effective exchange rate index "Real Broad Effective Exchange Rate for the United States as formulated by the Bank for International Settlements" (RBUSBIS) as opposed to selecting a single exchange rate between the US and one trading partner.

The remainder of this paper includes a brief review of the related literature, a discussion of the macroeconomic factors employed in the study, a presentation of the methodology and results, ending with the conclusions that we draw from our findings.

LITERATURE REVIEW

The study of dynamic causal relationships between stock prices and macroeconomic variables has received extensive attention in the literature. These studies have used different sets of macroeconomic variables and data from both developed and developing economies. In this section, we briefly review a selected number of research articles from a plethora of publications.

Mukherjee and Naka (1995) used the vector error correction model (VECM) methodology to study the relationship between stock market returns and macroeconomic variables, namely the exchange rate, inflation, money supply, Industrial Production Index, long-term government bond rate and call money rate in Japan. The authors find that there exists a long-run equilibrium relationship between the stock prices and the macroeconomic variables in Japan.

Wongbampo and Sharma (2002) studied the linkage between stock prices and five macroeconomic variables, namely GNP, inflation, money supply, interest rate and exchange rate, in five Asian countries: Malaysia, Indonesia, the Philippines, Singapore and Thailand. They employed monthly data for the time period between 1985 and 1996. Again, using the VECM methodology, the authors found that there is both a short-term and long-term relationship between the stock prices and the macroeconomic variables. They also found a feedback relationship between the stock prices and the macroeconomic variables in all the countries in their study.

Tsoukalas (2003) investigated the linkage between stock prices and the macroeconomic variables in Cyprus. The results from their study showed evidence of a strong relationship between stock prices and exchange rates. This could be due to the fact that the Cypriot economy mainly depends on tourism, offshore banking, etc.

Smyth and Nandha (2003) investigated the linkage between exchange rates and stock prices in four Asian countries, namely Bangladesh, India, Pakistan and Sri Lanka. Using daily data over a six-year period from 1995 to 2001, the authors found no evidence of a long-run equilibrium relationship between the financial variables in any of the four countries. However, the results show a unidirectional causal relationship running from exchange rates to stock prices for only India and Sri Lank but show no evidence of any causal relationship between exchange rates and stock prices in Bangladesh and Pakistan.

Gunasekarage et al. (2004) studied the effect of macroeconomic variables, specifically, the money supply, the Treasury bill rate (TBR), the consumer price index (CPI), and the exchange rate, on stock market equity values in Sri Lanka using monthly data from January 1985 to December 2001. They used VECM methodology in their study and found that the lagged values of macroeconomic variables such as the CPI, the money supply, and the TBR have a significant effect on the stock market. However, they failed to find any evidence to support the claim that the share price index has an effect on macroeconomic variables except the TBR.

Ratanapakorn and Sharma (2007) examined the long-term and short-term relationships among the US stock price index (S&P 500) and macroeconomic variables. They used quarterly data from 1975 to 1999 and found that stock prices are positively related to industrial production, inflation, money supply, short-term interest rate and exchange rate, but negatively related to the long-term interest rate.

Gay (2008) Using the Box- Jenkins ARIMA model, Gay (2008) investigated the relationship between stock prices and the macroeconomic variables exchange rate and oil price for four countries - Brazil, Russia, India and China. They employed monthly time series data for the period from March 1999 to June 2006 and found no evidence of any relationship between exchange rate and oil price on the stock prices of either country. This could possibly be due to the effect of other domestic and international macroeconomic factors on stock market returns. In addition, the author found no evidence of a relationship between present and past stock market returns.

Alam and Uddin (2009) investigated the relationship between stock prices and interest rates. They used monthly data from January 1988 to March 2003 for fifteen developed and developing countries, namely Australia, Bangladesh, Canada, Chile, Colombia, Germany, Italy, Jamaica, Japan, Malaysia, Mexico, the Philippines, South Africa, Spain and Venezuela. They documented the evidence of a negative relationship between interest rate and share price for all the countries and a negative relationship between changes in interest rate and changes in share price for six countries under study.

Wickremasinghe (2011) investigates the linkage between the Sri Lankan stock exchange (ASPI) and six macroeconomic variables, namely the USD exchange rate, the three-month fixed deposit rate (FDR), CPI, US stock market index, narrow money (M1), and the gross domestic product (GDP). The author used monthly data from January 1985 to December 2004. They document that the stock price index has feedback relationships with the FDR, US share price, and GDP, and a unidirectional causality running from the stock price index to the CPI, money supply, and exchange rate for Sri Lanka.

Srinivasan (2014) investigated the causal relationship between the gold price, stock price, and exchange rate in India using monthly time series data from June 1990 to April 2014. Employing the Autoregressive Distributed Lag (ARDL) bounds testing approach and the Granger causality test, their study found that the gold price and stock price have a long-run relationship with the exchange rate in India. However, they found no evidence of a stable long-run or short-run causal relationship between the stock price and gold price in India.

Oswin et al. (2019) employed an autoregressive method (ARDL) and Granger causality assessment to study the long-term effects of China's economic reforms since 1978. They investigated relationships, including those among the three economic arms of their economy (agriculture, services and industry), capital stock and size of labour force and their impact on GDP. Their study found that increases in agricultural output, capital stock and labour cause increases in China's GDP.

Upadhyaya et al. (2018) examined the relationship between the stock price and five macroeconomic variables – the national output, the M1 money supply, price level, nominal interest rate and exchange rate for India. They used monthly data from January 2006 to March 2016. Using the VECM model, their study shows that in the long run, output growth and the exchange rate are positively related to stock prices, while money supply is negatively related to stock prices. The results from variance decomposition analysis show that, in the shortrun, most of the variation in stock prices is captured by their own innovation, although the exchange rate, the price level and the interest rate have some effect on stock price variation.

Variables and the Data

This study uses monthly time series data over the period from May 1999 to August 2020 from the US. The data were obtained from the databases of the Federal Reserve Bank of St. Louis and *Yahoo!* Finance. The data set consists of the variables, "Dow Jones Index (DJIA)," "Consumer Price Index (CPI)," "Exchange Rate (ER)," "Money Supply (MS)," "Treasury Bill Rate (TBR)," and "Index of Industrial Production (IIP)." DJIA represents the stock price index for the US. The CPI, which is a proxy for inflation, represents the aggregate price level. The IIP is used as a measure of economic activity. The short-term interest rate is represented by the TBR. The time series data are expressed in natural logarithms prior to the empirical analysis. The econometric and statistical software packages EViews and R are used for data arrangement and cleaning, and for performing the statistical analyses.

To measure the overall price of stocks in the US, we utilised the DJIA, as it is one of the two highly monitored metrics related to US stock market. Similar to other studies, we use the three month TBR rate as a measure of short-term interest rates. The US index of industrial production (IIP) is adopted as one of two key measures of the goods market within the economy. We also use the CPI, a proxy for inflation, to represent the aggregate price level.

Several previous studies utilised the M1 money supply, whereas we adopt the M2 money supply. It includes the M1 components and adds savings deposits (including money market deposits), and small-denomination time deposits (less than $100,000). As noted by Parhizgari, Nguyen (2011), since the impact of changes in M2 is short-term, M2 may be better at predicting changes to stock processes which are also short-term. The QE policy implemented by the FED to stimulate the US economy in the recession that began in 2009 directly impacts M2. Therefore, we adopt M2 to measure the money supply.

For the exchange rate, we adopt the RBUSBIS. This exchange rate is calculated as weighted averages of bilateral exchange rates with major trading partners, adjusted by relative consumer prices. The relative importance of each trading partner is factored into the BIS exchange rate. We refer the reader to the BIS website (www.bis.org) for further details. This is unique in that previous studies have used exchange rates for a single comparative country; for example, Ratanapakorn and Sharma (2007) used the USD to Japanese Yen exchange rate.

METHODOLOGY AND EMPIRICAL RESULTS

In this article, we employed the Augmented Dickey–Fuller (ADF) and Phillips–Perron unit root tests for testing the stationarity of the variables, Johansen's cointegration test for testing the existence of a long-run relationship between the variables, and the Granger causality test for testing the causal relationships (if any) between the variables. Since these methodologies are well-known among econometric and time series researchers, we do not discuss them in this article. Interested scholars are referred to the relevant literature in the references.

Table 1: Unit Root Test Results

Variables	ADF Test		Phillips–Perron Test	
	Levels	First Differences	Levels	First Differences
DJIA	0.10 [0.965]	-15.37 [0.000]	0.15 [0.969]	-15.36 [0.000]
CPI	-1.88 [0.343]	-10.97 [0.000]	-1.90 [0.331]	-9.45 [0.000]
ER	-1.36 [0.600]	-10.40 [0.000]	-1.32 [0.621]	-10.61 [0.000]
M2	0.88 [0.995]	-8.55 [0.000]	1.19 [0.998]	-8.28 [0.000]
TBR	-0.57 [0.873]	-11.96 [0.000]	0.109 [0.966]	-11.83 [0.000]
IIP	-2.01 [0.283]	-12.13 [0.000]	-1.96 [0.303]	-11.66 [0.000]

The results from the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests are reported in Table 1. The results suggest that all six time series variables are non-stationary in their levels. However, the first differences of all variables are stationary at 0.01 level of significance. This indicates that all of the time series variables (DJIA, CPI, ER, M2, TBR and IIP) used in the study are integrated of order 1, or *I*. Since all the variables are integrated of the same order, we now proceed to perform the Johansen cointegration tests to test for a long run equilibrium relationship between the variables. If we find any evidence of a cointegrating relationship between them, then we will estimate a VECM and will carry out the related test of causality.

The Johansen's Multivariate Cointegration Test

Since all the variables are integrated in the same order, we computed the lag length of the vector autoregressive system. The results (not shown here but available from the authors upon request) show that the Hannan–Quinn (HQ) and Schwartz Information Criteria (SCI) identify a lag length of 2. Using this lag length, we ran Johansen's cointegration test (Johansen and Juselius, 1990) in order to test for the long-run relationship between the variables under study. From the empirical results, we see that the λ-trace statistic identified one cointegrating relationship, while the λ-max statistic identified no cointegrating relationship among the variables under study. According to Kasa (1992) and Serletis and King (1997), the trace statistic is more powerful than the maximum Eigen value statistic since it accounts for all of the smallest Eigen values. In addition, according to Cheung and Lai (1993), the λ-trace statistic is more robust than the λ-max statistic. Furthermore, Johansen and Juselius (1990) recommend the use of the λ-trace statistic when the two statistics provide inconsistent results. Thus, we accepted the result of the λ-trace statistic and concluded that there exists a cointegrating relationship between the macroeconomic variables under study.

Table 2: Johansen Test Results for the Cointegrating Relationship among the Variables

Null Hypotheses	λ_{trace} Statistic	P-Value	λ_{max} Statistic	P-Value
r = 0	111.01	0.0030*	35.67	0.1444
r ≤ 1	75.34	0.0169	31.20	0.1011
r ≤ 2	44.14	0.1070	21.68	0.2274
r ≤ 3	22.28	0.2832	13.01	0.4515
r ≤ 4	9.27	0.3408	7.88	0.3912
r ≤ 5	1.39	0.2377	1.39	0.2377

Notes: (*) denotes that the relation is statistically significant at 1% level of significance.

Table 3: Cointegration Equation Normalised with respect to the Dow Jones Index

DJIA	CPI	ER	IIP	M2	TBR	C
1.0000	1.802	-0.590	-1.927	-1.564	-0.304	39.381
	(1.585)	(0.393)	(0.440)	(0.563)	(0.100)	
	[1.137]	[-1.503]	[-4.384]	[-2.776]	[-3.035]	

Note: The figures in ( ) and [ ] represent the standard error and-statistics respectively.

After normalising the coefficient of DJIA to one, the long run equilibrium relationship between the DJIA and the macroeconomic variables can be expressed as follows.[1]

$$DJIA - 39.38 - 1.80 * CPI + 0.59 * ER + 1.93 * IIP + 1.56 * M2 + 0.30 * TBR \quad (1)$$

In equation (1), the coefficient of CPI is negative. Since the CPI is a proxy for inflation, this suggests that increases in the price level raise the firm's production costs, lower its revenue, and decrease future cash flows. This coefficient is, however, not statistically significant at a conventional level of significance. The positive coefficient of ER indicates a positive effect of the exchange rate on stock prices. This coefficient is, again, not statistically significant at a conventional level. The coefficient of IIP, which is a proxy for overall economic activity, is both positive and statistically significant. This finding is consistent with the belief that an increase (or decrease) in economic activity increases (or decreases) corporate profits and expected future cash flows, which consequently increase (or decrease) stock prices. This finding is in line with Upadhyaya et al. (2018) for India and others. The coefficient of M2 is both positive and statistically significant. One can interpret that the relationship is positive via the liquidity effect or the implicit link between the stock prices and the money supply (Ratanapakorn & Sharma, 2007). This result is empirically supported by Abdullah and Hayworth (1993), among others, for the USA and Mukherjee and Naka (1995) for Japan. Similarly, this study found a positive relationship between stock prices and TBR, a proxy for the interest rate. A possible explanation could be that an improvement in the profit outlook increases the aggregate demand in investment and consequently raises the interest rates. This result is consistent with that of Ratanapakorn and Sharma (2007) who found a positive long-run effect of interest rate on stock prices for the USA.

Granger Causality and Vector Error Correction Model

Since we have a cointegrating relationship between the DJIA and the macroeconomic variables in equation (1) above, we now proceed to estimate the VECM[2]. The VECM indicates the direction of causality among the variables and helps us distinguish between short- and long-run Granger causal relations (Masih & Masih, 1996). We use the *t*-test of the lag error correction term to test the long-run causal relationships and the Wald chi-squared ($\chi 2$) test to test the short run Granger causal relationships (see, e.g., Upadhyaya et al. 2018, for details)[3]. The authors are not aware of any existing studies that have examined both short- and long-run causal relationships between the DJIA and the macroeconomic variables included in our study for the US.

The results of the VECM reported in Table 4 indicate that the error correction terms corresponding to the target variables ΔDJIA, ΔCPI, ΔER, ΔM2, ΔIIP and ΔTBR are -2.80, 0.95, 2.65, 3.63, 0.53 and -0.35 respectively. Since the t-statistic corresponding to the target variable, ΔDJIA, is statistically significant at a 1% level of significance, we conclude that there are long-run Granger causalities from ΔCPI, ΔER, ΔM2, ΔIIP and ΔTBR to ΔDJIA. Similarly, the t-statistic corresponding to the target variables, ΔER and ΔM2 are also statistically significant at a 1% level of significance, we conclude that there are long-run Granger causalities from ΔDJIA, ΔCPI, ΔM2, ΔIIP and ΔTBR to ΔER, and from ΔDJIA, ΔCPI, ΔER, ΔIIP and ΔTBR to ΔM2. However, the

1 Since these variables are in logarithmic scales, these values represent long-term elastic measures. The numbers in the parentheses indicate the corresponding test statistics.

2 We employed the VECM Residual serial correlation LM tests to make sure our VECM model does not suffer from autocorrelation. The insignificant p-values suggested that the model is free of autocorrelation.

3 See, Devkota (2018), Devkota (2019), Ratanapakorn and Sharma (2007), Wickermasinghe (2011), and Upadhyaya et al (2018), for details.

t-statistics corresponding to the rest of the target variables are not statistically significant for any conventional level of significance, and hence, there are no long run Granger causalities running to these variables.

The t-statistic corresponding to the causality from ΔER to ΔCPI; ΔDJIA and ΔIPI to ΔM2; ΔDJIA, ΔM2, and ΔTBR to ΔIIP; and ΔDJIA to ΔTBR are statistically significant at 1% level of significance. Similarly, the t-statistics corresponding to the causalities from ΔDJIA to ΔER, ΔTBR to ΔM2, and ΔCPI to ΔTBR are statistically significant at 5% level of significance. Finally, the t-statistics corresponding to the causalities from ΔM2 and ΔIIP to ΔDJIA and from ΔTBR to ΔCPI are statistically significant at 10% level of significance. These results suggest that there are short-run Granger causalities from ΔDJIA to ΔER, from ΔM2 to ΔDJIA, from ΔDJIA to ΔM2, from ΔIIP to ΔDJIA, from ΔDJIA to ΔIIP and from ΔDJIA to ΔTBR. These results are summarised in Table 5.

Table 4: Granger Causality Test Results based on VECM Model

Dependent Variable	Chi-Squared Test Statistics						ECT
	ΔDJIA	**ΔCPI**	**ΔER**	**ΔM2**	**ΔIIP**	**ΔTBR**	
ΔDJIA	-	3.35 [0.187]	0.627 [0.731]	5.58 [0.061]*	5.00 [0.082]*	1.63 [0.44]	-2.80 [0.0055]***
ΔCPI	3.78 [0.151]	-	10.49 [0.005]***	2.45 [0.294]	3.94 [0.140]	5.92 [0.052]*	0.95 [0.3415]
ΔER	7.42 [0.025]**	2.9 [0.235]	-	3.56 [0.168]	4.17 [0.124]	0.149 [0.928]	2.65 [0.0086]***
ΔM2	17.45 [0.000]***	4.33 [0.115]	0.44 [0.802]	-	22.28 [0.000]***	8.95 [.011]**	3.63 [0.0003]***
ΔIIP	11.5 [0.003]***	0.90 [0.637]	2.15 [0.341]	10.88 [0.004]***	-	18.46 [0.000]***	0.53 [0.5968]
ΔTBR	15.5 [0.000]***	8.38 [0.015]**	0.58 [0.748]	0.70 [0.703]	4.5 [0.105]	-	-0.35 [0.7245]

Notes: ΔDJIA, ΔCPI, ΔER, ΔM2, ΔIIP, and ΔTBR denote the first differences of the logarithmic values of the Dow Jones Index, consumer price index, exchange rate, money supply, index of industrial production, and treasury bill rate respectively. In addition, *, **, and *** respectively denote the statistically significant causal relationships at the 10%, 5% and 1% level of significance. [.] represent the p-values for the corresponding test statistics.

Table 5: Causality Results based on Vector Error Correction Model

Causality From	To	Long-Rrun	Short-Run	Direction of Causality
CPI	DJIA	Yes	No	Unidirectional
DJIA	CPI	No	No	
ER	DJIA	Yes	No	Feedback
DJIA	ER	Yes	Yes	
M2	DJIA	Yes	Yes	Feedback
DJIA	M2	Yes	Yes	
IIP	DJIA	Yes	Yes	Feedback
DJIA	IIP	No	Yes	
TBR	DJIA	Yes	No	Feedback
DJIA	TBR	No	Yes	

The χ^2-statistic corresponding to the causality from ΔER to ΔCPI; ΔDJIA and ΔIPI to ΔM2; ΔDJIA, ΔM2 and ΔTBR to ΔIIP; and ΔDJIA to ΔTBR are statistically significant at 1% level of significance. Similarly, the χ^2-statistics corresponding to the causalities from ΔDJIA to ΔER, ΔTBR to ΔM2, and ΔCPI to ΔTBR are statistically significant at 5% level of significance. Finally, the χ^2-statistics corresponding to the causalities from ΔM2 and ΔIIP to ΔDJIA and from ΔTBR to ΔCPI are statistically significant at 10% level of significance. These results suggest that there are short-run Granger causalities from ΔDJIA to ΔER, from ΔM2 to ΔDJIA, from ΔDJIA to ΔM2, from ΔIIP to ΔDJIA, from

ΔDJIA to ΔIIP and from ΔDJIA to ΔTBR. These results are summarised in Table 5.

The diagnostic test of the estimated model (with DJIA as the dependent variable and the rest of the variables as independent variables) is performed using the residual analysis based on the Breusch-Godfrey serial correlation LM Test (Table 6). The χ^2 test statistic of 0.8129 with a p-value of 0.6660 confirms the adequacy of the model.

Table 6: Results from Breusch-Godfrey Serial Correlation LM Test

F-Statistic	0.381967	Prob F(2,237)	0.6829
Obs*R-Sq.	0.812888	Prob Chi-Sq. (2)	0.6660

SUMMARY AND CONCLUSION

This paper investigated the drivers of US stock prices using time series methodology. The CPI, exchange rate, IIP, money supply and TBR were the macroeconomic variables under consideration, while the Dow Jones Index was used to represent US stock prices. We used the monthly time series data from May 1999 to August 2020. The econometric methodologies such as the ADF test and Phillips–Perron test were used to test the stationarity of the variables, while Johansen's multivariate cointegration test was used to test the long-run equilibrium relation between the variables. Finally, the Granger causality test under the VECM framework was used to test the causal relationship between the variables.

The empirical results suggest that, in the long run, the exchange rate, IIP, money supply and TBR are positively related to stock prices, while the CPI is negatively related to stock prices. The VECM results suggest that there is a unidirectional Granger causality running from the CPI to stock prices. In addition, there are four feedback relationships that run between the exchange rate and stock prices; money supply and stock prices; IIP and stock prices; and TBR and stock prices.

The findings of both the unidirectional and the feedback relationships verify the connections between stock prices and macroeconomic variables in the US economy. Our results suggest that only the CPI, exchange rate and TBR—Granger-cause the stock price. A possible interpretation could be that, in the short run, the causal relations may not exist as the stock prices may follow a random walk (Ratanapakorn & Sharma, 2007). However, in the long run, all the variables listed by Granger affect the stock price. Hence, all macroeconomic variables have some impact on the US stock market. Thus, we can conclude that stock prices in the US can be predicted from selected macroeconomic variables. This result is consistent with Devkota (2018), who found a similar result for Nepal.

Of course, the study has some limitations. We limited this study to only five selected macroeconomic variables. One may possibly improve the results by including more variables such as the unemployment rate, and long-term interest rates and studying the relationships for a longer period of time.

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