

AN ABSTRACT OF THE ESSAY OF

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Title: The economic effects of 2018 U.S. Steel Tariffs: An Application of Event Study

Methodology

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In this essay I investigate the effect of United States March 2018 steel tariffs on producers' capital. I use intertemporal event study methodology to appraise the effect of announcement of the tariffs on March 01, 2018 on the stock returns of major US steel companies listed at New York Stock Exchange. I use data from Yahoo finance and include 17 US based companies in the analysis. The results show that major steel manufacturers saw a positive shift in their returns due to the event. Steel consumer companies included in the study showed significantly negative returns on the event day. I include 5 US Tech firms in the control group. The event did not affect their returns. Our evidence shows that the efficient market hypothesis holds in this case. Further, as posited by the economic theory, the tariffs reduced overall efficiency in the market.

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The economic effects of 2018 U.S. Steel Tariffs: An Application of Event Study Methodology

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I understand that my essay will become part of permanent collection of Oregon State University. My signature below authorizes release of my essay to any reader upon request.

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The economic effects of 2018 U.S. Steel Tariffs: An Application of Event Study

Methodology

1. Introduction

On March 01, 2018 President Trump announced his intention to impose a tariff on steel imports in the United States. A week later, on March 08 he signed an order to impose the tariff that would become effective on March 22, 2018. The rationale for his decision was to support the economy by giving economic relief to steel workers. He added that the tariffs would protect the steel industry from foreign competition and protect the jobs of steel workers.

However, most economists disagree with the president's decision. Conventional wisdom says that a tariff, which is a tax on imports, raise the price of that commodity. This has two direct effects. First, it raises surplus to producers of the commodity. Second, it lowers consumer surplus. Because the gain to producers is less than the loss to consumers, a tariff makes society worse off overall.

A tariff also has indirect or general equilibrium effects. Steel is used as a raw material in the production of many final products, such as the construction building, automobiles, and jetliners. Thus, a tariff on steel harms both producers and consumers in these steel using industries.

A final concern with tariffs is that they frequently lead to trade wars. That is, country A imposes tariffs on country B, and country B retaliates by imposing tariffs on country A. Wars such as these stifle gains from trade and make both countries worse off.

Economists argue that different sectors of the economy are interrelated like different organs in an organism. Giving protection to one area will take its toll on the other areas of the economy. Hence, these tariffs will lead to greater losses than gains. Thus, the conventional wisdom indicates that President Trump is wrong to think that a steel tariff is good for the U.S. economy.

In this paper, I investigate the effects of these tariffs on the market value, reflected in stock prices, of major steel companies. A fundamental reason for estimating the quantitative effects of an economic policy on a market is to test whether their actual effects are consistent with theoretical predictions. I use the inter-temporal event study methodology to determine the economic consequences of the steel tariffs on the value of steel companies, the value of companies that use large quantities of steel, and the value of companies that purchase little if any steel. The contribution of this study is that it is the first to investigate the effect of the 2018 steel tariffs on the U.S. economy.

The sample of firms includes major steel producers, steel purchasers, and firms that are unlikely to be affected by fluctuations in steel prices. These include the 7 largest steel producers in the U.S: Nucor Corporation, Steel Dynamics, US Steel, Carpenter Corporation, CMC Steel, AK Steel and Allegheny Corporation. The second group includes 5 companies that are major steel purchasers: 2 major construction firms (CAT and Cummins), 2 major automobile producers (Ford and General Motors) and finally an aerospace company (Boeing). The third group includes 5 major tech firms: Google, Facebook, Twitter, Amazon and Microsoft.

In this study, I test the predictions of the conventional wisdom. That is, the steel tariffs should benefit steel producers, harm steel buyers, and have little or no effect on companies that are far removed from the steel industry.

The rest of this essay is structured as follows. In the next section, I give a brief literature review of tariff theory and event study methods. In section 3, I explain event study methodology and my model for this study. After that, I provide the results of my analysis in section 4. In the last section I give policy recommendations in light of this study and conclude the essay.

2. Literature Review

The event study methodology was developed by Fama et. al (1969) and Ball and Brown (1968), and has been widely used in finance and economics. Fama et al. (1969) show how the fundamental value of a firm, as reflected by its stock price, depends on all available information in the market. Based on their work, the event study method implies that stock prices will respond in a predictable way to new information that is relevant to the expected future earnings of the firm.

Fama et al. (1969) apply their model to evaluate major stock splits of the firms at stock exchange from 1927 to 1959. In total, they measure 940 stock splits at the New York Stock Exchange (NYSE) in that period. The authors argue that regression of the specific returns on market returns over time is a satisfactory method for abstracting the effect of general market conditions on the rate of returns of individual securities. They report that residuals of the firms show changes in the returns in anticipation of the event. Most stock splits are associated with higher returns of the stocks around the announcement month. This effect is consistent with the theory that stock splits will have a non-negative effect on the value of the firm. In later work

Fama et al. (1969) finds that the empirical evidence is consistent with the predictions of the model.

Bhagat and Romano (2002b) review hundreds of applications of the event study methodology. They report that most of these studies have focused on the effect of corporate law litigations. The main objective of these applications is to determine the effect of a change in the law on shareholders' interests (Bhagat and Romano, 2002). However, there are fewer applications on the effect of financial regulations.

Mackinley (1997) discusses the pitfalls that should be avoided when applying the event study method. He also explains the assumptions on which the method is built and the proper way to measure abnormal returns. He adds that the test of the null hypothesis assumes a normal distribution of the returns with zero mean and standard deviation equal to one. Further, Mackinley (1997) recommends using a 5 % significance value when testing the null hypothesis. Moreover, he adds that the power of the event studies can be increased by using a larger sample size by including more companies in the sample by shortening the pre-event window. Pre-event window is the duration in the event window before the event day t and post-event window is the duration after the event day t . To get more accurate results, Bhagat and Romano (2002a) recommended taking a longer estimation window. Mackinley (1997) advises to take shorter time intervals preferring daily returns to weekly or monthly stock returns. Lastly, he recommends taking an event window rather than an event day to account for any information leaks in the market (MacKinlay, 1997).

Jarrell (1985) uses the event study methodology to investigate the deregulation of Securities Exchange Commission Act (SEC). The act regulated brokerage rates on exchanges on

the New York Stock Exchange with rates that are market determined. Jarrell was one of the first to use this method to evaluate the economic effect of government regulation/deregulation. He reported that the deregulation increased the returns of the top 25 brokerage firms. Further, it decreased the returns of the SEC and the underwriting firms (Jarrell, 1984).

Gokhale et. al. (2014) use the event study method to measure the effects of several product recalls on Toyota automobiles, due to braking concerns, on stake holders' wealth. The authors report that the minor recall had no significant effect on Toyota returns while a later major recall reduced Toyota returns significantly. The authors argue that the difference in the effect of the event on returns shows that investors put high value on information deriving from unbiased experts. The major recall had a significant negative impact on company value, indicating consumer concerns with Toyota's technical ability and future profit. This is consistent with the predictions of the efficient market hypothesis. Lastly, third party verification of Toyota's braking reliability on which the major recall was based had a significant positive impact on Toyota returns, implying that investors had confidence in Toyota's future profitability.

Due to its elegant simplicity, the event method has been applied in other disciplines such as law, management, marketing, history and political science. Event studies provide a good opportunity to observe changes in the stock values at the stock market which can be a good tool to measure the short term effects of corporate litigation (Corrado, 2011). It has been used to measure the effects of auto industry product recalls by Jarrell and Peltzman (1985) and by Thomsen and McKenzie (2001) to examine food industry recalls. It has been used to measure the effects of corporate litigation on stock holders' wealth by Jahera and Pugh (1991) and Romano (1990).

Cornell and Morgan (1990) provide an overview of the strengths and weaknesses of the event study methodology for analyzing impact of regulations. They argue that if an adequate sample of the firms from the same industry facing regulation is not selected, the methodology will result in overestimating or underestimating the effects of regulations. They add that if information about the implementation of a regulation is leaked before the announcement date, the methodology will underestimate the effect of the event on the event day. They recommend taking a longer event period in order to capture the impact of the information that are available to the public. The authors add that this method may fail when the exact event date is unclear. In order to capture the true impact of the event on stock returns, it is imperative that the event dates are accurate (Cornell and Morgan, 1990).

In the next section, I describe the model, event method, and the significance test being used in detail.

3. Event Study Methodology

I use the event method to analyze the effect of new tariffs on major steel firms' stock returns. This method was developed by Fama et al. (1969), and Bhagat and Romano (2002) review the methodology and its various applications to finance and economic policy issues. Event study analysis is one of the most successful uses of econometrics in policy analysis. By providing an anchor for measuring the impact of events on investor wealth, the methodology offers a fruitful means for evaluating the welfare implications of private and government actions.

The event study method is based on the market model of stock valuation. It assumes that the price of a stock reflects the time and risk adjusted discounted present value of all future cash flows that are expected to accrue to the holder of that stock. According to the semi strong version

of the efficient market hypothesis, the price of a stock reflects all publicly available information in an unbiased manner. Because the price of a stock reflects this information at any point in time, it is impossible for the average investor to earn abnormal returns (i.e., an economic profit) by investing in the stock market.

In particular, the return on i at time t (R_{it}) is a function of all available market information, which is measured as the market return on a large portfolios of stocks (R_{mt}). The market model assumes a stable linear relationship:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \quad (1)$$

$$\varepsilon_{it} \sim N(0, \sigma^2),$$

where the error term ε_{it} depends on unanticipated random events and is purely white noise.

Therefore, only an unanticipated event can change the price of a stock. This change should reflect the expected changes in the future cash flows of the firm or in the riskiness of these cash flows. Thus, an event that impacts the financial performance of a firm will experience an abnormal movement in the price of the stock. Movements in the stock market overall are usually subtracted from the stock's price movement in estimating the abnormal return.

Our goal is to test the null hypothesis that an event such as an announcement of a tariff has no effect on a company's abnormal returns. An abnormal return is defined as the actual ex post return minus the expected return. The normal return equals the expected return, conditional on the event never taking place. Formally, the abnormal return for firm i at event date τ is

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|R_{m\tau}), \quad (2)$$

where $E(R_{i\tau}|R_{m\tau})$ is the expected normal return and $R_{m\tau}$ is the pre-event conditioning information for the normal return model. In other words, $R_{m\tau}$ is the information that is used to forecast the expected return assuming that the event never happens.

An event study has four components: defining the event and announcement day, measuring the stock's return during the announcement period, estimating the expected return of the stock during this announcement period in the absence of the announcement, and computing the abnormal return (actual return minus expected return) and determining its statistical and economic significance.

Events under investigation are usually the announcements of various corporate, legal, or regulatory action or proposed action. After defining the event, the researcher searches for the first public announcement of the event. This is crucial because under the semi strong form of the efficient market hypothesis, the impact of the event on the value of the firm would occur when information about the event becomes public (i.e., on the announcement date). In our study the event is the imposition of steel tariffs by President Trump in March 2018. Our event date is March 01, 2018 when the President announced that 25% tariff would be imposed on all steel imports. On March 8th, he signed the order and the tariff went into effect on the 23rd of March, two weeks after he signed the orders.

To successfully implement this method requires stock price (and dividend) data before and after the event date. Let $\tau = 0$ be the event date and W_{pre} be the pre-event time period or estimation window. Let T_{pre} be the number of observations (days) in W_{pre} . The event window (W_{event}) identifies the time it takes for the event information to fully affect returns. In a perfectly efficient financial market, this will be a very short length of time and would include just one time

period. With real world imperfections, however, there may be information leaks before the event and lags in response to the event. With information leaks, W_{event} starts before $\tau = 0$; if it takes time for investors to evaluate the economic consequences of an event, then W_{event} extends into several periods after $\tau = 0$.

In this study, the event day is March 01, 2018. I use a five day period before the announcement to account for information leaks and 10 days after the event to account for any other unanticipated disturbance in the market. The event window in this study is 16 business days (-5 days before $t=0$ event day = 0, +10 after event day $t=0$) starting from February 23, 2018 and extends through March 15, 2018.

After defining the event and announcement period, one measures stock returns for this period. If daily returns are being used, this is straightforward: the return is measured through closing prices. In this study I use percentage stock returns of the firms listed on New York Stock Exchange.

The next step is to estimate the expected return of the stock during the announcement period assuming that the event never took place. Although it is straightforward to measure the actual return for the announcement period, determination of the impact of the event itself on the share price is more difficult. To measure this impact, the expected return must be subtracted from the actual announcement period return. The expected return is the return that would have accrued to the shareholders in the absence of this or any other unusual event.

It is customary for researchers to use between 100 and 250 daily returns preceding the announcement period. I use a 246 days estimation window in this study. A longer window will lead to a more precise estimate; however, a longer window increases the likelihood that it

contains information caused by other events (Bhagat and Romano 2002). The unexpected event period return, also known as the abnormal returns are defined as the actual returns observed in the market minus the estimated expected return during the event period.

The next step in evaluating the financial effect of an event is to accurately estimate expected normal returns. This requires estimation of the market model in equation 1. Under the conditions of the model, the parameters can be estimated with data from W_{pre} using ordinary least squares (OLS). Parameter estimates ($\hat{\alpha}_i$ and $\hat{\beta}_i$) and market data from W_{event} are used to forecast normal returns during the event window ($R_{i\tau}|R_{m\tau}$). Thus, the abnormal return at time τ is

$$AR_{i\tau} = R_{i\tau} - E(\hat{R}_{i\tau}|R_{m\tau}). \quad (3)$$

For the classic market model,

$$AR_{i\tau} = R_{i\tau} - (\hat{\alpha}_i + \hat{\beta}_i R_{m\tau}). \quad (4)$$

When W_{event} includes more than one period, sample abnormal returns are added up to obtain cumulative abnormal return, $CAR_{i\tau}$. If W_{event} ranges from $\tau = \tau_1 < 0$ to $\tau = \tau_2 > 0$, then

$$CAR_{i\tau} = \sum_{\tau=\tau_1}^{\tau_2} AR_{i\tau}. \quad (5)$$

This measures the total effect on abnormal returns for a multi-period event window. If the event has no effect on the value of the firm, then $AR_{i\tau}$ (and $CAR_{i\tau}$) will not be significantly different from zero, because actual returns will not significantly differ from normal returns. For a positive (negative) event, however, both $AR_{i\tau}$ and $CAR_{i\tau}$ will be positive (negative) and significantly different from zero.

The final step is to compute the statistical significance of this abnormal return. The standard error of the residuals from the estimated statistical model can be used as an estimate of the standard error for the announcement period abnormal return. However since individual stocks are quite volatile, this standard error could be quite high relative to the abnormal return. Event studies usually consider a sample of firms that have made or been the subject of the same type of announcement. One benefit of this approach is that it increases the likelihood that no other information besides the event under study will be valued since any additional unexpected information disclosed on one firm's announcement date will wash out with that on other firms' announcement days.

Traditional parametric tests have been discussed in Serra (2004) and Bhagat and Romano (2002). These tests generally assume that AR_{it} is independently and identically distributed with mean zero and variance (AR_{it}) . In this case,

$$\sigma^2(AR_{it}) = \sigma^2 \left(1 + \frac{1}{T_{pre}} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{\tau \in W_{pre}} (R_{m\tau} - \bar{R}_m)^2} \right) \quad (6)$$

where \bar{R}_m is the mean of market returns over the estimation window. We assume that the event has an effect on the mean and not the variance of abnormal returns during the event window. We can use the distributional properties of abnormal returns to make statistical inferences on abnormal returns for the event window. The null hypothesis is that abnormal returns are not different from zero during the event window. In order to compute the test statistic for abnormal returns, we standardize each daily abnormal return

$$SAR_{it} = AR_{it} / \sigma(AR_{it}). \quad (7)$$

SAR_{it} follows a t-distribution with $T_{pre}-2$ degrees of freedom.

CAR_{it} is assumed to be distributed independently and identically with mean zero and variance $\sigma^2(CAR_{it})$. The variance of CAR on day τ is given by the following expression

$$\sigma^2(CAR_{it}) = \sigma^2 \left(k + \frac{k^2}{T_{pre}} + \frac{\sum_{\tau=1}^{T_{pre}} R_{m\tau} - k(\bar{R}_m)^2}{\sum_{\tau \in W_{pre}} (R_{m\tau} - \bar{R}_m)^2} \right), \quad (8)$$

where parameter k is the day within the event window. The null hypothesis is that each cumulative abnormal return is not different from zero. The test statistic that is used to test the null hypothesis above is given by the following expression for standardized cumulative abnormal returns (SCAR)

$$SCAR_{i\tau} = CAR_{i\tau} / \sigma(CAR_{it}) \quad (9)$$

Under the null hypothesis of no abnormal performance, the Test statistic has a student-t distribution with $t-d$ degrees of freedom.

4. Data and Analysis

The raw data include adjusted closing prices of daily stocks of the firms included in the study and the market index measured as the Standard and Poor 500 Index (S&P 500). These data are obtained from Yahoo Finance. Daily returns of the firms are the daily percentage change in the firm's stock closing price and S&P returns is the daily percentage change in the value of S&P 500 Index.

In this study, seventeen firms are analyzed. In the first group, I include seven major US steel manufacturing firms. They are Nucor Corp., US Steel Corporation, Steel Dynamics, CMC Steel, Carpenter Steel, Allegheny Steel and AK Steel Company. In the second group, I calculate abnormal returns for 5 major consumers of steel. They include two major construction firms

(Caterpillar and Cummins), a major aircraft producer (Boeing) and two major automobile manufacturers (Ford and General Motors). In the third and final group I analyze the returns of 5 major tech companies: Amazon, Twitter, Facebook, Google and Microsoft. Economic theory predicts that the event will: (1) cause the major steel manufacturers to have significantly positive returns on the event day, (2) cause major steel consumers to have negative returns, and (3) have no effect on the returns of the control group that has no direct link to the steel industry.

I use 246 days estimation window for all the firms included in the study. The estimation window starts at March 01, 2017 and ends at February 22, 2018. For all the firms, the event window is 16 days. Event date for this study is March 01, 2018 when President Trump made the announcement. The event window starts 5 days before the event to account for the leak of information and ends 10 days after the event to capture its full effect. Thus, event window starts at February 23, 2018 and ends at March 15, 2018.

4.1 Results for Major Steel Manufacturing Companies

Table 1 presents summary statistics for the seven major US steel manufacturing firms. It includes mean, min and max values for the 7 US steel manufacturers' percentage daily returns and the Market Index. I also include a column for the number of estimation days for each firm. The final column shows the standard deviations of the returns.

Table 1

Summary Statistics of the Percent Change in Daily Returns for 7 US Steel Manufacturing Firms

Firm	N (days)	Mean (%)	Min (%)	Max (%)	Std. Dev
Nucor	246	0.041	-7.629	4.737	1.623
Steel Dyn.	246	0.124	-6.756	6.758	1.874
US Steel	246	0.093	-26.76	14.773	0.613
CMC	246	0.050	-4.09	1.744	2.221
Carpenter	246	0.100	-6.595	5.298	1.921

Allegheny	246	0.160	-7.827	11.493	2.729
AK Steel	246	-0.101	-21.538	13.740	3.774
S&P 500	246	0.050	-4.097	1.744	0.613

Table 2 presents the OLS parameter estimates from the market model for the 7 steel Firms listed in Table 1. The table shows that there is a significantly positive association between 6 major companies' returns and market returns. Returns for Carpenter Corporation and Allegheny Steel are not significant. Parameter estimates from each model are used to generate estimates of the abnormal returns and of cumulative abnormal returns for the event day, 5 trading days prior and 10 trading days after the event.

Table 2

Regression results for 7 US Steel Manufacturing Firms

Variable	Steel Dynamics	Carpenter	AK Steel	Allegheny	CMC	US Steel	Nucor
Intercept(α_i)	0.057	0.023	-0.188	0.041	0.025	0.012	-0.02
N	246	246	246	246	246	246	246
R ²	0.18	0.23	0.07	0.20	0.15	0.11	0.26
Slope(β_i)	1.31*	1.53*	1.71*	1.95	2.04*	3.14*	1.36*
Std. Error	(1.69)	(1.68)	(3.63)	(2.32)	(2.04)	(3.14)	(1.39)

Standard errors in parentheses. * p<0.05

Table 3 presents the percentage abnormal returns for the 7 steel companies for each event window. To test the null hypothesis that the event had no significant impact on the returns of the firms, I conduct parametric test. T-values are given in parentheses for each day of the window. For 5 of the major companies namely Nucor corporation, Steel Dynamics, US Steel, CMC Corporation and AK Steel the returns are significantly different from zero at 5% level. All of these firms showed positive returns on the event day. For Carpenter Corporation and Allegheny Steel the returns on the event day are not significantly different from zero. Nucor Corporation

saw 5.1% increase in their returns while Steel Dynamics saw 5.7% increase in their returns. AK Steel gained the highest increase in their returns at 11.9%. US Steel saw 8.2 % increase in their returns while CMC Corp. returns increased by 6.8%. None of the companies saw any significant increase before the event date which suggests that there was no appreciable leak before the event. Nucor, US Steel and Steel Dynamics report negative returns on 5 day of the event when President Trump signed the orders on 8th March, 2018.

Table 3

Abnormal Returns for 7 US Steel Manufacturing Firms

Event day	Nucor	Steel Dyn	US Steel	CMC	Carpenter	Allegheny	AK Steel
-5	0.044 (0.031)	-0.476*** (-0.281)	0.086 (0.027)*	-1.784 (-0.872)	0.223 (0.132)	2.587 (1.112)	-1.208 (-0.332)
-4	-2.179 (-1.564)	-3.275* (-1.932)	-1.732 (-0.551)	-0.458** (-0.224)	-1.707 (-1.015)	-0.801 (-0.344)	-4.692 (-1.291)
-3	-0.175 (-0.126)	-0.449 (-0.265)	-0.242 (-0.077)	-0.752 (-0.367)	-0.160 (-0.095)	-3.3324 (-1.429)	0.901 (0.248)
-2	0.896 (0.643)	0.555 (0.327)	1.512 (0.481)	0.142 (0.069)	1.171 (0.696)	2.585 (1.111)	-0.820 (-0.225)
-1	-1.263 (-0.906)	-1.246 (-0.735)	0.933 (0.297)	-1.901 (-0.929)	0.367 (0.224)	-2.020 (-0.868)	-3.577 (-0.984)
0	5.107*** (3.666)	5.699*** (3.363)	8.206*** (2.611)	6.851*** (3.349)	2.663 (1.584)	1.400 (0.602)	11.967*** (3.294)
1	-0.147 (-0.105)	-0.248 (-0.146)	-2.301 (-0.732)	1.056 (0.516)	-2.632 (-1.566)	2.796 (1.202)	0.027 (0.007)
2	-1.510 (-1.084)	-3.622*** (-2.138)	-3.470 (-1.104)	-2.519 (-1.231)	-1.254 (-0.746)	-0.651 (-0.280)	-3.634 (-1.000)
3	-0.450 (-0.323)	-1.124 (-0.663)	-0.994 (-0.316)	-0.750 (-0.366)	0.858 (0.510)	2.073 (0.891)	0.453 (0.124)
4	2.602* (1.867)	0.772 (0.455)	2.681 (0.853)	1.954 (0.955)	0.929 (0.553)	0.305 (0.131)	1.339 (0.368)
5	-3.245*** (-2.329)	-3.456*** (-2.039)	-3.774 (-1.200)	-4.219** (-2.062)	-2.022 (-1.203)	1.631 (-0.701)	-4.625 (-1.273)
6	-3.043** (-2.184)	-1.609 (-0.950)	-4.727 (-1.504)	-1.904 (-0.930)	-1.211 (-0.720)	-1.038 (-0.446)	-6.274 (-1.727)
7	0.991 (0.711)	1.491 (0.880)	-0.050 (-0.016)	1.103 (0.539)	1.273 (0.757)	1.482 (0.637)	2.308 (0.635)
8	0.662 (0.475)	1.334 (0.787)	-6.474** (-2.060)	-0.017 (-0.008)	0.300 (0.178)	-0.722 (-0.310)	-1.892 (-0.520)
9	-1.454	0.337	-3.572	-2.482	-2.361	-0.707	-5.188

	(-1.044)	(0.199)	(-1.136)	(-1.213)	(-1.404)	(-0.304)	(-1.428)
10	0.407	-1.314	0.262	-0.810	-1.852	-1.812	1.762
	(0.292)	(-0.775)	(0.083)	(-0.396)	(-1.101)	(-0.777)	(0.485)

t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 4

Cumulative Abnormal Returns for 7 US Steel Manufacturing Firms

Event day	Nucor	Steel Dyn	US Steel	CMC	Carpenter	Allegheny	AK Steel
-5	0.044 (0.031)	-0.476 (-0.281)	0.086 (0.027)	-1.784 (-0.872)	0.223 (0.132)	2.587 (1.112)	-1.208 (-0.332)
-4	-2.134 (-1.532)	-3.751** (-2.214)	-1.645 (-0.523)	-2.243 (-1.096)	-1.483 (-0.882)	1.785 (0.767)	-5.900 (-1.624)
-3	-2.310 (-1.658)	-4.201** (-2.479)	-1.888 (-0.600)	-2.995 (-1.464)	-1.643 (-0.978)	-1.539 (-0.662)	-4.999 (-1.376)
-2	-1.413 (-1.014)	-3.645*** (-2.151)	-0.375 (-0.119)	-2.852 (-1.394)	-0.472 (-0.281)	1.046 (0.449)	-5.819 (-1.601)
-1	-2.676* (-1.921)	-4.892*** (-2.887)	0.557 (0.177)	-4.754** (-2.324)	-0.096 (-0.057)	-0.974 (-0.418)	-9.397** (-2.586)
0	2.430 (1.744)	0.806 (0.476)	8.764*** (2.788)	2.097 (1.025)	2.567 (1.527)	0.426 (0.183)	2.570 (0.707)
1	2.283 (1.638)	0.558 (0.329)	6.462** (2.056)	3.153 (1.541)	-0.065 (-0.038)	3.222 (1.385)	2.598 (0.715)
2	0.772 (0.554)	-3.064 (-1.808)	2.991 (0.951)	0.633 (0.309)	-1.319 (-0.784)	2.571 (1.105)	-1.036 (-0.285)
3	0.321 (0.231)	-4.188** (-2.472)	1.997 (0.635)	-0.117 (-0.057)	-0.460 (-0.273)	4.644 (1.997)	-0.582 (-0.160)
4	2.924** (2.099)	-3.415** (-2.016)	4.679 (1.488)	1.837 (0.898)	0.469 (0.279)	4.950** (2.128)	0.756 (0.208)
5	-0.320 (-0.230)	-6.872* (-4.056)	0.905 (0.287)	-2.381 (-1.164)	-1.552 (-0.923)	3.318 (1.427)	-3.868 (-1.064)
6	-3.364** (-2.415)	-8.481*** (-5.006)	-3.822 (-1.216)	-4.285** (-2.094)	-2.764 (-1.644)	2.280 (0.980)	-10.143** (-2.792)
7	-2.373 (-1.703)	-6.990*** (-4.125)	-3.873 (-1.232)	-3.182 (-1.555)	-1.490 (-0.886)	3.763 (1.618)	-7.835** (-2.156)
8	-1.711 (-1.228)	-5.655*** (-3.338)	-10.347** (-3.292)	-3.200 (-1.564)	-1.189 (-0.707)	3.040 (1.307)	-9.728** (-2.677)
9	-3.165*** (-2.272)	-5.318*** (3.139)	-13.919** (-4.429)	-5.683** (-2.778)	-3.550** (-2.112)	2.333 (1.003)	-14.917** (-4.106)
10	-2.758** (-1.979)	-6.633** (-3.914)	-13.657** (-4.345)	-6.493** (-3.174)	-5.402** (-3.214)	0.520 (0.223)	-13.154** (-3.620)

t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 4 presents percentage cumulative abnormal returns for the 7 steel firms. Among the 7 firms only US Steel's returns are significantly positive on the event day and the day after. Nucor and Allegheny report significantly positive returns on the 4th day. Nucor loses the market on the 6th and 9th day of the event. Steel Dynamics show significantly negative returns starting from 3rd day of the event till the 10th day. US Steel, CMC and AK Steel shows significantly negative returns on the last 3 days of the event window.

Figure 1 shows abnormal returns for the 7 US steel manufacturing firms. The figure shows that most firms saw an increase in the returns on the event day. AK Steel saw the highest increase in their returns followed by Steel Dynamics and US Steel. Nucor saw a steady increase in their returns. Further, the figure shows that most firms included in this group returned to their pre-event level at by the end of event window.

Figure 1

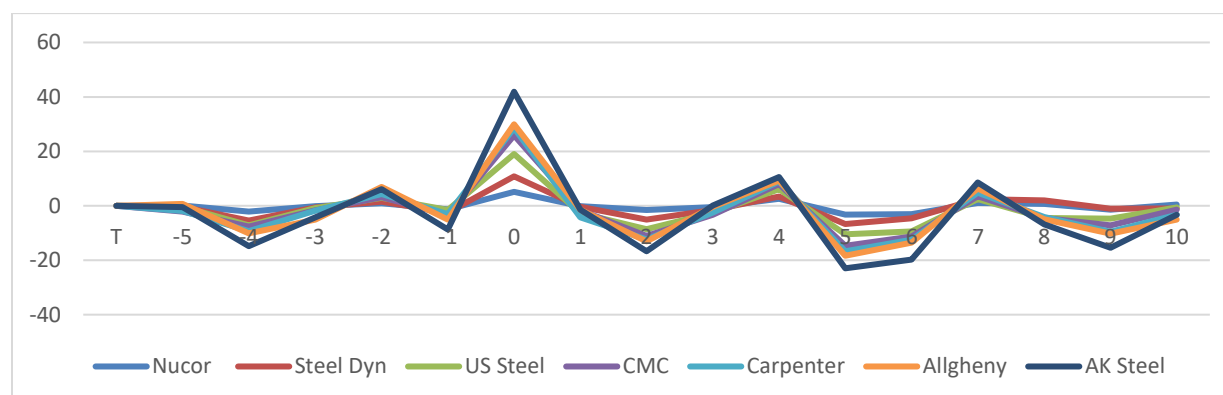


Fig.1. Abnormal Returns for 7 US Steel Manufacturing firms for the event window.

Figure 2 shows cumulative abnormal returns for the 7 US steel Manufacturing firms. The figure shows an increase in cumulative returns for most firms in the first two days of the event. The cumulative returns show a stable trend over the next three days. By the 5th day of event, the

cumulative returns start to decline for all firms except Nucor and do not show any recovery until the end of event window.

Figure 2

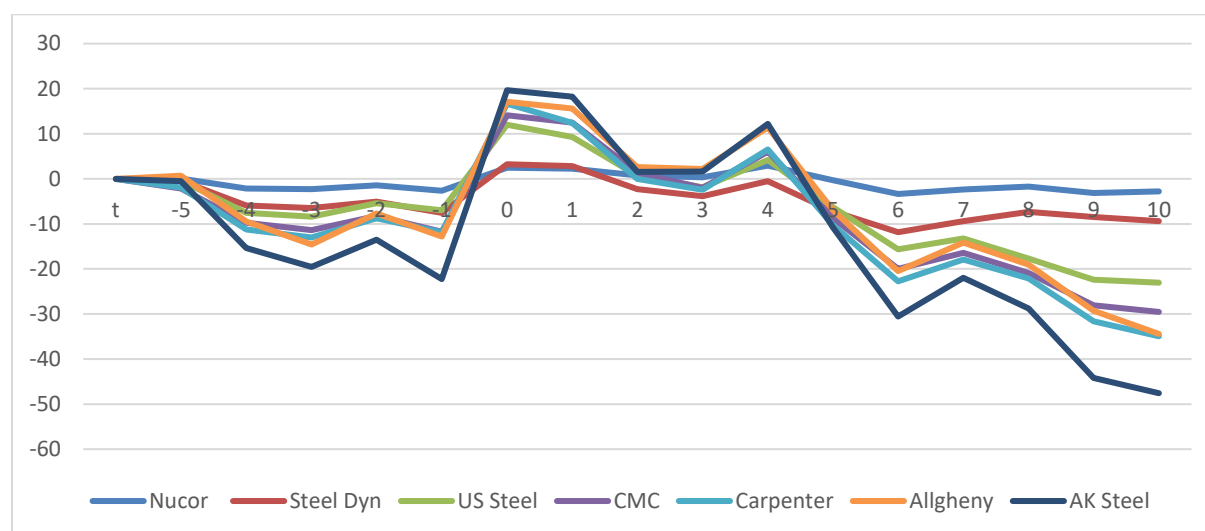


Fig.2. Cumulative Abnormal Returns for 7 US Manufacturing Firms over the event window.

4.2 Results for the Major Steel Consumer Firms

Table 5 provides the mean, min and max values for the 5 major US steel Consumers daily returns and the Market Index. I also include a column for the number of estimation days for each firm. The final column shows the standard deviations of the returns.

Table 5

Summary Statistics Percent Change in Daily Returns for 5 US Steel Consumer Firms

Firm	N	Mean (%)	Min (%)	Max (%)	SD
Boeing	246	0.283	-5.740	9.879	1.372
CAT	246	0.204	7.860	-5.410	1.372
Cummins	246	0.049	-6.206	6.099	1.191
Ford	246	-0.043	-7.022	5.078	1.254
General Mot.	246	0.064	-3.868	5.867	1.335
S&P 500	246	0.050	-4.097	1.744	0.613

Table 6 presents the OLS parameter estimates from the market model for the 5 steel consuming firms from Table 5. Table (7) shows that all firms have negative returns on event day, 3 of which are significantly different from zero. Returns for CAT and Ford Motors are not significant. Estimates for Cummins and General Motors are significant at 5 % significant level while returns are significant at 10 % significant level. Parameter estimates from each model are used to generate estimates of the abnormal returns and of cumulative abnormal returns for the event day, 5 trading days prior and 10 trading days after the event.

Table 6

Regression results for 5 US Steel Consumer Firms

Firm	Boeing	CAT	Cummins	Ford	GM
Intercept	0.223	0.138	0.001	-0.09	0.006
Slope	1.182*	1.304*	0.950*	.973*	1.100*
Std. Error	(1.165)	(1.142)	(1.041)	(1.108)	(1.152)
N	246	246	246	246	246
R Squared	0.279	0.329	0.239	0.225	0.255

Standard errors in parentheses. * p<0.05

Table 7

Abnormal Returns for 5 US Steel Consumer Firms

Event day	Boeing	CAT	Cummins	Ford	GM
-5	0.668 (0.573)	2.072* (1.814)	1.007 (0.968)	0.283 (0.255)	0.749 (0.650)
-4	-1.910 (-1.639)	0.004 (0.003)	-0.022 (-0.021)	-0.807 (-0.728)	-1.770 (-1.535)
-3	0.298 (0.256)	-0.884 (-0.774)	0.125 (0.120)	0.725 (0.655)	0.239 (0.207)
-2	1.597 (1.371)	0.034 (0.030)	0.286 (0.274)	-1.238 (-1.117)	-1.905 (-1.653)
-1	0.421 (0.361)	-2.802** (-2.453)	-0.05 (-0.05)	1.175 (1.060)	-0.826 (-0.716)
0	-2.104* (-1.806)	-1.245 (-1.090)	-3.063** (-2.942)	-1.623 (-1.465)	-2.504** (-2.172)
1	-2.258* (-1.938)	-3.363** (-2.944)	-1.695 (-1.628)	0.670 (0.604)	-1.517 (-1.316)
2	0.816 (0.700)	1.659 (1.452)	0.208 (0.200)	0.751 (0.678)	-0.392 (-0.340)

3	-1.621 (-1.391)	1.257 (1.100)	-0.432 (-0.415)	0.310 (0.280)	0.206 (0.179)
4	-0.705 (-0.605)	-1.532 (-1.341)	-0.826 (-0.794)	0.142 (0.128)	-0.454 (-0.393)
5	-0.264 (-0.226)	0.651 (0.570)	-0.456 (-0.438)	-0.527 (-0.476)	0.787 (0.682)
6	-0.618 (-0.530)	0.627 (0.549)	0.337 (0.324)	-0.466 (-0.420)	-1.919 (-1.664)
7	-2.986** (-2.563)	-2.342** (-2.050)	-1.302 (-1.251)	0.964 (0.870)	0.107 (0.093)
8	-1.075 (-0.922)	0.167 (0.146)	0.784 (0.753)	0.437 (0.394)	1.169 (1.014)
9	-2.030 (-1.742)	-0.140 (-0.122)	0.081 (0.078)	2.878** (2.598)	-0.218 (-0.189)
10	-0.216 (-0.185)	1.294 (1.132)	0.417 (0.401)	0.624 (0.564)	0.504 (0.437)

t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 8

Cumulative Abnormal Returns for 5 US Steel Consumer Firms

Event day	Boeing	CAT	Cummins	Ford	GM
-5	0.668 (0.573)	2.072* (1.814)	1.007 (0.968)	0.283 (0.255)	0.749 (0.650)
-4	-1.242 (-1.066)	2.077* (1.818)	0.985 (0.946)	-0.523 (-0.472)	-1.021 (-0.885)
-3	-0.843 (-0.810)	1.192 (1.043)	1.111 (1.067)	0.201 (0.182)	0.781 (-0.678)
-2	0.653 (0.561)	1.226 (1.073)	1.397 (1.342)	-1.036 (-0.935)	-2.687** (-2.331)
-1	1.075 (0.923)	-1.575 (-1.379)	1.339 (1.286)	0.138 (0.125)	-3.513** (-3.047)
0	-1.029 (-0.883)	-2.821** (-2.469)	-1.724 (-1.655)	-1.484 (-1.339)	-6.018** (-5.220)
1	-3.288** (-2.821)	-6.184** (-5.413)	-3.419** (-3.284)	-0.814 (-0.735)	-7.535** (-6.536)
2	-2.471** (-2.121)	-4.524** (-3.960)	-3.211** (-3.084)	-0.062 (-0.056)	-7.927** (-6.876)
3	-4.093** (-3.512)	-3.267** (-2.860)	-3.643** (-3.499)	0.247 (0.223)	-7.721** (-6.697)
4	-4.798** (-4.118)	-4.800** (-4.201)	-4.470** (-4.293)	0.390 (0.351)	-8.175** (-7.091)
5	-5.063** (-4.345)	-4.148** (-3.631)	-4.927** (-4.732)	-0.137 (-0.124)	-7.387** (-6.408)

6	-5.681** (-4.875)	-3.520** (-3.082)	-4.589** (-4.408)	-0.603 (-0.545)	-9.307** (-8.073)
7	-8.668** (-7.438)	-5.863** (-5.132)	-5.892** (-5.659)	0.360 (0.325)	-9.199** (-7.980)
8	-9.743** (-8.361)	-5.695** (-4.986)	-5.107** (-4.905)	0.798 (0.720)	-8.029** (-6.965)
9	-11.773** (-10.103)	-5.836** (-5.108)	-5.026** (-4.827)	3.676** (3.318)	-8.247** (-7.154)
10	-11.989** (-10.288)	-4.542** (-3.976)	-4.608** (-4.426)	4.301** (3.882)	-7.743** (-6.717)

t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 7 presents percentage abnormal returns for the 5 firms listed in Table 5. To analyze the null hypothesis that the event had no impact on the firms' normal returns, I conduct t-tests. T-values for all firms are given in parentheses for the 16 days event window. The table shows that 3 of the 5 firms' returns namely CAT, Cummins and GM are significantly different from zero on the event day at 5% significant level. Boeing's returns are significant at 10% significance level while Ford's returns are not significant on the event day. All the firms report negative returns on the event day. Boeing lost 2.1%, GM lost 2.5%, and Cummins's lost 3%.

Table 8 presents percentage cumulative abnormal returns for the 5 firms steel consumers. CAT and General Motors show significantly negative cumulative abnormal returns on the event day. All the companies except Ford show significant drop in the cumulative returns throughout the event window starting the third day of the event. Returns of Ford Motors remain stable throughout the event window. By the end of the event window Boeing's cumulative returns decrease by 10%, while General Motors return decrease by 6%. Cummins had a 4% decrease, while CAT returns drop by 3%.

Figure 3 shows abnormal returns for the 5 US steel consumer firms. The figure shows a decline in the returns of all companies on the event day except Boeing. The returns stabilizes by

the 3rd day of the event where they take a short dip on the 7th day of the event. Most firms abnormal return show a steady trend by the end of the event window

Figure 3

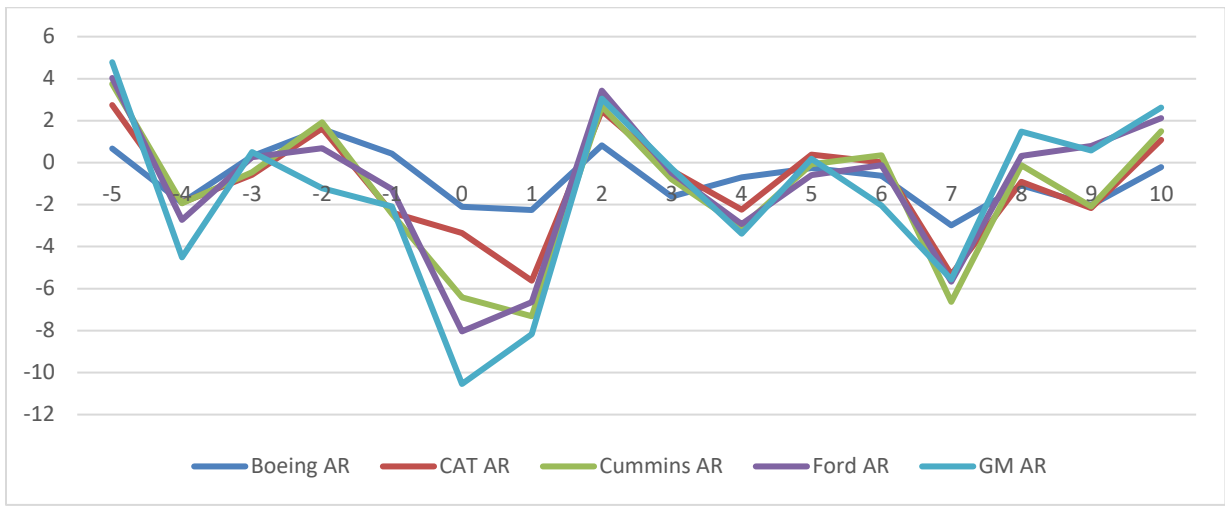


Fig.3. Abnormal Returns for 5 US Steel Consumer firms during the event window

Figure 4

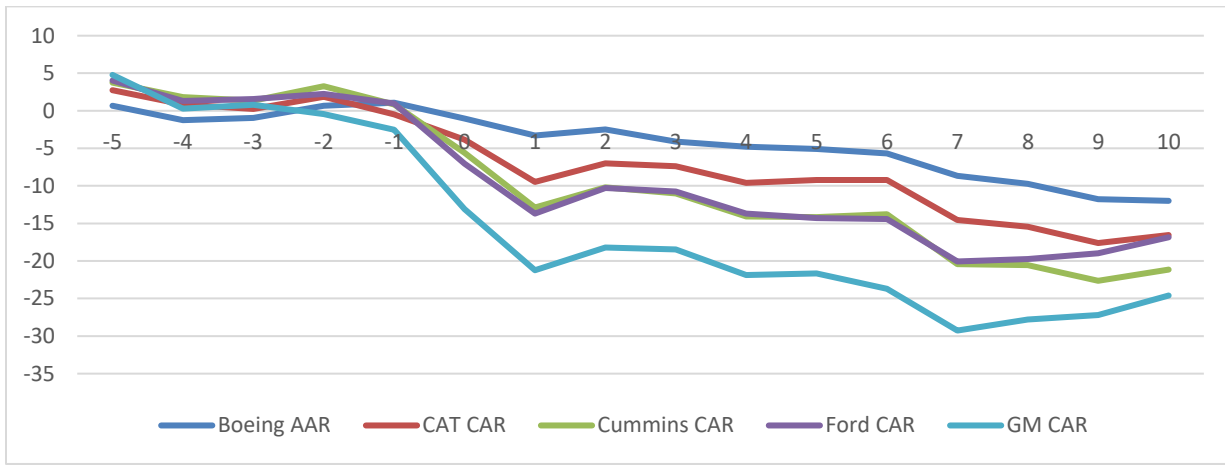


Fig.4. Cumulative Abnormal Return of 5 US Steel Consumers through the event window

Figure 4 shows cumulative abnormal returns for the 5 US steel consumer firms from the sample. The figure shows a consistent decrease in returns for all firms. It shows that all firms noted a decrease in their returns on event day and the pattern persists by the end of the event window.

4.3 Results for the Control Group

Table 9 provides the mean, min and max values of daily returns for the 5 firms that are unlikely to be affected by changes in steel prices. I also include a column for the number of estimation days for each firm. The final column shows the standard deviations of the particular returns.

Table 9

Summary Statistics of the Percent Change in Daily Returns for 5 US Tech Firms

Firm	N	Mean (%)	Min (%)	Max (%)	SD
Amazon	246	0.232	-4.678	13.216	1.466
Twitter	246	0.342	-14.125	18.494	2.806
Facebook	246	0.113	-4.773	4.248	1.279
Google	246	0.113	-5.280	4.261	1.166
Microsoft	246	0.154	-5.133	6.411	1.131
S&P 500	246	0.050	-4.097	1.744	0.613

Table 10 presents the OLS parameter estimates from the market model for the 5 US Tech firms from Table 9. The table shows that none of the returns of the 5 firms are statistically significant. Parameter estimates from each model are used to generate estimates of the abnormal returns and of cumulative abnormal returns for the event day, 5 trading days prior and 10 trading days after the event.

Table 10

Regression results for 5 US Tech Firms

Firm	Amazon	Twitter	Facebook	Google	Microsoft
Intercept	0.179	0.315	0.051	0.046	0.085
Slope	1.095	0.535	1.215	1.312	1.347
Std. Error	(1.306)	(2.787)	(1.041)	(0.844)	(0.777)
N	246	246	246	246	246
R Squared	0.209	0.013	0.339	0.477	0.531

Standard errors in parentheses. * $p < 0.05$

Table 11 presents percentage abnormal returns for the 5 firms from Table 9. To test the null hypothesis that the event had no impact on the firms' returns I conduct t-tests. T-values for all days of the event are given in parentheses. None of the returns on the event days are significantly different from zero. Hence, we fail to reject the hypothesis that the event had no impact on these firms' returns. Twitter's returns are significant on the 9th day of the event, Facebook returns are significant on 4th day, while Microsoft's returns are significant on 9th day. These results are consistent with economic theory: the tariff announcement had no significant effect on the returns outside the producers and consumers of steel.

Table 12 presents percentage cumulative returns for the 5 firms from Table 9. To test the null hypothesis that the event had no significant impact on the firms returns I conduct parametric test. T-values for all days of the event are given in parentheses. The table shows that Google returns decreased for the first 3 days of the event but recovered to its pre-event level by day 10. Microsoft's cumulative returns increased on the event day but recovered the next day. Twitter and Google's cumulative returns record a drop before the event but recover after the 4th day.

Table 11

Abnormal Returns of the 5 US Tech Firms

Event day	Amazon	Twitter	Facebook	Google	Microsoft
-5	-0.123 (-0.094)	-4.172 (-1.496)	0.437 (0.419)	-0.520 (-0.616)	0.045 (0.058)
-4	-0.948 (-0.725)	0.538 (0.193)	0.402 (0.386)	-0.512 (-0.606)	0.294 (0.378)
-3	-0.004 (-0.003)	-2.476 (-0.888)	-0.586 (-0.562)	-0.206 (-0.244)	-0.224 (-0.288)
-2	0.556 (0.425)	-2.247 (-0.806)	-0.383 (-0.368)	-0.668 (-0.792)	0.347 (0.447)
-1	1.066 (0.816)	2.002 (0.718)	-0.433 (-0.415)	0.193 (0.229)	0.952 (1.225)
0	0.022 (0.017)	1.590 (0.570)	0.233 (0.224)	-1.242 (-1.471)	0.728 (0.937)
1	-0.280 (-0.214)	1.769 (0.634)	-0.281 (-0.270)	0.475 (0.563)	-0.554 (-0.712)
2	0.168 (0.129)	3.881 (1.392)	0.747 (0.717)	-0.515 (-0.610)	-0.938 (-1.207)
3	0.451 (0.345)	-0.890 (-0.319)	-0.716 (-0.687)	0.167 (0.198)	-0.783 (-1.007)
4	0.351 (0.269)	3.573 (1.281)	2.193** (2.105)	1.300 (1.540)	0.557 (0.717)
5	-0.224 (-0.172)	-3.099 (-1.111)	-1.339 (-1.286)	0.653 (0.773)	-0.080 (-0.103)
6	-0.341 (-0.261)	0.188 (0.067)	-0.579 (-0.556)	0.457 (0.541)	-0.193 (-0.248)
7	1.194 (0.914)	0.176 (0.063)	-0.150 (-0.144)	0.558 (0.661)	0.323 (0.416)
8	-0.121 (-0.093)	3.890 (-1.395)	-0.836 (-0.803)	-1.443 (-1.709)	-1.667 (-0.214)
9	0.624 (0.478)	7.290** (2.615)	1.914* (1.837)	1.492 (1.767)	0.092 (0.118)
10	-0.639 (-0.489)	-2.459 (-0.882)	-0.135 (-0.130)	0.205 (0.243)	0.371 (0.477)

t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 12

Cumulative Abnormal returns of the 5 US Tech Firms

Event day	Amazon	Twitter	Facebook	Google	Microsoft
-5	-0.123 (-0.094)	-4.172 (-1.496)	0.437 (0.419)	-0.520 (-0.616)	0.045 (0.058)
-4	-1.071 (-0.820)	-3.633 (-1.303)	0.839 (0.805)	-1.032 (-1.222)	0.339 (0.436)
-3	-1.075 (-0.823)	-6.110** (-2.191)	0.253 (0.243)	-1.239 (-1.467)	0.114 (0.147)
-2	-0.519 (-0.397)	-8.357** (-2.998)	-0.129 (-0.124)	-1.908** (-2.259)	0.462 (0.595)
-1	0.546 (0.418)	-6.354** (-2.279)	-0.563 (-0.540)	-1.714** (-2.030)	1.415 (1.820)
0	0.569 (0.436)	-4.764 (-1.708)	-0.329 (-0.316)	-2.957** (-3.502)	2.143** (2.757)
1	0.289 (0.221)	-2.994 (-1.074)	-0.611 (-0.587)	-2.482** (-2.939)	1.589** (2.045)
2	0.458 (0.351)	0.887 (0.318)	0.136 (0.130)	-2.997** (-3.550)	0.651 (0.837)
3	0.910 (0.697)	-0.003 (-0.001)	-0.580 (-0.556)	-2.830** (-3.351)	-0.132 (-0.169)
4	1.262 (0.966)	3.569 (1.280)	1.613 (1.548)	-1.529 (-1.811)	0.425 (0.547)
5	1.037 (0.794)	0.469 (0.168)	0.273 (0.262)	-0.876 (-1.037)	0.345 (0.444)
6	0.696 (0.532)	0.657 (0.236)	-0.305 (-0.293)	-0.418 (-0.495)	0.152 (0.195)
7	1.890 (1.447)	0.834 (0.299)	-0.546 (-0.438)	0.140 (0.165)	0.476 (0.612)
8	1.768 (1.354)	-3.055 (-1.096)	-1.293 (-1.241)	-1.303 (-1.543)	-1.191 (-1.531)
9	2.393 (1.832)	4.235 (1.519)	0.620 (0.596)	0.188 (0.223)	-1.098 (-1.413)
10	1.753 (1.342)	1.775 (0.636)	0.485 (0.465)	0.394 (0.466)	-0.727 (-0.935)

t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

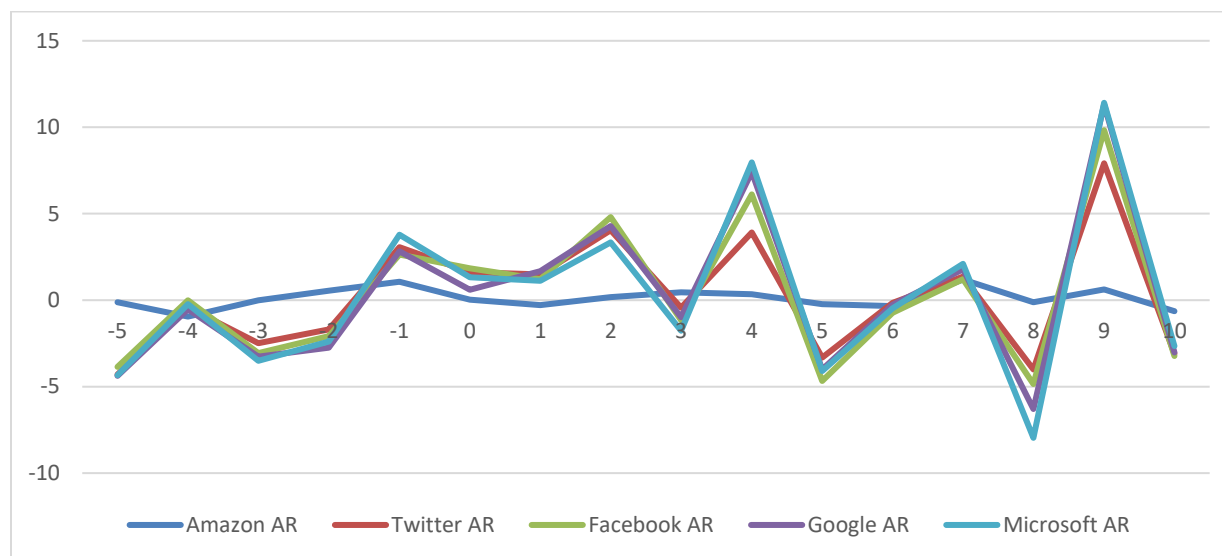
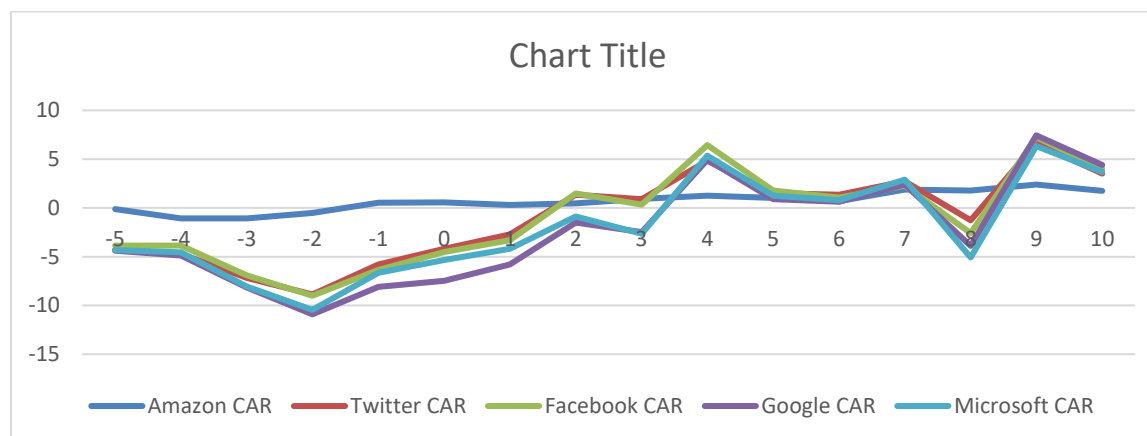
Figure 5**Fig.5.** Abnormal returns of the 5 US Tech firms throughout the event window

Figure 5 shows abnormal returns for the 5 US Tech companies included in the control group in the sample. The figure shows no change in the firms stock returns on the event day. Later in the event window, the figure shows fluctuation in the companies returns. However, the returns are not consistent and do not provide any evidence of the effects of the event on their performance.

Figure 6 shows the cumulative abnormal returns for the 5 US Tech firms for the event window. The graph shows that the companies included in this group show a steady rate of cumulative returns through the event window. No change is observed in the cumulative returns on the event day. Further, the returns for all firms keep the similar trend as observed before the event. This shows that the event had no effect on their cumulative returns.

Figure 6**Fig.6.** Cumulative abnormal returns of the 5 US Tech firms throughout the event window

5. Discussion/Policy Implications

My analysis shows that the tariffs had a significant effect on the stock market return of major US steel manufacturing and steel consuming firms. In general, the results are mainly consistent with the predictions of economic theory. Six of the seven US Steel manufacturing firms namely Nucor, Steel Dynamics, AK Steel, US Steel, CMC and Carpenter Corporation showed significantly positive returns on the event day. Only Allegheny Corporation showed insignificant returns. This provides evidence that the tariffs had a positive effect on Steel market on the event day. Significant results for most firms included in the sample show that the market reacted swiftly to the tariffs. The market showed a negative trend later in the event window when the President signed the order on 8th March, 2018 but resumes to its normal level in the succeeding days. All the firms showed a negative trend in the cumulative returns during the event window. Nucor Corporation resumes its former place in the market while other firms such as AK Steel and Steel Dynamics saw consistent decrease in their returns over the event window.

This shows that the tariffs were not helpful for the steel firms as their market returns reduced over the event window.

All of the US steel consuming firms except Boeing showed significantly negative returns on the event day. The market resumes to the normal level in the next few days when they lose market return again on March 08 when the President signed the tariff orders. Similarly, all firms show a consistent decrease in cumulative returns over the event window. The result shows that the tariffs harmed US steel consuming firms. When steel is a major raw material in a firm's production process ranging from automobile to construction industry, the result show that its market value is harmed by the tariffs.

As for the control group, all the firms seem to be unaffected by the event. Their returns are consistent with the market returns. This also indicates that the event was detrimental to the steel firms and that the method we use to capture abnormal returns is robust enough to provide significant results. Moreover, our results are consistent with the efficient market hypothesis in this case as information spreads in one event interval as can be seen above in the analysis.

The results imply that contrary to the popular narrative portrayed by the Trump administration that the tariffs are good for the economy and will save jobs in the indigenous industry seems to be flawed and not supported by the evidence. A detailed investigation shows that the effects might be otherwise portrayed by the political leadership. Tariffs increase the prices of basic commodities in the market thus reducing the market returns of the firms listed on stock market. This in turns results in lower revenue to the firms which will manifest in lower dividends. The evidence shows that what we gain by giving protection to one sector at one place is lost in other sectors, such that the overall loss exceeds the gain.

This is without accounting for the fact that tariffs once imposed lead to retaliatory measures leading to trade wars that further harm welfare. Further, the ensuing trade wars while increasing prices in the resultant markets lowers the surplus in all of the affected areas by tariffs. Hence, this study also provides evidence in support of the economic principle that taxes (tariffs) reduce overall surplus in the society leading to lower social welfare.

6. Conclusion

In this study, I used event study methodology to appraise the effects of the US steel tariffs of March 2018 on producer value. Sixteen firms listed on the NYSE were included in the study. These included 7 US steel manufacturing firms, 5 US steel consumer firms and a control group that included 5 major US Tech firms. Most of the firms included in the sample showed significant positive or negative abnormal returns on the day that tariff were announced. Fluctuation in the returns indicates that investors reacted to the tariffs and that it affected the market.

Future research may investigate the effects of other such tariffs that are imposed during the Trump presidency in order to measure their effects on overall social welfare. Further, they should investigate trade wars that tariffs cause. That may provide precise estimate of the possible losses incurred as a result of the President's general policy toward trade. Understanding the social effects of tariffs will enable policy analysts to make informed decisions and better serve the public.

7. References

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