GROUP 13

ASIA
DATATHON

PREPARED BY

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Question:

How are stock performances of food processing companies associated with changes in immigration policies?

Abstract

"America is a country of immigrants"

In recent times, no topic has been more contentious in American politics than immigration(Yahoo Is Part of the Yahoo Family of Brands, n.d.). The surge of individuals seeking political asylum in the United States has significantly stressed local, state, and federal resources. This increase has not only strained systems but has also intensely fuelled political discourse, especially from conservative circles. This is particularly notable since immigration falls under federal jurisdiction and President Biden, a Democrat, is gearing up for the 2024 reelection(Cooper, 2024). At its most extreme, the topic of new arrivals, whose numbers are often overstated, has been co-opted into anti-immigrant narratives that sometimes cross into explicitly racist or conspiratorial territories.

Since January 2024, a notable point of tension between Texas and the federal government is centred on the state's takeover of a public park in Eagle Pass(Davies, 2024). With the December 2024 election drawing near, immigration remains one of the most fiercely debated policy issues among politicians. In this dynamic era of shifting political leadership and evolving immigration policies, it is crucial for food processing companies and traders to discern potential risks and benefits associated with these changes.

Given the fact that undocumented immigrants comprise over 10% of the workforce in the food industry and thus determines food processing companies costs to further expand their production supply, changes in immigration policies are likely to significantly impact the stock market(Pew Research Center, 2020). Our analysis aims to investigate how potential policy alterations leading up to the election might affect the stock prices of processed food companies. By delving into historical events related to immigration policy changes, observing market reactions to shifts in these policies, and considering industry-specific indicators, we strive to offer a comprehensive and nuanced understanding of how immigration policies correlate with stock market performances.

Introduction:

Our research embarks on a comprehensive exploration of the intricate relationship between immigration policies and the stock market performance of processed food companies, incorporating two pivotal events that shape the policy landscape and market dynamics. We commence our investigation by constructing a daily market model, employing robust regression methodologies to scrutinise the interplay between market-wide returns and the returns of individual processed food firms.

In selecting the S&P 500 index as our benchmark for market-wide returns, we strategically leverage its comprehensive representation of 500 leading publicly traded companies across diverse sectors within the U.S. economy. The extensive historical data and broad sectoral coverage inherent in the S&P 500 align with our commitment to rigorous and comprehensive research methodologies.
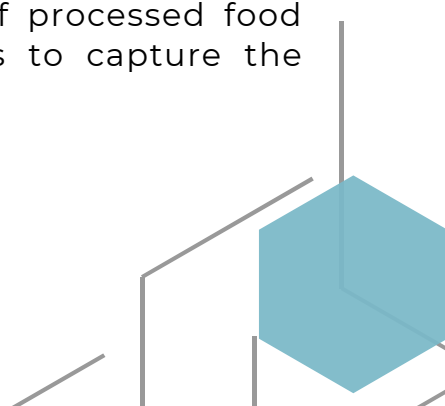
Our selection of processed food companies stems from meticulous data curation, drawn from the Stocks and ETFs dataset provided to us. The detailed stock information extracted from their respective stocks details dataset underscores our dedication to precision and reliability in our analytical endeavors.

The initial stage of our analysis lays the groundwork for deeper exploration into the dynamics of the processed food stocks market. By establishing a nuanced understanding of market dynamics through our daily market model, we set the stage for uncovering the broader implications of immigration policies on the sector.

Building upon this foundational framework, we incorporate two pivotal events into our analysis:

1. May 11, 2023: End of Title 42
The termination of Title 42 represents a significant milestone in immigration policy as the world embraces the post-COVID era. Title 42 was initially implemented in response to the COVID-19 pandemic to restrict non-essential travel and mitigate transmission risks, including the expulsion of undocumented immigrants at the border without standard immigration proceedings. With the end of it, the US reverted to Title 8, under which migrants expressing fear of returning to their home countries can request asylum through established procedures. More importantly, we identify this as a kick-start to the constructive transformation of immigration policy in the United States. We meticulously filter our data to extract stock details of processed food companies specifically during May 2023, enabling us to capture the market dynamics surrounding this pivotal event.

2. January 20, 2021: Inauguration of President Joe Biden

President Joe Biden's inauguration marks a paradigm shift in immigration policies, characterised by the repudiation of numerous Trump-era restrictions and the proposal of comprehensive reform legislation. His administration's actions, such as the pause on border wall construction and revival of the refugee resettlement program, introduced significant policy changes with far-reaching implications for the processed food industry. Amidst the surge in migrants at the U.S. border, we meticulously filter our data to extract stock details of processed food companies specifically during January 2021, capturing the market dynamics surrounding this transformative event.

Subsequently, our analysis extends to **Cumulative Abnormal Returns (CAR)**, a pivotal metric for gauging the collective market response to immigration policy shifts. Through tracking the cumulative abnormal returns over a specified time horizon, we aim to discern the reverberations of immigration policy changes within the stock market, shedding light on their impact on investor perceptions and valuations of processed food companies.

Our analysis further extends to regression methodologies, offering a quantitative lens to elucidate the nexus between immigration policies and the stock market performance of processed food companies. This regression analysis empowers us to pinpoint and quantify the specific channels through which immigration policies exert influence on stock prices, including labour market dynamics and shifts in consumer behaviour.

Through this comprehensive analytical framework, our research endeavours to provide actionable insights into the complex relationship between immigration policies and the stock market performance of processed food companies. By disentangling the interplay of policy dynamics and market forces, we aim to equip investors, policymakers, and industry stakeholders with a deeper understanding of the opportunities and challenges presented by immigration policy shifts within the processed food sector.
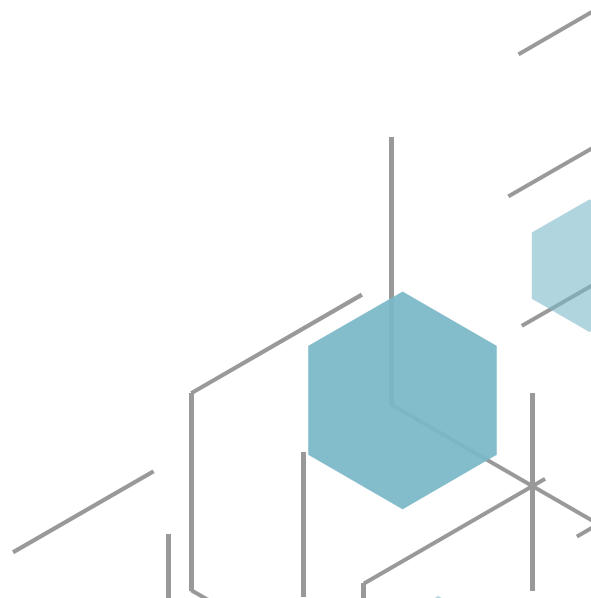
Nontechnical Summary:

Main Questions

Our investigations follow two central questions:
1. Why must immigration policy be examined for leading to larger fluctuations in the stock market?
2. Can changes in immigration policy lead to abnormal returns of food processing companies' stocks?

Let's begin by exploring why we opt to analyze immigration policy specifically to understand its impact on the stock market. Our team believes that studying immigration policy is crucial for several reasons.

Firstly, immigration policy plays a significant role in shaping the labor market by regulating the entry of foreign workers. Changes in immigration policy can result in shifts in the availability of labor, impacting wages, employment rates, and overall productivity. These changes directly influence the operational costs and profitability of businesses across various sectors, ultimately influencing their stock prices.

Secondly, different industries in the US have varying degrees of reliance on immigrant labor. Sectors such as agriculture, hospitality, technology, and healthcare often depend heavily on immigrant workers. Any adjustments in immigration policy can disrupt the labor supply chain within these sectors, leading to specific fluctuations in stock prices as companies adjust to changes in their workforce and associated costs.

Moreover, immigration policy can affect consumer demand. Immigrants contribute significantly to consumer spending by purchasing goods and services. Changes in immigration policy can alter the size and composition of the consumer base, directly impacting business revenues and profitability, and consequently, their stock prices.

Additionally, immigration policy changes can introduce uncertainty into the market. Investors may respond to this uncertainty by adjusting their investment portfolios, leading to fluctuations in stock prices. Furthermore, shifts in immigration policy can signal broader changes in government policies, economic conditions, and geopolitical relations, all of which influence investor sentiment and market volatility.

Lastly, changes in immigration policy may impose additional regulatory and compliance costs on businesses. Companies may need to invest resources in ensuring compliance with new immigration laws, impacting their operational efficiency and financial performance, potentially leading to fluctuations in stock prices.

In summary, by examining immigration policy and its effects on various aspects of the economy, we aim to provide insights into how policy changes can influence stock prices in the US market.

Question 2 will be discussed in the research findings section. We will delve into two case studies of major policy changes in the US and their impact on stock prices. These case studies will offer specific examples illustrating how changes in immigration policy can lead to abnormal returns for food processing companies' stocks. By analyzing these real-world examples, we aim to deepen our understanding of the relationship between immigration policy and stock market fluctuations.

Technical Summary

Data Exploration & Preprocessing

We have conducted an analysis on the combined datasets "all_stocks_and_etfs.csv" and "stock_descriptions.csv" to gather information regarding stock prices within the food processing industry. Apart from that, we have also mined data from Yahoo Finance to find the shares outstanding for each stock to calculate turnover ratios and market capitalisation.

Our primary focus was on stock prices surrounding two specific event dates: 2023-05-11, and 2021-01-25. Below are two graphical representations we created, illustrating the average percentage increase in closing prices over time across the two events, categorised by industry:
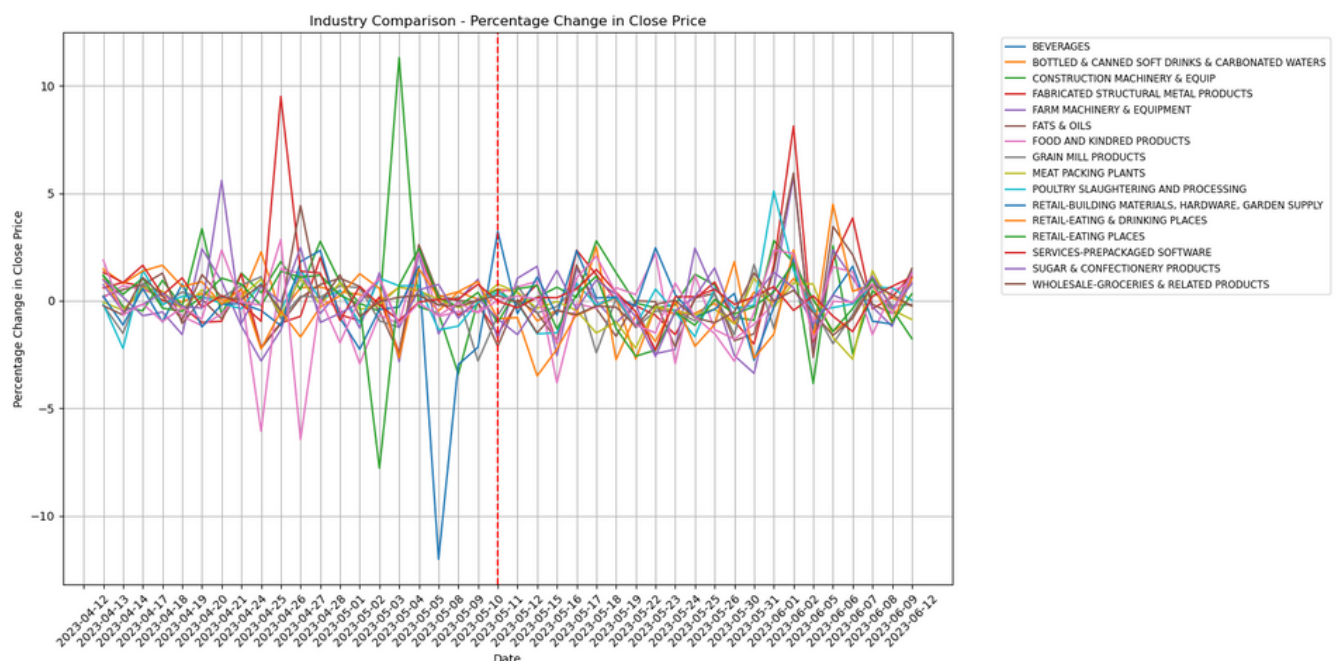

Figure 1: Average Percentage Increase in Close Price from 2023-04-12 to 2023-06-12. We can observe that the fluctuations in average percentage change across all industries decreased significantly after the event date.
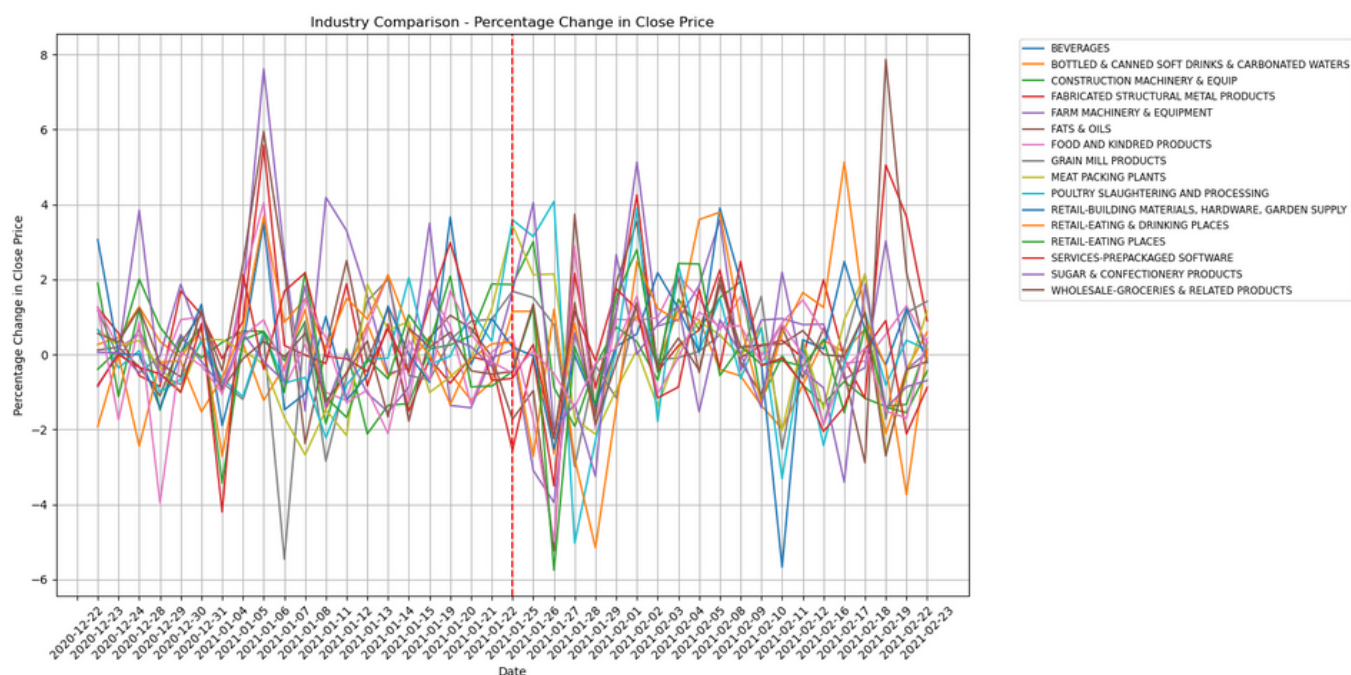
Figure 2: Average Percentage Increase in Close Price from 2020-12-22 to 2021-02-23. We can observe that the fluctuations in average percentage change across all industries increased significantly after the event date.

Regression Analysis based on Cumulative Abnormal Return (CAR)

We begin by estimating CAR in the standard way, discussed in Fama et al. (1969), which allows us to isolate the event response while controlling for broader market conditions. In particular, we estimate the following equation for each stock in our sample:

$$R_t = \alpha + \beta R_{mt} + \epsilon_t$$

The daily market model involves performing a linear regression of daily returns for each firm against market-wide returns.

To mitigate potential biases in the parameter estimates for alpha (α) and beta (β), we conduct the estimation using data from an estimation period that spans at least 21 days (approximately one month of calender days) prior to the event. Additionally, we limit the estimation period to a maximum of 42 trading days (approximately two months before and after the event).

After obtaining the estimated parameters for alpha (α) and beta (β) during the pre-event period, we can then calculate abnormal returns using the following approach:

$$AR_t = \varepsilon_t = R_t - \hat{\alpha} - \hat{\beta} Rm_t$$

where AR represents the abnormal return observed on day t, while α and β stand for the estimated parameters derived during the estimation period. It's important to note that AR is a random variable with an expected value of zero, and it is independent of the explanatory variable. In simpler terms, AR reflects the unique stock return of a firm, factoring in market-wide influences.

Next, we estimate CAR(-k, k) for each stock, which refers to the sum of abnormal returns of that particular stock from k days before the event till k days after the event.

We can estimate CAR using the following linear regression equation:

$$CAR(-k, k)_i = \beta_1 ln(MarketCapitalisation_i) \times \beta_2 Price_i \times \beta_3 Turnover_i \times \beta_4 Volatility_i \times \beta_5 Industry_i + \alpha + \epsilon_i$$

The dependent variable in this context is the CAR within the event window (-k, k) surrounding the event date, where k varies from -21 to 21 days. The independent variables considered are:

1. Natural logarithm of the market capitalisation of the stock, calculated by multiplying its outstanding shares by its market value.
2. Closing price of the stock.
3. Turnover ratio of the stock.
4. Volatility of the stock.
5. Industry classification of the stock.

After conducting the regression analysis, we examine the statistical significance of the intercept, which represents the expected CAR(-k, k) when all regressors are set to zero. A significant intercept suggests the presence of notable abnormal returns during the event window.

Research Findings

Findings for Event 1: The End of Title 42

In our investigation into the repercussions of the end of Title 42, a pivotal finding emerged from our rigorous regression analysis, spanning various k values from 1 to 15. Notably, we unearthed a striking baseline effect on the dependent variable, CAR, even in the absence of any discernible alterations in the independent variables. This effect was particularly pronounced within the range of k values from 5 to 11, inclusively, where all associated p-values from the regression analyses dipped below the customary threshold of 0.05, indicative of robust statistical significance (Figure 3).

This discovery sheds light on a remarkable trend observed within the processed food stock market during the period surrounding the end of Title 42. Specifically, CAR values displayed a consistent positive trajectory within the window period extending from 5 days before to 11 days after the cessation of Title 42. This anomaly suggests that investors reaped notably higher returns compared to the market's typical behaviour during analogous periods. The sustained positive CAR within this timeframe hints at favourable market conditions for the processed food sector (Figure 3).

Delving deeper, it becomes apparent that within this temporal range, a particular standout emerges when k equals 7, wherein the baseline CAR value surges to 40.8145. This significant peak underscores a particularly robust phase of positive abnormal returns, signifying heightened investor sentiment and potentially favourable economic conditions for the processed food industries (Figure 3).

Relating these findings to the real-world context surrounding the end of Title 42 unveils a narrative rich with implications. Title 42, implemented amid the COVID-19 pandemic, represented a crucial regulatory measure aimed at restricting cross-border movements to curb the spread of the virus. As this regulation drew to a close, the market responded with palpable optimism, particularly within the processed food sector. The observed surge in positive abnormal returns reflects investors' confidence in the sector's resilience and adaptability in navigating shifting regulatory landscapes.

Research Findings

k-value	Constant Term	p-value
1	4.3283	0.342
2	0.4513	0.956
3	4.8768	0.629
4	14.5526	0.219
5	27.8275	0.045
6	38.9444	0.021
7	40.8145	0.013
8	37.7407	0.007
9	36.3847	0.019
10	32.3564	0.045
11	28.3966	0.042
12	21.4766	0.136
13	15.6044	0.205
14	14.9412	0.285
15	23.0020	0.062

Figure 3: Statistic Summary of Regression Analysis on Event 1

## Findings for Event 2: Inauguration of President Joe Biden

In delving into a comprehensive regression analysis centred on the event of President Joe Biden's inauguration, a thorough examination spanning diverse k values, ranging meticulously from 1 to 15, was undertaken. Despite this meticulous scrutiny, none of the p-values associated with the constant term for any k-value fell beneath the conventional threshold of 0.05 (Figure 4). This lack of statistical significance suggests an inability to confidently assert the presence of abnormal returns within the processed food stock market surrounding the inauguration of President Joe Biden.

Translating these findings to the real-world context, it becomes evident that a multitude of factors may have contributed to the observed lack of conclusive evidence regarding the CAR of the processed food stock market during President Biden's inauguration. Notably, during his campaign and subsequent election, President Biden frequently articulated his intention to depart from the stringent border policies implemented by his predecessor, President Donald Trump. This stance likely created an atmosphere of anticipation and uncertainty within the market, potentially dampening the sensitivity of market participants to the inauguration event itself.

The market's perceived insensitivity during President Biden's inauguration underscores the intricate interplay between political rhetoric, market sentiment, and economic dynamics. The anticipation of policy shifts and the market's anticipation of subsequent regulatory changes could have mitigated the immediate impact of the inauguration on stock market behaviour, rendering it less discernible within the studied timeframe.

k-value	Constant Term	p-value
1	14.1306	0.193
2	14.5107	0.476
3	33.6062	0.171
4	21.3132	0.320
5	22.3403	0.260
6	24.0552	0.252
7	27.3367	0.132
8	23.5538	0.083
9	18.2035	0.283
10	3.7865	0.820
11	17.2170	0.261
12	18.4589	0.177
13	17.6627	0.191
14	12.8900	0.250
15	17.9936	0.114

Figure 4: Statistical Summary of Regressive Analysis on Event 2
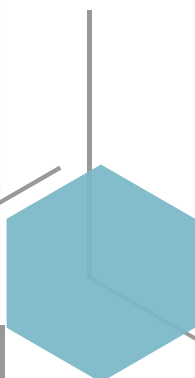
Limitations and Future Directions

Our analysis, while insightful, encounters a significant limitation due to the relatively small dataset of stock prices utilised. This constraint stems partly from the limited timeframe of the datathon, during which our focus was primarily on data mining to develop new features like volatility, market capitalisation, and abnormal returns, as well as on exploring methodologies to address our problem statement. Consequently, we could not fully integrate other complementary datasets.

This leads to pertinent questions: Can our findings be generalised to all changes in immigration policies? Are there other policy shifts that might have a more substantial impact on the stock prices of food processing companies? How do we measure the impact of the policy changes quantitatively in order to foresee the stock market's reactions? These uncertainties underscore the need for further research to validate our initial conclusions.

Post-competition, our team intends to delve deeper into exploring the intricate relationship between policy changes and stock market dynamics. Future studies would greatly benefit from more sophisticated financial APIs that can automatically generate necessary data or from extended research periods, allowing for a broader analysis of policy impacts beyond just the food processing sector. Regardless of these enhancements, the methodologies we have developed and employed in this initial study will continue to be valuable tools in understanding these complex interconnections.

Recommendations to food processing companies

The future of immigration policies seems uncertain, and as local sentiments around immigration issues grow increasingly pronounced, it's reasonable to anticipate heightened risks for food processing companies considering expansion in the near future. Our research indicates that these companies also face tangible financial risks, especially in the event of abrupt changes in immigration policies. These policy shifts could significantly impact workforce availability and dynamics, directly affecting operational capacities and financial stability. Therefore, it's essential for companies in the food processing sector to stay vigilant and adaptable, preparing for a range of scenarios as they navigate these potentially turbulent waters.

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