ORS GROUP
APPLIED A.I.

Risk - Reacting Under Uncertainty

A Case Study During COVID-19

Introduction

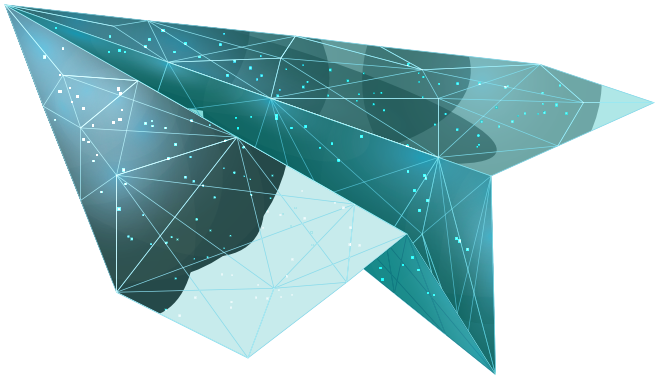
Never in human history has a natural event shaken up the entire global economy as it has during COVID-19.

This ordeal is relentlessly forcing companies into bankruptcy. As a result of the COVID-19 crisis, 38 major companies have declared bankruptcy, including giants such as JCPenney and Neiman Marcus. With the increased frequency of natural disasters and the inevitability of even stronger disease mutations, it is imperative that businesses are best prepared to respond to the uncertainties that the future holds. In this decade, natural disasters that cause at least $1 billion of damage are almost twice as frequent as they were last decade.

Whilst we cannot hold a crystal ball to understand what will cause tomorrow's shock, there are two main questions that one can and should be answered in order to create antifragility in any organization.

- **How should our organization react?**
- **Are we prepared to react if the need arises?**

This article focuses on answering the former in the context of a nationwide gas distributer and convenience store chain. The latter is merely prosed as a food for thought given our discoveries about our former.



Case Scenario

In order to answer how an organization should react, we need to create scenarios and assumptions about our future and use data to validate the risks and rewards from the decisions we could take.

A gas distributer and convenience store generates revenue by selling fuel and basic groceries where its costs stem primarily from staffing and inventory. COVID-19 has restricted travel and caused a great deal of unemployment, so intuitively we know that if less cars drive past a gas station, it is likely that the station will make less revenue. Similarly, with less disposable income consumers are less willing to spend. We cannot however be certain about the true effects of either, especially because lower disposable income does not necessarily lower aggregate consumption as it may skew consumption distribution towards basic goods. We need to find the right signals (data) so that we can infer patterns using a simple machine learning models, allowing us to determine relevant economic indicators that predict future outcomes.

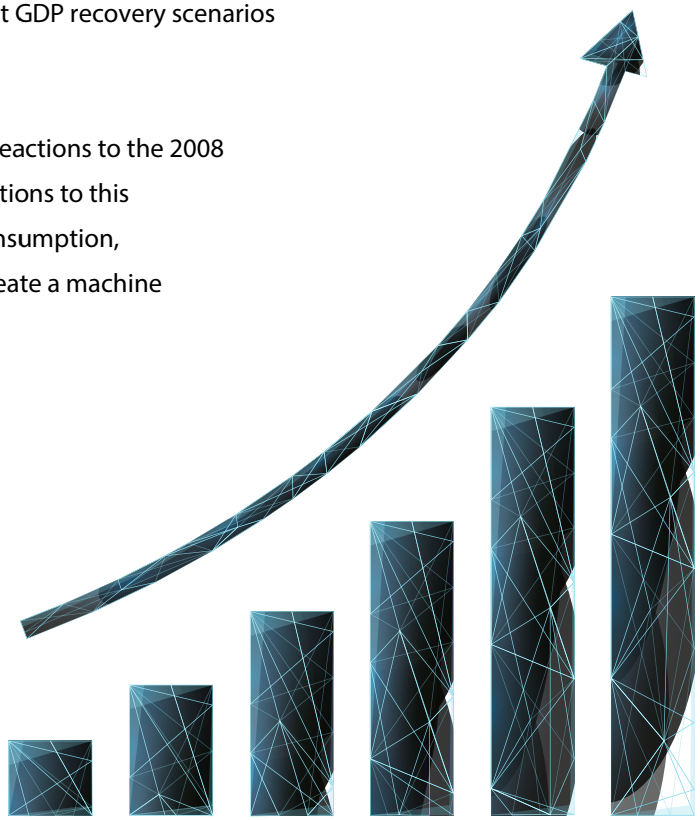
Data Preparation

1. We collected data from the FRED database on the miles travelled in the US, the US production index, and US fuel sales from 2001 to 2020.
   → This data was used to analyze the relationship between traffic data and GDP.
2. we collected quarterly data from the SEC public database on the company's operating income, revenue, number of stores from 2008 through 2018.
   → This data was used to analyze the company's past reactions to different economic events, such as the 2008 financial crisis.
3. We then collected a series of data relevant to industrial production, personal consumption expenditure, retail sales for food and non-food indicators, and employment rates.
   → This data was used to determine likely recovery scenarios from the current recession as well as probable impacts on consumer spending in convenience stores.
4. We collected data on different GDP recovery scenarios from The Conference Board.

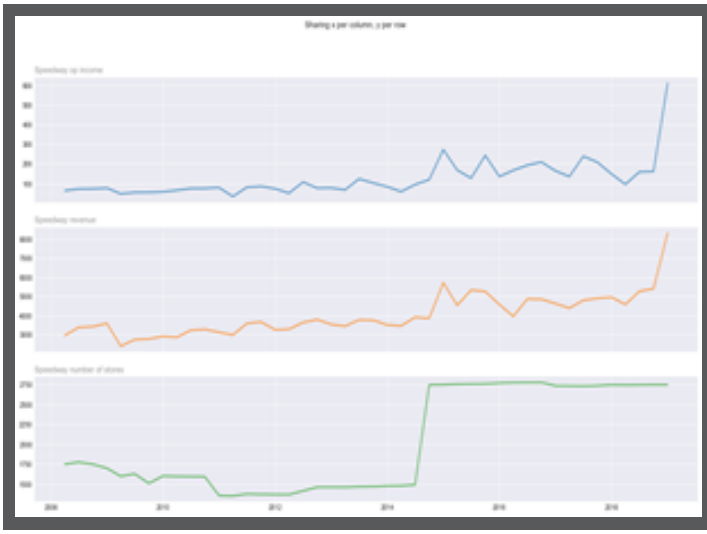
Much of this analysis is based on reactions to the 2008 financial crisis. The economic reactions to this recession in addition to traffic, consumption, and fuel sales data was used to create a machine learning prediction model.

Methodology

We used publicly available data on the US economy and an American convenience store and gas station chain. The US data used in this analysis was collected from the Federal Reserve Economic Data (FRED) database and the gas company data was collected from the SEC public database.



Total miles traveled in the US in millions of miles, the US industrial production index with 2012 at 100, and fuel sales in millions of dollars. All the data is recorded from 2001-2020.
Data taken from Federal Reserve Bank of St. Louis, Federal Reserve Economic Data database.



Sample gas distributer and convenience store quarterly operating income in millions of dollars, quarterly revenue in millions of dollars, and quarterly number of stores from Q1 2008 to Q4 2018.
Data taken from SEC public database.

- There was a direct observed correlation between miles driven each year in the US and GDP. After the 2008 financial crisis, Americans travelled 10% fewer miles for the three years following the crisis. This was a factor in the large decrease in fuel sales in 2008. The reduction in miles travelled would likely have a greater impact on the gasoline industry than convenience stores.
- However, consumer spending decreased in 2008 as a result of the recession, which resulted in a decrease in convenience store sales. In January of 2008, consumer confidence was above 78 points, but by November of 2008, consumer confidence had dropped to 55.3 points. Both food retail and non-food retail sales dropped greatly in 2008, but food retail was impacted less.
- We expect that reduction in miles traveled and retail sales would greatly decrease the traffic at gas stations and convenience stores attached to these stations. It is likely that stores in urban areas and stores which sell food will be less impacted than remote stores or stores that do not sell food. Unlike past economic disturbances, the COVID-19 health crisis has caused an unprecedented reduction in public transport use. New York's MTA predicts that it will lose $4 billion by the end of 2020.

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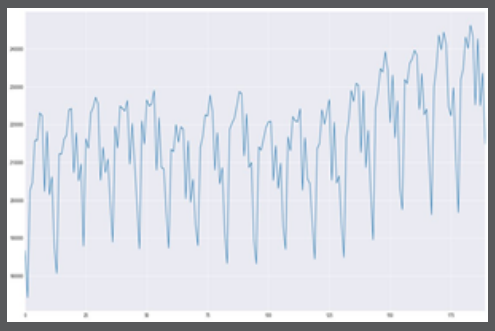

Miles driven in states where the company is most present in millions of miles. This graph was created by using a weighted average of miles depending on the company's presence in specific states.

US consumer confidence index, US personal expenditure on food in billions of dollars, US retail and food sales in billions of dollars, and US Retail sales excluding food in billions of dollars. All data is taken from 2001-2020. Data taken from Federal Reserve Bank of St. Louis, Federal Reserve Economic Data database

Recovery Scenarios

There are several potential recovery scenario based on historical recoveries from recessions as well as possible virus projections. Given the magnitude and timeline of this recession, it is likely that the recovery process will be U-shaped, so it typically takes three times longer for the economy to recover than it did for the recession to occur. The difficulty with this virus is that it is unknown when the lockdowns will end and the virus will be brought down to a non-threatening prominence.

There are four main recovery predictions for the US.

1. The first prediction is a quick recovery, where the US has hit its virus peak in mid-April, and the economy will begin to resume its regular activity in May. This is the most-optimistic prediction which would result in a 2020 GDP contraction of 3.6%.
2. The second prediction is a V-shaped recovery in which the US hits the virus peak in early May, which results in a large contraction for Q2, but recovery in Q3. This scenario would likely yield a 6.6% contraction in GDP.
3. The third prediction is the US extends social distancing measures into the fall, which extends economic weakness into Q3, but this controlled method will yield a U-shaped curve and allow businesses to best prepare for a return. This prediction would likely contract the GDP by 6.5% in 2020.
4. The last prediction is a W-shaped curve in which the economy opens, then there is a virus resurgence in the fall, which leads to another economic contraction. This prediction yields a 7.4% GDP contraction for 2020

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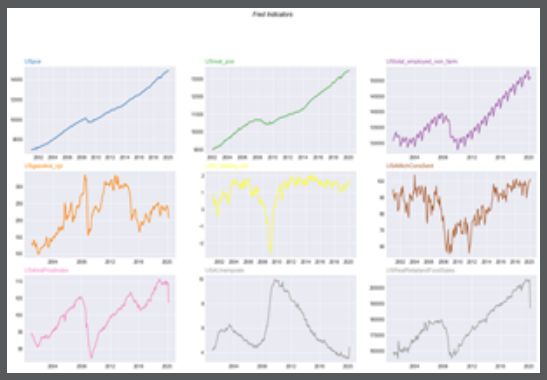


Financial indicators taken from 2001-2020. These indicators describe US prices, US production, US employment, and US consumption. Data taken from Federal Reserve Bank of St. Louis, Federal Reserve Economic Data database.

Results

Using these data and predictions, we ran a machine learning model which explains 80% of the variability in the company's revenues. We determined the following information from the model. Firstly, Q2, Q3, and Q4 revenues are more important than Q1 revenues, due to seasonality. Secondly, there is a strong statistical significance associated with the number of stores and the number of miles driven in states with the most company presence. Revenues are positively influenced by these figures. Revenues are also strongly impacted by changes in GDP and behavior of the food consumption index. Lastly, there is an inverse relationship between the fuel price index and revenues, but this figure does not significantly impact revenues. The Federal Reserve can accurately predict future GDP, so revenue reactions to GDP can be advantageous. The accuracy of the model in the past allow us to predict, with high accuracy, the future revenues of firms using.

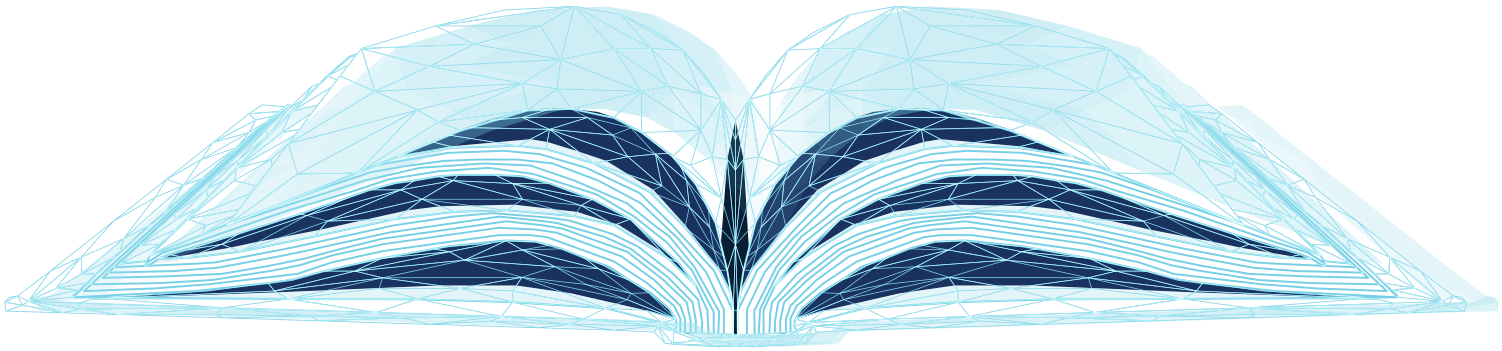
So, how should our organization react?

We studied the actual significance and correlations of the impact our assumed signals had on aggregate revenues. With this validation we can use signals that provide us with granularity of the physical world at a more local level (station, city, state). This allows us to create inventory and staffing policies that optimally allocates resource to meet future demand distributions post our shock. Optimally allocating ensures that we are meeting a given a service level at the lowest cost possible to ensure maximum margins.

Though we cannot change the circumstances of our environment, we can change how to best react.

Call to Action Statement

If you would like this report customized to your firm, please contact IRPA.



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ORS offers Syncronos™ which is a Digital Twin platform for business operations transformation. The platform is used by global organizations'' to Simulate, Optimize and Synchronize their business, identify new patterns, sense demand and react to business contingencies in real time. ORS Syncronos can move all critical decisions, including Capital Budgeting, Merchandising, Sourcing, Supply Chain, Allocation and Fulfillment closer to the market and closer to the season — creating the Supply Chain at the Edge™. Representative list of customers include Brooks Brothers™, Luxottica™, Bulgari™, Benetton Group™, Dimar SpA™, Biomin™ and Pirelli Tires™

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