Prepare for the Bullwhip's Sting

Rising inflation and global supply chain problems raise concerns that a recession is looming.

Yossi Sheffi January 13, 2022

Nearly two years into the disruption caused by the COVID-19 pandemic, signs are pointing to the growing risk of a global economic recession. High consumer demand, product shortages, and transportation disruptions in the second half of 2021 triggered inflation and changes to manufacturers' order patterns, setting up the bullwhip effect — a supply chain phenomenon that can have far-reaching consequences. The ups and downs of money flows, labor patterns, inventory management, and product demand are setting the stage for what happens next — and business leaders, particularly in supply chain roles, should prepare now for the greater challenges that may lie ahead.

Roots of an Upcoming Crisis

In early 2020, COVID-19 slapped down large swaths of the global economy. Individuals' fears and government restrictions significantly curtailed many commercial activities. Sales plummeted at restaurants, theaters, gyms, discretionary retail stores, and businesses in the travel and tourism industry; many production facilities were forced to slow operations or close. U.S. GDP plummeted 32.9% in the second quarter of 2020, and U.S. unemployment rose to a record 14.8%.1

Governments around the world responded by propping up their economies with lavish stimulus payments, unemployment benefits, paycheck protection schemes, and eviction moratoriums, while central banks worked to induce liquidity by keeping interest rates very low, among other means. While government actions certainly helped many struggling families stay afloat, many other households enjoyed a double bonus of lowered household spending plus higher income thanks to the government's largesse. As a result, the personal savings rate quadrupled in the United States, and consumers worldwide socked away some $5.4 trillion in excess savings. That surplus of money built the foundation for the subsequent rebound, product shortages, supply chain congestion, and inflationary surge. It also likely planted the seeds for the next economic downturn.

By mid-2020, home sales, home construction, and demand for building materials rebounded quickly as many people sought new, larger suburban homes. In spring 2021, consumer spending accelerated sharply as the rollout of vaccines and decline of COVID-19 case numbers encouraged a broader reopening of the economy.

The growing boom in demand induced a scarcity of semiconductor chips, home appliances, cars, and building materials that triggered inflation for many goods and commodities. The associated increase in imports also created significant congestion at ports, docks, warehouses, and rail yards. Consequent shortages of transportation equipment caused skyrocketing transport and storage prices, along with delayed deliveries. As businesses reopened, many faced shortages of front-line workers, which triggered ongoing wage inflation.

In June 2021, Federal Reserve Board chairman Jerome Powell told Bloomberg, “It turns out it’s a heck of a lot easier to create demand than it is to, you know, to bring supply back up to snuff.” While a central banker can quickly increase the money supply by trillions of dollars with the stroke of a pen, industrial and logistics organizations face the implacable laws of physics governing the extraction, processing, assembly, movement, and delivery of billions of tons of materials, parts, and finished products across thousands of miles.

From Surge to Purge: The Bullwhip Effect

The implications of the unprecedented demand surge and its aftermath are worse than Powell could imagine. The bullwhip effect imparts a painful sting during such times. When consumers start to unexpectedly strip store shelves bare, retailers have to order more goods from product distributors. The size of those new orders reflects not just the need to replenish retail inventories, but also retailers’ updated forecasts of growing future demand. Similarly, distributors will order more to cover both the replenishment of their own inventories plus the increased future demand from multiple retailers. In turn, product manufacturers, parts makers, and raw material producers will each follow the same process, all of which further amplifies the size of the orders (and inventories held) as they flow up the chain.

The bullwhip effect has been documented by many researchers and includes several other factors. The most important one in today’s context is that shortages and supply chain bottlenecks create uncertainty about product availability and time of delivery. Companies are not sure whether or when they will get the supplies they need, leading them to order more than they need “just in case” at every tier of the supply chain. Both the updated forecast and the uncertainty lead to more inventory held by retailers, distributors, manufacturers, suppliers, sub-suppliers, and so on.

If — or rather, when — demand drops, the bullwhip amplifies the downside for all those upstream suppliers that had overinvested in the surge. In response to lower demand — and to work off their bloated inventories — retailers slash new orders. Distributors likewise stop ordering more product from manufacturers and even cancel any outstanding orders until both the retailers and the distributors have sold their excess inventory. Each player up the chain suffers a worse and longer fall-off in demand, leading to reduced manufacturing and layoffs, which in turn exacerbate the contraction in demand, leading to and then exacerbating an economic downturn. Thus, the crack of the whip comes to the supply chain when boom flips to bust and intensifies the recession.

The bullwhip effect has been found in data for many product categories, such as pasta, soup, and soft drinks.2 Moreover, the 2008 financial crisis showed that the bullwhip can operate on a much broader, global scale. In that downturn, U.S. retail sales declined by 12%, yet U.S. manufacturers pulled down inventories by 15%, and manufacturers’ sales declined almost 30% while imports plunged over 30%.3 A survey of 125 Dutch companies found that those in tiers 1 and 2 relative to end consumers saw a 25% drop in revenues, while those in tiers 3 and 4 suffered a 39% to 43% drop.4

The point is that when supply chains are as tight as they were at the end of 2021, even a small change in consumer demand tends to cause a moderate change in manufacturing activity and a much larger change in the activity of raw material producers. The reason is that every member of the chain responds not just to the change in demand but also to the implied need to adjust all the inventories up and down the chain. The result is that a boom in demand pushes companies to invest in supplies, inventories, labor, and capacity, while a subsequent contraction leaves such companies with potentially fatal high inventories, high costs, high debts, and low revenues.

That contraction is on the horizon. As we get into 2022, central banks will likely fight inflation by raising interest rates, reducing the money supply, and cooling the economy. New waves of COVID-19 also remain a threat to the economy; as this article was being prepared, the rapidly spreading omicron variant was driving renewed restrictions and consumer caution. Any reduction in consumer demand will likely kick off a bullwhip-amplified economic downturn that will reverberate upstream in the world's supply chains. For example, following the 2008 financial crisis, 60 suppliers' plants closed, resulting in the loss of 100,000 jobs, and supplier bankruptcies in the automotive industry more than tripled between 2007 and 2009.5 Worse, in the current context of the pandemic, governments may have exhausted their abilities to offer (and appetites for) massive financial support to mitigate a downturn.

Preparing for the Bullwhip

For veterans of supply chain management, COVID-19 is not their first rodeo, even if it seems as though an entirely different kind of untamed animal has entered the arena. Although every disruption, whether volcano or virus, boom or bust, brings unique challenges, the fundamentals of preparing for and responding to disruptive conditions such as a recession remain the same. It entails understanding a company's specific supply chain vulnerabilities, determining what can be done about them beforehand, monitoring the situation for disruptions, and implementing countermeasures as needed.

1. Identify essential partners. The first step to managing the threat of supply chain disruption is understanding which partners are hard to replace and are providers of essential supplies, services, or access to customers. The bullwhip effect suggests that upstream suppliers are more vulnerable to a sharp downturn in demand. They have experienced an amplified demand surge (driving up costs via added capacity and inventories) that will inevitably be followed by an amplified plummeting of demand (causing severe cost-revenue imbalances). These partners are likely to sit deep in the supply chain for critical materials, additives, and specialized parts. Furthermore, in most industries, key suppliers serve most, if not all, players — and a downturn that reduces orders from multiple customers puts such suppliers at existential risk.

2. Assess partners' financial resilience. Gaining insight into the strength of each essential partner's balance sheet and their ability to weather a downturn helps a company predict where it might be stung by the disruptive effects of the bullwhip. This helps focus risk management on those partners that are essential but financially weak.

3. Monitor partners and the situation. Companies must monitor changing conditions both up and down their supply chains, especially any financially weak essential partners, in order to quickly detect and alert management of any problems. In preparation for a downturn, companies should seek greater visibility into the health of their direct suppliers, as well as those deeper in their supply chains. Fortunately, in the past 20 years, several sophisticated alert services have emerged that can help in this regard.6

At the same time, more timely data can now provide visibility into true consumer demand, helping companies and especially the deeper-tier suppliers assess the direction of the market. For example, when COVID-19 first entered the public consciousness, data such as smartphone locations, credit card transactions, and restaurant reservation systems documented the rapid shift in where consumers went and how they spent their money.

4. Support threatened partners. In the event of a significant recession, economic crisis, or other existential threat to an essential partner in the supply chain, a prepared company can be ready to offer support. During the 2008 financial crisis, stronger companies used their better credit ratings to secure loans for troubled partners, procure key materials on their behalf, or provide commitments for order volume. Some even took an equity stake in critical suppliers. Several automotive companies collaborated to prop up key industry suppliers.

Tactics for Managing in a Downturn

When the downturn hits, companies should be ready to deploy several tried-and-true tactics, including the following:

Conserving cash by reducing inventory levels, increasing days payable outstanding, and reducing days receivable, while being careful not to endanger the viability of vital suppliers.
Reducing the number of suppliers and focusing procurement on large and robust ones.
Reducing the number of product varieties (SKUs) and focusing on the fast sellers, which lowers costs by reducing manufacturing changeovers and increasing on-shelf availability of the top sellers.

Moving to more economical (and slower) modes of transportation, such as ocean instead of air, rail instead of truck, and truckload instead of less-than-truckload shipping.
Focusing on lower-priced and private-label goods as consumers become more frugal.
Prioritizing certain customers if the company will not have enough products to fulfill all orders.
At the same time, as economist Paul Romer said, “A crisis is a terrible thing to waste.” Executives should prepare to seize the opportunity of the downturn to evaluate suppliers and customers along the supply chain and make transformative changes as part of their recovery efforts.

Living With the Uncertainties of Our Complex Era

The first rule of forecasting — that all forecasts are wrong — has seldom been truer, given the unpredictability of coronavirus mutations, central bank action, and consumer behavior. First and foremost, COVID-19 hasn't been defeated, although vaccines and better treatments have certainly reduced transmission, disease severity, and death in many places. Waning immunity and mutating COVID-19 variants keep fueling waves of cases and government restrictions, affecting supply chains.

Second, the timing and intensity of central banks' response to inflation remains unclear. If central bankers make choices that accommodate political pressures, inflation may become further entrenched, increasing the costs and associated hardships of fighting it later.

Consumers' responses to COVID-19, inflation, and government actions are likewise difficult to predict. Might consumers hunker down under the threat of a resurgent virus or recessionary trends? Or might restriction-weary citizens throw caution to the wind and freely spend their accumulated cash and increased wages? Will scarcity accelerate spending, owing to a psychology of hoarding or fear of missing out? Or will high prices and fear of the future blunt demand?

In the face of overwhelming uncertainty, many companies are likely to adopt a posture of watching and waiting. However, those organizations that prepare for action will be primed to navigate the next pandemic wave, outburst of inflation, government action, or recession. In this pandemic era, it seems particularly apt that it was microbiologist Louis Pasteur, to whom we owe our understanding that germs cause disease, who said, "Chance favors only the prepared mind."

ABOUT THE AUTHOR

Yossi Sheffi (@yossisheffi) is the Elisha Gray II Professor of Engineering Systems at MIT, director of the MIT Center for Transportation and Logistics, and the author of *The New (Ab)normal: Reshaping Business and Supply Chain Strategy Beyond COVID-19* (MIT CTL Media, 2020).

REFERENCES (6)

1. G. Falk, P.D. Romero, I.A. Nicchitta, et al., "Unemployment Rates During the COVID-19 Pandemic," PDF file (Washington, D.C.: Congressional Research Service, Aug. 20, 2021), https://crsreports.congress.gov.
2. S.M. Disney and M.R. Lambrecht, "On Replenishment Rules, Forecasting and the Bullwhip Effect in Supply Chains," Foundations and Trends in Technology, Information and Operations Management 2, no. 1 (January 2008): 1-80.
3. Data on imports of goods and services was obtained via the U.S. Bureau of Economic Analysis's FRED (Federal Reserve Economic Data) database at https://fred.stlouisfed.org. See analysis of the crisis in J.C. Fransoo, R. Peels, and M. Udenio's August 2010 article, "Supply Chain Dynamics Have Major Impact on Course of Credit Crisis."
4. R. Peels, M. Udenio, J.C. Fransoo, et al., "Responding to the Lehman Wave: Sales Forecasting and Supply Management During the Credit Crisis," working paper 297, Beta Research School for Operations Management and Logistics, Eindhoven, Netherlands, December 2009.
5. "Restructuring for Automotive Suppliers," Roland Berger Strategy Consultants, Business Breakfast, Budapest, Hungary, March 31, 2010.
6. Examples include Resilinc, Everstream, Infor Nexus, Preware, and others.