

SUPPLY CHAIN CHAOS: Any End in Sight?



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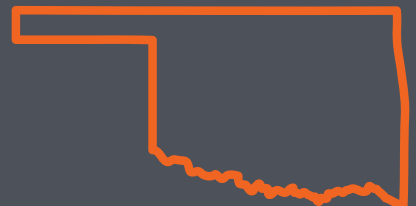


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INTRODUCTION

The shared norm of global value chain actors for most of the past 40 years has been “just in time” (JIT) manufacturing. This philosophy allowed minimum buildup of inventory while avoiding lag times or bottlenecks for manufacturers. The disruption from the 2020 Covid-19 pandemic has undermined this shared norm and has induced a scarcity mindset and ‘on-the-fly’ solutions that have focused on local optimization. This local optimization creates a perpetually imbalanced situation at the system level. For JIT to function, it requires effective institutions and shared norms to reduce transaction costs while simultaneously encouraging cooperation amongst economic actors. When this breaks down, imbalance exacerbates the perception of scarcity, which pushes producers of intermediate goods and end-consumers into ‘beggar-thy-neighbor’ behaviors.

This ugly marriage of negative supply shocks coupled with positive demand shocks has forged a new landscape defined by panic buying, logistical bottlenecks, and constant media coverage of “broken” supply chains. A closer examination of the crisis presents evidence that no single issue is the root cause and that there are many interconnected facets. Despite the interconnectedness, to achieve a firm grasp on the whole picture, it is useful to break the issues down first into large categories and proceed to divide these into subcategories. The categories of production, demand, and distribution set the stage for understanding the historic status quo of global supply chains.

Production of goods for the modern global economy evolved into a complex system of linkages over the course of the past 40 years. Production centered on JIT manufacturing with lean supply chains as the norm for most companies. This development was a sharp divergence from the vertically integrated strategy that dominated the first half of the 20th century. This efficiency-based model relied on cheap shipping as companies offloaded risk and assets from their balance sheets and outsourced what they could, converting as much as possible to variable costs. The model also increased specialization, as components often crossed many borders and traveled thousands of miles over the course of their conversion from raw materials to finished goods.

At each step in the supply chain the specific manufacturer would have just enough component inventory to keep goods moving through the factory and out the door at a continuous pace. Inventory buildup was frowned upon because it tied up working capital, added carrying costs, and created storage requirements. In the wake of the pandemic, however, the concept of JIT came into question as companies lost the sense of certainty and

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predictability about when or how goods would arrive. The first break in the supply chain was caused by labor shortages and policy-driven lockdowns. The disruption proceeded to extend to each step along the supply chain, from the manufacturer to the retail store. Companies grappled with trying to maintain safe working conditions as they responded to mandated lockdowns, and the virus' spread.

Consumption patterns in the United States also changed. People no longer spent their money on restaurants and vacations, but instead bought products for their homes and for personal entertainment. Contrary to many producer forecasts, demand for many products increased. Companies predicted that the initial massive drop in sales would persist and thus sold what inventory they had while not placing additional orders to maintain the flow of goods. However, most missed the fact that Americans, unable to leave their homes, would abruptly shift their buying patterns from services to products. This services spending drop also contributed to a glut of savings among middle- and upper-class American households that yielded a sustained change in purchasing of durable goods. Before long, the amount of durable goods needing to be moved outpaced the existing capacity of transportation infrastructure along supply chains that were plagued by other exogenous factors and shocks.

Transportation modes make global supply chains viable. Trucking, shipping, air, and rail historically have engaged in a “race to the bottom” for prices of moving goods, particularly after the 2008 global financial crisis.¹ Due to the JIT philosophy manifesting itself similarly across industries, maintaining a competitive edge was based on being both timely and cost effective. In order to stay ahead of the competition, transportation players in

Most missed the fact that Americans, unable to leave their homes, would abruptly shift their buying patterns from services to products.

particular, have operated on razor thin margins. This, as well as years of underinvestment in aging transport infrastructure such as ports, roads, and railyards, has resulted in a transportation network that simply cannot move the amount of goods being demanded as it faces warehouse limitations, truck driver and other labor shortages, and other causes of delays and bottlenecks.

In the next section we lay out in more depth how the complex web of factors of policy, inputs, structure, and exogenous shocks are all converging to create diverse, uneven, and in some cases outsized impacts along global supply chains. We believe that by mapping the interdependencies among many of these factors we can contribute to the ongoing conversation with a more comprehensive explanation of how and why supply chain disruptions have gotten so bad and what we can expect going forward. We conclude with an explanation of how Oklahoma can contribute to solving the supply chain dilemma in the U.S. and establish a more competitive and resilient footing in the future.

A NETWORK OF EFFECTS

COVID-19

On March 11th, 2020, The World Health Organization officially declared the Covid-19 virus a global pandemic. Fear and uncertainty gripped the globe as governments instituted travel restrictions and stay-at-home orders, all but grinding the normal cadence of life to a halt. Globally. Simultaneously. Ripple effects from fear of the virus and lockdown mandates began almost immediately. In the weeks that followed there were massive layoffs across industries, stock markets crashed, oil prices turned negative, and panic buying from consumers resulted in shortages of items like toilet paper. When supply chains are working, they are all but invisible; however, that changed in the wake of the pandemic. Chaos had arrived for supply chains and a clear understanding of what is really occurring requires a fleshing out of the story.



General Economic Uncertainty

Underpinning all the factors we will discuss is the uncertainty and panic brought on by the pandemic. The Dow Jones Industrial Average fell 33 percent from its February 2020 record high; lenders in all credit markets halted their lending; borrowers halted paying back debt or threatened default; and consumers stopped extra-neous spending on most goods (at least initially) and services. The United States Census Bureau reported that beginning in March of 2020, 115 million people experienced either an end to their employment or reduction in working hours over the course of the pandemic.² The initial onset of fear and widespread loss of income decimated demand for physical goods, besides necessary items like food and hygiene products. Retail sales suffered an 8.7 percent drop in March and April of 2020. For perspective, the Great Recession of 2008 saw only a 4 percent decline. The decline due to Covid-19 was led by apparel retailers (-50 percent), furniture (-26 percent), and food and automotive retailers (-25 percent).³ Consumer spending typically accounts for two thirds of U.S. economic activity, so a spending drop of this magnitude sent shock waves through the supply chain. With the dramatic drops in consumer demand, retailers altered their forecasts and stopped orders from their manufacturers. The drop in consumer demand in some cases resulted in retailers not paying their manufacturers for goods already produced.⁴

Production Disruption

One of the first shocks to the global system from Covid-19 stemmed from the shutdown of factories worldwide. Production of goods all but halted and many factory workers lost jobs and income. In February of 2020, twenty provinces in China that collectively accounted for 90 percent of the country's exports were shut down.⁵ The primary engine for goods production to the world was effectively shut off. Producers and retailers in the U.S. not only prepared for lack of demand from domestic consumers but would have been unable to have the goods manufactured even if they placed the orders.

The shutdown in China became a real hazard globally when it was revealed that China produced half of the world's personal protective equipment (PPE). When China's factories slowly came back online and started shipping PPE around the world, a container shortage began to appear due to the lack of goods being shipped back to China. Thus, when the non-PPE goods orders from the United States began to ramp up, the container shortage's impact started to be felt acutely. Furthermore, China has continued to have intermittent but massive lockdowns in major manufacturing and port cities such as Ningbo, Yantai, and Guangzhou, making existing disruptions worse. At one point in 2021 for example, the Ningbo-Zhoushan port, one of the world's busiest, was shut down after one worker tested positive for Covid.⁶ China continues to be the only state still pursuing a zero-Covid policy and these lockdown disruptions could persist.

Monetary & Fiscal Policy's Effect on Demand

It is no secret that the U.S. economy runs on credit. Households and companies borrow money to expand their purchasing ability. This expanded ability to spend allows other actors in the economy to earn and thus, on a basic level, typically results in U.S. economic growth. Because a borrower's credit worthiness is dependent on their perceived ability to pay a lender back, in an economic downturn lenders become extremely cautious. It goes without saying then that during a once in a generation pandemic, lenders would freeze all new lending and begin to recall debt to shore up their own accounts. Such actions would wreak havoc on the economy, forcing millions of individuals and companies into default and result in a collapse of the system. However, this potentially grim scenario did not come to pass due to swift substantial action by the Federal Reserve (the Fed).

During normal times, the Fed utilizes several tools to guide the U.S. economy through periods of expansion and contraction. Since borrowing increases the ability for economic actors to spend or invest, interest rates on loans and the amount of money available for loans are pivotal to the system's functioning. In response to the credit markets freezing, the Fed reduced interest rates (which make savings relatively less profitable when compared to investing/spending) and initiated various asset purchase programs, thus encouraging spending and ensuring enough liquidity was injected for lending to continue. A disruption as large as the one triggered by Covid-19 required drastic measures and by the end of the first six weeks, the Fed had provided \$2.3 trillion dollars of liquidity.⁷

The Fed's response to the Covid-19 crisis has been deemed largely successful. Even early evaluations showed that the expansionary actions taken by the Fed produced higher output growth, increased stock market returns, and curated a favorable long-term financing environment when compared with no or limited action.⁸ The economy was flush with available cash for lending and borrowers took advantage of it. Many but not all small and large businesses alike were able to stay afloat, and many new startups and ventures formed as well. However, despite the Fed's response, Fed driven actions alone could not shore up the economy as the scope of its power only encompasses the credit markets. Therefore, it was unable to assist with the large number of unemployed people who lost income completely or partially.

The only entity with the ability to transfer cash directly to households is Congress. On March 27th of 2020, the Coronavirus Aid, Relief, and Economic Security (CARES) Act was passed. The CARES Act prompted the distribution of \$2.2 trillion dollars of aid to households, small and large businesses, states, and municipalities. The transfer of cash allowed citizens to cover rent, purchase essentials such as groceries, or continue to pay back various forms of debt. Extensive studies utilizing demographic and zip code data have suggested that the CARES Act successfully alleviated some of the financial burden faced in many lower income communities.⁹ Stimulus checks were sent to individuals and the amount that states provided for unemployment benefits was increased. While health and safety remained precarious due to the virus, the expansive monetary and fiscal policy brought some sense of stability to the economy.

The economy was prevented from falling off a cliff, but Covid-19 drastically altered the spending habits of consumers.

The economy was prevented from falling off a cliff, but Covid-19 drastically altered the spending habits of consumers. Due to the implementation of social distancing guidelines, and other measures restricting in-person gatherings, at least 316 million individuals in 42 states

were ordered to stay at home.¹⁰ While service sector-oriented jobs suffered massive layoffs, many office jobs pivoted to working from home. Telecommuting via videoconference software platforms exploded as virtual meetings replaced office interactions and people hunkered down in their homes. Before Covid-19, Americans had typically spent a large portion of their disposable income on services such as travel, restaurants, movie theaters and other forms of recreation. With people confined to their homes, this income was suddenly freed up and a craze of online ordering began. While the trend of ecommerce expansion had been building steadily for years, it accelerated sharply during this period.¹¹ This reallocation of spending from services to goods created levels of demand in some sectors that supply chains were simply unprepared for.

Figure 1 is a graphical representation of the dollar value of U.S. imports over time. The pandemic in early 2020 triggered a substantial drop due to the economic uncertainty discussed previously. However, the relative stability of the economy that monetary stimulus provided along with the income freed-up as buying patterns moved away from services resulted in a surge of imports. Retailers that had gone dormant during the economic free fall weeks earlier came roaring back to life. Only this time, the shared JIT norm underlying the supply chain was nowhere to be found: the synchronized flow of both information and goods that make the just-in-time methodology work was no longer present nor predictable. Retailers faced a range of forecasting challenges. Companies took out loans to stay afloat and were chasing any sales they could get; no one was

TOTAL VALUE OF U.S. IMPORTS IN USD BILLIONS

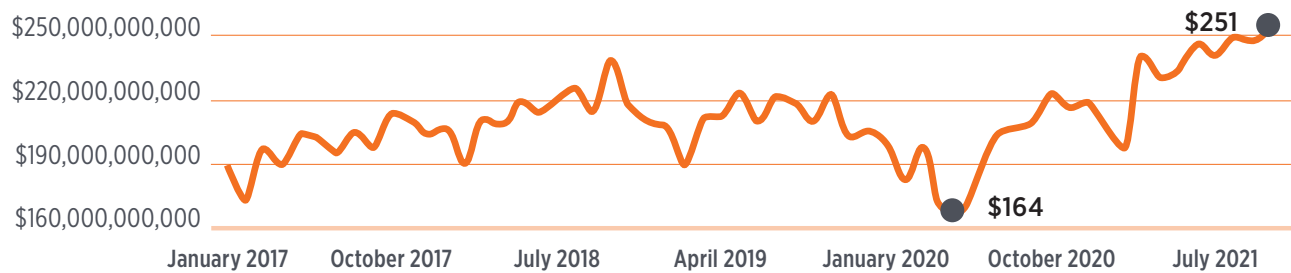


Figure 1: Source: U.S. Census Bureau¹²

certain how long consumer demand would last; production of goods in Asia, especially China, could be disrupted at any moment. Panic purchasing and a scarcity mindset descended upon U.S. retailers. The disarray that followed is summed up in what is called the bullwhip effect.

When viewed through the lens of demand, the bullwhip effect is a “phenomenon whereby a small variation in end-customer demand leads to a significant fluctuation in orders that the upstream supplier receives in the supply chain system”¹³ (for a visual representation of the converging factors that have disrupted supply chains see Figure 2). In other words, the scale of the impact grows the further it is from the source of the variation. When a retailer increases orders from a manufacturer, the manufacturer will increase orders from its suppliers, who in turn will increase their demand for raw material inputs and so on. When such shifts are sudden or dramatic, they can throw the system out of sync. JIT depends upon transparent communication, predictable demand signals, and a system that is relatively stable. To keep costs low and maintain a continuous supply of goods moving through the chain, information visibility must be maintained throughout the system. The pandemic created conditions that were anything but transparent or predictable. As retailers and producers first halted and then increased demand simultaneously (but unevenly depending on the sector), the sheer amount of goods to be transported led to the “supply chain crisis” that dominated headlines throughout 2021.

Within a range, a particular manufacturer may be able, relatively easily, to scale their production to meet an increase in the demand for goods but they then depend on transportation networks to move the goods. A manufacturer might increase hours, add workers, or purchase more equipment but logistics infrastructure is not nearly as flexible. Ports, container ships, cargo planes, truck chassis, cranes, and rail cars are unable to scale as quickly. This has become evident as strained capacity and with logistical failures that had been largely ignored pre-pandemic resulted in “broken” supply chains characterized by bottlenecks, delays, and shortages. Labor too, has impacted supply chains as the U.S. has grappled with issues ranging from wage equity and employee safety concerns, to a society-wide rethinking of work-life balance. Each step along the transportation chain has faced its own unique failures. These failures have played into the larger systemic (and chaotic) picture that is emerging as the reliability of the JIT philosophy has deteriorated as an institutional norm.

Logistics of Supply

In this section we detail how and why transport and delivery of goods were disrupted. The manifestation of the bullwhip effect is plainly demonstrated, as the impacts of multiple point issues amplified and compounded, they create one problem after another.

Maritime

Since their invention in 1956 by Malcolm McLean and wide adoption as a primary component in global supply chains since the late 1950s, shipping containers have become the backbone of the global economy.¹⁴ Because their role has become so essential, this has also now become a weakness. Due to China's rise as the manufacturing hub of the world, a large percentage of world's containers would leave China to be shipped to destinations such as Europe and the United States. However, when Covid-19 hit and the world needed PPE such as masks, containers originating in China were shipped worldwide. Typically, these containers would have been filled with goods either to return to China or to go on to another destination. However, many of the new destinations receiving containers carrying PPE were areas that did not have reciprocal trade flows with China and so empty shipping containers sat idle in these locations, thus reducing global availability.¹⁵ Making the maritime issues even worse were events like the Evergreen container ship's blockage of the Suez Canal in

CONVERGING FACTORS DISRUPTED SUPPLY CHAINS

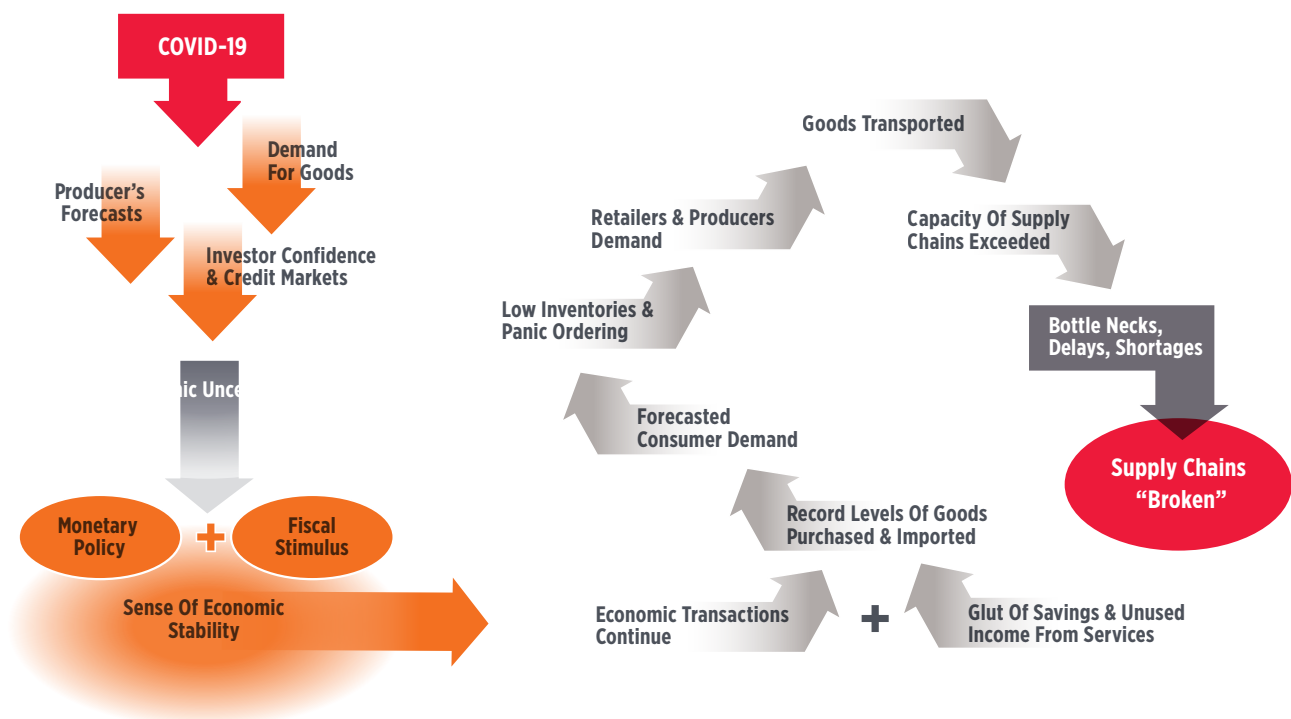


Figure 2

Source: CITD Analysis

March-April of 2021. That event, which was unrelated to the Covid shock, made visibly tangible how over-prioritization of cost and scale efficiencies can lead to system fragility because it creates underinvestment in supply chain infrastructure.

The business model of moving containers is a service that is largely undifferentiated. As such, the main competitive advantage for ocean carriers has been price. Over the past decade carrier rates for shipping containers have been in a race to the bottom. As a result, accelerating since the Great Financial Crisis of 2008, the shipping industry underwent a period of substantial consolidation. By 2018 only ten companies were handling 70 percent of all container shipments.¹⁶ The environment created during the pandemic paired with a heavily consolidated industry, was ripe for prices to continue climbing. In fact, since mid-2020, the demand for containers pushed the price for container freight up to all-time highs (See Figure 3) and the largest carriers saw it as their opportunity to enjoy larger margins. However, realistically the only way for prices to come down in the short term is a drop in demand for containers or increasing available capacity. Competitive disruption to bring prices down or restructuring the maritime industry is no simple matter.

Building a container ship is a capital-intensive endeavor that only a very few can afford, and it takes several years from the order date to a completed ship. This also means that once goods flows fill the available shipping capacity in the market, there is no quick way to add capacity. As a longer-term resilience strategy, a few large firms have started to purchase their own ships to avoid the continued issues with carriers. However, this is simply not an option for most. Additionally, the third-party carrier companies again provided an example of how lean and brittle supply chains had become, even for the largest companies.

Having large, expensive assets that required constant maintenance was not worth keeping on the balance sheet for companies maximizing their bottom line. Prior to the recent disruptions, large firms would elect to

CONTAINER FREIGHT WEIGHT INDEX WORLDWIDE 2019-2021

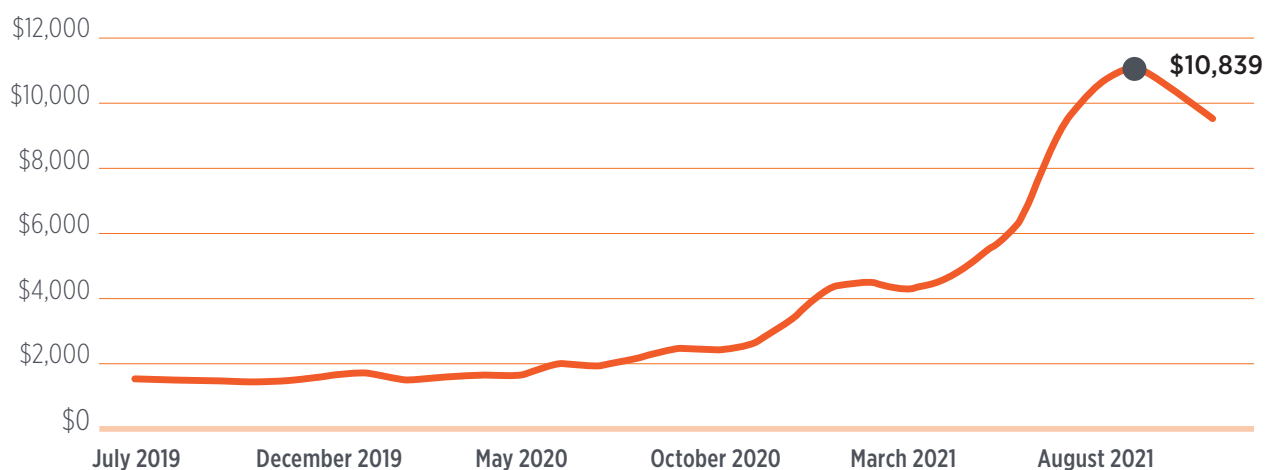


Figure 3. Source: Freightos Global container freight rate index from July 2019 to November 2021 (in U.S. dollars)

remove the financial risk and responsibility of large-scale logistical operations in order to maximize shareholder value. Ultimately, at the system level, disruptions touched off by the pandemic have called into question whether trading off resiliency for added profit is a prudent long-term strategy.

Ports

When a container was finally loaded onto a ship and reached its destination port, other shortcomings were exposed and delays manifested. Safety concerns and social distancing measures also took a toll on port operations. Crane operators, longshoremen, and drayage truck drivers all experienced waves of Covid-19 infections. As late as January of 2021, 700 dock workers at the port of Los Angeles contracted the virus.¹⁷ Struggling with the virus was not the only issue facing workers at the ports. Long hours, frustrating work conditions, and high



volumes of imports compounded issues of moving containers. Port throughput constraints led to there being more containers than space to store them and created an additional problem to be dealt with. Yard space for stacking containers filled up quickly, further delaying the unloading of ships. Eventually, the number of containers needing to be moved scaled far beyond the ports' ability to increase their own capacity of loading containers onto to either trucks or trains and on to their next destination.

Trucking

For the last several years it has not been uncommon in the trucking industry to hear about a looming truck driver shortage. A well-known trend within the industry has been that overall, the drivers are graying, overworked, at times underpaid and routinely receiving little to no gratitude for their work that keeps the economy moving. High attrition rates and a struggle to attract younger generations to its workforce have been very real challenges for the trucking industry for a number of years. In addition to these issues that have long plagued the trucking companies, other factors, such as the extreme fragmentation and volatility of the trucking market, have been at play as well. In contrast to the maritime shipping industry, which has high barriers to entry, the trucking market is relatively easy to break into. This market structure results in feast-or-famine swings where a surge of new players emerges whenever there is a gold rush of opportunity to move goods, but once demand recedes, many operators go bankrupt. The vicious cycle repeats again when demand starts to outstrip existing trucking capacity. This sort of fragmentation means that trucking still has a Wild West quality to it and operates in a way that is largely informal, inefficient, and limited in its ability to undergo wide systemic change.

As evidence of the industry's fragmentation, between July of 2020 and October of 2021, 113,000 new trucking companies were authorized to be "motor carriers of property", and roughly 70 percent of those applications were owner operators taking advantage of the increase in price for trucking goods.¹⁸ In other words,

self-employed individuals, rather than large well-funded companies, were driving their own trucks. The insight from the number of new trucking companies starting is that by the time this latest surge in new entrants began, the demand for goods was already outpacing capacity, and exceeding that portion of the supply chain's ability to keep up. While there was and technically still is a driver shortage, trucking companies and truckers are not disappearing. The current primary constraint is that the amount of goods needing to be moved through the supply chains has increased far faster than the logistics industry's ability to scale.



In addition to the many structural challenges inside the trucking market, an issue similar to that of the maritime container shortage has been identified as a central contributor to the supply chain issues: the combination of a positive demand shock coinciding with shortages of truck chassis. The chassis shortage was a phenomenon that few outside of the trucking industry could have imagined. During normal times, for instance, there are plenty of chassis at the ports of LA and Long Beach. The chassis are pooled together by various users and promised to be returned after use. However, the intense surge in demand for goods has resulted in longer wait times to lease a chassis. A large contributor to the increased wait time, port bottleneck issues and chassis shortages, was that a chassis might be left with a container on it for long periods of time due to labor supply issues, payment problems, or a filled warehouse with no room to take the goods. These chassis sitting idle meant the pool of available units in circulation for truckers to use was reduced.¹⁹ Additionally, yard space became a constraint to offloading containers from ships idled off the coast of California, specifically at the ports of LA and Long Beach. The inability to load containers on trucks meant the containers piled up at the ports until there was simply no more space.²⁰

Air Cargo

When compared with most other modes of transport, air shipments have usually been an expensive option. While the delivery times of goods shipped via air freight were much faster, only products with comfortable margins could justify the cost differential. Still, substantial tonnages of goods were shipped every year from Asia, often in the bellies of passenger planes. Global restrictions due to Covid-19 resulted in a severe contraction of air travel and throughout 2020 and the airlines struggled to recover even when commercial passenger demand resumed. In May of 2020, global air cargo capacity was down by 35 percent and only 20 percent of belly cargo was still flying.²¹ Despite the low levels of commercial air travel and the expense of shipping goods via air freight, the crisis of containers and maritime shipping delays began to drive companies towards chartering flights for their cargo.

By some estimates, the cost of shipping a container from China to the U.S. rose 500 percent or more from January 2020 to November 2021.²² Demand from ecommerce and the reduced number of available containers pushed the price far above what had previously been the norm. Further, paying more was no guarantee the goods would arrive or be transferred to their destination in a timely manner. The delays and issues were compounding. Under these circumstances, air cargo began to make sense for the delivery of goods. Air freight costs became comparable to shipping via container and there was a higher degree of certainty about when goods would arrive. By the end of 2020, the tonnage of goods moved in the cargo belly of planes began to recover, and as of this writing (December 2021) the trend of continued air cargo growth looks like it may continue. Many industry players have expressed bullish sentiments regarding air cargo demand if structural maritime shipping delays do not resolve.²³

Rail

The most reliable modality for transporting goods during the pandemic has been rail. The rise of ecommerce in previous decades led railroads to adapt by facilitating intermodal (IM) traffic. IM is the process of carrying trailers and containers on specialized rail cars from ports or manufacturers to inland distribution centers such as warehouses.²⁴ This enables the cargo to be moved easily from truck to rail and back if needed. The growing popularity of the IM approach and its cost effectiveness for moving consumer goods had grown pre-pandemic and thus the railroads were well positioned to meet the demand of the pandemic driven ecommerce boom. The biggest logistical snarl for the rail yards, just as for the ports, was the issue of finding trucks to move the goods once they were delivered. Similar to the dilemma experienced at ports, rail yards began to fill up with containers causing backlogs of goods yet to be unloaded.²⁵



Retail

One issue that ties together many of the supply chain jams is labor shortages. Many economists have taken to calling the phenomenon which is unfolding the “Great Resignation” in which wages, quality of life, and time devoted to labor are being questioned across the board from hourly paid service workers to white collar professionals.²⁶ Whatever the name, the pandemic has prompted a labor shortage in the U.S. that persisted even after the expansion of unemployment benefits and stimulus checks ended.²⁷ This “great resignation” or “great reshuffle” has been felt most bluntly by the last mile supply chain providers and retailers. According to the Bureau of Labor Statistics, retail employment has still not returned to pre-pandemic levels despite booming retail demand, a multitude of empty retail positions, and moves by employers towards offering higher wages.²⁸

Clearly labor is a key input and factor in many, if not all, of the supply chain issues addressed here, but a thorough treatment of this topic is beyond the scope of this study. As automation, robotics, additive manufacturing, autonomous vehicles, and other technology-based advances continue to emerge and be integrated into our economic life, navigating the disruptions to, and the role of, human labor will be some of the major challenges of this generation.

Considerations for Oklahoma's Role in Moving Forward

While pure cost and efficiency calculations have driven business decision making for decades, resiliency and flexibility are two attributes that supply chain participants will seek to weigh more heavily moving forward. In such a scenario, several competitive advantages exist for the state of Oklahoma to capitalize on to become a more prominent logistics hub. Aspects such as the state's central location in the U.S., business friendly environment, low cost of doing business, lack of congestion, availability of transportation modalities, and future infrastructure projects suggest significant opportunities for Oklahoma to play a more prominent role in supply chains in the coming decades.

Most U.S. imports, especially during the pandemic, were originally sourced from Asia and processed through the West Coast. The San Pedro Bay Port Complex (consisting of the Port of LA and Port of Long Beach) alone processed 31 percent of the nation's imports in 2020.²⁹ While California has significant distribution center infrastructure in place, this presents shippers with limited supply lane options to points east, and when the system is overwhelmed, this is yet another choke point. Due to its central location, Oklahoma could play a role in providing an alternative path for logistical transfer and distribution to any part of the U.S. in a timely manner by truck, rail, air and in some cases, by inland river shipments. Additionally, the advantage of a much sparser population and available space could provide ample room to design modern warehousing and distribution nodes.

Trucker haven

As mentioned previously, the U.S. trucking industry has faced challenges in terms of the quality of life for truck drivers. A nationwide survey and report sponsored by the U.S. Department of Transportation conducted in 2015 revealed that such concerns were shared by trucker drivers in every state. Two of the most prominent issues were the availability of safe parking spots and adequate sleeping accommodations. Over 90 percent of the surveyed drivers reported struggling to find parking from 7:00 p.m. to midnight and 75 percent regularly experienced problems finding safe parking locations when rest was needed.³⁰ Oklahoma's potential to be the premier truck stop state in the U.S. would make it competitive for attracting logistics companies.

Investment in quality, high-capacity truck stop destinations would be a draw for trucking industry labor. Unique approaches to the stops such as restaurant options and entertainment increase the appeal of stopping in Oklahoma and could lead to a higher quality lifestyle for truck drivers. The state could also play a role in reinventing how society perceives logistical labor and its importance to the economy. Such a strategy has

the potential to pay dividends in both the short- and long-term. One headwind to this strategy relates to the trend toward driverless vehicles. If and when long haul routes are dominated by driverless rigs, there will still be a need for centrally located maintenance and repair services. If managed strategically, this could be an opportunity for Oklahoma as well. Oklahoma's reputation as low cost of living state combined with the centrality of its location in the U.S. presents the opportunity to be at the forefront of transforming the real economy and supply chains for the 21st century.

Any End in Sight?

Industry leaders and economists alike predict that the various issues facing supply chains in the U.S. will continue into late 2022 at the very least. This brief does not propose to tell the future, only to show that neglecting the foundation by which physical goods end up on shelves and doorsteps has finally caught up with American society. Nearly six decades of outsourcing, four decades of cost and efficiency measures driving lean, JIT supply chains, and the past two decades of digital transformation across industries have brought consumer benefits but have also led us to this point of crisis. Covid-19 was a shock that revealed shortcomings built into the system. It has provided a wake-up call and is a potential catalyst for systemic innovation and investment in the supply chains our economy relies on so heavily.

In this report we have explored the various issues found throughout the supply chain crisis that dominated headlines in 2021. A once invisible support system for the American way of life was suddenly being discussed everywhere and nearly acquired the status of “today's weather” as a feature of small talk. Going beyond the trivial conversation to understand what has really been happening leads us into a complex network of linkages as well as deep structural weaknesses and systemic institutional norms that deserve reflection and revision. Many of the issues were already there, but the Covid-19 shock exposed them, profoundly. Now we have a rare opportunity to reassess and build (or repair and reassemble) supply chains — both philosophically and physically—for the future.

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