



Agricultural and Resource Economics ARE UPDATE

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“Containergeddon” and California Agriculture

Colin A. Carter, Sandro Steinbach, and Xiting Zhuang

We analyze the effects of the 2021 supply chain gridlock and resulting shipping container shortage on California agriculture. Due to exporters' difficulty obtaining empty shipping containers, the value of California's containerized agricultural exports fell by an estimated \$2.1 billion, about 17%, from May to September 2021. Indeed, we find that the financial damages suffered by California agriculture from the supply chain disruptions exceed the industry's losses from the 2018 U.S.-China trade war. The lost farm exports mirror the fact that California ports are among the least efficient in the world. As a result, some importers now view California as an unreliable supplier of agricultural products due to inferior port infrastructure.

The Covid-19 lockdown raised U.S. household savings to historical levels. Savings increased from an average of 8% of disposable income in 2019 to 16% in 2020, reaching as high as 34% in April 2020. Amplified by government stimulus payments, the extra savings led to an increase in U.S. consumer

spending. The resulting demand shock was partially met with imported goods from Asia, growing the 2021 U.S. goods trade imbalance with China by 15% for the first three quarters of 2021, compared with the same period in 2020.

Most goods from Asia arrive via containers, and before Covid-19, California ports typically handled around 40% of U.S. containerized imports. However, California ports became overwhelmed with the recent growth in imports. U.S. ports outside California handled more than 1.4 million additional loaded import containers (up 23%) from May to September 2021, compared to the average for the same five-month period from 2017–2019. In contrast, California ports moved only about 0.7 million additional loaded import containers (up 16%) during the same time period.

The Covid-related boost in imports resulted in increased demand for empty shipping containers in Asia, and freight rates from Asia to the United States rose so fast that more and more containers were being shipped back to Asia empty, as opposed to carrying U.S. export products. The empty containers were more valuable in Asia,

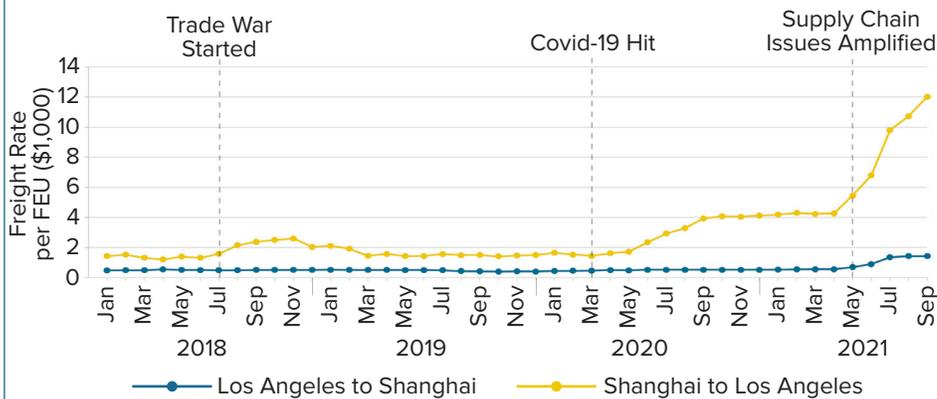
as they could be quickly loaded and sent back to the United States, earning a much higher freight rate compared to the backhaul rate from California to Asia. This meant that outbound cargo from California was impacted due to a shortage of containers for loading, creating lost export opportunities for California farmers.

In years past, U.S. agriculture would typically fill over 40% of all loaded shipping containers leaving California ports, and about one-third of those containers carried California farm products; thus, containerized shipping is crucial for farmers in the Golden State. The standard measure for shipping container cargo capacity is the twenty-foot equivalent unit (TEU); the largest container ships carry about 24,000 TEUs.

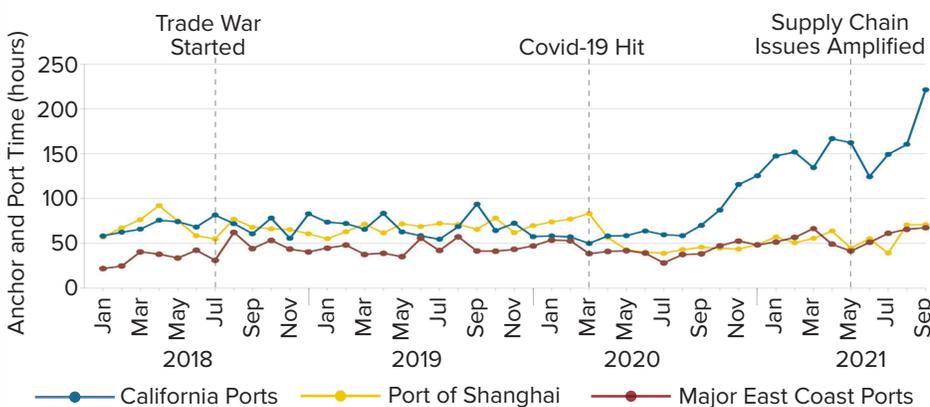
In the summer and fall of 2021, there was a noticeable drop in TEU exports outbound from California ports loaded with agricultural products. For instance, from May to September 2021, the monthly number of containers loaded with agricultural products declined by 18% out of Los Angeles, 15% out of Long Beach, and 34% out of Oakland. At times, the supply chain bottlenecks left over 80 loaded vessels

Figure 1. Freight Rates and Port Congestion

Panel A. Freight Rate per Forty-Foot Equivalent Unit (FEU)



Panel B. Average Anchor and Port Time



Source: Freight rates come from the World Container Index (Bloomberg, 2021) and average anchor and port times were calculated from data provided by the Maritime Portal (IHS Markit, 2021).

Note: The figures show freight rates for Shanghai to Los Angeles and Los Angeles to Shanghai in Panel A and average anchor and port time in Panel B. In Panel B, we compare the five major container ports for agriculture in California (Hueneme, Long Beach, Los Angeles, San Diego, and Oakland) with the five major East Coast ports or port districts (Baltimore, Charleston, Virginia, Savannah, and New York/New Jersey district) and Shanghai. Anchor time refers to time spent waiting outside the port and port time to time spent at a berth in the port.

stranded off the Southern California coast and caused significant port congestion, with docks and warehouses running out of space. In some cases, ships were idled offshore for over two weeks, and as a result, shipping container turnaround time almost doubled. In addition, demurrage and storage fees paid by exporters increased substantially, forcing some agricultural exporters to re-route shipments through Texas, Vancouver, or the East Coast at a great expense.

The growing Asian demand for empty containers increased the imbalance in loaded containers inbound from Asia versus loaded outbound containers.

Recently, for every ten containers inbound from Asia with freight, approximately eight were sent back empty. In September 2021, the fee for shipping a single 40-foot container (FEU) from Shanghai to Los Angeles was \$12,000 versus only \$1,400 for the backhaul from Los Angeles to Shanghai, as shown in Panel A of Figure 1. Due to the large difference in freight rates, shippers could not afford to wait for containers to be filled with agricultural goods stateside. Therefore, they canceled contracts and refused to supply empty containers to agricultural exporters, returning them unfilled to Asia instead. Some vessels returned to Asia directly

from Southern California, rather than stopping at Oakland to pick up containerized agricultural products (as was done previously) and, ironically, leaving the Oakland port with excess capacity. Although detrimental to U.S. exporters, the reason more containers are being shipped back to Asia empty is to keep high-value imported products flowing into the United States.

Demand Shock and Port Congestion

According to the World Bank’s Container Port Performance Index, California ports rank near the bottom in terms of global port performance. Out of 351 total ports, the latest figures rank Los Angeles at 337, Long Beach at 341, and Oakland at 334—far behind most ports in developing countries and those on the Atlantic Seaboard. Panel B of Figure 1 shows the average anchor and port time for container ships from January 2018 to September 2021. We calculated the average time required to discharge a container ship’s cargo at the five California container ports that export agricultural products and compared them with Shanghai and the major U.S. East Coast ports. The recent performance of California ports has been abysmal.

Before Covid-19, California ports took twice as much time to unload cargo ships as the comparison group. After May 2021, the delays increased substantially, with the average container ship waiting for more than nine days before unloading. The ports of Long Beach and Los Angeles drove this effect, recording substantial delays since May 2021. Note that Shanghai and the East Coast ports kept up with the increasing demand for shipped products, with only slight increases in anchor and port time.

Panel A of Figure 2 shows that empty containers made up 63% of all containers exported from California before Covid-19. This share increased to 75% between May and August 2021,

reaching a new record in September 2021, when about 79% of all containers leaving California ports were empty.

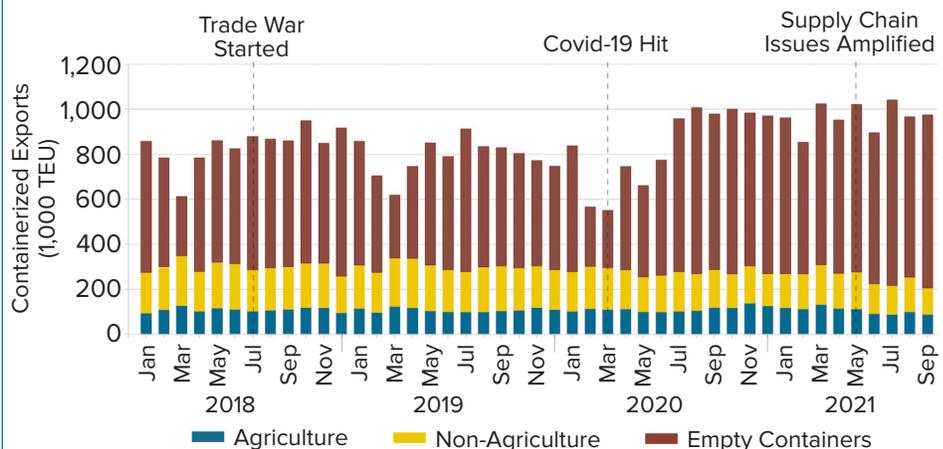
California Agriculture Trade Effects

As shown in Panel A of Figure 2, containerized agricultural exports shipped from California remained relatively stable between 2018 and 2020, with average exports of about 111,000 TEUs per month. This is a measure of all agricultural exports from California ports, including products from other states. However, supply chain disruptions caused a 9% reduction in total TEU exports from May to September 2021, compared to the total TEU exports for the same timeframe in the previous year. This adverse effect peaked in September when California's ports exported about 25,000 fewer containers filled with agricultural products than in May 2021, a 22% decline.

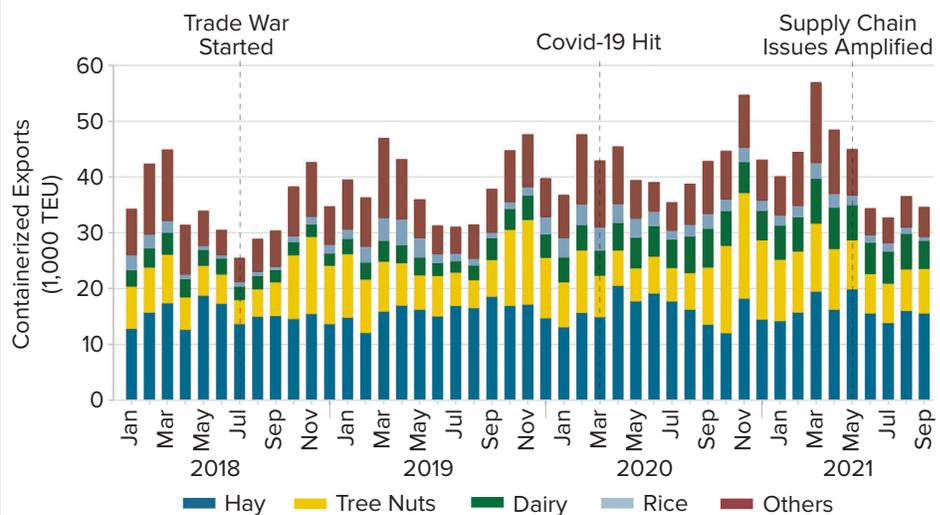
The trade effects caused by the supply chain logjam vary substantially for different agricultural products. Focusing on the major agricultural exports produced in California, Panel B in Figure 2 shows that hay—the largest containerized agricultural export good measured by TEUs—saw a reduction in export volume. It dropped by about 4,000 TEUs in total (4% on average) from May to September 2021 compared with the same period in 2020. Keep in mind that hay is a low-valued commodity per weight unit compared to tree nuts, wine, or dairy products. Tree nuts recorded a slight increase of 2,000 TEUs (up 8%), dairy products experienced a small reduction in TEUs (down 1%), and rice recorded a marked decline of 48% (down 6,000 TEUs). In addition, although other California agricultural export products, such as citrus, processed tomatoes, table grapes, and wine, account for a smaller share of containerized exports, they also saw a substantial decline in export volume of 16%, with more than 5,000 fewer TEUs exported.

Figure 2. Containerized Exports from January 2018 to September 2021

Panel A. Containerized Exports from California Ports



Panel B. Containerized Exports of Major California Products



Source: The data for this analysis comes from the PIERS database (IHS Markit, 2021).

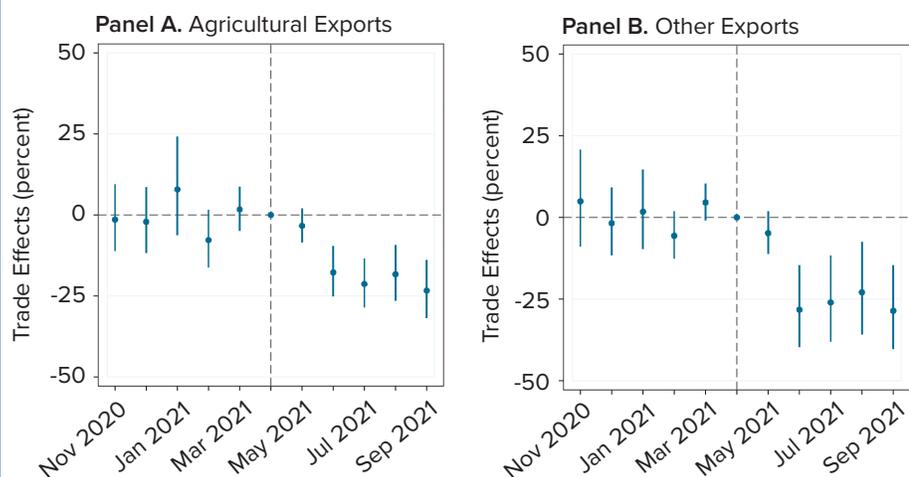
Note: The figures show changes in containerized exports for California between January 2018 and September 2021. We aggregated agricultural exports (HS Sections 0 to 24) in Panel A and broke out selected agricultural commodities produced in California in Panel B. Tree nuts includes almonds, pistachios, and walnuts, and others includes citrus, dairy products, processed tomatoes, table grapes, and wine.

To better understand the causal effects of port congestion on California containerized exports, we conducted an event study, an empirical analysis of how the market responds to a significant event. We used a statistical model and historical trade data for California ports to measure how the 2021 port congestion and container shortages impacted exports of agricultural goods and other products. Our model controls for unobserved factors with port-product-year and port-product-month fixed effects. We assigned May 2021 as the treatment month and constructed

an event window of five months before and after the pre-treatment month of April 2021. The statistical model identifies the treatment effect by comparing containerized exports from California ports with exports of the same commodities from all U.S. ports from 2015 to 2017.

Figure 3 (on page 4) shows the event study results. This type of figure is called a dot and whisker plot. The dots show the regression coefficients, and the whiskers represent the statistical confidence intervals. Note

Figure 3. Event Studies for Agricultural and Other Exports



Source: Data for this analysis come from PIERS (IHS Markit, 2021) and the World Container Index (Bloomberg, 2021).

Note: The figures show event studies for agricultural and other exports. All regressions include port, product-year, and product-month fixed effects and control variables. We plot trade effect estimates (dots) and corresponding confidence levels (whiskers) relative to the treatment month (April 2021). Detailed regression results are available from the authors upon request.

that we show estimated trade effects in percentage terms on the vertical axes. The regression coefficients are statistically significant if the whiskers do not cross the “zero” horizontal line. We find that California agricultural exports contracted slightly less (-17%) than exports of other goods (-22%) from May to September 2021. California ports handled about 97,000 fewer container exports (measured in TEUs) loaded with agricultural products compared to the counterfactual scenario. This amounts to \$2.1 billion in lost foreign sales. These economic losses are driven by meat, tree nuts, dairy products, oilseeds, and beverages. In addition, we applied the event study to major California agricultural product groups and found considerable heterogeneity in the results. The average trade decline was most pronounced for processed tomatoes (-44%), followed by rice (-34%), wine (-26%), and tree nuts (-17%).

Based on constant prices for April 2021, we calculated that California tree nut producers lost about \$520 million in foreign sales, followed by wine

with a loss of more than \$250 million, and rice with about \$120 million lost. Note that the overall level of tree nut exports is lagging substantially behind the pre-congestion levels, including the 2018 or 2019 harvest-season export volumes, which points towards very significant export losses for this sector of California agriculture.

Conclusion

The 2021 supply chain disruptions affected many countries worldwide, with shipping containers stalling at various ports. However, the problem was especially acute for California agriculture. We found that containerized agricultural exports from California ports were \$2.1 billion (or 17%) below their counterfactual level due to port congestion between May and September 2021. California farmers bore the brunt of these losses, with tree nuts, wine, rice, and dairy products suffering significant economic damages. The annualized economic impact is by far larger than that of the 2018 U.S.-China trade war, which caused economic losses of about \$500 million to California agriculture during the

fiscal year 2018/19. Moreover, the collapse of the supply chain had repercussions for the domestic market, with falling prices for tree nuts and other California agricultural products, and storage facilities overflowing. These additional impacts imply that the economic effects of port congestion are likely more extensive than just lost foreign sales. It has taken a supply chain crisis to fully reveal that California has inefficient port operations, even compared to ports in East Africa and Russia. As a result, the competitiveness of California agriculture in the world market is now being threatened by inadequate transportation infrastructure. We should have seen this coming.

Suggested Citation:

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For additional information, the authors recommend:

IHS Markit. 2021. New Global Container Port Performance Index. Available at: <https://bit.ly/3oNcgVU>.

Agri-Pulse. 2021. “Port Crisis Pulls California Farmers Into ‘Perfect Storm’ of Competing Interests.” Available at: <https://bit.ly/2Z9I5ja>.