



COVID-19 Series
Supply and Demand Indices—Washington Fresh Apples

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This publication is a direct application of the supply and demand indices developed by Lusk and Tonsor (2020). The goal of applying these indices and its welfare implications is to measure the impact of COVID-19 on the aggregate demand and supply for Washington (WA) apples and its welfare consequences. I use weekly apple shipment data from the Washington State Tree Fruit Association (2020). Figure 1 shows the supply quantity index and the demand quantity index for WA fresh apple shipments. These supply and demand indices are calculated using the first week of September 2017 (the first week of the 2017–2018 crop year) as the basis for comparison. The supply and demand index for September 2017 is set at 100. For example, the first week of May 2020, the demand index value was 272, that is, 172% higher than the first week of September 2017 ($272 - 100 = 172$).

COVID-19 impact on demand and supply on WA apples: Considering the time period between the first week of March and the first week of May 2018, 2019, and 2020, there are no statistically significant differences in the means of the demand indices across the three years. Conversely, for the same time period, the mean supply index for 2020 is higher by 48 units than the index for 2019 and lower by 28 units than the index for 2018. This analysis proves that COVID-19 has a negative effect on the supply index when comparing to a crop year of similar size. The WA apple production in 2017–2018 was 133 million 40 lb boxes, 2018–2019 was 117.5 million boxes, and 2019–2020 is projected at 137.3 million boxes. In addition, the variances of the supply and demand indices in 2020 are statistically, significantly higher compared to the variances in 2019 and 2018, leading to the conclusion that COVID-19 has increased WA apple supply and demand volatility.

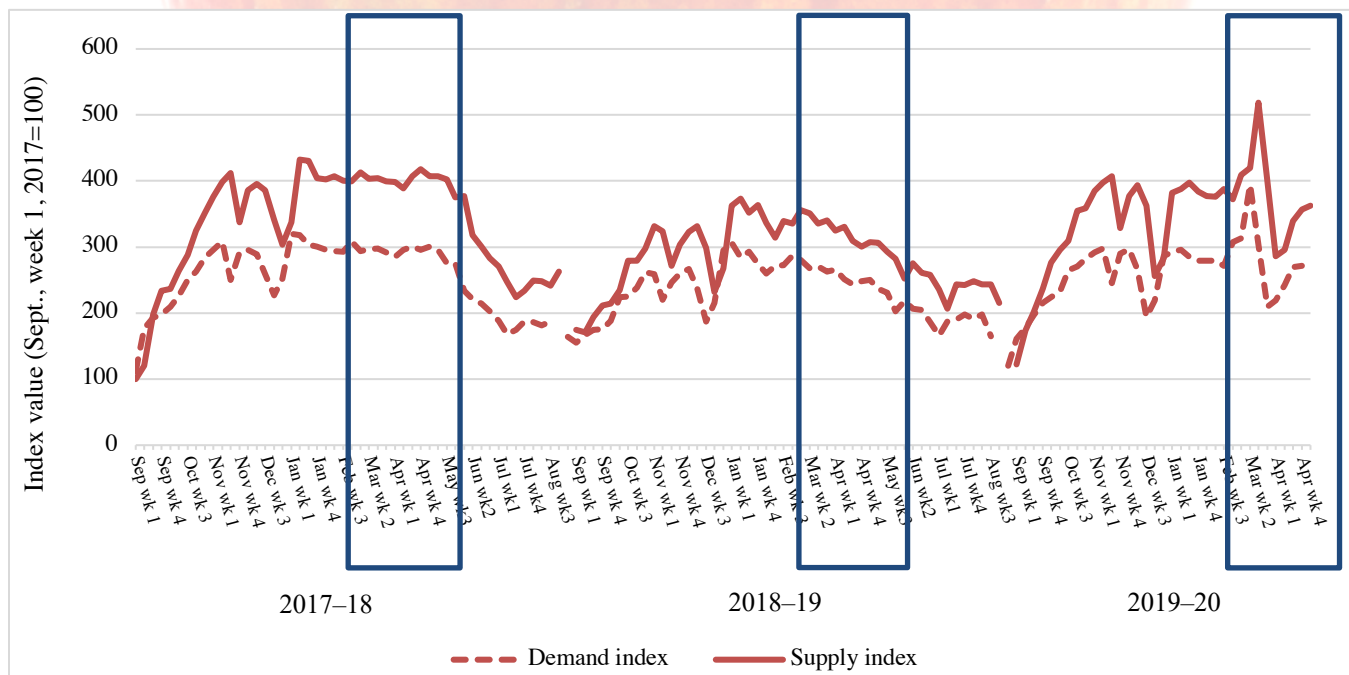


Figure 1. Washington apple supply and demand quantity indices (Sept., week 1, 2017 = 100).

Following Lusk and Tonsor (2020), I calculated the producer and consumer surplus weekly changes. Instead of calculating this relative to a base week in a given year, I consider week to week changes. To better visualize the COVID-19 effects on producer and consumer surplus weekly changes, I consider the time period between the first week of March and the first week of May for years 2018, 2019, and 2020. I calculate the welfare change by separate for each year. Results are shown in Figure 2.

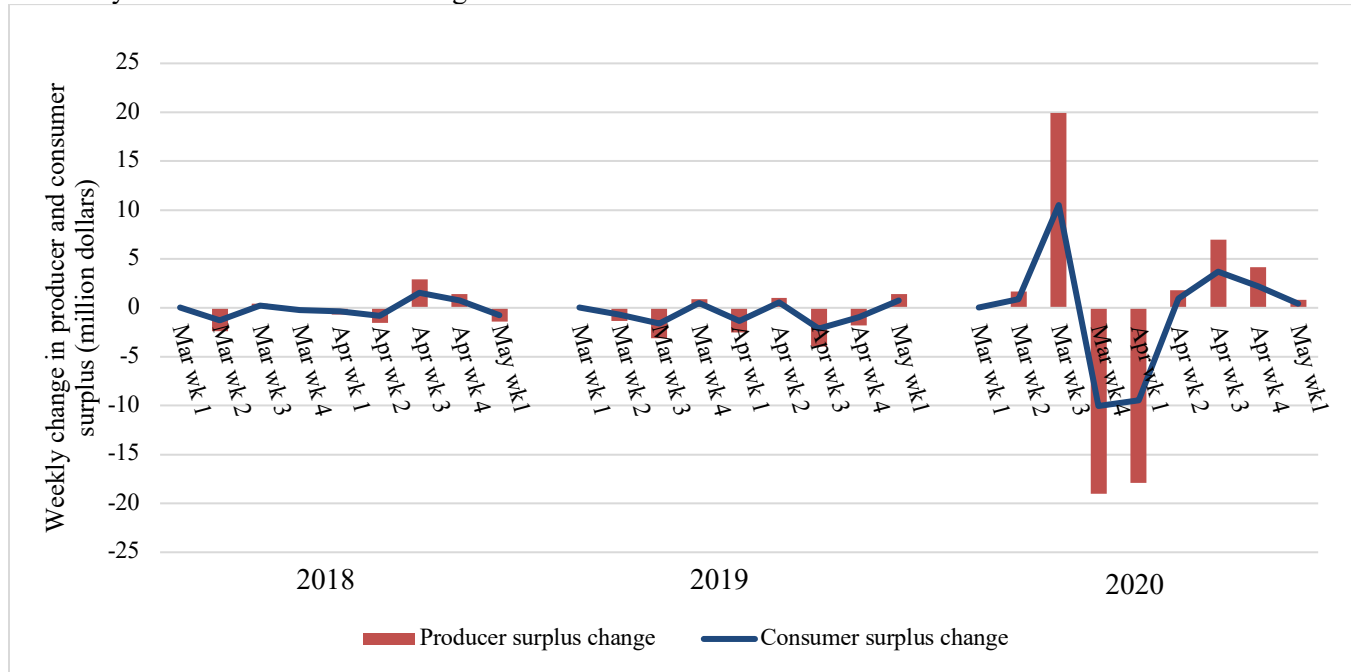


Figure 2. Weekly change in producer and consumer surplus (million dollars).

In 2020, for the time period considered, on average consumer surplus has decreased \$110,000 dollars weekly and producer surplus decreased \$200,000 dollars weekly. The largest weekly change in consumer and producer surplus is observed on the third and fourth week of March, and first week of April in 2020. The increase in producer surplus during the third week of March was offset by the decrease observed during the fourth week of March and first week of April. The highest variability in both consumer and producer surplus, across the three years, is observed in 2020, when the standard deviation of consumer surplus was 6.33 and producer surplus at 12.00. In 2019, the standard deviation for the consumer and producer surplus was 1.03 and 1.96, respectively. And in 2018, the standard deviation for the consumer and producer surplus was 0.92 and 1.75, respectively.

Conclusions

Supply indices for the period from the first week of March to first week of May are lower in 2020 compared to 2018, and both years show comparable crop sizes. Demand indices for the same time period are not statistically significant different across the three years. For producer and consumer surplus and considering measures of central tendency, such as the mean values, there are no statistically significant differences across 2020, 2019, and 2018 from the first week of March to first week of May. However, it is clear that COVID-19 has induced increased volatility both on the demand and supply of WA apples, and consumer and producer welfare.

References

Lusk, J.L., and G.T. Tonsor. 2020. [Supply and Demand Indices and Their Welfare Implications](#).

Washington State Tree Fruit Association. 2020. Various reports.