COVID-19 impact on fruit and vegetable markets: One year later

Lauren Chenarides | Timothy J. Richards | Bradley Rickard

1 W. P. Carey School of Business, Arizona State University, Tempe, Arizona, USA
2 Dyson School of Applied Economics and Management, S. C. Johnson School of Business, Cornell University, Ithaca, New York, USA
3 KEDGE Business School, Talence, France

Correspondence
Bradley Rickard, Dyson School of Applied Economics and Management, S. C. Johnson School of Business, Cornell University, Ithaca, NY 14853, USA.
Email: trichards@asu.edu

Abstract
More than 1 year after the outbreak of COVID-19, Canadian fruit and vegetable markets continue to adjust to the evolving landscape. In this article, we focus on three key measures of input and output market performance that serve as indicators of the stability of fruit and vegetable markets in Canada in the medium-term, and offer some insight for how these markets will continue to adjust in the longer run. Specifically, we use data to highlight the most recent trends in (1) the production and aggregate movement for major fruit and vegetable crops in the United States and Canada, (2) labor supply and immigration visa patterns, and (3) U.S.–Canada trade patterns for fruits and vegetables. We provide evidence that the fresh produce supply chain in Canada, and for markets in their largest trade partner in the United States, has remained relatively robust.

KEYWORDS
COVID-19, fruit and vegetables, supply chains, international trade

Résumé
Plus d’un an après l’éclosion du COVID-19, les marchés canadiens des fruits et légumes continuent de s’adapter à l’évolution du paysage. Dans cet article, nous nous concentrons sur trois mesures clés de la performance des marchés des intrants et des extrants qui servent d’indicateurs de la stabilité des marchés des fruits et légumes au Canada à moyen terme, et nous offrons un aperçu de la façon dont ces marchés continueront de s’ajuster dans le plus long terme. Plus précisément, nous utilisons des données pour mettre en évidence les tendances les plus récentes dans (i) la production et le mouvement global des principales cultures de fruits et légumes aux États-Unis et au Canada, (ii) l’offre de main-d’œuvre et les modèles de visa d’immigration, et (iii) États-Unis-Canada les tendances du commerce des fruits et légumes. Nous prouvons que la chaîne d’approvisionnement des produits frais au Canada et pour les marchés de leur principal partenaire commercial aux États-Unis est restée relativement solide.
1 | INTRODUCTION

In this article, we provide a retrospective look on the medium-term (1 year) impacts that COVID-19 had on fruit and vegetable markets in Canada, and in North America more generally. We focus our analysis on three key measures of input and output market performance that were highlighted in Richards and Rickard (2020): shipments from the farm, the stability of agricultural labor markets in the United States, and trade flows between the United States and Canada. Our objective is to examine the fundamental resilience of the North American fruit and vegetable supply chain, from a perspective 1-year removed from the onset of the pandemic, and to perhaps provide some foresight on the likely longer-run impacts of the disease on the markets for fruits and vegetables.

As in our original article on this topic, we consider the resilience of the North American market for fruits and vegetables given the high degree of integration between the U.S. and Canadian markets for fresh foods. Specifically, we first focus on trends in U.S. fruit and vegetable production and shipment patterns in 2019 and 2020, given that a large share of Canada’s fresh produce is produced in the United States. Second, because the greatest risk exposure from COVID-19 lies with labor-inputs, and labor is the most important input (by expenditure share) in fruit and vegetable production, we examine hiring patterns during the 2020 growing season in the United States in some detail, focusing on access to nonimmigrant guest workers. Namely, we compare H-2A certifications from the U.S. Department of Labor with visas issued by the U.S. Department of State across the entire 2020 production season, and compare season-long visa numbers to comparable values from the 2019 season. Third, we summarize recent trade flow patterns between Canada and the United States for fresh and processed fruits and vegetables in 2019 and 2020. Studying shipments from the farm, labor in key production regions, and trade between the United States and Canada provides key information as to the fundamental robustness of the North American fruit and vegetable supply chain throughout the COVID-19 pandemic.

1.1 | Aggregate production and shipments of key fruits and vegetables

In the United States, the market for specialty crops, which consists of fruit, tree nuts, vegetables, and pulses (including potatoes), generates a yearly average value of over $40 billion (USD) (USDA-Economic Research Service, 2020). While the majority of these cash crops produced in the United States is consumed domestically, foreign markets, like Canada, serve as an outlet for a sizeable portion of U.S. production volumes. In addition, Canada, in particular, serves as an important source of fruits and vegetables to the U.S. market, supplying high-quality produce from its extensive greenhouse industry.

The shock to demand during the months of March and April of 2020 that diverted sales away from foodservice to food retail tested the resilience of the supply chain for perishable foods. Although most production decisions for the 2020 growing season had been made prior to the COVID-19 outbreak and ensuing stay-at-home orders, the fruit and vegetable sector was particularly vulnerable due to the perishability of most fresh produce items. Further, supply–chain relationships between upstream suppliers and downstream buyers tend to be driven by long-standing contractual agreements and replenishment systems that are efficient, yet slow to change. To the extent that virus infection rates and stay-at-home orders also interrupted harvesting schedules by keeping farmworkers at home, thereby reducing the supply of fruits and vegetables, shipments from other countries served as a means to absorb some of these disruptions to U.S. domestic production.

Using data collected by the Agricultural Marketing Service (AMS) of the U.S. Department of Agriculture (USDA) from January 2, 2019 to January 5, 2021, we analyze shipping volume for six commodity markets: carrots, iceberg lettuce, onions, oranges, potatoes, and strawberries. Though selective, these six commodities provide a representative cross-section of specialty crops both produced and consumed. As with all produce, each is highly perishable, and varies according to the level of storability, labor costs associated with production and harvest, the proportion of volume allocated to food-at-home and foodservice, and the share of production sent to foreign markets. In the remainder of this section, we compare the U.S. production volumes between 2019 and 2020 for these select commodity markets, and describe Canada’s role as an import supplier during this period.

Figure 1 represents the total yearly U.S. shipment volume across the six commodities listed above, as well as the penetration of shipments from Canada and other countries (including Mexico, and other countries in Europe, Africa, Latin America, Asia, and Australia). Because a portion of U.S. production is exported, we distinguish between the total volume that was produced domestically in the United States but exported to countries outside the United States. Between 2019 and 2020, we note two trends. First, U.S. production of these six commodities decreased by 3% from the prior year. Total volume fell from 5.87 billion pounds (2019) to 5.71 billion pounds (2020). At the same time, shipments from abroad increased
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Figure 1  Total shipment volume by origin, domestic versus exported
Source: USDA-AMS Market News Service
Note: U.S. production volume includes the portion of produce that was consumed domestically or exported; Canadian and other volume is the amount that was imported and consumed in the United States; commodities: carrots, iceberg lettuce, onions, oranges, potatoes, and strawberries; conventional and organic varieties

by 44%, from 470.15 million (2019) to 677.32 million pounds (2020), with Canadian shipments accounting for 28.6% of U.S. imports across these six commodities in 2020 compared with a much smaller portion (10.2%) in the prior year.

Next, we examine weekly movement patterns in the United States, comparing 2019 and 2020 shipment volumes (Figure 2). As noted above, yearly U.S. production volume for the six commodities fell by 3%, yet the share of the production losses was felt most by domestic consumers. In other words, despite the week-over-week changes in U.S. production volume, U.S. shipments to countries abroad remained relatively stable, with losses only amounting to 2% of the total volume of shipments, compared to 11% domestically. Between March and July of 2020, U.S. exported shipments fell by nearly 50% (shipment volume peaked in March at 3.54 million pounds, and dropped to its lowest shipment volume of 1.78 million pounds by July), but appeared to recover and match the previous year’s average shipments (the average monthly shipment between August and December was 3.81 million pounds per week in 2019 and 3.66 million pounds per week in 2020). Nonetheless, across all commodities, it appears that most of the production losses domestically (U.S. shipments), relative to the prior year, occurred at the end of 2020, not during the weeks immediately following the stay-at-home orders (week 10). When we examine the relative differences in production for each commodity individually, however, we find that U.S. production volumes for lettuce, oranges, and potatoes experienced total losses of −5%, −12%, and −1%, respectively.

To illustrate Canada’s importance as a key supplier to the United States, we isolate the case of potatoes. Within the United States, the market for potatoes is perhaps the clearest example of the shocks to demand when the foodservice sector shutdown during the months of March and April. Figure 3 depicts the weekly movement of potatoes whose production originated in the states of Colorado and Idaho (Colorado representing a source of primarily retail potatoes, and Idaho a key source of foodservice potatoes). By the end of March, shipment volume had reached their apex for both food retail and foodservice, at 12.41 and 21.37 million pounds, respectively. Throughout the month of April 2020 (the weeks following the stay-at-home orders), shipments of potatoes from both Colorado (representing food retail) and Idaho (representing foodservice) fell for each consecutive week. By the end of the month, the foodservice sector faced substantial losses, especially when compared to the volume of shipments from the prior year (−21% in 2020; −3% in 2019).

Aside from this representation of the comparative losses between foodservice and food retail within the United States, Canada shipments into the United States proved to be crucial during 2020 (Figure 4). During the weeks following the stay-at-home orders, shipment volume for potatoes, for instance, from Canada into the United States, was negatively
FIGURE 2  Total shipment volume, U.S. origin, weekly movement
Source: USDA-AMS Market News Service
Note: Total volume is separated by what was produced domestically in the United States and remained in the United States (domestic, left-axis) and what was produced domestically but exported (exported, right-axis); commodities: carrots, iceberg lettuce, onions, oranges, potatoes, and strawberries; conventional and organic varieties; vertical line represents week 10 of the calendar year.

FIGURE 3  Movement: potatoes – retail (Colorado) versus foodservice (Idaho)
Source: USDA-AMS Market News Service
Note: U.S. production of potatoes (conventional and organic varieties) consumed domestically, excludes what was produced domestically and exported; vertical line represents week 10 of the calendar year.
correlated with movements of potatoes originating in the United States and consumed domestically. We see a spike in Canadian imports of potatoes during the month of April compared to the 2019 shipment volume. By June (week 23), shipment volume in the United States remained at lower capacity than 2019 shipment volume, whereas Canadian potato imports remained in much higher supply throughout the remainder of the year compared to 2019.

Across the six commodities, Canada’s increased supply of potatoes into the United States appeared to be the most pronounced (Figure 5). Together, these trends in the select perishables market suggest that the COVID-19 pandemic, though short-lived, did not have catastrophic effects on the total shipment volumes in the U.S. market, and trade partners, including Canada, helped to sustain temporary shocks to demand and supply.

1.2 Labor markets in the United States

As we explained in our original article (Richards & Rickard, 2020), fruit and vegetable production in the United States and, hence, exports to Canada, is critically dependent upon access to labor. Harvesting activities for many fruits and vegetables are highly labor intensive, approaching 50% of operating costs for some crops like lettuce and fresh tomatoes. Therefore, as stories spread of meat-packing plant shutdowns in the midwestern United States in April of 2020 (Restuccia, 2020), and consequent shortages of some meats, there was a well-justified fear that the fresh fruit and vegetable production season in the southern United States would be similarly interrupted. In fact, there were many anecdotal reports of localized outbreaks in heavy production areas, such as California and Florida (Rosenberg et al., 2020), as well as in more local production areas, at least for some Canadians, in southern Ontario. Fears of COVID-19-caused labor issues to arise during a period of generalized confusion, and a lack of either consensus or understanding as to the appropriate policy response.

Even without the COVID-19 pandemic, farmers in the fruit and vegetable industry have had an increasingly difficult time finding workers. Not only are domestic workers less willing to do the types of jobs that are necessary (Richards, 2018), but growing economic opportunities in Mexico, an increasing unwillingness to migrate from state to state in search of agricultural jobs (Fan et al., 2015), and an aging-out of the more experienced guest workers all combine to limit growers’
access to not only the number of workers, but the types of skills necessary for the jobs that have to be completed. The supply of labor in agricultural guest worker programs, such as the H-2A nonimmigrant worker program, has been exploding in recent years due to the shortage of both domestic and foreign workers, but employers still complain about the paperwork and expense associated with the certification process, the inflexibility of wage-rates under H-2A, the need to maintain employment for entire seasons, and other expenses associated with hiring H-2A workers. Regardless of industry concerns with the H-2A program, requests for H-2A employees have more than doubled in the last 5 years, and growers maintain that they could absorb many more if the program were sufficiently flexible (Figure 6). But, whether the H-2A program could continue to function during the COVID-19 pandemic was only one of many labor-issues fruit and vegetable growers faced during the 2020 growing season.

As 2020 wore on, many issues emerged that threatened the viability of the agricultural labor pool in the fruit and vegetable production region of the United States. First, the federal government stopped conducting interviews for guest worker visas (H-1B and H-2A visas) at foreign consulates, which is a necessary step in obtaining nonimmigrant farm workers, in March 2020, representing a potential barrier to obtaining guest workers. Requiring in-person interviews for H-2A status was relaxed only after considerable industry lobbying (Beatty et al., 2020; Farnsworth, 2020). Second, as the disease spread among undocumented workers, many were either unable to access medical services, or were isolated from their own support systems out of a sense of protecting others around them (Martin, 2020). Third, as in the well-documented case of slaughter-house workers in the Midwest United States (Taylor et al., 2020), COVID-19 cases spread quickly among workers living in group housing facilities in southern California (Beatty et al., 2020; Charlton & Castillo, 2020; Fielding-Miller et al., 2020; Neef, 2020). Although fruit and vegetable work generally takes place outside, exposures can occur in housing, transport, mealtime, and in transition between the field and packing plant. Fourth, higher rates of unemployment compensation authorized through the CARES Act also represent a substantial negative effect on newly unemployed workers’ willingness to move into agriculture. Beatty et al. (2020) point out that unemployment benefits in California, including both the $350 per week for their example construction worker, plus the $600 per week authorized by the CARES Act, is far above the average weekly earnings for an agricultural worker of $500 so there is no financial incentive for an unemployed worker to take an inherently difficult farm job. Tobin and Sweetman (2020) document a similar work-disincentive for Canadian workers through the Canada Emergency Response Benefit, which provided some $500 per week in additional employment insurance benefits to Canadian workers. Whether these issues had a material impact, however, is an empirical question.

**FIGURE 5** Total shipment volume by origin, by commodity
Source: USDA-AMS Market News Service
Note: U.S. volume excludes what was produced domestically but exported; Canadian and other imports reflect what was shipped into the United States and consumed domestically; conventional and organic varieties.
As COVID-19 emerged as a global problem in early 2020, concerns regarding access to labor spread to concerns regarding the viability of the H-2A program in the United States, and its Canadian equivalents (the Temporary Foreign Worker Program and Seasonal Agricultural Workers Program), and growers’ abilities to ensure the safety of workers brought in under agricultural guest worker programs. Due to the reliance of fruit and vegetable growers on harvesting labor, and the lack of viable substitutes, there were concerns that without guest workers, the entire production season would be lost. Moreover, if one country were to restrict entry, and others did not, there were fears that migrant workers would simply find the most pliable host. However, the data from the United States presented here, showing that shipments returned to near-normal after an adjustment period of perhaps 4–6 weeks, depending on the crop, suggest that these fears were perhaps unfounded. In fact, data gathered for the entire fruit and vegetable crop year (Figure 6) show that growers were able to certify, and obtain visas for, more workers than they hired during the same period in 2019. In fact, the rate of growth in certifications from 2019 to 2020 (4.2%) was nearly identical to the growth rate in the previous period (2019–2018, 4.3%). If the U.S. fruit and vegetable sector is indeed as reliant on H-2A workers as the literature suggests (Charlton & Castillo, 2020), our data show that guest worker employment in the fruit and vegetable sector does not appear to have been constrained by the COVID-19 pandemic.

While a deeper dive into the certification data does not change the COVID-19 story, it does suggest some nuance that may be of interest for more detailed research. Namely, the number of workers certified to work for farm labor contractors (FLCs) accounted for nearly 20% of all certifications in 2020. FLCs represent a more flexible form of hiring for many growers as the FLC takes care of the recruitment, certification, safety-assurance, and the other “fixed” costs of hiring seasonal and contract labor. In fact, in recent years, FLCs have grown to represent the bulk of immigrant-hiring activity in California. FLCs are able to overcome one of the key burdens to hiring H-2A labor, namely, the bureaucratic tangle necessary to file the paperwork (which is literally “paper” work as there was no electronic certification process in 2020) and to provide adequate assurances that all safety requirements are met. Data from the U.S. Department of Labor (U.S. Department of Labor, 2021) that show quarterly trends in “crop support” labor, the classification that includes FLC hiring, suggest a dramatically different story from that in Figure 6. Namely, the growth in crop support labor, which accounts for nearly half of all labor in fruit and vegetable crops, appears to have been on a negative trend even prior to COVID-19, but then accelerated as the pandemic began.

Why would crop support labor decline so rapidly as COVID-19 advanced in California, and is the mechanism behind this decline important to absolute levels of production? While a complete answer will likely not be forthcoming until the pandemic is over, we can speculate that direct hires for production activities were a priority for employers over hires for secondary roles. What matters more to overall production is the total of support and production activities. Figure 7 shows
that the total number of employees in 2020, including both guest workers and domestic workers, continued a regular pattern from past years. The fact that the total number of employees shown in this figure is so close to prior years, even with increased use of mechanized harvesting (Beatty et al., 2020), explains why total shipments for most fruit and vegetable crops was relatively stable from 2019 to 2020.1

1.3 North American trade in fruits and vegetables

In our earlier article (Richards & Rickard, 2020), we highlighted the importance of imports of fruits and vegetables coming into Canada each year. Canada imports seven times the amount of fruits and vegetables that it produces annually (Statista, 2020), and this means that there was the possibility that Canada would not be well insulated to adjust to substantial changes in trade patterns for fruits and vegetables (changes due to border restrictions and cross-border movement of goods, or changes in prices for imported products that might face higher costs of production due to COVID-19). The United States is the largest exporter of fruits and vegetables to Canada, and in 2019, Canada imported over 8.24 billion USD in fruits and vegetables from the United States (U.S. Census Bureau, 2021). Any loss in access to U.S. imports would also clearly affect the variety of fresh produce items available to Canadian consumers. As the pandemic began to unfold in March 2020, it seemed likely that U.S.–Canadian trade flows of the fruits and vegetables destined for foodservice markets would fall given the major reductions in sales of food consumed away from home in both countries in 2020.

Recent data describing the trade flows for fruits and vegetables between Canada and the United States suggest that patterns in 2020 were not substantially different from 2019. Figure 8 shows the monthly U.S. exports of all fruits, vegetables, and nuts to Canada. The values shown in Figures 8 and 9 include trade in fresh vegetable products (Harmonized Tariff Schedule [HTS] code 07); fresh fruit and nut products (HTS code 08); and processed fruits, vegetables, and nuts (HTS code 20). Here, we see that total exports in 2020 were approximately 8.19 billion USD, which is a decrease of about 50 million USD compared to 2019 (or a decrease of less than 1%). There is a noticeable drop in U.S. exports to Canada immediately following the start of the pandemic; total exports across all fruits, vegetables, and nuts (fresh and processed) in the months of May and April 2020 were down 8.0% compared to the same time period in 2019. However, this appeared to be a short-term adjustment and U.S. exports patterns to Canada returned to trends observed in 2019 beginning in July 2020.

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1 Note that our findings are opposite those of Ridley and Devadoss (2020), who conduct a preliminary econometric analysis of the likely impact of hypothetical labor-market scenarios on U.S. fruit and vegetable production.
Figure 8 shows the monthly U.S. exports to Canada in 2019 and 2020: fresh and processed fruits, vegetables, and nuts (USD millions)

Source: U.S. Census Bureau, USA Trade® Online, Available at: https://usatrade.census.gov/index.php

Figure 9 shows the monthly U.S. imports of fruits and vegetables from Canada in 2019 and 2020. These data show that the total flow of fruits and vegetables and nuts (fresh and processed) from Canada into the United States increased in 2020 relative to 2019 (by approximately 390 million USD), and that there was no short-term drop in total U.S. imports of fruits and vegetables from Canada in the months immediately following the outbreak (i.e., during May and April 2020). A closer look at more disaggregated data reveals that Canadian exports of fresh fruits and vegetables increased in the months of April and May in 2020 relative to 2019, but exports of processed fruits and vegetables fell during the same time period.
TABLE 1  Canada–U.S. trade in processed fruits, vegetables, and nuts: comparison of May and April 2019 and 2020

| HTS code | Category description                   | U.S. exports to Canada May and April (USD millions) | % Change | U.S. imports from Canada May and April (USD millions) | % Change |
|----------|----------------------------------------|----------------------------------------------------|----------|-----------------------------------------------------|----------|
| 20       | All processed fruit, vegetables, nuts (F&V&N) | 298.5                                              | -14.8%   | 269.5                                               | -7.1%    |
| 2001     | Preserved vegetables                   | 18.3                                               | -74.4%   | 1.8                                                 | 11.5%    |
| 2002     | Prepared tomatoes                      | 11.9                                               | -6.3%    | 1.1                                                 | -47.8%   |
| 2003     | Prepared mushrooms                     | 0.2                                                | -60.6%   | 0.3                                                 | -12.0%   |
| 2004     | Frozen vegetables                      | 22.1                                               | -47.7%   | 159.7                                               | -18.2%   |
| 2005     | Other processed vegetables             | 41.3                                               | -9.1%    | 27.2                                                | 12.1%    |
| 2006     | Processed F&V&N with sugar             | 0.5                                                | -35.4%   | 0.0                                                 | -74.3%   |
| 2007     | Jams and jellies                       | 11.5                                               | 32.0%    | 7.5                                                 | 27.3%    |
| 2008     | Other processed fruits and nuts        | 113.6                                              | -9.2%    | 64.0                                                | 4.2%     |
| 2009     | Fruit juice                            | 79.2                                               | -10.8%   | 7.9                                                 | 27.8%    |

Source: U.S. Census Bureau, USA Trade® Online, Available at: https://usatrade.census.gov/index.php.

*The complete HTS descriptions are as follows. 20: Preparations of vegetables, fruit, nuts, or other parts of plants, 2001: Vegetables, fruit, nuts, and other edible parts of plants, prepared or preserved by vinegar or acetic acid, 2002: Tomatoes prepared or preserved otherwise than by vinegar or acetic acid, 2003: Mushrooms and truffles, prepared or preserved otherwise than by vinegar or acetic acid, 2004: Other vegetables prepared or preserved otherwise than by vinegar or acetic acid, frozen, other than products of heading 2006, 2005: Other vegetables prepared or preserved otherwise than by vinegar or acetic acid, not frozen, other than products of heading 2006, 2006: Vegetables, fruit, nuts, fruit-peel, and other parts of plants preserved by sugar (drained, glacé, or crystallized), 2007: Jams, fruit jellies, marmalades, fruit or nut pureéd, and fruit or nut pastes, obtained by cooking, whether or not containing added sugar or other sweetening matter, 2008: Fruit, nuts, and other edible parts of plants, otherwise prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit, not elsewhere specified or included, 2009: Fruit juices (including grape must) and vegetable juices, not fortified with vitamins or minerals, unfermented and not containing added spirit, whether or not containing added sugar or other sweetening matter.
In addition to the aggregate trade flows, we also provide details on trade patterns between Canada and the United States for specific processed fruit and vegetable categories. We highlight the changes for processed fruits and vegetables because this is the subgroup of products that experienced the largest percentage decline in Canadian imports from the United States (Canadian imports of fresh fruit fell by 2.2% and imports of fresh vegetables decreased by 10.7% during this period), and the only subgroup of fruit and vegetable products that experienced a decline in Canadian exports to the United States in the months of May and April in 2020 relative to 2020 (Canadian fresh fruit exports to the United States were actually up 1.6% and fresh vegetable exports were up 17.2% during this time period). We expect that the decline in trade flows for processed fruits and vegetables was due, in part, to the lower demand by the foodservice industry.

Following the nine subcategories of processed fruits and vegetables (as defined by the 4-digit HTS codes), we show the changes in Canadian imports from the United States and the Canadian exports to the United States in 2019 and 2020 (for the months of May and April). Table 1 shows that there was a decline in trade flows in 2020 relative to 2019 in most of the subcategories, although the magnitude of the changes was not uniform across the categories. The category with the largest decline (in value and percentage change) for Canadian imports was preserved vegetables (followed by frozen vegetables); whereas for Canadian exports, it was frozen vegetables. In addition, Table 1 shows that there were modest increases in Canadian exports for many subcategories of processed fruits and vegetables in the May and April timeframe in 2020 compared to 2019.

Overall, the trade data presented here indicate that COVID-19 did dampen total trade flows of fruits and vegetables from the United States to Canada for approximately a 3-month period following the initial outbreak. Although the aggregate data do not show a similar decline in total traded fruits and vegetables from Canada to the United States, there was a short-term decline in processed (frozen) vegetable exports to the United States immediately following the outbreak of COVID-19. These adjustments were nontrivial, but they were closer to the lower end of the range of effects that we suggested in our earlier article. This result is likely due to a mix of market reactions, but largely linked to a relatively robust production system and supply chains in both Canada and the United States. It is also due, in part, to the limited disruption observed in the U.S. labor market during the months following the outbreak of COVID-19. Given that the change in the U.S. labor supply was not as pronounced as some had predicted, the total supply of fruits and vegetables, and the total exported quantity to Canada, was very similar in 2020 as it was in 2019. We expect that the reduction in U.S. exports of fruits and vegetables to Canada in May and April of 2020 was due to lower foodservice demand in Canada and some diversion of available U.S. supplies to U.S. food retailers.

2 DISCUSSION

In general, our analysis reveals a surprising level of resilience in the North American supply chain for fresh fruits and vegetables. While producers, and exporters, were somewhat slow to adjust to the shift to a near-total retail market for fresh foods, production, shipments, and exports returned to near-normal levels after a relatively short period of time (6–8 weeks). We also show that the number of agricultural workers hired by U.S. farmers changed very little in 2020 compared to 2019, suggesting that production capacity was surprisingly robust to the spread of the pandemic.

From our previous perspective of April 2020, we expected that access-to-labor issues in key production areas in the United States would have dramatic effects on production levels and, given the strength of retail demand for fresh food within the U.S. domestic market, we expected trade flows to be significantly impacted. However, neither production nor trade appears to have been significantly affected by the COVID-19 pandemic, beyond a 4–6 week period immediately after the initial shutdowns took place. The most likely explanation for this apparent resilience combines rapid responses from both the U.S. and Canadian governments in ensuring the viability of the food production system, and self-interested responses from all agents in the supply chain. From a government-policy perspective, failure of the food system was simply not an option due to the essential nature of the food supply. From the private-sector perspective, the demand for food is relatively constant, so COVID-19 presented as many new opportunities for generating value as it removed.

ORCID

Bradley Rickard © https://orcid.org/0000-0001-8832-9609

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