

CANADA'S FOOD PRICE REPORT 11TH EDITION 2021



AUTHORS AND ADVISORS

DALHOUSIE UNIVERSITY MEMBERS

Dr. Sylvain Charlebois

(Lead Author, Project Lead - Dalhousie University)

Faculties of Management and Agriculture
sylvain.charlebois@dal.ca

Alyssa Gerhardt

Faculty of Applied Social Sciences
alyssa.k.gerhardt@dal.ca

Stacey Taylor

Faculty of Computer Science
Stacey.Taylor@dal.ca

Mitchell Kane

Faculty of Computer Science
mkane@dal.ca

Dr. Vlado Keselj

Faculty of Computer Science
vlado.keselj@dal.ca

Dr. Elizabeth Fitting

Faculty of Applied Social Sciences
elizabeth.fitting@dal.ca

Dr. Karen Foster

Faculty of Applied Social Sciences
karen.foster@dal.ca

Dr. Kathleen Kevany

Faculty of Agriculture
kkevany@dal.ca

Dr. Stefanie Colombo

Faculty of Agriculture
scolombo@dal.ca

Janet Music

Faculty of Agriculture
janet.music@dal.ca

Don Fiander

DalAnalytics
don.fiander@dal.ca

UNIVERSITY OF GUELPH MEMBERS

Dr. Simon Somogyi

(Project Lead – University of Guelph)
Gordon S. Lang School of Business and Economics
ssomogyi@uoguelph.ca

Dr. Ethan Jackson

Vector Institute & School of Engineering
jackson.ethan.c@gmail.com

Dr. Graham Taylor

School of Engineering
gwtaylor@uoguelph.ca

Dr. Jess Haines

Family Relations and Applied Nutrition
jhaines@uoguelph.ca

Paul Uys

Ontario Agricultural College (OAC)
pauluys@uoguelph.ca

Dr. Erna Van Duren

Gordon S. Lang School of Business and Economics
evandure@uoguelph.ca

Dr. Maria Corradini

Ontario Agricultural College
mcorradi@uoguelph.ca

UNIVERSITY OF SASKATCHEWAN MEMBERS

Dr. Stuart Smyth

Agricultural and Resource Economics
stuart.smyth@usask.ca

Dr. Rim Lassoued

Agricultural and Resource Economics
rim.lassoued@usask.ca

UNIVERSITY OF BRITISH COLUMBIA MEMBERS

Dr. James Vercammen

Faculty of Land and Food Systems
james.vercammen@sauder.ubc.ca

Dr. Kelleen Wiseman

Faculty of Land and Food Systems
kelleen.wiseman@ubc.ca

Dr. Richard Barichello

Faculty of Land and Food Systems
rick.barichello@ubc.ca

Dr. Matias Margulis

School of Public Policy and Global Affairs
matias.margulis@ubc.ca

PRODUCTION TEAM

Janet Lord

Copy Editor, Paragon Services

Erin Casey

Communications

Christine Darrah

Designer, Dalhousie Design Services

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

OVERVIEW OF 2019: HOW WE DID 6

COVID-19 8

- COVID-Related Facility and Safety Measures 8
- Shift from Food Service to Food Retail 9
- Shifting Consumer Demands 10
- Growing Income and Food Insecurity 11
- Canadians' Changing Relationship with Food 12
- Revisiting Local Food Supply Chains 13
- Low Oil Prices and the Canadian Dollar 13

CANADA'S FOOD PRICE REPORT: 2021 FORECAST 15

- Methodology 15
- Recurrent Neural Network Model 15
- Ridge-Regularized Linear Regression Model 16
- 2021 Macroeconomic Factors and Drivers 16
- Food Price Forecast by Province 18
- The 2021 Watch-List Items 19
- What to Expect in 2021 21
- COVID-19 and Changing Trends in the Food Supply Chain 21
- Sustained Consumer Demand and Investment in E-Commerce 21
- Agricultural Trade 22
- Food Manufacturing 22
- Plastic Packaging 23
- Continued Action to Mitigate Climate Change 24



EXECUTIVE SUMMARY

This is the 11th edition of Canada's Food Price Report, published annually by Dalhousie University and the University of Guelph. In 2021, for the first time, Canada's Food Price Report welcomes the University of Saskatchewan and the University of British Columbia to the team. This year, the report faces unusual challenges due to the unexpected and unprecedented global COVID-19 pandemic. The impacts of the pandemic and the uncertainty that accompanies it will continue into 2021. COVID-19 has caused economic volatility in global markets and presented rapidly changing circumstances and disruptions to which all stages of the agri-food supply chain—from farmgate to retail—must quickly adapt. It has also induced changes to consumer habits and preferences, and the question remains whether these changing habits will become the new normal. Therefore, the 2021 Canada's Food Price Report focuses on the impacts of the pandemic and recognizes that the future is shrouded in uncertainty.

In last year's report, our models predicted that overall food prices would increase 2 to 4% in 2020 and that the average Canadian family would spend up to \$12,667 on food. Based on the 2020 inflation rate to date, they are likely to spend \$12,508 in 2020, if consumers continue to visit restaurants at the same rate as past years. Due to the pandemic, that is highly unlikely.

Besides the pandemic, many other factors contributed to a rise in food prices this year. Our forecasts for 2020 were reasonable in predicting the percent change in many food categories; however, our predictions for bakery, dairy and meat were slightly below (0.1% to 0.2%) what was actually observed. For meat, especially, the increase in price significantly outpaced our forecast. For 2021, the report uses the same categories of food and makes the following predictions:

2021 FOOD PRICE FORECASTS

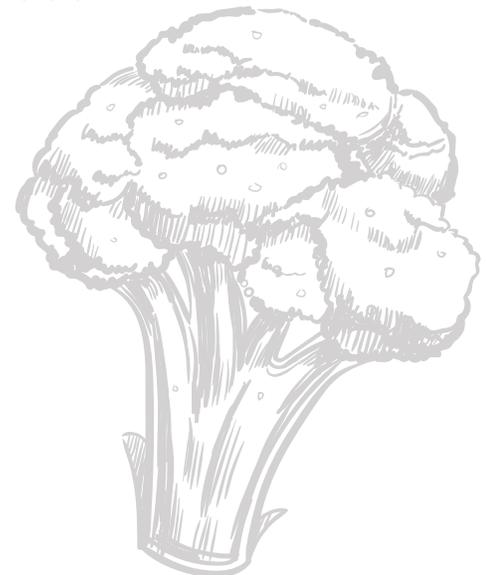
Food Categories	Anticipated Changes (%)
Bakery	3.5% to 5.5%
Dairy	1% to 3%
Fruits	2% to 4%
Meat	4.5% to 6.5%
Other	2% to 4%
Restaurants	3% to 5%
Seafood	1.5% to 3.5%
Vegetables	4.5% to 6.5%
Total Increase in Food Prices	3% to 5%

Over the last decade, this report has considered many market instruments and macroeconomic factors in its forecasts: financial indicators, recession signals, currencies and Canada-specific information.

The 2021 report forecasts that overall food prices will increase 3 to 5%. In previous years, Canada's Food Price Report predicted an annual food expenditure for the average Canadian family. This year, recognizing the diversity of Canadian families, we are providing average food expenditure by individual consumer based on age and gender. This allows the reader to construct the household or family that best reflects their own reality. **We are also using a new food basket, excluding food service** altogether even though we are still providing a forecast for menu prices.

For example, based on a family that includes a man (age 31–50), woman (age 31–50), boy (age 14–18) and girl (age 9–13), the annual food expenditure is predicted to be **\$13,907** in 2021, which would be an increase of **\$695** (5%) compared to 2020, excluding food service. In dollars, that is the highest predicted increase by Canada's Food Price Report. The food inflation rate in 2021 is likely to outpace the general inflation rate.

2020 experienced the unprecedented COVID-19 global pandemic. The pandemic affected the entire agri-food chain from farmgate to consumers. It caused border and facility closures, shifted consumer demand from food service to food retail and created unemployment and underemployment. It also introduced modifications in production, manufacturing, distribution and retailing practices to accommodate enhanced safety procedures, from testing of personnel to additional time for sanitizing. The repercussions and uncertainty of the pandemic continue to impact the global economy. This year also saw an oil price war and devaluation of the Canadian dollar, which impacted food prices.



In 2021, we can expect to feel the continued effect of COVID-19 on our agri-food chain and global food systems, in addition to the growing impact of climate change. We can also expect to see adaptations in the agri-food chain based on lessons learned from the pandemic, for example, the growth in e-commerce platforms and online services. Other notable events to watch in the food industry in 2021 include the continuing loss of the food manufacturing sector, the national ban on some single-use plastics, continued actions to mitigate the effects of climate change, and the impact of the U.S. presidential election outcome on food policy and on our currency. The 2021 projections of price changes by province are shown in the table below.

2020 PROVINCIAL BREAKDOWN OF FOOD PRICES

Province	2020 Changes ¹	2021 Forecasts ²
Alberta	↓	↓
British Columbia	↑	↑
Manitoba	↓	↓
New Brunswick	↓	↑
Newfoundland and Labrador	↓	↑
Nova Scotia	↑	↑
Ontario	↑ ³	↓
Prince Edward Island	↑ ⁴	↑
Saskatchewan	-	↓
Quebec	-	-

OVERVIEW OF 2019: HOW WE DID

The 2019 forecasts were accurate except for bakery, dairy and meat, but we missed these categories by no more than 0.2%. Price increase predictions for these categories were lower than what was observed.

- 1 (↑) Expected above-average food price increase, (↓) Expected below-average food price increase, (-) Expected average food price increase. Lower confidence intervals at the provincial level.
- 2 (↑) Expected above-average food price increase, (↓) Expected below-average food price increase, (-) Expected average food price increase. Lower confidence intervals at the provincial level.
- 3 Second highest food inflation rate in country in 2020.
- 4 Highest food inflation rate in country in 2020.

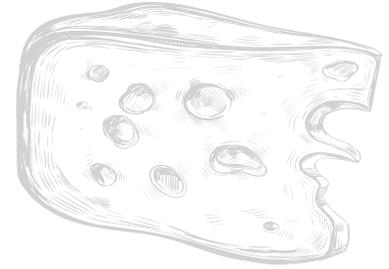


FIGURE 1: 2020 YTD FORECAST RESULTS

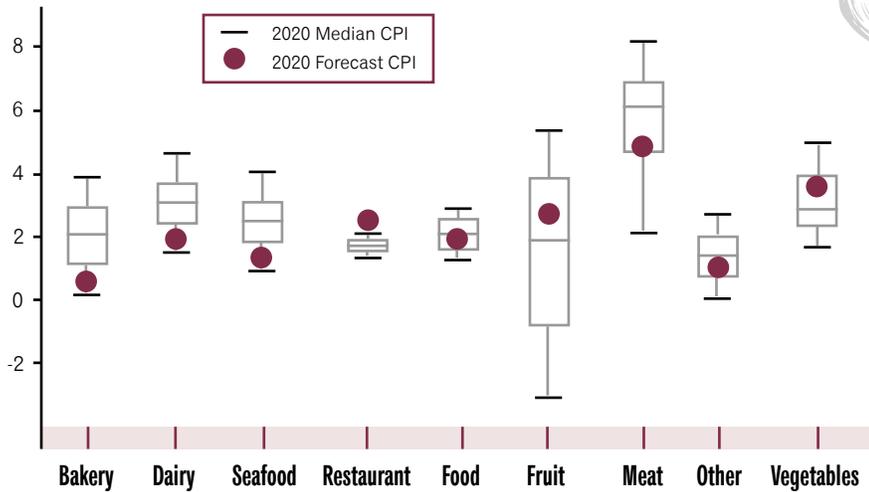


TABLE 1: 2020 FOOD PRICE RESULTS

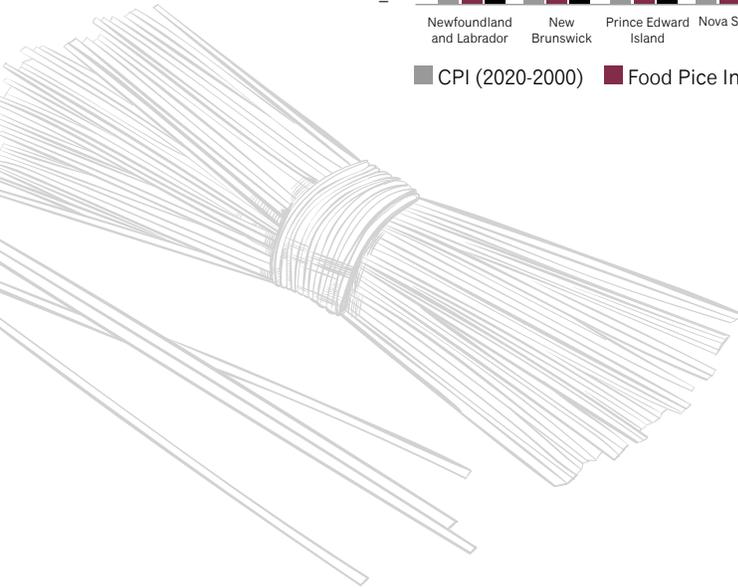
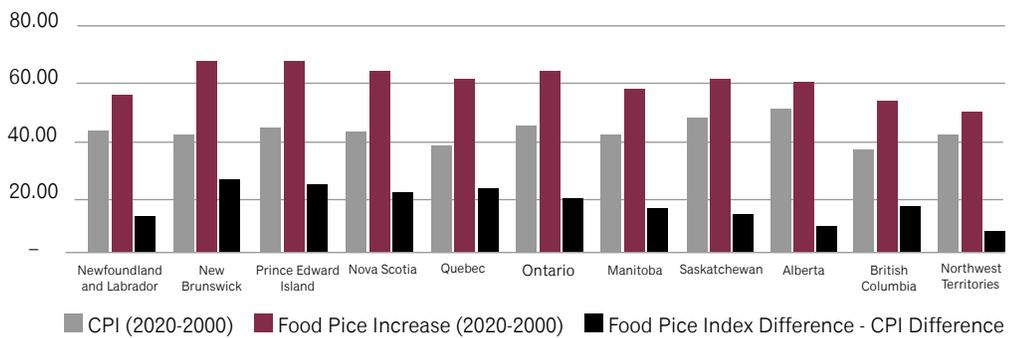
Categories	Anticipated Increase for 2020	Results (Oct. '19 to Sept '20)
Bakery	0% to 2%	2.2%
Dairy	1% to 3%	3.1%
Fruits	1.5% to 3.5%	1.8%
Meat	4% to 6%	6.1%
Other	0% to 2%	1.8%
Restaurants	2% to 4%	2.1%
Seafood	2% to 4%	2.6%
Vegetables	2% to 4%	2.4%
Total Food Categories Forecast	2% to 4%	2.7%

For meat, especially, the increase in price significantly outpaced the 2019 forecast. Price increases in the bakery category could be explained by rising wheat futures. Seafood depends on two distinct supply chains: aquaculture and wild capture. The aquaculture supply chain has experienced a lot of volatility, particularly with our reliance on Asia for aquaculture imports.

«
The food inflation index has outpaced the general inflation index over the last 20 years, and that trend is likely to continue for a while.
 »

It is important to note that, overall, the food inflation index has outpaced general inflation over the last 20 years in Canada (see Figure 2). The typical grocery bill for Canadians has risen approximately 170% over the last two decades.⁵ This means that, over the last 20 years, Canadian households—especially those in Eastern Canada—have been spending a greater proportion of their household budgets on food.⁶ Historically, the food component of household expenditure has been less than 10% as opposed to the 1970s when it was over 20%.

FIGURE 2: CONSUMER PRICE INDEX COMPARED TO FOOD PRICE INDEX (2000–2020)



5 Charlebois, S. (2020, September 23). Noticed your grocery bill seems to be getting higher? Here's why. Retail Insider. <https://www.retail-insider.com/retail-insider/2020/9/noticed-your-grocery-bill-seems-to-be-getting-higher-heres-why>

6 Charlebois, S. (2020, September 27). Column: Your grocery bill is rising and COVID-19 will only make it worse. The Sudbury Star. Retrieved from <https://www.thesudburystar.com/news/local-news/column-your-grocery-bill-is-rising-and-covid-19-will-make-it-worse>

COVID-19

While there is no evidence that COVID-19 can be transmitted from food or food contact surfaces,⁷ the pandemic has posed major challenges to the global food system and Canadian agri-food supply chains—from farmgate to consumer. COVID-19 has resulted, for example, in shifts in consumer demand, slowdowns and closures of food plants and distribution centres, labour shortages and logistics disruptions. Despite national assurance that our food supply remains safe and stable, the ability of the food chain to successfully adapt to challenges and disruptions and whether the pandemic continues into 2021 will determine the potential for food insecurity⁸ and the extent of food price increases.

COVID-RELATED FACILITY AND SAFETY MEASURES

Challenges for growers/farmers and food processors in the Canadian agri-food supply chain have resulted from the increased safety protocols and preventive measures to fight the spread of COVID-19. Disruptions in the food supply chain—resulting from closures of borders and facilities—have caused temporary shortages of food and/or higher prices for some products. National border closures did not stop the flow of food, but did pose challenges to growers who are reliant on migrant labour—or temporary foreign workers—during their harvest seasons, and food processors who rely on imported raw materials.⁹ Border closures to migrant labour were short-lived; in April 2020, the Canadian government issued exemptions to temporary foreign workers from COVID-related travel restrictions. The Canadian government also provided financial aid for farmers to cover the wages and living costs of workers during the mandatory two-week self-isolation period.¹⁰ The pandemic shed light on the poor working conditions and treatment of migrant

7 Canadian Food Inspection Agency. (2020). Coronavirus (COVID-19): information for consumers about food safety and animal health. <https://www.inspection.gc.ca/covid-19/information-for-consumers-about-food-safety-and-an/eng/1584648921808/1584648922156>

8 Holland, K. L. (2020). Canada's Food Security During the COVID-19 Pandemic. University of Calgary: The School of Public Policy, 13(13). <https://www.policyschool.ca/wp-content/uploads/2020/06/Food-Security-Holland.pdf>

9 Hailu, G. (2020). Economic thoughts on COVID-19 for Canadian food processors. Canadian Journal of Agricultural Economics, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264577/>

10 Holland, K. L. (2020). Canada's Food Security During the COVID-19 Pandemic. University of Calgary: The School of Public Policy, 13(13). <https://www.policyschool.ca/wp-content/uploads/2020/06/Food-Security-Holland.pdf>

«
The
food industry's
performance during the
pandemic so far has been nothing
short of a miracle. We should
be thankful to everyone
involved.
»

workers in Canada as the virus spread rapidly through a number of farms, resulting in some deaths.¹¹

The meat processing sector also faced challenges because of COVID-19–related closures. Relatively high requirements for manual labour and close physical working conditions common in meat processing facilities means the virus has the potential to spread quickly. With increased safety measures (e.g., physical distancing), processing plants were operating below regular capacity and efficiency. In worst-case scenarios, whole plants faced shutdown, for example, Cargill's High River Facility in Alberta¹² and Olymel in Yamachiche, Vallée-Jonction and Princeville in Quebec.¹³ These shutdowns resulted in a large temporary backlog of animals on Canadian farms.¹⁴

SHIFT FROM FOOD SERVICE TO FOOD RETAIL

Declared states of emergency and shutdowns in Canadian provinces had a significant impact on the food service industry as restaurants were forced to close and Canadians were asked to stay home. The mass closure of restaurants across the country resulted in increased consumer demand for food retail. The financial impact on the food industry was significant as more people worked from home and potentially outside urban cores. Before the pandemic, the food retail/service ratio stood at 62/38. In other words, 62% of food budgets were spent on food retail, and 38% on food service. Monthly food retail sales in Canada were approximately \$7.7 billion, versus \$5.3 billion for food service, according to StatCan. In May 2020, the last month before restaurants started to re-open, the ratio went to 91/9, with food retail generating \$7.8 billion in sales in May 2020 versus \$891 million in food service. Despite new sanitary measures, we believe the ratio is currently 74/26, approximately, but we do not expect that in 2021 it will return to near where it was

- 11 Beaumont, H. (2020, July 20). Coronavirus sheds light on Canada's poor treatment of migrant workers. *Globe and Mail*. Retrieved from <https://www.theguardian.com/world/2020/jul/20/canada-migrant-farm-workers-coronavirus>
- 12 Holland, K. L. (2020). *Canada's Food Security During the COVID-19 Pandemic*. University of Calgary: The School of Public Policy, 13(13). <https://www.policyschool.ca/wp-content/uploads/2020/06/Food-Security-Holland.pdf>
- 13 Hailu, G. (2020). Economic thoughts on COVID-19 for Canadian food processors. *Canadian Journal of Agricultural Economics*, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264577/>
- 14 Glen, B. (2020, August 27). Plants whittle down COVID backlog. *The Western Producer*. Retrieved from <https://www.producer.com/2020/08/plants-whittle-down-covid-backlog/>

before COVID. As such, many companies are pivoting, using e-commerce and recalibrating their portfolio of channels and products.¹⁵

Grocers had to quickly adapt to the changing circumstances. The shift in consumer demand from food service to food retail also had an impact on food distributors. For example, produce intended for restaurants was wasted;¹⁶ surplus food initially intended for restaurants was redirected to retailers;¹⁷ foods were repackaged for food retail rather than food service; and there was reduced bulk demand.¹⁸ Still, supply chains geared to food service were not always easily adaptable to the food retail market in terms of distribution and packaging.¹⁹

SHIFTING CONSUMER DEMANDS

In addition to the shift in demand from food service to food retail, other interesting consumer trends came to light in the early stages of the pandemic, for example, panic buying and hoarding behaviour. Although it was short-lived, Canadians emptied shelves of goods such as tuna, pasta, soup, peanut butter, flour, rice, and frozen fruits and vegetables.²⁰ Sales of these items increased immensely, for example, rice sales in mid-March 2020 increased by 239% compared to mid-March 2019.²¹

While panic buying and hoarding represent only a brief moment in time, a shift in consumer demand for online grocery services will likely have longer-lasting effects. Despite grocers' increased investment in e-commerce platforms over the years, surges in demand for online grocery shopping due to COVID-19 caused existing infrastructure to struggle—for example,



«
COVID-19 has
made our entire food
supply chain more open
and, frankly, more democratic.
With e-commerce, most agri-food
companies, from farm to retail,
now have equal access
to consumers.
»

15 <https://www.dal.ca/sites/agri-food/research/restaurants-post-covid-19.html>

16 New Food Magazine. (2020). How is Canada's Food Industry Coping with COVID-19? <https://www.newfoodmagazine.com/article/109402/canada-covid19/>

17 Goodard, E. (2020). The impact of COVID-19 on food retail and food services in Canada: Preliminary assessment. *Canadian Journal of Agricultural Economics*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264603/>

18 Shaw, R. (2020, April 7). B.C. farms dumping milk because of problems getting it to the store. *Vancouver Sun*. Retrieved from <https://www.timescolonist.com/news/local/b-c-farms-dumping-milk-because-of-problems-etting-it-to-the-store-1.24114195>

19 Hobbs, J. E. (2020). Food supply chains during the COVID-19 pandemic. *Canadian Journal of Agricultural Economics*. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264576/>

20 Donnelly, A. (2020, March 3). Coronavirus fears: Empty shelves as Canadians heed health minister's advice to stock up. *National Post* Retrieved from. https://nationalpost.com/news/canada/coronavirus-canada-stockpiling?video_autoplay=true

21 Statistics Canada. (April 2020). Canadian Consumers Prepare for COVID-19. Retrieved from <https://www150.statcan.gc.ca/n1/pub/62f0014m/62f0014m2020004-eng.htm>





COVID-19

*made us realize
that many whose jobs
are too important to shut down
are the ones making the least money.
Grocers could potentially afford to
pay employees more as their
business model is slowly
changing.*



Wait times at grocery stores for a pickup slot were sometimes over a week.²² Grocers scrambled to hire more employees and increased wages to meet increased consumer demand for food retail and to retain frontline employees.²³

In early March 2020, large grocery chains like Sobeys, Loblaws and Metro implemented a “hero pay” program. This provided an additional \$2 per hour in pay for frontline staff, along with a \$50 bonus per week.²⁴ The premium ended in June 2020, triggering much public criticism.²⁵ COVID-19 and shifting consumer demands for food retail brought to the forefront the importance of frontline grocer workers who are also some of the lowest paid workers in Canada.

GROWING INCOME AND FOOD INSECURITY

COVID-19 has resulted in increased income insecurity as many Canadians found themselves either unemployed or underemployed. Income insecurity is a key factor in food insecurity. During the height of the first wave of the pandemic, between February and April 2020, Statistics Canada reported that 5.5 million Canadians had been impacted by either job loss or reduced hours. Some of the largest employment declines took place in sectors that are more frequently characterized by low-wage and precarious work, for example, accommodation and food services, and retail.²⁶ Workers in these sectors are already more likely to experience income and food insecurity in normal circumstances and with an overrepresentation of women

- 22 Goodard, E. (2020). The impact of COVID-19 on food retail and food services in Canada: Preliminary assessment. Canadian Journal of Agricultural Economics. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264603/>
- 23 Wilson, J. (2020, March 23). Walmart Hires 10000 workers amid COVID-19. Canadian HR Reporter. Retrieved from <https://www.hrreporter.com/focus-areas/payroll/walmart-hires-10000-workers-amid-covid-19/327795>
- 24 Edmiston, J. (2020, March 23). ‘We will not spare any expense’: Big grocers move to boost pay for front-line workers. Financial Post. Retrieved from <https://financialpost.com/news/we-will-not-spare-any-expense-big-grocers-move-to-boost-pay-for-front-line-workers>
- 25 Chase, S. (2020, July 10). Grocery executives defend decision to cut \$2-per hour ‘hero’ pay for workers. The Globe and Mail. Retrieved from <https://www.theglobeandmail.com/politics/article-grocery-executives-defend-decision-to-cut-covid-19-pay-premiums-for/>
- 26 Statistics Canada. (2020). COVID-19 and the labour market in April 2020. Retrieved from <https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2020034-eng.htm>

and racialized populations in these sectors, a disproportionate impact of income insecurity is felt by these groups.²⁷

The Canadian government introduced the Canada Emergency Response Benefit (CERB) to mitigate the financial hardship of Canadians who lost their income. Grocery sales saw sharp upticks (40%) in March 2020, which appeared to be directly linked to the implementation of CERB.²⁸ Canadian food banks reported steep increases in demand for services early into the pandemic, anywhere from 20% to 50% in certain areas.²⁹ Under the Food Policy for Canada's Local Food Infrastructure Fund, the federal government announced \$100 million in emergency funding for food banks and other organizations that facilitate accessibility to food for food-insecure families impacted by COVID-19.³⁰ Despite efforts by the federal government to mitigate the financial hardships resulting from COVID-19, almost one in seven Canadians reported to Statistics Canada in May that they had experienced food insecurity in their household during the previous month, with 2% reporting the most severe type of food insecurity, and these are likely conservative numbers.³¹

«
Food insecurity levels are likely to increase across the country in 2021.
»



- 27 Scott, K. (2020). COVID-19: The great revealer. Canadian Centre for Policy Alternatives. Retrieved from <https://www.socialwatch.org/node/18533>
- 28 Statistics Canada. (2020). Canadian Consumers Adapt to COVID-19: A Look at Canadian Grocery Sales Up to April 11 .Retrieved from <https://www150.statcan.gc.ca/n1/daily-quotidien/200511/dq200511a-eng.htm>
- 29 Badets, N. (June 2020). Food insecurity and family finances during the pandemic. The Vanier Institute of Family. Retrieved from <https://vanierinstitute.ca/food-insecurity-and-family-finances-during-the-pandemic/>
- 30 Agriculture and Agri-Food Canada. (2020). Emergency Food Security Fund. Retrieved from <https://www.agr.gc.ca/eng/agricultural-programs-and-services/emergency-food-security-fund/?id=1585855025072>
- 31 Statistics Canada. (June 2020). Food insecurity during the COVID-19 pandemic, May 2020. Retrieved from <https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00039-eng.htm>

CANADIANS' CHANGING RELATIONSHIP TO FOOD

In addition to the major challenges COVID-19 has posed to the agri-food supply chain and Canadians' financial and food security, it has had notable impacts on Canadians' relationship to food and their food choices.

Especially during the height of the first wave of the pandemic in early 2020, most Canadians were spending much of their time at home. An important study carried out by the University of Guelph examined whether Canadians' eating habits had changed since staying home. Results showed that 60% reported making more meals from scratch, 70% spent more time cooking, 55% ate more meals with children and 50% involved their children in meal preparation more often. Participants also reported changes in eating behaviours like eating more food overall, eating more snack food and eating less fast food or takeout.³²

«
Our
relationship with food
has changed as we cooked
and gardened more this year
than since the 1970s.
»

It is uncertain what impact the pandemic is having on household food waste. Spending more time at home and eating more meals at home may mean more food is wasted. A recent study showed that Canadians could be generating 13.5% more food waste (unavoidable and avoidable) since the start of the pandemic. It is uncertain whether more food waste will be generated over time, as some respondents believed they were actually wasting less compared to before the pandemic. Respondents noted that they were eating leftovers more often and looking through their cupboards or refrigerator more often to reduce their food waste.³³

One in five Canadians started home gardens this year, with two-thirds of new gardeners being significantly influenced by COVID-19. While most home gardeners do not grow all of the produce they consume, the decision to grow their own food could be related to increasing concern with food supply chains and food shortages. About 53% of Canadians surveyed remain concerned about food supplies.³⁴

32 Carroll, N., Sadowski, A., Laila, A., Hruska, V., Nixon, M., Ma, D.W.L., & Haines, J. (2020). The impact of COVID-19 on health behaviour, stress, financial and food security among middle to high income Canadian families with young children. *Nutrients*, 12(2352).

33 Agri-Food Analytics Lab. (2020). Household Organic Food Waste-COVID-19. Retrieved from <https://www.dal.ca/sites/agri-food/research/household-organic-food-waste---covid-19.html>

34 Agri-Food Analytics Lab. (2020). Home Food Gardening During COVID-19. Retrieved from <https://www.dal.ca/sites/agri-food/research/home-food-gardening-during-covid-19.html>

REVISITING LOCAL FOOD SUPPLY CHAINS

The local food movement has always been important to Canadians. However, COVID-19 has sparked renewed interest in local food supply chains, food autonomy and whether there are possibilities for viable local alternatives in food supply chains. Many consumers reported they had shopped locally in their own communities during the pandemic, to support small business and also because locally sourced food supply chains—especially in-season fresh produce—are less susceptible to border closures, trade disputes and facility closures due to labour shortages.³⁵ Both the pandemic and climate change impacts (e.g., California wildfires) have served as reminders of the importance of sustainable alternatives to food imports.³⁶ A recent study suggests that 4 in 5 Canadians are willing to pay extra for “locally grown” produce,³⁷ and an October study on consumer habits and perceptions in Nova Scotia found that 95.6% of respondents reported shopping at farmers’ markets over the past 12 months. The main reasons stated were to “support local” (89%) and because of the “quality of products” (81.5%). E-commerce also played a role in shopping at farmers’ markets during the pandemic; over half of respondents shopped online at farmers’ markets or farm websites and 73% reported that they would continue to do so after the pandemic.³⁸

LOW OIL PRICES AND THE CANADIAN DOLLAR

Both low oil prices and the low Canadian dollar affected food prices in 2020, and the two are inextricably linked. This year saw an oil price war between Russian and Saudi Arabia, resulting in lower energy and distribution costs for food products. However, because of the link to oil and importance of the oil industry in Canada, the Canadian dollar saw its lowest level in many years. A weak Canadian dollar affects the buying power of importers, meaning imported items likely cost more for the consumer.³⁹ Energy costs, though, have been lowered.

-
- 35 Hobbs, J. E. (2020). Food supply chains during the COVID-19 pandemic. *Canadian Journal of Agricultural Economics*. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7264576/>
- 36 Charlebois, S. (2020, Sept. 15). As California burns, so does our winter lettuce. *New Food*. <https://www.newfoodmagazine.com/article/119890/as-california-burns-so-does-our-winter-lettuce/>
- 37 Agri-Food Analytics Lab. (2020). COVID-19 Food Autonomy. Retrieved from <https://www.dal.ca/sites/agri-food/research/covid-19-food-autonomy.html>
- 38 Bryan, C., Fitting, E., Foster, K. (October 2020). Farmers’ markets, community supported agriculture & the local food system in Nova Scotia: A snapshot of consumer habits and perceptions. Dalhousie University.
- 39 Charlebois, S. (2020, March 12). How COVID-19 and the oil price war could lead to cheaper food in Canada. *Retail Insider*. Retrieved from <https://www.retail-insider.com/retail-insider/2020/3/how-covid-19-and-the-oil-price-war-could-lead-to-cheaper-food-in-canada>

CANADA'S FOOD PRICE REPORT: 2021 FORECAST

METHODOLOGY

In the 11th edition, Canada's Food Price Report uses predictive analytics models applying machine learning to support the analytical process of determining the future of food prices. The report, a collaborative effort by Dalhousie University, the University of Guelph, the University of Saskatchewan and the University of British Columbia, continues to focus on food prices in Canada while giving insights into industry trends. Dalhousie University's predictive analytics capabilities through the Faculties of Agriculture, Management and Computer Science have been applied to build the forecasts. The University of Guelph's Centre for Advancing Responsible and Ethical Artificial Intelligence, known for its commitment to the agri-food sector, contributed to the analysis of prices using machine learning predictive analysis for the different categories of food and predicting the 2020 CPI changes. All four institutions provided public policy and business expertise to enhance the report. Three models were developed that consist of a machine learning approach to forecasting Canada's food prices in 2021: Autoregressive Integrated Moving Average (ARIMA); Recurrent Neural Network (RNN); and Ridge-Regularized Linear Regression Model.

«
For the first time, four universities are behind this year's report, combining knowledge and expertise from world-class institutions.
»

RECURRENT NEURAL NETWORK MODEL

A Recurrent Neural Network (RNN) was created using Keras' SimpleRNN function. The hyperparameters of this base model were first "trained" using the Canadian Consumer Price Index (CPI) for meat from September 1978 to June 2020. It was found that training on 360 months of CPI data and using 12 months of data to predict the future CPI value (label) with one to 12 months delay, yielded the best overall accuracy over our 36-month validation period. The model was adjusted to include two layers following the RNN: a dense layer of 10 nodes and a second dense layer with a single output node. Starting with this base model for each of eight food categories, potential data sets (features) were then investigated one at a time, identifying the correlation between feature and label and whether inclusion of

the feature improved the validation accuracy. Once identified, these features were included in the training data one at a time in order of impact until there was no improvement in validation accuracy. The result was a unique model for each food category consisting of its own training data set. The models were then retrained on these data sets from September 1989 to August 2019, using data from September 2019 to August 2020 to predict monthly labels for September 2020 to August 2021 for each food category.

RIDGE-REGULARIZED LINEAR REGRESSION MODEL

Data used to fit this forecasting model were obtained from Statistics Canada and the Federal Reserve Economic Data (FRED) database. From StatCan, we used historical CPI values for the eight food categories considered throughout this report as dependent variables and as lagged independent variables. From FRED, we used 14 sources of economic data from Canada and the United States that cover currency exchange rates, energy prices, market indices, unemployment rates, housing costs and other food and non-food consumer prices. Data are provided at either daily or monthly frequencies; we resampled all data to mean monthly observations where applicable. Before modelling, we then year-over-year differenced the data and standardized the independent variable observations. Differencing is an important step in linear modelling to promote stability, and standardization is a scaling technique that makes it easier to interpret the relationships between independent variables in models. Finally, all data were separated into training and validation sets: 80% of historical data were used to fit models and the most recent 20% of data were used both to evaluate model accuracy and to select the most accurate models. Using this strategy, and like any other forecasting technique, we assume that past patterns in the data are useful for predicting future patterns.

All forecasts were generated using ensembles of ridge-regularized linear regression models for direct forecasting. Ensembling is a commonly used technique in machine learning that aggregates the output of multiple contributing models. Regularization is also commonly used in machine learning to constrain model complexity. Direct forecasting is a technique for generating predictions over fixed



«
*A combination
of several methods
has allowed advisors
access to optimal machine
learning models and
analytics.*
»

time windows. To produce 18-month forecasts, 18 underlying models were fit, one for each monthly horizon. In general, ensembling and regularization improve the accuracy of predictions by ensuring that forecasts are produced with multiple perspectives considered using models less likely to have overfit the data. For this report, forecasts were generated by considering the mean and variance of the 10 most accurate contributing models that were identified via iterative experimentation. These contributing models could differ in their selection of independent variables, lag period, and regularization parameter. Overall, we found these forecasts to be reasonably accurate when compared against actual CPI values from 2015 to the present, with mean absolute errors ranging from 0.4 to 2.2 CPI point.

2021 MACROECONOMIC FACTORS AND DRIVERS

The report considers multiple macroeconomic factors impacting the global landscape, the food and agricultural sector and Canada as a whole. Climate change, geopolitical conflicts, energy, material, inflation, currencies, trade deals, food retail and manufacturing figures, consumer debt and expenditures, and of course the COVID-19 global pandemic influence our forecasts for 2021 food prices in Canada. As the pandemic disrupts our lives, climate change continues unabated. The year 2020 saw record and worsening heat, ice loss, wildfires, floods and droughts.⁴⁰ Furthermore, Canadian food prices may face risks from macro-level drivers such as trade relations, nationalist agri-food policies, currency fluctuations, food price inflation and under- and unemployment.



40 World Meteorological Organization. (2020). United in Science: A multi-organizational high-level compilation of the latest climate science information. Retrieved from https://public.wmo.int/en/resources/united_in_science

TABLE 2 – MACROECONOMIC DRIVERS FOR CANADA'S FOOD PRICES IN 2021

Variables	Categories	Impact ⁴¹	Price Effects ⁴²	Likelihood ⁴³
Macro-Level	Climate Change	Very Significant	Variable	Very Likely
	Geopolitical Risks	Very Significant	Variable	Very Likely
	Input Costs	Significant	Increase	Likely
	Energy Costs	Moderate	Decrease	Likely
	Inflation	Moderate	Increase	Likely
	Currencies and Trade Environment	Significant	Increase	Very Likely
	COVID-19	Significant	Increase	Likely
Sectoral-Level	Food Retail and Distribution	Significant	Increase	Very Likely
	Food Processing Figures	Very Significant	Increase	Likely
	Policies and Regulations	Moderate	Increase	Very Likely
	Consumer Awareness and Trends	Moderate	Decrease	Likely
Domestic-Level	Consumer Indebtedness	Very Significant	Decrease	Very Likely
	Consumer Disposable Income	Very Significant	Decrease	Very Likely

We do not expect the outcome of the U.S. election and a Biden-led administration coupled with a Republican-controlled Senate to have much of an impact on trade and foreign policies affecting Canada. America will continue to be influenced by an agenda to support a nationalistic economy. The price of some inputs like wheat and canola could also impact the cost to process food and could influence prices at retail. Our Canadian dollar could potentially weaken in 2021 because of a much higher level of central bank assets due to COVID-19 and the financial support needed for some socio-economic measures taken by Ottawa. The price of oil on

41 Varying between Insignificant, moderate, significant and very significant.

42 Varying between Decrease, variable and increase.

43 Varying between Unlikely, likely and very likely.



A perhaps more predictable Biden-led administration and a Republican-controlled Senate won't change things for Canadians. If anything, due to increasing nationalistic tensions, trading conditions will continue to be challenging.



the other hand will likely remain depressed, which could also increase the cost of imported goods.

While unemployment has slowly been returning to pre-pandemic levels,⁴⁴ we can expect further unemployment and under-employment of Canadians due to COVID-19, especially given the predicted second wave of the virus. The household debt ratio dropped to 158% of disposable income between April and June, down from 175%, though this is likely due to increased motivation to save and increased government income-support measures as a result of the pandemic.⁴⁵ Given its prevalence in our contemporary society, personal debt should be considered a growing factor in families' budgets, disposable income and financial wellbeing. Many measures of income, socioeconomic status and poverty continue to exclude debt servicing, making these measures somewhat incomplete and inefficient,⁴⁶ especially when income used to service debts cannot be spent on other goods and services, for example, food.

FOOD PRICE FORECAST BY PROVINCE

The Atlantic region will continue to be highly vulnerable to many systemic variables as most production and processing of food is done outside the region. Prince Edward Island experienced the highest increase in food prices in 2020. Most Atlantic provinces will continue to experience above-average increases, except for New Brunswick where prices have increased significantly already over the last decade.

44 Statistics Canada. (2020, October 9). Labour Force Survey, September 2020. Retrieved from <https://www150.statcan.gc.ca/n1/daily-quotidien/201009/dq201009a-eng.htm>

45 The Canadian Press. (2020, September 11). Statistics Canada says key household debt-to-income ratio fell in Q2. The Star. Retrieved from <https://www.thestar.com/business/2020/09/11/statistics-canada-says-key-household-debt-to-income-ratio-fell-in-q2.html>

46 Scott, R. & Pressman, S. (2013). Household debt and income distribution. *Journal of Economic Issues*, 47(2): 323-332.

TABLE 3: 2020 PROVINCIAL BREAKDOWN OF FOOD PRICES

Province	2020 Changes ⁴⁷	2021 Forecasts ⁴⁸
Alberta	↓	↓
British Columbia	↑	↑
Manitoba	↓	↓
New Brunswick	↓	↑
Newfoundland and Labrador	↓	↑
Nova Scotia	↑	↑
Ontario	↑ ⁴⁹	↓
Prince Edward Island	↑ ⁵⁰	↑
Saskatchewan	-	↓
Quebec	-	-

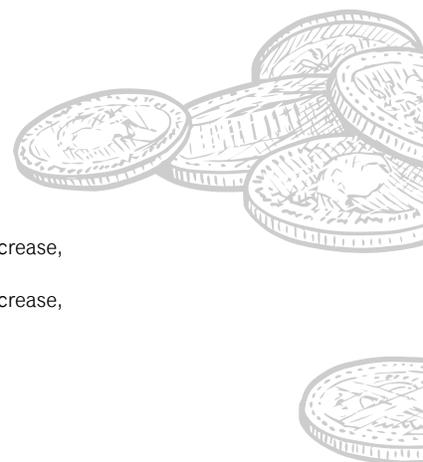
Outside the Atlantic region, due to specific regional market conditions, we are expecting British Columbia to experience higher than average price increases.

THE 2021 WATCH-LIST ITEMS

Overall, prices for all food categories could increase by up to 5% in 2021 with bakery, meat and vegetables expected to see the biggest increases. Predicted bakery price increases are related to the increase in wheat futures. While, COVID has created a lot of volatility in the meat industry.

To reflect the diversity of Canadian households, this year Canada's Food Price Report predicts annual expenditure increases based on individual consumers of different genders and ages (see Table 5). This allows Canadians to estimate their potential food expenditures based on their own situation. Food expenditure predictions based on individual consumers also reflect the growing reality of Canadian households. Statistics Canada reported in 2019 that one in six adult Canadians now live alone, making one-person households the most common

- 47 (↑) Expected above-average food price increase, (↓) Expected below-average food price increase, (-) Expected average food price increase. Lower confidence intervals at the provincial level.
- 48 (↑) Expected above-average food price increase, (↓) Expected below-average food price increase, (-) Expected average food price increase. Lower confidence intervals at the provincial level.
- 49 Second highest food inflation rate in country in 2020.
- 50 Highest food inflation rate in country in 2020.



household type for the first time in recorded Canadian history.⁵¹ Our predictions show that in 2021, for example, a man⁵² aged 31–50 years old can expect to pay \$169.49 more for food compared to 2020. A woman of the same age can expect to pay \$152.08 more.

TABLE 5: PREDICTED FOOD EXPENDITURES FOR INDIVIDUAL CONSUMERS 2021

Demographics	Total Annual Cost	
Child	6-11 Months	\$2,548.73
	1-3 Years	\$2,016.38
Boy/Man	4-8 Years	\$2,630.63
	9-13 Years	\$3,386.88
	14-18 Years	\$3,973.79
	19-30 Years	\$3,739.56
	31-50 Years	\$3,559.37
	51-70 Years	\$3,457.31
	70+ Years	\$3,323.00
Girl/Woman	4-8 Years	\$2,519.50
	9-13 Years	\$3,180.49
	14-18 Years	\$3,302.21
	19-30 Years	\$3,256.34
	31-50 Years	\$3,193.60
	51-70 Years	\$3,126.94
	70+ Years	\$2,990.99

53

Table 6 provides examples of different household compositions and their predicted annual food expenditure for 2021. Using these calculations, based on a family comprising a man (age 31–50), woman (age 31–50), boy (age 14–18) and girl (age 9–13), the annual food expenditure is predicted to be \$13,907 in 2021. This represents an increase of up to \$695, compared to 2020.


\$695
for a family of four, including a man, a woman and two children, is the highest increase we have forecasted to date.

51 Tang, J., Galbraith, N., & Truong, J. (2019). Living alone in Canada. Statistics Canada. Retrieved from <https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2019001/article/00003-eng.pdf?st=rarUI5c1>

52 While recognizing the fluidity and multiplicity of gender identities, for the purpose of the exercise we have included two genders based on biological needs.

53 Calculated with data from the Montreal Diet Dispensary: <https://www.dispensaire.ca/app/uploads/Co%C3%BBt-PPN-base-FR-septembre2020.docx.pdf>

TABLE 6: EXAMPLES OF CANADIAN HOUSEHOLDS AND PREDICTED ANNUAL FOOD EXPENDITURE 2021

Household Demographics	Total Food Expenditure 2021
Four People: Man (31-50), Woman (31-50), Boy (14-18), Girl (9-13)	\$13,907.25
Three People: Woman (19-30), Boy (4-8), Child (1-3)	\$7,903.35
Four People: Two Women (31-50), Girl (14-18), Boy (9-13)	\$13,076.29
Two People: Man (51-70), Woman (51-70)	\$6,584.25
Six People: Woman (70+ Years), Man (31-50), Woman (31-50), Girl (9-13), Boy (4-8), Child (6-11 Months)	\$18,103.81

⁵⁴, ⁵⁵

There are some important limitations of the data presented in Tables 5 and 6. Food expenditures presented are calculated based on data that assume a family only cooks at home and has no food service costs. The data are also based on 5% food waste and do not account for specialized diets or fees for the ever-growing trend of online food retail. Therefore, these numbers are likely conservative and don't necessarily reflect the reality of all Canadians' eating habits.



⁵⁴ Calculated with data from the Montreal Diet Dispensary: <https://www.dispensaire.ca/app/uploads/Co%C3%BBt-PPN-base-FR-septembre2020.docx.pdf>

⁵⁵ Calculations do not include ungendered Canadians.



WHAT TO EXPECT IN 2021

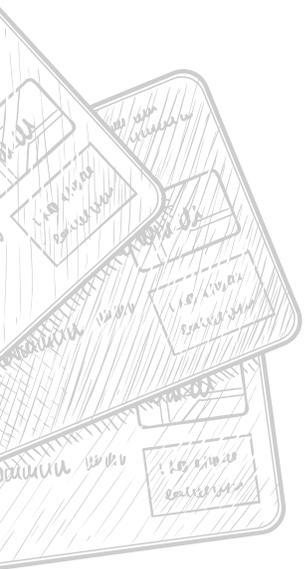
COVID-19 AND CHANGING TRENDS IN FOOD SUPPLY CHAIN

With sustained uncertainty about the COVID-19 pandemic, we can expect that the virus will continue to impact the food industry and food prices in 2021. However, the agri-food supply chain has learned valuable lessons from the first wave of COVID and may be more adaptable to challenges posed by subsequent waves.

SUSTAINED CONSUMER DEMAND AND INVESTMENT IN E-COMMERCE

We can expect Canadian families to spend less on food service in 2021 as subsequent waves of COVID-19 will likely cause shutdowns of the food service sector. While this might suggest that families will have more money in their overall food budget—even despite food price increases—this may not be the case due to the anticipated increase in, and continued demand for, online food retail and services. Given the challenges to online infrastructure during the first wave of the pandemic, grocers are investing more in their e-commerce platforms and the digitization of food retailing. Costs of these growing investments may translate to higher consumer food prices. Like food retailers, to ensure business survival in the food service industry, more restaurants can be expected to partner with online delivery apps, for example, Uber Eats and SkipTheDishes. There is also anticipated growth in consumer markets for fresh delivered meal kits in 2021, such as HelloFresh, Chef's Plate and GoodFood.

Consumer demand for online food retail services, delivery services and meal kits will result in higher overall expenditures for Canadian households given the fees to access those services. Some apps, for example Instacart, an online grocery delivery service, includes delivery fees, service fees and tip options. Consumers' household budgets will have to adapt to include the multiple fees associated with these online



services if they choose to use them. With the increasing investment in e-commerce platforms, consumers can also expect to see fewer food bargains and discounting.

Investment in e-commerce platforms isn't restricted to food retailers (e.g., grocers) and food service (e.g., restaurants). Suppliers are increasingly considering investing in e-commerce platforms with direct access to consumers—resulting in a more democratic and open food supply chain. This phenomenon may be observed all the way to the farmgate,⁵⁶ as the pandemic has resulted in consumers purchasing more food online from farms and farmers' markets, with plans to continue this behaviour after the pandemic.⁵⁷

AGRICULTURAL TRADE

Global recession is the likely outcome of the COVID-19 pandemic which will have implications for trade. Given the importance of agricultural trade to the Canadian economy, changes are noteworthy. Overall, smaller declines in demand for food products and food imports are expected compared to the expected declines in overall trade. Considering income elasticity of demand, foods like bread and cereal are expected to see smaller declines in demand than vegetables and fruits, and high-protein foods like meat. In 2021, depending on the longevity and consequences of the pandemic, the implementation of national protectionist food policies may affect agricultural trade in addition to ongoing public health restrictions.⁵⁸



«
*Delivery,
service fees and
tip options significantly
increase the cost of food if
someone has to self-isolate
or cannot leave
their home.*
»

56 Tucker, R. (2020, August 10). How COVID-19 could forever change the way Ontarians buy food. *Tvo50*. Retrieved from <https://www.tvo.org/article/how-covid-19-could-forever-change-the-way-ontarians-buy-food>

57 Dalhousie University. (2020, October). Farmers' markets, community supported agriculture & the local food system in Nova Scotia: A snapshot of consumer habits and perceptions.

58 Barichello, R. (2020). The COVID-19 pandemic: Anticipating its effects on Canada's agricultural trade. *Canadian Agricultural Economics Society*, 68: 219-224. Retrieved from <https://onlinelibrary.wiley.com/doi/epdf/10.1111/cjag.12244>



Food

manufacturing is really the centerpiece of our entire agri-food sector, which is slowly eroding because of increased fees. Without it, supporting farmers, while assuring our own food security is much more challenging.



FOOD MANUFACTURING

Canada is experiencing an increasingly weakened food manufacturing sector, which is a key element of the agri-food supply chain. Since 2012, this sector has seen the loss of 40,000 jobs due to plants closing and lack of investment. Small family-owned operations and large multinational companies alike are finding it harder to build their businesses in Canada. For example, Maple Leaf Foods recently built a \$300 million plant in the U.S. despite many of their ingredients coming from Canada. Losses in the Canadian food processing sector means that we could see more imported foods in upcoming years. This phenomenon can be partly explained by the increase in fees and costs offloaded by large grocers, like Loblaw's and Metro, onto suppliers. Grocers have justified these fees with reasons like mitigating climate change and following new packaging rules. These measures taken by big grocers not only impact food manufacturers, but smaller independent grocers too. While the major grocers offload costs to suppliers, smaller, independent grocers must continue to cover these costs themselves.⁵⁹

PLASTIC PACKAGING

Canada's Food Price Report 2020 flagged single-use plastic packaging for food products as an important issue. We anticipate this to continue into 2021 despite the COVID-19 pandemic. The Liberal government is moving forward with its national ban on various single-use plastics that will come into effect in 2021. The single-use plastics included in the ban are grocery checkout bags, straws, stir sticks, six-pack rings, plastic cutlery and food takeout containers made from hard-to-recycle plastics. Stores will be providing alternatives to customers.⁶⁰ Some provinces have already implemented plastic bag bans in 2020, for example Newfoundland, Prince Edward Island and Nova Scotia. It will be interesting to observe the extent

59 Charlebois, S. (2020, October 29). Canada's grocery industry needs a code of conduct. The Globe and Mail. Retrieved from <https://www.theglobeandmail.com/business/commentary/article-canadas-grocery-industry-needs-a-code-of-conduct/>

60 Tunney, C. (2020, October 27) Liberals' 2021 single-use plastic ban includes grocery bags, takeout containers. CBC. Retrieved from <https://www.cbc.ca/news/politics/single-use-plastics-1.5753327>



of the costs of alternative packaging offset to consumers, and how retailers and consumers perceive and adapt to these bans.

Results from a recent study show that the number of Canadians who are actively shopping for non-plastic-packaged goods has essentially not changed even despite the pandemic; however, there was a small measurable decline in concern and consumers' motivations to avoid plastics. There has also been a noticeable decline in support of stronger regulations on plastics (decline of 11% in 2020) and a ban on single-use plastics (decline of 12% in 2020).⁶¹

CONTINUED ACTION TO MITIGATE CLIMATE CHANGE

It is expected that Canadians will continue to consider the environmental impacts of their dietary choices in 2021. In recent years there has been a rise in meat-free diet trends in Canada, continuing through the COVID-19 pandemic.⁶² Plant-based dietary decisions are being increasingly motivated by growing knowledge of the impact of global food production and, more specifically, industrial meat production, on environmental degradation.⁶³ In Canada, there has been a greater adoption of Canada's Food Guide, which encourages plant-based food substitutes for a more sustainable food system. Reasons for consuming or not consuming plant-based foods include taste, price, convenience, or health and environmental gains. Beyond a focus on individual consumer motivation, there is a call for increased public education around the adoption and accessibility of plant-based diets.⁶⁴

61 Agri-Food Analytics Lab. (2020). Plastic food packaging: Before and after COVID-19. Retrieved from <https://www.dal.ca/sites/agri-food/research/plastic-food-packaging--before-and-after-covid-19.html>

62 Para, R. (2020, November 2). Halifax professor says consumers turning to plant-based diets during pandemic. The Signal. Retrieved from <https://signalhfx.ca/halifax-professor-says-consumers-turning-to-plant-based-diets-during-pandemic/>

63 Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... & Jonell, M. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447-492.

64 Kevany, K., English, M., & Viana, L. (2020). Drivers and deterrents of Canadians adopting the new Canada's Food Guide and adding plant-based foods. *Nutrients*.





Agri-Food
Analytics Lab

dal.ca/aal

 [@dalagriculture](https://twitter.com/dalagriculture)

 [/dalagriculture](https://facebook.com/dalagriculture)



uguelph.ca

 [@arrellfoodinstitute](https://twitter.com/arrellfoodinstitute)

 [@arrellfoodinstitute](https://instagram.com/arrellfoodinstitute)



SAIFood_blog

 [@stuartsmyth66](https://twitter.com/stuartsmyth66)



mfre.landfood.ubc.ca

 [@ubcMFRE](https://twitter.com/ubcMFRE)