



CANADA'S FOOD PRICE REPORT 12TH EDITION 2022



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EXECUTIVE SUMMARY

This is the 12th edition of Canada's Food Price Report, published annually by Dalhousie University and the University of Guelph. Last year, for the first time, Canada's Food Price Report welcomed the University of Saskatchewan and the University of British Columbia to the research team, strengthening both the national scope and regional expertise of the report. This year, the report continues to recognize and contend with the lingering challenges posed by COVID-19 as an unprecedented global crisis. Despite the Canadian food supply chain's resiliency and adaptability to the challenges posed by the virus, it remains unclear when the COVID-19 pandemic will end and what permanent changes to the Canadian food industry it will leave behind. Canada's Food Price Report 2022 focuses on COVID-19-related disruptions to the food supply chain while also attending to climate change and adverse weather effects, labour force challenges, high inflation and food transportation challenges.

«
For a family of four, we missed our target by \$106 this year.
»

In last year's report, our models predicted an overall food price increase of 3% to 5% in 2021. Once again, our overall forecast for 2021 was accurate in predicting price increases. It was also accurate in several food categories including fruits, restaurants and seafood. However, for some food categories our predictions were either higher or lower than the observed price change in 2021.

In recognition of the increasing diversity of Canadian families, in the 2021 report we also estimated annual food expenditures for individual consumers based on their age and gender. This approach allowed readers to construct the household and corresponding predicted annual food expenditure that best reflected their reality. In 2021, for example, we predicted an annual food expenditure of up to \$13,907 for a family of four including a man (age 31-50), woman (age 31-50), boy (age 14-18) and girl (age 9-13). In dollars, this was the highest predicted increase by Canada's Food Price Report. From what was observed in 2021, the total annual expenditure for a family with the same demographic makeup was \$13,801, **meaning a difference of -\$106 for the year.**

For 2022, the report uses the same food categories and makes the following predictions:

2022 FOOD PRICE FORECASTS

Food Categories	Anticipated Changes (%)
Bakery	5% to 7%
Dairy	6% to 8%
Fruits	3% to 5%
Meat	0% to 2%
Other	2% to 4%
Restaurants	6% to 8%
Seafood	0% to 2%
Vegetables	5% to 7%
Total Increase in Food Prices	5% to 7%

Over the last twelve years, this report has considered many market instruments and macroeconomic factors in its forecasts: financial indicators, recession signals, currencies and Canada-specific information. The 2022 report forecasts that overall food prices will increase by 5% to 7%. This report maintains the same approach as last year and shows predicted annual food expenditures by individual consumer based on their age and gender. This year we are adding two new consumer categories to the report: pregnant women and nursing women.

This year we are predicting, for example, that a family of four, including a man (age 31-50), woman (age 31-50), boy (age 14-18) and girl (age 9-13) will have an annual food expenditure of up to \$14,767, an increase of up to \$966 from what was observed as the total annual cost in 2021.

In 2021, Canada's food supply chain experienced logistical disruptions due to the ongoing COVID-19 pandemic, as public health-mandated lockdowns and stay-at-home orders continued during the third and fourth waves of the virus—with some regions and provinces more deeply affected than others. In 2021, the general inflation rate was the highest since the early 2000s, driven by high oil costs, high housing costs and rising food prices. The food supply chain faced many challenges due to high transportation costs and reduced maritime transport capacity. Labour force challenges were experienced

«
Our 2022
forecast predicts the
highest increase in both
percentage and dollars
in 12 years.
»



throughout the food chain, but most notably in the food service sector. Drought conditions and wildfires throughout 2021 have also contributed to food price increases this year.

Consumers' food choices in 2021 were motivated by health and environmental sustainability—with a greater consumer desire for more transparency and ethical practices around food products. Consumers continued to support local food supply chains, and many plan to continue COVID-19 shopping habits in the future (e.g., online platforms). There is an indication that overall food literacy in the population has improved but many still struggle with healthy eating and meal management in the wake of COVID-related disruptions to everyday life.

In 2022, we expect to feel the continued effect of COVID-19, but to what extent is still uncertain as many Canadians are now fully vaccinated and we are gradually regaining a sense of normalcy. In 2022, food insecurity will be a big issue as Canadians' grapple with rising prices. Food programs may face increased demand along with higher costs for food, and food retailers may see increased rates of theft. We will continue to feel the growing impact of climate change and the continued effect of both transportation and labour market challenges.

FOOD PRICE FORECAST BY PROVINCE

Province	2021 Changes ¹	2022 Forecasts ²
Alberta	↑	↑
British Columbia	↓	↑
Manitoba	↑	↓
New Brunswick	↑	↓
Newfoundland and Labrador	-	↑
Nova Scotia	↑	↓
Ontario	-	↑
Prince Edward Island	↑	↓
Saskatchewan	↓	↑
Quebec	↑	↓

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.



OVERVIEW OF 2021: HOW WE DID

«
 Every year,
 we look at one wild
 card, climate change. Over
 the past two years, we had to
 contend with two wild cards,
 climate change and
 the pandemic.
 »

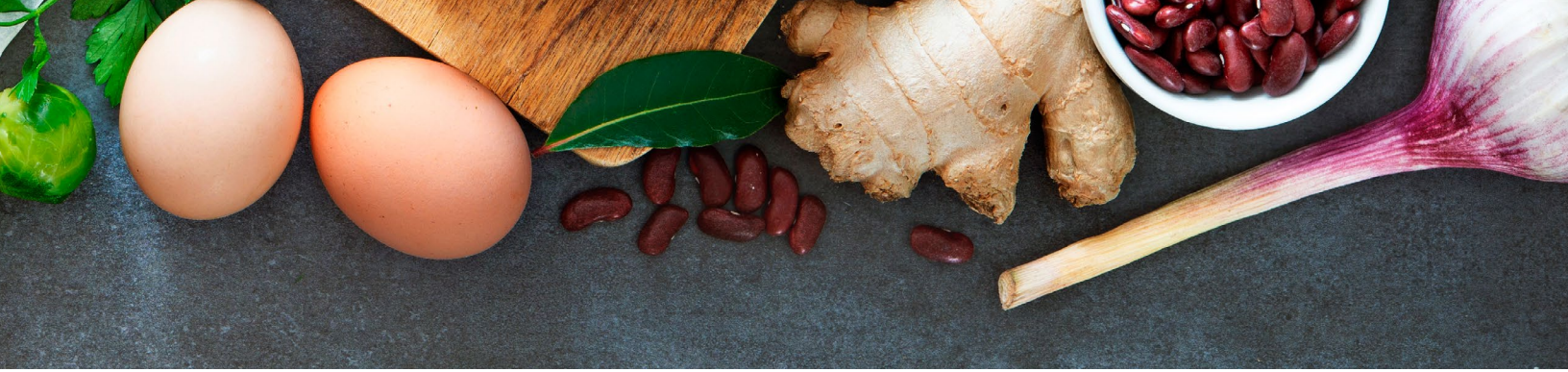
Food inflation is the progressive increase in the value of all food goods. Food price rise is the increase in the price of a product at retail. While Statistics Canada measures inflation, **Canada's Food Price Report** looks at relative price increases at retail. But to conduct our forecast, we can only use food inflation data.

Nonetheless, the 2021 forecasts were accurate except for a few categories. **Canada's Food Price Report has now accurately predicted overall food price increases ten times in the last eleven years.** Bakery prices were lower than predicted but we are expecting prices to rise again in the new year due to factors outlined in the 2021 report. For the dairy, meat and other categories, price predictions were lower than what was observed due to global inflationary pressures.

TABLE 1: 2021 FOOD PRICE RESULTS: 2021 FORECAST VS OBSERVED³

Categories	2021 Canada's Food Price Report Forecast	2021 Actual Change (CPI, Oct. '20 to Sept. '21)
Bakery	3.5% to 5.5%	1.7%
Dairy	1% to 3%	5.1%
Fruits	2% to 4%	2.5%
Meat	4.5% to 6.5%	9.5%
Other	2% to 4%	5.3%
Restaurants	3% to 5%	3.1%
Seafood	1.5% to 3.5%	2.5%
Vegetables	4.5% to 6.5%	-2.1%
Total Food Categories Forecast	3% to 5%	3.9% (4.2% excluding restaurants)

³ Statistics Canada Consumer Price Index (CPI) numbers retrieved from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000403&pickMembers%5B0%5D=1.2&cubeTimeFrame.startMonth=09&cubeTimeFrame.startYear=2021&referencePeriods=20210901%2C20210901>



Price increases in dairy can be explained by a rise in transportation costs and supply chain disruptions. The discrepancy between the forecasted increase for vegetables and the 2021 observation is likely explained by better-than-expected harvests and a higher Canadian dollar increasing the buying power of out-of-season vegetable imports.

Our predicted annual expenditures for Canadian consumers based on age and gender were slightly higher than what was observed in 2021; however, the category with the greatest difference between predicted and observed was boy/man 14-18 years (\$30.28) for the entire year, whereas for some consumer categories we overestimated by less than \$20 for the year.



TABLE 2: 2021 ANNUAL FOOD EXPENDITURE BY AGE AND GENDER – PREDICTED VS. OBSERVED

Demographics		Predicted Cost 2021	Observed Cost 2021	Difference
Child	6-11 Months	\$2,548.73	\$2,529.31	(\$19.42)
	1-3 Years	\$2,016.38	\$2,001.01	(\$15.37)
Boy/Man	4-8 Years	\$2,630.63	\$2,610.58	(\$20.05)
	9-13 Years	\$3,386.88	\$3,361.07	(\$25.81)
	14-18 Years	\$3,973.79	\$3,943.51	(\$30.28)
	19-30 Years	\$3,739.56	\$3,711.36	(\$28.20)
	31-50 Years	\$3,559.37	\$3,532.25	(\$27.12)
	51-70 Years	\$3,457.31	\$3,430.97	(\$26.34)
	70+ Years	\$3,323.00	\$3,297.67	(\$25.33)
Girl/Woman	4-8 Years	\$2,519.50	\$2,500.29	(\$19.21)
	9-13 Years	\$3,180.49	\$3,156.26	(\$24.23)
	14-18 Years	\$3,302.21	\$3,277.06	(\$25.15)
	19-30 Years	\$3,256.34	\$3,231.53	(\$24.81)
	31-50 Years	\$3,193.60	\$3,169.26	(\$24.34)
	51-70 Years	\$3,126.94	\$3,103.14	(\$23.80)
	70+ Years	\$2,990.99	\$2,968.20	(\$22.79)

2021 HIGHLIGHTS

HIGH INFLATION AND FOOD INSECURITY

As outlined in Canada's Food Price Report 2021, the food inflation index has well outpaced general inflation over the last twenty years in Canada. **A typical grocery bill rose by 70% between 2000 and 2020.** Historically, Canada has ranked among the few countries that consumers spend less than 10% of their income on food (9.1%).⁴ However, maintaining this allocation proportion may become more difficult for **Canadians as data show that while median income in Canada grew by 6.6% between 2015 and 2019,** the national average food expenditure (including both food retail and food service) increased by 16.3%, with food retail on its own increasing by 19%. This means that Canadians are having to allocate a higher proportion of their income for food,⁵ a trend that has only been exacerbated by COVID-19.

According to the **Global Food Security Index**, Canada ranked 18th in the world in 2019 when food affordability was measured. Now, in 2021, Canada ranks 24th in the world.⁶

Inflation in 2021 increased to 4.4%, reaching an 18-year high. This substantial increase was driven by high oil costs, high housing costs and rising food prices. COVID-19–related supply chain disruptions and labour market challenges likely are driving inflationary increases.⁷ Rising inflation will not affect all Canadians equally, as lower-income households spend a higher proportion of their income on basic needs such as housing and food and will have a harder time maintaining their existing quality of life as costs go up. Real concerns around food insecurity persisted in 2021 as **wages and salaries for most have not kept pace with the increase in prices.**⁸ There are some

«
With higher
shelter and food
costs coupled with stagnant
wages, Canadians are facing
the perfect economic
storm.
»

- 4 Gray, A. (2016, December 7). Which countries spend the most on food? This map will show you. World Economic Forum. Retrieved from <https://www.weforum.org/agenda/2016/12/this-map-shows-how-much-each-country-spends-on-food/>
- 5 Statistics Canada. (2021). Detailed food spending, Canada, regions and provinces. Retrieved from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110012501>
- 6 <https://impact.economist.com/sustainability/project/food-security-index/Index>
- 7 Gordon, J. (2021, October 20). Canada's inflation rate hit 18-year high, puts focus on central bank rate policy. Reuters. Retrieved from <https://lifelworks.com/en/news/war-talent-heats-2022-salaries-set-increase-fastest-pace-five-years>
- 8 The Conference Board of Canada. (2020, September 21). Low-income Canadian households will suffer the most from soaring inflation. Retrieved from <https://www.conferenceboard.ca/insights/featured/canadian-economics/low-income-canadian-households-will-suffer-the-most-from-soaring-inflation>

indications that salaries will increase in 2022, but inflation is likely to continue to outpace the increase.⁹ Disproportionately higher food prices will have a more severe impact on women, Indigenous populations, people of colour and other vulnerable populations.¹⁰

The rise in food prices and food inflation has not been lost on consumers. According to a 2021 study on inflation, 86% of surveyed Canadians perceived food prices to be higher. Meat was the food category in which the highest proportion noticed a price hike, also known as “meatflation”, followed by fruits and vegetables. Almost half of surveyed Canadians have changed their meat purchasing habits because of observed price increases,¹¹ while 73.5% had noticed a phenomenon called “shrinkflation” in which food is sold in smaller quantities but for the same or a higher price.

LABOUR MARKET CHALLENGES

In 2021, “help wanted” signs were displayed in many business windows as Canada experienced labour force challenges. Framed in mainstream media and popular discourse as a “labour shortage”, this phenomenon has been especially apparent in the food service sector. A survey conducted in July of 2021 by Restaurants Canada showed that most participating restaurants reported difficulty hiring back- and front-of-house staff (80% and 67% respectively).¹²

According to Statistics Canada data recorded for September 2021, though overall employment has returned to pre-pandemic levels, approximately 180,000 positions in accommodation and food services still need to be filled to reach pre-pandemic sectoral employment levels.¹³ The Canada Emergency Response Benefit (CERB) and other government supports have been quickly blamed for labour market challenges, but the issue is more complicated than that. Restaurant positions, even

9 LifeWorks. (2021, September 15). War for talent heats up as 2022 salaries set to increase at the fastest pace in five years. Retrieved from <https://www.businesswire.com/news/home/20210915005424/en/War-for-talent-heats-up-as-2022-salaries-set-to-increase-at-the-fastest-pace-in-five-years>

10 Music, J. & Charlebois, S. (2021, October 8). Is food inflation here to stay? Corporate Knights. Retrieved from <https://www.corporateknights.com/food-beverage/is-food-inflation-here-to-stay/>

11 Agri-Food Analytics Lab. (2021). COVID-19 food price inflation. Dalhousie University. Retrieved from <https://www.dal.ca/sites/agri-food/research/covid-19-food-price-inflation.html>

12 Restaurants Canada. (2021, August 11). Reopening of restaurants leading to labour shortages. <https://www.restaurantscanada.org/resources/reopening-of-restaurants-leading-to-labour-shortages/>

13 Statistics Canada. (2021). Labour Force Survey, September 2021. Retrieved from Statistics Canada: <https://www150.statcan.gc.ca/n1/daily-quotidien/211008/dq211008a-eng.htm>.



prior to COVID-19, were difficult to fill because they are typically lower-paying with no (or few) employee benefits, physically demanding and prone to sexual harassment and abuse.¹⁴ These already challenging working conditions are exacerbated by restaurant workers being exposed to a higher risk of contracting COVID-19, having to wear masks during long shifts, and having additional responsibilities to check and validate vaccine passports—the added pressures are making these types of jobs not worthwhile for many.¹⁵

«
Canada is not
experiencing a 'Great
Resignation' per se. It's
more like a Great
Protest.
»

As Canadian provinces moved in and out of lockdowns and restaurants closed or operated with reduced staff, the insecurity of work in the industry became apparent. Many workers have used the pandemic as an opportunity for a career change and found jobs in other sectors with more stability.¹⁶ The changing labour dynamics in the restaurant industry have forced restaurant owners to consider how they can redevelop and adapt their business models with a shortage of employees. Many restaurants are operating with reduced hours or even closing several days a week, limiting their menu items, and/or offering employment incentives such as more vacation time or higher wages to attract workers.¹⁷ Food service is not the only sector in the Canadian food supply chain affected by the challenges of finding and retaining employees—this was observed in 2021 at the farm, food-processing and food-manufacturing levels of the chain. Reduced labour at the level of farms, for example, has resulted in increased food waste.¹⁸

TRANSPORTATION ISSUES: MARITIME TRANSPORT CAPACITY AND HIGH OIL PRICES

The fragility of global supply lines for many products, including food, came to the forefront in 2021. There were major disruptions, delays and reduced capacity, especially in maritime transport as congestion of cargo ships was apparent at both Canadian and U.S. ports. For example, in Vancouver during September and October, port operators struggled with delayed cargo arrivals, high volumes of imports and a reduced trucking capacity moving out of the

14 McAdams, B., & Gorden, R. (2021, September 28). Labour shortage or lack of decent work? What really ails Canadian restaurants. The Financial Post. Retrieved from <https://financialpost.com/fp-work/labour-shortage-or-lack-of-decent-work-what-really-ails-canadian-restaurants>

15 Macdonald, D. (2021). Tipping point: Pandemic forced restaurant and bar workers into better paying jobs. Canadian Centre for Policy Alternatives. Retrieved from <https://monitormag.ca/articles/tipping-point-pandemic-forced-restaurant-and-bar-workers-into-better-paying-jobs-2>

16 McAdams, B., & Gorden, R. (2021, September 28). Labour shortage or lack of decent work? What really ails Canadian restaurants. The Financial Post. Retrieved from <https://financialpost.com/fp-work/labour-shortage-or-lack-of-decent-work-what-really-ails-canadian-restaurants>

17 Charlebois, S. (2021, August 25). Labour shortage in the food industry? Nonsense. Our labour market has been broken for years. Retail Insider. Retrieved from <https://retail-insider.com/retail-insider/2021/08/labour-shortage-in-the-food-industry-nonsense-our-labour-market-has-been-broken-for-years-s>

18 Ibid.

port. These challenges have resulted in concerns for Canadian supply chain in general,¹⁹ but also the food supply chain and food prices as many food imports come to Canada by container ships.

The disruptions to maritime transport capacity and global supply chains are due to multiple factors including the resurgence of COVID-19 in various countries, the approaching holiday season, booming (pent-up) consumer demand, U.S.-China trade relations, equipment shortages and extreme weather.²⁰ Some companies, for example Walmart, have begun to charter their own ships to mitigate the disruptions in the supply chain.²¹ On-top of rising food prices, consumers are likely noticing empty shelves in their grocery stores and will continue to see them for the next while. In addition to supply chain disruptions, oil prices are a driver of food prices and in 2021 oil prices hit a 7-year high—meaning increased costs for food transport. While the food supply chain has been working to absorb increased transportation costs, eventually those costs will make their way to consumers in higher food prices.²²

«
Food access
will likely never be
an issue in Canada. But
empty shelves will be a common
sight at the grocery store due to
compounded logistical
and labour issues.
»

CLIMATE CHANGE AND INCREASING CONSUMER DEMAND FOR SUSTAINABLE PRACTICES

Considerations of rising food prices have become increasingly intertwined with climate change and resulting adverse weather effects. Although the climate crisis did not disappear during the onset of the COVID-19 pandemic, it was not a top-of-mind issue for many as more immediate worries and action around the virus took priority. Yet in 2021, Canada experienced climate change–related adverse weather effects, such as severe wildfires in British Columbia and drought conditions in the Prairies, that affected the prices of meat and bakery products. Smaller harvests

19 Putzger, I. (2021, October 10). 'Canada's supply chain is at risk' warning, as congestion hits port of Vancouver. The Loadstar. Retrieved from <https://theloadstar.com/canadas-supply-chain-is-at-risk-warning-as-congestion-hits-port-of-vancouver/>

20 Baertlein, L., Saul, J., & Cavale, S. (2021, October 7). 'Containergeddon': Supply crisis drives Walmart and rivals to hire their own ships. Reuters. Retrieved from <https://www.reuters.com/business/autos-transportation/containergeddon-supply-crisis-drives-walmart-rivals-hire-their-own-ships-2021-10-07/>

21 Ibid.

22 Charlebois, S. (2021, August 17). Pandemic to cause largest increase in grocery prices in Canadian history: Sylvain Charlebois. Retail Insider. Retrieved from <https://retail-insider.com/retail-insider/2021/08/pandemic-to-cause-largest-increase-in-grocery-prices-in-canadian-history-sylvain-charlebois/>


«
The effects of
a \$170/mt carbon tax
on food affordability by
2030 are largely
unknown.
»

and poor crop yields will continue to raise the price of bakery items;²³ while water scarcity and heat have forced farmers to reduce herd sizes causing increases in meat prices.²⁴

Additionally, consumers are increasingly demanding environmental sustainability and transparency around food. Results of a 2021 survey of Canadians suggest that shopping at food retail outlets with strong sustainability and ethical practices was important. Seventy-one percent of respondents said it's important for them to know where their food comes from, while 61% are concerned about the amount of packaging used for online food orders, and 42% said they would buy more locally sourced food even if it cost more.²⁵

CONSUMER HABITS IN 2021: FOOD LITERACY, MEAL MANAGEMENT AND SHOPPING HABITS

Now, almost two years into the COVID-19 pandemic, its effects on Canadians' relationships with food are becoming clearer. A study conducted in early 2021 suggests that **food literacy** levels have increased among Canadians during the pandemic. For example, over one-third of Canadians sampled reported they had learned a new recipe since the beginning of the pandemic and 48% said they had used a new ingredient in their cooking (e.g., spices, vegetables, oils). At the same time, many Canadians are still struggling to maintain healthy eating habits and meal management as the pandemic continues to disrupt daily life and routine. In relation to food choices, 70.5% of sampled Canadians reported that health was the most important factor driving their food choices, followed by the economy (52.7%) and the environment (28.3%).²⁶

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- 23 Paull, H. (2021, September 4). Canadian grocery prices expected to rise this fall due to climate change, COVID-19. The Deep Dive. Retrieved from <https://thedeepdive.ca/canadian-grocery-prices-expected-to-rise-this-fall-due-to-climate-change-covid-19/>
- 24 Music, J., & Charlebois, S. (2021, October 8). Is food inflation here to stay? Corporate Knights. Retrieved from <https://www.corporateknights.com/food-beverage/is-food-inflation-here-to-stay/>
- 25 Deloitte. (2021). The Future of Food: A Canadian Perspective. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/consumer-business/ca_futureoffood_pov_en_AODA.pdf
- 26 Agri-Food Analytics Lab. (2021, February). COVID Food Literacy. Dalhousie University. Retrieved from [https://cdn.dal.ca/content/dam/dalhousie/pdf/sites/agri-food/COVID%20Food%20Literacy%20\(February%202021\)%20EN%20.pdf](https://cdn.dal.ca/content/dam/dalhousie/pdf/sites/agri-food/COVID%20Food%20Literacy%20(February%202021)%20EN%20.pdf)

Research suggests that some Canadians will continue their COVID-19 shopping habits in the future—for example, in a 2021 study, 22.2% of Canadians intended continue purchasing **their groceries online**. Research also suggests that the major food retailers may have less influence on consumers as independent retailers are becoming more popular. Consumers want to see local food products in stores but, interestingly, while 75.2% of sampled Canadians support more availability and visibility of local food products, **only 47.4% intend to buy those products**.²⁷

«
*Food inflation
can be less of an
issue for your household if
you're food literate.*
»

CANADA'S FOOD PRICE REPORT: 2022 FORECAST

METHODOLOGY

In the 12th 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 insight 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 2022 Consumer Price Index (CPI) changes. All four institutions provided public policy and business expertise to enhance the report. Different models were developed, namely: Recurrent Neural Network (RNN) Model; Autoregressive Integrated Moving Average (ARIMA) Model; and mixed ensembles of Machine Learning Models.

In addition to the forecasting models, academics from the participating institutions provide input and expertise from their respective disciplines on the macroeconomic factors driving food prices, food trends and expectations for the food industry in the following year.

«
*Having four
universities working
on our report provides a
national perspective on
a very important
issue.*
»

27 Agri-Food Analytics Lab. (2021, May 27). COVID Grocery Look. Dalhousie University. Retrieved from [https://cdn.dal.ca/content/dam/dalhousie/pdf/sites/agri-food/COVID%20Grocery%20outlook%20\(May%2027%202021\)%20EN.pdf](https://cdn.dal.ca/content/dam/dalhousie/pdf/sites/agri-food/COVID%20Grocery%20outlook%20(May%2027%202021)%20EN.pdf)



RECURRENT NEURAL NETWORK MODEL

The Recurrent Neural Network (RNN) created for the 2021 Canada Food Price Report was adapted for use again this year. The base model uses Keras' SimpleRNN function. The hyperparameters of this base model were first “trained” using the Canadian 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 estimate the future CPI value (label) with 1 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 individually, 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. Some of the many adjustments made since last year include the averaging of five separate runs of the model for each food category using random seeds, the normalization of all data, a change to predicting the difference in CPI values vs the target CPI, the addition of ridge regression, as well as the training of and comparison to Long Short-Term Memory models. Finally, Shapley values were used to identify the impact each feature set was having on the final predictions. The models were then retrained on these data sets from October 1990 to September 2021, using data from October 2020 to September 2021 to predict monthly labels for October 2021 to September 2022 for each food category.

MIXED ENSEMBLES OF MACHINE LEARNING MODELS

An ensemble of forecasts was produced using up to three different machine learning-based forecasting algorithms: Prophet, NeuralProphet, and Neural Basis Expansion for Interpretable Time Series Forecasting (N-BEATS). The Prophet model produces univariate, autoregressive forecasts using trend and seasonality extrapolation. NeuralProphet additionally supports the inclusion of lagged regressors. This enables the inclusion of additional dependent variables, such as historical exchange rates or oil prices, into the forecasting model. N-BEATS is

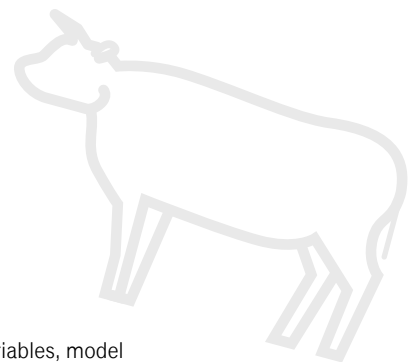
fundamentally different from most other forecasting methods. It uses a single, deep neural network model to learn from many time series simultaneously. It learns a shared set of patterns and trends (basis functions) that it uses to generate forecasts. In this sense, its forecasts are influenced by additional variables, but not explicitly dependent on them.

To produce this year's forecast, we designed an experiment to determine which configuration of models and dependent variables would have produced the most accurate forecasts, per food price category, over the last 6 years. All variables used in the experiment were downloaded from either Statistics Canada (StatCan) or the Federal Reserve Economic Data (FRED) database. Prophet models do not incorporate additional variables. In our configurations, NeuralProphet models may incorporate one additional variable at a time (e.g., using the CAD/USD exchange rate as an additional regressor for vegetable forecasts). N-BEATS models are trained using 334 time series variables from StatCan and FRED.²⁸

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

2022 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 2022 food prices in Canada. Logistical disruptions caused by COVID-19 continue, along with adverse weather effects (e.g., wildfires and drought) caused by the climate emergency.



28 See <https://github.com/VectorInstitute/foodprice-forecasting> for the full list of variables, model configurations and experimental results.

TABLE 3: MACROECONOMIC DRIVERS FOR CANADA'S FOOD PRICES IN 2022

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

«
A government-coordinated code of conduct for our grocers will undeniably help our food processors and discourage collusion within the industry.
 »

The food sector is awaiting a **Code of conduct** to address tensions with the supply chain, specifically, between grocers and food processors in our country. This follows from an inquiry conducted last year by a working group—including the Federal Agriculture Minister and provincial and territorial ministers—into disputes concerning suppliers having to pay additional fees and fines to big grocers during the pandemic.²⁹ This could lead to more much-needed harmony in the sector, with more stable pricing for consumers over time by maintaining more

²⁹ Edmiston, J. (2021, July 15). Government to grocery business: It's time to come to a consensus on code of conduct. Financial Post. Retrieved from <https://financialpost.com/commodities/agriculture/government-to-grocery-business-its-time-to-come-to-a-consensus-on-code-of-conduct>

processing capacity in our country. While employment has reached pre-pandemic levels,³⁰ as rising inflation continues and wages do not rise at the same pace, purchasing power of consumers may be reduced. In addition, in 2020 the debt-to-income ratio dropped because of increased savings and/or increased government income-support benefits³¹ but as the economy reopens, consumer indebtedness may increase as pent-up consumer demand is released or Canadians are required to take on debt to afford basic needs in the wake of rising prices.

FOOD PRICE FORECAST BY PROVINCE

Several provinces are expected to see higher than average food inflation rates in 2022, including **Alberta, British Columbia, Newfoundland and Labrador, Ontario, and Saskatchewan**. Higher food prices will likely be due to inflationary conditions specific to these regions. In other words, **these provinces could see price increases of up to 7% next year.**

TABLE 4: 2022 PROVINCIAL BREAKDOWN OF FOOD PRICES

Province	2020 Changes ³²	2021 Forecasts ³³
Alberta	↑	↑
British Columbia	↓	↑
Manitoba	↑	↓
New Brunswick	↑	↓
Newfoundland and Labrador	-	↑
Nova Scotia	↑	↓
Ontario	-	↑
Prince Edward Island	↑	↓
Saskatchewan	↓	↑
Quebec	↑	↓

30 Statistics Canada. (2021). Labour Force Survey, September 2021. Retrieved from Statistics Canada: <https://www150.statcan.gc.ca/n1/daily-quotidien/211008/dq211008a-eng.htm>

31 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>

32 (↑) Expected above-average food price increase, (↓) Expected below-average food price increase, (-) Expected average food price increase. Lower confidence intervals at the provincial level.

33 (↑) Expected above-average food price increase, (↓) Expected below-average food price increase, (-) Expected average food price increase. Lower confidence intervals at the provincial level.





The Canadian Dairy Commission's recommendation this year will likely push many prices higher in the dairy section of the grocery store in 2022.



THE 2022 WATCH-LIST ITEMS

Overall, prices for all food categories could increase by up to 7% in 2022 with the dairy and restaurant categories expected to see the largest increases (6% to 8%). Dairy price forecasts are informed by a recent review of farm gate milk prices and other costs associated with the supply management system conducted by the **Canadian Dairy Commission**, which found that increased costs of production due to COVID-19, particularly for feed, energy and fertilizer, along with other increased costs in milk processing (e.g., packaging, labour and transportation) have exceeded farm gate revenues. Therefore, farm gate milk prices and processing costs will increase.³⁴ **Menu prices at restaurants are predicted to increase** as businesses contend with rising food prices, rising commercial rents and labour market challenges. There are also large increases predicted in the bakery and vegetable categories (5% to 7%) because of, for example, adverse weather (e.g., drought and winter storms).

TABLE 5: 2022 FOOD PRICE FORECASTS

Food Categories	Anticipated Changes %
Bakery	5% to 7%
Dairy	6% to 8%
Fruits	3% to 5%
Meat	0% to 2%
Other	2% to 4%
Restaurants	6% to 8%
Seafood	0% to 2%
Vegetables	5% to 7%
Total Food Categories Forecast	5% to 7%

To reflect the diversity of Canadian household composition, **Canada's Food Price Report 2022** uses an approach of predicting annual food expenditure based on individual consumers' age and gender. This year we are adding two additional categories: pregnant or lactating women. This allows Canadians to calculate the annual expenditure predictions that reflect the composition of their household

34 Canadian Dairy Commission. (2021). Farm gate milk prices to be increased. Government of Canada. Retrieved from <https://cdc-ccl.ca/index.php/en/news/latest-news/latest-news-for-2021/farm-gate-milk-prices-to-be-increased/>

whether it's, for example, a single person living alone, a single-parent-headed family or a multi-generational family.³⁵

«
We added two
categories this year,
'Pregnant Woman' and
'Nursing Woman'.
»

TABLE 6: PREDICTED FOOD EXPENDITURES FOR INDIVIDUAL CONSUMERS 2022

Demographics		Total Annual Cost
Child	6-11 Months	\$2,706.36
	1-3 Years	\$2,141.08
Boy/Man	4-8 Years	\$2,793.32
	9-13 Years	\$3,596.34
	14-18 Years	\$4,219.55
	19-30 Years	\$3,971.15
	31-50 Years	\$3,779.50
	51-70 Years	\$3,671.14
	70+ Years	\$3,528.51
	Girl/Woman	4-8 Years
	9-13 Years	\$3,377.20
	14-18 Years	\$3,506.45
	19-30 Years	\$3,457.74
	31-50 Years	\$3,391.11
	51-70 Years	\$3,320.36
	70+ Years	\$3,175.97
Pregnant Woman	< 18 Years	\$4,050.30
	19-30 Years	\$3,941.80
	31-50 Years	\$3,900.06
Nursing Woman	<18 Years	\$3,957.94
	19-30 Years	\$3,941.80
	31-50 Years	\$3,908.75

The following table 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 up to \$14,767 in 2022**. This is an increase of up to **\$966** from the observed annual expenditure for a family of the same demographic makeup in 2021.

35 The authors would like to acknowledge and issue a special thank you to the Dispensaire diététique de Montréal. Its food basket and monthly expenditure data were used in predicted annual food expenditure calculations. <https://www.dispensaire.ca/>

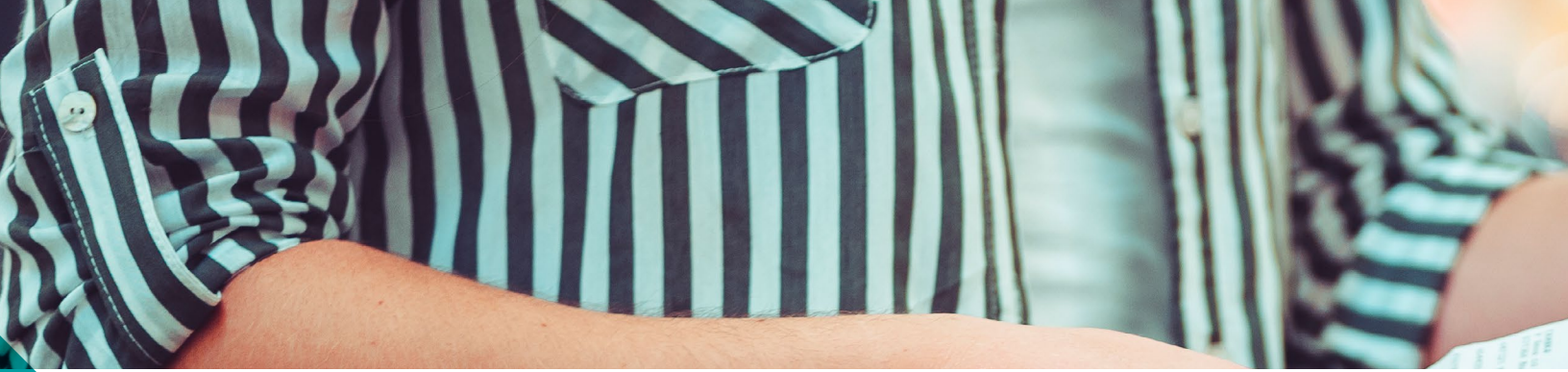


TABLE 7: EXAMPLES OF CANADIAN HOUSEHOLDS AND PREDICTED ANNUAL FOOD EXPENDITURE 2022

Household Demographics	Total Predicted Food Expenditure 2022
Four People: Man (31-50), Woman (31-50), Boy (14-18), Girl (9-13)	\$14,767.36
Three People: Woman (19-30), Boy (4-8), Child (1-3)	\$8,741.78
Four People: Two Women (31-50), Girl (14-18), Boy (9-13)	\$11,716.62
Two People: Man (51-70), Woman (51-70)	\$7,690.65
Six People: Woman (70+ Years), Man (31-50), Woman (31-50), Girl (9-13), Boy (4-8), Child (6-11 Months)	\$19,223.46
Two People: Man (19-30), Pregnant Woman (19-30)	\$8,704.24

There are some important limitations of the data presented in the preceding tables that need to be considered. First, the data are based on a very conservative 5% assumed food waste when Canadian studies have demonstrated that **avoidable food waste** is likely higher, especially in the context of the pandemic when Canadians are eating at home more often.³⁶³⁷ Second, the calculated expenditures assume that Canadians are exclusively cooking and eating at home, and do not include food service costs. While there was a substantial decrease in consumer demand for food service in 2020 especially as restaurants were closed during a significant part of the year, in 2021 and 2022 food service has rebounded and will likely continue to do so.

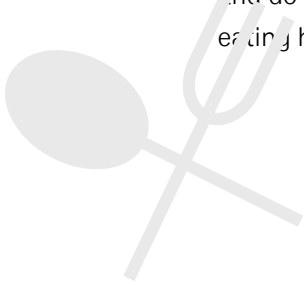
36 Agri-Food Analytics Lab. (2020). COVID Organic Food Waste. Retrieved from [https://cdn.dal.ca/content/dam/dalhousie/pdf/sites/agri-food/COVID%20Organic%20Food%20Waste%20\(September%201\).pdf](https://cdn.dal.ca/content/dam/dalhousie/pdf/sites/agri-food/COVID%20Organic%20Food%20Waste%20(September%201).pdf);

37 Everitt, H., va der Werf, P., Seabrook, J.A., Wray, A., & Gilliland, J.A. (2021). The quantity and composition of household waste during the COVID-19 pandemic: A direct measurement study in Canada. *Socio-Economic Planning Sciences*. <https://doi.org/10.1016/j.seps.2021.101110>



Third, the data do not account for specialized diets or fees associated with online food retail, despite many Canadians still relying on e-commerce platforms to buy groceries—especially the immune-compromised. Individuals or households who continue to use online grocery platforms and/or delivery services can expect to pay an additional 2% to 8% depending on the number of items, total dollars spent, whether they are doing curbside pickup or delivery, and location for delivery. In addition, for Canadians who continue to use online platforms and delivery services there are increased costs associated with missing exclusive in-store discounted items and food promotions, for example, “**Enjoy Tonight**” **meals**. Overall, these predicted expenditures are likely conservative and do not necessarily reflect the diverse reality of all Canadians’ eating habits.

«
Pre-pandemic, Canadians spent 35% of their food budget at the restaurant. In November, we estimate that we were at 27%. It’s unclear when, or if, we will get back to 35%.
»



WHAT TO EXPECT IN 2022

INCREASING FOOD INSECURITY AND GROCERY RETAIL THEFT

We can expect food insecurity to become a growing issue in 2022 as the inflation rate and food prices continue to rise. There will likely be more demand for and reliance on food programs or **food banks** if incomes do not rise to meet food expenditures and other basic needs. At the same time, organizations that provide aid to the food-insecure may have difficulty meeting increased demand and rising food expenditures while operating with stagnant funding and budgets.

A growing phenomenon related to increasing food insecurity caused by high inflation is **theft from grocery stores** which is anticipated to intensify in 2022. Grocers are anecdotally reporting an uptick in theft, particularly of items such as meat, cheese, over-the-counter medication and



energy drinks. Unreported loss to theft could be as high as \$3000 to \$4000 each week in some Canadian grocery stores.



Restarting global food supply chains is like steering a large cruise ship, only with paddles. But the ship is not the Titanic either. Food will get to its destination, but it will be slow and more costly.



CONTINUING CLIMATE CRISIS AND THE INCREASED CARBON TAX

In 2022, we can anticipate the ongoing effect of the continuing climate crisis and adverse weather effects on food prices.

Wildfires, record-breaking heat and drought, floods and cold fronts are becoming increasingly commonplace and affecting food prices year after year. For certain food categories that have felt the impact of adverse weather in 2021, we may yet see an increase in costs because of forward-buying in the chain—for example, meat and grain.

In late 2020, the Trudeau government announced that the carbon tax would increase to \$170 per tonne by 2030 from \$40 in 2021 to reduce emissions and combat climate change—another factor that will drive higher gas prices and transportation costs.³⁸ It remains unclear what the effect of the carbon tax on food prices will be and more data are needed.

STRATEGIES FOR CONTAINING FOOD PRICES BY REDUCING FOOD LOSS AND FOOD WASTE

Food loss (foods produced but not marketed) and food waste (food purchased but not consumed) are significant drivers of climate change and global food insecurity.³⁹ Efforts are being made to reduce food loss and food waste by 50% to align with the United Nations' Sustainable Development Goals. Researchers are examining an

38 Kaplan, L., & Milke, M. (2021). Canadian motorists can expect to pay up to \$900 more per year at the pump to cover the federal carbon tax. Canadian Energy Centre. Retrieved from <https://www.canadianenergycentre.ca/up-to-350-per-cent-higher-at-the-pump-by-2030-the-impact-of-higher-carbon-taxes-on-gasoline-prices/>

39 Teigiserova, D. A., Hamelin, L., & Thomsen, M. (2020). Towards transparent valorization of food surplus, waste and loss: Clarifying definitions, food waste hierarchy, and role in the circular economy. *Science of The Total Environment*, 706, 136033.



array of strategies to reduce household waste using incentives to modify purchasing practices, as well as levers involving the price of food.⁴⁰ Incentive programs for consumers targeted at waste reduction should focus on the environmental benefits as well as the cost-saving benefits, where household food dollars go further.⁴¹ Governments, retailers and food sector actors are encouraged to consider strategies that simultaneously attend to food security and food sufficiency, while also addressing climate change, including reducing emissions from food loss and waste.

LABOUR MARKET CHALLENGES, SUPPLY CHAIN DISRUPTIONS AND HIGH INFLATION CONTINUE

We are expecting some important lingering issues to impact global food supply chains in 2022. With limited access to some ingredients and higher input costs, we anticipate less choice as food processors and manufacturers will consolidate their portfolio of brands. In food service, we expect fewer menu choices and higher menu prices. We will continue to feel the effects of ongoing supply chain disruptions due to COVID-19, labour market challenges and high inflation in 2022. Companies may experience high international shipping costs and empty shelves as a result.⁴²



40 Hamilton, S. F., & Richards, T. J. (2019). Food policy and household food waste. *American Journal of Agricultural Economics*, 101(2): 600-614.

41 Aschemann-Witzel, J., De Hooge, I., Amani P., Bech-Larsen, T., & Oostindjer, M. (2015). Consumer-related food waste: Causes and potential for action. *Sustainability*, 7(6), 6457-6477.

42 Johnson, M. (2021, October 19). Global supply chain disruption will hinder Canada's growth into 2022: reports. *Advisor's Edge*. Retrieved from <https://www.advisor.ca/investments/market-insights/global-supply-chain-disruption-will-hinder-canadas-growth-into-2022-reports/>



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