

IMPACT OF COVID-19 ON FOOD PRICES IN REMOTE INDIGENOUS COMMUNITIES-  
THE CASE OF FOX LAKE IN LITTLE RED RIVER CREE NATION (LRRCN).

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## ABSTRACT

Recent studies suggest significant increase in food prices due to the Covid-19 pandemic in Indigenous communities across Canada and the US. This study investigates whether and to what extent food prices might have changed in response to the Covid-19 pandemic using Fox Lake, a remote community within Little Red River Cree Nation in Northern Alberta, as an interesting case study. The study uses retail price data for selected food items from Fox Lake's local store, The Northern, and respective retail prices for similar products in Alberta, over a five-year period from 2017 to 2021. The study is guided by three specific objectives. First, it investigates disparities in price levels and temporal price changes between Fox Lake and Alberta. Second, the study assesses the extent to which temporal changes in food prices may have been driven by Covid-19 in Fox Lake in comparison to respective changes at provincial level. Finally, the study examines the implications of potentially higher food prices on the living wage requirements for Fox Lake households.

Results show that between 2017 and 2022, Fox Lake's prices for selected food items were up to 175% and 186% higher than in Alberta, particularly for food items like canned tuna and margarine respectively. Food prices in Fox Lake, however, did not soar during the pandemic. On average prices increased by 1.1% in Fox Lake, which is three times lower than the average food price increase in Alberta. The thesis' findings are, hence, in contrast to significant price surges of 400%, observed during the Covid-19 pandemic e.g., in northern Ontario. Nevertheless, a modest 1.1% increase in food prices would increase annual food expenses by \$179 and require a living wage increase from \$19.58 to \$19.63 for a family of four with two working members.

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## DEDICATION

I dedicate this study to my mum, Comfort Mensah and to my siblings Janet Matthew and John Matthew for their words of encouragement and motivation through every step of my studies.

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## LIST OF ABBREVIATIONS

AAL .....	Agri-Food Analytics Lab
Covid-19.....	Coronavirus disease of 2019
CAD.....	Canadian Dollars
CPI .....	Consumer Price Index
FAO.....	Food and Agriculture Organization
FN .....	First Nation
HICs.....	High Income Countries
LRRCN.....	Little Red River Cree Nation
NNC.....	Nutrition North Canada
NWC .....	Northwest Company
SPs .....	Sampled Products
USA.....	United States of America
WHO .....	World Health Organization

## Chapter 1 Introduction

### 1.1 Background

Food prices are important in the daily food purchasing decisions of households. Price shocks can, hence, trigger changes in consumption which can last up to a year (Aziz et al., 2020). The largest price shock after the food price crises in 2008 and 2011 is related to the recent Covid-19 pandemic which affected several economic sectors globally. Stringent Covid-19 policies battered the demand and supply of many food items following supply chain disruptions, changes in consumption patterns, labor shortages and transportation problems (Bairagi et al., 2022).

Price theory suggests that the equilibrium price of a commodity is determined by forces of demand and supply (Friedman, 2021). Price changes may also depend on whether a commodity is an essential, luxury, perishable, or storable commodity (Bairagi et al., 2022). Impulsive buying of essential and storable commodities by consumers, due to lockdown measures (Sharma et al., 2020), resulted in higher prices of commodities in this category in 2020 (Bairagi et al., 2022). At the global level the Food and Agriculture Organization's (FAO) food price index increased by 25.7% in 2021 (FAO, 2022).<sup>1</sup> In Canada, food prices surged by 4.9 percent, 3.6 percent, and 3.9 percent in 2019, 2020 and 2021 respectively (Statistics Canada, 2021). Food price shocks can have detrimental impacts on households' food security. In the context of Indigenous people in Canada, it is imperative to first understand their food system and how price changes may affect their food security status.

First Nation households in Canada have used land-based procurement strategies such as traditional food harvesting and food sharing as a means of livelihood sustenance (Natcher, 2019). However, these strategies do not suffice amidst the obstacles that threaten the ability of First Nation households to harvest community-based food (Skinner et al., 2012). This insufficiency in food supplies have transformed Indigenous communities from a subsistence economy to mixed economy; livelihood by traditional food harvesting (subsistence) and store-bought food consumption (Kuhnlein et al., 2001; Usher, 2002; Nuttall et al., 2005; Bzdell, et al., 2010; Furgal, et al., 2012; Wendimu et al., 2018; Mirzaei & Natcher, 2021). Regarding the latter, affordability of store-bought foods is a crucial element that is in turn affected by transportation costs for both

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<sup>1</sup> The Food and Agriculture Organization food price index is based on 2014-2016 average price level.

suppliers and consumers. Some studies suggest a positive relationship between poor road access and high food prices. For example, the cost of a weekly food basket was \$112-\$140 higher among remote First Nations communities without road access than non-remote First Nations communities in 2016 (Wendimu et al., 2018). According to the executive director of Sioux Lookout First Nations Health Authority, James Morris, “The general rule of thumb is that the cost of food for most things is about 1.5 times (or more) higher in remote communities”.<sup>2</sup> “If you buy something for \$10 in the city, then it’ll be \$25, \$30 in the community” (Zoledziowski, 2021, paragraph. 4).

There is ample evidence that the Covid-19 pandemic has continued to drive up food prices for Indigenous communities in Canada. For example, Zoledziowski, (2021) reports that shipping costs of food to fly-in or remote areas in northern Ontario increased by 500% during the pandemic. Narine (2021) reports a 400% price surge during the pandemic in northern Ontario. According to Yassie, chief of Sayisi Dene First Nation in northern Manitoba, the amount of money needed to support a family at Tadoule Lake is insufficient given the high cost of living there. The Chief claimed that even with subsidies from the community trust and Nutrition North Canada (NNC), shoppers in Tadoule Lake still spend twice as much for groceries as they would elsewhere in Canada (Monkman, 2022). Using receipts from a grocery shopping trip, a mother from Iqaluit, capital of Nunavut, showed that despite receiving annual subsidies through the NNC, northerners have high rates of food insecurity due to overwhelming high prices vis-à-vis the Covid-19 pandemic (Sing, 2021). Semple (2022) also argued that some food items sold at the Iqaluit market were being sold for two or three times the national average. Compared to the national average, food prices in remote Indigenous communities were already up to 2.5 times higher. Thus the 9% increase in food prices on the national level in 2022 can feel more like 20% in remotes communities (Aziz, 2020).

Consequently, Covid-19 also contributes to higher vulnerability to food insecurity among Indigenous communities in Canada (Martin et al., 2016; Holland 2020; Polsky et al., 2022). Households with children, lone-parent families, and persons whose only source of income is government aid are particularly prone to food insecurity (Kenny et al., 2020). Thus, increases in food prices put a larger burden on families in their attempt to improve their food security status. According to Statistics Canada (2021), the percentage of food insecure (moderate or severe)

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<sup>2</sup> Sioux Lookout is a town in northwestern Ontario, Canada.

persons increased from 13.1 in 2019 to 15.1 in 2020. However, the true prevalence of food insecurity in Canada is often underestimated because on-reserve First Nations people and the homeless make up minor percentages of the Canadian population, and hence their high levels of food insecurity are often overlooked (Tarasuk, 2020). Food insecurity is a major problem for almost half of on-reserve households and the prevalence was relatively higher than for non-Indigenous households in Canada (Batal et al., 2021; Power, 2008). Anchan (2022) showed that the prevalence of on-reserve food insecurity was higher in western Canada with Alberta experiencing the highest food insecurity. According to a report by Alberta Health Services on food insecurity in 2017, “the prevalence household food insecurity amongst Indigenous people is at least two to three times higher compared to the general public across Canada” (Alberta Health services, 2023, pg. 8).

This thesis investigates temporal food price changes over the course of a five-year period from 2017 to 2021 in Fox Lake, one of the three reserves in Little Red River Cree Nation (LRRCN), northern Alberta. LRRCN of Alberta has one of the largest registered populations of all First Nations in the province yet remains one of the most geographically isolated. Fox Lake I.R. 162, is accessed via seasonal ice roads and a summer ferry over the Peace River. Based on the above-mentioned literature, one would expect that food prices spiked in Fox Lake due to the Covid-19 pandemic. Using retail food price data from Fox Lake’s local store, The Northern, and respective retail prices for similar products in Alberta, this thesis examines whether and to what extent the Covid-19 pandemic caused food price changes. The specific research objectives are summarized in the following sub-section.

## **1.2 Research objectives**

This thesis compares price levels and temporal price changes observed in the remote Indigenous community of Fox Lake and its corresponding province and how these changes might have been driven by the Covid-19 pandemic. In addition, potential consequences for households’ livelihood are discussed. More specifically, this thesis is aimed to:

1. Assess the differences in price levels and price changes between Fox Lake and Alberta,
2. Investigate and compare the impacts of the Covid-19 pandemic on observed price trends in Fox Lake and Alberta and
3. Identify observable implications of food price changes in Fox Lake.

To address the first two objectives, this thesis uses retail prices of 51 food items that make up a standard food basket observed in Fox Lakes's store, The Northern, over a five-year period from December 2017 to December 2021. To allow comparison with food price levels and food price changes in Alberta, respective retail prices for similar products are obtained from Statistics Canada (2021) and changes in the Consumer Price Index (CPI) are observed. To achieve objective 3, the thesis focuses on the implications of observed price changes on living wages using survey data on expenditures among Fox Lake households originally collected by Mirzaei and Natcher (2021) in 2018.

Despite a widespread concern on how food prices have been affected by the Covid-19 pandemic, there is limited empirical evidence about differences in price levels and temporal food price changes between First Nation rural communities and the province of Alberta. It is a pressing concern when households, in a locality, are faced with food prices higher than what is observed, on average, either on a provincial or national level. The thesis findings will be useful for LRRCN in guiding their decisions on how to potentially improve the affordability of store-bought foods and revise living wages. The findings may also be relevant for policy makers and the general public and potentially guide other Indigenous communities in similar situations.

### **1.3 Organization of study**

The remainder of this study is organized as follows. Chapter 2 reviews the literature related to potential underlying channels that affect food prices in remote Indigenous communities such as their food system, infrastructure, and shocks. Chapter 3, focuses on the study area of Fox Lake, presents background information such as its socio-economic characteristics between Fox Lake in relation to Alberta, presents living wages and expenses, and sheds more light on the relevant literature. Chapter 4 introduces the data and methods used to achieve the objectives of the study. Chapter 5 presents the main results and discusses the implications on living wages and, finally, Chapter 6 provides concluding remarks.

## **Chapter 2 Literature review**

### **2.1 Introduction**

This section reviews relevant literature on factors that influence on-reserve food prices in Indigenous communities. In the following subsections, I focus on Indigenous food systems, the role of price shocks such as the Covid-19 pandemic, infrastructure, and retail competition, as channels that affect food prices in remote Indigenous communities.

### **2.2 Indigenous food systems and the role of food prices**

Food security and food sovereignty are “crucially intertwined necessities” from the perspective of Indigenous people because traditional food harvesting is a critical component in achieving both ideals (Batal et al., 2018; Natcher 2019). Indigenous food sovereignty manifests in their close connection to community ethics and cultural identity, the effort that Indigenous communities put in to restore their food systems, harvesting, processing and consumption of harvested traditional food - a significant source of nutritional benefit (Kuhnlein et al., 2006; Cote 2016). Prior to westernization of their food systems, Indigenous people in Canada were supported on land-based traditional foods (Natcher 2019; Wendimu et al., 2018; 2010; Kenny et al., 2020). This source of livelihood is gradually being severed due to several factors. Treaties signed by Indigenous people in the 1800s have caused the deterioration of Indigenous food systems while also establishing long-term reliance on the government, putting Indigenous peoples' food security at risk (Wendimu et al., 2018). Colonization of Indigenous peoples' food systems resulted in isolation, extended poverty, food insecurity, and reliance on government handouts (Wendimu et al., 2018; Kenny et al., 2020). Natural resource extraction has consistently and systematically been prioritized over First Nations territorial interests in Alberta's land use legislation (Natcher 2019). There have been restrictive policies on agriculture, hunting and forced confinement on reserves to accelerate the assimilation by Indigenous people of colonial objectives. (Mirzaei & Natcher 2021; Wendimu et al., 2018)

Over the last century, Indigenous communities across Canada have seen dramatic changes in culture, including traditional methods of food collection, production, and processing. Indigenous people in Canada face inequalities being tied closely to land loss, forced displacement due industrial land appropriation and colonial history (Domingo et al., 2021; Kenny et al., 2020). First Nation hunters must now travel longer distances, which requires much more time and money to

participate, for instance, in moose hunts (Natcher, 2019). However, this is insufficient to sustain the nutritional needs of households over time. Two most pressing questions that affect the sovereignty of Indigenous people over access, sufficiency, and ability to replenish supplies of traditional food are:

*“We worried whether our traditional food would run out before we could get more?”*

and

*“The traditional food that we got just didn’t last, and we couldn’t get any more?”*

(Batal et al., 2021. Pg.4)

Because of the challenges faced by Indigenous people, there is still an unequal distribution of economic resources and other socioeconomic determinants of food security between First Nations peoples and the rest of Canada (Batal et al., 2021). Indigenous people in Canada currently participate in a hybrid of two food systems: conventional (market) food systems and Indigenous (local) food systems (Shukla et al., 2019). Many Indigenous communities' contemporary diets are dominated by market-based foods, the majority of which are nutritionally deficient (Shukla et al., 2019; Natcher 2019; Mirzaei & Natcher, 2021; Wendimu et al., 2018; Tarasuk, 2019). Given the nutritional shift to store-bought foods, many First Nations communities in northern Canada must rely on grocery stores that are often not locally owned and that carry foods at much higher costs than in Southern communities (Martin et al., 2016). With a restricted food budget, these families often rely on lower-cost foods that are devoid of nutritious value and ultra-processed (Batal et al., 2018). The dietary balance comes from commercial sources, at an estimated yearly cost of \$8,676,972 (CAD), or approximately \$9,871 per First Nation household, with traditional foods accounting for around 20% of the household diet in Alberta, Canada (Natcher, 2019). The cost of feeding a family in northern Canada is twice as much as in the south (Martin et al., 2016).

Given the insufficiency associated with traditional food harvesting and high prices of store-bought food, food-insecure Indigenous households have, over the years, developed coping strategies (Tarasuk 2016). These strategies include but are not limited to skipping meals, relying on lower quality, lower cost foods, buying less meat, milk, fruits and vegetables, cancelling services for household utilities, and selling personal possessions (Tarasuk, 2016; Henderson 2022). These coping mechanisms have dire long-term consequences on wellbeing and health. While



revitalizing traditional food systems is crucial to addressing contemporary food insecurity and related health concerns faced by Indigenous peoples, policies, and measures to provide access to affordable, nutritious market foods are also critical (Wendimu et al., 2018).

### **2.3 Food prices amid Covid-19**

Food costs may not be the only factor affecting the food security of rural First Nation households, however, they play a critical role (Martin et al., 2016). On the global front, the FAO food price index measures change in international prices of the average of five commodity group price indices weighted by the average export shares of each of the groups over 2014-2016. Using 2014-2016 as average price level (100 = baseline), their results show that there was an overall decline in food prices in 2020 against an approximately 26 percent increase in 2021 (FAO, 2023). Their results also showed that there was an increase in the price of dairy and cereal products in 2020 and 2021. Prices declined for meat, vegetable oils and sugar in 2020 while price increases were recorded in 2021.

The 2020 Food Price Report released by Agri-Food Analytics Lab (AAL, 2020) notes that the Covid-19 pandemic would put extreme pressures on the food retail and processing sectors. The uncertainty surrounding the epidemic caused considerable changes in consumer purchasing habits. Consumer panic-buying of large quantities of commodities is thought to be the primary cause of the shortages experienced in 2020 (Holland, 2020). Due to lockdown measures, impulsive buying of essential commodities on the spur of the moment, drove up the price of these goods in 2020 (Sharma et al., 2020; Bairagi et al., 2022). For Indigenous people in Canada, the main impacts of the Covid-19 were experienced on its negative toll on access to food, as shelves of the few groceries empty out, shipments of food boxes are delayed because of supply chain disruptions, and hunting and gathering are restricted by government regulations and environmental conditions (Pineo 2017). The federal government has stated that supply chain concerns will almost certainly result in higher food prices for Canadians (Holland, 2020). If the prices of food rise, impoverished households are likely to suffer since most of them are net buyers of food (Mkhawani, 2016). High food prices limit poor households in their ability to patronize other essential non-food expenses like education and health care. Pineo (2017) showed that many people had to shop at on-reservation stores characterized by high food prices due to Covid-19. (Zoledziowski, 2021). Evidence from some Indigenous communities have shown that shipping food to fly-in or remote areas cost five

times more during the pandemic. Thus, further exacerbating already existing high food prices in that area, when compared on a provincial or national level (Aziz, 2020; Zoledziowski, 2021; Sing, 2021; Semple 2022; Monkman, 2022). Food costs, however, are not the only factor affecting affordability, which is inextricably related to financial food insecurity (Holland, 2020).

Some studies in the US have also identified some impacts of the Covid-19 pandemic on the Indigenous people. Native Americans tend to spend more on food than the typical American, despite having lower wages than people living outside of Indian Country and living in locations where access to food is more difficult due to distance and transportation challenges (Pineo, 2017). The author showed that due to Covid-19, many people were left with no option than to shop at on-reservation stores that naturally have high prices. A comparison of four staple foods between off-reservation (Chamberland) and on-reservation (Pine Ridge) both in South Dakota, showed that it costs at least 40% more to shop within a tribal community (Native Hope, 2020). Using longitudinal survey across 4 months during the COVID-19 pandemic (August 24, 2020- November 30, 2020), Henderson et al. (2022) examined the impact of the COVID-19 pandemic on food insecurity in the Blackfeet American Indian Tribal Community. Their results showed that Covid-19 further intensified the problem of food security among Blackfeet households, especially among female-headed households. Kenny et al. (2020) systematically synthesized literature pertaining to the retail food sector relevant to Indigenous people in High Income Countries (HICs). Their results showed issues relating to limited store availability/access as well as high food prices and low food quality in certain Indigenous communities.

Indigenous people in Alberta have experienced hikes in the prices of a standard food basket over the years (Kenny et al., 2020). As such they are more vulnerable to the problem of high-price induced food insecurity and its effects. Food prices have been one of the significant factors which affect households' food security. According to Ivanic et al. (2008), rising food prices increase the risk of poor households being food insecure. Price volatility or extreme price shocks have the potential to exacerbate and contribute to broader socioeconomic problems related to food security (Kalkuhl et al., 2016).

## **2.4 Infrastructure and food prices**

Empirical evidence suggests that new highways and railroads lower transportation costs and expand trade (Donaldson 2018). Furthermore, improved road systems increase firms'

productivity (Holland 2016), decrease transportation costs (Datta 2012) and provide better access to international trade (Cosar and Demir 2016; Volpe et al., 2017). Construction of all-weather resistant roads is a milestone to subduing poverty, improving employment opportunities, and improving producers' access to markets and in turn reduces prices. (Pradham Mantri Gram Sadak Yojana, 2005). Studies in the Global South, such as the Nigerian case study by Okpala et al. (2021) showed that good quality road infrastructure improves farmers' access to the necessary agricultural inputs (equipment, seeds, seedlings, and labor) during the cropping season, whereas the lack of such infrastructure currently impedes food production, distribution, and supply. Poor road networks coupled with high fuel prices exert high production cost for producers and in cases where these producers generate a surplus, they must confront great hurdles in marketing their products (Lebailly et al., 2011). This results in high prices of goods for consumers, further exacerbating food insecurity for individuals and households.

Food price disparities have been associated with community and geographic factors such as road access (Kenny et al., 2020). Canada has, over the last decade, experienced an increase in road infrastructure. However, it barely offsets the current erosion of the road system (Roy, 2009). This insufficiency in transportation networks may cause the problem of social exclusion, which describes the situation where there are constraints to people's ability to access education, employment, public services, and activities in the society (Litman, 2003). Litman (2003) reckoned that about 20% of Canadians households do not own an automobile and 10% fall within the low-income category, and, hence, would require adequate road networks and transport policies to meet their daily standards of living. Many Canadian communities are becoming more reliant on cars which tend to increase transport-induced social exclusion problems. Residents of remote regions may have difficulty accessing essential activities and services (Litman 2003) without proper transport systems. He further asserts that Canada has strong social problems and there is only a weak national effort on local transport planning policies to address problems of social exclusion, which in turn exacerbates vulnerability to food insecurity.

General remoteness, significant distance, and poor infrastructure such as roads to regional centers limit options for shopping outside communities. Wendimu et al., (2018) and Burnett et al., (2017) found that more than half of the communities in the provincial Norths and Far North without year-round road access did not have a grocery store that competed with the Northwest Company

(NWC). The NWC is a top retailer to underserved rural regions in Northern and Western Canada, rural Alaska, the south pacific islands, and the Caribbean. With many store locations, the NWC offers a broad range of products and service with much emphasis on food.

## **2.5 Retail competition and food prices**

Food access and choice are largely shaped by the local retail food environment. Inadequate food surroundings, such as grocery store unavailability, have been linked to poorer diet quality and obesity (Kenny et al., 2020). Many Indigenous communities in rural areas have one or two local stores. These stores are often small in nature, serve a small customer base, and have significant operating costs and complicated logistics (Kenny et al., 2020). Individuals have the option of placing food orders online or sometimes travelling to other food supermarkets/grocery stores with larger food diversity and lower prices. However, poor roads, time of travel due to long distance, and internet access may be constraints. (Kenny et al., 2020).

Issues of food insecurity related to store availability have been linked to limited retail competition in terms of oligopolies or monopolies (Parker et al., 2018). By examining the potential retail competition faced by the NWC and by reporting on the grocery shopping experiences of people living in the provincial North, Burnett et al. (2017) showed that northern communities without retail competition had consumers finding it difficult to afford nutritious foods due to high prices and low quality of foods.

Limited retail choices also affect the range and quality of foods that people can purchase. Indeed, the need to address the existing market-based food system and the oligopolies that have facilitated the current conditions present in most northern communities is urgent. One study that directly examined the issue (i.e., presence of a second retailer by community) in the provincial north of Canada found that over 90% of remote FN communities surveyed are serviced by a single corporate food retailer (Burnett et al., 2017). This can be problematic, as communities with a single food retailer exhibit higher food costs. Although the presence of a second retailer may still not render food prices affordable, increased competition of grocery stores has been associated with better food pricing and quality (Kenny et al., 2020; Burnett et al., 2017).

## **2.6 Summary**

Insights from this chapter show the importance of traditional food in the daily diets of Indigenous households in Canada. With contemporary diets being dominated by market-based

products, food prices play a major role in their food security status. The literature suggests a positive relationship between poor infrastructure, such as roads and internet connectivity, and high prices. The Covid-19 has simply made food insecurity worse. Strong curfews and obligatory 72-hour lockdowns limited the movement of community residents. Many consumers are compelled to buy at grocery stores on reservations, which are inevitably more expensive. The closure of many production plants constricted the supply of many food items whereas panic buying, due to restrictions, reduced the quantity of food available to other consumers. Nevertheless, the impact of Covid-19 in driving food prices up or down depends on how demand is constricted over supply or vice versa. In addition, the local retail food environment plays a major role in choice and affordability of food for Indigenous households. This is because limited retail competition can put a burden of high prices on consumers.

Evidence from reviewed literature have shown that food prices have significantly gone up in Indigenous communities following the Covid-19 pandemic, which posed supply and demand shocks. The literature search found related studies in Manitoba, northern Ontario, other parts of Canada and Pine Ridge, South Dakota (USA). I set out to see what happened in the case of Fox Lake in the next chapter. More precisely, I describe the study area, compare socio-economic characteristics between Fox Lake and Alberta, present living wages and expenses in Fox Lake, and examine the relevant literature through the lens of Fox Lake's context.

## **Chapter 3 The case of Fox Lake**

### **3.1 Introduction**

This section describes the underlying case study of this thesis, Fox Lake, as one community within the Little Red River Cree Nation in northern Alberta. Specifically, this section presents Fox Lake's socio-economic characteristics in relation to Alberta, present living wages and expenses in Fox Lake in subsection 3.2, and discusses the factors affecting food prices, reviewed in the previous chapter, in the context of Fox Lake. With respect to the latter, Fox Lake's current food system, infrastructure and transportation system, and Covid-19 measures are examined in subsection 3.3.

### **3.2 Fox Lake's socio-economic characteristics and living wages.**

LRRCN is located about 1.5 hours east of High Level in Northern Alberta and is composed of three woodland Cree reserves: John D'Or Prairie which is the Administrative Center, Garden River, and Fox Lake. Fox Lake is the most populated Cree reserve. According to recent statistics, about 65% of households living on reserve in LRRCN reside in Fox Lake (LRRCN, 2020). This study focuses on Fox Lake for studying price disparities due to its remoteness and the seasonality of transportation routes, which will be explained later in this section.

Table 3.1 shows that Fox Lake has a population of 2,035 residents. approximately 42% are under the age of 14. The average household is made up of 7 members. In comparison to Alberta, one can observe that Fox Lake's residents are, on average, 17 years younger than the Albertan resident, and households are more than twice as large. In terms of per capita household income and consumption, Fox Lake is much poorer than Alberta.<sup>3</sup> In fact, per capita median household income in Fox Lake is approximately a quarter of what is observed in Alberta. In 2017, the per capita food expenditure in Fox Lake stood at \$13,775.8, 19.7% more of what was observed in Alberta.

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<sup>3</sup> The primary source of income for most households in Alberta are employment earnings, market income, and transfers from the government.

**Table 3.1: Socio-economic characteristics of Fox Lake and Alberta**

<b>Characteristic</b>	<b>Description</b>	<b>Fox Lake</b>	<b>Alberta</b>
Number of household members by age	0 to 14 years	855	809,640
	15 to 64 years	1125	2,823,770
	65 years and over	55	629,220
	Average age (years)	22.3	39
Number of households by household size	1 person	15	424,055
	2 persons	25	551,420
	3 persons	20	249,135
	4 persons	35	243,400
	5 or more persons	205	165,215
	Average household size	7	3
Per capita median total income of households	Including market income, government transfers and employment income	\$7,442	\$32,000
Per capita household food expenditure	2017	13775.8	\$11,505.8
	2018	-	\$11,809.3
	2019	-	\$12,296.4
	2020	-	\$13,357.7
	2021	-	\$13,129.3

Source: Data on age characteristics, household size and median total income of households stems from Stats Canada (2022) and Household food expenditure stems from Mirzaei and Natcher (2021).

Next, I focus on living wages, i.e., the hourly wage a worker needs to earn to cover their basic expenses within their community (Alberta Living Wage Report, 2021). It is re-calculated on an annual basis to ensure that it accurately reflects changing living expenses. The living wage calculation is based on a family of four with two parents working 35 hours per week, from

expenditure survey data originally collected in 2018 by Mirzaei and Natcher. Hourly wages were calculated by dividing the total expenditure by hours worked in a year as shown by equation 3.1. and 3.2 <sup>4</sup>

$$\text{Assuming one individual working: } \frac{\text{Total expenditure}}{(35 \text{ (hours)} * 52 \text{ (weeks)})} \quad (3.1)$$

$$\text{Assuming two individuals working: } \left( \frac{\text{Total expenditure}}{(35 \text{ (hours)} * 52 \text{ (weeks)})} \right) / 2 \quad (3.2)$$

The survey included a list of expense categories and sub-categories. Table 3.2 presents the estimated living expenses and hourly wages for a family of four in 2016 in Fox Lake and LRRCN. Expenditure on food, shelter, and educational services account for a high proportion of total expenses for a family of four. A household with only two working individuals would require an hourly wage of \$19.58 in order to meet the total living expenses. This is half of what would be required for a household with only one working member. With expenses on food accounting for the greatest proportion of households' annual expenses, food price increases would put more economic burden on households in Fox Lake.

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<sup>4</sup> The survey included 15 categories and 67 subcategories including the 'Other' - category/subcategory to record any expenses that may not have been listed. The survey was co-designed with the LRRCN and tailored to include First Nation-specific expense categories and subcategories e.g., attendance and participation in cultural events. See Appendix A for details.



**Table 3.2: Living expenses and hourly wages for a family of four.**

	<b>Fox Lake</b>		<b>LRRCN</b>	
	Living expenses (\$)	Share in total expenditure	Living expenses (\$)	Share in total expenditure
Food	16,292	22.86%	16,287	22.14%
Educational services	13,775	19.33%	13,740	18.68%
Shelter	12,792	18.00%	12,792	17.39%
Other household costs	7,958	11.17%	8,494	11.55%
Clothing	6,046	8.48%	4,619	6.28%
Transportation	4,311	6.04%	7,823	10.64%
Healthcare services	4,204	5.90%	4,161	5.66%
Professional services	3,142	4.41%	2,806	3.82%
Contingency fund	2,741	3.85%	2,829	3.85%
<b>Total</b>	<b>71,261</b>		<b>73,551</b>	

**Hourly Wages (\$)**

assuming:

Two individuals working

19.58

20.21

One individual working

39.15

40.41

Source: Mirzaei and Natcher (2021)

Notes: The professional services, healthcare services, and educational services expenses include both expenditures incurred by the household and the LRRCN government. The shelter expense is calculated using the Canadian Rental Housing Index. It includes the cost of rent plus utilities including heat, hot water, and electricity for an average 3-bedroom dwelling in Division No. 17 in Alberta. The contingency fund is calculated as the amount of two weeks' worth of wages.

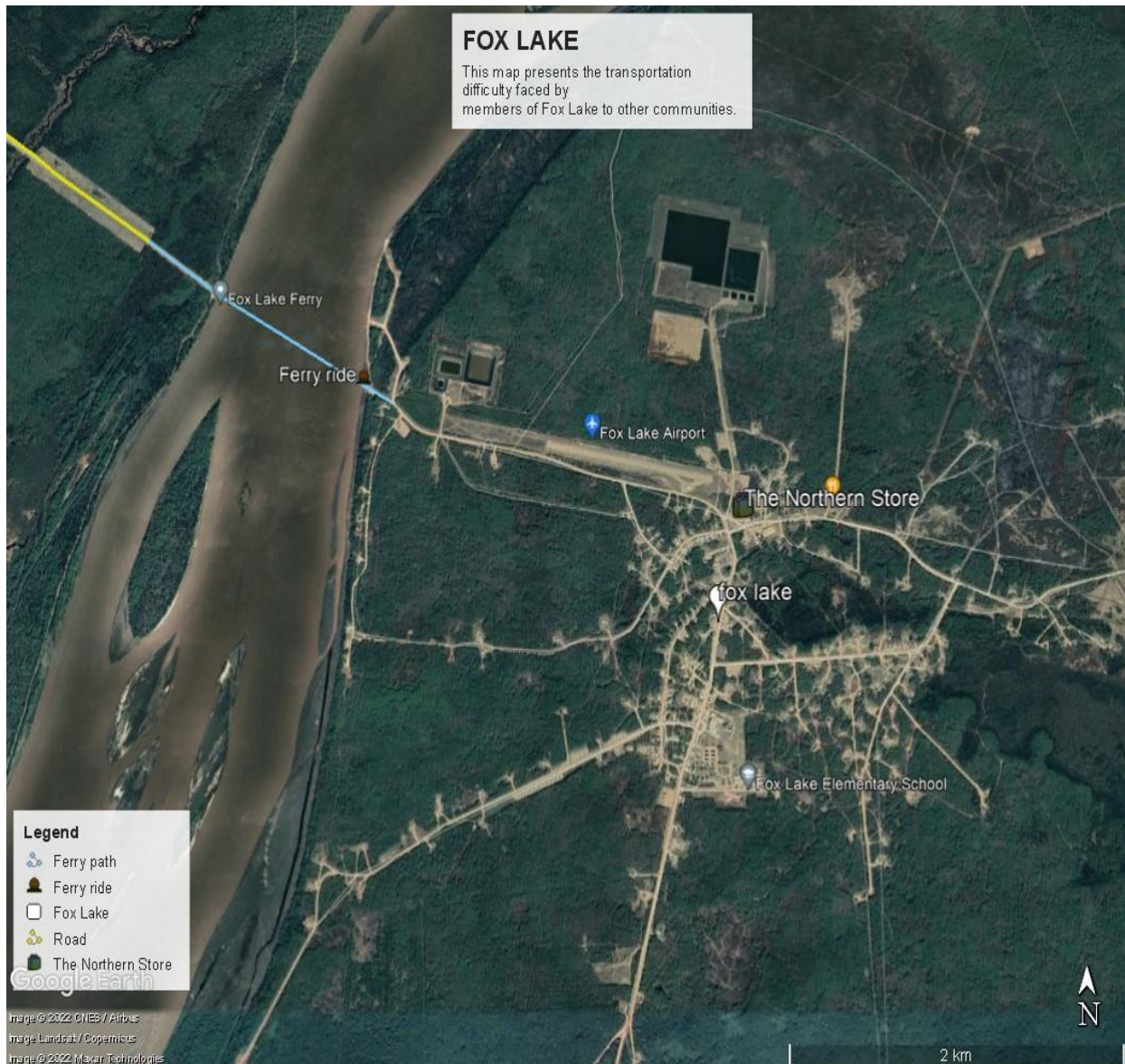
### **3.3 Fox Lake's food systems, infrastructure, and Covid-19 measures**

#### **3.3.1 Fox Lake's food system**

Fox Lake generally relies on two co-existing food systems to sustain itself, i.e., (i) the land-based forest and freshwater food harvesting system and (ii) the market-based retail food purchasing system. With regards to land-based forest and freshwater food harvesting, moose hunting is by far the most predominant, accounting for 70% of the entire food harvest. Bison, black bear, beaver, various freshwater fish, and migratory bird all made significant contributions (Natcher, 2019). Market-based food system is also a crucial component of community food security and one's sustenance, because of its growing proportion in the diet of Indigenous people (Shukla, 2019). Currently, 'The Northern store' is the only local grocery store in Fox Lake suggesting that households are faced with limited retail choices (see Figure 3.1). The closest grocery store is 115km away.

#### **3.3.2 Fox Lake's infrastructure**

Cost of food has been one of the drivers of food insecurity in rural communities. Another major factor that influences the cost/pricing of food is transportation costs for producers and consumers, which in turn is influenced by the level of infrastructure and distance. Fox Lake is only accessible by air, seasonal ice roads, and a dirt road that is subject to weather-related closure. For the most part of the year, Fox Lake is accessible seasonally despite periods of fall freeze up and spring break up that affect the stability of its winter ice (Mirzaei & Natcher, 2021). Travel to and out of Fox Lake involves either transportation across the Wabasca river during open water on a ferry and/or dirt road travel which is susceptible to weather conditions. Driving conditions out of Fox Lake can be quite challenging given the condition of the roads, causing high travel costs per trip. The only way out of Fox Lake in the summer is by air in small planes, or by a barge that carries one vehicle at a time (see Figure 3.1). The ferry crossing is within close proximity to the community and typically does not result in significant travel delays. The difficulties arise during fall freeze (waiting for the ice to form to construct the ice road) and spring break-up (waiting for the ice to melt to put in the ferry). With changing weather patterns these dates have become quite variable. Many households in Fox Lake currently rely on social assistance to meet daily standards of living. Consequentially, one can observe higher transportation costs in Fox Lake relative to other reserves with better transportation networks (Mirzaei & Natcher, 2021).



**Figure 3.1. Transportation condition and location of the local store in Fox Lake**

Source: Esri Inc. (2022)

Mirzaei and Natcher (2021) found that expenditures on food and transportation account for significant proportion of on reserve households' expenditure in LRRCN. This is because a high proportion of their income is not only spent on food but also on transportation to near and far destinations that offer relatively affordable prices for food. Table 3.3 shows trip characteristics of grocery destinations outside Fox Lake. The three most frequently visited shopping destinations outside Fox Lake are High Level, LaCrete and Fort Vermillion. These grocery destinations are between 115km and 158km from Fox Lake. The largest annual average grocery expenditure are

made at the local store in Fox Lake (\$5,377), followed by High level (\$1,748). On average, households make approximately 7 visits to their local store and 6 visits to High Level every month.

***Table 3.3. Trip characteristics of grocery destinations outside Fox Lake***

<b>Destination</b>	<b>Distance by road from Fox Lake (km)</b>	<b>Estimated gas cost per one-way trip</b>	<b>Number of annual visits</b>	<b>Annual average household expenditure per capita</b>
High Level	158.05	\$25.462	66	\$1,748
LaCrete	145.6	\$23.452	47	\$1,347
Fort Vermillion	115.3	\$18.571	48	\$1,171
Edmonton	931.31	\$150.020	5	\$923
Peace River	447	\$72.013	3	\$1,176
Slave Lake	689.13	\$111.014	6	\$625
Grande Prairie	604.54	\$97.381	4	\$1,407

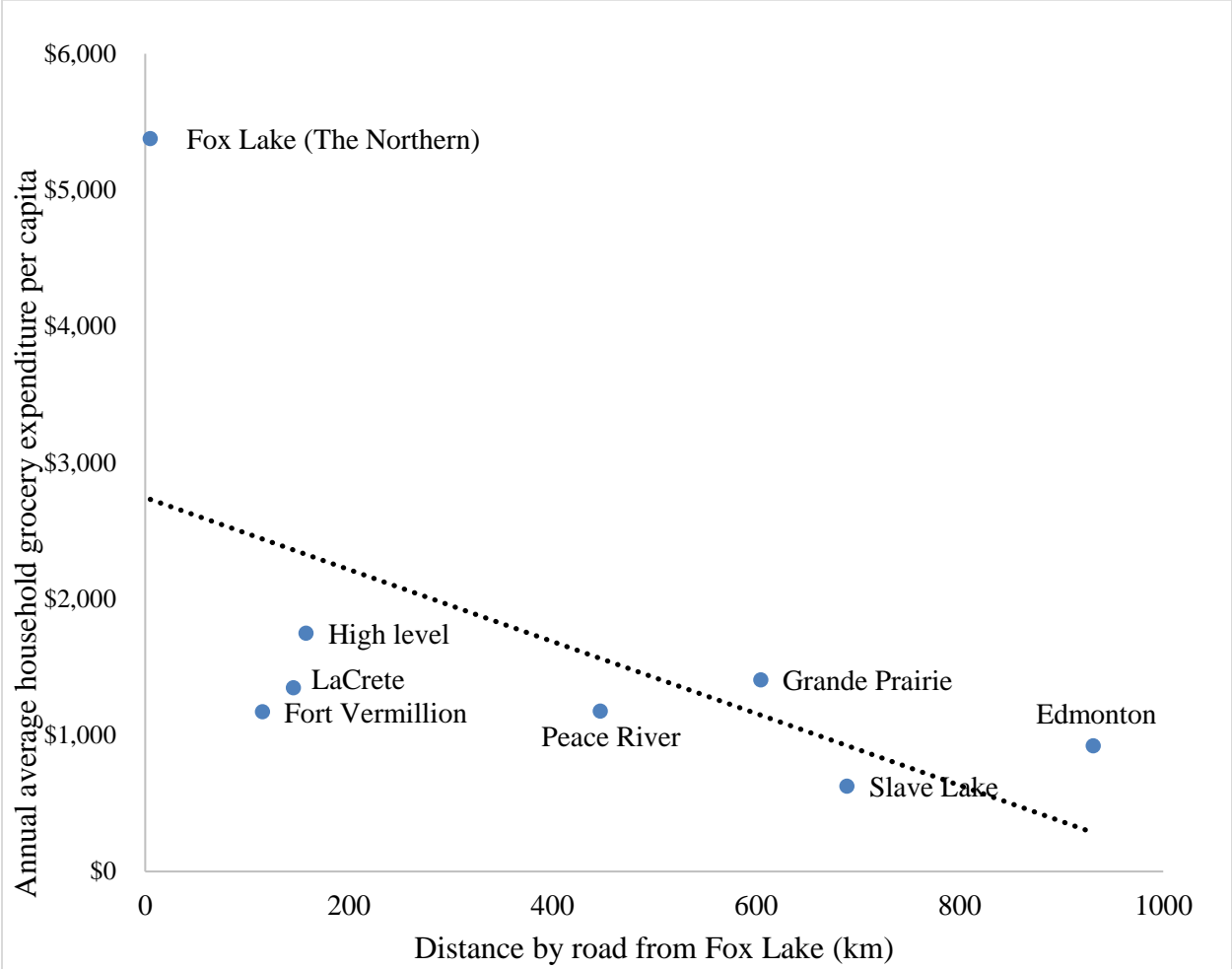
Source: Esri Inc. (2022), Fuel cost calculator (2022).

Note: Gas cost per trip to each grocery destination was calculated using a fuel cost calculator based on information on distance of the destination from Fox Lake, fuel efficiency of the car being used and gas/fuel price per liter. The thesis assumed an average fuel efficiency of 9 liters per 100 km (L/100 km) and a gas/fuel price of \$2.64 per liter to estimate gas/fuel cost per trip.

For a return trip to High level, which is the third closest grocery destination from Fox Lake, a household must spend approximately \$50 on gas. Not all reserve residents have the means to buy groceries outside Fox Lake due to the time and travel costs associated with these trips. For households that depend solely on social assistance, high transportation costs present a great burden. Wendimu et al. (2018) suggests that Indigenous community members who own cars can shop outside the community while other members have no other option than to shop exclusively in their community. Destinations outside Fox Lake may have relatively cheaper prices for some food items, however, households burdened by lack of vehicles or other economic means have no option than to shop exclusively from the local store in Fox Lake.

If one relates average annual food expenditures per capita and distance to grocery shopping destinations, we obtain an inverse relationship as shown by Figure 3.2. The inverse relationship, shown by the line of best fit, suggests that households spend more on closer destinations and vice

versa. Nevertheless, travel costs to grocery destinations outside Fox Lake put various levels of economic burden on Indigenous household who do not own vehicles. Natcher (2019) suggests that there are 27 privately owned and operated businesses in LRRCN with 30% of these businesses dominated by transportation services.



**Figure 3.2. Relationship between annual average households’ grocery expenditure per capita and distance to grocery destinations outside Fox Lake**

Source: Mirzaei and Natcher (2021)

3.3.3 Fox Lake’s Covid-19 measures

Another factor that has affected prices not only in Canada but globally, is the pandemic that hit the world early 2020. Quintero et al., (2021) showed that households reduce their distance travelled during the pandemic especially in 2020, households living on reservations make a higher number of trips to convenience stores. First Nations, Inuit, and Métis peoples are among the most vulnerable, and that individuals living in remote and fly-in only areas of the country are most

vulnerable to Covid-19 (Mashford et al., 2021). In view of this, several communities expressed concerns over policies made by external governments (such as federal, provincial/territorial, and/or municipal) over the health and welfare of Indigenous people during the height of the pandemic (Quintero et al., 2021). Based on revisions of by-laws at the First Nation level, many Indigenous communities resorted to locking down their borders to keep outside people from entering their communities. In the case of Fox Lake, protective strategies to reduce the number of outsiders coming into the reserve, with Covid-19, led to a strict closure of the ferry on the Wabasca river.

### **3.4 Summary**

In comparison to average household characteristics in Alberta, Fox Lake is largely characterized by a relatively young population, living in large households. Yet, income levels are only a fourth of that observed in Alberta. Consumption expenditures per person in Fox Lake, in 2017, was 19.7% higher compared to Alberta. In terms of local diets, moose hunting accounts for 70% of all harvested food and ‘The Northern’ is the only retail store in Fox Lake. Despite the poor nature of roads and high transportation costs involved, some households shop for groceries outside Fox Lake. In terms of grocery purchases, the largest annual average grocery expenditure shares are spent at the local store (\$5,377), followed by High Level (\$1,748), a nearby town. On average, households make approximately 7 visits to their local store and 6 visits to High Level every month. The pandemic that hit the world in early 2020 came with stringent policies that meant that households’ travel for grocery shopping has been reduced.

The next chapter describes the data sets and methods used in this study.

## **Chapter 4 Data and Methods**

### **4.1 Introduction**

In this section, the data and methods used to address the research questions in this thesis are described. I use both price data and survey data that are described in subsection 4.2. Subsection 4.3 describes the methods used.

### **4.2 Price data and survey data**

To address my first two objectives, I use a collection of yearly retail prices for selected food items from Fox Lake's local store, 'The Northern' and data on monthly average retail prices for selected products for Alberta from Statistics Canada (2021). I use the same eight food categories as used by Statistics Canada in calculating the Consumer Price Index (CPI) for food in various provinces across Canada as shown in Table 4.1. Note that there is, however, a comparison problem with the fresh and preserved fruits and vegetables category in Fox Lake following modifications made to separate fresh and preservable fruits and vegetables. I, hence, compare food price changes of all other categories except fresh and preserved fruits and vegetables between Fox Lake and Alberta.

Based on this categorization, a list of food items was developed to which the manager of 'The Northern' provided pricing data of selected food items for five consecutive years in the month of December only (Dec. 2017-Dec 2021). To compare average changes in food prices between Fox Lake and Alberta, I utilize data on prices from 'The Northern' in Fox Lake and annual percentage changes of the Consumer Price Index (CPI) not seasonally adjusted from December 2017 to December 2021 in Alberta collected by Statistics Canada (2021). Scanner data (also known as transaction data) obtained from Canadian food retailers is used by Statistics Canada to compute the average prices and determine monthly and annual percentage changes in food prices by category and across all foods in different provinces including Alberta. In the case of Fox Lake, this thesis calculates annual average changes in food prices following the standard CPI approach as explained in subsection 4.3.

**Table 4.1 Food categories and sampled products in Fox Lake**

<i>Food category</i>	<i>Sampled products</i>
Meat	Fresh or frozen meat (excluding poultry) Fresh or frozen poultry Bacon Ham excluding deliham
Fish, seafood, and other marine products	Fresh or frozen fish (including portions and fish sticks) Canned salmon Canned tuna Shrimps and prawns
Dairy products	Whole milk Low fat milk Butter Cheddar cheese Processed cheese Mozarella cheese Ice-cream and related products
Eggs	Eggs
Bakery and cereal products (excluding baby food)	Bread, rolls and buns Crackers and crisp breads Cookies and sweet biscuits Rice and rice-based mixes Breakfast cereal and other cereal products (excluding baby food) Dry or fresh pasta products Flour and flour-based mixes
Fresh fruits and vegetables	Apples Oranges Bananas Potatoes Tomatoes Lettuce
All other preserved fruits and vegetables	Canned fruit Jam, jelly, and other preserves Frozen fruit Frozen and dried vegetables Canned vegetables and other vegetable preparations
Other food products and non-alcoholic beverages	Sugar and syrup Margarine Roasted or grounded coffee Instant or other coffee Tea Fermented or pickled vegetables Sauces, condiments, and dips Herbs, spices, and seasonings Soup Infant formula Frozen food preparations Nut butter Potato chips and other snack products Non-alcoholic beverages

Source: Statistics Canada (2021)



To address my third objective, i.e., to examine the implications of potential food price changes in Fox Lake, I utilized survey data on household expenditure in Fox Lake, primarily collected by Mirzaei and Natcher (2021) in 2018.

Mirzaei and Natcher (2021) used a standard format of a household expenditure questionnaire to solicit information on respondents' various expense categories including groceries (including diapers, baby food, personal hygiene items), take-out food including coffee, restaurants, traditional food, and other. Teams of First Nations researchers were trained and administered expenditures surveys amongst households living on reserve in the three communities of the LRRCN including John D'or Prairie, Fox Lake, and Garden River. In total, 177 surveys (i.e., 25%) were administered and used in this study (i.e., John D'or Prairie: 67 (26%), Fox Lake: 84 (24%), and Garden River: 26 (25%). The survey included a list of expense categories and sub-categories (see Appendix B).

#### **4.3 Consumer Price Index (CPI) calculation.**

The Consumer Price Index (CPI) is a measure of how consumer prices have changed. By comparing the price of a set basket of consumer goods and services over time, it gauges price change. As long as the number and quality of the products in the basket remain constant or equivalent, the index measures only "pure" price change (Statistics Canada, 2023).

Generally, the CPI is calculated in two stages as shown on Figure 4.1. The first stage, also referred to as the lower-level computation, determines price relatives by keeping constant all quality characteristics across time, then averaging them to generate elementary price indices. The primary constituents of the CPI are the elementary aggregates and their price indices. Elementary aggregates can be defined as *'the smallest aggregate for which expenditure data are available and used for CPI purposes. The values of the elementary aggregates are used to weight the price indices for elementary aggregates to obtain higher-level indices. The range of goods and services covered by an elementary aggregate should be relatively narrow and may be further narrowed by confining the goods and services to those sold in particular types of outlets or in particular locations. Elementary aggregates also serve as strata for the sampling of prices'* (Lamboray, 2019, pg. 2). Since there is just one grocery store in Fox Lake, all food items were selected from that single store.

The second stage, also known as the upper-level computation involves aggregating calculated elementary price indices as an asymmetrically weighted arithmetic fixed-basket formula to obtain aggregate indices. As shown in Figure 4.1, I calculate the lower and upper-level indices across all eight food categories using price data on Sampled Products (SPs) from ‘the Northern’ and expenditure shares from Statistics Canada (2021). Further explanation is provided on the two stages in subsections 4.3.1 and 4.3.2.

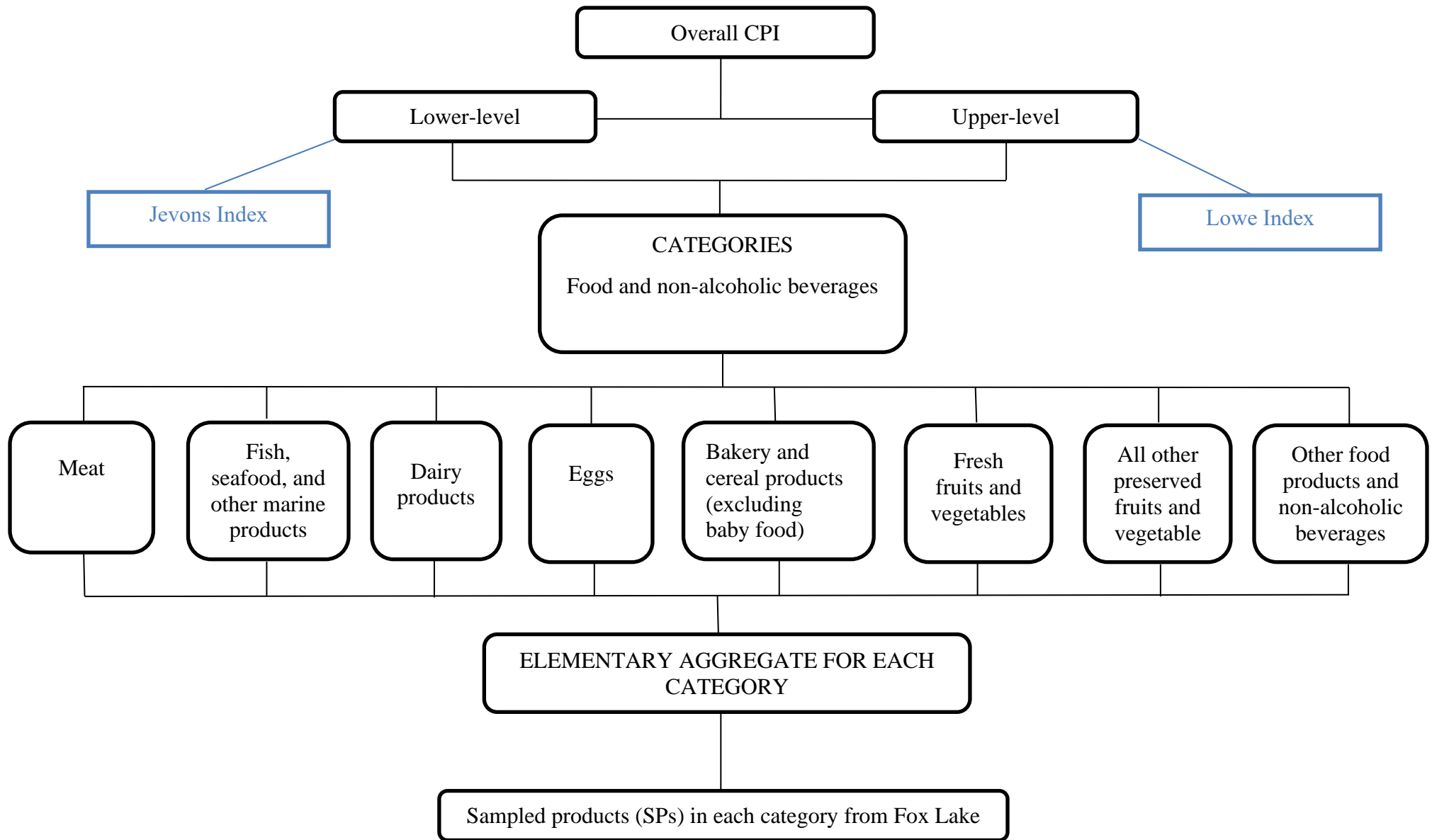


Figure 4.1 Aggregation structure of Consumer Price Index (CPI) used in this study.  
 Source: Adopted from OECD (2004).

### 4.3.1 Lower-level computation

Elementary price indices, estimated from elementary aggregates, can be calculated using a variety of approaches. The three most used approaches are the Carli index, the Dutot index and the Jevons index (Lamboray, 2019), which are shortly introduced in what follows.

The Carli index is a simple, or unweighted, arithmetic mean of price ratios for the two periods being compared.

$$I_C^{0:t} = \frac{1}{n} \sum \left( \frac{p_i^t}{p_i^0} \right) \quad (4.1)$$

where

$p_i^0$  and  $p_i^t$  denote the price of the  $i$ -th sampled product in the baseline period 0 and period  $t$  respectively and  $N$  is the total number of sampled products in the elementary aggregate 'a' representing a food category.

The Dutot index is defined as a ratio of the unweighted arithmetic mean prices.

$$I_D^{0:t} = \frac{\frac{1}{n} \sum p_i^t}{\frac{1}{n} \sum p_i^0} \quad (4.2)$$

The Jevons index ( $I_J$ ) is calculated as the unweighted geometric mean prices of the observed sampled products within an elementary category.

$$I_{J,a}^{0:t} = \frac{\prod_{i=1}^N (p_i^t)^{\frac{1}{N}}}{\prod_{i=1}^N (p_i^0)^{\frac{1}{N}}} \quad (4.3)$$

where

the nominator denotes the geometric mean price for all SPs for a food category in period  $t$ , while the denominator denotes the same for the baseline period.

The criterion used in selecting the appropriate index formula is that the index is required to meet specific test requirements (Lamboray, 2019). In this study, I focus on the following three main basic tests.

- Transitivity test: Between any two periods, the chain indices should be identical to the corresponding direct indices.<sup>5</sup> Table 4.2 below demonstrates that the Jevons and Dutot indices both pass this test, in contrast to the Carli index, which fails. For example, the chained index and direct index are both identical for the Jevons and Dutot indices in 2018, 2019 and 2020.
- Time reversal test: If all the price data from the two periods being compared were interchanged, the resulting price index should be identical to the original price index's inverse. The Dutot and Jevons indices satisfy this test which is not the case for the Carli index.
- Proportionality test: If all prices observed in a particular year are a result of prices in the reference period (2017) multiplied by a scalar, the resulting index in that particular year is the scalar. For example, if we assume that prices for the respective products in 2021 are 0.1 times prices observed in 2017, the resulting index for the Carli, Dutot and Jevons indices are 0.1.

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<sup>5</sup> The change in the index from one year to the next is displayed by each *year-to-year index*. *Chained year to year indices* links the various year-to-year indices by successive multiplication. *The direct indexes* directly compare each succeeding year's prices to those of the reference year (2017).

**Table 4.2 Calculation of price indices for elementary aggregate**

	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
Fresh or frozen meat (excluding poultry)	8.19	7.79	6.49	6.69
Fresh or frozen chicken	21.29	20.99	20.99	20.99
Bacon	6.19	8.69	7.99	6.29
Ham excluding deliham	5.39	5.69	6.99	7.39
<b>Arithmetic mean</b>	10.265	10.79	10.615	10.34
<b>Geometric mean</b>	8.733	9.482	9.339	8.988
<b>Year to year price ratios</b>				
Fresh or frozen meat (excluding poultry)	100	95.116	83.312	103.082
Fresh or frozen chicken	100	98.591	100	100
Bacon	100	140.388	91.945	78.723
Ham excluding deliham	100	105.566	122.847	105.72
<b>Current to reference year (2017) price ratios</b>				
Fresh or frozen meat (excluding poultry)	100	95.116	79.243	81.685
Fresh or frozen chicken	100	98.591	98.591	98.591
Bacon	100	140.388	129.079	101.616
Ham excluding deliham	100	105.566	129.685	137.106
<b>Carli index- arithmetic mean of price ratios</b>				
Year to year index	100	109.915	99.526	96.882
Chained year to year index	100	109.915	109.394	105.983
Direct index on 2017	100	109.915	109.149	104.749
<b>Dutot index- the ratio of arithmetic mean prices</b>				
Year to year index	100	105.115	98.378	97.409
Chained year to year index	100	105.115	103.410	100.731
Direct index on 2017	100	105.115	103.410	100.731
<b>Jevons index- arithmetic mean of price ratios</b>				
Year to year index	100	108.577	98.492	96.242
Chained year to year index	100	108.577	106.939	102.920
Direct index on 2017	100	108.577	106.939	102.920

Source: Own calculations based on OECD (2004)

Although the Jevons and Dutot indices satisfy all three tests, the Dutot index is acceptable as an estimate only when the set of items covered are homogenous by nature or at least nearly homogenous. For example, it may be acceptable for a set of tomatoes although tomatoes may be of different varieties, but not for the prices of different kinds of vegetables such as lettuce, cucumber, onions some of which could cost significantly more per item or per kg than others. This disadvantage associated with the Dutot index makes the Jevons index the most preferred index.

For the first stage of the CPI calculation, I hence use the Jevons elementary price index to calculate an unweighted index at the lowest level of aggregation. In what follows, I will explain the Jevons calculation in detail.

An estimate using equation (4.3) provided a change in average prices. Table 4.3 shows how the short-term Jevons Index is estimated for fish, seafood, and other marine products category (made up of four SPs). First, I calculated the geometric mean for each year. Then, to calculate the Jevons index for 2019, for instance, I divide the 2019 geometric mean by the 2018 geometric mean and multiply it with 100 [(Geometric mean 2019/Geometric mean 2018) \*100].

***Table 4.3 Jevons index (short-term) for fish, seafood and other marine products.***

<b>Fish, seafood and other marine products</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
1. Fresh or frozen fish (including portions, fish sticks)	11.99	10.79	14.79	14.59	14.69
2. Canned salmon	4.69	4.69	5.69	5.69	5.69
3. Canned tuna	3.55	3.69	3.69	3.69	3.69
4. Shrimps and prawns	19.79	19.79	19.79	19.59	19.69
Geometric mean	7.928	7.797	8.853	8.802	8.828
Jevons index (Short term)	100	98.344	113.559	99.407	100.299

Source: Own calculations based on retail data collected from The Northern  
 Note: Geometric means and Jevons indices were rounded to 3 decimal places.

### **4.3.2 Upper-level computation**

The second stage, also referred to as upper-level computation, involves the calculation of aggregate price indices using fixed-quantity weighted averages (Statistics Canada, 2023). The

significance of using fixed-quantity weights lies in the advantage that the index can use the same weights repeatedly. Some indices used to estimate the upper-level index include the Laspeyres-type index, which requires data on quantity consumed, and the Lowe index which allows the use of expenditure data in situations where data on quantity consumed of various food items is unavailable.

Due to unavailability of data on quantity consumed of the selected 51 food items collected from ‘The Northern’, I utilized the Lowe index in calculating the upper-level indices. The Lowe index compares the total value of a given basket of goods and services between two observed time periods. The Lowe index is further described below.

In the absence of expenditure data for Fox Lake, this study used Albertan average expenditure data from 2016 to proxy Fox Lake’s expenditure. Although the approximation is imperfect, it allows me to reflect the upper-level CPI by the Lowe index. Following Statistics Canada, (2023), the Lowe index is expressed as the weighted sum of elementary price indices, where the weights are represented as expenditure shares as shown below.

$$I_{Lo,A}^{0:t} = \sum_{i=1}^n (p_i^t / p_i^0) s_i^{ob} \quad (4.4)$$

where

$I_{Lo,A}^{0:t}$  is the Lowe’s index for aggregate class A between period 0, the base year 2017, and period  $t$  defined as the product of the total weighted ratio of  $p_i^t$  and  $p_i^0$ , the prices of the  $i$ -th SP in period  $t$  and 0 and expenditure shares  $s_i^{ob}$ .  $N$  is the total number of  $i$  SPs in the aggregate class A. I assume the same baseline year for the lower CPI calculation, namely 2017.

Expenditure shares  $s_i^{ob}$  are defined as

$$s_i^{ob} = \frac{p_i^0 q_i^b}{\sum_{i=1}^n (p_i^0 q_i^b)} \quad (4.5)$$

They are hybrid expenditures because the prices and quantities (that equal the expenditures when multiplied) are from different periods, 0 and  $b$ .  $q_i^b$  is the quantity weight of elementary aggregate  $i$ , in the weight reference period  $b$ . To estimate the upper-level indices, I distinguish between two kinds of reference periods:



- Price reference period ( $t$ ). The period for which prices are used as denominators in the index calculation. The price reference period for the upper-level computation is 2017.
- Weight reference period ( $b$ ). The period covered by the expenditure statistics used to calculate the weights. Usually, the weight reference period is a year. In most cases, the weights are calculated using data from an expenditure survey that was carried out before the price reference period. In this study, I utilize household's expenditure on selected food items recorded on a provincial level in Alberta in 2016.

While the price comparison periods are usually months or quarters, the weights frequently refer to an entire year, or even two or three years. In actual use, the weight reference period and the price reference period are always distinct time periods.

I assume that the expenditure shares of selected food items in 2016 (weight reference period  $b$ ) and for each sampled product in Fox Lake, is the same as the provincial level data (Alberta) sourced from Statistics Canada (2021). Again, I assume that prices observed in the price reference period  $p_i^0$  (2017) is the same average price used by Statistics Canada in calculating household expenditure on selected food items in 2016. Using equation (4.4), I calculate the Lowe index for each elementary aggregate and across all eight food categories in the five periods being compared. With reference to 2017, I present long-term percentage changes in prices for each food category in Fox Lake from (2017 to 2021). Table 4.4 presents an example showing how the Lowe Index is estimated for the fish, seafood, and other marine products category.

**Table 4.4. Lowe index for fish, seafood and other marine products**

		Expenditure	Price ( $p_i^0$ )	Price ( $p_i^t$ )	
Fish, seafood and other marine products	(2016)	Shares( $s_i^{ob}$ )	(2017)	(2018)	$((p_i^t/p_i^0)*s_i^{ob})*100$
1. Fresh or frozen fish	63	0.013	11.99	10.79	1.209
2. Canned salmon	5	0.001	4.69	4.69	0.107
3. Canned tuna	25	0.005	3.55	3.69	0.555
4. Shrimps and prawns	24	0.005	19.79	19.79	0.512
Total exp. across all SPs	4686				
Lowe's index					2.383

Source: Own calculations based on retail data collected from The Northern and expenditure data from Statistics Canada (2021).

Note: Expenditure shares and Lowe index were rounded to 3 decimal places.

The expenditure share for each food item is the ratio of its expenditure and the total expenditure across all SPs. The Lowe index for 2018 is the weighted sum of elementary price indices, where the weights are represented as expenditure shares.  $[(p_i^t/p_i^0)*s_i^{ob}]*100$ . The Lowe index for 2018 suggests that prices in this category increased by 2.38% from the price reference period (2017).

#### 4.4 Summary

This section presented data and methods used in achieving the objectives of this study. To assess the disparities in price levels and price changes and compare the impacts of the Covid-19 pandemic on observed price trends in Fox Lake and Alberta (objective 1 and 2), this study utilized price data of 51 food items collected from 'The Northern'. I also utilized data on monthly average retail prices for selected products and annual percentage changes of the CPI not seasonally adjusted from December 2017 to December 2021 in Alberta, collected by Statistics Canada (2021). To compare price levels and price trends between Fox Lake and Alberta, I followed the CPI approach and calculated the Jevons index as the best suitable index for the lower-level analysis and the Lowe index as the preferred index for the upper-level analysis. Furthermore, survey data on living expenses originally collected by Mirzaei and Natcher (2021) in 2018 was used to investigate the implications of observed food prices disparities on living wages in LRRCN (objective 3).

The next chapter presents the results.

## **Chapter 5 Results and discussion**

### **5.1 Introduction**

This chapter presents the main findings addressing the thesis' three research objectives. Subsection 5.2 addresses the first research objective, where I compare price levels and temporal price changes across food categories between Fox Lake and Alberta. In sub-section 5.3, I assess the impact of Covid-19 on price changes in Fox Lake and Alberta. Finally, sub-section 5.4 addresses the consequences of relative food price changes and discusses the implications of observed price trends for living wages in Fox Lake.

### **5.2 Disparities in price levels and price changes between Fox Lake and Alberta.**

First, I investigate differences in price levels between Fox Lake and Alberta. Note that this comparison is only based on a selection of food items due to data unavailability. Table 5.1 shows average retail prices of different food items available as observed in December 2017 to December 2021. One can note that prices for all the selected food items are higher in Fox Lake than in Alberta. Before the Covid-19 pandemic, average retail prices were up to 163% larger in Fox Lake, especially for food items like canned tuna (ranging between 150% and 163%) or margarine (ranging between 145% and 157%). In addition, meat-based products such as ground pork, pork loin chops or wieners are at least 56% more expensive in Fox Lake. During the pandemic, differences in price levels are even higher for most of the selected food items, reaching maximum differences up to 186% for margarine or 175% for canned tuna. Smaller price differences can be observed for bacon, ranging between 14% in 2021 and 78% in 2018, and canned salmon ranging between 50% and 72%.

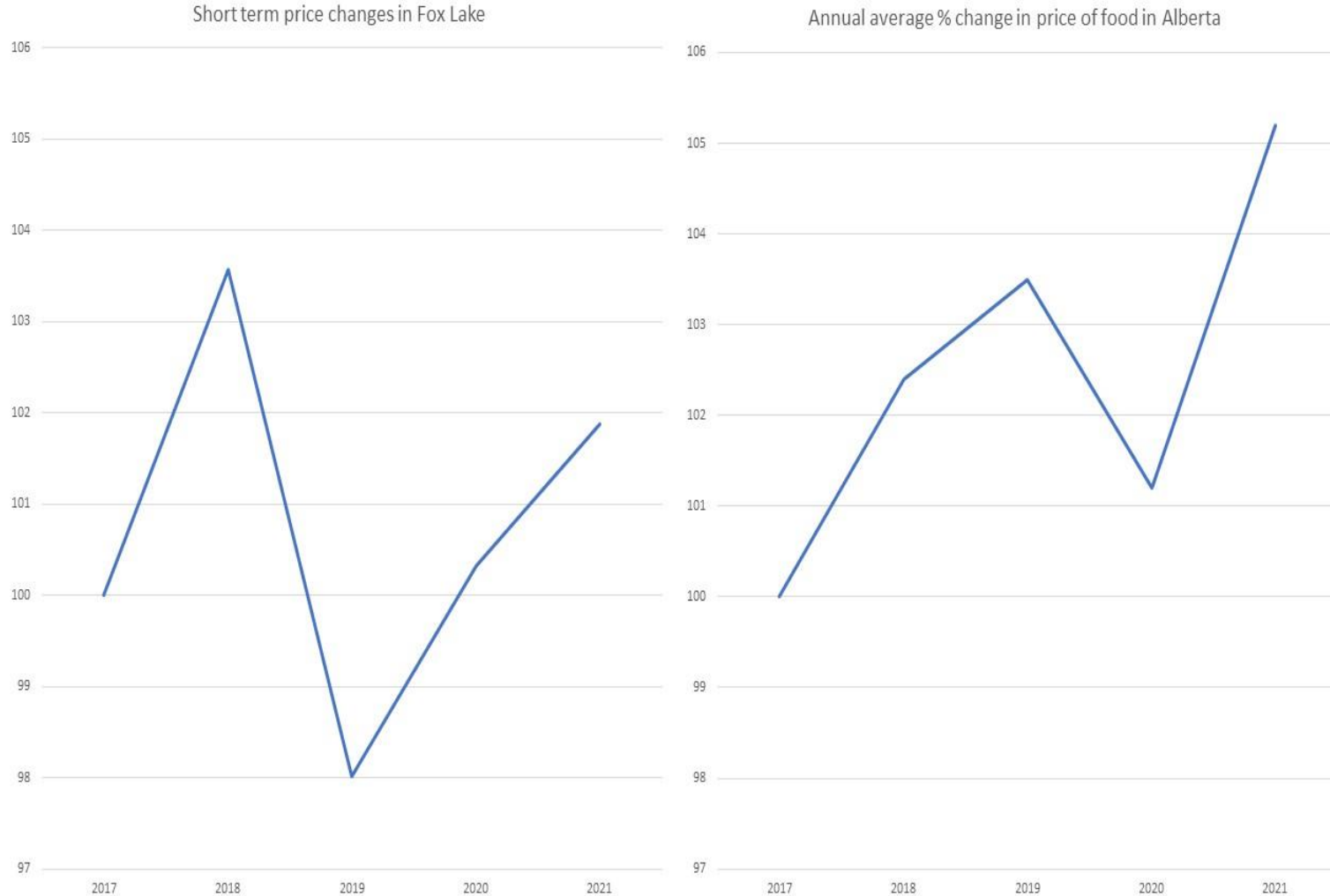
**Table 5.1. Average retail prices of selected food items in Fox Lake and Alberta.**

Food item	2017	2018	2019	2020	2021
<b>Ground beef (per 1kg)</b>			<i>Prices (\$)</i>		
Alberta	9.28	8.74	10.41	10.20	10.56
Fox Lake	20.48	19.48	16.22	16.73	20.00
Price difference	11.20 (121%)	10.74 (123%)	5.81 (56%)	6.53 (64%)	9.44 (89%)
Average of price difference			8.74 (91%)		
<b>Pork Loin chops (per 1kg)</b>					
Alberta	9.67	10.50	9.23	8.90	9.66
Fox Lake	17.32	17.32	18.65	19.32	19.32
Price difference	7.65 (79%)	6.82 (65%)	9.42 (102%)	10.42 (117%)	9.66 (100%)
Average of price difference			8.79 (93%)		
<b>Bacon (per 500g)</b>					
Alberta	5.92	6.51	6.66	6.35	7.34
Fox Lake	8.25	11.59	10.65	8.39	8.39
Price difference	2.33 (39%)	5.08 (78%)	3.99 (60%)	2.04 (32%)	1.05 (14%)
Average of price difference			2.90 (45%)		
<b>Wieners (per 400g)</b>					
Alberta	3.66	3.73	4.16	4.15	4.41
Fox Lake	8.10	8.10	8.42	8.42	8.42
Price difference	4.44 (121%)	4.37 (117%)	4.26 (102%)	4.27 (103%)	4.01 (91%)
Average of price difference			4.27 (107%)		
<b>Canned Salmon (per 213g)</b>					
Alberta	3.40	3.91	4.39	4.40	4.30
Fox Lake	5.88	5.88	7.13	7.13	7.13
Price Difference	2.48 (72%)	2.00 (50%)	2.74 (62%)	2.73 (62%)	2.83 (66%)
Average of price difference			2.55 (62%)		
<b>Canned Tuna (per 213g)</b>					
Alberta	1.76	1.76	1.85	1.77	1.68
Fox Lake	4.45	4.62	4.62	4.62	4.62
Price difference	2.69 (153%)	2.86 (163%)	2.77 (150%)	2.85 (161%)	2.94 (175%)
Average of price difference			2.82 (160%)		
<b>Butter (per 454g)</b>					
Alberta	4.01	4.25	4.11	4.84	4.93
Fox Lake	7.69	7.99	7.99	8.39	8.39
Price difference	3.68 (92%)	3.74 (88%)	3.88 (94%)	3.55 (73%)	3.46 (70%)
Average of price difference			3.67 (83%)		
<b>Margarine (per 907g)</b>					
Alberta	4.21	4.15	4.12	4.39	4.90
Fox Lake	10.30	10.60	10.60	12.30	14.00
Price difference	6.10 (145%)	6.45 (155%)	6.48 (157%)	7.91 (180%)	9.10 (186%)
Average of price difference			7.21(165%)		

Source: Own calculations based on retail data collected from 'The Northern' and from Statistics Canada (2021).

Note: Price differences for respective years were calculated by taking the difference between observed prices in Fox Lake and Alberta. Resulting price differences were represented as percentages of prices observed in Alberta for each selected item (as shown in brackets). The average price difference was calculated by taking the average price differences observed for the respective food items.

Having identified that price levels are significantly higher in Fox Lake than in Alberta, at least for the food items available for comparison, let's focus next on temporal food price changes. Note that this comparison is based on 51 food items, where I use the short-term price changes as informed by the Jevons index to represent price changes for Fox Lake and annual percentage changes in the CPI to represent price changes for Alberta. Figure 5.1 shows that in 2018, food prices increased by 3.6% relative to a 2.4% increase in Alberta. This was followed by a 2.0% decline in prices in 2019 compared to a 3.5% increase in Alberta. Prices increased by 0.3% in 2020 but at a higher rate of 1.9% in 2021 in Fox Lake. Alberta recorded an appreciated increase of 5.2% in 2021 following a 1.2% diminished increase in 2020. On average, Fox Lake recorded a 0.8% increase in food prices prior to the onset of the Covid-19 pandemic (2018 and 2019) and a 1.1% increase during the pandemic (2020 and 2021). In Alberta, pre-pandemic and during-the-pandemic price increases are 2.95% and 3.2%, respectively. In other words, average temporal price increases are lower in Fox Lake than in Alberta, both before and during the pandemic. In contrast to comparable studies in other Indigenous communities, such as Narine (2021), which found a 400% price surge during the pandemic in northern Ontario, this thesis found subtle prices changes (ranging between 0.3% and 1.3%).



**Figure 5.1: Comparison of short-term price trends (year-to-year) between Fox Lake and Alberta.**

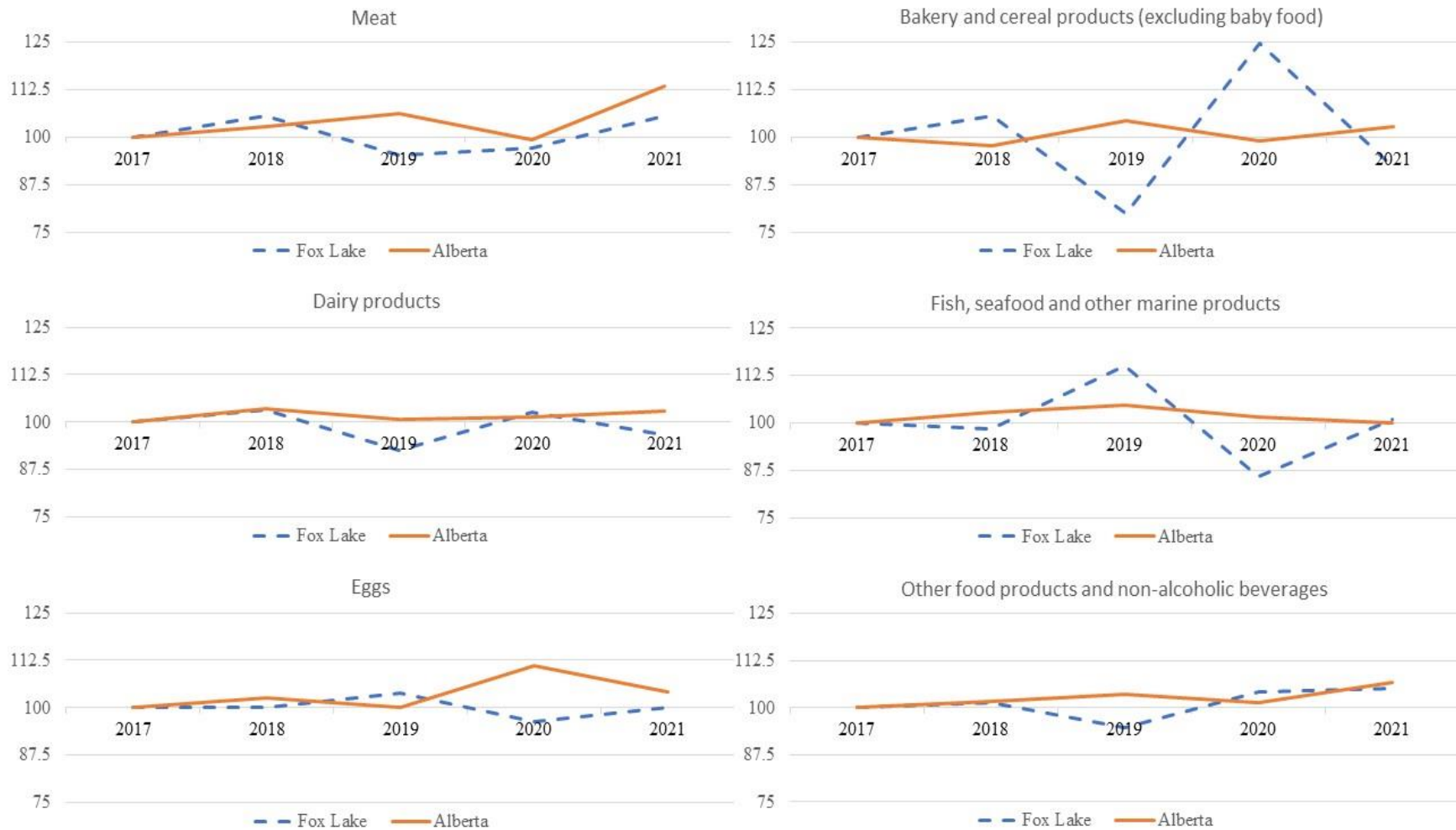
Source: Own calculations based on retail data collected from The Northern and Statistics Canada (2021).

Note: Year-to-year price changes in Fox Lake and Alberta are based on estimates from the Jevons index and annual percentage changes from the CPI not seasonally adjusted respectively.

Next, I further explore the differences in temporal price changes across 8 different food categories. The blue dashed line and the orange solid line in Figure 5.2 shows annual average changes in food prices for Fox Lake and Alberta respectively. One can note that Fox Lake recorded increases in the price of all food categories in 2018 except for eggs and fish, seafood, and other marine products. Prices of these categories, however, increased in 2019 while all other food categories recorded a fall in price, with the highest drop among bakery and cereal products (excluding baby food). The highest and lowest price changes in the first year of the pandemic in 2020 were observed on bakery and cereal products (24.6%) and fish, seafood and other marine products respectively (-11.3%). In 2021, decreases in price were observed on only dairy products and bakery and cereal products while there was no change in the price of eggs.

In the case of Alberta, price increases were observed in all food categories in 2018 except for bakery and cereal products. There was no change in the price of eggs in 2019, however all other food categories recorded price increases during this period. The highest and lowest price changes during the first year of the pandemic were observed on eggs (11.1%) and bakery and cereal products (excluding baby food) (-0.9%). All food categories recorded price increases in 2021, with the highest and lowest price increase observed on meat (13.2%) and fish, seafood and other marine products (0.1%).

In the following, I explore the differences in temporal food price changes between Fox Lake and Alberta for each food category.



**Figure 5.2: Annual average % change in price between Fox Lake and Alberta (2017-2021)**

Source: Own calculations based on retail data collected from The Northern and Statistics Canada (2021).

Note: Annual price changes in Fox Lake and Alberta are based on estimates from the Jevons index and annual percentage changes from the CPI not seasonally adjusted respectfully.



### *Meat*

In 2018, the price of meat products increased by approximately 5.6% and 2.7% in Fox Lake and Alberta respectively. The price increase in Fox Lake can be explained by the increase in the prices of all the sampled products in this category, especially bacon. Prices declined in 2019 and further in 2020 in Fox Lake probably due to greater reliance on country foods. In the case of Alberta, prices in the meat category increased by approximately 6.1% in 2019 but declined by 0.7 in 2020.

The closure of restaurants coupled with alternative sources of land-based protein further caused a downward spiral in 2020 especially in the price of bacon and beef (see Appendix C) (Canada Food Report (2021), Deaton (2021), Hailu (2021), Goddard, E. (2021)). More than 4,500 workers in major meat processing factories in Canada tested positive for Covid-19 as of February 2020, reducing the number of available workers and resulting in underutilization of plants (Hailu, 2021). Labor shortages caused by the Covid pandemic, slowed production, shutdown on plants, for example, Cargill's High River Facility, JBS plant and Olymel plant in Alberta induced supply of meat. Demand was constricted more than supply thus accounting for the decline in price observed in 2020 (Statistics Canada, 2021., Hailu, 2021). However, in 2021 border closures and logistical problems during the pandemic contributed to the price spike. The sharp increase in demand for meat after some restrictions were eased in 2021 could not be proportionally met in the short term by recovering meat supply chains coupled with the additional cost of restarting processing operations thus resulted in high prices in 2021 (Deaton, 2021).

Generally, meat price changes in Fox Lake follow the Albertan trend, albeit at a lower level. An exception is the year 2019, where meat prices drop in Fox Lake in contrast to a price spike in Alberta.

### *Dairy products*

Fox Lake and Alberta recorded similar price trends in 2018 and 2020. Alberta recorded a higher price increase in 2018 while Fox Lake recorded a higher price increase in 2020. In the case of Fox Lake, increases in the price of low-fat milk, whole milk and butter account for the price increase observed in 2018 (see Appendix C). The increase in the price of butter and ice-cream and other related products drove prices up in 2020. In 2019 and 2021, however, observed price trends moved in opposite direction between Fox Lake and Alberta. While Fox Lake recorded price

declines, Alberta recorded price increases in both years. In 2019, the decline in the prices of whole milk, low-fat milk and ice-cream and related products account for low prices observed in this category in Fox Lake. In 2021, however the price reduction is due to fall in prices of cheddar cheese, mozzarella cheese and processed cheese.

### *Eggs*

In contrast to Alberta which experienced price increases in 2018 and 2021, Fox Lake saw no change in the price of eggs in both years. While Alberta recorded no change in the price of eggs, Fox Lake recorded a 3.8% decline in price. Same price trends, however, were observed in 2020 between Fox Lake and Alberta with Alberta recording a higher price increase.

### *Bakery and cereal products excluding baby food*

The fall in world output coupled with rising demand contributed to rising wheat prices in 2018 not just in Canada but globally (Canada's food price report, 2021). The increase in the price of wheat globally in 2018 caused price spikes in the bakery and cereal products category. Although this holds for Fox Lake due to an observed price increase of 5.5%, it does not hold for Alberta as prices declined. The price increase recorded in Fox Lake in 2018 can be explained by price increase observed on all sampled products in this category. The reverse was observed in 2019, as Fox Lake recorded a 20% decline in price while Alberta recorded a 4.2% increase. The price decrease in Fox Lake in 2019 may have been driven by a decline in the price of flour and flour-based mixes. In 2020, Fox Lake recorded a 24% price increase in contrast to a 0.9% price decline in Alberta. In 2021 however, consumers in Fox Lake saved 7.9% on purchases in this category while Alberta, on average, recorded a 2.7% increase in price.

### *Fish, seafood and other marine products*

People do not typically buy fish from the store in Fox Lake due to the ample supply of wild caught fish available. Nevertheless, while Fox Lake recorded a decline in prices in 2018 and 2020, Alberta recorded price increases. The price decline in Fox Lake is driven by price decreases in fresh or frozen fish (including portions and fish sticks). Based on data from the government department of Fisheries and Oceans Canada (DFO), the Canadian Fish audit reported a decline in the population and deterioration in the health of fish and other seafood in 2019 with immediate policies failing to restore depleting stocks (Montgomery, 2019). Demand for canned, frozen, and processed fish increased in response to the decrease in demand for fresh fish. This explains the

increase in the price of canned salmon in 2019 in Fox Lake (see Appendix C). Challenges affecting the supply of fish, seafood and other marine products in 2019 caused market forces to drive prices up by approximately 15.2% and 4.2% in Fox Lake and Alberta respectively.

In 2020, there was a price decline in Fox Lake while prices increased in Alberta. Following the ease of some restrictions and re-opening of restaurants and other hospitality services, increases observed in consumer demand for fish, seafood and other marine products resulted in price increases recorded in both Fox Lake and Alberta in 2021 (Deaton, 2021).

#### *Other food products and non-alcoholic beverages*

This category contains a variety of different products such as sugar and syrup, margarine, roasted or grounded coffee, fermented or pickled vegetables, sauces, condiments and dip, soup, and non-alcoholic, hence analyzing price drivers is difficult. Both Fox Lake and Alberta recorded price increases in 2018, 2019 and 2021 with Fox Lake recording higher price increases. In 2020, however prices fell in Fox lake while it increased in Alberta.

Due to inconsistencies in the fruit and vegetable categories, Figure 5.3 presents each category separately for Fox Lake on the left and for Alberta on the right.

#### *Fresh fruits and vegetables*

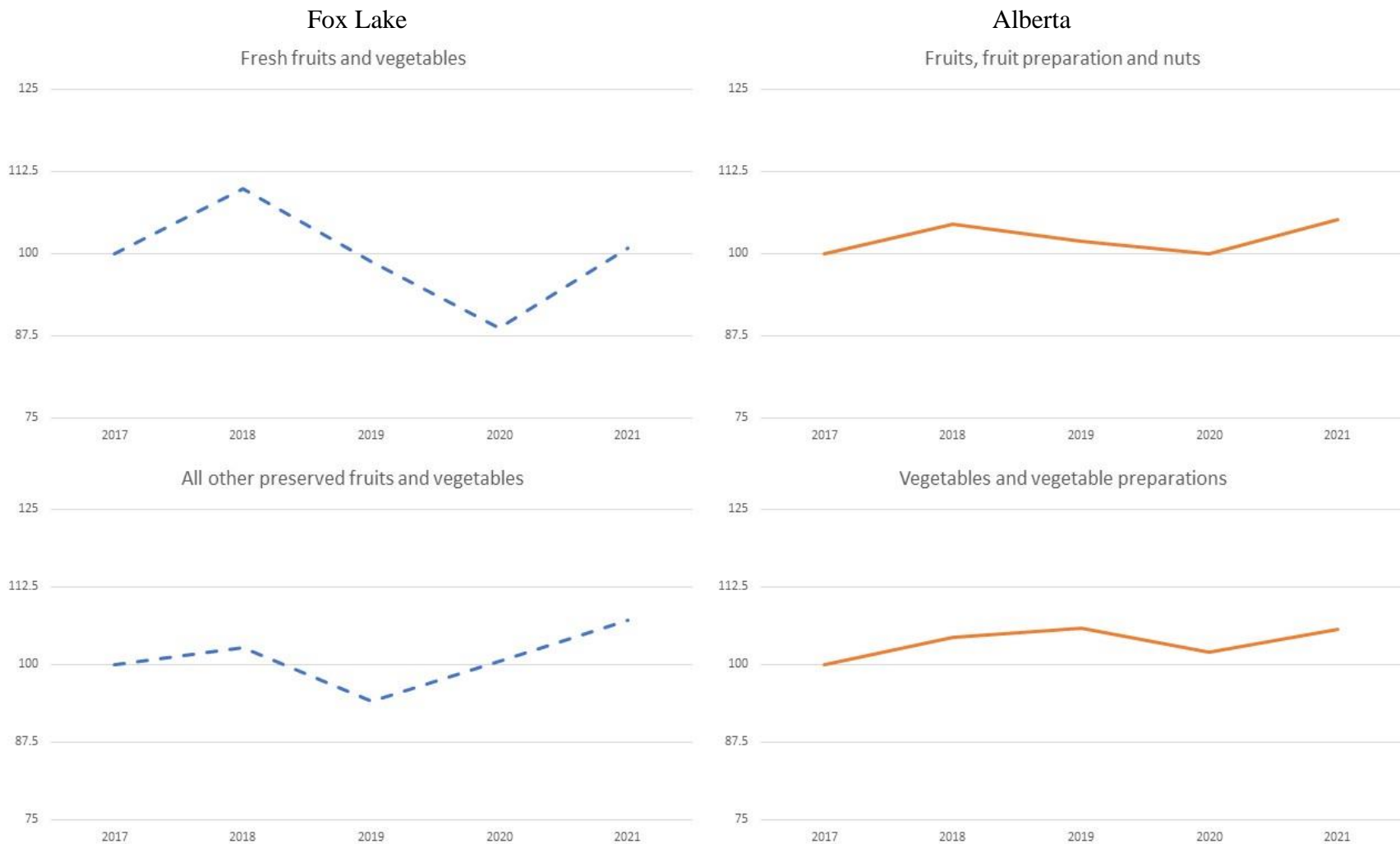
Fox Lake recorded price increases in all years but 2020. Price increases observed in 2018, 2019 and 2021 in Fox Lake is due to price increase observed on apples, potatoes and lettuce. Due to short growing season, Canada is heavily reliant on imports of fresh fruits and vegetables from the U.S. and other countries (Goddard, 2021; Deaton, 2021). The main drivers of fruit and vegetable pricing in Canada are, the favorability of weather conditions, exchange rate volatility and seasonality in Canadian production (Goddard, 2021). With supply being negatively affected by unavailability of farm workers due to the onset of Covid-19, price of fresh fruits and vegetables were expected to increase in 2020, however the fall in demand for fresh fruits and vegetables falling drastically due to its perishable nature and the closure of many hospitality services, accounts for the decline in price observed in 2020.

#### *All other preserved fruits and vegetables*

This category recorded price increases in all years except 2019. The hike in price observed in Fox Lake was due to price increases recorded in all sampled products except canned vegetables

and other vegetable preparations. In 2019, prices fell by approximately 5.9% following price falls recorded on canned fruit, frozen fruit and canned vegetables and other vegetable preparations (see Appendix C).

In 2020 and 2021, Covid-19 induced demand shocks possibly account for the 0.5% and 7.1% increase in prices in this category respectively. Prices may have risen in 2021 due to consumers' increased preference for stockpiling canned goods due to its storability.



**Figure 5.3: Average % change in price of fresh fruit and vegetable and fruits, fruit preparation and nuts (2017-2021)**

Source: Own calculations based on retail data collected from The Northern and Statistics Canada (2021).

Note: Annual price changes in Fox Lake and Alberta are based on estimates from the Jevons index and annual percentage changes from the CPI not seasonally adjusted respectfully.

To summarize the comparison of temporal price changes between Fox Lake and Alberta at this stage, one can note that price trends in meat, dairy and other food products and non-alcoholic beverages seem to be similar except in 2019, where there is a drop in Fox Lake contrary to an increase in Alberta. A similar pattern can be observed among eggs, i.e., similar price trends in all years, and a divergence in 2020. Furthermore, exact opposite trends are observed for bakery and cereal products. A similar pattern was observed for fish, seafood and other marine products in 2018 and 2020 and a convergence in 2021.

So far, the comparison of food price trends in Fox Lake and Alberta has been based on the lower-level Jevons index. The upper-level Lowe index is presented in Appendix (A).

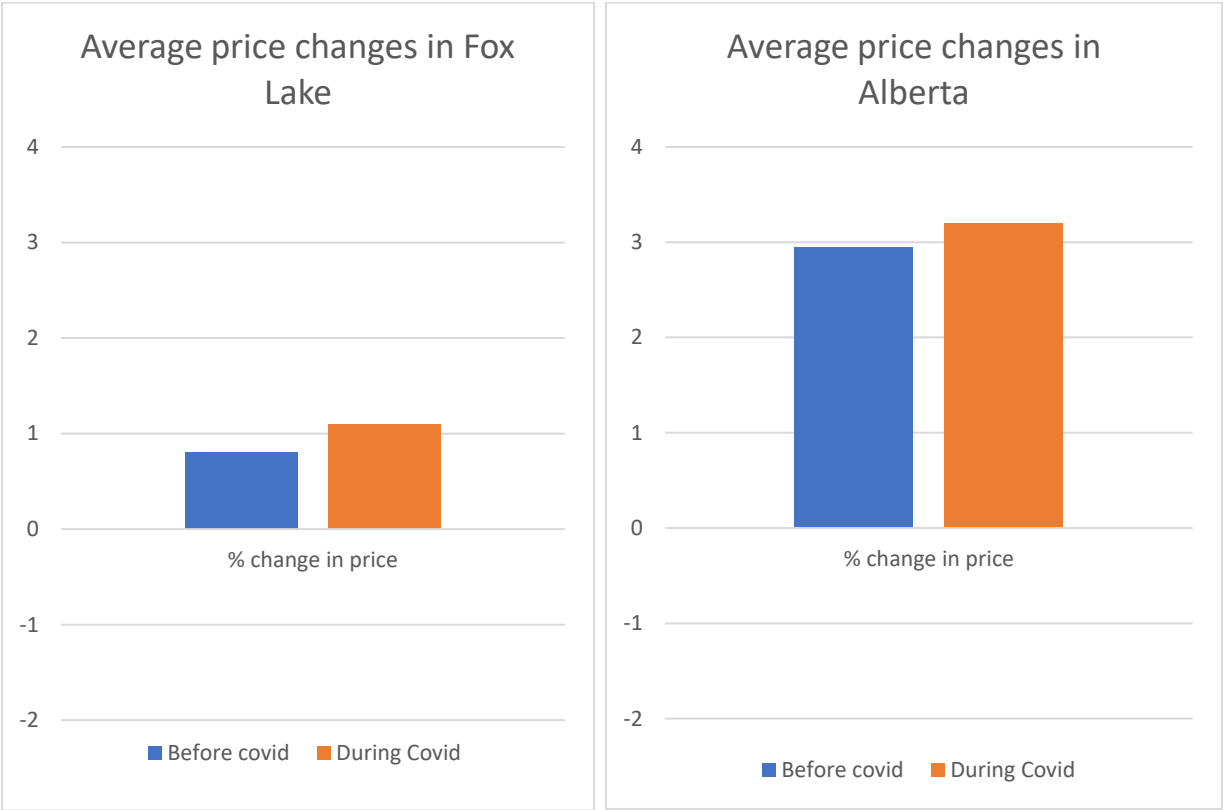
As mentioned earlier, the Lowe index considers expenditure shares and as such, the higher the expenditure share, the higher the index of the sampled product. Other processed meat and canned salmon recorded the highest and lowest expenditure shares respectively in 2016. This explains why they account for the highest and lowest price increases observed from 2018 to 2021 respectively (see Appendix D). In years where we have prices falling from the previous year, as shown by the Jevons index, the Lowe index still suggests price increases due to expenditure shares. This explains why on average, prices did not fall for all the food categories.

The Lowe index is an asymmetrically weighted price index, meaning the weights used to compute the elementary price indices refer to a time frame before the price reference month. Because of this, the Lowe formula is susceptible to substitution bias since it does not accurately reflect the current consumer spending habits. The Lowe index requires frequent update of weights, in this case expenditure shares, to reduce biases. Due to data unavailability, weights were not updated in this analysis. This weakness associated with the Lowe index in this study makes the Jevons index more informative.

### **5.3 Impact of Covid-19 on food prices (Before and during pandemic)**

In this subsection, I analyze the impact of Covid-19 on food price changes in Fox Lake and Alberta. To do so, I first compare overall average percentage price changes by food category before (2018 and 2019) and during the pandemic (2020 and 2021). Following that I delve deeper into each food category.

Figure 5.4 shows bar charts of average percentage price changes before and during the pandemic in blue and orange, respectively. On average, Fox Lake recorded a 0.8% increase in food prices prior to the onset of the Covid-19 pandemic and a 1.1% increase during the pandemic. In the case of Alberta, there was an average price increase of 2.95% prior to the onset of the pandemic compared to a 3.2% increase during the pandemic. Average price increases in Fox Lake were lower both before and during the pandemic.



**Fig 5.4: Average % price changes before and during the Covid-19 pandemic**  
 Source: Own calculations based on retail data collected from The Northern and Statistics Canada (2021).

Figure 5.5 helps to understand which food items drive the relative price changes before and during the pandemic in Fox Lake (upper panel) and Alberta (lower panel). In Fox Lake, the average increase in food prices before the pandemic of 0.8% is largely driven by fish, seafood and other marine products (6.8%) as well as fresh fruits and vegetables, eggs, and meat each approximately 4%, 1.9% and 0.4% respectively. During the pandemic, average prices increased further by approximately 2%. Bakery and cereal products is the category for which one can observe the largest increase in prices during the pandemic. Other categories that contribute to the average price

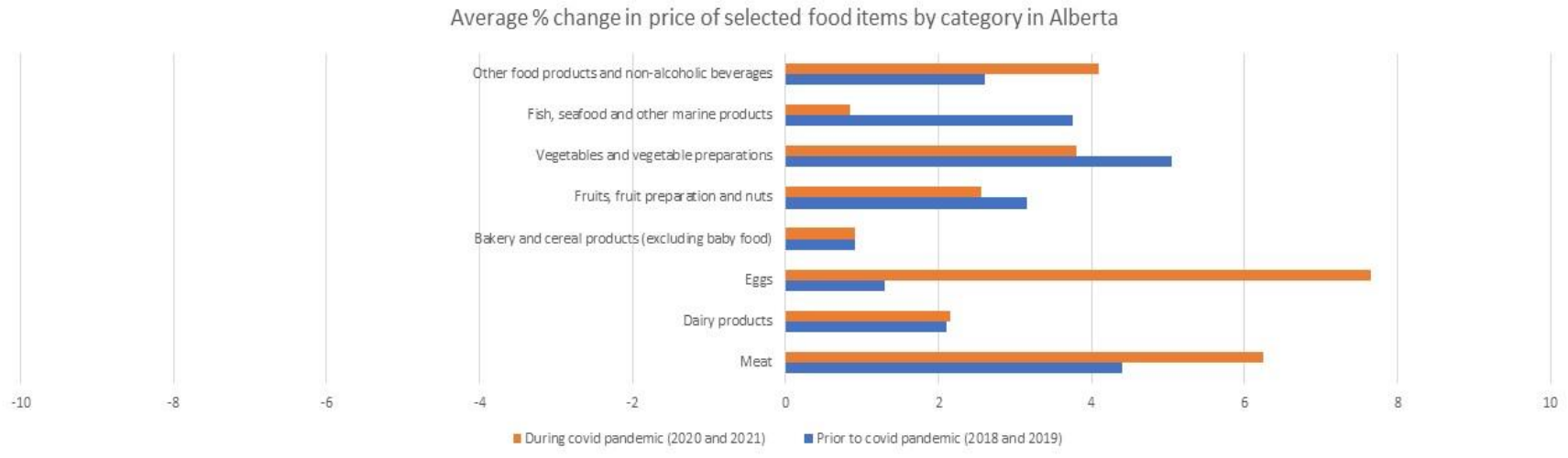
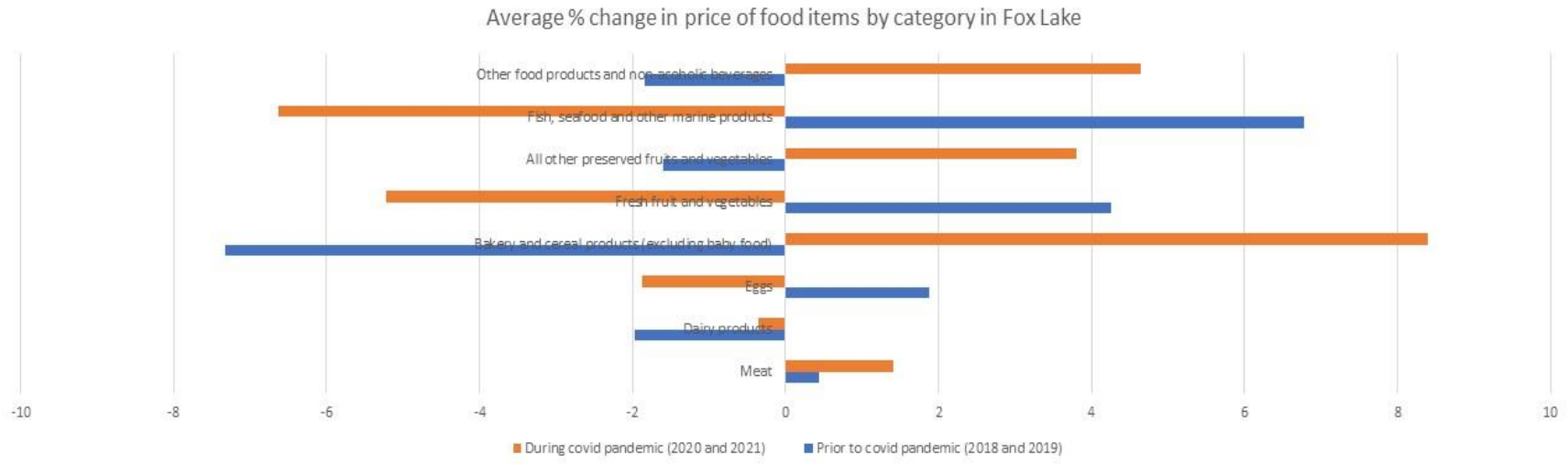
increase during the pandemic are other food products and non-alcoholic beverages, all other preserved fruits and vegetables and meat by approximately 5%, 4% and 1% respectively.

In Alberta, the average increase in food price prior to the pandemic of 2.95% is driven by all food categories with the highest and lowest contributions observed on meat (4.4%) and bakery and cereal products (0.9%), respectively. There was a further increase in average food price during the pandemic of 3.2%. This increase is attributable to increases observed in all food categories with eggs and baking and cereal products (0.9%) contributing the highest and lowest, respectively.

To summarize results at this stage, one can note that there have been significantly higher price levels of selected food items in Fox Lake than in Alberta, especially in fish and meat products. However, general food price increases in Fox Lake are lower when compared to Alberta. Furthermore, temporal food price changes before and during the pandemic are lower in Fox Lake than in Alberta. The largest price changes are seen in bakery and cereal products in Fox Lake. In contrast to what one would expect based on similar studies from Indigenous communities in Canada, no large food price increase was observed in Fox Lake. Nevertheless, there exist large disparities in food price levels between Fox Lake and Alberta.

In the next subsection, I will discuss the implications of these findings.





**Figure 5.5: Average % change in food prices in Fox Lake (Upper panel) and Alberta (lower panel)**  
 Source: Own calculations based on retail data collected from The Northern and Statistics Canada (2021).

## 5.4 Implication of high food prices on households in Fox Lake

In this sub-section, I discuss potential consequences of the observed food price changes on living wages in Fox Lake as introduced in Chapter 3. For a family of four, the cost of living in Fox Lake is 27% more expensive than in Grand Prairie, a city in northwestern Alberta, and 7.3% more expensive than in Edmonton (Alberta Living Wage Report, 2021). As shown in Table 3.2, two full-time workers in a household of four in Fox Lake requires a living wage of \$19.58 per hour that is 23% (\$4.51) and 7% (\$1.37) higher than compared to Grande Prairie and Edmonton respectively (Alberta Living Wage Report, 2021). The 1.1% increase in food prices, observed in Fox Lake during the pandemic, would increase food expenses from \$16,292 to \$16,471.21 and hence the hourly wage would need to increase from \$19.58 to \$19.63 (see table 5.2). In other words, even a modest increase in food prices would have an impact on households given the existing high cost of living in the communities. Table 5.2 shows the impact of average change in price, observed in Fox Lake during the Covid-19 pandemic, on living expenses and living wage.

***Table 5.2. Impact of observed price change on annual living expenses and living wage.***

	<b>Fox Lake Living expenses (\$)</b>	<b>Impact of 1.1% increase in food price on food expenses and hourly wages</b>
Food	16,292	$(1.1\% * 16,292) + 16,292$ =16,471.212
Educational services	13,775	13,775
Shelter	12,792	12,792
Other household costs	7,958	7,958
Clothing	6,046	6,046
Transportation	4,311	4,311
Healthcare services	4,204	4,204
Professional services	3,142	3,142
Contingency fund	2,741	2,741
<b>Total</b>	<b>71,261</b>	<b>71,440.212</b>
<b>Hourly wages (\$)</b>		
<b>Assuming:</b>		
two individuals working	19.58	19.626
one individual working	39.15	39.252

Source: Own calculations based on retail data collected from Mirzaei and Natcher (2021)

Note: Calculation of impact on hourly wages is based on equations 3.1 and 3.2.

The effect of price changes may be especially detrimental for low-income families and those receiving social assistance to meet basic daily needs, and mental health of families due to frustration and constant stress (Wendimu et al., 2018; Kalkuhl et al., 2016). Price-shock related food insecurity may undermine the resilience of poor households (Kalkuhl et al., 2016).

## **5.5 Summary**

In addressing the research questions, this section presented results on disparities in price levels and average price changes between Fox Lake and Alberta, assessed the impact of Covid-19 in driving prices and the implications of observed price trends on living wages in Fox Lake. Results show that for the selected food items, price levels were relatively high in Fox Lake when compared to Alberta. Findings also showed that when compared to Alberta, average increases in prices in Fox Lake was lower prior to the onset and during the pandemic. In the case of Fox Lake, the highest and lowest average percentage change in food prices in Alberta was observed on bakery and cereal products (excluding baby food) and eggs respectively.

Rising food prices present several implications for First Nation Households. In the case of Fox Lake, a 1.1% increase, as observed during the pandemic, would increase annual food expenses by approximately \$179. Following this increase in food expenses, hourly wage for a family of four and two working members would have to increase from \$19.58 to \$19.63. Particularly, poorer households may need to adapt to food prices by sacrificing expenses on other important needs such as health, clothing, or shelter, further perpetuating poverty.

## **Chapter 6-Summary and conclusion**

### **6.1 Introduction**

This section summarizes the thesis' main findings and identifies potential entry points for policies and programs to improve livelihood in Fox Lake and makes policy suggestions to improve livelihood in Fox Lake. Finally, I discuss limitations and make suggestions for future research.

### **6.2 Summary of main findings**

This thesis investigated the extent to which the Covid-19 pandemic impacted food prices in a local community in northern Alberta and compared the results on a provincial level. Specifically, I compared disparities in food price levels and percentage changes in price between Fox Lake and Alberta, investigated the extent to which changes in food prices over time is driven by Covid-19, and finally, examined the implications of price changes on living wages in Fox Lake. The analysis on food prices is based on prices of fifty-one food items that make up a standard food basket in a local store in Fox Lake.

The comparison of selected food items such as ground beef, pork loin chops, canned salmon, canned tuna, butter and others, showed that price levels in Fox Lake are significantly higher than in Alberta. Especially for fish and meat products, the price level is more than twice as high. During the Covid-19 pandemic, however, Fox Lake's food prices increased by 1.1%, which is lower than the 3.2 increase in similar products observed in Alberta. Compared to other studies in Indigenous communities such as northern Ontario (Narine, 2021), the results from this thesis show that Fox Lake did not experience the same level of food price spikes during the pandemic. Nevertheless, even subtle changes such as a 1.1% food price increase, would increase annual food expenses by \$179. Also, a family of four, with two working members, would require an increase in living wage from \$19.58 to \$19.63.

### **6.3 Limitations and future research**

In contrast to expectations from other indigenous studies in Canada and the US (Narine, 2021; Sing, 2021; Zoledziowski, 2021; Monkman, 2022; Semple 2022; Henderson et al., 2022), this thesis showed that the Covid-19 pandemic is not associated with a food price spike in Fox Lake. Yet, disparities in food price levels were already large before the pandemic. Future research is needed to understand how these findings can be explained. For example, what are the socio-

political relationships and dynamics between the local store, the community, and its leaders? What mitigation strategies have been implemented by First Nation members? Future research could also assess food prices in grocery destinations in Fox Lake's proximity, to gain insights on the trade-off between potentially lower food prices and transportation costs. In this regard, focus group discussions could further shed light on monetary and non-monetary aspects that may explain the thesis' findings.

In addition, some technical limitations to this study should be acknowledged. First, the food price level comparison, as shown in Table 5.1, was based on eight selected food items from the Northern and Statistics Canada. Data on other food items was unavailable. It should, hence, be noted that the comparisons and conclusions are based on these food items.

Second, to assess food price changes, this study sought out to estimate the overall CPI across the 51 selected food items observed in Fox Lake's local store. However, due to unavailability of data on quantity purchased for each food item for respective years, my analysis of temporal price changes was based on the Jevons index. Furthermore, temporal price changes for Alberta were based on annual percentage changes of the Consumer Price Index (CPI) not seasonally adjusted. In other words, conclusions on disparities in temporal average food price changes between Fox Lake and Alberta need to take these measurement differences into account.

Third, both price data sets from Fox Lake's local store and statistics Canada excludes characteristics such as quality differences between food items being compared.

Finally, long term price changes in Fox Lake, estimated from the Lowe index assumed the same expenditure shares as observed in Alberta. These estimates may not reflect the true long-run average price changes in Fox Lake as expenditures shares of the sampled products may be different. Estimates from the Lowe index were significantly influenced by expenditure shares. Higher expenditure shares were associated with high indices and vice versa.

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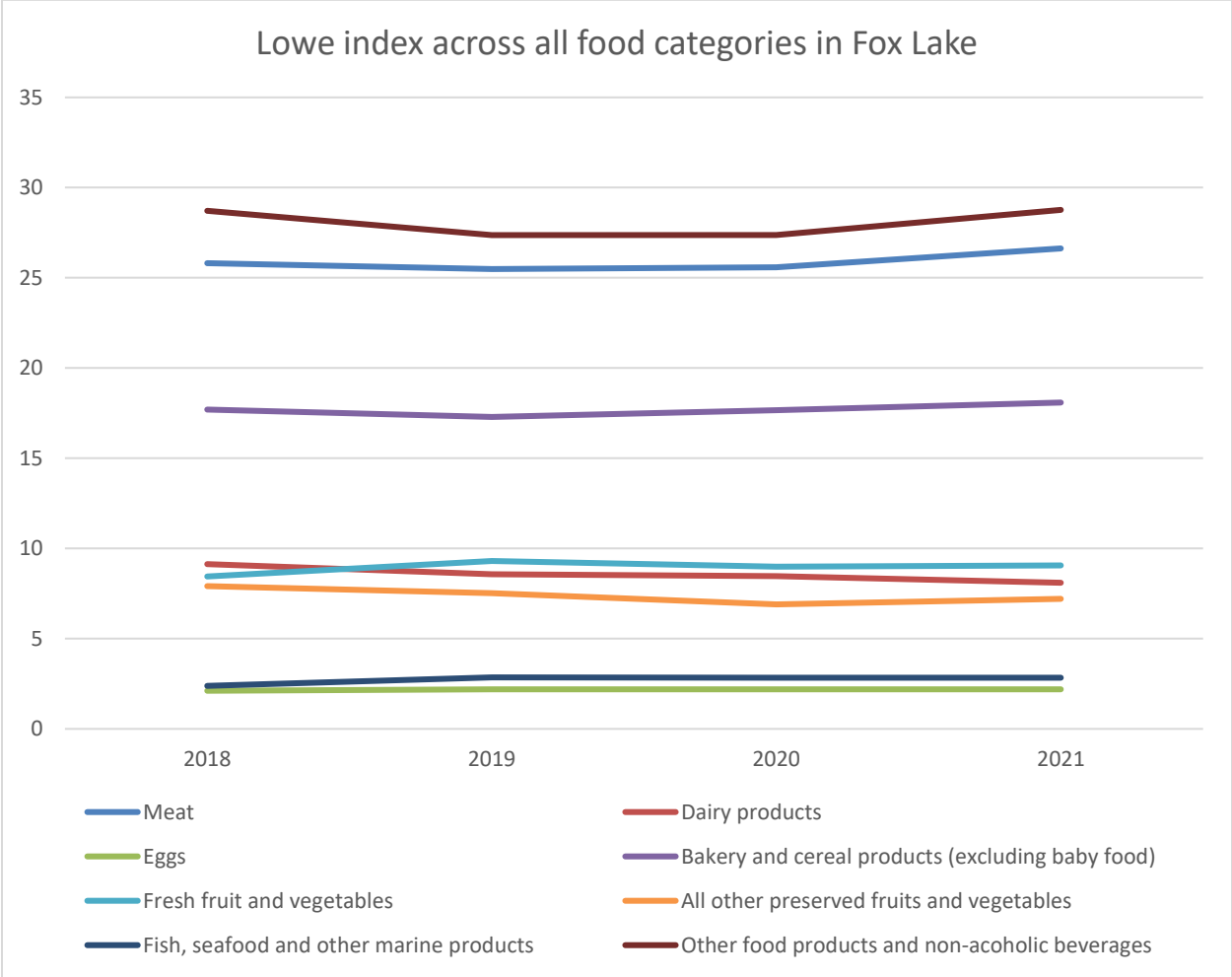
## Appendices

### Appendix A. *Expense categories and subcategories*

<b>Categories</b>	<b>Subcategories</b>
Transportation	Vehicle payment, vehicle purchases, insurance, repairs, and gas (including ATV, Skidoo and boats); airfare and taxi fare; and other.
Hunting/fishing	Fuel (gas, diesel, propane); small equipment (e.g. net, ammo, chain saw); large equipment (e.g. firearms, boat, ATV); and other.
Food	Groceries (including diapers, baby food, personal hygiene items); take-out food/coffee; restaurants; traditional food; and other.
Clothing	Men; women; children; and other (e.g. traditional clothing).
Professional services	Legal; accounting; appraisers; funerals; childcare; food processing (e.g. meat cutting & sausage making); and other (e.g. veterinary).
Healthcare services	Dental; vision; prescription; traditional medicine; and other.
Household furnishing/equipment	Furniture; electronics; appliances; and other.
Household operations	Utilities (power, water/sewer, propane, garbage disposal); insurance; repairs and construction (e.g. renovations and R&M for cabins); internet (including Netflix); phone (home and cell, iTunes); TV; and other (e.g. laundromat, maintaining your yard, lawn).
Personal care	Salon (e.g. hair, nails, waxing, pedicure); gym membership; piercing and tattoos; and other (including gifts).
Personal education/training	N/A
Tobacco and other products	Cigarettes/tobacco; vaporizers; snuff/chewing tobacco; alcohol/drugs; and other.
Recreation	Attendance and participation in sports (e.g. golf, hockey, baseball); vacations/holidays; and other.
Gaming	Bingo; VLT; poker; lottery tickets; and other.
Attendance and participation in cultural events	Powwow; hand games; tea dance/round dance; gathering/assembly; and other.
Other	N/A

Source: Mirzaei and Natcher, 2021

Appendix B. Lowe index showing % changes in price across all food categories in Fox Lake.



Source: Own calculations based on retail data collected from Mirzaei and Natcher (2021) and Statistics Canada (2021).

Appendix C. Annual % change in the prices (Jevons index) of selected food items in Fox Lake

<i>Food item</i>	<i>% change in prices (2017)</i>	<i>% change in prices (2018)</i>	<i>% change in prices (2019)</i>	<i>% change in prices (2020)</i>	<i>% change in prices (2021)</i>
Fresh or frozen beef	100	-5	-12	+20	+1
Fresh or frozen pork	100	0	+8	-4	0
Fresh or frozen chicken	100	-1	+1	0	+14
Bacon	100	+40	-48	-13	+21
Ham excluding deli ham	100	+6	+17	-17	-2
Other processed meat	100	0	+4	-4	0
Fresh or frozen fish (including portions and fish sticks)	100	-10	+47	-38	+2
Canned salmon	100	0	+21	-21	0
Canned tuna	100	+4	-4	0	0
Shrimps and prawns	100	0	0	-1	+1.5
Whole milk	100	+4	-21	+16	+1
Low-fat milk	100	+4	-22	+17	+1
Butter	100	+4	-4	+5	-5
Cheddar cheese	100	0	0	-4	-11
Processed cheese	100	+5	+10	-23	+6
Mozzarella cheese	100	0	0	-4	-11
Ice cream and related products	100	+7	-11	+7	0
Eggs	100	0	+4	0	0
Bread, rolls and buns	100	+2	+1	-3	+4
Crackers and crisp breads	100	+14	-3	-13	+10
Cookies and sweet biscuits	100	+6	-6	+2	+2
Rice and rice-based mixes	100	+1	+3	-4	0
Breakfast cereal and other cereal products (excluding baby food)	100	+1	-2	+2	-2
Dry or fresh pasta	100	0	-25	+25	0
Flour and flour-based mixes	100	+16	-78	+154	-92

Apples	100	+2	+9	-12	+4
Oranges	100	-10	+50	-56	+49
Bananas	100	+21	-21	-16	+16
Fruit juices	100	+3	+12	-38	+33
Canned fruit	100	+2	-11	+19	-1
Jam, jelly and other preserves	100	0	+2	+1	-3
Frozen fruit	100	+6	-15	+12	-2
Potatoes	100	+1	+11	-6	-9
Tomatoes	100	-2	-14	+16	-15
Lettuce	100	+58	-46	+1	-34
Frozen and dried vegetables	100	+5	+6	+3	-7
Canned vegetables and other vegetable preparations	100	0	-23	+6	+17
Sugar and syrup	100	+2	-17	+40	-15
Margarine	100	-7	+18	+5	-2
Roasted or ground coffee	100	+1	-20	+25	-2
Instant and other coffee	100	0	+10	-1	-5
Tea	100	0	+7	-34	+27
Fermented or pickled vegetables	100	+10	-19	+5	+5
Sauces, condiments and dips	100	+4	-4	0	+9
Herbs, spices and seasonings	100	+1	-33	+38	+5
Soup	100	+26	-38	+12	+3
Infant formula	100	+13	0	-25	+17
Frozen food preparations	100	+1	+2	-3	+6
Nut butter	100	-22	+32	-12	+2
Potato chips and other snack products n.e.c.	100	0	-4	+4	+13
Non-alcoholic beverages	100	0	0	0	0

Source: Own calculations based on retail data collected from The Northern.

Note: + represents an increase

- represents a decrease



Appendix D. Annual % change in the prices of in the prices (Lowe index) of selected food items with reference to 2017.

<i>Food item</i>	<i>% change in prices (2017)</i>	<i>% change in prices (2018)</i>	<i>% change in prices (2019)</i>	<i>% change in prices (2020)</i>	<i>% change in prices (2021)</i>
Fresh or frozen beef	100	+6.3	+5.3	+5.4	+5.7
Fresh or frozen pork	100	+3	+3.2	+3.4	+3.4
Fresh or frozen chicken	100	+5.2	+5.2	+5.2	+5.9
Bacon	100	+1.3	+1.2	+0.9	+0.9
Ham excluding deli ham	100	+1.1	+1.4	+1.4	+1.5
Other processed meat	100	+8.9	+9.3	+9.3	+9.3
Fresh or frozen fish (including portions and fish sticks)	100	+1.2	+1.7	+1.6	+1.6
Canned salmon	100	+0.1	+0.1	+0.1	+0.1
Canned tuna	100	+0.6	+0.6	+0.6	+0.6
Shrimps and prawns	100	+0.5	+0.5	+0.5	+0.5
Whole milk	100	+0.6	+0.5	+0.5	+0.5
Low-fat milk	100	+2.9	+2.4	+2.4	+2.4
Butter	100	+0.7	+0.7	+0.7	+0.7
Cheddar cheese	100	+2.1	+2.1	+2.1	+1.7
Processed cheese	100	+0.8	+1.0	+0.9	+0.9
Mozzarella cheese	100	+0.4	+0.4	+0.4	+0.3
Ice cream and related products	100	+1.5	+1.4	+1.5	+1.5
Eggs	100	+2.1	+2.2	+2.2	+2.2
Bread, rolls and buns	100	+6.0	+6.2	+6.2	+6.5
Crackers and crisp breads	100	+1.6	+1.7	+1.7	+1.8
Cookies and sweet biscuits	100	+1.6	+1.6	+1.6	+1.7
Rice and rice-based mixes	100	+0.8	+0.8	+0.8	+0.8
Breakfast cereal and other cereal products (excluding baby food)	100	+6.2	+6.1	+6.2	+6.1
Dry or fresh pasta	100	+0.7	+0.5	+0.5	+0.5
Flour and flour-based mixes	100	+0.8	+0.3	+0.6	+0.6

Apples	100	+1.7	+2.0	+2.0	+2.0
Oranges	100	+1.5	+2.1	+1.7	+2.3
Bananas	100	+1.5	+1.5	+1.3	+1.3
Fruit juices	100	+1.9	+2.2	+1.7	+1.8
Canned fruit	100	+0.5	+0.4	+0.5	+0.5
Jam, jelly and other preserves	100	+0.4	+0.4	+0.5	+0.5
Frozen fruit	100	+1.3	+1.2	+1.2	+1.2
Potatoes	100	+1.0	+1.2	+1.2	+1.2
Tomatoes	100	+1.3	+1.1	+1.1	+0.9
Lettuce	100	+1.3	+1.5	+1.7	+1.3
Frozen and dried vegetables	100	+1.1	+1.2	+1.4	+1.5
Canned vegetables and other vegetable preparations	100	+2.8	+2.1	+1.7	+1.7
Sugar and syrup	100	+0.9	+0.8	+1.0	+1.1
Margarine	100	+0.3	+0.4	+0.4	+0.5
Roasted or ground coffee	100	+2.9	+2.3	+2.5	+2.6
Instant and other coffee	100	+0.6	+0.7	+0.7	+0.8
Tea	100	+1.5	+1.6	+1.2	+1.2
Fermented or pickled vegetables	100	+0.8	+0.7	+0.7	+0.7
Sauces, condiments, and dips	100	+6.2	+6.2	+6.2	+6.7
Herbs, spices and seasonings	100	+2.1	+1.4	+1.5	+1.7
Soup	100	+1.8	+1.6	+1.6	+1.6
Infant formula	100	+0.5	+0.6	+0.5	+0.5
Frozen food preparations	100	+2.4	+2.4	+2.4	+2.6
Nut butter	100	+0.5	+0.5	+0.5	+0.5
Potato chips and other snack products n.e.c.	100	+1.2	+1.2	+1.2	+1.2
Non-alcoholic beverages	100	+7.0	+7.0	+7.0	+7.0

Source: Own calculations based on retail data collected from The Northern and Statistics Canada (2021).

Note: + represents an increase

- represents a decrease