

# Traditional Indigenous foodways and retail subsidies: Evidence from the Northwest Territories Community Survey and Nutrition North Canada

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## Abstract

Traditional foods (often referred to as “country foods”) play a critical role in Indigenous culture, nutrition, food sovereignty and food security. Policies that prioritize store-bought food are often viewed as undermining these foods. We provide evidence that one such policy does not appear to negatively impact traditional foods and if anything increases their consumption. Our analysis uses community surveys conducted over several decades in the Northwest Territories that measure the relative importance of harvested versus store-bought meat in consumption and the share of the population engaged in hunting/fishing activity. Using a difference-in-difference methodology, we show that two transitions associated with the Nutrition North Canada subsidy program – the transition from Food Mail to Nutrition North in 2011-2012 and the expansion of eligibility to new communities in 2016 – had a zero or positive impact on these outcomes. We use price and quantity data from several sources to provide evidence on mechanisms and find support for a standard economic interpretation – traditional foods appear to have a high enough income elasticity and low enough substitutability with store-bought food that they are gross complements rather than substitutes for this population.

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## 1. Introduction

The collection (through hunting, fishing, trapping, and gathering) and consumption of traditional foods (often referred to as “country food” in the literature) occupies a central place in Indigenous communities (Gombay, 2010; Kumar et al., 2019). As the basis of the historical Indigenous economy, these foods have a special cultural importance and are prioritized in treaties and land claim agreements negotiated between Indigenous peoples and European settler-states (Freeman, 1976; Brice-Bennett et al., 1977). They also play a quantitatively important role in the diets of Indigenous peoples against a backdrop of low income, high retail food prices, dietary inadequacy, and high food insecurity (Valerie et al., 2018; Leblanc-Laurendeau, 2020). Warltier et al. (2021) estimate that a majority of Nunavut communities satisfy their protein requirements through locally harvested food. Across the 34 communities in the Northwest Territories, the average share of households that report consuming most (more than 75%) of their meat and fish out of hunting/fishing is over 40%.<sup>1</sup> For their cultural significance and nutritional importance, as well as their role in fostering food sovereignty and local employment, Indigenous communities and leadership frequently center traditional food collection and consumption in their food security strategies and policy consultations (Council-Alaska, 2021; Canada, 2016; Kanatami, 2021).

While traditional foods remain culturally and nutritionally important, their consumption has declined steadily as a result of centuries of trade and later deliberate government policy. Early trade with Europeans often supported traditional food production, with guns, bullets and steel traps being among the most popular items exchanged for furs. As settler colonialism encroached on more Indigenous lands, Burnett and Hay (2023) describe how food policy became a tool of assimilation, documenting a long history of hunting restrictions, government propaganda, and coercive policy designed to promote European diets and reduce the importance of traditional foods. In its place was store-bought food, which was increasingly purchased with government benefits due to declining income from the fur trade. Family Allowances (cash transfers) were provided conditional on settlement, which increased population density and lowered the accessibility of traditional foods. Forced purchasing lists – which prevented many Indigenous people from using Family Allowances on hunting

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<sup>1</sup>This figure comes from the Northwest Territories Community Surveys we describe and analyze later.

supplies and instead forced them to receive in-kind food transfers from local retailers – constituted both a form of corporate welfare (supporting retailers that experienced declining fur trade profits) and a mechanism for assimilation into the Canadian nation state. Policies perceived as prioritizing store-bought food over traditional foods continued through the Food Mail program, which subsidized air freight of specific products (including meat) to remote communities lacking year-round surface transit by sea and land, and its successor, Nutrition North Canada, which pays a freight subsidy directly to retailers for eligible food products. The transition from Food Mail to Nutrition North has been explicitly criticized on the basis that hunting supplies were subsidized under Food Mail but not under Nutrition North (Stephenson and Wenzel, 2017; St-Germain et al., 2019; Burnett and Hay, 2023; Daley et al., 2024b).

In this paper, we quantitatively assess whether recent policy changes in Canada's North have undermined the consumption and production of traditional foods. We use data on consumption and production of traditional foods for the 34 communities in the Northwest Territories between 1998 and 2018, together with price data from multiple sources and data on quantities and subsidies collected by the Nutrition North program. Across communities, we find that consumption of traditional foods is highly correlated with Indigenous identity and the price of store food, but only weakly with income. We then use a difference-in-difference framework to analyze two major policy changes that occurred during our sample period – the transition from Food Mail to Nutrition North subsidies that affected 10 communities from 2011-2012, and the transition to full Nutrition North subsidies in 2016 that affected 4 communities that were previously ineligible.

Somewhat surprisingly, in light of the concern that a retail subsidy undermines collection and consumption of traditional foods, we find that both transitions increased the share of households consuming most of their meat/fish from hunting/fishing, and find some evidence that the 2016 transition increased the share of people hunting. We examine key mechanisms behind this effect, and interpret our result as being driven by a positive income elasticity of hunting and consumption of traditional foods, and a low substitutability between store-bought foods and traditional foods. We show that both of the transitions lowered the price of store food, but that meat makes up only a small share (16%) of the value and weight of subsidized foods. The value of subsidies is substantial (equivalent to 2.5% of median income for the average household in the 2016 transition communities) but subsidy increases

seem to have only a modest effect on the quantity of subsidized food shipped, particularly meat. We interpret these findings as suggesting that the transitions saved households a substantial sum of money without incentivizing greater consumption of store-bought foods (and particularly store-bought meat), providing households with more time and resources to pursue hunting and consume traditional foods. Thus, rather than being an inferior goods that is easily substituted for store-bought meat, traditional foods and the activities to procure them look more like normal goods with a high enough income elasticity and low enough substitutability that they are complements with store bought food. This contrasts with the Indian setting analyzed by Li (2023), who shows that government food security programs can reduce subsistence production when they take the form of in-kind benefits. A key difference is that subsidized and home-produced staples are close substitutes in that case, while traditional foods are not widely commercialized in Indigenous communities. Li (2023) also finds that when own-production is the most efficient way for households to procure food at the margin and own-produced food is a normal good, food security policies that act like income transfers can increase own-production of staples for consumption, consistent with the mechanism identified here.

To our knowledge, this is the first study to quantitatively assess the determinants of traditional Indigenous food consumption and production in Canada across communities, and to specifically assess how they are affected by subsidies like Nutrition North that support retail food consumption. Several recent studies have undertaken quantitative analysis of the Food Mail to Nutrition North transition (St-Germain et al., 2019; Daley et al., 2024b), showing that it was associated with increased food insecurity in Canada's North. We contribute to an understanding of this transition by providing the first quasi-experimental evidence that this transition lowered prices for a broad basket of foods. Other studies have estimated pass-through of Nutrition North subsidies to retail prices, showing that pass-through (including for the 2016 transition we study here) was incomplete and was partly captured by monopolistic retailers (Galloway and Li, 2023, 2024). Here, we show that the subsidies that did get passed-through did not have a large effect on consumption quantities for store-bought food and especially meat, but rather resulted in household savings that may have inadvertently promoted the traditional food sector.

The rest of the paper is organized as follows: we first provide some more background on the history of traditional foods and government food policy vis a vis In-

Indigenous people, then we discuss our data and some descriptive statistics on traditional foods in the Northwest Territories, followed by our main difference-in-difference estimation of the effects of Nutrition North transitions and then an exploration of economic mechanisms.

## 2. Background

### 2.1. Traditional foods

Noting that the Food and Agriculture Organization (FAO) defines food security as “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life,” Indigenous organizations like Inuit Tapiirit Kanatami (which represents Inuit across Canada) highlight “the centrality of harvested foods to our culture and way of life, as well as for meeting our dietary needs and food preferences” Kanatami (2021). These foods are described as “a pillar of Inuit culture, identity, and health and are a major source of food... an essential component of our physical and mental health, well-being, and spiritual sustenance and are demonstrably superior in nutritional value and quality.”. They note that “the monetary value of harvested foods in Nunavut suggest that country food harvesting enables tens of millions of dollars in household savings when comparing harvested protein to store-bought sources of protein” and that “harvesting rights... are affirmed in Inuit-Crown land claims agreements.” These views likely apply to most if not all Indigenous peoples in Canada living in non-urban areas, although they are strongest in Canada’s North where as little as a century ago these foods constituted close to 100% of local diets.

Burnett and Hay (2023) and Mitchell (1996) describe government policies that limited the acquisition and trading of traditional foods, including Provincial Hunting Laws that asserted that the state shall supervise and control this economic resource to maintain its viability in the long-run. The Ontario government initiated this process by passing “An Act to Amend the Act for the Protection of Game and Fur-Bearing Animals” in 1892. Although this legislation permitted hunting for self-nourishment, it prohibited sales of this food. Enforcement of similar legislation and interpretation of treaty rights reduced the viability of hunting, prevented the emergence of a commercial sector for traditional foods, and made Indigenous communities more depen-

dent on store-bought food exchanged for furs, crafts, and later government benefits. Given the importance of food sharing networks and ambivalence about commercialization, limitations on the growth of a commercial sector for traditional foods have also been supported by some Indigenous peoples at various times Gombay (2010).

Burnett and Hay (2023) also emphasize the role of Family Allowances from the 1940s to 1960s in eroding the food sovereignty of Indigenous peoples. This policy worked on multiple fronts. It incentivized peoples who had traditionally lived in low density, semi-nomadic and highly dispersed hunting camps to settle in permanent communities, to receive services and assimilate them into European “western domesticity.” This had the – perhaps desired – consequence of eliminating Indigenous foodways, as it made access to traditional food sources more difficult (due to the limited ability of local wildlife to support a large population) and made access to store food easier. The policy also provided resources Indigenous families could use to purchase store food even as income from the fur trade declined, supporting profits of Northern retailers. In most communities, the Hudson Bay Company trading post – which had previously been at the center of a fur trade in which furs were exchanged for imported food but also hunting supplies – transitioned its main role from purchaser to retailer, as reflected in the creation of the “Northern Stores Department” in 1959. In many cases, Indigenous peoples were subject to “forced purchasing lists” which limited the set of goods on which they could spend their Family Allowance and excluded hunting supplies.

Policies that directly subsidize store-bought food, potentially at the expense of traditional food sources, continued through the Food Mail and Nutrition North Canada programs described in the next section. Although there are a number of programs that provide subsidies for traditional hunting/fishing activities (including in Quebec, Nunavut, and the Harvester Support Grant introduced by Nutrition North Canada in 2019), it remains the case that the cost of hunting and fishing is prohibitive for many households and has increased dramatically as Indigenous people switched from traditional hunting methods to capital intensive ones. Higher population density means hunters must travel farther than ever from their communities. Fuel is particularly expensive in remote communities where there may be limited storage capacity and fuel is often flown-in. Furgula (2016) describes the high cost of basic items, such as \$1,200 for a rifle, \$10,000 for a ski-doo or all-terrain vehicle, \$30,000 for a fishing boat and motor. Duhaime et al. (2002) show that access to a cash income raises the proportion

of traditional foods in the diet of Quebec Inuit. Hillemann et al. (2023) highlight that successful hunting is dependent on engagement with the cash economy, including wage labour, and that food sharing networks associated with hunting (and the social status they confer) also have socio-economic correlates, with low-income households more likely to have food-receiving ties and high-income households having more food-giving ties. Given the need to supply wage labour to afford hunting supplies, constraints on both time and money impose limits on the ability of community members to pursue traditional food collection. Community consultations almost universally emphasize a desire to receive subsidies for hunting supplies (Canada, 2016).

Other factors affecting the decline in traditional foods include evolving preferences, loss of cultural knowledge and climate change (Hillemann et al., 2023). Decades of exposure to different foods combined with deliberate policy – “food guides” and propaganda about healthy eating, reinforced by subsidies that are focused on certain non-traditional foods (milk, frozen fruits and vegetables) – have likely reduced local preferences for traditional food. Traditional knowledge about animals and the land may have also declined. Crown-Indigenous Relations and Northern Affairs Canada (2020) indicates that there is high demand for nutrition education initiatives focusing on traditional food knowledge and skills. A review by Akande et al. (2015) indicates that in recent decades there was a particular shift away from traditional foods and towards energy-dense store-bought foods among younger Inuit.

## **2.2. Nutrition North Canada transitions**

The Food Mail program was introduced in a somewhat ad-hoc way in the late 20th century, and by the 2000s consisted of subsidized air-freight through Canada Post for a specified list of items. In the Northwest Territories, shipping eligible perishables costs 80 cents per KG and non-perishables cost \$2.15 per KG, with even lower rates for some communities in the Beaufort Delta region when served out of Inuvik. The list of eligible items excluded some foods deemed unhealthy, but included many non-food essentials, including some hunting equipment (“Fishing nets, rods and lures, snowmobile, ATV and outboard motor parts” – see Appendix B of Standing Committee on Aboriginal Affairs and Northern Development (2011)). Communities were eligible if they lacked year-round surface (road/rail/marine) access, and there were 10 communities in the Northwest Territories that were eligible on this basis. While consumers had access to the subsidy for direct orders, most of the subsidized ship-

ments under the program were received by retailers, who may have passed on the savings to households.

For a variety of reasons (see Dargo (2008)) the Food Mail program was abolished and transitioned to the Nutrition North Canada in 2011, with a phase-out and phase-in of item eligibility between March 2011 and 2012. Nutrition North Canada has similar community eligibility criteria, and continued the equity objective of Food Mail by making explicit what had formerly been implicit – communities with higher air freight costs receive higher subsidy rates. Some communities that had access to Food Mail but made minimal use of it received a very low “partial” Nutrition North subsidy of 5 cents per KG. The biggest changes relative to Food Mail were that subsidies were paid directly to retailers per KG of eligible goods shipped (as opposed to being paid to Canada Post to subsidize air freight used by retailers) and the list of eligible items changed to prioritize higher subsidies on goods deemed more nutritious and perishable. Notably, fresh and frozen meat and fish likely experienced a subsidy increase, relative to Food Mail, while other products (ranging from ice cream to macaroni and cheese dinners to dried legumes and bottled water) lost subsidy eligibility. Previous studies show that the cost of the Revised Northern Food Basket (a food costing tool developed under Food Mail that continued to feature prominently in analysis of Nutrition North) fell as a result of the transition from Food Mail to Nutrition North from 2011 to 2012 (Crown-Indigenous Relations and Northern Affairs Canada (2020)), but this basket puts substantial weight on foods that receive high subsidies and there are no estimates of price effects that account for actual consumption patterns. The transition between programs was essentially budget neutral, which suggests that any effects of the transition were largely driven by the price effects of reallocating subsidies across goods (and to some extent across communities) and changes in subsidy pass-through.

Hunting equipment was no longer subsidized after the transition from Food Mail to Nutrition North. The combination of higher subsidies for fresh/frozen meat, and removal of subsidies for hunting, has been criticized by observers who view these policies as a continuation of earlier assaults on traditional Indigenous foodways in favour of imported store food (Stephenson and Wenzel, 2017; Burnett and Hay, 2023). However, there are no data available on either the prices or quantities of hunting supplies before or after the transition from Food Mail and it is likely that any subsidy on hunting supplies had a small effect, both because the subsidy was lower for non-



perishable items and because most non-perishable items (particularly vehicles) are shipped by seasonal surface freight. It is also unclear from published reports whether some key hunting supplies (like bullets) were subsidized, and fuel was definitely not subsidized.<sup>2</sup>

In October 2016, eligibility for the full Nutrition North subsidy expanded to 37 additional communities, some of which had previously been ineligible and some of which had previously received only the partial subsidy. There were four such communities in the Northwest Territories. Galloway and Li (2023) and Galloway and Li (2024) show that subsidy increases were not fully passed-through to retail prices, but pass-through was not zero, such that prices for subsidy-eligible items were still reduced. Compared to the Food Mail to Nutrition North transition, this transition did not reduce subsidy funding for any goods and therefore constitutes a larger injection of funds into communities.

The Nutrition North program has continued to evolve since then, with its budget more than doubling from about \$60 million a year at inception to more than \$130 million in 2024. Most notably, given our focus here, the strong demand from community consultations and Indigenous leadership lead to the creation of the Harvesters Support Grant as part of a package of subsidy reforms in 2019. This program allocates funds to Indigenous organizations (but not individuals) to subsidize harvesting trips, purchase of harvesting equipment, provision of training, and other activities. In combination with the Community Food Program, the government has allocated \$144.7 million to support 5,500 harvesters in over 100 eligible communities since the program's inception (Crown-Indigenous Relations and Northern Affairs Canada, 2023). As these reforms occur after our data end, we do not consider them here, but if data become available this is an important priority for research on the program.

### 3. Data and descriptive statistics

Our main outcomes come from the consolidated survey results available on the website of the Northwest Territories (NWT) Bureau of Statistics. These surveys (the NWT Labour Force Survey and NWT Community Survey) report data for 1998, 2003, 2008,

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<sup>2</sup>According to a former retail employee in the region (personal correspondence), hunting supplies like bullets were sometimes flown in when retailers misjudged demand between summer sea-lifts, but there is no evidence that Food Mail provided a major subsidy to hunting.

2013, and 2018. The surveys are conducted for 34 communities in the NWT that can be aggregated into six regions (Beaufort Delta, Dehcho, Sahtu, South Slave, Tli-cho and Yellowknife area). Our analysis focuses on one main outcome: the share of households in the community who report that 75% or more of the meat or fish they consumed was obtained through hunting or fishing. These surveys also collect data on the number of households, median household income, household insecurity (the share of households reporting that they are “worried about not having enough money for food,” 2018 only), share of households with Indigenous identity (2008 only), the share of population over age 15 that hunted/fished in the last year, and measures of the frequency with which households go hunting/fishing.

The Northwest Territories Bureau of Statistics website also reports an index of historical food prices collected from the NWT Community Price Survey. These are available for most of the 34 communities and are reported for the years 1997, 2000, 2001, 2004, 2010, 2012, 2015 and 2019. The food price index is expressed relative to Yellowknife (=100) for each year and is not meant to capture changes over time, and the documentation cautions that “data may not be comparable over time due to methodological changes.” Although we could not find a document that describes the survey methodology, data for individual product prices are reported for some years, which suggests that the list of products has expanded over time to include over 40 product ranging from fresh fruits and vegetables to soft drinks.

We combine these data with information from the website of Nutrition North Canada. The website provides data on the price of the Revised Northern Food Basket (RNFB), a fixed weight nutritious food basket consisting of 67 items that constitutes a local-preference adapted diet that is nutritionally adequate for a family of four over one week. These are supplemented with historical data from archived government websites on RNFB prices extending back to 2005, when the Food Mail program that preceded Nutrition North was still operating. Note that these prices are only available for communities that receive a full or partial (prior to 2016) Nutrition North subsidy. The website also provides us with data on the subsidy value and quantity of eligible foods shipped to each community by category. Finally, we determine program “treatment” using data from the current and historical Nutrition North Canada websites and press releases. The Northwest Territories has 10 communities that were eligible for Food Mail and transitioned to a full Nutrition North subsidy by 2012 (Aklavik, Colville Lake, Deline, Fort Good Hope, Norman Wells,

Paulatuk, Sachs Harbour, Tuktoyaktuk, Tulita, and Ulukhaktok), and four more that transitioned from zero or partial subsidy to full subsidy in October 2016 (Gameti, Wekweeti, Whati, and Lutselk'e).

Figure 1 displays the variation in our main outcome variable, the share of households that source most of their meat from hunting (note that this includes fish/fishing henceforth). The left panel shows that there was a pronounced downward trend from about 25% to 14% for the territory as a whole. Almost half of the population lives in Yellowknife, which has a particularly low share of meat from hunting and substantially lowers the aggregate. When we look at the mean *across communities* of this variable it is much higher, over 45%, but still drops more than five percentage points over the 1998-2018 period, although this trend is somewhat reversed in the last period. The right panel plots the community level data for 2008 (before the NNC transitions we study) and 2018 (after they have occurred) and labels the three types of communities in our sample – those that are never NNC eligible during our sample period, those that transition from Food Mail by 2012, and those that gain eligibility for the full subsidy in 2016. Most communities lie close to and below the 45 degree line indicating that the share decreased moderately, but some experienced small increases. There is also lots of variation across communities, with Yellowknife and Hay River having only a very small share of households that rely on hunting for most of their meat consumption and others having rates over 80%.

Figure 2 presents scatter plots that show the correlation of the importance of meat from hunting and other variables in our data. In the top row, we observe a strong positive correlation between this variable and the share of the population over age 15 that hunts or hunts frequently. This is important as it suggests that the relative importance of traditional foods in consumption is likely driven by higher quantities of traditional foods rather than lower quantities of store food. There is a negative correlation with the number of households in the community but this appears to be largely driven by Yellowknife which is a major outlier and has the smallest Indigenous population share in the territory. There is a strong positive correlation with the Indigenous share of the population. In the bottom row, we see that there is a negative relationship between median household income and the importance of meat from hunting. However, much of this correlation appears to be driven by a few communities with high income and lower than average Indigenous population share (Yellowknife, Hay River, Norman Wells, and to a lesser extent Fort Smith and Inuvik).

Among the communities with incomes below this level, which tend to have much higher Indigenous population shares, the correlation looks positive. We also observe a positive correlation with food insecurity and a remoteness index.<sup>3</sup>

Finally, the bottom right panel shows that the share of households that get most of their meat from hunting is positively correlated with retail food prices. While most of the correlations above have been established in the literature, we believe that this is the first evidence that higher retail food prices are associated with greater reliance on traditional foods. However, we caution against interpreting this relationship as causal, given that communities with higher prices may have different preferences and/or better access to traditional food sources due to their size and location.

Table 1 uses a regression framework to further explore the conditional correlations in the cross-section. Columns 1 to 4 regress the log share of households getting most of their meat from hunting on community characteristics and year fixed effects. This and all subsequent regressions cluster standard errors by community. We observe that larger communities have lower traditional food shares conditional on other covariates, which is consistent with the view that there are more limited hunting opportunities per person in larger communities. A higher Indigenous population share also has a large positive conditional correlation. The price index also has a positive correlation, suggesting that communities with higher food prices rely more on hunting and fishing. The remoteness index is no longer positively correlated when controlling for additional covariates, suggesting the correlation in Figure 2 may operate largely through price or demographics. Column 2 adds income, which requires that we drop several communities missing income data, and we find no significant correlation with median household income. Column 3 adds region year fixed effects, which can account for common agro-climactic and cultural factors across the different regions and Indigenous groups, and the correlations are unchanged. Column 4 drops the Yellowknife region, which is a major outlier in terms of population, and the correlations from the last column are robust except for price. Columns 5 through 8 consider the share of the population over 15 that hunted in the last year, which has generally weaker associations with the same variables but has a robust negative correlation with community size and positive correlation with retail food prices. Interestingly, the share Indigenous is not strongly correlated with hunting on

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<sup>3</sup>The remoteness index is constructed by considering a community's population size and distance to all the population centers for a given travel radius (Statistics Canada, 2022) and ranges from zero to one, where higher values showcase greater degree of remoteness.

the extensive margin, suggesting that there is not a one to one relationship between hunting and dietary importance of traditional foods.

## 4. Estimating the effects and mechanisms of Nutrition North transitions

To assess whether the Nutrition North Canada subsidies had an effect on traditional food consumption and collection, we employ a difference-in-difference framework. We have all 34 communities in the Northwest Territories in our sample, of which 10 underwent a transition from Food Mail to Nutrition North between the 2008 and 2013 survey and 4 became eligible for the full Nutrition North subsidy between the 2013 and 2018 survey. We estimate specifications like:

$$\ln(\text{share})_{it} = \alpha_i + \gamma_t + \beta_1 FMNNtransition_{it} + \beta_2 NN2016transition_{it} + \epsilon_{it} \quad (1)$$

where  $FMNNtransition_{it}$  is a dummy variable equal to 1 after a community transition from Food Mail to Nutrition North and  $NN2016transition_{it}$  is a dummy variable equal to 1 after a community becomes eligible for a full Nutrition North subsidy after 2016. The coefficients  $\beta_1$  and  $\beta_2$  can be interpreted as the percent change in the share of households getting most of their meat from hunting due to these transitions. We also consider other outcomes that we consider important for the plausibility of any causal interpretation and that shed light on the mechanism underlying our findings, including the share of households hunting, retail prices, and the value and quantity of subsidized foods shipped under NNC. The difference-in-difference approach accounts for any time-invariant factors affecting the outcome variable, and any common time-varying factors such as the cost of hunting supplies (gas, bullets, etc.) or territorial-level policies. The key assumption is that there are no underlying trends correlated with treatment, which we explore more formally in the next section.

### 4.1. Effects of Nutrition North subsidies on country food consumption and hunting

Table 2 presents our main results for the share of households getting most of their meat from hunting (Panel A) and the share of the population over 15 that hunted

in the previous year (Panel B). Column 1 omits the year fixed effects and includes a year time-trend and column 2 considers the year fixed effects specification. These show that both transitions had a positive effect on traditional food consumption, but only the 2016 transition had a statistically significant and sizable effect on hunting. In column 3 we add the log of household income, which is missing from many communities and lowers the sample size by about a third. The coefficients on the transitions are stable but we lose some statistical significance. Interestingly, household income now has a positive association with hunting, suggesting that conditional on community preferences and traditional food availability, increases in income may increase hunting activity. In subsequent columns we omit the income variable to preserve as much of the sample as we consider other restrictions on the identifying variation. Column 5 includes region-year fixed effects, which may account for correlated regional shocks that could affect hunting activity, and we find both transitions have significant positive effects on consumption. Column 6 drops the Yellowknife region and column 7 drops both the Yellowknife region and the bottom 25% of communities by size and results are similar to column 5.

Note that the magnitudes represent percent changes in shares, so the transitions did not lead to a 36 or 53 percentage point increase in the share of the population getting most of the meat from hunting but a smaller change in the 13-20 percentage points given the sample mean share of 0.41. These effects still strike us as quite large, but the implied 95% confidence intervals are consistent with more modest increases. Our results certainly provide evidence against the concern that either of these Nutrition North transitions reduced the importance of hunting or consumption of meat from hunting. The fact that we find positive effects for consumption, and either zero or positive effects for hunting, helps rule out the possibility that the consumption effect we identify was driven by decreasing quantity of store-bought meat as opposed to increasing quantity of hunted meat.

To assess whether there are any major pre-trends associated with either Nutrition North transition, we consider a dynamic difference-in-difference specification given by:

$$\ln(\text{share})_{it} = \alpha_i + \gamma_{rt} + \sum_{j=2003}^{2018} \beta_1^j FMNNtransition_i * d_t + \sum_{j=2003}^{2018} \beta_2^j NN2016transition_i * d_t + \epsilon_{it} \quad (2)$$

where  $d_t$  is a dummy variable equal to 1 if  $j = t$  and we include region by year fixed

effects as in Table 2 column 5. The  $\beta^j$  coefficients then represent the “effect” of the transition at different horizons, relative to the omitted category (1998). If the transitions were exogenous and uncorrelated with trends across communities, we would expect these coefficients to be significantly different than zero only in the periods after the transition took place.

Figure 3 plots the coefficients from this exercise. The left panel plots the coefficients for the Food Mail to Nutrition North transition, which shows signs of a slight correlated pre-trend (the coefficient for 2008 is significantly different than zero at conventional levels) but with a small magnitude, followed by a jump in the two years after the transition to Nutrition North occurred. The right panel shows that the communities that became eligible for Nutrition North in 2016 had an abnormally high share 10 years before the transition but not in the other two periods, relative to other communities. Altogether, we view these results as supporting a causal interpretation of our main findings but recognize that given our small sample of treated and untreated communities and the sparse time-series (with only a few data points to observe pre-trends, five years apart), we cannot definitively rule out that part of the effect we identify is driven by correlated trends. However, our findings on mechanisms in the next section further support the plausibility of a causal economic interpretation.

## 4.2. Economic mechanisms

Much of the literature that criticizes Nutrition North subsidies on the grounds that it might undermine traditionally hunted foods is based on the simple intuition that subsidies lower the cost of store-bought meat, which could be a close substitute for traditionally hunted foods. However, the Nutrition North subsidies potentially lowered the cost of a range of goods, some of which may be more complementary with traditional foods, and may therefore have had substantial income effect given household savings. If traditionally hunted foods are perceived as normal or even luxury goods – due to their cultural significance, local preferences, and the high-perceived costs of time and materials (and associated enjoyment of hunting) – then it is possible that the Nutrition North Canada subsidies could have promoted the production and consumption of traditional foods.

Economic theory shows that the demand response for a good (e.g. traditional meat  $i$ ) in response to the price change of another good (e.g. store food  $j$ ) can be

decomposed as:

$$\partial x_i / \partial p_j = \partial h_i / \partial p_j - x_j \partial x_i / \partial w \quad (3)$$

where  $x$  represents quantity,  $p$  represents price,  $h$  represents a Hicksian demand function and  $w$  represents income. This says that if the substitution between traditional meat and store food ( $\partial h_i / \partial p_j$ ) is low, store food is important in consumption ( $x_j$  is large), and traditional food is viewed as a “normal” good whose consumption rises with income ( $\partial x_i / \partial w > 0$ ) or even a luxury whose consumption share rises with income, a reduction in the price of store food could increase consumption of traditional foods.

To assess the plausibility of these mechanisms, we first establish that the transitions we study in fact lowered prices for a large basket of food. We do not observe the universe of prices, so cannot rule out that increases in prices for goods that received subsidies under Food Mail and lost them under Nutrition North occurred. However, the prices we do observe in the NWT Price index and the RNFB cover a large and important set of products, and there is only limited literature establishing the price effects of the transitions we study. Crown-Indigenous Relations and Northern Affairs Canada (2020) shows that prices for the RNFB were lowered between March 2011 (before Nutrition North was phased in) and March 2012 (after it was fully phased in) but do not consider a control group. Galloway and Li (2023) show the October 2016 subsidy eligibility changes were not fully passed-through but still lowered RNFB prices in the communities that transitioned from a partial to a full subsidy. Thus, in what follows, we provide the first quasi-experimental evidence on food price effects from the Food Mail transition using two different data sets, and use a novel alternative to the RNFB price data to show that some of the 2016 Nutrition North reforms were passed-through to lower prices.

Table 3 presents results from our price regressions. Panel A uses the NWT Price index as the dependent variable, and implements a similar difference-in-difference as earlier with community fixed effects in all regressions. Column 1 includes a time trend, column 2 includes year fixed effects instead, and column 3 includes year-region fixed effects. The Food Mail to Nutrition North transition appears to have significantly lowered the NWT price index in affected communities by about 7 percent relative to Yellowknife. The 2016 transition also had a negative effect on these prices although it is only marginally significant in column 3. Panel B uses RNFB data to examine the transition from Food Mail to Nutrition North for a larger set of commu-



nities. Columns 1 and 2 show that there was a large reduction in costs, with the lower number in column 2 suggesting that flexibly accounting for time-varying factors affecting prices in these communities is important when estimating the magnitude of price reductions. The almost \$25 dollar reduction in column 2 translates into an approximately 6 percent reduction in prices in column 3, which uses the  $\log(\text{RNFB})$  price as a dependent variable.

The fact that Nutrition North subsidies lowered the price of some store-bought food suggests a plausible mechanism through which they may have increased hunting and consumption of traditional foods, by freeing up income that would have otherwise been spent on food at the store. On the other hand, this is less plausible if the amount of money saved is small or if the subsidy's effects are primarily concentrated on meat sold at the store. Although we are not aware of any community-level data on quantities shipped under Food Mail, Nutrition North collected quarterly data on the subsidy value and weight of subsidized shipments to each community between 2012 and 2018 that we can use to assess these questions and the impact on the 2016 transition communities.

We first note that for our sample communities that receive Nutrition North subsidies, the dollar value of the subsidy is quite high – about \$3,000 per household in 2017-2018 for the communities that transitioned from Food Mail and \$2,000 per household for communities that became eligible in 2016 (and that previously received zero or almost zero subsidies). The quantity of subsidized goods shipped is also high, with an annual mean of 890KG and 784KG per household respectively. However the share of meat in this total is fairly low – approximately 16% in terms of subsidy value or weight. This suggests that most of the subsidy went to lowering the cost of non-meat foods that might be more complementary to traditional foods, and there is less likelihood of substitution.

Table 4 uses the community-level subsidy data to explore this further in a difference-in-difference framework. Columns 1 and 2 look at the subsidy value per household for all goods and for meat only. The 2016 transition communities experienced an \$1,888 increase in subsidy spending per household, but only a \$253 increase in meat subsidy spending per household, representing 13% of the increase. This number can be compared to a median household income of \$74,000 in the transition communities, so the increase in subsidy value was equivalent to 2.6% of median income, resulting in substantial savings even under the pass-through rates estimated in Galloway and

Li (2023). Columns 3 and 4 look at changes in the weight of subsidized foods shipped per household. The overall quantity of subsidized goods shipped rose in response to the increase in subsidy rates, but this increase was modest (78 KG per household per year) and represents about 10% of the weight of subsidized goods that had been shipped under the partial subsidy. The effect on the weight of subsidized meat shipments was tiny and not significantly different than zero.

Overall, our findings here add to the plausibility of our main results and the economic mechanism that can explain it. The Nutrition North transitions lowered the price of many foods but only a small share of the subsidy went to meat. There was only a modest response in terms of greater consumption of (subsidized) store foods and no significant effect on consumption of subsidized meat. Households appear to have used the substantial savings – which amounted to 2.6% of income – to increase their hunting and consumption of traditional foods, consistent with the suggestive evidence of positive income elasticities in Table 2 and within-community correlations with socioeconomic status identified in other literature (Duhaime et al., 2002; Hillemann et al., 2023).

## 5. Conclusion

Our findings contradict the notion that the Nutrition North Canada retail subsidies have contributed to the declining importance of traditional foods in consumption that has occurred in recent decades. Despite potentially increasing the cost of some hunting supplies, and lowering the price of store foods such as meat, the net effect of the transition from Food Mail and expansion of community eligibility for the full subsidy was to put more money in the pockets of households with a high, unsatisfied demand for traditional food consumption and harvesting.

However, our results should not be taken to imply that retail subsidies for imported food are the best way to support these communities and their stated desire for greater support for the traditional food sector. Our results imply that any increases in income are likely to support this goal, and may have an even larger effect per dollar, depending on how the income is distributed and how it affects store food prices (see Daley et al. (2024a)). Moreover, we are unaware of any quantitative evaluations of the effectiveness of direct support to harvesters, whether through provincial/territorial programs or the Nutrition North Harvester Support Grant introduced in 2019. How

these programs affect traditional food collection, distribution, consumption and other outcomes is an important topic for future research.

Future work could also use other data sources that record traditional food consumption and production such as the Aboriginal Peoples Survey and Inuit Health Surveys and cover more recent periods. In addition to providing a larger sample to examine the effects of Nutrition North transitions we consider, this would also allow for an analysis considering the large increases in subsidies that occurred in 2019 and 2020. Future work could also explore the effect of exogenous income transfers such as child benefit expansion and COVID-19 benefits on the collection and consumption of traditional foods.

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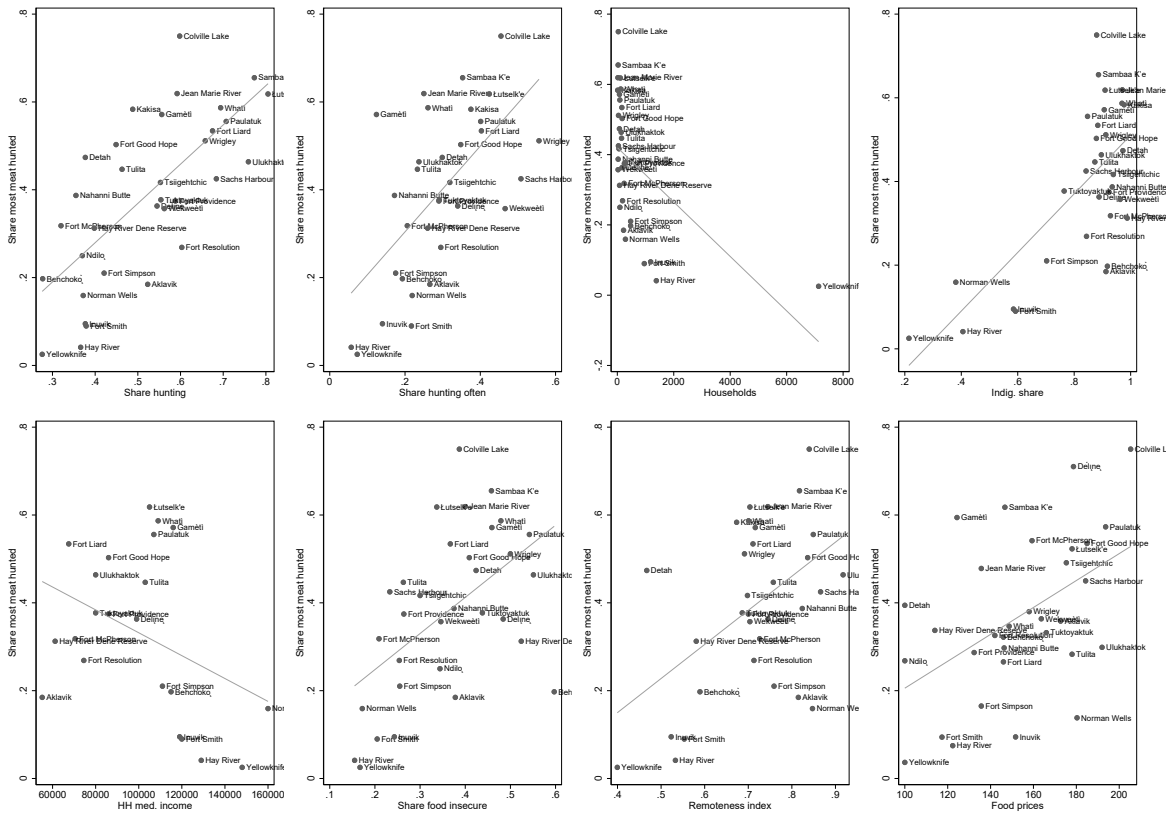


Figure 2: Correlates of the share of households that consume 75% or more of meat/fish from hunting/fishing in the NWT Community Survey in 2018. All data come from the 2018 NWT community survey except Indigenous share of the population (from the 2008 survey), remoteness index (from Statistics Canada) and Food Price Index (from the NWT Community Price Survey in 2013, with Yellowknife=100).



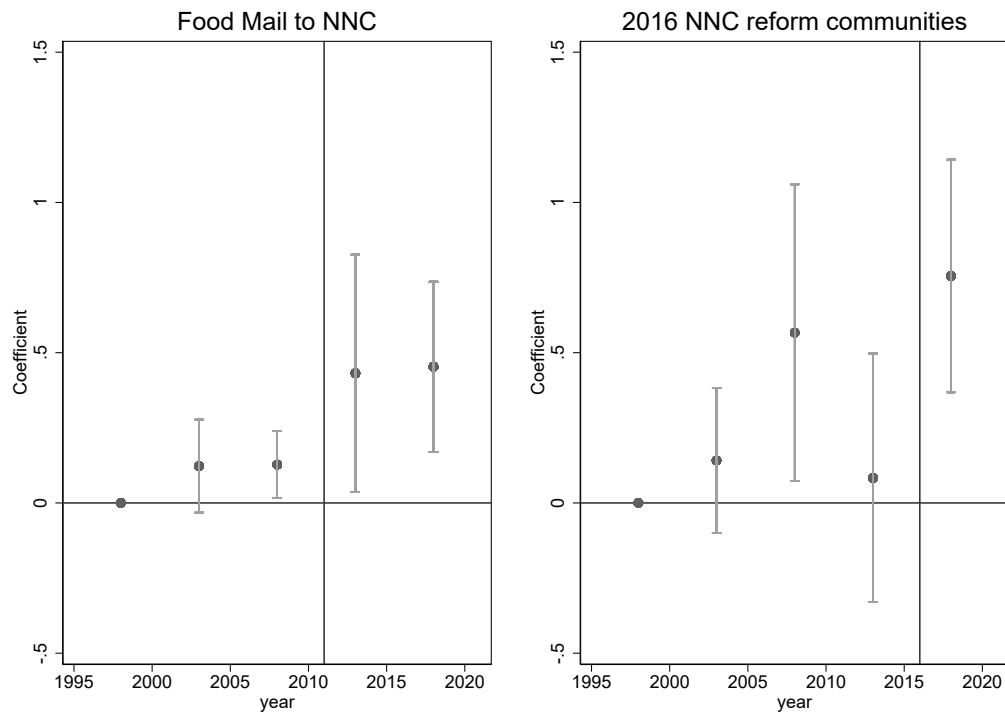


Figure 3: Period-by-period estimates for each NNC transition with 95% confidence interval. Omitted category is the 1998. See text for description of regression; all estimates include region-time fixed effects and community fixed effects, with standard errors clustered by community.

Table 1: Cross-sectional correlates of traditional food consumption and collection in the Northwest Territories.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent var.	ln(share hh most meat hunting)				ln(share pop. over 15 hunting)			
ln(Households)	-0.177*** (0.057)	-0.221** (0.084)	-0.251*** (0.078)	-0.247** (0.095)	-0.072 (0.050)	-0.108* (0.056)	-0.151*** (0.050)	-0.151*** (0.050)
Price index	0.006*** (0.002)	0.007*** (0.002)	0.008** (0.003)	0.005 (0.003)	0.003*** (0.001)	0.003** (0.001)	0.007*** (0.002)	0.007*** (0.002)
Share Indigenous	1.928*** (0.218)	1.440*** (0.295)	1.748*** (0.385)	1.809*** (0.432)	0.102 (0.253)	-0.320 (0.267)	0.170 (0.270)	0.170 (0.270)
Remoteness index	-0.540 (0.494)	-0.790 (0.476)	-0.865 (0.641)	-0.513 (0.714)	0.103 (0.369)	-0.144 (0.402)	-0.422 (0.398)	-0.422 (0.398)
ln(median hh. income)		-0.325 (0.195)	-0.207 (0.246)	-0.233 (0.268)		-0.241* (0.141)	0.149 (0.173)	0.149 (0.173)
Year FE	Yes	Yes	No	No	Yes	Yes	No	No
Year-region FE	No	No	Yes	Yes	No	No	Yes	Yes
Excl. Yellowknife	No	No	No	Yes	No	No	No	Yes
Observations	124	89	88	83	121	84	84	84
Adj R-squared	0.964	0.968	0.962	0.899	0.516	0.536	0.650	0.650

Standard errors clustered by community in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ . Dependent variable constructed from responses to “Households where 75% or more (most or all) of the meat or fish eaten in the household was obtained through hunting or fishing, by community” and “Share of population 15+ that went hunting or fishing.” All data come from the NWT community surveys conducted in 1998, 2003, 2008, 2013, 2018 except for the remoteness index (from Statistics Canada) and Food Price Index (from the NWT Community Price Survey years, interpolated to NWT community surveys, Yellowknife=100) and are weighted by the number of households in each community.

Table 2: Effects of Nutrition North transitions on traditional food consumption and collection.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Dependent var. is ln(share of hh with most meat from hunting/fishing)						
Food Mail to NNC transition	0.270*** (0.073)	0.237*** (0.070)	0.208** (0.098)	0.357*** (0.110)	0.357*** (0.108)	0.334*** (0.113)
2016 NNC transition	0.418*** (0.153)	0.443** (0.162)	0.383 (0.264)	0.529*** (0.141)	0.531*** (0.137)	0.591*** (0.131)
ln(hh.income)			0.311 (0.392)			
Observations	160	160	112	160	146	111
Adj R-squared	0.963	0.965	0.963	0.981	0.944	0.941
Panel B: Dependent var. is ln(share of pop. over 15 hunting/fishing)						
Food Mail to NNC transition	0.077 (0.073)	0.007 (0.073)	-0.041 (0.075)	0.057 (0.044)	0.057 (0.044)	0.067 (0.049)
2016 NNC transition	0.197* (0.101)	0.288** (0.109)	0.151 (0.186)	0.257 (0.160)	0.259 (0.158)	0.289 (0.175)
ln(hh.income)			0.441* (0.255)			
Community FE	Yes	Yes	Yes	Yes	Yes	Yes
Time-trend	Yes	No	No	No	No	No
Year FE	No	Yes	Yes	No	No	No
Year-region FE	No	No	No	Yes	Yes	Yes
Exclude Yellowknife	No	No	No	NoYes	Yes	
Exclude smallest 25%	No	No	No	No	No	Yes
Observations	168	168	113	168	154	112
Adj R-squared	0.565	0.738	0.735	0.853	0.761	0.752

Standard errors clustered by community in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ . All regressions weighted by number of households. Data come from the Northwest Territories Community Surveys from 1998, 2003, 2008, 2013, and 2018. Panel A is based on "Households where 75% or more (most or all) of the meat or fish eaten in the household was obtained through hunting or fishing, by community" and Panel B is based on "Share of population 15+ that went hunting or fishing."

Table 3: Effects of Nutrition North transitions on retail prices.

	(1)	(2)	(3)
Panel A: NWT Price index (Yellowknife=100)			
Dependent variable	Price index	Price index	Price index
Food Mail to NNC transition	-6.842*** (2.257)	-7.605** (2.845)	-19.533** (7.268)
2016 NNC transition	-8.283 (7.155)	-9.075 (7.488)	-10.152* (5.436)
Community FE	Yes	Yes	Yes
Time-trend	Yes	No	No
Year FE	No	Yes	No
Year-region FE	No	No	Yes
Observations	253	253	253
Adj R-squared	0.888	0.904	0.916
Panel B: Revised Northern Food Basket (RNFB) cost, all Canada			
Dependent variable	RNFB cost	RNFB cost	ln(RNFB cost)
Food Mail to NNC transition	-37.953*** (2.607)	-24.697*** (5.541)	-0.059*** (0.013)
Community FE	Yes	Yes	Yes
Time-trend	Yes	No	No
Year FE	No	Yes	Yes
Observations	591	591	591
Adj R-squared	0.829	0.848	0.848

Standard errors clustered by community in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ . Panel A uses data from the NWT Community Price Surveys for 1997, 2000, 2001, 2004, 2010, 2012, 2015 and 2019. Panel B uses data on RNFB costs from the Nutrition North Canada and Food mail websites (current and historical/archived versions) for all communities with available data from 2005 to 2016.

Table 4: Effects of Nutrition North transition on subsidy value and quantity of eligible foods (2012-2018). All variables reported per household.

	(1)	(2)	(3)	(4)
Dependent var.	NNC value	NNC meat value	NNC weight	NNC meat weight
2016 NNC transition	1,888.065*** (222.871)	253.112*** (16.713)	77.811* (36.347)	4.930 (5.575)
Community FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	76	71	71	71
Adj R-squared	0.956	0.968	0.778	0.830

Standard errors clustered by community in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.10$ . Subsidy and weight per community/year come from the Nutrition North Canada website and number of households comes from the NWT community survey. We restrict the sample to community/year cells with at least 400KG of subsidized food shipped per household.