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Review Article

From greedy grocers to carbon taxes and everything in between: What do we think we know about food prices in Canada and how strong is the evidence?

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Abstract

In Canada, the task of explaining food prices falls to a handful of grey literature reports that shape media coverage and public understanding and carry significant political and policy influence. We performed an in-depth analysis of fifty-one of these influential reports, including thirty-nine reports by Statistics Canada (including Consumer Price Index reports and other studies) and twelve reports from the Canada Food Price Report (CFPR) series. Our goal was twofold: 1) to identify and classify the various explanations given for food price changes, and 2) to evaluate the scientific rigor of these explanations. We identified 232 total explanations for food price changes, spread across seven thematic categories and thirty-two sub-categories. We find that most claims made in these reports are scientifically incomplete (only 28.6% of all claims meet established criteria for the completeness of scientific arguments). We also identify a lack of comprehensiveness in the areas of emphasis and the claims being presented and drivers being explored, particularly with respect to issues presently at the centre of food price discourse in Canada, such as the agency of grocers and other supply chain actors, corporate growth imperatives, and climate change. Considering the importance of food prices and food security to prosperity and well-being in Canada, we conclude with a series of recommendations for

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strengthening the scientific rigor of these reports, including greater inclusion of supporting evidence, opportunities for peer review, and increased transparency regarding conflicts of interest and funding sources.

Keywords: Agri-food policy; food prices; price of food; food affordability; scientific rigour; inflation; pandemic; greedflation; carbon tax

Résumé

Au Canada, la tâche d'expliquer les prix des aliments incombe à une poignée de rapports de littérature grise. Ceux-ci façonnent la couverture médiatique et la compréhension du public, et exercent une influence politique et stratégique considérable. Nous avons réalisé une analyse approfondie de 51 de ces rapports importants, dont 39 de Statistique Canada (y compris des rapports sur l'indice des prix à la consommation et d'autres études) et 12 de la série de rapports sur les prix alimentaires au Canada. Notre objectif était double : 1) identifier et classer les diverses explications données aux variations des prix des aliments et 2) évaluer la rigueur scientifique de ces explications. Nous avons relevé 232 explications, réparties en 7 catégories thématiques et en 32 sous-catégories. Nous constatons que la plupart des affirmations contenues dans ces rapports sont scientifiquement incomplètes (seulement 28,6 % d'entre elles répondent aux critères établis quant à l'exhaustivité des arguments scientifiques). Nous notons aussi des lacunes quant aux domaines ciblés, aux affirmations présentées et aux facteurs explorés, en particulier en ce qui concerne les questions actuellement au cœur du discours sur les prix des aliments au Canada, telles que le rôle des épiciers et d'autres acteurs de la chaîne d'approvisionnement, les impératifs de croissance des entreprises et les changements climatiques. Compte tenu de l'importance des prix des aliments et de la sécurité alimentaire pour la prospérité et le bien-être au Canada, nous concluons par un ensemble de recommandations visant à renforcer la rigueur scientifique de ces rapports, notamment l'intégration de plus de preuves à l'appui, la possibilité d'examen par les pairs et l'amélioration de la transparence concernant les conflits d'intérêts et les sources de financement.

Introduction

In this paper, we review and evaluate the current evidence base regarding the drivers of food prices in Canada. Food prices and inflation in general are currently high-profile topics in Canada and around the world; recently, the United States Federal Trade Commission (FTC) found that large grocers have manipulated prices and otherwise distorted the impacts of the COVID-19 pandemic on supply chains to increase their profits at the expense of consumers (FTC, 2024). Their findings add weight to a broader pattern of

apparent malpractice described in a brief from the Groundwork Collaborative (Pancotti & Owens, 2023), which attributes to corporate price manipulation as much as half of the effects of inflation seen in the US in the last half of 2023. In Canada, concerns about similar behaviour are high and arguably justified by precedent (Gregoire, 2023); in 2017, grocers in Canada were found to have collaborated in a price-fixing scheme for bread (Competition Bureau of Canada, 2023a). During the post-pandemic period, major Canadian grocers have also enjoyed noteworthy increases in profit and profit-margin (Competition Bureau of Canada 2023b; Oved, 2022; Stanford, 2022; Taylor & Charlebois, 2022). Canadian food prices are also presently in the political spotlight in relation to debates over the merits of carbon taxes as a climate change mitigation strategy; for example, the Conservative Party of Canada recently criticized the Federal carbon pricing regime for being a source of inflation, including of groceries (Wherry, 2023), and attempted to leverage the issue to trigger a national election (Tasker, 2024).

Given the obvious role that food prices can play as a discursive tool in Canadian policy and politics, a sound, science-based understanding of food prices is of critical importance to the effective democratic governance of Canada's food system. Understanding food process is also important to Canadian society at large. The price of food is widely understood as a principal component of poverty, food insecurity, and public health (Headey & Martin, 2016). Access (i.e., availability and affordability) to healthy food has been linked to health outcomes for childhood (physical and intellectual) development, management of chronic diseases, and aggregate public health outcomes such as life expectancy and quality of life (High Level Panel of Experts, 2017). Though the impacts of high food prices are understood to be generally problematic for consumers (and low-income consumers in particular), there remains debate about the role that high and low food prices play in determining *aggregate* poverty and food insecurity (Headey & Martin, 2016), as high food prices can benefit farmers and farm workers and may enable adoption of more sustainable food production practises (Headey & Hirvonen, 2023). Still, increasing food prices have become a central issue facing Canadian society, with implications for the health and well-being of Canadians from coast to coast to coast (Herbert, 2023; Isai, 2023; Miller, 2022).

The importance of food to human health and well-being is underscored by its increasing recognition as a fundamental human right (see Article 25-1in UN, 1948 and Article 11 in UN, 1966), for example, as well as Kent, 2005, and Messer & Cohen, 2007). Unlike many other rights, however, which individuals realise through their own agency and under the protection of the state as part of a social contract, food is an uncommon case of a right that is commonly provisioned by the private sector. Coming to grips with food price dynamics is thus also important, given the fact that food's commodified status introduces a potential incommensurability, if not outright conflict of interest, between people's fundamental right to food and the role of private firms and markets in determining food access and availability (Bellemare, 2015; Kloppenburg, 2005; Meerman & Aphane, 2012).

However, in recent years there appears to be little consensus on what the predominant factors driving food price changes have been, as numerous different positions on the drivers in Canada have been put forward by elected officials, labour groups, the Bank of Canada, members of the public, research reports, and Canadian agribusiness (Bank of Canada, 2023; Bulowski, 2022; Canadian Labour Congress, 2022; Gregoire, 2023; Oved, 2022;). This lack of consensus is perhaps understandable given that the task of explaining food prices is very complex due to the complicated and globalized nature of

our food system. Here, we seek to contribute to this discussion with an analysis of prominent reports on food prices in Canada. We approached this work with two research questions in mind:

1. How do these food price studies explain changes in the price of food in Canada?
2. Are the explanations for food price changes scientifically rigorous?

Working with a set of fifty-one reports on food prices in Canada, we employed descriptive coding and thematic analysis (Braun & Clarke, 2006) to identify types and categories of arguments made regarding the drivers of food price change. We adopted a qualitative analytical approach that would allow us to identify the explanations given for food price increases and to understand the ontological framing behind the reports (i.e., the assumptions about the nature of the world that predispose analysts' construction of plausible explanations, e.g., Geels, 2010). We also used the well-known Toulmin model of scientific argumentation to execute a deductive, framework-driven textual analysis of the completeness and rigour of each scientific argument we identified in the reports (Karbach, 1987; Toulmin, 2003). Our goal with the second part of this analysis is not to determine whether the claims made in these reports are correct, but whether they are scientifically rigorous (i.e., constructed and presented in a way that is evaluable by readers and that follows established scientific practice for constructing sound and defensible scientific arguments).

With this work, we contribute to the public good in two ways. First, our review raises concerns about the current role of grey literature in Canadian politics and discourse over food prices, especially if these reports are being presented or interpreted as scientific in nature. Second, we offer potential theoretical and practical reforms that could move these reports in the direction of producing the rigorous and trustworthy evidence Canadians need for understanding food price dynamics in Canada. The reforms we suggest include, as described in Section 4.4, enhanced peer-review processes, improved argument rigour, heightened transparency regarding conflicts of interest and funding sources, and further research effort from additional sources. Through these two contributions, we seek to summarize and contextualize prominent food price studies and offer a path for future research concerned with explaining food prices.

Methods

Identifying reports and our parameters for inclusion

When selecting reports to include in the study, we started with a purposive approach, including reports with which we were already familiar and which are known as contributing to political discourse around food prices in Canada. Specifically, this includes the Canadian Food Price Report series co-published by the Agrifood Analytics Lab and the Arrell Food Institute, as well as a mix of annual and ad hoc reports by Statistics Canada. We chose to start with these reports given our collective knowledge of food systems and food policy discourse in Canada.

To be sure that additional reports from these or other publishers were not overlooked, we also conducted an internet search using a variety of search terms, including "Canadian food prices", "explaining food prices in Canada", "changing costs of food in Canada", "food price changes in Canada", "food price research in Canada", and "food price studies". We also conducted an informal scan of mainstream online Canadian news media (including articles published by the *Toronto Star*, the CBC, CTV News, and the *National Post*) to identify articles covering food prices in Canada and distinguish source materials upon which media coverage was based. These searches reinforced our understanding of the dominant and sole influence of reports from these two publishers, and likewise did not reveal any additional resources beyond those from the two publishers. We opted against performing a meta-analysis or systematic review of peer-reviewed literature, again because the goal of this work was specifically to analyse known policy-facing documents that are regularly noted in media and political discourse. Although grey literature is not necessarily expected to conform to the standards of peer-reviewed science, these public-facing reports are presented with the authority of academic institutions and written in a language that purports an objective and positivist stance. Given the prominent role these reports currently play in public and political discourse, we believe that it is crucial to assess whether they meet scientific criteria for rigour.

We used several criteria to screen reports to ensure they were relevant to our research questions. First, we only included reports in our analysis if they provided explicit explanations for food price changes (either increases or decreases) in Canada. Next, we only evaluated reports written in English (a result of the language proficiency of the research team). Finally, we narrowed the scope to include only reports from the last ten (complete) years and 2023 reports published between January and May 2023. We set this temporal boundary to ensure reports from before, during, and after the COVID-19 pandemic (a major event for food prices in Canada and globally) were included.

Finally, we also sought out any supplementary materials referenced within the reports we analysed. However, these materials did not yield any additional explanations or supporting materials regarding food price changes beyond those listed in the reports themselves, and thus they ultimately were not included in our sample.

Coding strategy by research question

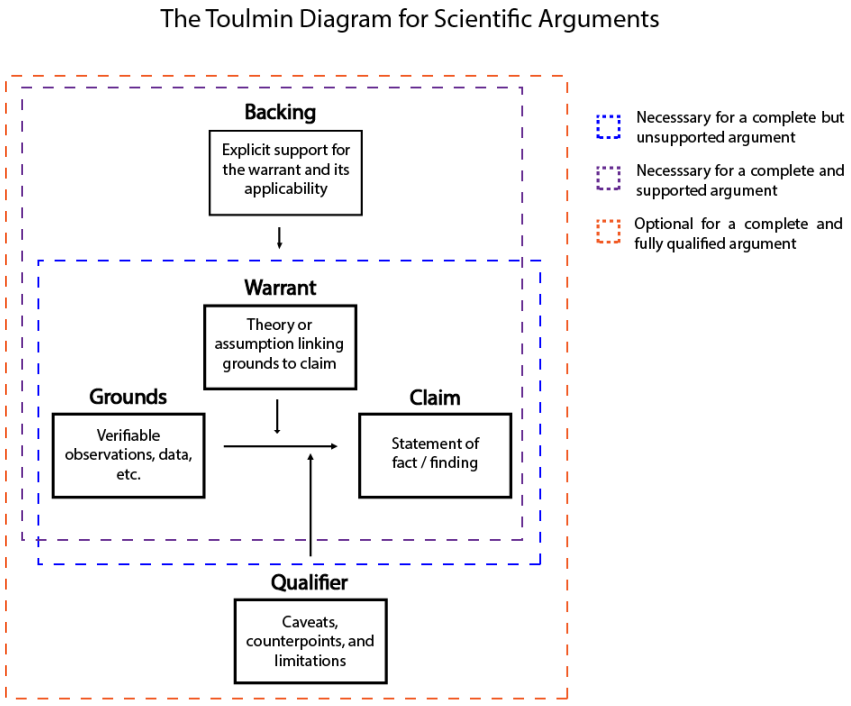
Research question one: How do food price studies explain changes in the price of food in Canada?

We used an inductive approach to thematic analysis (using NVivo Version 17.1; Braun & Clarke, 2006) to identify the explanations for changing food prices in Canada provided in the reports. Our first coding pass employed content coding, flagging each claim made regarding changing food prices. Coding was performed primarily by Author two; 100% of the codes assigned in the initial round of coding were reviewed by Author one in collaborative discussion with Author two. We followed this coding with thematic analysis, in which authors one, two, and four collaborated on an iterative process to combine and condense similar codes and organise them into discrete thematic categories and subcategories.

Research question two: Are the explanations for food price increases scientifically rigorous?

To answer our second research question, we assessed the scientific rigour of each claim identified in our thematic coding process by evaluating their completeness against the Toulmin framework for scientific arguments (Figure 1). The Toulmin framework (see Toulmin, 2003) breaks down scientific arguments into various critical and optional components—complete and rigorous scientific arguments, according to Toulmin (2003), possess three key components and two optional components. To be complete, arguments must contain a claim (e.g., that food price was affected by the war in Ukraine), grounds (e.g., evidence that some aspect of the war in Ukraine caused a change in food price), and a warrant: assumptions or theories about the mechanism linking the grounds and the claim (e.g., an economic model or theory that shows that a reduction in grain exports from Ukraine would impact global grain prices). In addition to these three components, the rigour of scientific arguments can be increased by providing backing, (i.e., additional evidence) that supports the relevance and accuracy of the warrant, and one or more qualifiers (e.g., caveats or counterarguments).

Figure 1: The Toulmin diagram for scientific arguments, showing the components of scientific arguments, their relation to each other, and their respective contributions to argument completeness (derived from Toulmin, 2003).



With these five components in mind, we developed a typology of argument rigour (Table 1). Using this typology, we reviewed each claim we identified in our thematic coding process to determine which of the Toulmin dimensions applied. We recorded results on a presence or absence basis and tracked our results in an online tracking sheet. Each presence or absence decision for each Toulmin dimension code was assigned by Author two and reviewed by Author one via discussion to ensure accuracy, and instances of disagreement and uncertainty were resolved through discussion and collaborative analysis.

Finally, we also searched each report for three additional components of research practice: i) evidence that reports had been subjected to any level of peer review (internal, external, blind, etc.); ii) an acknowledgement of funding sources; and iii) a declaration of conflicts of interest.

Table 1: Definitions of different kinds of complete and incomplete arguments, adapted from the Toulmin schematic for scientific arguments (i.e., Karbach, 1987; Toulmin, 1958.

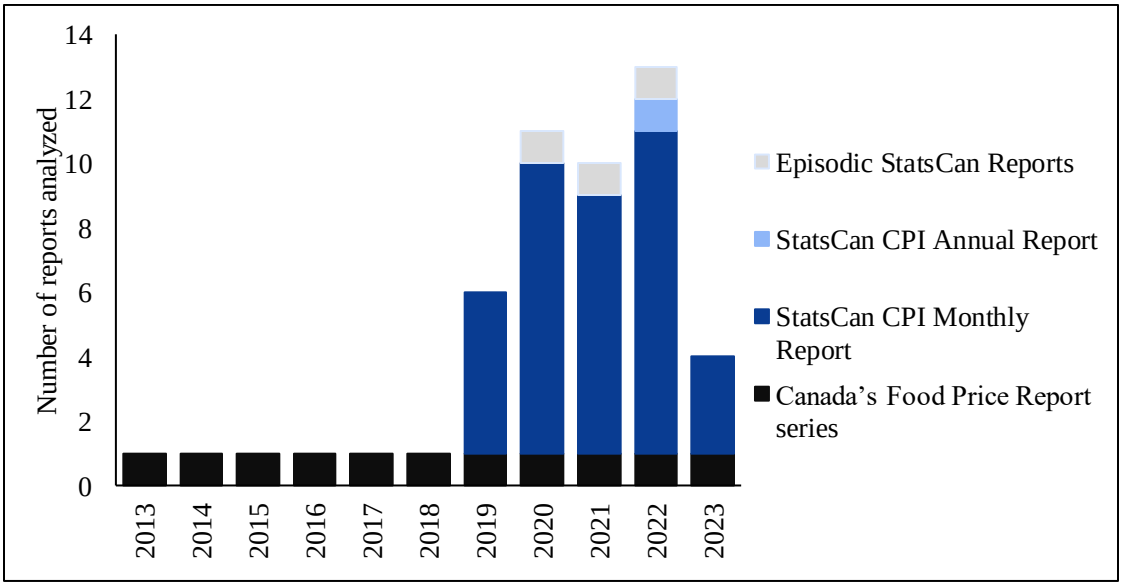
Argument Status	Elements present	Description
Complete and fully qualified	Backing, warrant, grounds, qualifier	Argument presents evidence to support the claim, connects the evidence logically using a warrant, justifies the warrant with backing, and offers possible qualifiers (e.g., caveats, counterpoints) to the argument
Complete but unqualified	Backing, warrant, grounds	Argument presents evidence to support the claim, connects the evidence logically using a warrant, justifies the warrant with backing, but offers no possible qualifiers (e.g., caveats, counterpoints) to the argument
Complete but unjustified	Backing and warrant	Argument presents evidence to support the claim, connects the claim to the evidence using a warrant, but does not justify the validity or relevance of the warrant (i.e., commits a fallacy of unwarranted assumption)
Incomplete (unwarranted)	Backing	Argument presents evidence to support the claim but does not provide a rationale for connecting the evidence to the claim (i.e., commits a fallacy of relevance)
Incomplete (unsupported)	No elements present	Argument is baseless, in that it lacks any presentation of evidence

Results

We identified fifty-one reports as eligible for analysis (Figure 2 and see Supplementary Materials for a full list of the reports we assessed). The majority of the reports we assessed were published by Statistics Canada (thirty-nine), while Canada's Food Price Report series accounts for the remaining reports (twelve). This collection comprises both periodic (monthly, annual) and *ad hoc* publications. As specified in our inclusion criteria, all reports share the defining feature of offering explanations for changes in the price of food in Canada.

The reports are similar in a number of other respects as well; they are generally less than thirty pages long and are often organised at least in part around significant news relevant to the price of food in Canada in their respective reporting periods. The reports do differ somewhat in their overall objectives and scope, however. Statistics Canada CPI reports analyse the price of different "baskets" of goods and services in the economy, and include healthcare, shelter, and clothing in addition to food, whereas the CFPR series focuses specifically on food prices. While the Statistics Canada reports typically identify and explain price changes from previous periods, the CFPRs explain previous price movements and make projections about the price of food in the future in Canada. Additionally, the CFPRs are more varied in their stated methods, and, in some instances, they include consumer surveys. Despite these different styles, methods, and approaches, the reports included here are generally considered authoritative on the issue of food prices in Canada, as they serve as the basis of innumerable news articles on food prices, and some of their authors have provided testimony to Parliamentary committees and frequent commentary in the media (i.e., Alsharif, 2023; Brehaut, 2023; House of Commons, 2023; Lord, 2023; Moore, 2022).

Figure 2: Reports comprising our sample, listed by source and date. We reviewed fifty-one reports in total across the four source types.

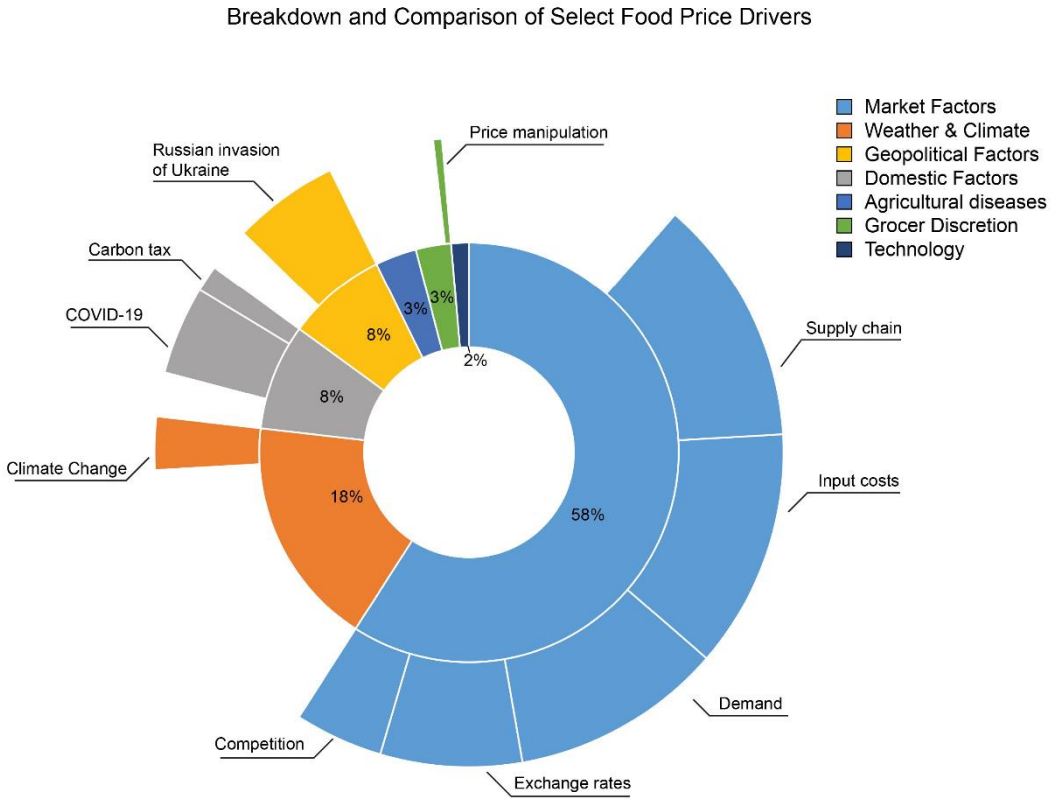


As noted above, we also checked all documents for a declaration of conflicts of interest, an acknowledgement of funding sources, and evidence of peer review. None of the reports contained any mention of or described potential conflicts of interest, disclosed funding, or described an external peer-review process. We discuss the role of these elements of research practise in the context of food price studies in Section 4.4.

What explanations do food price reports provide for changes in the price of food in Canada?

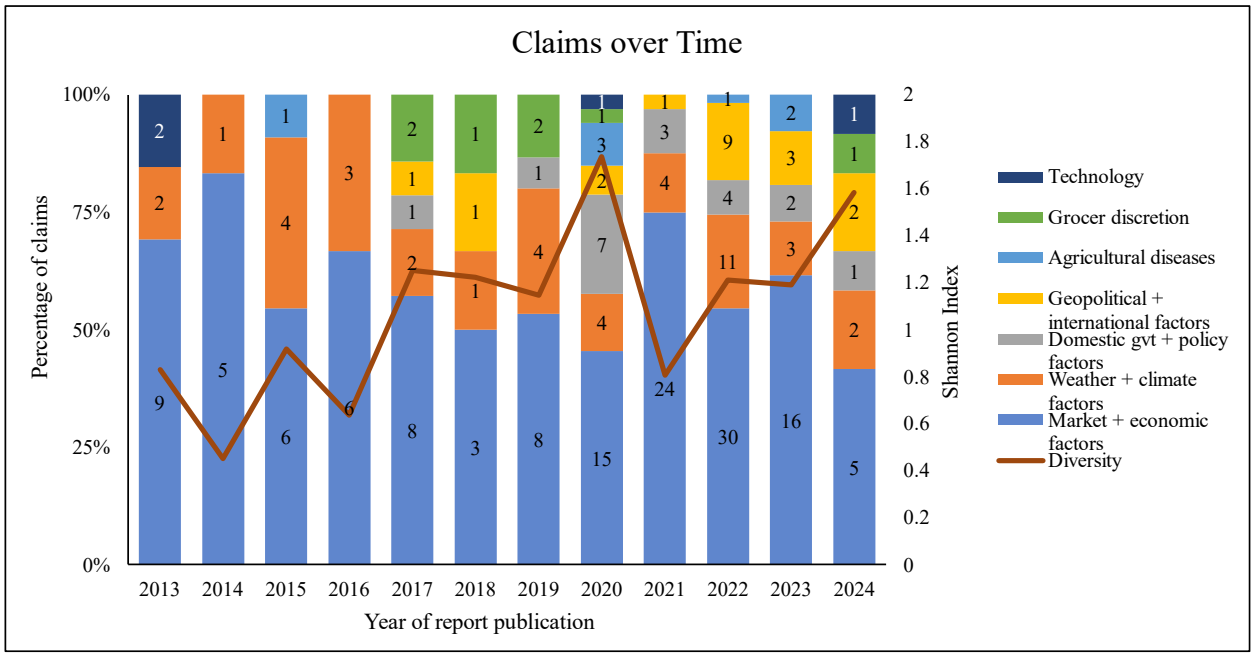
We identified 232 individual claims regarding the drivers of food price changes across the fifty-one reports in our sample. Thematic coding of these claims resulted in seven groups and thirty-two sub-groups of drivers (Figure 3). Market-oriented drivers, such as supply-chain problems, input costs, demand, and exchange rates, are the most discussed drivers across the reports (n=135). Labour costs and shortages occur in this category, but infrequently (n=8). Weather and climate factors are the next most common category of driver (n=41), followed by domestic politics and policy drivers (which includes carbon pricing) (n=19) and international and geopolitical issues drivers (n=19). Rounding out the end of the list were agricultural diseases (n=7), grocer discretion (n=6), and technology (n=4).

Figure 3: The seven categories of food price drivers identified in the reports and the percentage of all claims each category accounts for. Commonly identified sub-categories are presented in the outer ring of the figure. Climate change, the carbon tax, and price manipulation are also presented for comparison. See Supplemental Materials for additional details.



Viewing how claims changed over time (Figure 4), our results suggest an overall increase in the number of claims made to explain changes in the price of food during the study period. This increase is apparent over the entire period but is exaggerated in reports published in 2020, which may be the result of an increased desire to understand the impact of the global COVID-19 pandemic on food prices. For example, prior to 2020, the Statistics Canada Monthly CPI reports did not include price explanations, but Statistics Canada added them in 2020 and continued to include them in subsequent years. Additionally, while market and economic factors account for a large percentage of claims throughout the study period, the range of themes linked to changing food prices started increasing in 2017.

Figure 4: Number of claims identified by theme category and year. Solid line indicates the relative diversity of claims each year as calculated with the Shannon diversity index (Shannon & Weaver, 1949). Dotted line is the smoothed, two-year running trendline.



Are the claims made in food price studies scientifically rigorous?

Of the 232 claims we identified, we found that 164 (71%) were incomplete (unsupported and unwarranted), with 141 (60.7%) of the claims receiving no support and twenty-three (9.9%) receiving only grounds. As per the Toulmin argument definition, only sixty-eight (29.3%) of the claims were made as part of a scientifically "complete" argument (i.e., the claim is linked to at least grounds and a warrant; see Table 1, Table 2, and Figure 5). Canada's Food Price Report Series had the most total claims, and fifty-five (44.4%) of that source's claims could be considered scientifically "complete". This proportion is lower than the Statistics Canada Annual Summary and episodic reports we assessed, though the considerably different number of claims identified between sources is important to factor

into any direct comparisons (see Table 2). Eighty-six (94.5%) of the claims presented in the Statistics Canada CPI monthly reports were incomplete, and only five (5.5%) of that source's ninety-one claims could be considered "complete". We summarise the results of our claim audit (as guided by the Toulmin argument) in Figure 5 and Table 2 below.

Figure 5: Sankey diagram showing, from left to right, the number of claims by report, claim theme, and degree of argument completion.

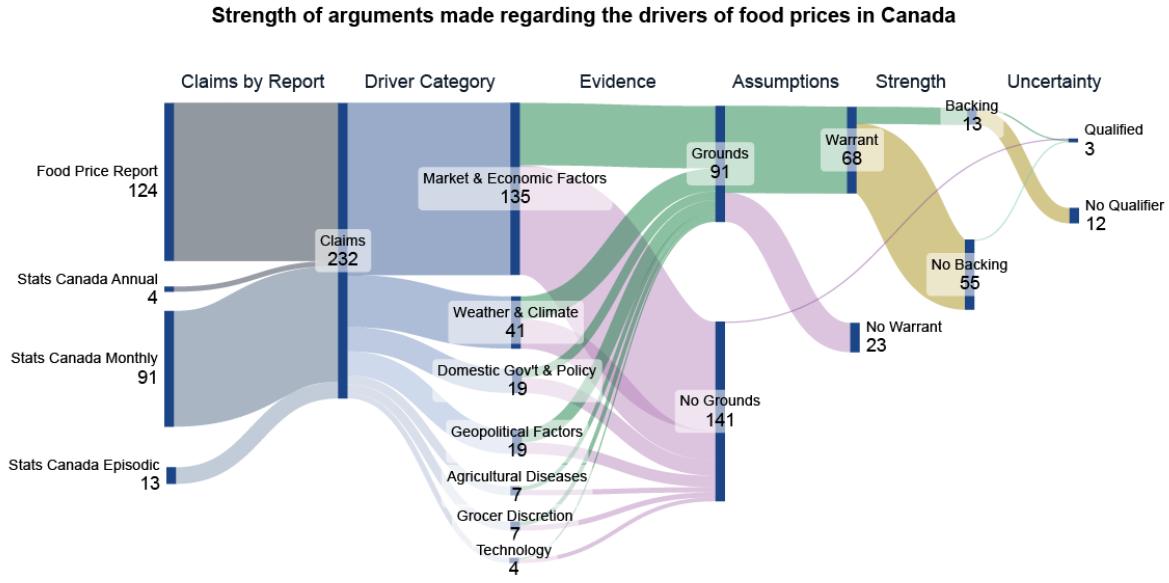


Table 2: Number of reports, claims identified, and "completeness" of arguments by report source.

Publisher	Report type	# of reports assessed	# of claims made	Incomplete arguments		Complete arguments		
				Unsupported arguments	Unwarrented arguments	Complete but unjustified	Complete but unqualified	Complete
Statistics Canada	CPI Monthly reports	35	91	85 (93.4%)	1 (1.1%)	5 (5.5%)	1 (1.1%)	0 (0.0%)
Statistics Canada	CPI Annual Summary reports	1	4	2 (50.0%)	0 (0.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)
Statistics Canada	Various episodic reports	3	13	7 (53.8%)	0 (0.0%)	3 (23.1%)	1 (7.7%)	1 (7.7%)
Agri-Food Analytics Lab	Canada's Food Price Report Series	12	124	47 (37.9%)	22 (17.7%)	45 (36.3%)	10 (8.1%)	0 (0.0%)
Total		51	232	141 (60.8%)	23 (9.9%)	55 (23.7%)	12 (5.2%)	1 (0.4%)

Discussion

On the types of food price drivers and grocery agency

The reports identify a wide diversity of drivers as being potentially implicated in changing food prices, which is likely a function of the interconnectedness of markets, the complexity of supply chains, and the number of stakeholders involved in the food system. Unsurprisingly, market factors (i.e., vagaries of currency strength and exchange rates, changes in demand, supply chain dynamics, etc.) make up the lion's share of the explanations provided (n=135 or 58.1% of all claims identified). There is also an unsurprising emphasis on drivers situated in short-term trends and current events, specifically emergencies impacting global food supply chains such as COVID-19 and the war in Ukraine.

Interestingly, the reports make little reference to the possible role of grocer and supplier agency in food price dynamics. Only seven (or 3%) of the claims we identified position grocers or suppliers as having agency and influence over the price of food (see Figure 5), implying that consumers are essentially entirely subject to the whims of the market, government decisions, and world events. Relatedly, some noteworthy elements of the design of the food system and the role corporate grocers play within that system are unexamined. Corporate imperatives for growth in revenue, profit, profit margins, and fulfilling fiduciary duties to shareholders are the fundamental goals of companies that are publicly traded (as the major Canadian grocers are). We did not find any instances of the relationship between these structural factors and food prices in the reports we assessed.

Other factors related to grocer agency, i.e., the desire for expanded revenue and profits, appear only fleetingly in the context of the price of food. We found one instance of a report attributing price increases to price manipulation—the CFPR for 2019 makes direct reference to the now well-known bread price-fixing scandal that took place over a fourteen-year period. However, in the previous year's CFPR report, the authors had dismissed the possibility that price-fixing had taken place, writing:

> To suggest that food prices are inflated in Canada is somewhat far-fetched, especially the idea, as some believe, that Canadian consumers are paying too much for bread due to price-fixing schemes. The evidence for this claim is simply not apparent. At the centre of this investigation is a much deeper problem that lies in the food supply chain. (Charlebois et al., 2018, p. 18)

While the 2019 and 2020 reports did acknowledge the scandal, they did not acknowledge the 2018 error or the insufficient argument that supply chain dynamics were to blame. Neither have following years' reports exhibited an increased attention to corporate decisions or malpractice as a driver following this revelation. Given the recent revelations about corporate collusion in the US around prices in food and other sectors, further investigation of the role of the private sector in actively driving food price increases is called for.

Presenting an ensemble of possible and alternative established drivers, from taxes to climate change to fossil fuel markets, and comparing their relative explanatory power would go far towards enhancing the rigour of the arguments these reports present. Without such due diligence, the reports are in danger of reifying an ontological framing of food price as something of a *deus ex machina,* wherein grocers are largely absent of any agency or power; the implication, we argue, is that

food prices are inherently capricious and price variability is virtually incurable through policy intervention.

On the roles of weather, climate change, climate policy, and major environmental trends

With respect to environmental factors, the reports often link weather and climate to changes in the price of food. We found forty-one claims (17.6%) that weather (thirty-three) and/or climate change (eight) drove changes in food prices, and all the latter groups appear in the CFPR. We also identified three claims (1.4%) that link climate *policy* to changing food prices, specifically the Government of Canada's carbon pricing system, generally referred to as the "carbon tax". These three claims all appear in a CFPR; the various Statistics Canada reports we assessed did not contain any clear claims of how climate change or the federal carbon pricing system would impact food prices.

Though we identified eleven claims linking climate change to changes in the price of food (eight through environmental impacts and three through policy), most of the climate change discussion in the CFPRs is unaccompanied by specific claims about food price behaviour (e.g., the directionality of price changes). There is widespread sentiment in food systems research that unmitigated climate change will impact food prices in myriad ways, even if the immediate impacts of climate change are experienced elsewhere in the world (Arora, 2019; Bradbear & Friel, 2013; Kotz et al., 2024). The relative lack of attention in these reports to identifying nascent impacts of climate change on food prices represents a missed opportunity for understanding and communicating the impacts of climate change and climate policy on food prices to the media and the public. Understanding and communicating these links are especially important as the relationship between climate change, climate policies such as the carbon tax, and the price of food in Canada has become a major political wedge issue at the federal level (Conservative Party of Canada, 2023; CPAC, 2023; Dawson, 2023).

Other potential environmental factors related to food production and the resilience of the food system are overlooked in the reports. There is significant evidence, for example, that (long-term and accelerating) ecological declines, biodiversity decline, and collapse of pollinator populations, among other similar issues, have implications for food production and thus food costs (Coghlan & Bhagwat, 2022; Reilly et al., 2020). Though "ecological threats" were mentioned twice by the 2020 CFPR, they were not accompanied by a discussion of how they would impact prices. We did not identify any instances of these environmental factors being cited to explain changes in the price of food in the reports we assessed.

On scientific rigour

Readers should know that most arguments made in these reports are, as per the Toulmin framework, incomplete and lacking in rigour. Nearly two-thirds (60.7%) of the claims we identified appear entirely unsupported, in that no grounds (i.e., direct evidence) are presented in support. Just under a third of all arguments (n=68, or 29.3%) pass the minimum threshold for completeness. Yet even reports with technically complete arguments still fail to offer the backing and qualifiers that would be necessary for readers to fully evaluate the arguments being presented. All told, only one claim in the entire sample set (coming from a Statistics Canada episodic report citing unfavourable weather) satisfies all the Toulmin conditions for a complete and rigorous scientific

argument. Given the importance of food prices for human health and food security, these low rates of effective scientific argumentation suggest that these reports should not be considered scientifically rigorous or interpreted as constituting evidence by policymakers, at least in their current form.

Strengthening understanding, transparency, and accountability for food prices in Canada

Our results suggest the current landscape of prominent grey literature contains constrained analytical framings and weak argumentation, limiting our collective ability to understand what is happening in the food system, to what extent and where agency exists, and what can and should be done to ensure that food prices are appropriate and fair. At best, the reports reviewed here can be thought of as an incremental step forward into understanding why food prices in Canada change. They offer an overview, albeit not an entirely comprehensive or well-defended one, of the variety of factors and events which may influence, if not determine, food prices. At worst, the content in the reports and the strength of the claims presented could obfuscate the true mix of drivers causing food prices in Canada to change, with implications for public discourse and public policy.

Other sources with the potential to contribute to high-quality and rigorous explanations for food price changes have also provided evidence that could be considered incomplete. Executive officers for major Canadian grocers, who have been at the centre of the food price issue, have said in testimonies in Parliament that price gouging on groceries is not occurring in their stores, and that the increased grocer profitability that has coincided with increased food prices is the result of strong performance in other departments (namely pharmaceuticals and beauty products; see Competition Bureau Canada, 2023b; Standing Committee on Agriculture and Agri-Food, 2023). However, major grocers do not publish food-specific results in public disclosures. While grocers stated in their testimony that they have provided information to the Competition Bureau to underscore their position that they are not benefitting from increasing food prices, the Bureau has commented on the provision of that information, stating:

> The Bureau is not able to disclose the specific information it was provided, owing to the confidentiality requirements of the Competition Act. However, in general, the Bureau can say that the level of cooperation varied significantly [among grocers], and was not fulsome. In many instances, the Bureau was not able to obtain complete and precise financial data, despite its repeated requests. (Competition Bureau Canada, 2023b, p. 24)

Between the food price reports we assessed and the lack of cooperation from major grocers with Competition Bureau requests, the Canadian public is left with an incomplete understanding of what is happening in the food system and what truly explains price changes. In an effort to contribute towards an improved understanding of food prices (and, ideally, improved policy and public discourse), we briefly sketch theoretical and practical options for reform below.

First, increasing transparency and social literacy regarding the drivers of food prices is critical to achieving a just, food-secure, and sustainable society. There is much recognition in the sustainable food systems literature of the need to better account for the true ecological and societal costs of our food, for example by removing unsustainable subsidies and

unmasking the hidden ecological "externalities" (i.e., degradation) in the production process that currently keep food prices as low as they are (Baker et al., 2020). Internalizing such costs within production, however, would very likely increase the price of food. By promoting transparency, we can make sure that food is priced accurately, reflecting all the social and ecological costs associated with its production. This approach will also allow us to more precisely adjust other social policies, like minimum wages and basic incomes, to match the true cost of living. Without transparency and a sound understanding of food price dynamics, however, it will be impossible to ensure that food price increases are serving these social and ecological goals, rather than benefiting only the accumulation of wealth by the private sector.

Structural and procedural reforms around food price research could also help strengthen the evidence explaining changes in the cost of food in Canada and globally. Government reports and grey literature reports (which constitute our entire sample) are fundamentally different types of publications than research articles published in peer-reviewed journals and are not necessarily subject to the same norms and practices as are articles in (high-quality) academic journals. As we note in Section three, none of the CFPRs we assess describe their review process, include clear statements disclosing their funding sources, or include clear statements disclosing any conflicts of interests which may exist. While this may in large part be in keeping with the norms and practices of grey literature, our results, together with the critical nature of this issue to public health and well-being, lead us to argue that a higher standard is necessary. Reforms could look different for the various publishers, which we explain below.

With respect to the Statistics Canada (i.e., government) reports, a transparent and open peer-review process could strengthen their argumentation. Standards and procedures exist for establishing transparent external peer-review processes for government science issues that closely affect the Canadian public. For example, the Canadian Science Advisory Secretariat (CSAS) was created following the collapse of northern cod in the Northwest Atlantic to enhance peer review within the Department of Fisheries and Oceans (DFO). CSAS is an arms-length body dedicated to co-ordinating peer review of the science produced by DFO scientists. Peer review under this body takes place in meetings where experts external to DFO are invited to review and debate data, methods, and results, as well as the formal advice DFO Science provides based on the findings. The process is transparent, open, and inclusive of different perspectives, following the standards set out in the Government of Canada's Principles and Guidelines for the Effective Use of Science and Technology Advice in Government Decision Making (the SAGE principles, see for example DFO, 2020). It is worth considering if such a system of inclusive, challenge-based peer-review experts may be warranted in the case of food price studies in Canada.

The same sort of open and challenge-based peer-review system that has worked previously in the production of government science may not work well for grey literature reports produced by teams of academics like the CFPRs. But the arguments in the CFPR reports could still be strengthened, perhaps through adherence to an argumentation framework like the Toulmin argument. At a minimum, it would be helpful for the reports to provide evidence for underlying claims, cite appropriate academic reports, and clearly communicate levels of uncertainty. The latter could take inspiration from the standards for communicating uncertainty established by the Intergovernmental Panel on Climate Change

(Mastrandrea et al., 2011). Additionally, clear declarations of funding sources and conflict of interest statements would allow readers to assess the claims being made, weigh their conclusions, and understand their implications more effectively. These statement-oriented research practices would be easy to implement.

We also acknowledge that many readers go to the CFPR for food price forecasting; we think this service will also be improved by adopting a more open and peer-driven process. For years the arctic science community, for example, used an open ensemble approach to forecasting annual sea ice behaviour, a process that not only created more robust forecasts but also advanced sea ice science (Hamilton & Stroeve, 2016). It is worth exploring whether creative solutions for increasing transparency and inclusion such as this could improve food price forecasting and help build our primary knowledge base about why prices change.

Finally, while the options for reform we outline above apply to the current landscape of food price research in Canada, expanding the number of sources and studies could also help strengthen the overall understanding of food price dynamics. The current discourse and media coverage of food prices in Canada rely largely on the two sources we assess here, which is perhaps too concentrated a reliance on a small number of sources. Given the complexity of the global food system and the numerous factors impacting price changes, additional perspectives published in public-facing venues could improve the robustness of food price understanding in Canada, with benefits for public policy and Canadians.

Conclusion

The increasing cost of food has been a central topic of public discourse, public policy, and politics in Canada as well as in multiple other locales. Producing high-quality research and evidence is an imperative for the food research community, given the contribution the food system makes to human health and well-being. It is paramount that such research be able to accurately inform policy and discourse and to understand where agency exists and what can be done, if anything, to ensure fairness in food pricing.

Our assessment of prominent government and academic reports suggests that the explanations provided for changes in the price of food in Canada are analytically limited and scientifically incomplete. It is worth emphasizing that our results do not suggest that the claims made in the various reports we assess are incorrect, but rather that they are presented in a way that is scientifically incomplete and therefore makes critical evaluation of the claims presented in the reports difficult. Incomplete argumentation is a significant issue given the influence the reports likely have on public policy and public debates.

We suggest theoretical and practical reforms for efforts seeking to understand and effectively communicate the multi-faceted drivers of the price of food in Canada and elsewhere. Better attention to what constitutes rigorous arguments about causation, for example following a framework such as Toulmin, would result in a knowledge base that is more complete in terms of the evidence being leveraged, and more transparent about uncertainty, alternative explanations, and conflicts of interest. Drawing on lessons from science production in other sectors, we suggest a "challenge-based" peer-review process and the adoption

of a set of scientific principles seeking to be inclusive, open, transparent, and in line with the SAGE Principles deployed in other areas of government science. Finally, broadening the landscape of public-facing, accessible research into food price dynamics could improve the understanding of food price dynamics and allow for additional contextualization of the existing set of such reports.

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