Prominent Factors that Influenced Canadian Egg Prices in 2024*

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A multivariate linear regression model was applied to egg pricing data from 2024. Key factors such as farming conditions, vendor, and egg color were identified as significant predictors of egg prices over time. These findings can help consumers make more informed decisions while grocery shopping.

Introduction

Groceries in Canada have been one of the consumer goods most affected by inflation. According to the Bank of Canada, key factors driving grocery inflation include, the rising "cost of energy, labor, and transportation" (Bank of Canada 2024). Historical inflation trends in the United States show that certain grocery items, particularly eggs, dairy products, and lettuce, are especially sensitive to price fluctuations. For example, egg prices in the U.S. surged by 60% in 2022 alone (CNBC 2023). A lot of research on grocery inflation has been centered around the United States and this analysis broadens the scope a looks at the Canadian grocery sector, specially egg prices. Given that eggs are a staple purchase for most households, understanding the factors influencing their price is crucial for Canadian consumers to make more economic choices. This analysis used a multivariate regression model to predict egg prices and found that factors such as farming conditions, vendor, and egg color impact sale price significantly. The estimands for this paper are the estimated coefficients of the model that quantify predictor srength. This paper is divided into the following section: data, model, results, discussion, and appendix. The data section will give a brief overview of all variables used in analysis. The appendix gives a broader insight into data collection methodology. All other sections are self explanatory.

*Code available at : https://github.com/redpinecube/grocery

Data

The data used for this analysis was sourced from Jacob Filipp's Project Hammer. This project "aims to drive more competition and reduce collusion in the Canadian grocery sector" (Filipp 2024). The raw data consists of two data sets: one containing detailed product information from the grocery vendors Voila, T&T, Loblaws, No Frills, Metro, Galleria, Walmart, and Save-On-Foods, and the other containing time series data on product prices. This data was filtered and cleaned using R (R Core Team 2021) and the Tidyverse package (Wickham et al. 2019), to examine discrepancies in egg prices over time. A clean data set was constructed with the following variables for analysis: price of an egg, vendor, time, egg color, egg size, product brand, egg type, and whether the product was on sale or not. This section briefly examines variables of interest.

Egg Prices

The average price of an egg in Canada in 2024 was $0.52. The minimum price of an egg was $0.3 while the maximum price was $0.82. The distribution of egg prices can be seen in Figure 1, with two modes at 0.42 and 0.6. The trend of egg prices over time in 2024 can be seen in Figure 2. In 2024, egg prices increased dramatically from February to October but then faced a sharp price decline afterward. According to Sylvain Charlebois, a "professor in food distribution policy at Dalhousie University," grocery prices dropped in fall since the Bank of Canada "cut interest rates by 25 basis points" (The National Post 2024).

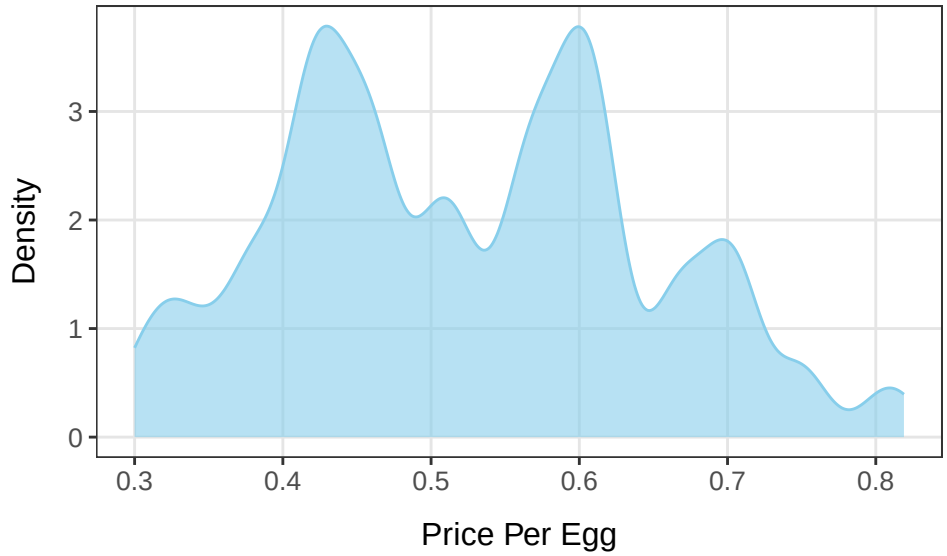

Figure 1: Density of Canadian Egg Prices in 2024

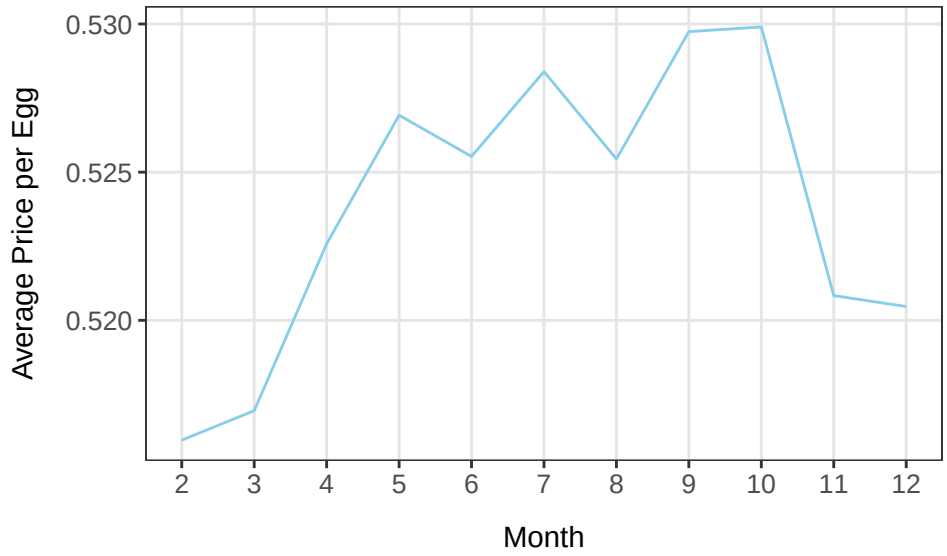

Figure 2: Canadian Egg Prices by Month in 2024

Grocery Vendors & Brands

Three popular grocery vendors were considered in this analysis: Loblaws, Metro, and Voila. As seen in Figure 3, the brands these vendors source their eggs from include Blue Menu, Compliments, Conestoga Eggs, Gold Egg, Gray Ridge, Longo's, and President's Choice. Among the vendors, Metro offers the most expensive eggs, followed by Loblaws, with Voila being the least expensive, as seen in Figure 4. Price per egg at Metro is $0.64 on average, $0.62 for Loblaws, and $0.51 for Voila. From February to April, the price of eggs decreased for Metro and Voila while it increased for Loblaws. During this price hike, Loblaws was accused of price gouging by many consumers, prompting a boycott of the retailer (Appel 2024).

According to Figure 5, Blue Menu and Conestoga Eggs are the priciest brands, while Compliments and Gray Ridge are the more affordable options. Compliments is a store brand launched by the retailer Sobeys in 2005 (Sobeys 2024). Store brands, like Compliments, are often a more economical choice for consumers compared to name brands. For example, in the United States, "consumers save more than $40 billion a year on grocery and household purchases by opting for the store brand over the national brand version of their favorite products" (Private Label Manufacturers Association 2024).

Egg Color, Size, and Type

Chicken eggs sold at Metro, Loblaws, and Voila, come in two colors and three sizes. Eggs are either white or brown and they are labeled medium, large, or extra large. As seen in Figure 6, medium sized eggs are the most expensive, followed by extra large eggs, with large

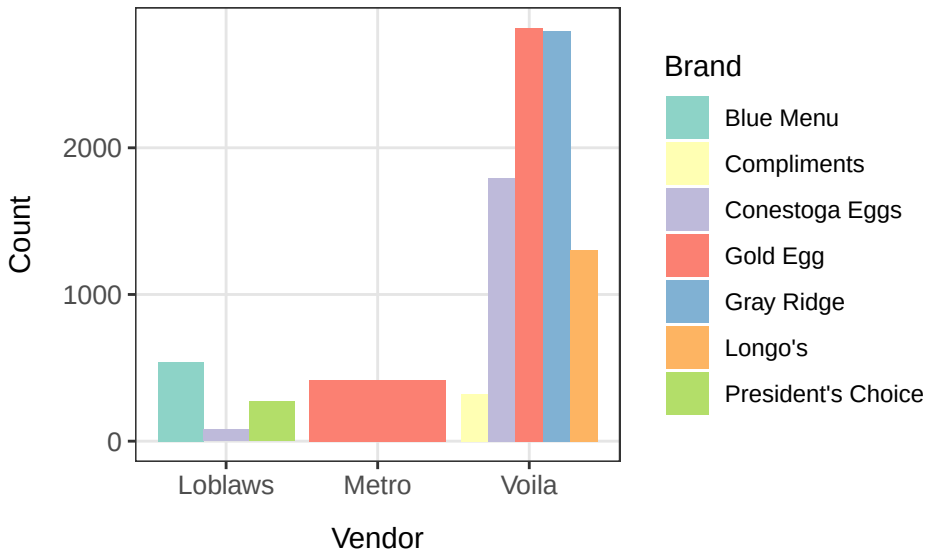

Figure 3: Frequency Distribution of Price Changes by Brand

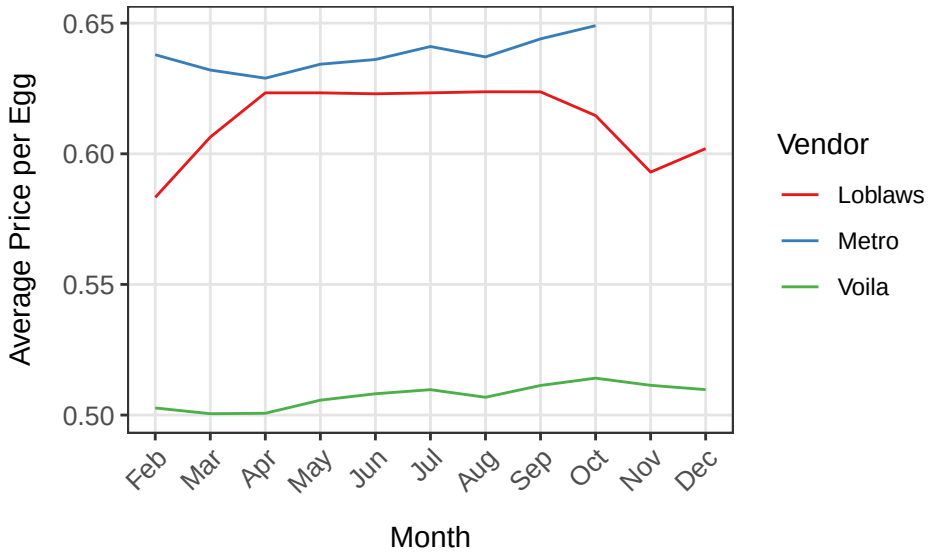

Figure 4: Average 2024 Egg Prices by Canadian Vendors over Time

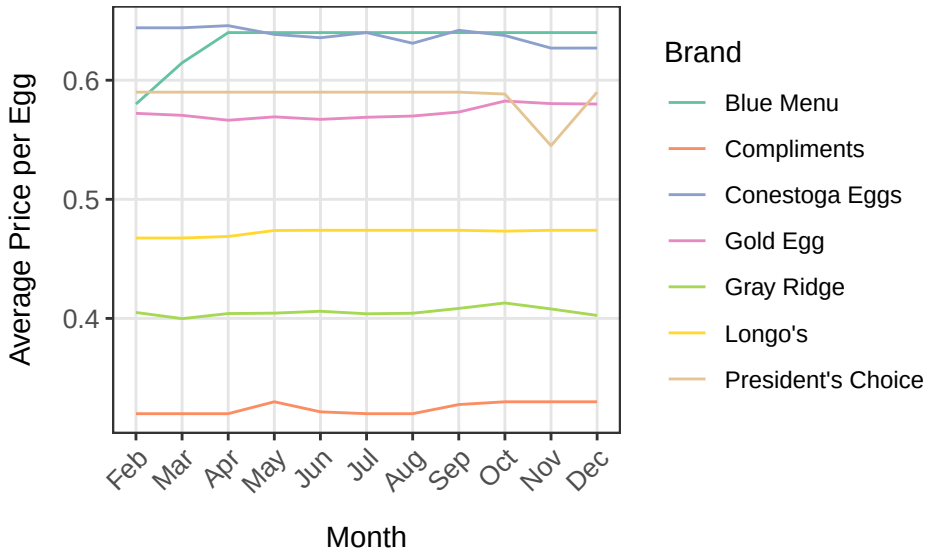

Figure 5: Average 2024 Egg Prices by Canadian Brands over Time

eggs being the cheapest. Figure 7 shows that egg color is a strong indicator of price. Brown eggs on average cost around $0.57, while white eggs cost on average $0.44. Brown eggs com from larger breeds of chickens that require "more food, which makes the eggs more expensive for farmers to produce" (Consumer Reports 2024).

Eggs are also divided by the conditions their hens are raised in. Some common ways hens can be raised is organic, free range, free run, and none of the above. Looking at Figure 8 tells us that organic eggs have an average sell price greater than $0.70 per egg which is around $0.20 higher than the average price of an egg. Eggs that are not raised in farms with special conditions are the cheapest with an average price point of $0.40. Free range and free run eggs have similar price points around $0.60 with free range being $0.02 higher in price per egg.

Sale

In 2024, the price of discounted eggs was up to $0.23 cheaper than the average cost of non sale eggs which was around $0.53. The largest discount price occurred in July, followed by minor peaks in discounts in October and December, as seen in Figure 9.

Measurement

Variables such as egg size are challenging to measure accurately, as many brands rely on subjective labels like "large," "medium," or "extra large." On the other hand, some variables in this analysis, such as egg price, are easier to measure and more reliable, as prices are

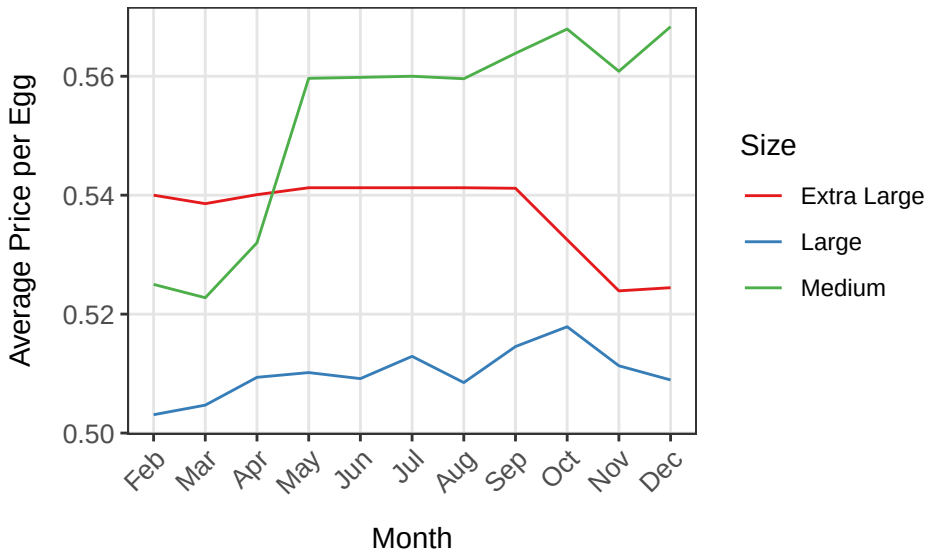

Figure 6: Average 2024 Egg Prices by Egg Size over Time

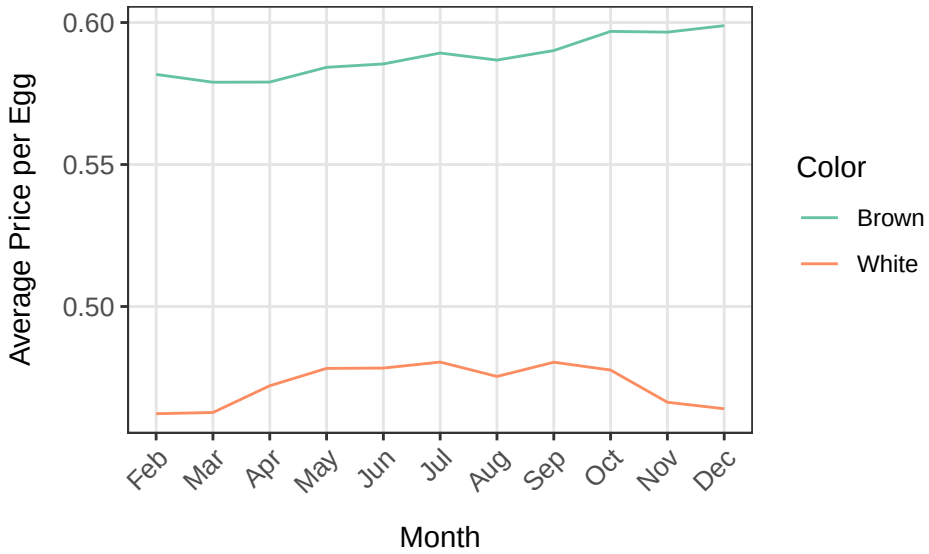

Figure 7: Average 2024 Egg Prices by Egg Color over Time

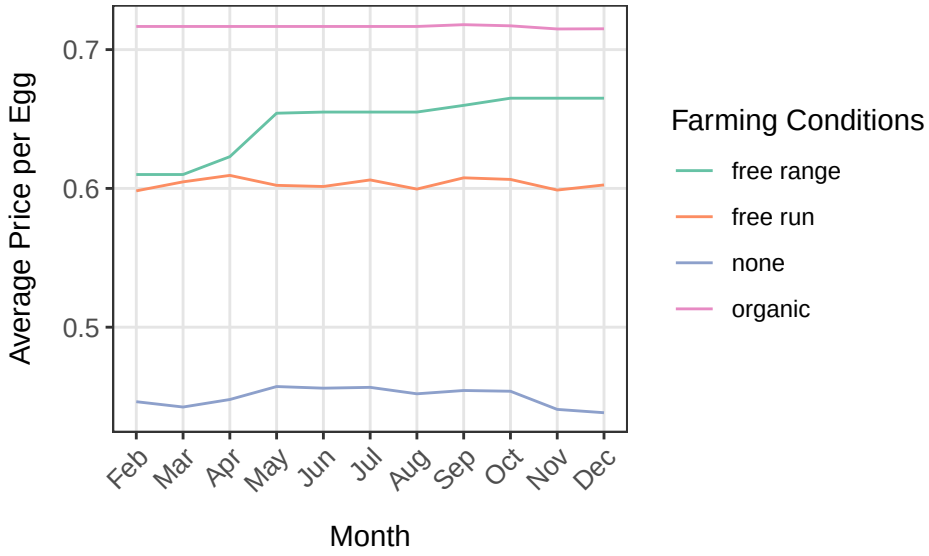

Figure 8: Average 2024 Egg Prices by Farming Conditions

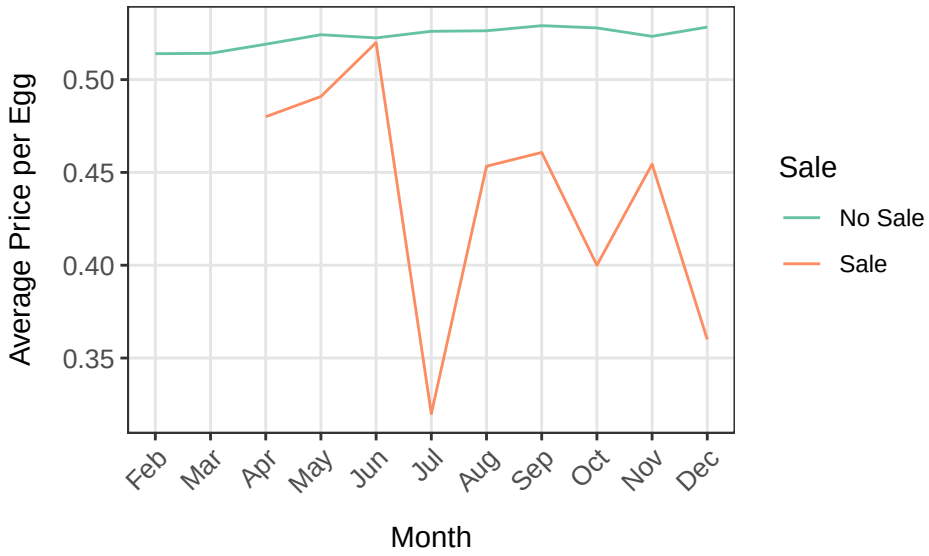

Figure 9: Average 2024 Egg Prices by Discount Type over Time

typically set by the retailer. However, it's important to note that gathering a comprehensive measurement of prices across all vendors and brands is difficult, particularly due to the large number of small businesses across Canada that this dataset may not fully capture.

Similarly, assessing farming conditions is inherently subjective. Farmers within each category often follow different standards, making it difficult to measure farming conditions consistently.

Model

A multivariate linear regression model was built to predict egg prices. The predictors chosen for the model were: sale, organic, brown, voila and month. All variables except for month are indicator variables. Month is an integer that represents the months past the first day of 2024. This model can be represented using the following equation :

$$\text{price} = \beta_0 + \beta_1 \cdot \text{sale} + \beta_2 \cdot \text{voila} + \beta_3 \cdot \text{brown} + \beta_4 \cdot \text{large} + \beta_5 \cdot \text{organic} \tag{1}$$

Where :

β_0 is the intercept.

$\beta_1, \beta_2, \cdots, \beta_5$ are the coefficients for the independent variables defined.

ϵ is the error term that accounts for uncertainty.

This model assumes that the predictor variables are independent of each other. It also assumes linear relationships between the predictors and egg pricing. The potential limitation of this model is that it's susceptible to outliers. Extreme values could significantly alter results. The variables included in the model were selected based on their strong linear relationships with egg prices as identified in the data section. Indicator variables were used to numerically represent categorical features, making them suitable for multivariate linear regression.

While time series models are considered due to the temporal nature of the data, the limited historical data available led to the decision to prioritize this linear regression model. Additionally, this analysis uses the abundance of product-related information to focus on exploring the effects that brands and vendors have on egg pricing, making this analysis a good use case for multivariate linear regression. R (R Core Team 2021) was used to create and validate this model using RMSE.

Results

The following estimator $\hat{p}$ for price was constructed using prepossessed data :

$$\hat{p} = 0.60 - 0.05 \cdot \text{sale} - 0.12 \cdot \text{voila} + 0.06 \cdot \text{brown} + -0.02 \cdot \text{large} + 0.18 \cdot \text{organic} \quad (2)$$

term	estimate	std.error	statistic	p.value
(Intercept)	0.60	0.00	184.21	0
sale	-0.05	0.01	-8.39	0
voila	-0.12	0.00	-41.61	0
brown	0.06	0.00	31.90	0
large	-0.02	0.00	-8.27	0
organic	0.18	0.00	49.27	0

Figure 10: Model Summary

This estimator has a RMSE score of 0.08. RMSE was calculated by splitting data into randomized training and testing sets with an 80 20 split. Additional model information can be seen in Figure 10.

Discussion

This paper examines the key factors influencing egg prices in Canada, with a particular focus on the role of vendor identity. The analysis reveals that while traditional factors—such as egg size, color, and farming method—do have some impact on pricing, vendor selection emerges as the second strongest determinant. These findings suggest that egg prices are more heavily influenced by market dynamics tied to specific vendors than by broader supply-side factors, such as production methods or egg characteristics. This challenges the assumption that the egg market is homogeneous and highlights the significant role vendor-specific practices play in price variation.

The substantial price discrepancies observed across different vendors point to the possible presence of monopolistic behavior within the egg market. In an oligopoly, a small number of firms exert significant market power, enabling them to influence prices independently of other factors. This could explain the significant fluctuations in egg prices observed between vendors, even when other variables, such as egg size or farming method, remain constant. The concentration of market power among a few dominant vendors could limit competition, allowing them to adjust prices in ways that benefit them, potentially at the expense of consumers.

Overall, this study underscores the importance of considering vendor influence when analyzing egg prices. It challenges the conventional view that factors such as farming practices and

egg characteristics are the primary drivers of price. The findings suggest that a deeper understanding of vendor behavior and market concentration is essential for policymakers and consumers alike. Future research should explore these dynamics further, particularly by examining regional market structures, vendor-specific pricing strategies, and potential regulatory interventions aimed at improving market transparency and competition.

Limitations

While the use of a multivariate linear regression model provides valuable insights, several limitations must be acknowledged.

First, the assumption of linearity between the independent variables (e.g., vendor, egg size, farming method) and the dependent variable (egg price) may not fully capture the true relationships. If these relationships are non-linear, the model could provide biased estimates. Additionally, multicolinearity—where variables such as vendor type and farming method are highly correlated—could distort the coefficient estimates, making it difficult to isolate the independent effects of each factor on price.

Another potential limitation is omitted variable bias. The model may not have accounted for important factors such as regional price differences, transportation costs, or seasonal fluctuations in supply and demand, all of which could influence egg prices. Furthermore, the assumption of homoscedasticity (constant variance of errors) may not hold, especially if egg prices exhibit greater variability across different vendors or regions, which could affect the precision of the regression results.

The use of 2024 data raises another concern: temporal factors such as shifts in consumer behavior or changes in government policy might not be fully captured in the analysis. Price dynamics could vary over time, and failure to incorporate these temporal variations may limit the generalizability of the findings.

Lastly, while the analysis identifies vendor as a significant determinant of egg prices, the model may not have fully captured the complexity of vendor-specific pricing strategies or regional market dynamics, which could vary beyond the variables included in the regression.

Future Research Directions

While this paper provides valuable insights into the role of vendor identity in shaping egg prices, several avenues for future research remain. One key area for exploration is the causal mechanisms behind the strong influence of vendors on pricing. The reasons for this market behavior—such as vendor pricing strategies, brand loyalty, or regional market power—remain unclear. Future studies could investigate the specific practices that vendors use to set prices and explore how these practices might differ based on market segment, location, or competition levels.

Another promising direction for future research is to explore the impact of market concentration. This study suggests that the Canadian egg market may exhibit oligopolistic characteristics, but it does not fully explore how market concentration influences pricing in a dynamic way. Analyzing the relationship between market share, competition, and pricing could offer deeper insights into whether fewer vendors in the market lead to higher or more stable prices, and how this might affect consumers. Comparative studies across other food sectors or countries with different market structures could provide valuable lessons.

Additionally, external factors—such as regulatory policies, consumer behavior, or seasonal supply and demand fluctuations—were not fully incorporated into this analysis. While vendor-specific variables were found to be dominant, it would be important to explore how broader factors like government policies on food pricing or subsidies might affect vendor pricing power. Investigating these external influences could provide a more comprehensive understanding of egg price dynamics.

Finally, this study focused on a specific set of variables and used a multivariate linear regression model. Future work could apply alternative modeling techniques, such as machine learning or non-linear models, to capture more complex relationships between pricing and the independent variables. Expanding the dataset to include a larger sample size, longer time periods, or more granular geographic data could also strengthen the robustness and generalization of the results.

Smarter Consumer Behavior

While addressing the structural issues of Canada's grocery market—such as its monopolistic tendencies—remains a challenging task, there are practical steps consumers can take to reduce their grocery bills in the short term. One effective strategy is to purchase store brands, like No Name, which tend to offer more affordable alternatives without compromising quality. In addition, consumers can incorporate more plant-based meals into their diets, as plant-based foods like beans, lentils, and grains are often more affordable than animal products. Another cost-saving approach is to buy in bulk, particularly for non-perishable items such as rice, beans, and pasta, which can reduce costs over time. Meal planning is also a valuable strategy, helping consumers buy only what they need, reduce food waste, and avoid impulse purchases—ultimately contributing to lower grocery costs (Hughes 2024).

However, it is important to acknowledge the limitations of this analysis. The data used in this study primarily reflects prices from major grocery chains, which excludes smaller, local farmers and independent food producers who may offer more competitive prices. Local food sources, such as farmers' markets or community-supported agriculture (CSA) programs, might provide more affordable and fresher alternatives, though these are not represented in the data set. Moreover, the analysis does not account for food substitutions that consumers may make when prices rise. For instance, when the price of eggs or meat increases, shoppers may turn to cheaper alternatives, such as plant-based proteins or canned goods. These substitution effects

are important to understanding broader consumer behavior but were not considered in this study.

Additionally, the relationship between egg size and price is another important consideration. While larger eggs are often more expensive, the analysis reveals some inconsistencies in this pattern, which could be attributed to differences in egg quality (e.g., free-range vs. conventional eggs). Egg quality was not factored into the analysis, and thus we cannot conclusively state that larger eggs are always more expensive simply due to size—quality and other factors likely play a role.

Appendix

The data collection for this study was based on screen scraping of the website user interfaces (UIs) of eight well-known vendors in Canada, as outlined by Project Hammer (Filipp 2024). The screen scraping technique involved programmatically extracting price information for eggs and related product variables from the vendors' online storefronts. This data was specifically gathered through the "in-store pickup" option, as this method typically provides accurate pricing and product availability, reflecting actual prices that consumers would pay when purchasing eggs for pickup rather than delivery. This method is often chosen because it minimizes discrepancies that can arise due to delivery fees or location-specific pricing.While this approach provided valuable data, there are limitations to screen scraping, particularly in the context of price accuracy and completeness. Websites often display product information in a way that is optimized for visual presentation rather than data extraction, which can result in incomplete or inconsistent data. Furthermore, vendor websites are frequently updated, and changes to UI elements or the underlying structure of web pages could lead to the loss of important data or inaccurate price representations.A more robust and comprehensive method of data collection would be the use of internal APIs provided by grocery retailers, which are often more structured and reliable than publicly accessible websites. APIs allow direct access to the retailer's product catalog, offering a more complete and accurate set of product options, prices, and related data, often including various filters and variables not visible on the website UI. In contrast to screen scraping, APIs are typically designed to deliver raw, structured data that can be easily queried, making it a more consistent and efficient data source. For instance, APIs would list not only the eggs available for in-store pickup, but also the full range of products that could be purchased, including promotions, bulk discounts, and regional variations that might not be represented on the website's UI.Using internal APIs would also mitigate the risk of data loss due to website redesigns or technical issues. A study by Choudhury et al. (2017) on API-based data collection in e-commerce found that using APIs led to more accurate price tracking and more complete product information compared to web scraping, as APIs provide direct access to a vendor's backend systems (Choudhury, O'Leary, and Kurnia 2017). Moreover, internal APIs often provide real-time data updates, which is particularly important when tracking fluctuating commodity prices like eggs.However, while using APIs

presents numerous advantages, it is important to note that this method requires explicit access permissions from the vendors themselves. Retailers may impose limitations on API access, or charge for this data, which could increase the complexity and cost of the data collection process. Additionally, not all grocers may offer open or public APIs, limiting the scope of this method.In summary, while screen scraping of website UIs provided a useful data source for this study, using internal APIs would offer a more robust and scalable approach to data collection, providing more accurate, complete, and timely data for price analysis. Further research in this area could explore how API access could be standardized across the grocery industry to support more comprehensive price tracking and market analysis.

Appel, Jeremy. 2024. "Loblaw's Great Canadian Grocery Gouge." https://jacobin.com/2024/05/loblaw-grocery-price-gouge-boycott.

Bank of Canada. 2024. "What Drives up the Price of Groceries." https://www.bankofcanada.ca/2024/07/what-drives-up-the-price-of-groceries/.

Choudhury, A., D. O'Leary, and S. Kurnia. 2017. "E-Commerce Pricing and Web Scraping: From a Vendor Perspective." *International Journal of E-Commerce and Business* 16 (4): 18–31.

CNBC. 2023. "School Lunch, Eggs and Airfare: Why Inflation Soared for 10 Items in 2022." https://www.cnbc.com/2023/01/13/why-inflation-hit-these-10-items-hardest-in-2022.html.

Consumer Reports. 2024. "Why Are Brown Eggs More Expensive Than White Ones?" 2024. https://www.consumerreports.org/health/food-shopping/why-are-brown-eggs-more-expensive-than-white-ones-a1141700310/.

Filipp, Jacob. 2024. "Project Hammer." https://jacobfilipp.com/hammer/.

Hughes, Tegwyn. 2024. "5 Canadians Share the Smart Ways They're Cutting Grocery Costs." https://chatelaine.com/food/save-money-on-food/.

Private Label Manufacturers Association. 2024. "Store Brand Facts." 2024. https://plma.com/about_industry/store_brand_facts.

R Core Team. 2021. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Sobeys. 2024. "Our Brands." 2024. https://corporate.sobeys.com/our-brands.

The National Post. 2024. "These Grocery Items Are Expected to Be Cheaper This Fall in Canada." https://nationalpost.com/news/canada/these-grocery-items-are-expected-to-be-cheaper-this-fall.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.