

# Predicting the Future of Canada and China Trade: Insights from Historical Import and Export Data

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**Abstract:** *This report analyzes Canada-China trade relations over the past decade, focusing on key trends, challenges, and opportunities for future growth. The study examines trade data from 2013 to 2023, exploring how geopolitical events like the U.S.-China trade war and the COVID-19 pandemic have impacted import-export dynamics. Through the application of ARIMA models, we forecast future trade trends and assess the implications for policy and investment decisions. Our findings highlight Canada's reliance on China for manufactured goods and China's demand for Canadian natural resources, identifying potential risks related to trade imbalances and supply chain disruptions. The report offers strategic insights to optimize trade policies and foster long-term economic cooperation between the two nations.*

**Keywords:** *Canada-China trade, import-export dynamics, ARIMA model, geopolitical impact, trade imbalances, natural resources, manufacturing, supply chain, economic cooperation, trade policy*

## Introduction

Since establishing diplomatic relations in 1970 and signing the "Trade Agreement" in 1973, China and Canada have developed robust economic ties. China remains Canada's second-largest trading partner, source of imports, and export destination. This project examines the trade values and categories between Canada and China over the past decade, analyzing the evolution of their trade relationship and identifying factors that could influence future trade dynamics.

The analysis provides insights into how significant geopolitical events, such as the U.S.-China trade war and the detention of Huawei's CFO, Meng Wanzhou, have episodically influenced these economic interactions. The Huawei incident, in particular, stands out as a pivotal moment that brought issues of international law, corporate governance, and bilateral trust to the forefront, impacting trade discussions and policies between Canada and China. These events have served as catalysts for shifts in trade policies and have had direct and indirect effects on various trade categories.

This research seeks to uncover the key factors that have shaped the trade relationship by examining import and export dynamics over the past decade. By focusing on specific categories affected by these historical events, the study highlights growth opportunities and supports macroeconomic regulation. It underscores China's expanding role in international markets and offers strategic insights that can help both nations optimize their trade agreements and policies to foster continued economic growth and cooperation, and also give some suggestions to the investors.

This study is crucial for shaping data-driven policies and enhancing economic cooperation between Canada and China. It provides a comprehensive view of how historical events have interplayed with economic factors to influence trade patterns, offering a forward-looking perspective on potential challenges and areas for growth in the evolving global economic landscape.

## Preliminary Literature Review

Over the past decade, China-Canada engagement has become increasingly complex and multifaceted, and its related research has become broader and more diverse.

First, most studies of Canada-China trade are closely related to the changing cooperative relationship between the two countries. Before a decade, Fen and Latif used data from the United Nations Trade Statistics Database (UNTSD) to analyze the main trends and changes in bilateral trade between China and Canada and to explore issues such as trade intensity, intra-industry trade, and comparative advantage between the two countries (2014), with the results of the volume of exports and imports between China and Canada has grown significantly over the past few years.

Secondly, in the 2018 report, Landriault and Minar paid close attention to the negotiation of a free trade agreement between the two governments, which in turn led to a discussion of the cross-border investment sector in the energy market and related public opinion (2018); this

coincides with another paper in 2022 that looks at the impact of the signing of a China-Canada free trade agreement on bilateral trade, with attention paid to both the energy sector and the agricultural industry (Thompson and Toledo, 2022). As a further example, in March 2019, China restricted import licenses for Canadian canola, which has also generated much discussion and research. Two papers in 2019 and 2020 respectively examined the impact of the change on the change in exports on the international market (Cardwell and Brewin, 2019) as well as on the price of canola in the Canadian market (Wells and Slade, 2020), with an international trade economic model to visualize the change.

Besides, some other researchers chose to study the agri-food trade relationship between the two stocks at the firm level using relevant international trade data and validated the 'new-new' trade theory through an example strategy. (Xie et al., 2018) It also used mainly quantitative research methods by analyzing official trade data and economic indicators, developing an econometric modeling framework to understand the growth of China's import trade estimating and predicting the channels through which this growth occurs, and finally comparing Canadian export suppliers and their competitors, it finally confirms that Canada's agri-food and food-processing sectors are more likely to be traded directly in China, while giving an estimated cycle of co-operation turnover rates.

Meanwhile, a few studies review and summarize Canada-China trade in a yearly range. For example, a series of Canada-China trade reviews from 2019 to 2023 cover total imports and exports (Alton et al., 2019-2023), major commodity groups, and bilateral trade relations, with detailed and explicit data analysis and official data visualization charts to provide readers with detailed and descriptive trade data. However, in the future outlook section, the authors mainly take into account the political impact of the tense diplomatic relations between the two countries and the economic downturn, but without specific supporting data for their prediction.

In summary, we intend to learn from their past research experience and improve it. In terms of the analyzed object, we will use broader data in the range of ten years; As for the research methodology, we will visualize official data using line graphs, pie charts, and bar charts, and then use curve-fitting to predict future changes in trends; About the target audience, unlike other studies, which target politicians and professionals in specific business fields, we prefer to present past, present, and future developments in Canada-China trade relations in a concise and easy-to-understand manner to the above readers, as well as to investors, to give them sound advice and reference directions.

## **Dataset and Data Cleaning**

In our project, we have three data sets. There is no missing data in our data set. At the same time, our data sets are all selected with the latest data.

The first data set is Canadian import and export data from January 2013 to July 2024 which is collected monthly from the website (2024) Statistics Canada. We collect 139 months of import and export data in units of 1,000,000 dollars. Each month statistics three trade data: the value of imports, exports, and the trade balance which is Canada's exports minus imports. These three data are numerical. In each trade data, there are two categories, one is Canada's total import and

export data, and the other is the import and export data with China. Therefore, the data is in 6 rows and 139 columns.

The second data set is Canada's imports from China in 2023 which is collected by import product category from the website (2024) Trading Economics. There are 97 product categories. The data are listed from highest to lowest import value. The import data values are string types because every data value is a combination of number and unit. The units of import value are billion dollars, million dollars, and thousand dollars. Therefore, the data is in 97 rows and 1 column.

The third data set is Canada's exports from China in 2023 which are collected by import product category from the website (2024) Trading Economics. There are 93 product categories. The export data values are string types with a combination of numbers and units from highest to lowest export value which is similar to the second data set. The units of import value are billion dollars, million dollars, thousand dollars, and per dollar. Therefore, the data is in 93 rows and 1 column.

During the process of handling the dataset, we first organized the data by categorizing it into relevant groups and aggregating total values, ensuring the dataset was structured by year and month to guarantee comprehensive and systematic collection from the source website. Subsequently, we conducted Exploratory Data Analysis (EDA) by visualizing key trends, distributions, and relationships within the dataset using charts, graphs, and summary statistics. In the data cleaning phase, we addressed missing data primarily by dropping problematic rows or columns; moreover, we corrected inconsistencies in the data, such as standardizing date formats, and units of measurement, and fixing inconsistent categorizations or labeling. This entire process ensures accuracy and efficacy in the data analysis.

## **Guiding Question**

### **1. What happened?**

- What were the historical trends in Canada-China import and export trade?
- How has the trade relationship evolved over the past few years? What major changes occurred?

### **2. What's happening now?**

- What is the current state of Canada-China import and export trade?
- What are the rankings and proportions of key commodities traded between the two countries?
- What are the most traded commodities by type, volume, and value?
- Are there any interesting or unexpected findings in the current trade dynamics?
- How have external factors (e.g., political relations, global economic shifts) impacted past trade recently?

### **3. What will happen?**

- What are the potential future trends for Canada-China import and export trade?
- Which commodities show the highest growth potential in future trade between the two countries?
- How might policy changes or international developments influence future trade patterns?

This research also focuses on analyzing future trends in Canada-China import and export trade, exploring which commodities show the highest growth potential, and how policy changes or global developments might influence trade patterns. Understanding the future trajectory of trade between these two nations is crucial as China remains Canada's second-largest trading partner. Analyzing these trends will help forecast shifts in trade dynamics and inform business and policy decisions.

Identifying key commodities with the highest growth potential will guide investment and resource allocation. This is important for both countries as they seek to optimize trade opportunities and ensure continued economic cooperation. By focusing on which sectors are poised for growth, this research will offer valuable insights into areas that could drive future trade.

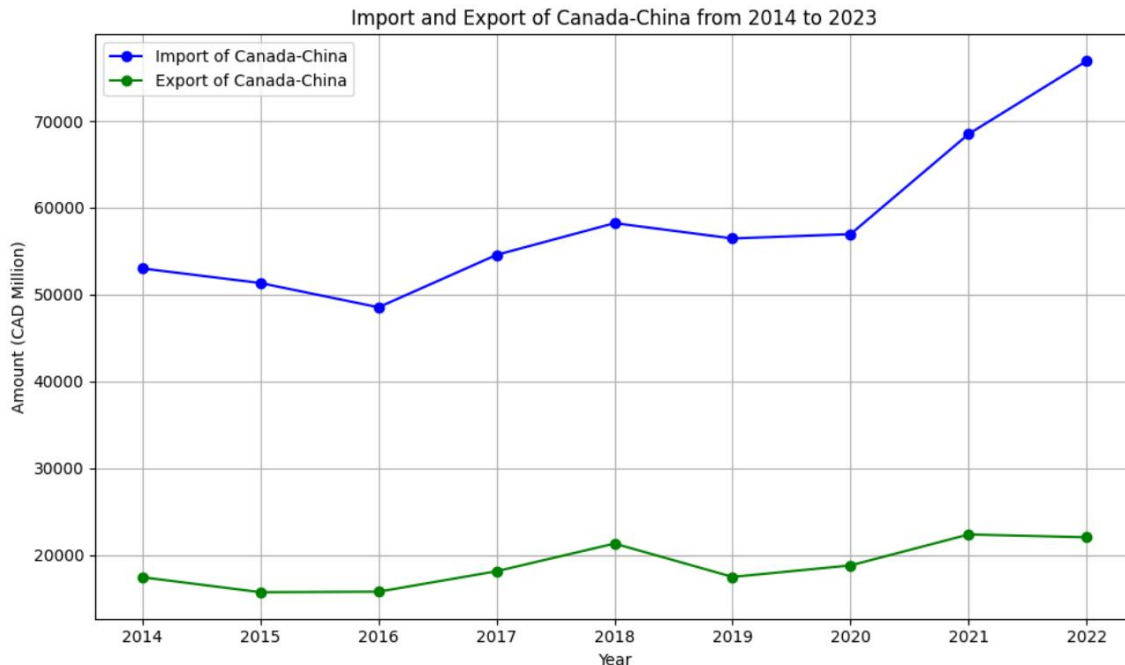
Moreover, the impact of international policy changes and global developments, such as trade agreements, geopolitical shifts, or global economic challenges on trade patterns will be examined. Understanding these external factors will help both countries anticipate risks and capitalize on opportunities in a changing global economy. This analysis will provide a strategic foundation for navigating the evolving trade landscape and enhancing bilateral economic ties.

## **Visualization & Analysis**

### **1. Overall Review**

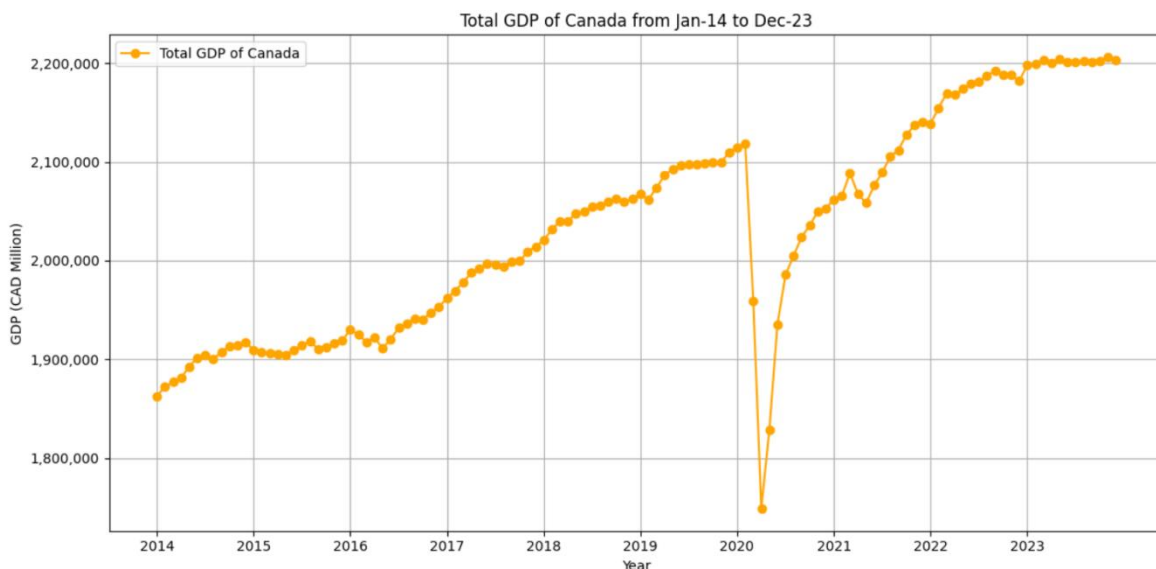
Canada-China trade has experienced several distinct phases over the past decade. From 2014 to 2019, both imports and exports between Canada and China showed steady growth, although Canada consistently faced a trade deficit, with imports from China growing faster than exports. In 2020, there was a significant decline in both imports and exports, mainly due to the impacts of the COVID-19 pandemic. From 2021 onwards, trade volumes began to recover as the global economy improved.

In terms of major changes in Canada-China trade relations over the past decade, significant fluctuations occurred between 2019 and 2021 due to the US-China trade war and COVID-19. Trade volumes dropped sharply in 2020 but started to recover in 2021 as economies reopened. Despite the recovery, ongoing challenges such as supply chain disruptions and inflation continue to affect trade dynamics.

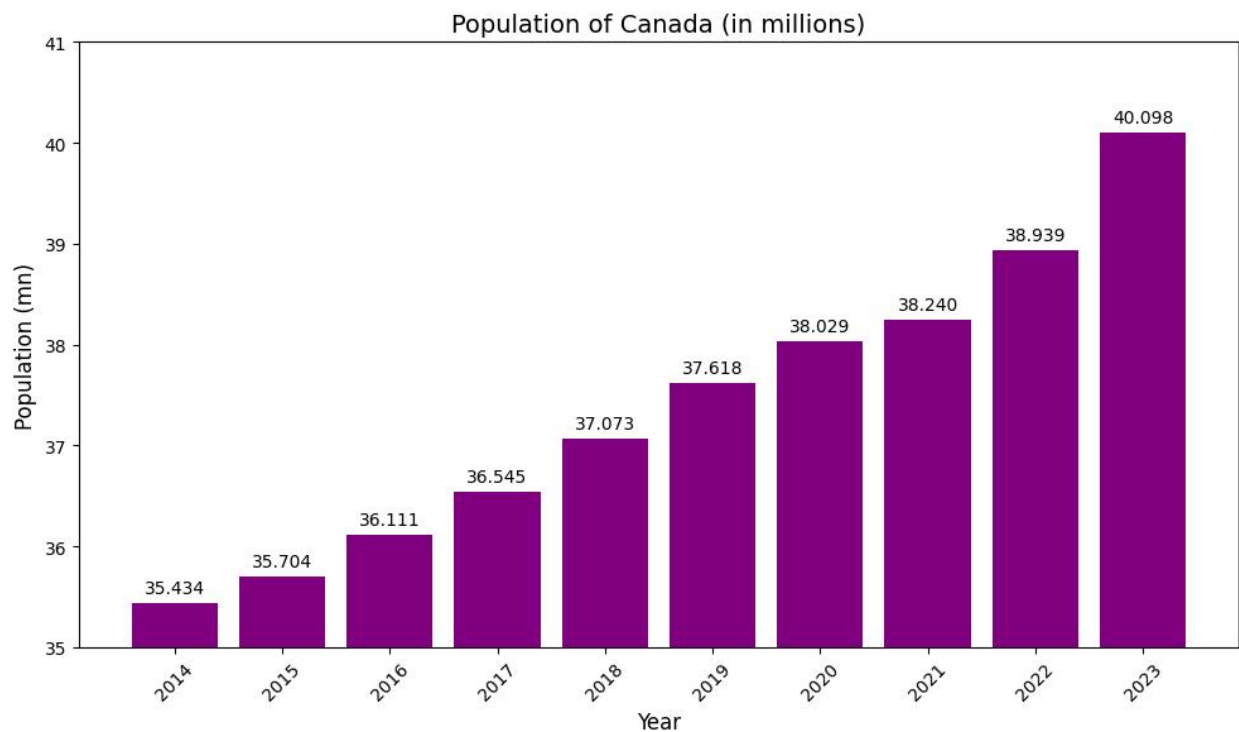


The relationship between Canada's GDP and its trade with China shows a positive correlation. When GDP increases, both imports from and exports to China generally rise. In 2020, there was a significant decline in GDP and trade volumes due to the COVID-19 pandemic. However, post-pandemic recovery began in 2021, leading to a rebound in GDP, with both imports and exports also increasing, though exports recovered at a faster rate.

At times, there has been divergence, such as when rising import costs due to inflation have caused imports to increase even if GDP growth has slowed. This highlights the complexity of factors influencing Canada's trade dynamics with China.



We have analyzed the changes in Canada's population over the past decade as below:



Combining this with the changes in GDP and trade data during the same period, we found that:

From 2020 to 2021, Canada's GDP experienced a significant decline, likely due to the global pandemic. However, during the same period, Canada's population continued to grow steadily. Despite the GDP decline, there is no clear evidence that population growth had a direct mitigating effect on the economic downturn. This suggests that while population growth, driven by natural factors or immigration policies, continued, it did not necessarily correlate with immediate improvements in GDP. The phenomenon highlights that population growth and economic performance do not always move in sync, as they can be driven by different factors.

Even in years when imports and exports declined (such as in 2019, when the trade volume dropped due to the COVID-19 pandemic), Canada's population still grew steadily. However, there is no strong indication that this population increase directly influenced trade recovery or growth. This suggests that short-term fluctuations in economic activity, such as trade, may not be directly impacted by population growth, which could be sustained by immigration policies and natural population trends.

## 2. Most Traded Commodities

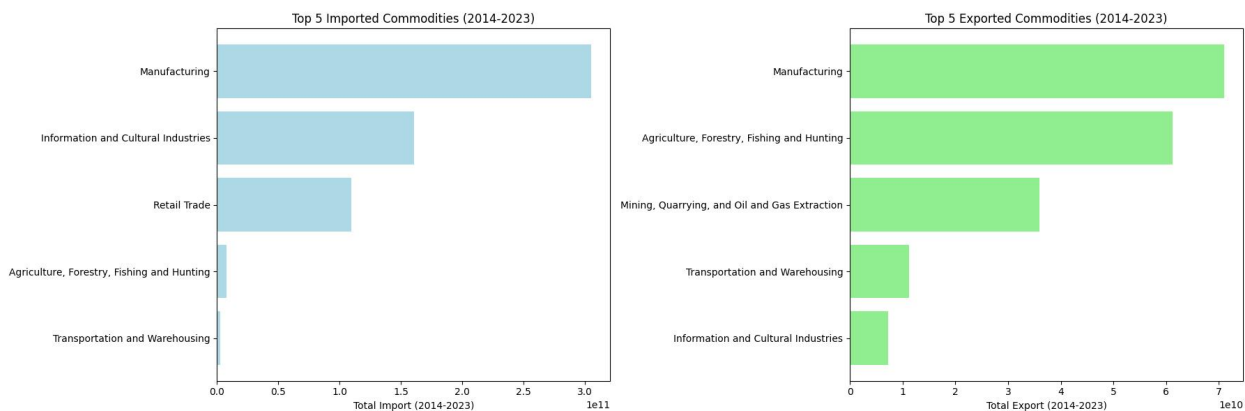
The trade relationship between Canada and China is crucial for both countries, as it affects their economies in significant ways. Understanding the major commodities involved in this trade helps us see where each country's strengths lie and how they depend on each other. By analyzing

these trade patterns, we can identify opportunities to improve balance and find areas that need attention.

In the chapter, we would focus on the visual analysis of the trade relationship between Canada and China, especially the important insights into the most traded commodities from 2014 to 2023.

### 2.1 Top Imported and Exported Commodities (2014-2023)

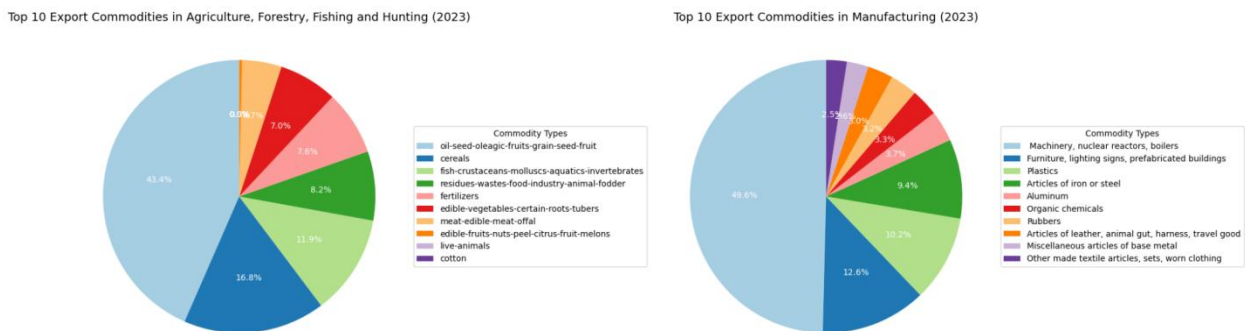
First, we found the top five imports and exports commodities, as shown in the figures below:



The figures show that the main imports from China to Canada are Manufacturing, followed by Information and Cultural Industries, and Retail Trade. This shows a strong dependence on industrial products from China. On the export side, Canada mainly exports Manufacturing, Agriculture, Forestry, Fishing, and Hunting, Mining, Quarrying, and Oil and Gas Extraction. This highlights Canada's strength in natural resources and industrial products for export.

### 2.2 Top 10 Commodity Trends in Specific Sectors

Next, we used two pie charts to show the top 10 subcategories for the highest import and export sectors in the figures above.

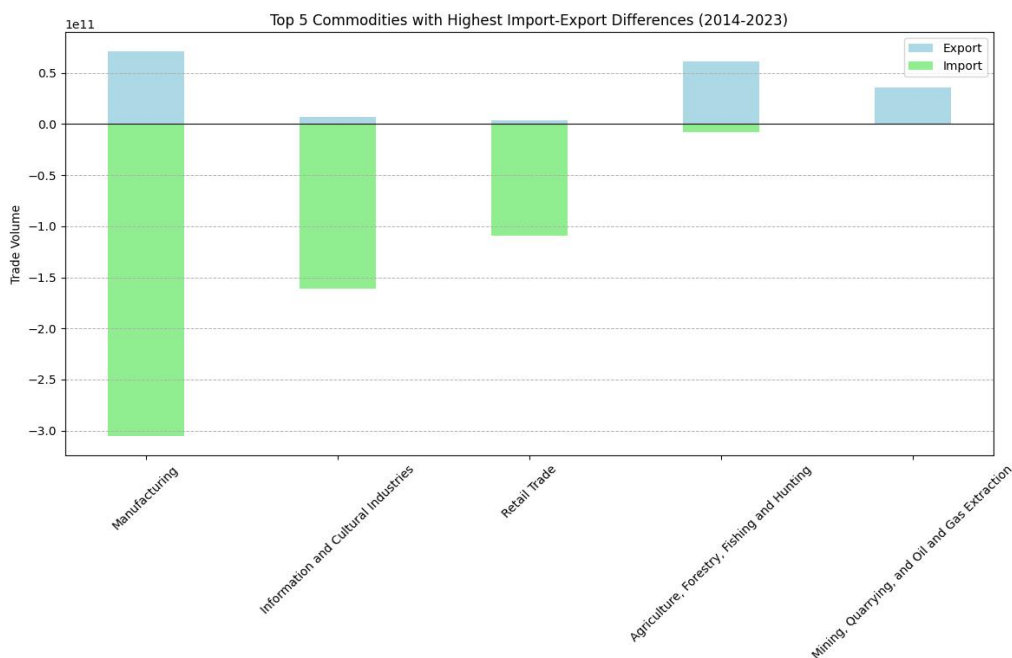




The pie chart on the left shows the top 10 export commodities in Agriculture, Forestry, Fishing, and Hunting. Oil-seed, cereals and fish products make up a large proportion, accounting for 43.4%, 16.8%, and 8.2%, respectively. This shows Canada's strong export capacity in agriculture and natural resources, especially for oil-seed and cereals. Fertilizers (7.6%) and edible vegetables, roots, and tubers (7.0%) also hold important positions, indicating the diversity of Canadian agricultural products and their demand in the export market.

Meanwhile, the right one shows the breakdown of Canadian imports in the manufacturing sector. Machinery, nuclear reactors, and boilers make up 49.6% of imports, which means Canada relies heavily on China for heavy industrial equipment. The next largest categories are furniture, lighting signs, prefabricated buildings (12.6%), and plastics (10.2%), showing China's advantage in light industry and manufactured goods. Other important imported products include articles of iron or steel (9.4%), aluminum (3.7%), and organic chemicals (3.3%), which indicates Canada's significant need for industrial materials and chemicals from China.

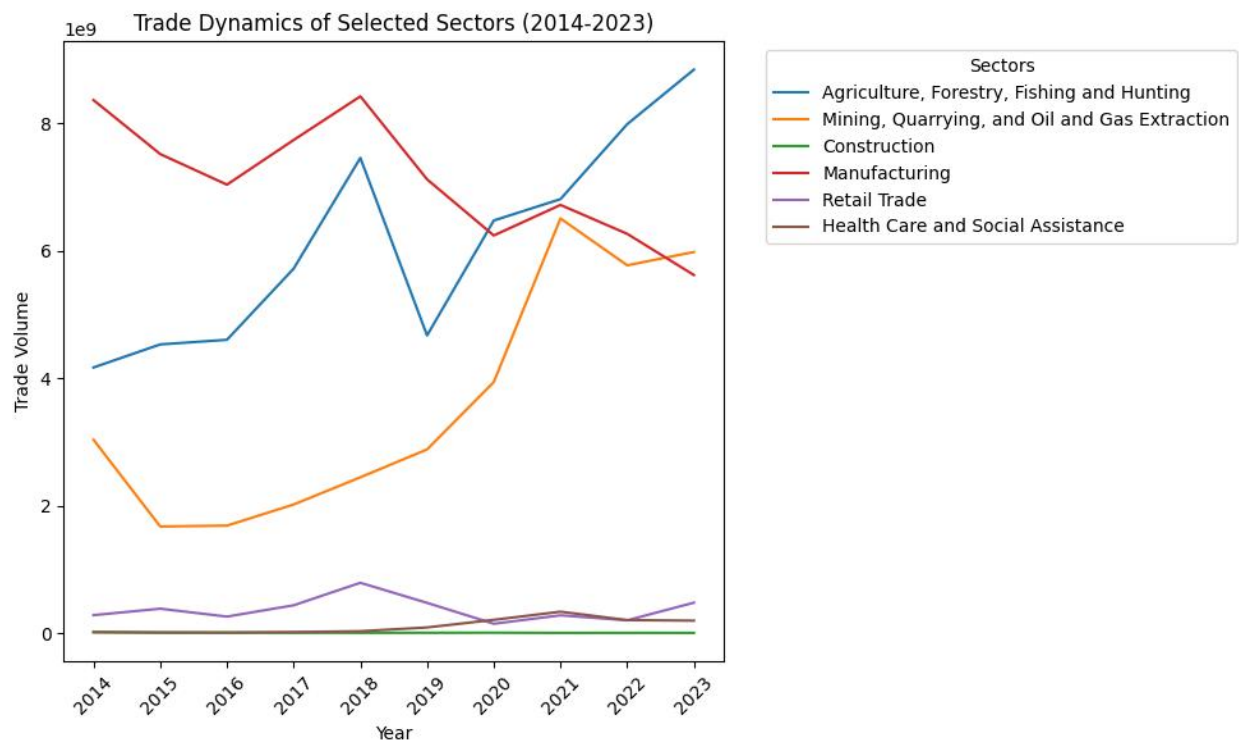
### 2.3 Import-Export Differences (2014-2023)



The bar chart shows the top five commodities with the top 5 biggest import-export differences. Manufacturing has a big, and also the largest negative difference, meaning Canada imports much more from China than it exports. On the other hand, sectors like Agriculture, Forestry, Fishing, and Hunting and Mining, Quarrying, and Oil and Gas Extraction have a positive trade balance, which means Canada is a net exporter in these areas. This pattern aligns with the strengths of each country: China is a leader in manufacturing, while Canada has a strong position in natural resources.

In conclusion, the trade relationship between Canada and China is dynamic, with both strengths and dependencies. Canada heavily relies on China for manufactured goods, creating a trade imbalance that could be a challenge if disruptions occur in Chinese manufacturing. At the same time, Canada is strong in exporting natural resources like oil-seed, cereals, and mining products, which are in high demand in China, supporting the Canadian economy. The agricultural sector also shows a positive trade balance, reflecting the demand for Canadian agricultural products in China. These visualizations suggest that there are opportunities for both countries to diversify their imports and exports to create a more balanced trade relationship in the future.

### 3. Current Trade Dynamics



The chart titled "Trade Dynamics of Selected Sectors (2014-2023)" shows the trade volume trends of six different sectors over the period from 2014 to 2023. The Y-axis represents the trade volume in billions, while the X-axis indicates the years. Each line corresponds to one of the six sectors:

**Agriculture, Forestry, Fishing, and Hunting (Blue):** The trade volume shows a general upward trend, peaking in 2023 at around 9 billion. There is a dip around 2020, but the sector quickly recovers and continues its growth.

**Mining, Quarrying, and Oil and Gas Extraction (Orange):** This sector has experienced a steady rise from 2016 onward, peaking around 2021 and 2022. It slightly drops after 2022 but remains one of the higher-volume sectors, reaching close to 6 billion in 2023.

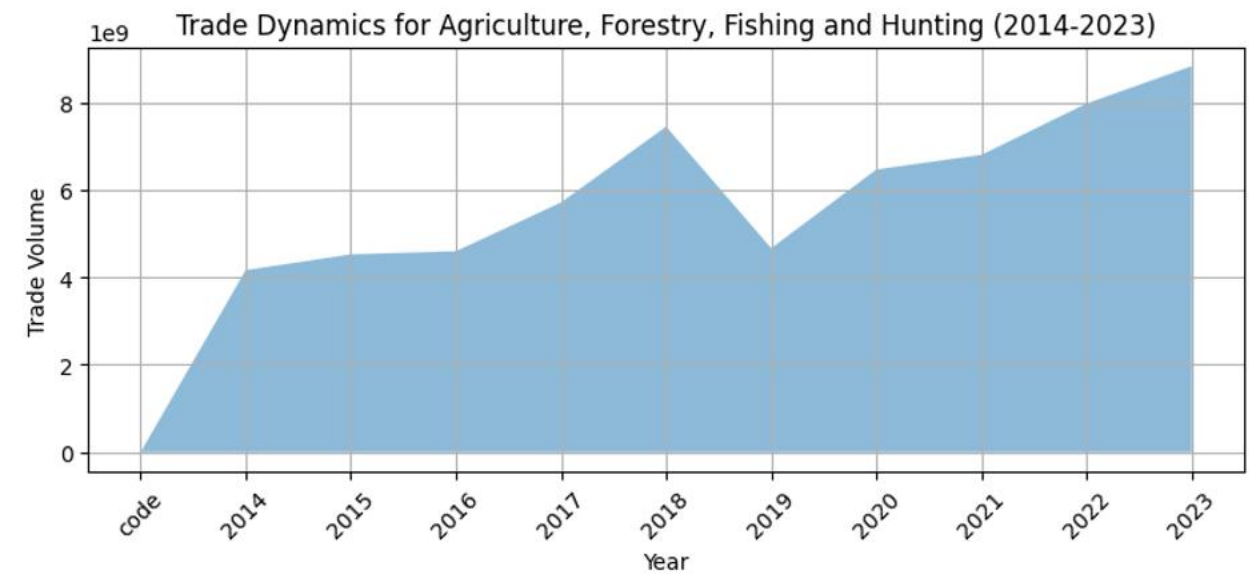
**Manufacturing (Red):** Manufacturing starts with the highest trade volume in 2014, slightly declines, and then fluctuates through the years. It reaches its lowest point in 2023 at approximately 6 billion, declining from the earlier peak of around 8 billion.

**Retail Trade (Purple):** Retail trade has remained relatively stable over the years, with minor fluctuations and a trade volume that stays consistently low, around 0.5 billion throughout the period.

**Health Care and Social Assistance (Brown):** This sector shows very little variation, maintaining a low and almost flat trade volume across the years, remaining close to zero.

**Construction (Green):** Construction remains consistently low throughout the period, showing no significant fluctuations in trade volume.

### 3.1 Trade Dynamics for Agriculture, Forestry, Fishing and Hunting



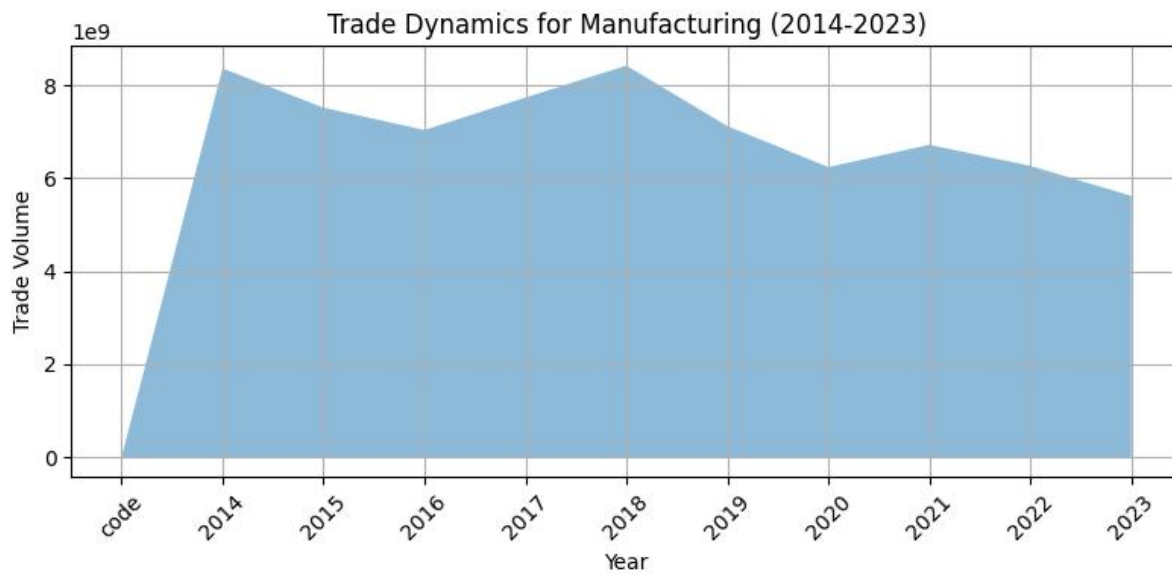
From 2014 to 2016, the trade volume exhibited steady growth, reaching around 5 billion. In 2018, the trade volume peaked at over 8 billion, marking the most significant spike during this period. However, after 2018, there was a noticeable dip in 2019, followed by a recovery and a steady upward trend, particularly from 2021 to 2023. By 2023, the trade volume showed a strong finish, nearing 9 billion, indicating continued growth and demand in this sector.

### 3.2 Trade Dynamics for Construction



The trade volume for the construction sector peaked significantly in 2014, reaching  $1.6 \times 10^7$ , followed by a steady decline from 2015 to 2017. Although there was a slight recovery in 2019, it was not sustained, and by 2021-2023, the trade volume remained low, fluctuating around  $0.4 \times 10^7$ , indicating a continuous downward trend.

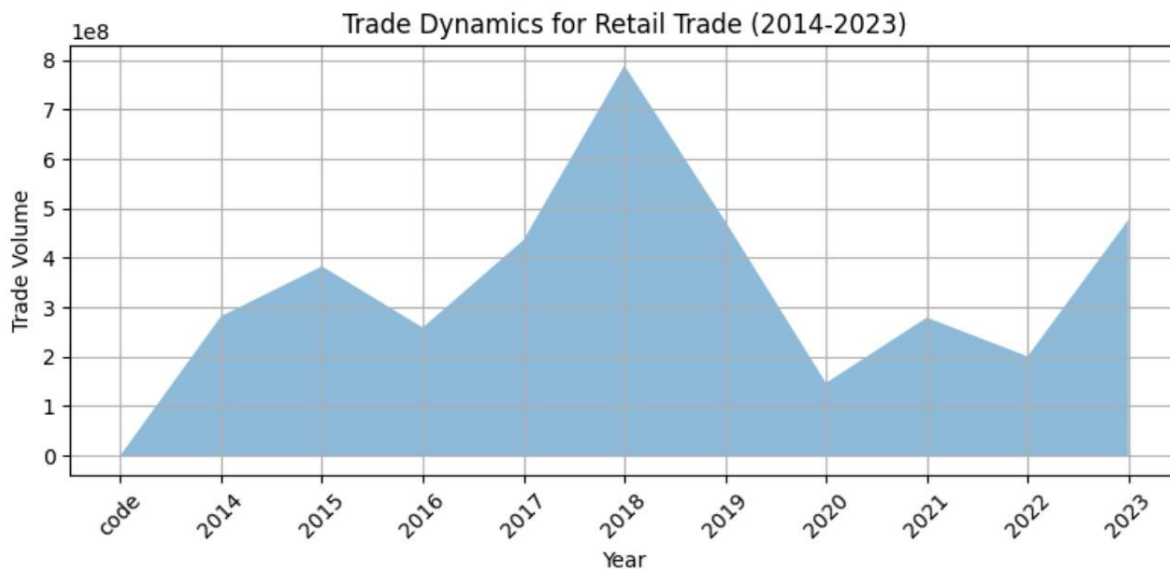
### 3.3 Trade Dynamics for Manufacturing



The chart shows the trade volume trends for the manufacturing sector over a decade. Starting in 2014, the trade volume quickly rose to a peak of over  $8 \times 10^9$ , marking one of the highest points

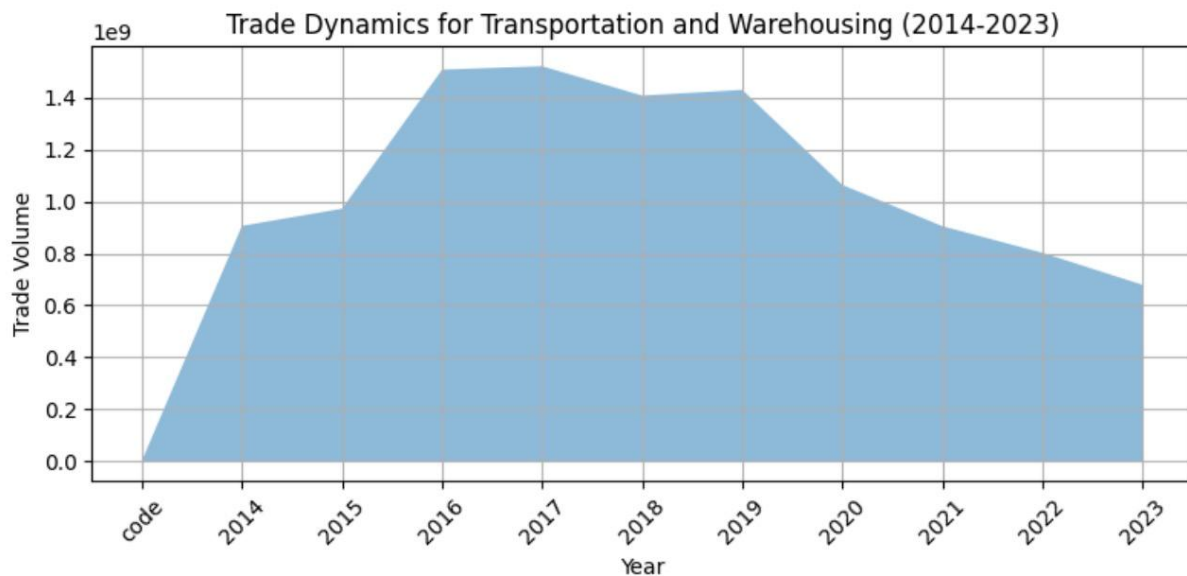
for the sector. However, after 2014, the sector saw a slight decline, with another peak occurring in 2018, again reaching around  $8 \times 10^9$ . Post-2018, the trade volume decreased gradually, and by 2023, it had dropped to just above  $6 \times 10^9$ . This trend indicates that while manufacturing experienced strong periods of growth, the overall trade volume has declined in recent years.

### 3.4 Trade Dynamics for Retail Trade



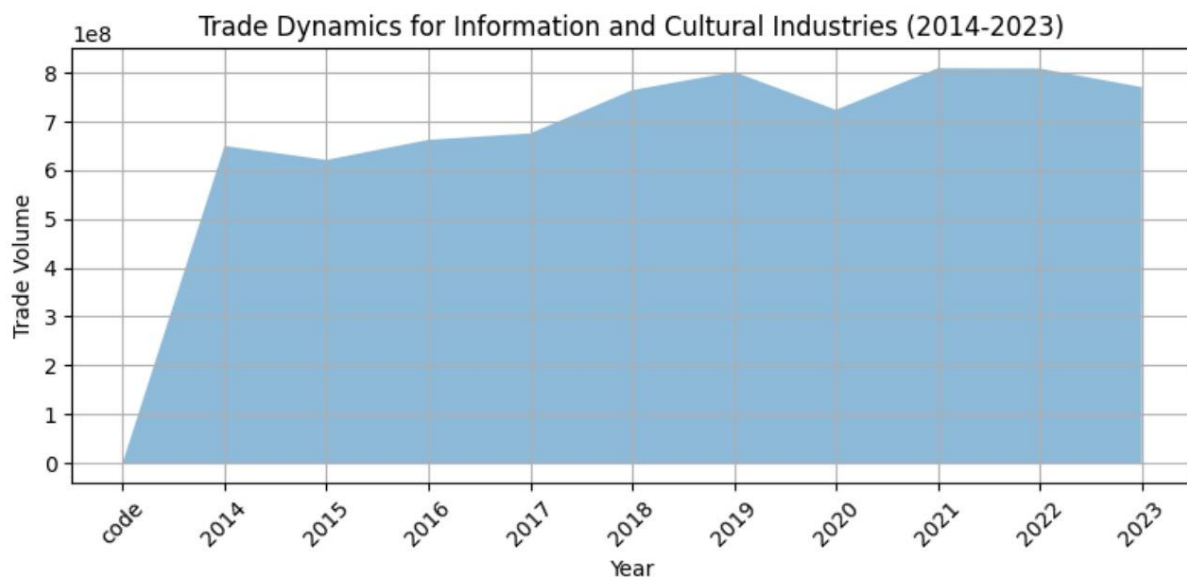
From 2014 to 2016, the retail trade sector experienced a gradual increase in trade volume, reaching approximately  $4 \times 10^8$  by 2016. In 2018, the sector saw its highest trade volume peak, reaching around  $8 \times 10^8$ , marking the most significant spike during the observed period. However, after 2018, the sector faced a sharp decline, with trade volume dropping to around  $2 \times 10^8$  in 2019, followed by further fluctuations, including another dip in 2021. In 2023, the sector rebounded, with the trade volume rising to approximately  $5 \times 10^8$ . Despite the recovery, the trade volume remained below the peak level of 2018, indicating a sector characterized by volatility, with periods of sharp increases followed by downturns.

### 3.5 Trade Dynamics for Transportation and Warehousing



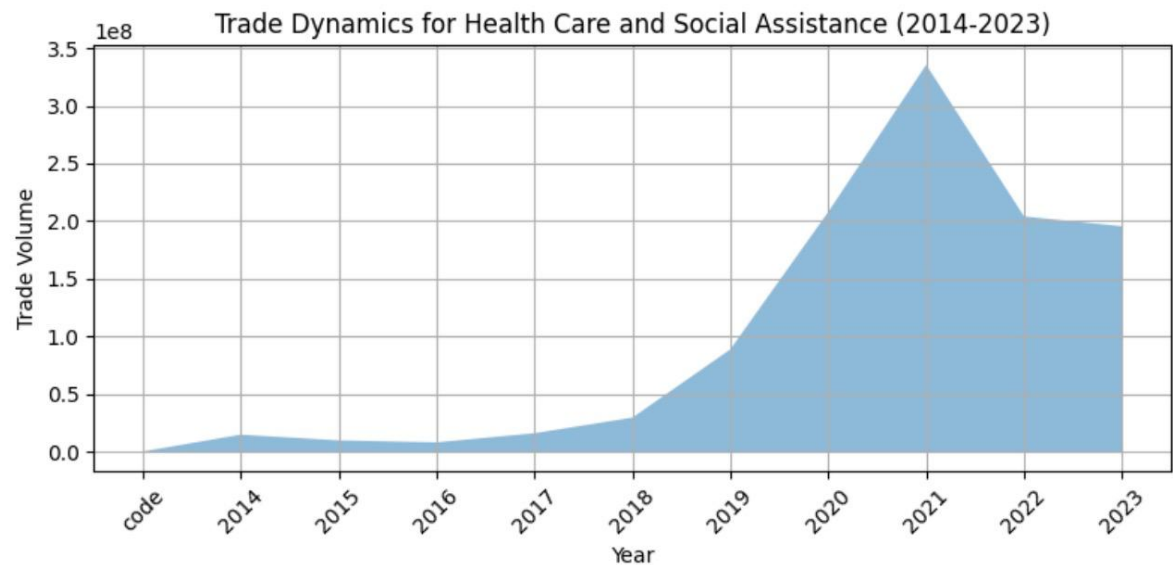
The transportation and warehousing sector experienced rapid growth from 2014 to 2016, with the trade volume rising from near zero to over  $1.4 \times 10^9$  by 2016, indicating a sharp increase in trade activity. From 2016 to 2018, the trade volume remained relatively stable at peak levels of around  $1.4 \times 10^9$ , marking the highest and most sustained trade volumes for the sector. However, starting in 2019, the trade volume began to decline steadily, dropping to approximately  $0.6 \times 10^9$  by 2023. This decline represents a significant reduction in trade activity, suggesting a potential downturn in the sector in recent years, with trade volumes nearly halving from their peak.

### 3.6 Trade Dynamics for Information and Cultural Industries



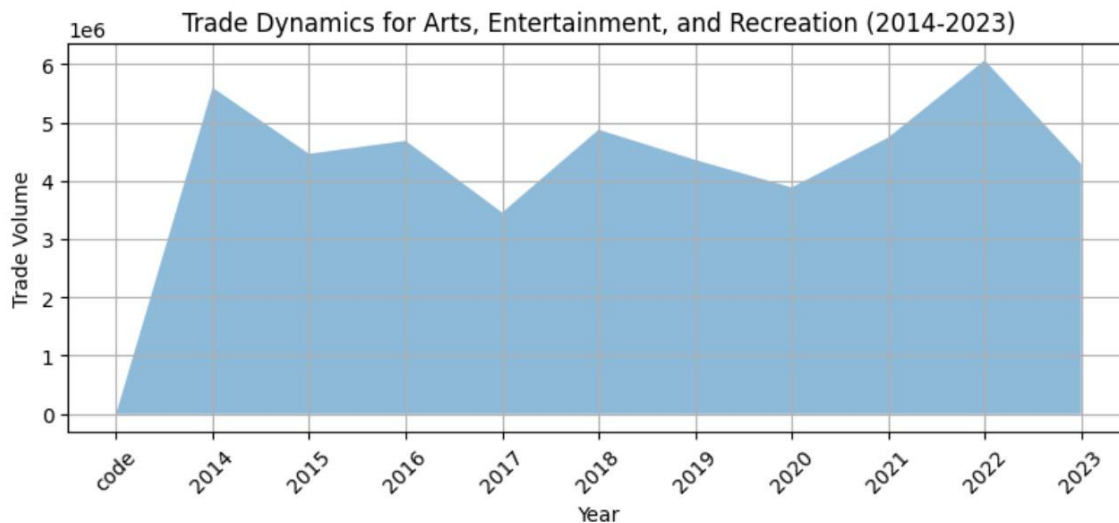
The information and cultural industries sector saw rapid growth from 2014 to 2015, with trade volume increasing from near zero to over  $6 \times 10^8$  by 2015, marking a substantial rise in trade activity. From 2015 to 2018, the sector continued to grow steadily, reaching a peak of approximately  $8 \times 10^8$  in 2018. After 2018, the trade volume fluctuated, with a slight decline in 2019, followed by recoveries in 2020 and 2021, and another slight decrease in 2023. Throughout this period, the trade volume remained above  $7 \times 10^8$ , demonstrating resilience despite these fluctuations. In 2023, the trade volume dropped slightly, ending at around  $7 \times 10^8$ , which, while lower than the peak in 2018, still represents a high level of trade activity.

### 3.7 Trade Dynamics for Health Care and Social Assistance



The healthcare and social assistance sector experienced very low and stable trade volumes from 2014 to 2018, staying under  $0.5 \times 10^8$ , with little significant trade activity during these years. However, starting in 2019, the trade volume began to rise sharply, peaking in 2021 at over  $3 \times 10^8$ , representing the most significant growth period for the sector. After 2021, the trade volume saw a sharp decline, dropping to around  $2 \times 10^8$  in 2022. Despite this decline, the trade volume in 2022 and 2023 remained much higher than the levels seen before 2019. By 2023, the trade volume appeared to stabilize around  $2 \times 10^8$ , indicating that the sector had maintained a higher level of trade compared to earlier years, though it remained lower than the peak in 2021.

### 3.8 Trade Dynamics for Arts, Entertainment, and Recreation

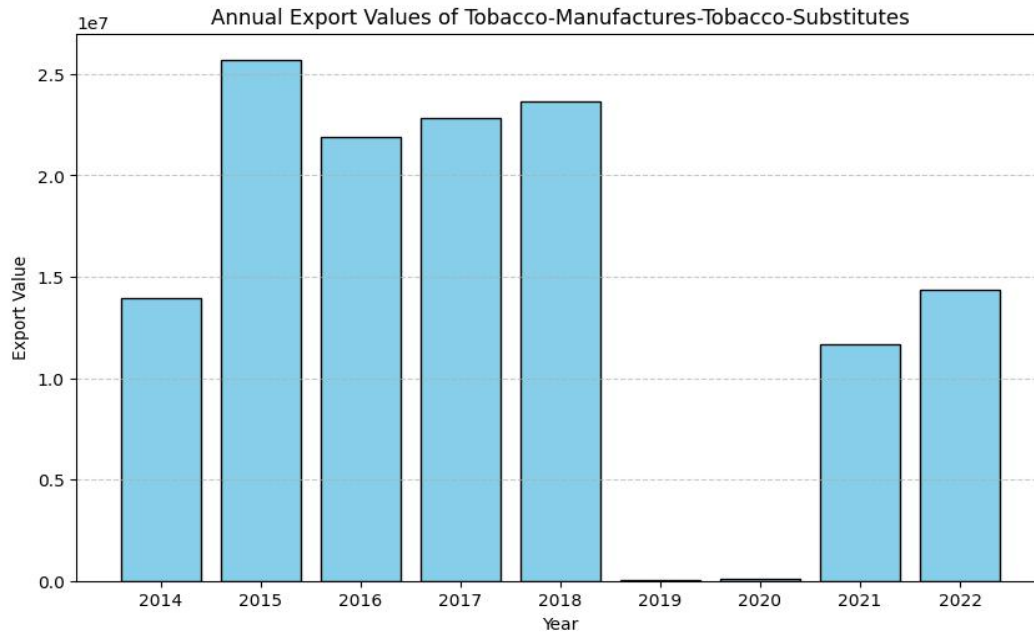


The arts, entertainment, and recreation sectors experienced considerable fluctuations in trade volume over the decade. There was a sharp increase in 2014, with the trade volume surpassing  $5 \times 10^6$ , marking one of the highest points during this period. From 2015 to 2019, the trade volume fluctuated, showing periodic dips and rebounds, remaining between  $4 \times 10^6$  and  $5 \times 10^6$ , with noticeable dips in 2016 and a recovery in 2018. In 2022, the sector saw significant growth, with the trade volume peaking at around  $6 \times 10^6$ , the highest point in the chart, surpassing the 2014 peak. However, this was followed by a moderate decline in 2023, with the volume dropping to around  $5 \times 10^6$ , though still higher than most other years.

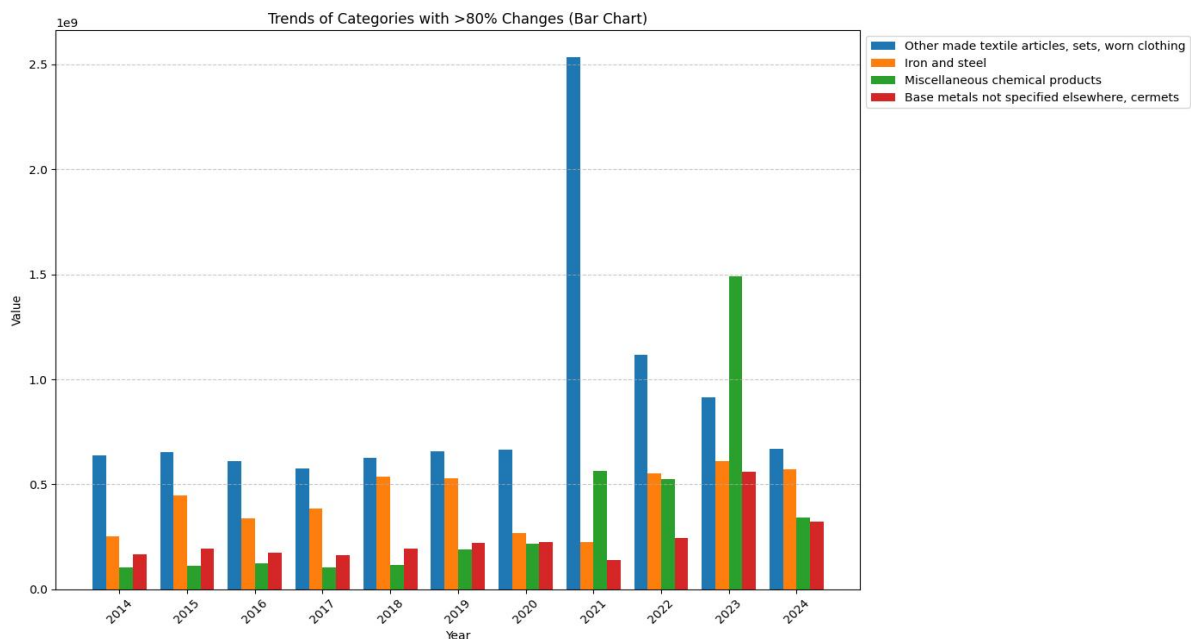
## 4. External Factors

There are many factors that can affect import and export data. The following are several types of import and export products that have been selected to reflect the impact of external factors.



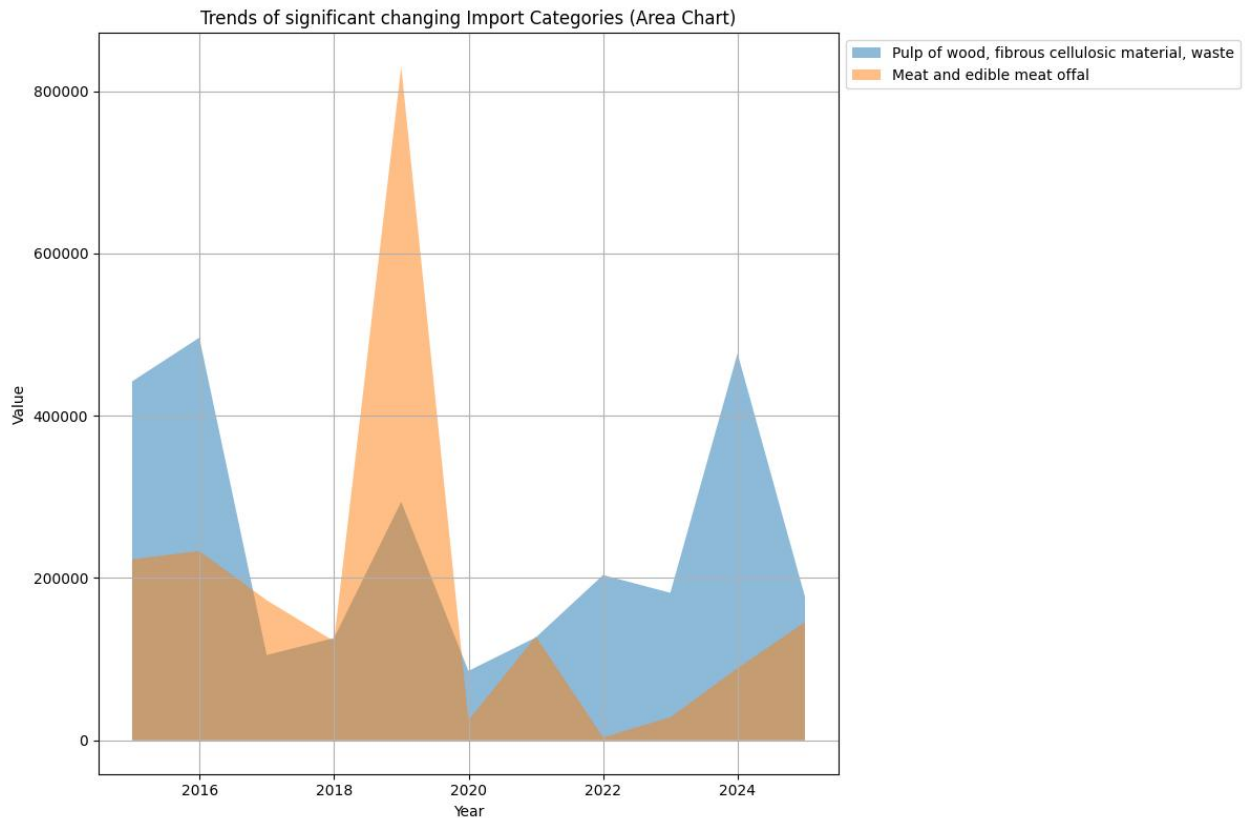


As can be seen from the figure, exports of tobacco products and substitutes fell sharply from 2019 to 2020 and gradually recovered in 2021. This reflects the impact of the epidemic on imports and exports. COVID-19 has led to a reduction in the workforce, hampered transportation, and thus severely disrupted global supply chains. Trade in many industries has been reduced, and so do tobacco-related products. Factories are often forced to close temporarily, affecting production capacity and export volumes. From another perspective, the economy was affected during COVID-19, and people's demand for non-essential goods such as tobacco products decreased. This shift in consumer demand has led to a decrease in demand for tobacco substitutes, which has a direct impact on export volume.



This bar chart shows the import values of four categories that changed significantly (more than 80%) across years. The blue and orange bars represent textiles, suits as well as iron and steel. These two products are also greatly affected by COVID-19. Other textile products, suits, and used clothes increased significantly in 2020. The pandemic has led to a surge in demand for various textile products, including personal protective equipment such as masks and protective clothing. Many countries have increased the import of textile-related products to meet healthcare needs, which may be the reason for this increase. Iron and steel, on the other hand, show a downward trend. This may be due to the stagnation of production caused by COVID-19, the demand for such production raw materials decreased, leading to a reduction in imports.

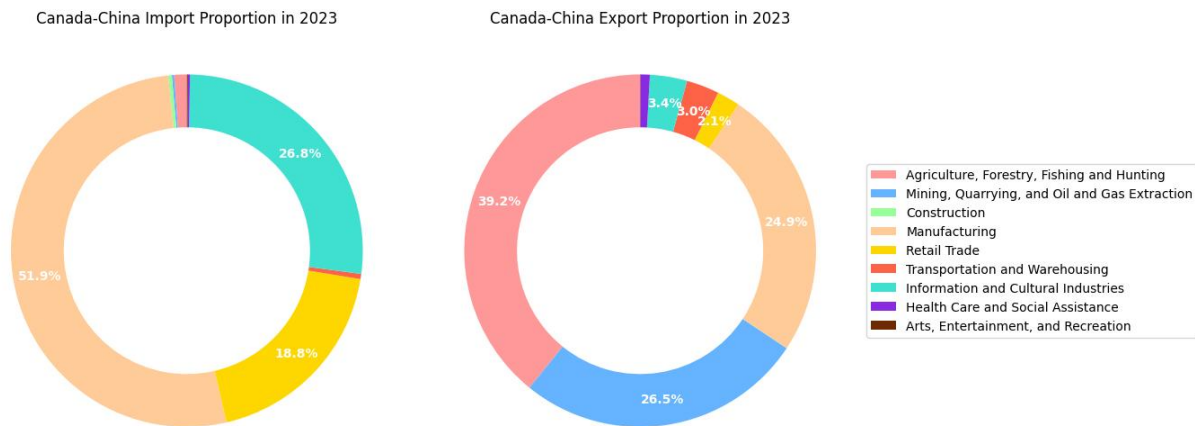
Miscellaneous chemical products (green) and base metals, cermet (red) both have significant growth in 2023. This relates to the recovery of manufacturing and industrial production after COVID-19. Base metals and cermet are used in various applications such as electronics and machinery, which are likely to see increased demand during the economic recovery phase. Likewise, imports of these products decline in 2024 after initial demand is met.



Import trends of wood pulp, fibrous cellulosic materials, and edible meat offal reflect significant sensitivity to external factors. The surge in meat imports around 2019 likely reflected stockpiling due to anticipated supply chain disruptions and potential livestock diseases. In addition, under the impact of COVID-19, countries have increased imports to ensure basic food resources. Conversely, the peak in pulp imports in 2024 suggests a shift toward sustainable materials, likely

due to increased demand in sectors such as construction and packaging. The fluctuations demonstrate the impact of the health crisis, environmental policies, and trade regulations on import volumes as countries try to adapt to changing global environmental conditions and economic situations.

## 5. Potential Future Trends



From the two donut charts comparing Canada-China import proportions and Canada-China export proportions in 2023, we can find several key factors in the international trade between Canada and China.

### 5.1 China's Dominant Role As A Manufacturing Hub

Manufacturing dominates imports from China, accounting for the largest share at 51.9%. Also, retail trade contributes 18.8%, reflecting the direct trade of goods sold to consumers. China is one of the world's largest producers of manufactured goods, including electronics, machinery, textiles, and other consumer products. Many companies in Canada, as in other countries, source these goods from China because of China's lower production costs, high efficiency, and well-established manufacturing infrastructure. We can see that Canada now relies heavily on China to produce goods that fuel both consumer demand and industrial processes.

This situation should also raise concerns for Canada. Canada's heavy reliance on manufacturing imports from China poses potential risks in terms of supply chain vulnerabilities. Any disruptions in China's manufacturing sector (e.g., due to geopolitical tensions, trade tariffs, or pandemics) could severely impact Canada's access to key products.

Though the import of low-cost manufactured goods could benefit Canadian consumers by keeping prices low, Canada should encourage initiatives for local production of certain essential goods and make policies that support small-scale, sustainable, or high-tech manufacturing to improve self-reliance in critical areas without sacrificing affordability for consumers. Canada can

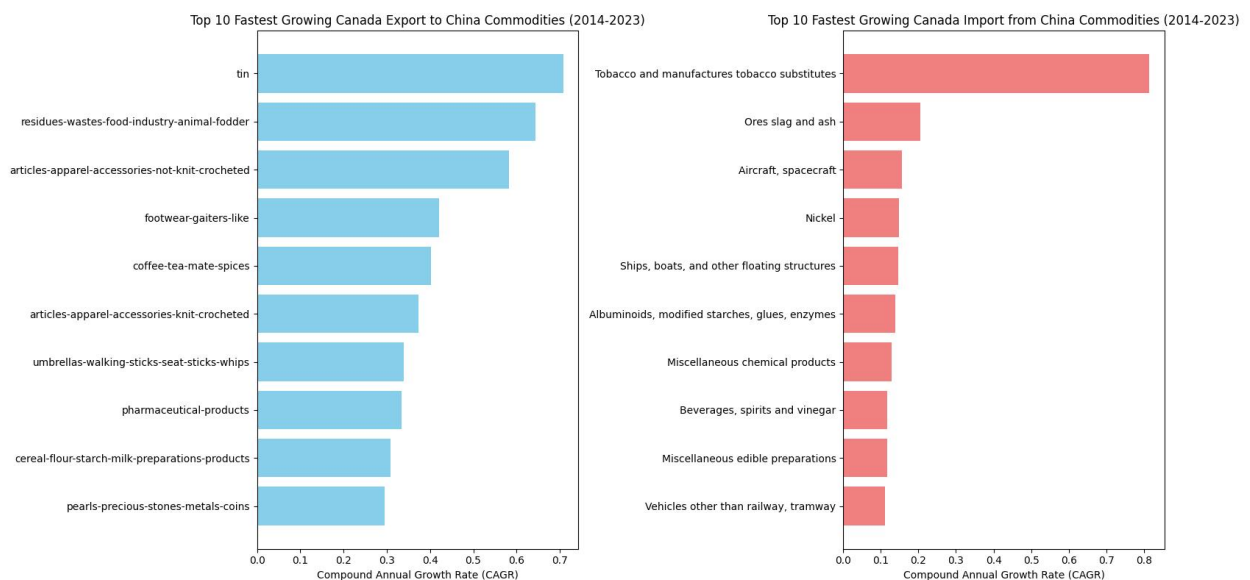
further promote Canadian brands and local businesses to strengthen the retail market. Encouraging Canadian consumers to support locally produced goods and using incentives for businesses that source or manufacture domestically could help balance trade dynamics.

5.2 Canada’s Exports to China Have Heavy Dependence on Natural Resources

A significant proportion of Canada’s exports to China comes from natural resource sectors such as ‘Agriculture, Forestry, Fishing, and Hunting’ (39.2%) and ‘Mining, Quarrying, and Oil and Gas Extraction’ (26.5%). This is unsurprising given Canada’s abundant natural resources and China's large demand for food, raw materials, and energy to fuel its growing economy. However, the heavy reliance on commodity-based exports exposes Canada to commodity price volatility. Global commodity prices can fluctuate significantly based on demand, geopolitical tensions, or environmental factors, which may create potential international trade instability for Canada. A downturn in global demand, or a slowdown in China’s economy, could lead to declining export revenues in these key sectors.

With around 65% of Canada’s exports to China coming from just two sectors, we can say that Canada’s export base to China is quite narrow. This lack of diversification increases vulnerability to changes in agricultural demand, new trade regulations, or environmental policies. If China shifts its resource needs to new suppliers, this could negatively impact Canadian exports significantly.

Canada could focus on expanding its exports in high-value sectors such as technology, pharmaceuticals, and services to reduce its dependence on primary resources. Putting more investment in research and development (R&D), clean technology, and innovation could help Canada broaden new export markets and diversify its trade with China beyond just raw materials.



Then we have the top 10 fastest-growing export and import commodities between Canada and China from 2014 to 2023, based on the Compound Annual Growth Rate (CAGR). There are also some insights derived from these charts:

### **5.3 Trade Commodity Imbalance**

There's a notable trade imbalance in that Canada imports more manufactured goods from China while exporting mostly raw materials to China. As we found in the Canada-China import proportions and Canada-China export proportions in 2023 plots, Canada has a high reliance on China for manufactured goods and China has a reliance on Canada for raw materials. Canada's fastest-growing exports to China still largely include natural resources like tin and residues. This dependence on commodity exports exposes Canada to the risks of commodity price fluctuations and changes in China's demand for raw materials.

### **5.4 The Promising Tobacco Market in Canada**

From the import plot, we can see that 'tobacco and manufactured tobacco substitutes' have had a very outstanding compound annual growth rate over the past ten years. The substantial growth rate of tobacco-related products reflects consumer behavior changes in Canada, likely driven by the rise of e-cigarettes and alternative smoking devices. As traditional cigarettes decline, consumers are shifting toward vaping and nicotine substitutes, many of which are produced in China.

This also presents an opportunity for Canada to tap into the evolving vaping and alternative tobacco market, particularly by partnering with Chinese manufacturers for distribution. There's also a potential opportunity for Canadian companies to develop their own vaping technologies and nicotine substitutes, leveraging China as a manufacturing hub.

However, this sector also faces regulatory risks. The rise in health concerns associated with vaping and increased scrutiny by government agencies could lead to future restrictions. Canada must balance capitalizing on the growth of this sector with careful management of its health impact.

## Modeling and Forecasting

We draw line charts of Canada's imports and exports to all countries and to China and observe their trends.

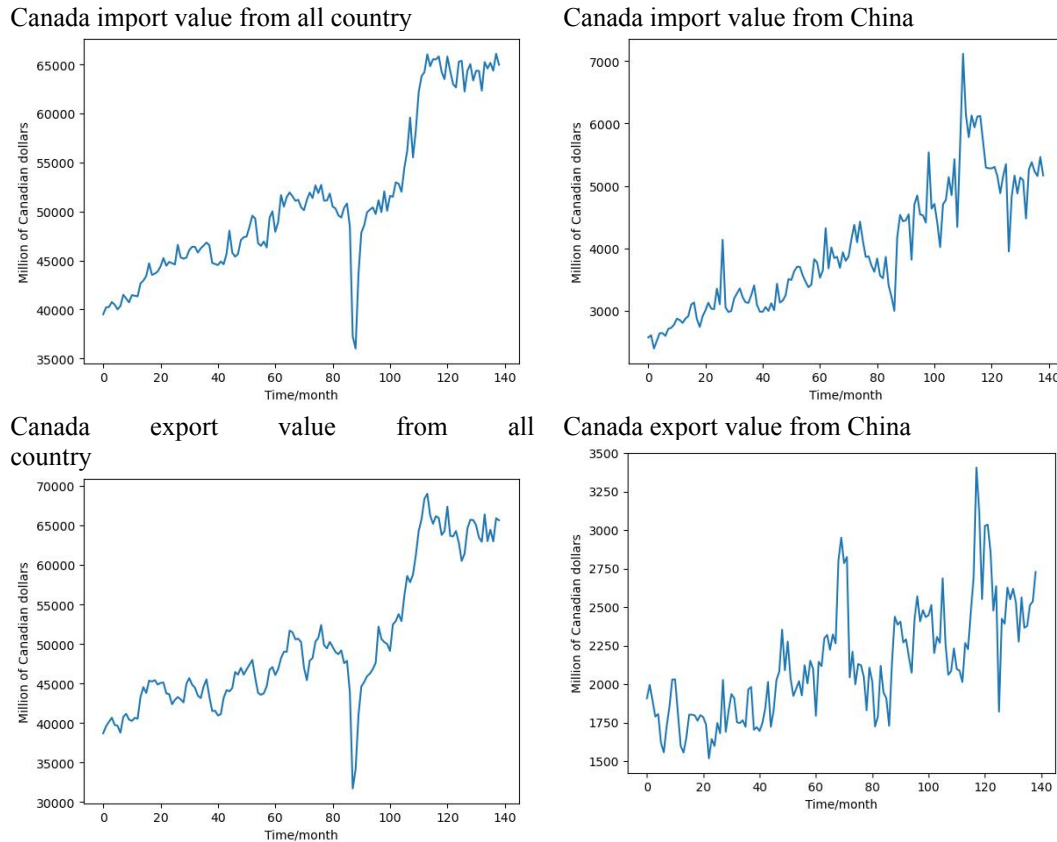


Figure 1: The plot of Canada's import and export data

We find there is We see a seasonal trend in net exports. Therefore, we choose to use the autoregression integrated moving average (ARIMA) model in the time series model to fit the import and export data. There are three parameters in ARIMA model which are  $p$ ,  $d$ ,  $q$ . From Box's (2015) book and Hyndman's (2021) video, we know that these three parameters are judged by partial autocorrelation function (PACF), difference order, and Autocorrelation function (ACF) respectively. We will use data imported by Canada from China to demonstrate the building process of our model.

First of all, we can see from Figure 1 that Canada's import value from China has a seasonal trend and is not stable. Therefore, we made the first-order difference between the import and export data over 12 months, and the data graph after the first-order difference is as follows:

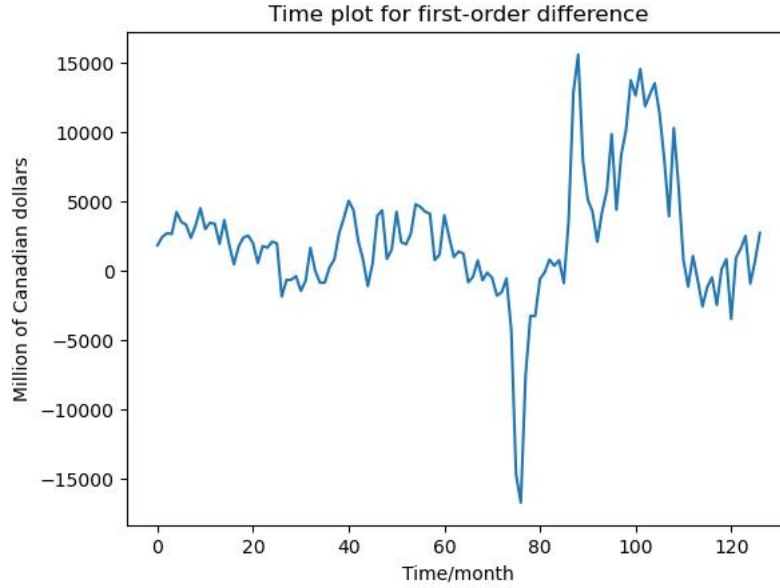


Figure 2: First-order differential import data

The data after the first difference fluctuates around 0. We think that the data after the first difference tends to be stable. Therefore, we get  $d = 1$ . We draw ACF and PACF plots for the data after the first-order difference, and the results are as follows:

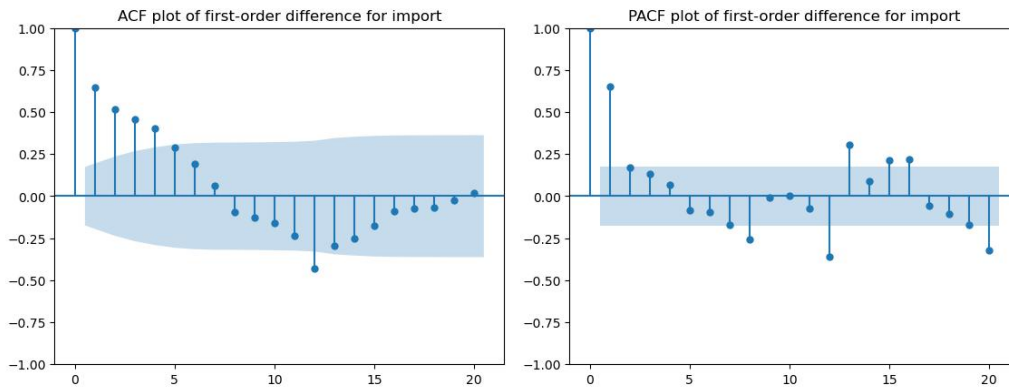


Figure 3: The plot of ACF and PACF

The blue areas in the image are the areas where ACF and PACF tend to be 0. Our  $p$  and  $q$  values correspond to the point where ACF and PACF change from insignificant to significant 0. From the ACF plot on the left, ACF is in the blue area after 5, which means ACF is close to 0. Therefore,  $q = 5$ , we have five terms Moving Average (MA). From the PACF diagram on the right, PACF is in the blue area after 2, which means PACF is close to 0. Therefore,  $p = 2$ , we have two terms Autoregression (AR). According to the selection of the above parameters, we finally choose ARIMA (2, 1, 5). We fit the ARIMA (2, 1, 5) model with data from January 2013 to December 2023, and the result is as follows:

Dep. Variable:	China_Im	No. Observations:	132			
Model:	ARIMA(2, 1, 5)	Log Likelihood	-956.079			
Date:	Wed, 16 Oct 2024	AIC	1928.158			
Time:	23:12:18	BIC	1951.160			
Sample:	0	HQIC	1937.505			
	- 132					
Covariance Type:	opg					
=====						
	coef	std err	z	P> z	[0.025	0.975]
-----						
ar.L1	0.6330	0.059	10.711	0.000	0.517	0.749
ar.L2	-0.9311	0.087	-10.653	0.000	-1.102	-0.760
ma.L1	-1.1138	0.088	-12.653	0.000	-1.286	-0.941
ma.L2	1.1486	0.121	9.487	0.000	0.911	1.386
ma.L3	-0.2678	0.111	-2.413	0.016	-0.485	-0.050
ma.L4	-0.2265	0.099	-2.297	0.022	-0.420	-0.033
ma.L5	0.2064	0.087	2.378	0.017	0.036	0.377
sigma2	1.258e+05	1.12e+04	11.217	0.000	1.04e+05	1.48e+05
=====						
Ljung-Box (L1) (Q):		0.03	Jarque-Bera (JB):		95.10	
Prob(Q):		0.87	Prob(JB):		0.00	
Heteroskedasticity (H):		5.45	Skew:		0.64	
Prob(H) (two-sided):		0.00	Kurtosis:		6.97	
=====						

Figure 4: ARIMA (2, 1, 5) about Canada import from China

This ARIMA (2, 1, 5) model expression:

$$y_t = 0.6330y_{t-1} - 0.9311y_{t-2} + \epsilon_t - 1.1138\epsilon_{t-1} + 1.1486\epsilon_{t-2} - 0.2678\epsilon_{t-3} - 0.2265\epsilon_{t-4} + 0.2064\epsilon_{t-5}$$

Repeat the model fitting process above to fit Canada's import data from all countries, Canada's export data to all countries, and Canada's export data to China.

For Canada import data from all countries, we fit the ARIMA (2, 1, 6) model with data from January 2013 to December 2023, and the result is as follows:



Dep. Variable:	All _Im	No. Observations:	132			
Model:	ARIMA(2, 1, 6)	Log Likelihood	-1163.006			
Date:	Wed, 16 Oct 2024	AIC	2344.013			
Time:	23:12:17	BIC	2369.890			
Sample:	0	HQIC	2354.528			
	- 132					
Covariance Type:	opg					
=====						
	coef	std err	z	P> z	[0.025	0.975]
-----						
ar.L1	-1.2966	0.090	-14.415	0.000	-1.473	-1.120
ar.L2	-0.9090	0.087	-10.483	0.000	-1.079	-0.739
ma.L1	1.3667	0.101	13.532	0.000	1.169	1.565
ma.L2	0.9333	0.136	6.880	0.000	0.667	1.199
ma.L3	-0.0846	0.112	-0.758	0.448	-0.303	0.134
ma.L4	-0.0889	0.112	-0.793	0.428	-0.309	0.131
ma.L5	0.0031	0.133	0.023	0.982	-0.257	0.263
ma.L6	-0.0069	0.102	-0.068	0.946	-0.206	0.192
sigma2	3.413e+06	2.66e-08	1.28e+14	0.000	3.41e+06	3.41e+06
=====						
Ljung-Box (L1) (Q):		0.11	Jarque-Bera (JB):		850.89	
Prob(Q):		0.75	Prob(JB):		0.00	
Heteroskedasticity (H):		4.94	Skew:		-1.49	
Prob(H) (two-sided):		0.00	Kurtosis:		15.13	
=====						

Figure 5: ARIMA (2, 1, 6) about Canada's import from all countries

This ARIMA (2, 1, 6) model expression:

$$y_t = -1.2966y_{t-1} - 0.9090y_{t-2} + \epsilon_t + 1.3667\epsilon_{t-1} + 0.9333\epsilon_{t-2} - 0.0846\epsilon_{t-3} - 0.0889\epsilon_{t-4} + 0.0031\epsilon_{t-5} - 0.0069\epsilon_{t-6}$$

For Canada's export data to all countries, we fit the ARIMA (2, 1, 6) model with data from January 2013 to December 2023, and the result is as follows:

Dep. Variable:	All_Ex	No. Observations:	132			
Model:	ARIMA(2, 1, 6)	Log Likelihood	-1170.543			
Date:	Wed, 16 Oct 2024	AIC	2359.086			
Time:	23:12:19	BIC	2384.963			
Sample:	0	HQIC	2369.601			
	- 132					
Covariance Type:	opg					
=====						
	coef	std err	z	P> z	[0.025	0.975]
-----						
ar.L1	-0.6698	0.138	-4.847	0.000	-0.941	-0.399
ar.L2	-0.8535	0.152	-5.628	0.000	-1.151	-0.556
ma.L1	0.7874	0.150	5.254	0.000	0.494	1.081
ma.L2	0.8964	0.168	5.333	0.000	0.567	1.226
ma.L3	0.0400	0.098	0.409	0.683	-0.152	0.232
ma.L4	-0.0779	0.136	-0.574	0.566	-0.344	0.188
ma.L5	-0.0739	0.121	-0.613	0.540	-0.310	0.162
ma.L6	-0.1019	0.130	-0.782	0.434	-0.357	0.153
sigma2	3.713e+06	2.65e+05	14.026	0.000	3.19e+06	4.23e+06
=====						
Ljung-Box (L1) (Q):		1.89	Jarque-Bera (JB):		876.52	
Prob(Q):		0.17	Prob(JB):		0.00	
Heteroskedasticity (H):		3.61	Skew:		-1.82	
Prob(H) (two-sided):		0.00	Kurtosis:		15.14	
=====						

Figure 6: ARIMA (2, 1, 6) about Canada's export to all countries

This ARIMA (2, 1, 6) model expression:

$$y_t = -0.6698y_{t-1} - 0.8535y_{t-2} + \epsilon_t + 0.7874\epsilon_{t-1} + 0.8964\epsilon_{t-2} + 0.0400\epsilon_{t-3} - 0.0779\epsilon_{t-4} + 0.0739\epsilon_{t-5} - 0.1019\epsilon_{t-6}$$

For Canada's export data to China, we fit the ARIMA (2, 1, 5) model with data from January 2013 to December 2023, and the result is as follows:

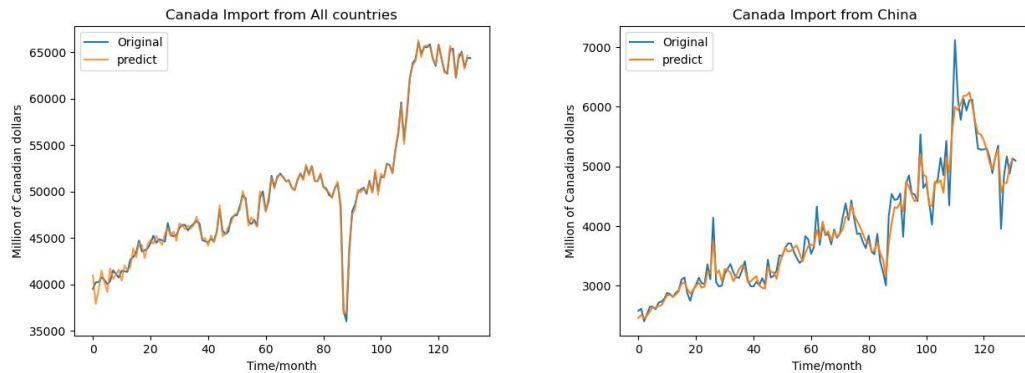
Dep. Variable:	China_Ex	No. Observations:	132			
Model:	ARIMA(2, 1, 5)	Log Likelihood	-884.413			
Date:	Wed, 16 Oct 2024	AIC	1784.825			
Time:	23:12:21	BIC	1807.827			
Sample:	0	HQIC	1794.172			
	- 132					
Covariance Type:	opg					
=====						
	coef	std err	z	P> z	[0.025	0.975]
=====						
ar.L1	1.8309	0.154	11.912	0.000	1.530	2.132
ar.L2	-0.8790	0.169	-5.211	0.000	-1.210	-0.548
ma.L1	-2.2029	0.198	-11.144	0.000	-2.590	-1.815
ma.L2	1.4762	0.337	4.379	0.000	0.815	2.137
ma.L3	-0.3599	0.269	-1.337	0.181	-0.887	0.168
ma.L4	0.2183	0.252	0.868	0.386	-0.275	0.711
ma.L5	-0.1188	0.143	-0.832	0.405	-0.399	0.161
sigma2	4.258e+04	4627.600	9.201	0.000	3.35e+04	5.16e+04
=====						
Ljung-Box (L1) (Q):		0.03	Jarque-Bera (JB):		34.70	
Prob(Q):		0.86	Prob(JB):		0.00	
Heteroskedasticity (H):		3.80	Skew:		-0.07	
Prob(H) (two-sided):		0.00	Kurtosis:		5.52	
=====						

Figure 7: ARIMA (2, 1, 5) about Canada export to China

This ARIMA (2, 1, 5) model expression:

$$y_t = 1.8309y_{t-1} - 0.8790y_{t-2} + \epsilon_t - 2.2029\epsilon_{t-1} + 1.4762\epsilon_{t-2} - 0.3599\epsilon_{t-3} + 0.2183\epsilon_{t-4} - 0.1188\epsilon_{t-5}$$

Based on these ARIMA models, we fit data from 2013 to 2023. Plot the fitting data and the original data to observe the fitting effect of our model.



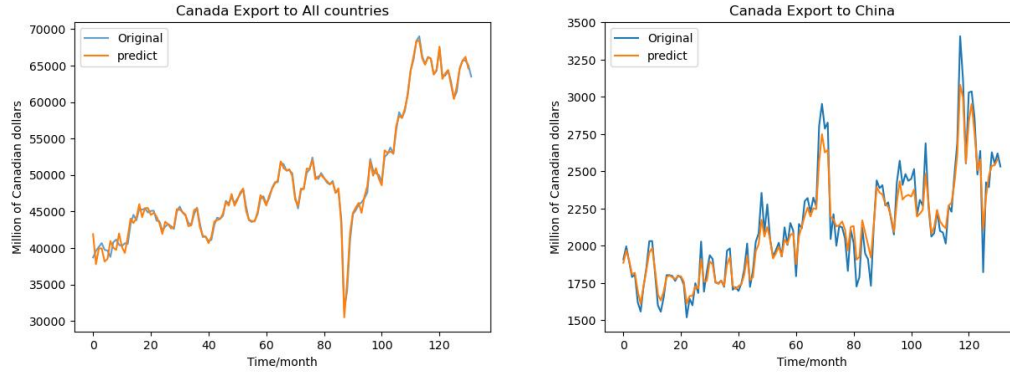


Figure 8: The plot of Canada import and export original and fitted value

The import and export data show an upward trend due to seasonal factors. During the COVID-19 period, the data fluctuated.

Finally, we also forecast the 2024 data and compared it with the data we have collected from January to July 2024. The results are as follows:

Table 1: Canada Import value

	From all country			From China		
Time	Original	Predict	Percentage	Original	Predict	Percentage
Jan-24	62335.60	64121.69	2.87%	4479.50	4861.36	8.52%
Feb-24	65247.80	64317.57	1.43%	5260.90	4960.25	5.71%
Mar-24	64588.50	64276.29	0.48%	5380.70	5137.65	4.52%
Apr-24	65169.60	64142.76	1.58%	5233.00	5149.48	1.60%
May-24	64369.40	64355.32	0.02%	5160.30	4991.80	3.27%
Jun-24	66097.40	64201.09	2.87%	5462.70	4880.98	10.65%
Jul-24	64974.00	64207.86	1.18%	5168.00	4957.63	4.07%

Table 2: Canada Export value

	To All country			To China		
Time	Original	Predict	Percentage	Original	Predict	Percentage
Jan-24	62937.30	63213.47	0.44%	2277.50	2558.05	12.32%
Feb-24	66393.80	63444.48	4.44%	2564.00	2578.02	0.55%
Mar-24	63017.50	63105.69	0.14%	2367.90	2591.42	9.44%
Apr-24	64458.50	63334.53	1.74%	2378.40	2604.12	9.49%
May-24	62987.40	63583.34	0.95%	2513.90	2615.58	4.04%
Jun-24	65918.00	63221.38	4.09%	2538.00	2625.41	3.44%
Jul-24	65658.00	63251.48	3.67%	2729.50	2633.33	3.52%

Table 1 and Table 2 show the original data and predict data for Canada's import and export values. We also calculate the percentage about  $\frac{Original - Predict}{Original}$ . Most of the percentages are below 5%. Therefore, we can think that the fitting effect of our model is good and we can use this model to predict future net exports.

## Conclusion

Our project provides a comprehensive analysis of Canada-China trade relations over the past decade, identifying key trends, challenges, and potential growth areas. The findings reveal that Canada's trade with China has experienced notable fluctuations, largely influenced by geopolitical events, global economic shifts, and the COVID-19 pandemic. Import and export values have grown, with China playing a dominant role as a manufacturing hub and Canada relying heavily on natural resource exports.

The study highlights several critical factors shaping trade dynamics, including Canada's dependence on Chinese manufacturing and China's demand for Canadian natural resources. The trade imbalance, with Canada importing more manufactured goods while exporting raw materials, presents potential risks, such as vulnerability to supply chain disruptions and commodity price volatility.

Using ARIMA models, the project effectively forecasts future trends in trade, showing a reliable fit between predicted and actual data. This model provides valuable insights for policymakers and investors, helping anticipate future shifts in trade dynamics and offering strategic guidance for optimizing trade policies and agreements.

In conclusion, Canada-China trade relations are expected to continue evolving, with opportunities to diversify trade, reduce reliance on specific sectors, and strengthen economic cooperation in the years to come. For Canadian investors, they would be suggested to focus on the natural resources sector, particularly agriculture and mining, as these industries have stable demand in the Chinese market and show significant growth potential. Meanwhile, it is advisable to invest in local manufacturing and high-tech manufacturing to reduce reliance on imports from China. Additionally, the rapidly growing e-cigarette and alternative tobacco market presents a promising investment opportunity.

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