Impact of Exchange Rate Volatility on International Trade: Case of USA and Canada

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ARTICLE INFO	ABSTRACT
	Purpose: The aim of this study is to investigate the impact that exchange rate volatility has on international trade flows including here exports and imports. **Design/methodology/approach:** This study is based on quarterly data from 2000-2018 making 224 observations in total. To measure the relationship between the chosen variables, it was used VAR-Vector Autoregressive Model. One of the main advantages of this model is traced back at the fact that it allows for dynamic relationship specification. Given that we are dealing with financial and macroeconomic variables, the role of each variable cannot be expected to be immediately monitored. On the contrary, it could be expected that it takes time for the interrelationships to be obvious and manifested. All this justifies the use of VAR. In total, two equations each with three independent variables are used to answer to the research question. Regressors are selected after a deliberate literature review and they are: price level, GDP, exchange rate and its volatility. **Findings:** The results suggest that there exists indeed an impact of exchange rate volatility on international trade among the US and Canada. This relationship seems to be changing among months and at different levels of significance. The final findings indicate a positive long-run relationship between exchange rate volatility and exports. These results are in line with the findings that other researchers have concluded in their studies. Regarding the imports, there exists a long-run relationship, but its impact differs in different periods. **Research limitations/implications:** One of the limitations and also a recommendation for improvement, is the number of explanatory variables. This came as a result of some lack of data for the included period. **Originality/value:** This topic is not only of great importance to policy maker, but it is also an added value to the current literature on the matter as it provides a thorough up-to-date analysis. It also draws on a sample of considerable size, thus providing consistency.

1. INTRODUCTION

1.1 A Brief Historical Background on the Matter

For a country operating under the fixed exchange rate regime, the term volatility would be either unfamiliar or quite irrelevant. In contrast, being under a free-floating exchange rate regime exposes all parties involved and the country as a whole to the risk of unexpected exchange rate fluctuations which in turn affect the outcomes to trade. This is a phenomenon that countries all over the world are facing on a regular basis and have learnt to cope with.

From the end of World War 2nd until the collapse of Bretton Woods System, international trade worldwide took place under a fixed exchange rate regime. After 1973, countries turned to free-floating exchange rates, fully determined by market forces, thus raising the risks of unpredictable exchange rate volatility. As globalization started to spread across the globe, the importance of international trade flows (e.g. exports, imports) increased, as more and more countries shifted from closed economies to open ones. At the same time, the exposure to foreign exchange rate

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risk increased. They needed to minimize the risk, while still benefiting from the international cooperation and collaboration which brought economic benefits and others alike. As the saying goes, the risk and return go hand in hand in finance world; yet the idea is to undertake investments which are characterized by reasonable levels of risk so as to incur minimal financial losses.

The impact of exchange rate is noticed in the trade surplus or deficit. If we are dealing with a weak domestic currency, exports are encouraged while imports get more expensive, and vice versa happens with a strong domestic currency. Trade surplus and deficit play an important role also in the economic growth. Trade surplus has the good impact on the economic growth, when exports are higher than imports. In this case, it means that the country has a higher output from its factories and more employed people. Higher exports mean a high flow of fund in the country and this raises the consumer spending leading to a positive impact on the economic growth. In any case, for a healthier economy it is better when there are high imports and exports which leads to a stronger economy.

As the phenomena spread together with the concern of investors and other involved parties, so did the term Foreign Exchange Rate Risk (FER). Such term emerged so as to show the likelihood that a certain individual can incur financial losses due to unexpected appreciation or depreciation in the value of a currency during a certain period of time, which is used as the main medium of conducting the said trade transaction. If we turn to some simple math logic, for sure we expect that the "quantity of money at stake" depends on a variety of factors where two are quite straightforward:

-The amount of change in the value of one currency against another

-The total amount of exposure (said transaction)

The larger these two elements, the greater the risk is in times of massive instability and uncertainty.

However, it must be emphasized that here even behavioral science does play a huge role. Even though sometimes the underlying economic factors do not lead to a certain phenomenon, if there exists a wide-spread belief about a matter of financial nature then due to the behavior of the involved parties, the expected outcome will emerge. As said earlier this will not be the result of the existing circumstances that were before, but simply a result of investors' expectations and their consequent behavior (Rodriguez, 1974).

1.1.1   A time Evolution of International Trade – USA Case

Starting with the ruling of Theodore Roosevelt, United Stated became a significant player in international trade, particularly with its neighboring regions. Trade policy in United States has developed significantly in the long time since the entry of milestone 1934 Reciprocal Trade Agreements Act (RTAA). At the start of this time, the US and its partners had set up high import taxes. At that time, there were no international agreements that would settle some ground rules for trade among countries. The existing ones were mostly on bilateral basis and more in manufacturing goods and trying to lower or eliminate import taxes. Starting from then, many obstacles have been lowered or eliminated between US and its trading countries. Its first Free Trade Agreement was in 1985 with Israel. After that, US made another agreement with Canada which was Canada – United States Free Trade Agreement in 1988 which later was superseded by the NAFTA (North American Free Trade Agreement). NAFTA was established in 1994 and it was between US – Mexico – Canada. Nowadays, United States is one of the leading countries in the free trade movement, being part of large groups such as General Agreement on Tariffs and Trade (GATT).
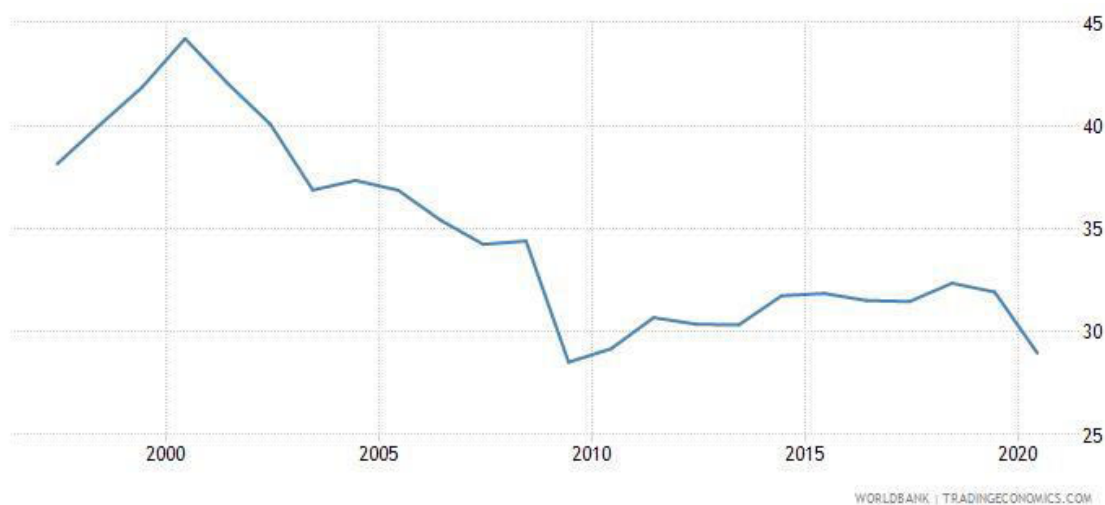

Figure 1.1 Canada – Exports of Goods and Services as share of GDP

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1.1.2   A time Evolution of International Trade – Canada Case

International trade seems to be considered the soul of the Canadian economy (see Figure 1.1 and Figure 1.2). The country, through years, relies in its exports and imports, especially during the huge development of worldwide trade, the decades following the Second World War, to help their rising standards of life. With the new findings in different areas, improvement of technology, information, the country was led to new ways of development of new goods and services and trading them. The lowering of trade barriers, definitely has had huge effects in the economy of the country, prompting in efficiency, furthermore expectations for life standards. The country's exports have had a fast increase after the adoption of NAFTA. Being such an important factor to the economy, the country has made many bilateral and multilateral trade agreements with many countries. Some of the countries that the Canada has Free Trade Agreements (FTAs) are: Chile, Costa Rica, Colombia, Honduras, Israel, Korea, Jordan, Panama and Peru. Other FTAs the country has are: European Free Trade Association (EFTA) and Comprehensive Economic and Trade Agreement (CETA). Lately the country has suffered some decrease in exports, but the Bank of Canada is taking the proper measures in gaining the desired results. In a speech held by the Deputy Governor of the Bank of Canada, Timothy Lane, it was said that the bank is building new proportions that better catch the competitiveness of the country, relative to their export market as well as compared to third nations (Lane, 2017).
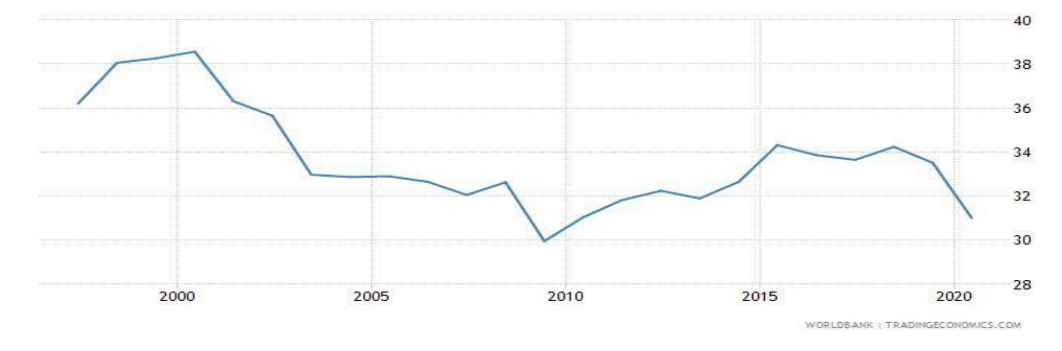

Figure 1.2 Canada – Imports of Goods and Services as share of GDP

1.2 Main Components of International Trade flows

International trade incorporates many elements, yet an important term tightly connected to it is International Trade Balance. The latter is explained by the difference of imports and exports. Import means foreign goods coming in the country while export means domestic products traded outside the country. These variables are also included in the four components of GDP as a difference between each other (X=E-I). They are the primary indicators for the country's international trade which is important for the growth of the economy. Higher exports are better than higher imports and, in this way; a positive net export can be achieved.

Nevertheless, the pool of factors affecting international trade flows is not restricted to exchange rate risk and FDI. Researchers have found that there are plenty political, macroeconomic and financial variables that do impact the trade flows in international level. Among such authors are: Boateng et al. (2015), Uddin et al.(2019), Kayalvizhi & Thenmozhi (2018), Slaveski & Nedanovski (2000).

1.3 Research Questions and Motivation

Studying the role of risk and its exposure on various investment decisions it is really important in the world of finance. In this thesis we go further. The thesis tends to examine, critically analyze and measure how the volatility of exchange rate between US and Canadian Dollar affects the respective trade flows between two of the largest economies in the world.

In short, driven also by my personal interest on the matter I will try to answer the following:

-Which is (if any) the role of Exchange Rate Volatility on imports and exports between the selected countries.

1.4   Scope of the Study

This study focuses only on the case of USA and Canada. It investigates the international trade flows between these two countries since they are among the strongest and largest economies in the economic arena in a global level. Checking the pattern and the results of the analysis for these two countries can be really informative and useful to the practitioners, academicians, investors and policy makers worldwide.

2. LITERATURE REVIEW

2.1 Some International Evidence on the Matter

Based on a qualitative method, an analysis was done with the purpose to find out the possible positive effect that the volatility has on national productivity and labor demand which lead to an impact in exports too. It is said that while the RER volatility goes up, at the same time are increased also the export opportunities to the world market (Broll & Averlant, 2010). In this study, it was said that volatility does impact the international trade, but there are a lot of studies that concluded the opposite.

A study by Crowley & Lee (2003) suggests by their findings that the relationship between exchange rate volatility and investment is very weak in case that the volatility would be low, but stronger if the opposite happens with the volatility of exchange rate.

Like the previous study, in a sample of twelve African countries, it was found that indeed exchange rate volatility has an impact on trade flows in many of the countries. But this impact changes when it comes to short-run and long-run. In short-run, the impact was on many of the countries, while on long-run the impact was only on export in five countries and only on import for one country. At the same moment, the study states that economic activity level in the world and at home, are major determinant of exports and imports (Oskooee & Gelan, 2018). In another study conducted by Senadza & Diaba (2017) for Sub-Saharan Africa, were found almost the same results. It was found no significant impact of volatility on import, while in short-run and long-run was found a negative and positive impact of volatility on exports respectively. The study was conducted over the period 1993 to 2014.

Two researchers, Calderon & Kubota (2018), conducted a study to find whether the composition of international trade facilitates the impact that shocks have on real exchange rate for 82 countries. Indeed, their study found an impact proving that it is important for real exchange rate stability. It was shown that trade done in manufacturing can decrease RER volatility and the opposite happens with trade in non-manufacturing.

Another study, done on the bilateral trade between Korea and Japan, analysis the short-run and long-run effects on trade flows coming as cause of the changes in exchange rate. With the usage of ARDL approach, findings indicate that in short-run, there is indeed an impact on the exports and imports of Korea by the bilateral exchange rate, but not that sensitive in long-run (Baek, 2013). Continuing with Japan, a study by Oskooee et al. (2016) is conducted to observe the commodity trade with Pakistan (2016). Taking in consideration 44 Pakistani export industries to Japan and 60 Pakistani import industries from Japan, was found that not many of these industries, short-run nor long-run, were impacted by the volatility of exchange rate. Also, in Nigeria, a study (Osinubi & Amaghionyeodiwe, 2009) showed that foreign investors need not to worry about the volatility of exchange rate.

In 2013, a study was conducted on the effects of exchange rate volatility in the RMB-JPY rate on the trade between Japan and China. The study was based on data between January 2002 and December 2011, but focusing more on the period after January 2005 which consists with the time when a new reform was done on the exchange rate regime. This reform came after more than a decade carefully pegging the renminbi to (RMB) to the U.S. dollar at a swapping scale of 8.28 and it reevaluated the currency and a change of the conversion scale system. The revaluation sets the renminbi at 8.11 against the dollar, which adds up to a valuation for 2.1%. Under this reform, instead of referring only to one currency, the People's Bank of China will create a pool of currencies while picking its target for their currency. In the paper were used two methods to measure the volatility: AR-EGARCH model and the other one is standard deviation of daily changes of exchange rate. For defining the short run and long run impacts of different variables in exports of these two countries, was used the ARDL approach. Based on the findings, it seems that the volatility has no impact on the Japan's exports to China, but a negative one was found on the China's exports to Japan which seems to be during the reform. China seem to be more sensitive toward the exchange rate risk. High volatility is more likely to affect China's exports to Japan (Nishimura & Hirayama, 2013).

In 2014, a study was constructed taking in consideration bilateral trade between Czech Republic and its major trading partners. By using Johansen cointegration test, with quarterly data, it was found that volatility does not have any clear effect on trade flows (Šimáková, 2014).

Another study examines the possible impact that the exchange rate uncertainty has on the exports in the Southeast Asia, more precisely for the ASEAN-5 group (Thailand, Malaysia, Singapore, Indonesia and Philippines). The model used includes world output, domestic output, terms of trade and volatility. To estimate volatility, is used the GARCH model while for the relationship is used the Johansen-Fisher panel cointegration test. Findings say that a change in both, world and domestic output, leads to a positive impact on the amount of exports, whereas a depreciation in exchange term has a negative impact on exports. Lastly, it was found that the volatility of exchange rate has indeed a negative effect on the exports of ASEAN-5 group. The study suggests that despite of the fact that getting rid of volatility is not conceivable, there can be found other ways of keeping it in control in order to minimize the fluctuations through the government and the central banks (Upadhyaya et al., 2020).

An analysis by Oskooe & Kovyryalova (2008) implemented on the trade between UK and USA, uses annual data for the period 1971-2003 with 177 product exchange. This study tends to find the effect that the volatility of exchange rate has on the trade based on disaggregate exchange data in order to avoid the aggregation bias problem. The results have shown that in short-run, the volatility of exchange rate (GBP/USD) is a huge impact on imports of 109 businesses and 99 exports. Most of the time this impact is negative. But in the study is noticed that during the long-

run, for a huge part of the cases, these effects are somehow lowered. In long-run, the imports of 62 businesses and exports of 86 are affected. Yet, when considered in the overall findings, in most of the cases the impact seems to be negative.

2.2 Research on USA and Canada

A study conducted by Belanger et al. (1992), focused on the trade between Canada and US in five sectors, concluded that there is no significant relationship between the exchange rate volatility and the trade between the two countries. Exchange rate volatility did not decrease the volume of trade significantly.

In contrast, Choudry (2005) found that there is indeed a significant impact of the exchange rate volatility on exports and this impact seems to be negative. Continuing with the Canadian exports to US, the results of the study by Lee (2003) do not show a long-run relationship between export, foreign income, relative price and exchange rate volatility while ARDL models used in the study estimate that in short-run there is indeed an adverse effect on exports.

Opposite from the study of Choudry (2005), McKenzie & Brooks (1997) in their analysis conducted with focus on the impact exchange rate volatility on Germany-US bilateral trade flows, found a positive relationship between exchange rate volatility and trade flow by using ARCH derived measure for volatility.

Recent years many studies have been done using industry levels data to many countries in order to find out which commodities trade are more sensitive to the volatility of exchange rate. This model is used also in a paper conducted on the USA-Chile trade by Oskooee et al. (2014). The study brings new insights in the aggregate trade and 49 individual industries. By using the ARDL cointegration method, it was found that 10 out of 40 interacted enterprises have encountered with an improvement on their trade in the long-run, after the deterioration of dollar. Then by the J curve, was found that only nine industries pursue such an example.

Another study by using disaggregated data for the time spam from 1989-2002, monthly based, tries to bring a new insight in the impact that the exchange rate volatility in each component has on the trade of USA with Canada, Germany and Hong Kong, employing a technique that enables decomposition of movements within the rate of exchange to changes within the basic and impermanent elements and measure of the corresponding volatility. Findings show that the effect of the volatility coming from the basic components of the bilateral trade, differs through the product types. Meaning that a higher volatility caused by the basic components causes an increase in the amount of trade for some products and a decrease in the amount of trade for some other. This can be as a result of the fact that traders find different ways to cooperate with the volatility that they face, and these ways are different for different products. While, regarding the impermanent or transitory elements, the volatility being caused by this fact, seem to have a negative on trade for both aggregate and disaggregate product levels. Study found that if uncertainty and volatility is high, this leads to a decrease in the amount of trade (Tadesse, 2009).

Continuing with the usage of disaggregated data, this study analysis the impact that the volatility of exchange rate has on the trade between USA and Korea for ten industries. Taking in consideration the role of volatility and the third country, the ARDL method is generated for imports and exports apart with the purpose to have more accurate results. It was revealed that Korea's larger export manufactures like machinery and transportation articles were very sensitive to the bilateral exchange rate, volatility and third country in short and long-run. While its imports were unresponsive to all the mentioned variables in short and long-run. All in together leads to the conclusion that the devaluation of the Korea currency can have a positive impact in short and long-run on the Korea's amount of exports. Also, the economic growth is considered to be very important and has a key role in influencing the trade between these two countries (Baek, 2014).

2.3 The Identified Literature Gap

Analyzing the literature review on US-Canada, is noticed a lack of studies. Not many studies are conducted on the bilateral trade between these two countries and the possible relationship between exchange rate volatility and international trade in terms of exports and imports. This study will be an addition to the literature review and also it will be an up-to-date analysis.

3. METHODOLOGY

3.1 Data Selection

In this paper, dependent variables will be exports and imports as they are the main components of international trade. As independent variables, for the analysis are chosen: GDP, CPI, exchange rate and volatility. Exchange rate is used only to find the volatility and not included in the model.

Below a brief explanation of the independent variables is given, and what their plausible effect can be.

Firstly, let's start with Growth Domestic Product (GDP). GDP is an indicator that shows the total value of goods and services of a country within one year. All researched use GDP as an indicator for the economic growth of one country as it better explains the economy of one country from one year to another. Being hard to find monthly data for GDP, researchers try to use a proxy to explain it. As some researchers do, the Index of Industrial Production (IIP) is chosen as a proxy for GDP. IIP is a monthly measure of the trend of Gross Domestic Product.

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Another explanatory variable is Consumer Price Index. It is a measure of the average changes in the price level of market basket of consumer goods and services purchased by households. The goods sold in daily basis to an average consumer, is where CPI has its focus. If there occurs an increase in CPI, it is considered as an indicator for inflation and vice versa, a decrease in CPI shows deflation. It is closely related to interest rates which can impact exchange rates. A very high inflation can have a direct influence on input costs, which can affect exports. These increasing expenses may lead to a significant impact on export competitiveness in the international market place.

Our next variable is exchange rate. It is the rate at which one currency will be exchanged for another one. Also, it is explained as the value of one country's currency to another country's currency. Its effect is very important since both countries chosen for this research, operate in a free-floating exchange rate. Based on the data found, the exchange rate volatility is generated.

These all are important components of calculating the GDP of a country: GDP= C+I+G+ (X-M),where C is consumers spending, I are investment spending, G are government spending, X are exports and M are imports.

And the last variable is volatility. Operating in a free-floating exchange rate regime, volatility is always expected to be there. It represents the degree to which a variable change over time. The more it changes, or the quicker it changes over time, the higher will be the volatility. High volatility might make decisions harder for international trade and investments.

3.2 Sample
This paper takes as case study the countries USA and Canada. Data are retrieved from reliable sources which consist of official websites of the countries and they belong to the period 2000-2018. Total number of observations is 224 since data are taken monthly based. They are retrieved from official websites such as World Bank and also the official pages of the countries such as: U.S. Bureau of Economic Analysis and Bank of Canada. Cross checking was done on different sources in order to make sure about the reliability of the data selected for the model.

3.3 Research Method
The method used for the study is quantitative research. This research draws a linear regression with the aim to explain international trade regarding exchange rate volatility by using three independent variables. The variables that are included in the model (mentioned above) were chosen based on the literature review McKenzie & Brooks (1997) and the availability of the data. Unlike other studies that focused on one variable, here all the variables are gathered in one model to have a clearer idea of the impact that volatility has.

Regarding the method used, many researchers use different ways to find the relationship between the variables. Mainly in the studies, the ARDL method approach is noticed to have been used to analyze the relationship. Baek (2014), Oskooee et al. (2014), Lee (2013), Nishimura & Hirayama, (2013) and other researchers use the ARDL method in their studies. Other researchers such as: Upadhyaya et al. (2020), use Johansen-Fisher panel cointegration test, while Renani & Mirfatah (2012), use Johansen and Juselius's cointegration approach. Different from the methods mentioned above, this research will be using the abovementioned variable in order to explain all the bidirectional relationships that might exist between each variable and lags of itself as well as lags of other variables by using a VAR model.

Vector Autoregression (VAR) Model is a model used to show the linear interdependencies among multiple time series. It is used to determine whether a long run relationship exists among variables. At the end, there are given individual equations for each one of them, but our focus will be only in the ones that explain the dependent variables used in this paper.

Regarding the volatility, again there are different methods that can be used. One of the mostly used in the studies above, were the ARCH and GARCH methods (ex.: McKenzie & Brooks (1997) used ARCH method, Upadhyaya et al. (2020) used GARCH method, etc.). Nishimura & Hirayama (2013) used two methods for volatility: 1. AR-EGARCH model and 2. Standard deviation of each daily changes of exchange rate. Based on the literature review, it was decided to use the standard deviation method to measure the volatility of exchange rate for each month.

3.4 Robustness Test
In order to be able to use VAR model and for the model to work, all variables have to be stationary. In the first test, the results showed that GDP was not stationary. For this problem to be fixed, all data were generated again at first difference to ensure that all variables are stationary. It was conducted the unit root test of Philips Perron and it seems that at first differences the problem of spurious regression is not present. Said that, all the variables are integrated of order I (1); hence were included all explanatory variables and the explained variables in this form. Lastly, the relevant assumption of stationary is satisfied as well (see Table 3.1). This means that there exists enough evidence to reject the null hypothesis.

Table 3.1 Unit Root Test (Philips Perron Test)

Null hypothesis: *The Variable is Non-Stationary (It has a unit root)*

			Adj. t-Stat	Prob.*
cpicanada	Phillips-Perron test statistic		-13.587	0.0000
			Adj. t-Stat	Prob.*
cpiusa	Phillips-Perron test statistic		-9.4382	0.0000
			Adj. t-Stat	Prob.*
Exchange rate volatility	Phillips-Perron test statistic		-178.55	0.0001
			Adj. t-Stat	Prob.*
exports	Phillips-Perron test statistic		-108.05	0.0001
			Adj. t-Stat	Prob.*
gdpcan	Phillips-Perron test statistic		-88.685	0.0001
			Adj. t-Stat	Prob.*
gdpusa	Phillips-Perron test statistic		-42.659	0.0001
			Adj. t-Stat	Prob.*
imports	Phillips-Perron test statistic		-116.54	0.0001

After making sure all variables are stationary, next step is to decide the lag length criteria for the VAR model. AIC is widely used in the length specification criteria and is said that the lag with the lower AIC, is better. By checking the results (see Table 3.2), it is noticed that the lowest AIC is at lag length 8. This means that our optimal Lag Length based on AIC is 8.

Table 3.2 VAR Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3681.425	NA	2204743.	34.47126	34.58136	34.51575
1	-3215.493	897.0269	44793.10	30.57470	31.45552*	30.93063
2	-3132.179	154.9496	32548.28	30.25401	31.90554	30.92137*
3	-3101.416	55.20043	38731.65	30.42445	32.84669	31.40325
4	-3025.050	132.0350	30190.85*	30.16869	33.36165	31.45893
5	-2995.636	48.93147	36651.16	30.35174	34.31541	31.95342
6	-2946.763	78.10558	37294.04	30.35292	35.08731	32.26604
7	-2890.348	86.46831	35597.62	30.28362	35.78872	32.50818
8	-2826.175	94.15962*	31850.98	30.14182*	36.41764	32.67782
9	-2787.084	54.80049	36361.89	30.23443	37.28096	33.08186

Prior the generation of the VAR model, LM test was computed to check whether there exists serial correlation in the residuals. Based on the obtained results, the null hypothesis (No serial correlation at lag h) was rejected.

In the Table 3.3, found below, as the final results suggest, there is not enough evidence to reject the null hypothesis meaning that no serial correlation exists at lag 8.

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Table 3.3 Serial Correlation LM Test

VAR Residual Serial Correlation LM Tests

Included observations: 222

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	149.6618	49	0.0000	3.209498	(49, 1024.9)	0.0000
2	70.71382	49	0.0228	1.459458	(49, 1024.9)	0.0229
3	82.87022	49	0.0018	1.720420	(49, 1024.9)	0.0018
4	80.15747	49	0.0033	1.661923	(49, 1024.9)	0.0033
5	63.18139	49	0.0838	1.299271	(49, 1024.9)	0.0840
6	87.37251	49	0.0006	1.817841	(49, 1024.9)	0.0006
7	63.08152	49	0.0852	1.297155	(49, 1024.9)	0.0853
8	61.58545	49	0.1070	1.265479	(49, 1024.9)	0.1072

The results gained after conducting the serial correlation LM test, show that at a lag length VAR Model of order 8, the problem of serial correlation in residuals is fully mitigated. That said, we are able to satisfy the respective Gauss Markov Assumption.

With respect to assumptions related to Random Sampling and Normality in residuals, it can be said that both of them are automatically satisfied.

4. DISCUSSION AND RESULTS

4.1 VAR Model Specification

To achieve the results, as mentioned above, the analysis will be based on two models as specified below:

- $E_t^{US} = f\{G_t^{US}, G_t^{Can}, P_t^{US}, P_t^{Can}, X_tV_t\}$

- $I_t^{US} = f\{G_t^{US}, G_t^{Can}, P_t^{US}, P_t^{Can}, X_tV_t\}$

Where, E_t^U are exports of US with Canada and I^{US} imports of US with Canada. G_t stands for Gross Domestic Product, P_t for Consumer Price Index, X_tV_t for exchange rate volatility and for this, the exchange rate of USD/CAD is used.

Based on this model, the sequent analysis will be conducted to check the relationship between exchange rate volatility and the other variables. For our analysis, we used dynamic specification, a VAR model of order 8 decided based on the lowest value of Akaike Information Criterion. Prior running the main model, we ran a simple regression analysis, just for testing, using as dependent variables imports and exports and as independent variable only exchange rate volatility.

4.2 Empirical Findings & Discussions

To provide an analysis on the impact of exchange rate volatility to international trade, the VAR model is used, which gives us the chance to interpret the bidirectional relationship between variables and their lags. Also, as mentioned above, the results gained from the simple regression, showed that there is no significant relationship between exchange rate and imports/exports. This means that there is no impact of exchange rate on the imports and exports.

As mentioned above (Table 3.2), using Akaike Information Criterion was decided that the optimal lag length to estimate our VAR model is of order 8. After deciding the lag length and all the tests explained above, the model was generated to provide us dynamic results due to lag length. All obtained results are explained below.

Main focus of the research are the models that explain and give the answer to the research question mentioned in the beginning. Further to the obtained results (see Appendix A), it is noticed that the first significant model is Exports of US to Canada as a dependent variable. As results indicate, there is a relationship between exports of US to Canada with the following variables: price level of US, GDP of Canada, GDP of US, imports, its own lags and exchange rate

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volatility. Considering all variables one by one, it can be seen that CPI of US has a significant impact at lag (-7) and (-8). Since for t-statistics the absolute value of a result higher than 1.645 the significance level is 10%, based on these results, it can be said the same for CPI in both periods. This means that an increase on the CPI, will show a positive impact on exports after seventh month, but it will be changed to a negative one after eighth month. Continuing with the GDP of Canada, there is a significant relationship with the exports at lag (-5) with a negative impact and later a positive one after the eighth month, at a significance level of 10%.

Also, an increase in the current GDP of US, has a positive impact in after second, third and fourth month, but no relationship or impact after that. At second month, the significance level is 10%, but it changes for the third and fourth month. Since the t-statistic value at that period is higher than 1.95, there is a significance level of 5%. These results are also supported by the research conducted by Baek (2014) where the results state the economic growth has a significant role on trade. Also imports seem to have a significant impact on exports after the fourth month at a significance level of 10% and at fifth month at a significance level of 10%. After fifth month, the results show no significant impact on exports. Coming to the final independent variable included in the model which is exchange rate volatility. As seen in the results, volatility of exchange rate has a significant impact on exports at lag (-1) at 5% significance. This means that an increase in the current exchange rate volatility, will have a positive effect after the first month. A significant positive impact is also noticed after the seventh month but based on the value of t-statistics the impact is at significance level of 10%. Based on the results, exchange rate volatility has a positive impact on exports which complies with the findings of Senadza & Diaba (2017). Also Baek (2014) and McKenzie & Brooks (1997) suggest a positive impact of exchange rate volatility on exports after the devaluation of exchange rate.

The analysis continues with the next model where imports are the dependent variable. Based on the results gained by VAR model, it can be noticed that there exists a significant relationship with the independent variables: price level of USA, exports, GDP of USA, with its own lags and exchange rate volatility. At significance level 5%, there is a positive impact of price level on exports after first month which later after the second month it is converted into a negative one. After second month, results show no significant impact anymore. After price level, also exports show a negative and positive significant impact on imports after fourth and seventh month respectively (based on t-statistics at 5% significance level). The results indicate no impact of GDP of Canada on exports at all periods, while the USA GDP shows an impact after the first month at significance level 5% and an impact after fourth month, but at significance level 10%. This means that an increase on GDP will cause a positive impact at both periods. After the fourth month, there is no impact anymore. Coming to the last variable, it can be seen that the results indicate firstly a positive effect of exchange rate volatility on exports at the lag (-1). This means that an increase on the exchange rate volatility, will give a positive impact after the first month at a significance level 5%. While after the fourth month, there exists a negative relationship between these two variables, meaning that an increase on the exchange rate volatility will lead to a negative effect on imports and after that no significant impact is noticed in the model. Also Oskooe & Kovyryalova (2008) in their research support these findings based on their analysis. They also indicated a negative impact of volatility on imports.

Looking at the overall results, it is noticed that for some variables, the relationship among variables changes among different months. Taking a look at exchange rate volatility as an independent variable, we can notice that it has an impact on other models too. For the price level of Canada there is no significant relationship at all, meaning no impact while on the other hand, on the price level of USA, there is a significant positive impact after first month and sixth one. Regarding the GDP of each country, the results indicate a negative impact on the GDP of Canada after fourth month and later no impact at all. At that same period, a negative impact is noticed also on the GDP of USA later to be followed by a positive one after sixth period.

5. CONCLUSIONS

5.1 Final Findings

International trade flows have always been considered the cornerstone of innovation, economic growth and progress. Their influence can be spread in various aspects and fields, yet various hazards and risks exist. Knowing that currently currencies around the world are subject to free forces of the market (i.e. demand and supply), the fluctuations in the rates of exchange and cross rates can be huge. This gives rise to what is known as Foreign exchange risk.

This thesis builds on secondary data collected over a 19-year period, so as to answer the research question on how the above-mentioned exchange rate risk affects the trade flows in international level and more specifically between US and Canada. VAR model is used so as to check in a dynamic way the direction, strength and statistical significance of the interrelationships between on one hand: GDP, CPI, exchange rate and volatility and on the other: exports and imports between the two studied countries.

The results suggest that there exists indeed an impact of exchange rate volatility on international trade among the US and Canada. This relationship seems to be changing among months and at different levels of significance. The final findings indicate a positive relationship in long-run between exchange rate volatility and exports. These results are in line with the findings that other researchers have concluded in their studies. Regarding the imports, there exists a long-run relationship, but its impact differs in different periods. Also, other researchers indicate in their studies that

the gained results are not that consistent, and change based on data, countries and industries involved. There exist periods when a change in exchange rate volatility brings no impact on exports nor imports. A potential clarification for such results can be the increase of subsidiary instruments such as option and future which make it possible for investors to be preventive to the riskiness of possible profits that arise by the fluctuations of prices and exchange rates. Also, another implication can be the fact that there are multinational companies, corporations that operate worldwide and the losses that can be suffered by the volatility of a currency can be recuperated with the profits coming from the fluctuations of another currency. All these fluctuations caused by the volatility of exchange rate suffered an increase after the Bretton Woods collapse. Due to the fact that the market sharers are risk averse, this brought an increase in the future market. The more they grow, more inconsistent impact there will be. Also, as can be seen in the literature review, there were cases when there was no impact on trade or significant impact but weak. Another key point to be mentioned is the fact that developing countries would be more impacted by these fluctuations than the developed ones due to the fact that their markets are not yet that strong.

All in all, it seems that all authors have found different results of exchange rate volatility impact that come as a result of the countries with different economies that are studied in different periods. This makes it difficult to generalize the significance of the impact of exchange rate volatility. However, our study focuses on the existence of this relationship between two trading partners USA and Canada. For the imports, results suggested different impact after different periods but after the fourth month no relationship at all. While for exports we have a positive long-run relationship between them. The chosen countries are both developed economies and have already developed ways to prevent and absorb the possible risks that might encounter from these fluctuations.

Variables (lags)	Exports		Variables (lags)	Imports
CPI_USA (-7)	+		CPI_USA (-1)	+
GDP_CAN (-5)	-		GDP_USA(-2)	-
GDP_CAN (-8)	+		EXPORTS (-7)	+
GDP_US (-2) (-3) (-4)	+		GDP_US (-1) (-4)	+
IMPORTS (-4) (-8)	-		ERV (-1)	+
IMPORTS (-5)	+		ERV (-4)	-
ERV (-1) (-7)	+			

Note: + positive impact, - negative impact, ERV Exchange Rate Volatility

Figure 5.1 Summary of the Final Findings

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