Fundamentals of the Canadian Dollar and the Prevalence of the Dutch Disease

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Abstract

The purpose of the paper is to discuss the factors affecting the Canadian dollar and determine whether it is a commodity driven currency. It further assesses whether the Dutch disease is prevalent in Canada. While much research has been done to explain exchange rate movements, it remains one of the more complicated areas of economics. However, there is some common ground among the various models, and several basic determinants of the exchange rate may be identified. Modification to these models may be applied for specific situations as in the case of Canada, where commodities are found to be one of the important components of exchange rate models. In Canada's specific case, commodities form an esstial part of the overall economic output. Therefore their inclusion in such models is necessary. With a large commodity trade portfolio, the country is susceptible to the Dutch disease in cases of a commodity boom. However, research shows that in the case of Canada, it is not a problem of currency appreciation but external factors leading to depreciation of the currency of their largest trading partner, the US. Therefore, the Dutch disease may not be prevalent, but the lack of diversification in the trade portfolio may be leading to negative effects ON the manufacturing sector. A similar effect is reflected by the empirical findings where commodity driven currency appreciation is negatively related to manufacturing output. However, given the multiple economic interactions, these results should be treated with caution.

Keywords: exchange rate, Canadian dollars, commodity-driven currency, Dutch disease, manufacturing output, productivity

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Introduction

Canada is one of the larger economies of the world and a member of the Organization for Economic Cooperation and Development (OECD) and the Group of Seven (G7) countries. The services sector accounts for most of its output followed by manufacturing and then other sectors. It is among the leading countries in forestry products but also has other commodities and manufactured goods in its trade portfolio, which forms a significant portion of the total economic output. Proximity to one of the largest economies of the world, the US, has led to it being Canada's major trading partner accounting for the bulk of Canadian exports.

A large manufacturing base and a resource-rich land in energy and non-energy commodities make it a formidable competitor in international trade. However, its proximity to the US has, naturally, resulted in a major portion of its exports going to them, thereby leaving Canada with massive exposure to the US economy. Since the adoption of the floating exchange rate, the existence of this exposure is more emphasized as it has made Canada more susceptible to exchange rate variation and the lack of diversification has led to severe problems for the local economy (Blecker & Seccareccia, 2009; Mundell, 1961).

Various models and theories have been used to explain the exchange rate fluctuations, but the increasing complexity of the global exchange rate movements introduces a weakness in the explanatory power of these models (Ozbilgin, 2015). Since the trade, especially commodity trade, forms a significant portion of the Canadian economy, these models include a component of commodity prices, but volatile commodity markets result in these models either becoming outdated, applicable in some time periods and not in others, or vulnerable to failure to capture exchange rate fluctuations.

In light of this situation, the main purpose of this paper is to discuss the factors affecting the Canadian dollar and determine whether it is a commodity-driven currency. It will further look into the phenomenon of the Dutch disease and discuss if it is prevalent in Canada.

Explaining Exchange Rate Fluctuations

Developments in Exchange Rate Models

In most cases, research agrees on the ability of models to predict exchange rates. While interest rate differentials satisfactorily predict short-term movements in exchange rates, macroeconomic fundamentals can well explain long-term currency trends. Various models can explain exchange rate movements, but results remain inconclusive. A range of factors are proposed to be affecting exchange rates, and the list of these factors has expanded over the years. An important and widely applied work, concerning exchange rate movements, belongs to Balassa (1964) and Samuelson (1964). They respectively showed that absolute purchasing power parity (PPP) could not, by its very nature, provide an unbiased prediction of the exchange rate.

Balassa and Samuelson’s assertion is based on the productivity differences between two economies, which renders the absolute PPP a biased predictor variable. At the root of this phenomenon is the difference between tradable and non-tradable goods sectors. A high-income economy will have higher productivity in the tradable goods sector, which would push wages up and make non-tradable goods more expensive than in a lower income economy. In the long run, the productivity difference will lead to a significant deviation in the PPP trend. This brings inflation into play, that is, the relative price levels between the two countries, which will determine the exchange rate movement.

However, later empirical evidence shows that, while Balassa and Samuelson were on the right track, their conclusion may have been misplaced. Canzoneri et al. (1999) find that relative prices were more closely related to labor productivities rather than the difference between tradable and non-tradable goods. That is because the law of one price does not hold for tradable goods and, since the Balassa-Samuelson model relies on the price equalization of tradable goods over time, the model fails as a good predictor of exchange rate movements. Meanwhile, the relative price level of non-tradable goods showed a significant relationship with the relative labor productivities.

While it may not be able to fully explain exchange rate movements, the Balassa-Samuelson model does explain the relative price levels, showing that high-income countries with higher labor productivities will have higher price levels due to the differences between tradable and non-tradable goods' sectors. It is known as the Penn Effect and is also shown by Canzoneri et al. (1999)'s empirical findings. Kravis and Lipsey (1982) and Bhagwati (1984) shed some light on another aspect of this phenomenon, which is based on factor endowments. If high-income economies are considered capital rich, then their capital to labor ratios will be higher than those of lower income economies putting their marginal labor productivity at a higher level. As prices of tradable goods equalize, price levels in high-income economies will be higher than those of lower income economies. Put another way, within the Balassa-Samuelson framework, the more capital intensive an economy is, the higher their real exchange rate is.

In their pursuit of comparing national price levels, Kravis and Lipsey (1982) also face the same problem as identified by Canzoneri et al. (1999) They explain that in the absence of comparative data due to diverse product categories, the variables need to be converted to a common exchange rate. However, that equality does not hold, as the converted exchange rate's purchasing power may be widely different from the converted price level. Therefore, a separate purchasing power parity variable is added in order to adjust the difference of international price levels.

This means that the purchasing power parity and exchange rates together influence the price levels through an interdependent relationship. The root of this relationship may also be traced to the Balassa-Samuelson model, where the differences between tradable and non-tradable goods leave the absolute PPP relationship incomplete in fully explaining the fluctuation in exchange rates. As the price levels of non-tradable goods follow the difference in income levels, the PPP relationship can explain a portion of the exchange rate fluctuations. This leaves the fluctuation through the tradable goods sector unexplained, which is also highlighted by Kravis and Lipsey (1982), as they identify the difference in the basket of goods representing international price levels.

Kravis and Lipsey (1982) also point towards the complexity in predicting exchange rate variations and the variety of approaches attempting to achieve this objective. Therefore, in their final analysis of comparing price levels, they include exchange rate fluctuations as a short-term measure in order to capture the timing differences, such as differences in the speed with which goods prices respond to changes in domestic monetary variables or differences in the speed with which domestic prices and exchange rates respond to changes in these variables.

Perhaps the most common approach is that of absolute PPP, but as the Balassa-Samuelson model shows, that approach is unable to fully explain exchange rate movements. Apart from the problem of the difference between tradable and non-tradable goods, it holds for frictionless markets only, where transport and distribution costs are non-existent, which is never the case in real-world applications. Even the relative PPP model is weak in predicting exchange rate movements due to the non-applicability of the law of one price for tradable goods.

PPP is widely applied (Takizawa, Lee, & Hauner, 2011) because of its ability, at least, to identify the general trend of the exchange rate movements. This monetary approach explains currency value as a function of its demand and supply. If the law of one price is held to be true, then the exchange rate of two currencies should be equal to their PPP. By the demand and supply factors, the exchange rate is then a function of the nominal money supply, nominal interest rates, and the real income, where nominal money supply and nominal interest rates have a positive relationship while the real income has a negative relationship with the exchange rate. If the nominal money supply or the nominal interest rates increase, the exchange rate will increase, and vice versa for the relationship of real income and the exchange rate.

Also, if the central bank increases interest rates as a means to monetary tightening (which is very likely in GDP booms), the currency value will be expected to appreciate. At the same time, the capital inflows mechanism in booms will very likely appreciate the nominal exchange rate. Thus, higher GDP growth will generate a higher exchange rate, given the Balassa-Samuelson effect, anticipated monetary policy tightening, or capital inflows (Takizawa, Lee, & Hauner, 2011).

However, there are opposite effects of the same measure given various different approaches. Dornbusch (1980) shows empirical evidence of the instability of the monetary approach and that the PPP fails to explain the variation in the exchange rate. He applies the Mundell-Fleming model, with some relaxations in their assumptions, expanding the monetary approach to include current account, wealth effects, expectations, and relative prices to cover the unexplained variation in exchange rates.

The Mundell-Fleming model relates the exchange rate to interest rate and output. Specifically, the model applies monetary approaches and the productivity growth in explaining exchange rate movements. In the original Mundell-Fleming model, they assume free flow of capital, so that if local interest rates are lower than global interest rates, financial capital flows out of the economy leading to currency depreciation. This monetary effect is offset by cheaper exports, which pushes output upwards, ultimately raising the local interest rates to the global level.

Dornbusch (1980) explains that the key factor introduced in his expansion is the expectation, which he models through incorporating "news" of extraordinary market changes, these include monetary and domestic output demand changes. This creates expectations leading to market reactions that temporarily affect exchange rate movements causing them to deviate from the PPP equilibrium. For instance, an exchange rate depreciation will be expected to occur after a current account deficit. Dornbusch goes on to elaborate that the immediate appreciation is only possible if there are short-run price stickiness and rational expectation.

In this extended model as well, the Balassa-Samuelson model's basic theoretical framework is seen at work. As incomes rise through productivity gains, demand increases push the prices upwards leading to a currency appreciation. Dornbusch (1980)'s application does not address the difference between tradable and non-tradable goods, but it does capture the timing difference till the prices of tradable goods equalize as per the Balassa-Samuelson model.

Determining a Model for the Exchange Rates

Over the years, exchange rate models have been attempting to explain exchange rate movements by adding more influencing factors and applying different approaches. In each successive iteration, a new influencing factor is added, in an attempt to capture another detail of exchange rate movements. However, the complexity and the interdependencies of the multiple factors influencing exchange rate movements make the task difficult, if not impossible.

Therefore, it is clear that it may not be possible for a single factor to explain the variation in exchange rates satisfactorily. Some factors may be influencing the exchange rate and the timing differences further add to the complication. As Dornbusch (1980) explains, the exchange rate may have experienced wide fluctuations until the impact of one factor materializes. This is also explained by Frenkel (1976) and Mussa (1976), according to whom the small holding and trading costs of currency make them especially susceptible to market expectations, and it may have a magnified impact on exchange rate movements as new information arrives.

Overall, exchange rate models would remain incomplete if they do not include the basic short-run monetary or long-run productivity factors. While the currency follows demand and supply dynamics, this monetary nature is influenced by productivity factors, such as output, expenditure, consumption, wages and so on. Further, these factors are included in exchange rate models through their interaction with the monetary factors. For instance, in the Mundell-Fleming model, output gains from exports lead to a rise in the exchange rate that offsets the depreciation from capital outflows due to the decline in interest rates.

Fundamentals of the Canadian Dollar

The Canadian Dollar Exchange Rate Models

The previous discussion about the nature of exchange rates and their models highlights their complexity, and at the same time establishes the fundamental factors influencing exchange rate movements. It is through these approaches that a more significant portion of the variation in the exchange rates may be explained. While models attempt to bring the global exchange rate on common grounds, different economic structures, interest rate policies and growth targets make the task even more complicated. The assumptions that hold for a model may not apply to the situation of the economy being studied.

In the case of Canada, research points towards commodity prices (Cayen, Coletti, Lalonde, & Maier, 2010; Helliwell, Issa, Lafrance, & Zhang, 2005) as being the primary currency driving factor. Since the economy is commodity driven, global commodity prices have a significant impact on trade balances, ultimately affecting the exchange rate. For this reason, the Bank of Canada includes a trade variable in their exchange rate models reflecting the global commodity price movements. A similar assertion is made by the Reserve Bank of Australia and the New Zealand authorities as well, both of which also have a commodity-driven economy (Chen & Rogoff, 2002).

As Chen and Rogoff (2002) also refer to the prevailing economic conditions. Despite the large industrial base of Canada, the country relies heavily on commodity exports which mostly comprises of forestry products, where Canada holds a dominant position. Moreover, while it may hold a market leader position for this commodity, it remains a price taker for most of its commodity exports.

Chen and Rogoff (2002) further show this relationship through graphical evidence and data description, plotting the Canadian dollar price relative to three currencies (Namely, the US dollar, the British pound and the non-US dollar currency basket) against the world price of non-energy commodities. They also plot the Canadian-US real exchange rate against standard macroeconomic variables, real income differentials, and real interest rate differentials. This data sample period starts from the establishment of the floating currency regime when real exchange rates are adopted as the price of the domestic currency in foreign currency terms adjusted by the CPI. Also, the nondollar basket is taken from the Broad Index of the Federal Reserve comprising over 30 currencies, which should provide the proper adjustment against shocks to the US dollar.

Commodity price indices are geometric averages of the world market prices of the relevant commodities weighted by their share in the domestic production. The individual commodity prices are quarterly averages of the world transaction prices expressed in US dollars adjusted by the US CPI (Chen and Rogoff, 2002). They also find that in the case of Canada, the relationship between currency movements and commodity prices lacks robustness, although the existence of a relationship may not be entirely overlooked. This relationship is particularly significant when the comparison is made with the US dollar but could not stand the robustness test against other currencies. The weakness in this relationship, as Chen and Rogoff (2002) explain, may be due to the relatively lower share of commodity trade in their overall economic output.

Another area tested by Chen and Rogoff (2002) that reflects the weakness in the relationship between the Canadian dollar and commodity prices is that of the endogeneity of commodity prices. They clarify that this bias may arise from two sources where commodity prices may be influenced endogenously. The first of these two sources is a global economic boom outside the economy. An economy with heavy reliance on commodity exports may experience considerable impact on the prices, that is, a rise in the relative price of exportable goods might lead to a proportional rise in the price of non-traded goods. However, in a situation in which the commodity exporting economy does not experience a boom, their currency value is most likely to depreciate rather than appreciate because of the effect of lower economic activity, independently of changes in commodity prices. The second source of endogeneity bias comes from the power of the commodity exporting economy over some products for which they hold a market leader position. In this case, as well, the Canadian currency shows an insignificant relationship with commodity price movements.

Chen and Rogoff (2002) also look into the currency value's relationship with productivity differentials in the tradable and non-tradable goods sectors. However, they conduct this analysis for other countries in their selected sample and not Canada. Regardless, they find that the relationship between commodity prices and currency movements is more robust than the relationship identified through the Balassa-Samuelson approach.

Helliwell et al. (2005) shed more light on the subject of the relationship between exchange rates and commodity prices for the Canadian economy by dividing commodities into energy and non-energy commodities groups. The Commodity Price Exchange (CPE) model has been the mainstay for the Canadian monetary authority to interpret exchange rate movements. This model relies on the relationship between the bilateral exchange rate and real commodity prices, where commodities are categorized as energy and non-energy commodities. For the exchange rate, this model only relies on the Canada-US exchange rate. This perhaps, explains the explanatory power of this model, as Chen and Rogoff (2002) also show the relationship to have significant prevalence when considering the exchange rate with the US dollar but not with other currencies.

Helliwell et al. (2005) highlight that the CPE shows that the exchange rate depreciates when energy prices are high despite Canada being a net energy exporter and the US being a net importer. They also refer to other research showing that the inclusion of energy commodities in the CPE has had a limited role in explaining exchange rate movements post 1970.

In response, Helliwell et al. (2005) propose a new model called the Nominal Exchange Rate Model (NEMO). Like the CPE, or any other contemporary exchange rate model, it includes long-run fundamentals and factors bearing influence in the short run. NEMO incorporates two long-run fundamentals: real non-energy commodity prices and labor productivity differentials with the United States. Higher prices of Canada's exportable commodities lead to a higher real exchange rate. The relationship between the real exchange rate and real non-energy commodity prices is evident in their findings (Helliwell et al., 2005).

For the short-run dynamics, NEMO includes interest rate differentials, changes in the nominal US dollar, and changes in the relative GDP as primary variables. In further expansions of the model, Helliwell et al. (2005) also include financial market variables, which influence capital flows. These variables include relative stock market prices, international risk premiums, Canada-US fiscal deficit differential and the US current account deficit as a proportion of nominal GDP, which leads to the US dollar to depreciate, thus causing an appreciation of the Canadian dollar. However, the US current account deficit and the Canada-US fiscal deficit differential do not turn out to be significant in explaining exchange rate variations. While risk premium differentials have a significant contribution, the overall financial market variables do little to explain the variation in the exchange rate.

Helliwell et al. (2005)'s best-fit NEMO equation includes the monetary variables (the interest rate differentials), the nominal exchange rate, a proportional change in prices, other long-run fundamentals, as well as commodity prices.

The model takes the productivity approach from the fact that manufactured goods form the greater portion of the traded goods. They point towards two reasons for including relative productivities, one is the relative supply effect, which will depreciate the currency value if Canada's productivity rise, as this will be required to increase sales. The second is that of the

Balassa-Samuelson model, which points towards increasing relative prices in the non-tradable goods sector as a result of the real wage increases due to the relative productivity gains in the tradable goods sector.

The empirical results of the model, however, do not support the Balassa-Samuelson hypothesis and reflect a negative coefficient for relative productivity. This is so because there must be demand for the productivity growth to boost output, which will ultimately increase prices. Moreover, for the demand to increase, prices have to come down, which will be achieved through the depreciation of the nominal exchange rate.

Helliwell et al. (2005) argue that this finding is quite robust in the context of Canada; however, in later discussion, they explain that the omission of the difference between traded and non-traded goods has led to a failure to capture the Balassa-Samuelson effect. Commodity price effects are found to be positive and significant and to have a major influence on exchange rate movements over the period 2003-04, along with the short-run factors including US dollar depreciation against other currencies and lower international risk premiums.

Canada's free trade agreements with the US has led to commodities comprising a significant portion of its economic output. Therefore, all models attempting to explain the variation in the Canadian exchange rate include some form of commodity price component. CPE's failure to capture exchange rate movement post-1970 due to energy-related commodity prices movements is also supported by Issa et al. (2008). They further explain that this lack of the CPE is only for the period from 1970 to 1980; however, the trend is reversed during the 1990s. The negative relationship during the period from 1970 to 1980 is shown to be due to the dip in global demand as a result of the high energy prices. When Issa et al. (2008) split their sample period into two, they find a significant relationship between energy commodities and exchange rates from the 1990s onwards. However, when they consider the period from the 1970s to 2005, the negative and positive relationship between the energy commodity prices and exchange rate seem to nullify each other.

Cayen et al. (2010) take yet another approach to modeling exchange rate movements. Their primary objective is to identify the factors influencing the exchange rate fluctuations. For this purpose, they employ two methodologies. This first is a dynamic factor model, which allows them to identify the factors with the highest correlation. The second is a state-space model, which allows the addition of restrictions enabling further explanation of the influencing factors. The overall approach reduces the risk of misspecification and adds to the robustness of the results.

Cayen et al. (2010) apply both models across six currency pairs, including the Canadian-US dollar. The dynamic factor model is a latent factor model based only on the data pattern and lacking any economic interpretation. It identifies two significant factors. The first has a positive coefficient for all the currency pairs. This means that all the currency pairs move in the same direction relative to this factor. The second factor has mixed results, which is in line with the theory behind the relationship between commodity prices and the exchange rate, as some countries are net importers while others are net exporters. The factor is positive for net exporters meaning that their currency value is expected to appreciate following an increase in the commodity prices and vice versa.

This factor is positive for Canada in the dynamic factor model, as well as for Australia and New Zealand, which have also been identified by Chen and Rogoff (2002) in their multiple currency comparisons testing the relationship between commodity prices and exchange rates.

However, unlike Chen and Rogoff (2002), Cayen et al. (2010) find this relationship to be significant for all the exchange rates in their study, but there is a qualifier to these results. Cayen et al. (2010) apply their model only over currency pairs with the US dollar, a relationship that is found to be positive in the Chen and Rogoff (2002) study as well.

The second factor in the dynamic factor model pertained to productivity differentials as explained by the Balassa-Samuelson model. The productivity differentials are measured relative to the US productivity, and it is found that the relationship with exchange rate fluctuations is negative until around the 1990s.

In their state-space model, Cayen et al. (2010) include fiscal policy differentials, measured by the government debt to GDP ratio, and commodity prices, as the two factors affecting exchange rate movements. The results show a positive and significant relationship with the fiscal policy differentials and a mixed but significant relationship with the commodity prices whether the country being a net exporter or a net importer. Their findings show that the relationship between the Canadian dollar and commodity prices has strengthened in the post-1990s period, which is in line with what Issa et al. (2008) found: energy-related commodities prices and global demand dynamics had a nullifying impact on the commodity and exchange rate relationship prior to 1990s, but the relationship turned positive post in this period.

The state-space model’s two factors explain about 46% of the variation in the Canadian dollar relative to the US dollar. In the more recent period from 2002 to 2007, these two factors explain more than 60% of the total variation in the Canadian dollar relative to the US dollar.

The dynamic factor model and the state-space model applied in Cayen et al. (2010)'s study show the same results where their respective two factors explain a significant portion of the variance in the exchange rates, while domestic factors explain a less portion for the rest.

The Role of Commodity Prices in Canadian Currency Models and Fundamentals

There is much evidence that commodity prices have a positive and significant relationship with the foreign exchange value of the Canadian currency. In more recent research (Helliwell et al., 2005; Cayen et al., 2010), this relationship is shown to be true and significant, and further findings also explain the possible reasons why this relationship may not have held in the past.

In Chen and Rogoff (2002)'s analysis, although energy-related commodities are excluded, they do not differentiate between the period before 1990s and the post-1990s period, where global energy price shocks make the energy commodities effect and the non-energy commodities effect counteract each other. This may have caused their results to be insignificant for the relationship between the Canadian dollar and commodity prices, even though they included only non-energy commodities in their analysis.

Issa et al. (2008) shed more light on this development in international commodity prices by taking into account the differences in global economic conditions between the post-1990s period and the years before that. Issa et al. (2008)'s empirical research shows a strong relationship between commodity prices and the exchange rates. The currency pair most often used is the Canada-US dollar exchange rate, which even Chen and Rogoff (2002) find to have a close relationship with the commodity prices.

However, in Chen and Rogoff (2002)'s analysis, they also include a basket of non-US dollar pairs, which implies that the Canadian dollar's value relative to the international scenario, rather than only the US dollar, may not have a significant relationship with commodity prices. As further evidence, Chen and Rogoff (2002) also cite Canada's position in the global commodity markets as being relatively small and that of a price taker.

Nevertheless, in all exchange rate models attempting to explain the Canadian dollar, a commodity price variable is included in some form. For the most part, these models are running comparisons with the US dollar and show a positive and significant relationship between commodity prices and the Canadian dollar. The use of the US dollar may be justified by it being a major trading partner of Canada and therefore having a significant influence on the Canadian domestic exchange rate. Further, the inclusion of commodity prices in models explaining Canadian dollar movements against the US dollar can explain a significant portion of the exchange rate fluctuations.

While there isn't evidence that commodity prices explain a significant portion of exchange rate movements all the time, they are an essential component in explaining exchange rate variations and an essential element during some periods. Therefore, it may not be entirely accurate to conclude that commodity prices, unequivocally, determine the Canadian dollar prices, but their inclusion is necessary to capture better the currency value fluctuations.

While it is debatable that if commodity prices can explain the variation in exchange rates, it may be a different story regarding productivity. The Balassa-Samuelson model has been repeatedly shown to fail at explaining the variation in the Canadian dollar. However, the relative supply effect of productivity, that is, price reductions to increase demand, dominates the demand effects of wage increments resulting from productivity gains in the tradable goods sector as per the Balassa-Samuelson model.

For short-run dynamics, interest rate differentials have been found to have a closer relationship to the Canadian dollar's price than the variables used for describing capital flows. Mundell-Fleming models find that result by including the impact of interest rate differentials on capital flows. Based on that, Dornbusch (1980) adds expectation as another important explanatory variable. These expectations also pertain to interest rate differentials, to the way in which they will be affected by monetary decisions, and to their ensuing impact on the money flows.

Prevalence of the Dutch disease in Canada

Commodities, whether energy commodities or non-energy commodities, has been one of the key components of any exchange rate model for Canada. Commodities form an important sector of the overall economy with this relationship. In this scenario, there is a possibility for the prevalence of the Dutch disease, which is the phenomenon where the overall economy suffers a negative impact due to the exchange rate appreciation caused by one sector. In the specific case of Canada, this phenomenon could be the result of currency appreciation due to high commodity exports. The increased currency value would, in turn, make the prices of other products less competitive in the international markets.

The Governor of the Bank of Canada and Chairman of the Financial Stability Board, Mark Carney, outright rejected the prevalence of Dutch disease in Canada in an address to the Spruce Meadows Round Table in 2012 (Carney, 2012). He agreed that the evidence for the prevalence of the Dutch disease is not based on causal grounds, as the decline in manufacturing activity could be the result of changing economic dynamics and may be unrelated to increases in commodity prices and currency appreciation. As in a bid to reduce manufacturing costs and increase competitiveness, much of the developed world's manufacturing capacity had been outsourced with only the very high-value-added processes remaining performed domestically. This trend is not an indication of a decline in the manufacturing activity resulting from falling demand in the manufacturing sector; in fact, this decline is lower than that experienced in other OECD member countries, and the overall manufacturing to GDP ratio is still higher than that prevailing a couple of decades ago. Therefore, it is not correct to conclude that the commodity boom has had a negative impact on the manufacturing sector.

Carney (2012) also brings to light the fact that a diverse set of factors can influence the Canadian dollar and not just commodity prices, which explain around 40% of the variation in the Canada-US exchange rate since 2002. The rest is attributable to capital flows into Canadian bonds due to Canada being an attractive haven for global investors which in itself is contrary to the Dutch disease argument. The same influence of capital flows into Canadian bonds can also be observed in the correlation between Canadian 10-year yields and equity prices, both of which tend to decrease at the same time.

Carney (2012) further adds that the structural changes brought about by the commodity-driven exchange rate appreciation are net positive for the Canadian economy, despite their temporary pressures. Since the commodity price hikes are largely demand driven, they are also a sign of overall economic growth that is expected to be sustainable over the long run. Therefore, the increase in commodity prices does not imply the prevalence of the Dutch disease. This is also corroborated by how commodities interact with the Canadian economy. Being a net exporter, Canada has improved terms of trade with an advantageof high commodity prices, which offset its loss of competitiveness in the manufacturing sector, leading to overall economic growth.

Moreover, when supply disruptions cause higher commodity prices, the Dutch disease problem should also be attributed to international economic activities and shocks. Carney (2012) explains that in all these interactions Canada remains shielded from the effects of the Dutch disease, as the economic output and income growth following from rising commodity prices can offset the negative effects that such a situation may lead to.

In contrast, Blecker and Seccareccia (2009) argue that the appreciation of the Canadian dollar has, to some extent, resulted in the Dutch disease. They specifically mention the example of "Hollywood North", the Canadian movie industry, which enjoyed the protection of the low-priced Canadian dollar growing exponentially over the "Hollywood North" period. After the removal of this protection, the industry has experiened a great distress. The situation for manufacturing is much worse. In the wake of rising oil prices, high consumer spending led to high economic growth. However, during that same period, from 2002-03 onwards, employment in the manufacturing sector declined, by a magnitude that matched the decline last witnessed during the recession of 1990-91. Other data regarding manufacturing sector exports and total output, during this period, also support the argument in favor of the prevalence of the Dutch disease.

The manufacturing output declined relative to the overall business sector from 2000 onwards, and manufacturing exports began to decline significantly in 2005 and the following years. Blecker and Seccareccia (2009) further explain that, while there is evidence in favor of the prevalence of the Dutch disease, it may not be entirely attributed to the boom in commodity prices. Specifically, the Canadian monetary policy stance targeting inflation often results in higher interest rates than those prevailing in the US, which further worsens the currency appreciation problem. The decline in employment in the manufacturing sector did accelerate immediately as oil prices started to soar, but that may have been the result of the decline in manufacturing output that had begun before the rise in oil prices. Another factor to take into account is competition from emerging economies, especially China, whose lower prices made the Canadian manufacturing sector less competitive.

Coulombe (2013) also provides some perspectives, in this scenario of complicated currency exchanges and the impact on other economic fundamentals. He refers to these developments not as the Dutch disease, but rather the “Canadian disease”, which is a result of Canada’s heavy reliance on a single trading partner, that is, the US. As external factors, not related to the Canadian economy, lead to the depreciation of the US dollar, Canadian exports become less competitive, and the trade exposed manufacturing sector begin to lose ground resulting in a loss of employment and a dip in overall output.

However, Coulombe (2013) holds that the overall impact of the commodity boom was positive and the so-called Dutch disease may only have been the Dutch Affair. It would require a long-term disintegration of the manufacturing sector to show that Canada is suffering from the Dutch disease, which is not the case in the given circumstances. In his analysis, Coulombe (2013) uses the core-periphery model (Bone, 2010) to explain the differences in the commodity and manufacturing sectors in the context of Canada and to show how the commodity boom may not be causing a Dutch disease.

In a country, the core has the infrastructure and the resources to achieve economies of scale and therefore has a developed manufacturing sector, whereas, the periphery may have the resources but lack the infrastructure to develop a manufacturing base. In Canada’s unique situation, the core is more in proximity to the US trading lines than to its own periphery, and that reliance makes it especially susceptible to the shocks affecting the US economy. Therefore, currency appreciations may benefit the periphery but will be detrimental for the manufacturing core and vice versa for currency depreciations.

Coulombe (2013) highlights an important point in this discussion as Carney (2012) also did: if the manufacturers were to import their machinery, it would soften the impact of the US dollar depreciation. Coulombe (2013)'s argument relies on the primary conditions under which the Dutch disease is believed to prevail, i.e., that the appreciation has to be driven by commodity prices and that the resource boom should be harmful to the manufacturing sector. He explains how commodity prices drive the appreciation of Canadian dollar to some extent, but a portion of exchange rate fluctuations is also due to the US dollar depreciation, which is not sufficient to show the prevalence of the Dutch disease. Now if the causal effect flows from the depreciation of the US dollar rather than the Canadian dollar, this may be called the Canadian disease. Empirical findings comparing employment in the same industries in Canada and the US further add to this understanding. Indeed, Coulombe (2013) shows that from 1987 to 2007, a small portion of the loss in employment may be attributed to the Dutch disease, while most of it is attributed to the depreciation of the US dollar and the remainder to a long-run structural decline.

Coulombe (2013) concludes that a portion of the US dollar depreciation may have resulted in the prevalence of the Dutch disease phenomenon, but it was only limited to being a Dutch Affair. Since that causal relationship leaing to the Dutch disease may not be defined, the recommended remedies may not be applicable. This implies that appropriately categorizing the problem first is more important. Coulombe (2013) identifies that the problem is not of currency appreciation or depreciation, but rather the lack of diversification. He cites the example of Australia, where a commodity boom has not led to the occurrence of the same problem. At the same time, Canada's geographical location makes it obvious to have the US as its major trading partner and it may be difficult to diversify that exposure.

Carney (2012) also identifies the problem of manufacturing crowding out as a result of the lack of diversification, not the US dollar depreciation. Further, other factors may also affect the currency value. This fact does not support the conclusion that the Dutch disease prevails. Finally, the deceleration of the manufacturing sector had begun to occur even before the extraordinary currency appreciation era. This may be due to the structural changes in the manufacturing sector as explained by Carney (2012), or due to the competition from emerging economies, particularly China, as identified by Blecker and Seccareccia (2009).

Therefore, the problem of manufacturing deteriorating may not be attributed to the commodity boom, especially when the net effect of the boom has been positive for the overall economy. A net positive impact means that manufacturing exports that lost gound in the international markets can be made up for by increasing internal demand. Thus, the conclusion of the prevalence of the Dutch disease phenomenon is not justified.

Testing the Prevalence of the Dutch Disease

Modeling Issues

The prevalence of the Dutch disease in Canada is a much-studied topic, and some factors do seem to indicate its prevalence. However, a detailed look into these factors does not reflect a causal relationship. Also, their incidence is related to other factors which may not lead to the conclusion of the prevalence of the Dutch disease. The primary theory of the phenomenon of the Dutch disease states that an economy going through a resource boom may end up crowding out its manufacturing sector. This is the result of currency appreciation due to high export demand for resources which renders the manufacturing output less competitive in the international markets, ultimately leading to deterioration of the local manufacturing sector. This means that the primary factors of interest are the exchange rate, manufacturing output, and commodity prices.

However, there are other considerations to be taken into account. In order to determine the prevalence of the Dutch disease, the manufacturing sector must be crowding out as a result of the commodity boom through its effect on the currency rate. Beine et al. (2012) focus not on these direct factors, but instead they separately analyze the components of these factors as they interact with the exchange rates. For this purpose, they account for the fact that each exchange rate has two components. For instance, in the Canadian exchange rate relative to the US dollar, there is a component affected by the economics of Canada that may include commodities as one of the major influence, whereas the US component may be entirely governed by its domestic monetary policy. This is also elaborated through an example of exchange rates international movements. More specifically, if the domestic currency appreciates against all other currencies then the movement might be the result of domestic policy or economic conditions, but if the appreciation is against a single foreign currency, then that change is most likely due to depreciation in the single foreign currency rather than the result of the domestic economic environment.

While this shows that taking into account the components of the influencing factors is important, the currency debate itself is far from conclusive. Various models attempt to capture the currency movements with a varying number of factors. Most models include commodities as an important factor in explaining Canadian currency movements, but some studies show that the relationship of commodities with currency movements is only restricted to the Canada-US pair and is not significant when considering the Canadian dollar against currencies other than the US dollar (Chen & Rogoff, 2002).

A similar consideration applies to the manufacturing sector. For instance, Blecker et al. (2009) refer to the competition from China affecting the Canadian manufacturing sector negatively. Further, for some periods the manufacturing sector decline does not align with the currency appreciation, and empirical results explaining this as a causal relationship may be spurious. In other cases, currency movements have a direct impact on the manufacturing sector. This is more evident for industries having a high exposure to trade.

Global developments can also affect domestic manufacturing. Dion (2007) explains that the productivity decline experienced in Canada around the beginning of this millennium may have been the result of the disruption caused by information and communication technologies and of the failure of Canada to fully adapt and benefit from those developments. The resulting low skilled labor is one channel through which productivity was affected along the labor reallocation caused by high resource prices. However, data suggests that the resource price effect only contributed to enhancing the negative effect of labor productivity on overall productivity, and may not be classified as a stand-alone cause for productivity decline (Dion, 2007).

In other studies, exchange rates are shown to affect labor productivity through the manufacturing sector. Huang et al. (2014) show that exchange rate appreciation induced by a commodity boom has a small but significant and negative impact on employment in the manufacturing sector.

Huang et al. (2014)'s work, based on Beine et al. (2012)'s model, also includes the impact of regional differences. Differences in industrial composition of different regions might also affect the degree of impact that exchange rates can have on the manufacturing output. Further, the exchange rate is not the only channel through which a resource boom contributes to the Dutch disease phenomenon. Huang et al. (2014) refer to what is known as the “resource curse”, that is, the crowding-out effect on the manufacturing sector caused by a commodity boom. Other mechanisms through which a “resource curse” is realized include rent seeking, corruption, domestic conflict, and high volatility. Rent seeking is also covered by Boadway et al. (2012) as resource-rich provinces’ utilization of the rents may not be directed at areas which may prevent the occurrence of a Dutch disease, which also explains why regional differences have a contributory role in the prevalence of this phenomenon.

Timing differences are also applied to the commodity price element. Research shows that the inclusion of energy-related commodities in the commodity price factor post-1970 had little explanatory power for exchange rates (Issa et al., 2008). This is because of a net negative impact on the currency rates due to the low demand resulting from the higher energy prices, which leads to a nullification of the commodity factor’s effect on the exchange rate for samples including this period. Later models include both commodity categories separately when studying the impact on the exchange rate.

It is also important to carefully select of the dependent variable used to measure the manufacturing sector. The two main variables used in previous research are simple output or labor productivity. Huang et al. (2014) study the impact of exchange rates on labor productivity, while Helliwell et al. (2005) include direct productivity (i.e., output per hour) in their currency model, skipping the manufacturing output. As Dion (2007) explains, productivity could be affected by a reallocation drive that may be induced by an extraordinary increase in commodity prices and currency appreciation. However, such a reallocation could be only transitory and therefore might not justify the conclusion of the prevalence of the Dutch disease.

Further, the effect of higher resource prices on productivity is evident through their action on the resource sector itself, where higher commodity prices become an incentive to exploit marginal reserves. So higher commodity prices (and resulting currency appreciation) may align with productivity decline so that their interaction with the manufacturing sector is not necessarily indicative of the prevalence of the Dutch disease. This also points towards a relationship between energy commodity prices and productivity. However, this relationship may not persist in the long-run.

Modeling Approach

The complexity brought about by the number of different variables and their interaction may point towards the reason why previous studies on the prevalence of a Dutch disease find contradicting results. While multiple factors can contribute to the phenomenon of the Dutch disease, manufacturing output, commodity prices, and exchange rates are identified as the most directly acting influences. It is reiterated that the Dutch disease is under the broader literature of the “resource curse” (Huang et al., 2014). A boom in the commodity prices leading to an appreciation of the exchange rate will render the manufacturing output less competitive, especially in those sectors most exposed to trade.

Therefore, to establish the prevalence of the Dutch disease, the relationship between commodity prices and exchange rates needs to be established first. If commodity prices significantly explain exchange rate movements, then the impact of exchange rates on the manufacturing sector may determine the prevalence of the Dutch disease. It is also important to select the time period in our data sample, as relationships that hold during some periods may not apply to others.

In the case of Canada, the primary factors explaining most of the currency rate movements are commodity prices, interest rate differentials, and the supply-side effect of productivity, which is opposite to the prediction of the Balassa-Samuelson model. Since the intent of this paper is to establish whether there exists a relationship between commodity prices and exchange rate movements, these three factors should be sufficient to capture most of the exchange rate movements and explain the relationship with commodity prices. A further division in energy commodity prices and non-energy commodity prices will account for the specific varying relationship between energy commodities and exchange rate movements.

As outlined in the previous section, productivity and output explain different, nevertheless related, effects. In exchange rate models, the idea is to capture the impact of the relative productivities of the two economies on the currency pair. This is important to explain the relative goods movements between the two economies, which ultimately determine the price effects on the currency.

A relative supply effect would mean that the economy with relatively higher productivity would experience a depreciation of its currency in order to boost demand to match the increased supply in the tradable sector. A second effect is the Balassa-Samuelson, that is, higher productivity in the tradable sector would increase real wages which would push the relative prices of non-tradable goods upwards. In the case of Canada, there is more evidence in favor of the supply side effect.

Once we established the relationship between the exchange rate and commodity prices, the second step is to determine the relationship between the exchange rate and the manufacturing sector. More specifically, we are interested in studying whether currency appreciation results in crowding out of the manufacturing sector. Shakeri et al. (2012) utilize industrial production data to analyze the prevalence of the Dutch disease. They do this separately for eighty industries and find the relationship between currency appreciation and manufacturing crowding out to hold in twenty-five of them, which are mostly labor-intensive industries. This indicates that comparisons against labor productivity inevitably show no or weak evidence of the prevalence of the Dutch disease. Labor intensive industries will generally have lower labor productivity than the overall manufacturing sector, so comparing the overall manufacturing labor productivity with exchange rate movements may not show significance because the higher productivity industries might nullify that negative impact.

Beine et al. (2012) utilize manufacturing employment data to determine the prevalence of the Dutch disease. They contend that while employment changes may occur due to structural changes (such as a shift to the services sector), in the case of Canada the period post-2001 shows a significant decline in manufacturing employment, which aligns to energy price increments and the ensuing currency appreciation. They conclude that the prevalence of the Dutch disease phenomenon can explain a significant portion of the decline in manufacturing output.

Since these models use different variables to establish the crowding out effect of exchange rate appreciation on the manufacturing sector, their specification is quite different. Beine et al. (2012)'s approach is more focused on the currency components in determining the prevalence of the Dutch disease. Their model includes currency components of Canada and the US pair, along with their lagged values. The employment data (the explanatory variable in the model) use a similar variable structure, where current and one-period lagged employment are included for the US, and one-period lagged employment only is included for Canada. Shakeri et al. (2012) take industrial output as the dependent variable, and the exchange rate, non-energy gross domestic product, industry output in the US, industry-specific inflation, domestic interest rate, and total government expenditure as the explanatory variables. What both models share in common is that they use a direct manufacturing sector indicator as the dependent variable to analyze the crowding-out effect of currency appreciation.

Another common factor in those models is the inclusion of variables for the other economy in the currency pair, that is, the US. These variables are included to control for the global manufacturing industry, as changes affecting the global manufacturing output will also affect Canada, but will not matter for establishing the prevalence of the Dutch disease. In the case of Canada, using US data is more appropriate because it represents the largest share of Canadian trade.

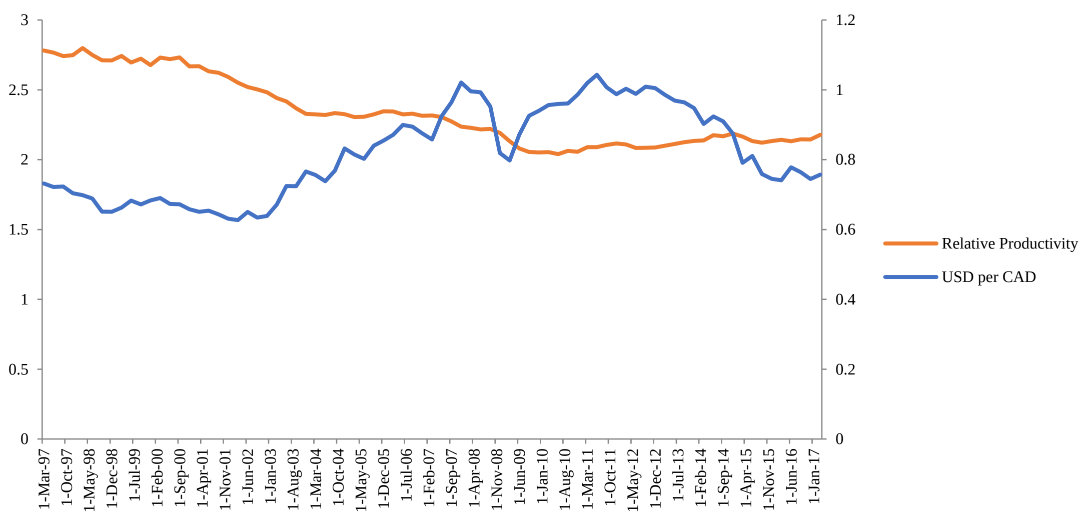
Coulombe (2013) also employs a comparison against the US economy when studying the prevalence of the Dutch disease in Canada. The virtue of geography places Canada particularly vulnerable to the Dutch disease due to a lack of diversification of its export markets. Further, global trade is governed by a gravity equation. In the case of Canada, there is more pull from the US than any other country in the world. As Canada is in proximity to such a large economy, there has been no doubt diverting most trades to the US. Therefore, the Canada-US currency pair may be the only relevant pair for studying Canada's economy.

Dutch Disease in Canada: Empirical Inquiry

Indications from the Data Trends

Our selected data includes quarterly averages from Mar-1997 to Mar-2017. In this sample, the Canadian dollar (See Appendix 1, *cad*) and the relative productivity (See Appendix 1, *rp*) reflect more support for the supply-side effect of productivity than for the Balassa-Samuelson model's assertion. The data series seems to be converging from the sample beginning, i.e., appreciating currency and declining relative productivity with the US. This convergence is observed until the financial crisis of 2008 when there is a short period where the data seem to agree with the Balassa-Samuelson effect. In more detail, the productivity decline is aligned with the currency depreciation, and the currency depreciation is sharper and seems to precede the productivity decline. That may be attributed to the overall decline in demand during this period (Rose & Spiegel, 2009). At the same time, the relationship of interest rate differentials and commodity prices with exchange rate movements seems to hold during this period, which further suggests that the decrease in productivity following the currency depreciation is likely due to a decrease in demand. After that, the productivity and currency value continue to diverge. Figure A shows the movements of the exchange rate and relative productivity of the US and Canadian economies from 1997 to 2017. The data trend is indicative of the possible presence of the Dutch disease. However, we cannot come to that conclusion until we establish the relationship between the exchange rate and commodity prices.

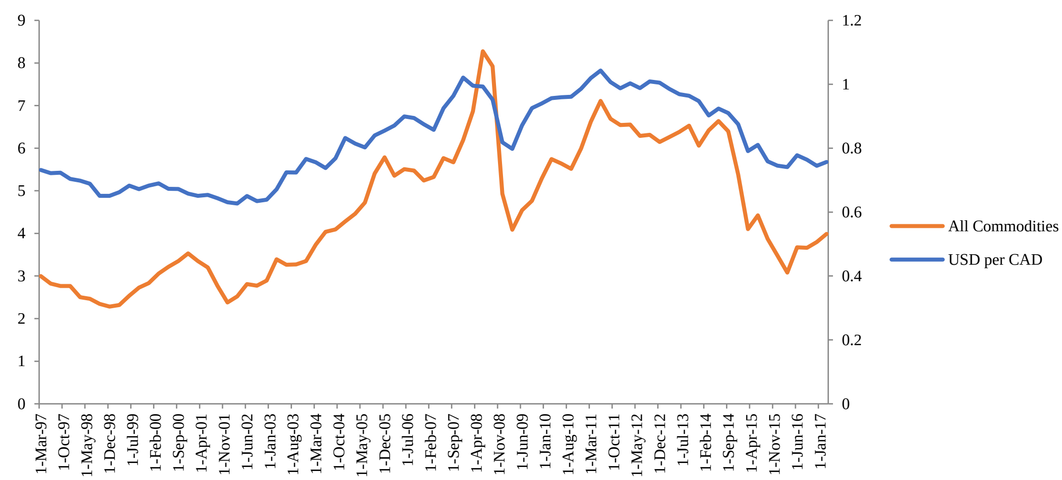
Figure A: Exchange Rate and Relative Productivity of the Economies in the Currency Pair, 1997-2017



At first glance, energy and non-energy commodity prices seem to have a mixed relationship with exchange rate movements. The US dollars per Canadian dollar exchange rate seems to follow commodity price movements in some periods only, with a slight bump and then dip following the 2008 financial crisis. Commodity prices follow a similar pattern around this year, only much more enhanced (See Figure B). This pattern is observed in both energy and non-energy commodities (See Figure C and Figure D).

Demand fluctuations from emerging economies could be the main reason for commodity price movements, before and post the 2008 financial crisis. However, some research finds more correlation of commodity prices with the financialization of commodities over the several years before the 2008 crisis (Tang & Xiong, 2012). More specifically, Tang et al. (2012) find that the increased commodity index investment and other derivative products related to commodities (which they define as "financialization" of commodities) has led to an increased correlation of commodity prices with the overall financial markets. This relationship contributes to explaining the high volatility experienced by commodity prices during the 2008 financial crisis.

Figure B: Exchange Rate and All Commodities Price Index, 1997-2017



Tang et al. (2012) observe another trend not strictly related to financialization: energy and non-energy commodity prices seem to move together. This trend is very likely to reflect in the Fisher price index for Canada, although the volatility observed in energy prices is much more pronounced than in non-energy commodities. This price pattern seems to be averaging out in the overall commodity prices but is very much visible, as observed in the comparison of Figure C and Figure D. To explain this phenomenon, Tang et al. (2012) point towards the relationship between different commodities. For instance, high oil prices mean high transportation costs for other commodities; high costs of grain mean high input costs for livestock, and so on. It means that energy prices and non-energy prices are likely to reflect a relationship with the exchange rate of similar degree and direction. The energy commodities' price volatility is much more than that for non-energy commodities, and so is the index level, but overall they follow a similar pattern.

Figure C: Exchange Rate and Non-Energy Commodities Price Index, 1997-2017

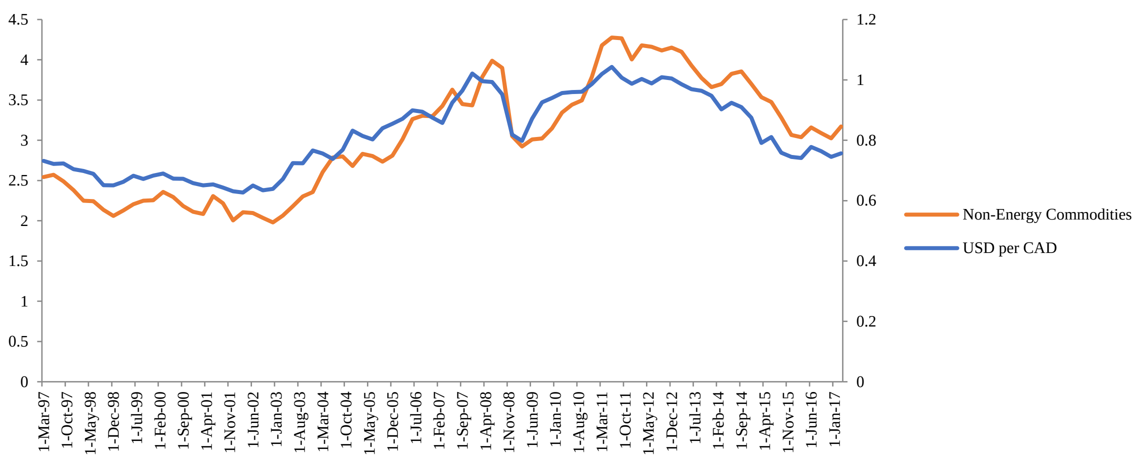
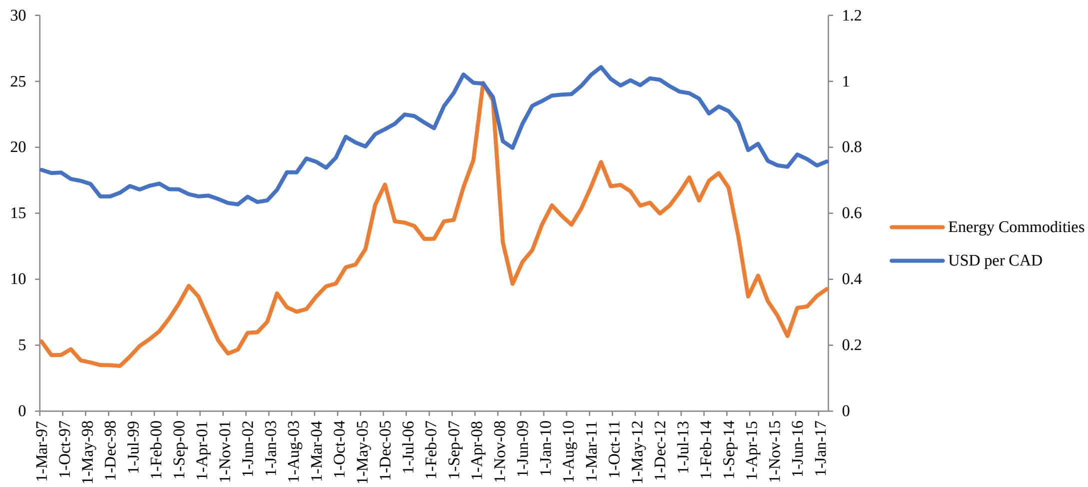


Figure D: Exchange Rate and Energy Commodities Price Index, 1997-2017

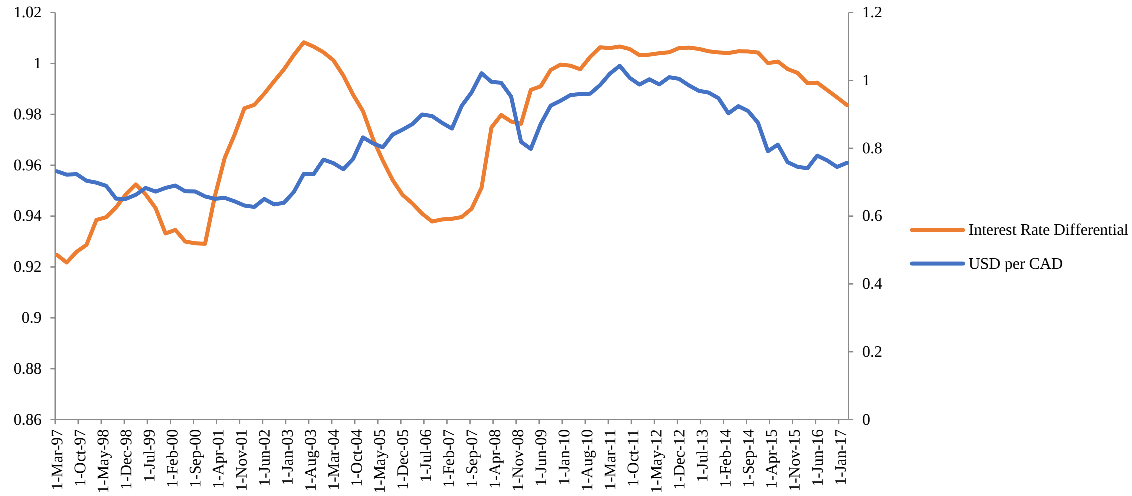


The relationship between the exchange rate and the interest rate differential is theoretically positive. A higher interest rate means a higher return that increases the demand for the domestic currency against the foreign currency, leading to a currency appreciation. However, this relationship does not always hold as other factors influencing the exchange rate may override the impact of interest rate differentials. Figure E shows that the relationship of interest rate differentials on exchange rates is significant but small, which means that large fluctuations in the interest rate differential will only cause small changes in the exchange rate. In most cases, other factors influencing the exchange rates will supersede the impact of interest rates.

Further, the cause of the interest rate change can also affect the direction of the exchange rate movement. That mixed impact of interest rates is perhaps why interest rate differentials have a small effect on exchange rates.

In this paper, we can observe a similar situation by plotting the differential between the Canadian 3-month rate and the equivalent US interest rate against the exchange rate. The trend shows slight movements in the relative interest rates corresponding to large currency movements while the commodity prices align more closely with currency movements.

Figure E: Exchange Rate and Interest Rate Differential of the Economies in the Currency Pair, 1997-2017



Our objective is to find the relationship between commodity prices and the exchange rate, which would then explain if manufacturing is being crowded out by the commodity boom. Now the relationship seems to be positive as observed in the figures we plotted. Further, currency fluctuations seem to follow non-energy commodity prices more closely than energy commodity prices, although overall commodity price fluctuations exhibit a pattern that is more closely related to the energy price movements. The influence of energy price movements can also be observed in non-energy commodity prices, which Tang et al. (2012) explain is natural since energy commodities are used as inputs for production. It means that if exchange rates show a significant relationship with the manufacturing output, the direction of that relationship can enable to establish the prevalence of the Dutch disease.

Comparison of currency prices relative to manufacturing output growth shows a pattern that supports the prevalence of the Dutch disease (See Figure F and Figure G). A prolonged currency depreciation, spread over more than four quarters, follows a sharp spike in manufacturing output, while a currency appreciation precedes a gradual decline in manufacturing output despite the seasonal spikes. The one point in the series where currency depreciation and manufacturing output follow the same direction and pattern is during the 2008 financial crisis when there is an extreme and sharp decline in currency value and the same movement in manufacturing output growth. After that, the negative relationship between currency and manufacturing output continues, with an initial currency appreciation followed by manufacturing output gains, but with further exchange rate appreciation ensued by a decline in manufacturing output growth.

Figure F: USD per CAD, 1997-2016

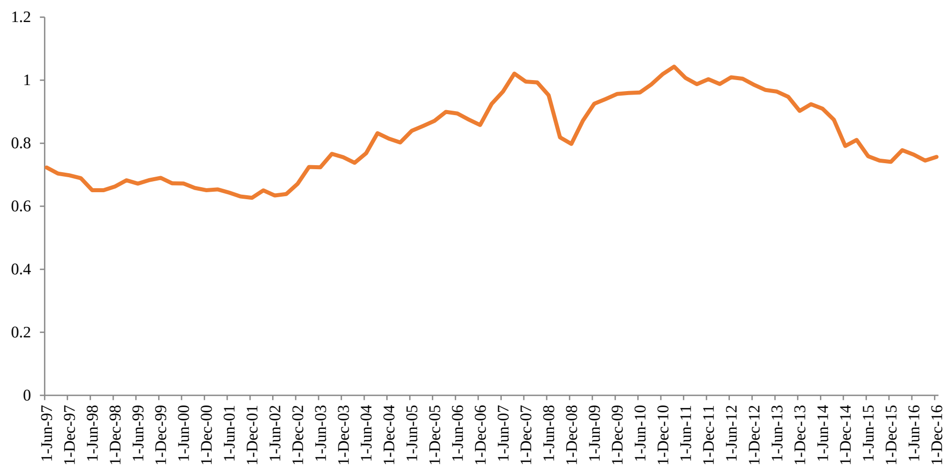
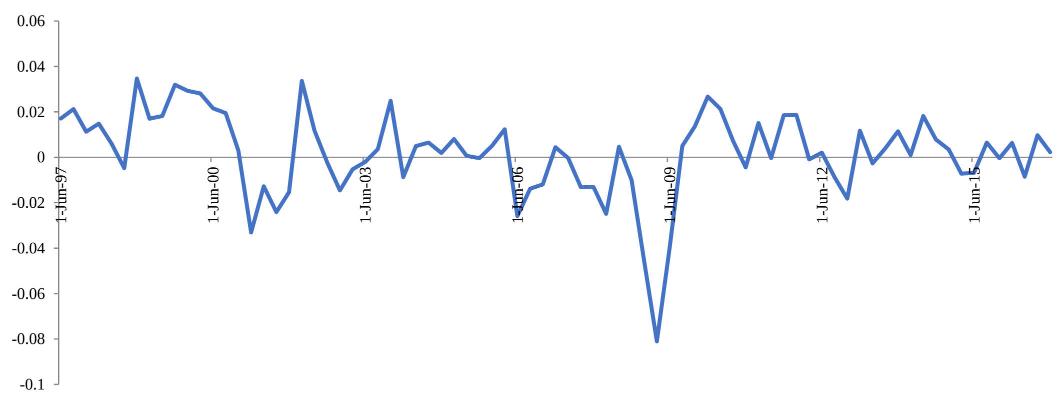


Figure G: Canada Manufacturing, 1997-2015



Description of the Model

The final exchange rate model is the second iteration of the initial specification (Equation 1). In the final model, the interest rate variable is dropped because of a lack of significance. This is perhaps due to the weak relationship between interest rates and exchange rates, or by the mixed relationship of currency movements with interest rates. In a number of exchange rate models, the interest rate variable is included with a lag. In the observed pattern of exchange rate and interest rate differentials, little evidence was found to support a lagged effect. However, the objective of this paper is to test the relationship between commodity prices and the exchange rate. Therefore, variables with little explanatory power could be omitted without sacrificing our the primary goal.

Commodity price effects for energy and non-energy commodities are separated because of the varying nature of the impact that they have on the exchange rate over time. The data suggest that both energy and non-energy commodity prices may have the same effect on exchange rates during the sample data period.

The variables are structured such that a positive coefficient would indicate a positive relationship and vice versa.

$$cad_t = \beta_0 rp_t + \beta_1 cpne_t + \beta_2 cpe_t + e_t$$

(Refer to Appendix 1 for variable description) *(1)*

The Dutch disease model is adapted from Shakeri et al. (2012) where the manufacturing output is considered as a function of profitability and is used to test the prevalence of the Dutch disease in each separate industry. The model also includes overall economic variables that reflect total demand and monetary and fiscal policy. In this paper, industry-specific variables are replaced with their equivalent for the overall economy in the form of the overall CPI, used to reflect the economy-wide price level. Since inflation in an open economy is a target goal for monetary policy, the overall CPI may also capture the impact of the monetary policy.

In line with the primary objective of this paper, i.e., to establish the prevalence of the Dutch disease, it is important to find if the exchange rate significantly affects manufacturing output growth. Therefore, manufacturing quarterly output growth is included as the dependent variable in the second regression estimated in this paper. It is expected that its relationship with the exchange rate would more closely explain how manufacturing output growth is affected. The quarterly adjusted data would also contribute to alleviating the problem of the lag in the exchange rate's expected effect on the manufacturing output as observed in the data. The same is applied to other output related variables and the fiscal policy indicator.

The final specification of the model used to test the prevalence of the Dutch disease excludes the fiscal policy variable and the control variables relative to the US equivalent of the dependent variables for Canada. The total demand measured by the non-energy GDP already incorporates the impact of fiscal policy variable and the control variables, as their exclusion has little to no effect on the coefficients of the other two independent variables; that is, the exchange rate and the inflation indicator. Exclusion of government expenditures does not change the coefficients of the exchange rate and inflation at all, whereas exclusion of the US manufacturing output growth decreases the exchange rate coefficient slightly. However, since its inclusion is designed to act as a control variable for the global economic scenario, and the same type of effect is also reflected in the domestic non-energy GDP, its exclusion is not expected to deviate from the primary objective of testing the prevalence of the Dutch disease. Government expenditures and

US manufacturing output coefficients have opposite signs, and the same is observed in the effect of their exclusion on the coefficient of non-energy GDP. More specifically, the coefficient increases when government expenditures are excluded, and vice versa for US manufacturing output.

A negative relationship between manufacturing output and the exchange rate would indicate the prevalence of the Dutch disease.

$$mfgcan_t = \beta_0 cad_t + \beta_1 gdpne_t + \beta_2 cpi_t + e_t$$

(Refer to Appendix 1 for variable description) *(2)*

Correction of the Regression

The exchange rate variables show significant autocorrelation as tested by the Durbin-Watson statistic, which is well below the value of 1. Therefore, a correction is implemented through the Feasible Generalized Least Square (FGLS) method, which may not yield the best unbiased estimator but is more likely to provide a more consistent and efficient estimator (Wooldridge, 2009). For this reason, the FGLS method is sufficient to establish the direction and significance of the relationship. However, this is not the case when estimating the model of the Dutch disease. The Durbin-Watson statistic is not below 2 in this case. An augmented Dicky-Fuller test and a Phillips-Ouliaris test are applied to test for stationarity and cointegration, respectively. The series is transformed or variables are dropped in the final specification of each model because the series is non-stationary or has cointegration. This allows us to obtain more reliable estimates of the direction and significance in the relationship between the variables.

Discussion of the Results

The currency equation results (See Table A) show a positive and significant relationship with both energy and non-energy commodities. Although the FGLS coefficients are not the best linear unbiased estimators, they are indicative of the relationship and are in line with the theory. The coefficient for energy commodities shows that they have a lower impact on the exchange rate than the non-energy commodity prices do. However, both of the commodity price coefficients are positive and significant at the 5% level, which means that the Canadian dollar is driven by commodity prices, and specifically more by the non-energy commodities. The energy commodities exhibit a similar but weaker relationship. This might also explain the mixed relationship observed between the currency and the combined commodity prices, given that higher energy prices have a larger influence on the overall commodity price index.

Table A: Currency Equation: Dependent Variable – cad

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.220	.040		5.487	.000
	rpF1	-.159	.057	-.222	-2.793	.007
	cpneF1	.001	.000	.338	3.340	.001
	cpeF1	8.548E-005	.000	.427	4.873	.000

**F1 indicates FGLS processed variable*

***For detailed statistics refer to Appendix 2*

Other studies also find a weak relationship with energy commodities. Helliwell et al. (2005) fail to find a significant relationship between energy commodities and the exchange rate. However, their sample period combines the pre and post-1990s periods, which as Issa et al. (2008) explain is the reason for a weak or no relationship between energy prices and the Canadian currency.

Shakeri et al. (2012) also refer to the role of energy prices as being weakly indicative of the prevalence of the Dutch disease phenomenon. They further highlight that numerous other factors might influence the manufacturing sector, like the aggregate demand and supply, and especially the international competition has more explanatory power than energy prices do. In contrast, they find that the effect of non-energy prices on the exchange rate is even more significant.

Works focusing on other countries found similar evidence. Oomes and Kalcheva (2007) show a positive relationship between energy prices and the exchange rate and a subsequent decline in manufacturing growth in Russia. However, they also argue that their study cannot confirm the prevalence of the Dutch disease as other factors influencing the manufacturing sector, such as local production energy costs and international competition, are not controlled for.

The relative productivity variable has a negative coefficient, which is in line with other empirical studies supporting the relative supply effect of productivity. It is expected from the patterns observed in the data that currency appreciation seems to follow a decline in the relative productivity of Canada to the US. This is despite the data sample including a period of financial crisis, an extraordinary event when this relationship does not seem to hold. In line with our objective to identify the long-run relationship between relative productivity and exchange rates, this result is quite relevant as it shows that the relationship between exchange rate and relative productivity is negative under normal circumstances (i.e., in the context of the regular business cycle). It means that the relative supply effect of productivity, where currency depreciation pushes demand in the lower productivity economy, dominates the currency appreciation effect leading to the increase in demand as a result of the increase in productivity, as Balassa-Samuelson model suggest.

The only time in which this relationship does not seem to hold was during the 2008 financial crisis period when the demand impact is so magnified that it supersedes the expected higher productivity impact of currency depreciation. The relative productivity ratio during this period is lower than in the rest of the sample and can be explained by the slow growth in labor productivity during this period in both economies. In the case of the US, compared to the prior ICT boom, a productivity decline had already been observed even before the period of the financial crisis and the following recessionary period (ECB, 2016).

Concerning the second regression model, there is a negative relationship between the manufacturing output and the exchange rate, which is indicative of the Dutch disease phenomenon (See Table B). However, the relative coefficient is significant only at the 10% level. This significance level improves after adding more variables in the final model specification but not above the 10% level. The addition of variables also does not change the value of the coefficient by a considerable amount, which suggests that the results obtained from the final specification are reliable. However, the higher p-value points towards the weakness of the relationship, which is perhaps indicative of the results of other research that the relationship only holds in some industries, so that the relationship for the overall economy is weak.

For the Dutch disease phenomenon to be present, the crowding out of manufacturing due to the commodity boom needs to prevail over a long period to be able to have a negative impact on the overall economy. However, this situation is not observed in the case of Canada, where the net impact on the overall economy is positive. Moreover, in sectoral research, the prevalence of the Dutch disease is found only in some industries and not in all the sectors of the Canadian economy.

The results also reflect the influence of other factors on the manufacturing sector. The *gdpne* variable has a high significance and explanatory power for the manufacturing sector growth. It means that the non-energy GDP, combined with the impact of other macroeconomic variables, has a larger influence on the overall manufacturing sector than the exchange rate does. For this reason, it would not be prudent to conclude that the commodity-driven exchange rate's negative relationship with the manufacturing sector necessarily indicates the prevalence of the Dutch disease.

The manufacturing sector also has a higher correlation with the *gdpne* variable than with any other variables. During the 2008 financial crises, when the negative relationship between the exchange rate and the manufacturing sector growth does not hold, the decline in the manufacturing sector is much more pronounced when the non-energy GDP also exhibits a significant decline. It is the largest negative point in the manufacturing sector growth data in the entire data sample. It is also the largest negative observation for non-energy GDP. In this observation, exchange rate reflects an appreciation, which perhaps contributes to enhancing the negative impact on the manufacturing sector growth.

The coefficient attached to the CPI variable reflects the expected positive relationship with the manufacturing sector growth. Manufacturing output will benefit from higher price levels as the productivity and economy grow. However, its explanatory power is relatively weak for the manufacturing sector output, even though it is significant. That is in agreement with Shakeri et al. (2012)'s findings that indicate that the price level and fiscal and monetary policy have weak to no explanatory power for the manufacturing sector output.

Table B: Dutch Disease Equation: Dependent Variable - mfgcan

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.053	.011		-4.582	.000
	cad	-.017	.009	-.117	-1.840	.070
	gdpne	2.797	.158	.958	17.668	.000
	cpi	.001	.000	.247	3.636	.001
For detailed statistics refer to Appendix 2						

Conclusion

In this discussion, our goal has been to first highlight the complexity in predicting exchange rate fluctuations. This area of economics remains elusive today as it was when Balassa (1964) and Samuelson (1964) found the failings of the absolute PPP model as an adequate explanation for international exchange rate movements. Over the years, exchange rate models have expanded to include a number of short-run and long-run factors that are believed to influence the exchange rates. However, where one model applies, others may not.

The changing international economic environment has also contributed to the complexity of exchange rate models, where more open economies, free capital flows, and overall globalization have resulted in increasingly complex interactions between the exchange rate explanatory variables and new factors influencing exchange rate fluctuations. Further, what one model will predict, others might reject. In all these models, however, there are common grounds, and the fundamental economic factors affecting exchange rate fluctuations may be, at least, identified through these models.

In most of the research on exchange rates, these models can be modified to fit particular situations. This is what has been done in the Canadian situation where a component reflecting commodity prices is included in some form due to the economy's reliance on commodity exports as one of its major economic driver. Commodity prices remain one of the most important inputs in any exchange rate models for Canada, although they do not explain the entire variation in the exchange rate. Also, which commodities are included may, at times, lead to inaccurate conclusions. Nevertheless, the inclusion of this variable is important and makes a significant contribution to explaining currency fluctuations in Canada.

Another important explanatory variable is the Canadian dollar relative to the US dollar, given that the US is Canada's major trading partner. While some exchange rate models also include other currency pairs, in such a case, the exchange rate and the commodity prices are not as closely related as when including the US dollar in our studies.

Given the close relationship between the exchange rate and commodity prices, the economy may be afflicted by the Dutch disease when it experiences a commodity boom. However, in the case of Canada, the problem is not so much of currency appreciation; in fact, empirical evidence shows that the net effect of such a development has been overall positive for the economy. Instead, its reliance on the US as the biggest trading partner creates problems of a lack of diversification, exposing the currency to magnifying impacts of appreciation from a commodity boom and impacts of depreciation from external factors, which results in a deterioration of the Canadian manufacturing sector. Evidence in favor of the Dutch disease ignores the presence, or more appropriately, the absence of a causal relationship between the deceleration of the manufacturing sector and commodity price hikes. This might lead to the incorrect conclusion that the Dutch disease is indeed present in the Canadian economy.

While empirical results point towards the prevalence of the Dutch disease, the weakness of the relationship indicates that other more significant economic interactions may be driving the manufacturing output. For instance, Dion (2007) highlights the impact of transitory labor reallocation during a resource boom, which affects productivity independently of the currency appreciation. Shakeri et al. (2012) point towards the prevalence of the Dutch disease in only a few industries. Beine et al. (2012) identify the currency components as an important role in describing the phenomenon. The research also points out that only a persistent decline in the manufacturing sector resulted from the commodity boom may be classified as the Dutch disease. In conclusion, for all these reasons, the negative relationship between the appreciation of commodity-driven exchange rates and the overall manufacturing output should be treated with caution.

References

Asea, P. K., & Corden, W. M. (1994). The Balassa-Samuelson Model: An Overview. *Review of International Economics*, (Special Issue). http://www.econ.ucla.edu/workingpapers/wp710.pdf

Balassa, B. (1964). The Purchasing Power Parity Doctrine: A Reappraisal. *Journal of Political Economy*, *72*, 584–96.

Bank of Canada. (2017). Bank of Canada. http://www.bankofcanada.ca/

Beine, M., Bos, C. S., & Coulombe, S. (2012). Does the Canadian Economy Suffer from Dutch Disease? *Research and Energy Economics*, *34*(4), 468–492. https://doi.org/https://doi.org/10.1016/j.reseneeco.2012.05.002

Bhagwati, J. (1984). Why Services are Cheaper in Poor Countries. *Economic Journal*, *94*, 279–86.

Blecker, R. A., & Seccareccia, M. (2009). Would a North American Monetary Union Protect Canada and Mexico against the Ravages of "Dutch Disease"? *Ola Financiera*, *3*, 104–46.

Boadway, R., Coulombe, S., & Tremblay, J.-F. (2012). The Dutch Disease and the Canadian Economy: Challenges for Policy-Makers. *In Thinking Outside the Box. Queen's University.*

Bone, R. M. (2010). *The Regional Geography of Canada*. Oxford University Press.

Canzoneri, M. B., Cumby, R. E., & Diba, B. (1999). Relative Labor Productivity and the Real Exchange Rate in the Long Run: Evidence for a Panel of OECD Countries. *Journal of International Economics*, *47*(2), 245–266.

Carney, M. (2012, September). Mark Carney: Dutch disease. Remarks by Mark Carney, Gov. of Bank of Canada and Chairman of Financial Stability Board. *Spruce Meadows Round Table, Calgary, Alberta*.

Cayen, J.-P., Coletti, D., Lalonde, R., & Maier, P. (2010). What Drives Exchange Rates? New Evidence from a Panel of U.S. Dollar Bilateral Exchange Rates. *Bank of Canada: Working Paper*.

Chen, Y., & Rogoff, K. (2002). Commodity Currencies and Empirical Exchange Rate Puzzles. *IMF Working Papers*.

Coulombe, S. (2013). The Canadian Dollar and the Dutch and Canadian Diseases. *The School of Public Policy Research Papers*, *6*(30).

Dion, R. (2007). Interpreting Canada's Productivity Performance in the Past Decade: Lessons from Recent Research. *Bank of Canada Review*, 19–32.

Dornbusch, R. (1980). Exchange Rate Economics. Where Do We Stand? *Brookings Papers on Economic Activity*, *1*. https://www.brookings.edu/wpcontent/uploads/1980/01/1980a_bpea_dornbusch_branson_whitman_kenen_houthakker_hall_lawrence_perry_fellner_brainard_vonfurstenburg.pdf

European Central Bank. (2016). The Employment-GDP Relationship since the Crisis. *ECB Economic Bulletin*, *Issue 6/2016*

Frenkel, J. A. (1976). The Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence. *Scandinavian Journal of Economics*, *78*, 200–224.

Government of Canada, S. C. (2017, March 24). National Economic Accounts: Quarterly Government Finance Statistics. http://www5.statcan.gc.ca/cansim/a45?lang=eng&childId=37641031&CORId=3764&pre

State=1&childIds=37641092;37641094;37641032;37641033;37641084;37641091;37641090;37641034;37641085;37641087;37641027;37641029;37641023;37641026;

Helliwell, J. F., Issa, R., Lafrance, R., & Zhang, Q. (2005). NEMO: An Equation for the Canadian Dollar. *Bank of Canada.*

Huang, H., Pang, K., & Tang, Y. (2014). Effects of Exchange Rates in Employment in Canada. *LCERPA Working Paper*, 2014–8. http://lcerpa.org/public/papers/LCERPA_2014_8_Pang.pdf

Issa, R., R., L., & J., M. (2008). The Turning Black Tide: Energy Prices and the Canadian Dollar. *Canadian Journal of Economics*, *41*(3), 737–759.

Kravis, I. B., & Lipsey, R. E. (1982). Towards an Explanation of National Price Levels. *National Bureau of Economic Research*. http://www.nber.org/papers/w1034.pdf

Mussa, M. (1976). The Exchange Rate, the Balance of Payments, and Monetary and Fiscal Policy under a Regime of Controlled Floating. *Scandinavian Journal of Economics*, *78,* 229-248.

Oomes, N., & Kalcheva, K. (2007). Diagnosing Dutch Disease: Does Russia Have the Symptoms? *IMF Working Paper*. https://www.imf.org/external/pubs/ft/wp/2007/wp07102.pdf

Organization for Economic Co-operation and Development. (1961, January 1). Consumer Price Index: Total, All Items for Canada©. https://fred.stlouisfed.org/series/CPALCY01CAQ661N

Ozbilgin, H. M. (2015). A Review on the Relationship between Real Exchange Rate, Productivity, and Growth. *Central Bank Review*, *15*, 61–77.

Rose, A. K., & Spiegel, M. M. (2009). Cross-Country Causes and Consequences of the 2008 Crisis: International Linkages and American Exposure. *Pacific Economic Review*, *15*, 340–363. https://www.frbsf.org/economic-research/files/wp09-17bk.pdf

Samuelson, P. (1964). Theoretical Notes on Trade Problems. *Review of Economics and Statistics*, *23*, l–60.

Shakeri, M., Gray, R. S., & Leonard, J. (2012). Dutch Disease or Failure to Compete? *Institute for Research on Public Policy*. http://irpp.org/research-studies/study-no30/

St. Louis Fed. (2017). Federal Reserve Economic Data | FRED | St. Louis Fed. https://fred.stlouisfed.org/

Takizawa, H., Lee, J., & Hauner, D. (2011). In Which Exchange Rate Models Do Forecasters Trust? *IMF Working Papers*, 1–17.

Tang, K., & Xiong, W. (2012). Index Investment and the Financialization of Commodities. *Financial Analysts Journal*, *68*(6), 54–74. https://doi.org/10.2469/faj.v68.n6.5

US Department of Commerce, B. E. A. (2017). Bureau of Economic Analysis. https://www.bea.gov/national/index.htm#gdp

Wooldridge, J. M. (2009). Introductory Econometrics: A Modern Approach (5th ed.). *Cengage Learning*.

Appendix 1

cad – Canadian exchange rate expressed as US dollars per Canadian dollar. This data was obtained from investing.com.

rp – relative productivity as the ratio of Canada's productivity to the US' productivity. Productivity is expressed as the real GDP (seasonally adjusted) per hour worked. For Canada, this data was obtained from CANSIM (Table: 36-10-0206-01). For the US, this data was constructed by using total hours worked data obtained from the Bureau of Labor Statistics (Reference: CES0000000001) and the real GDP (seasonally adjusted) data obtained from the Bureau of Economic Analysis (Table: 1.1.3.).

int – interest rate differential as the difference between the US and Canada 3-month LIBOR rates. For Canada, LIBOR was discontinued from May-2013 and instead Canadian Dollar Offered Rate (CDOR) is reported. CDOR has been used post the period since LIBOR was discontinued. The US and Canada 3-month LIBOR data was obtained from Federal Reserve Bank of St. Louis Economic Data (FRED Code: USD3MTD156N, CAD3MTD156N) and CDOR was obtained from the Bank of Canada.

cpne – commodity prices excluding energy related commodities. This is the Fisher price index excluding energy related commodities. The data was obtained from CANSIM (Table: 10-10-0132-01).

cpe – commodity prices of energy related commodities only. This is the Fisher price index for energy commodities. The data was obtained from CANSIM (Table: 10-10-0132-01).

mfgcan – change in Canada's manufacturing output measured through the seasonally adjusted manufacturing GDP based on chained 2007 dollars. The data was obtained from CANSIM (Table: 36-10-0449-01).

gdpne – change in Canada's non-energy output measured through the seasonally adjusted non-energy GDP based on chained 2007 dollars. The data was obtained from CANSIM (Table: 36-10-0449-01).

mfgus – change in US' manufacturing output measured through the seasonally adjusted index of US manufacturing sector output. The data was obtained from Federal Reserve Bank of St. Louis Economic Data (FRED Code: OUTMS).

cpi – Canada's Consumer Price Index (CPI) excluding food and energy. The data was obtained from Federal Reserve Bank of St. Louis Economic Data (FRED Code: CANCPICORMINMEI).

gexp – change in Canada's government expenditure measured through the seasonally adjusted final consumption expenditure. The data was obtained from CANSIM (Table: 36-10-0127-01).

Appendix 2

Natural log of *int* variable shows lower autocorrelation as depicted by the PACF, therefore this variable is included. However, we drop this variable due to a lack of significance after applying the FGLS procedure.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.227	.041		5.602	.000
	rpF	-.194	.064	-.265	-3.045	.003
1	cpneF	.001	.000	.342	3.369	.001
	cpeF	8.295E-005	.000	.419	4.723	.000
	lnintF	-.437	.362	-.091	-1.208	.231

Final model results and statistical tests SPSS output as below.

Time Series Tests for Variable: cad

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.9558
Note(3)	None
Truncation Lag(3)	4

Time Series Tests for Variable: rp

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.94507
Note(3)	None
Truncation Lag(3)	4

Time Series Tests for Variable: cpne

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.58318
Note(3)	None
Truncation Lag(3)	4

Time Series Tests for Variable: cpe

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.83806
Note(3)	None
Truncation Lag(3)	4

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.830[a]	.689	.676	.02395	.689	55.343	3	75	.000	1.500

a. Predictors: (Constant), cpeF1, rpF1, cpneF1

b. Dependent Variable: cadF1

Correlations

		cadF1	rpF1	cpneF1	cpeF1
Pearson Correlation	cadF1	1.000	-.557	.754	.727
	rpF1	-.557	1.000	-.578	-.328
	cpneF1	.754	-.578	1.000	.673
	cpeF1	.727	-.328	.673	1.000
Sig. (1-tailed)	cadF1	.	.000	.000	.000
	rpF1	.000	.	.000	.002
	cpneF1	.000	.000	.	.000
	cpeF1	.000	.002	.000	.
N	cadF1	79	79	79	79
	rpF1	79	79	79	79
	cpneF1	79	79	79	79
	cpeF1	79	79	79	79

Time Series Tests for Variable: cadF1

	Values
Test(1)	Phillips-Ouliaris Conintegration
Variables(1)	rpF1 cpneF1 cpeF1
P-Value(1)	0.01
Note(1))	p-value smaller than printed p-value
Truncation Lag(1)	0
Intercept Included(1)	Yes

Variables *mfgus* and *gexp* show a low level of significance. Removing *gexp* improves the significance of *cad* and removing *mfgus* worsens the significance of *cad*, while the coefficient of *cad* is only slightly affected. Note that the coefficient of *cad* after removing *mfgus* only remains the same as after removing both *mfgus* and *gexp.* Also note that the coefficient of *gdpne* increases when *gexp* is removed and vice versa for *mfgus*, retaining its high level of significance in both cases. Therefore, the impact of *mfgus* and *gexp* is reflected through *gdpne.* In either case, the main purpose is to test the relationship, significance, and direction of the impact of *cad* on *mfgcan*. Final results are discussed in the paper.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.051	.012		-4.296	.000
	cad	-.018	.009	-.128	-1.955	.054

	gdpne	2.730	.194	.935	14.075	.000
	mfgus	.039	.057	.044	.688	.494
	cpi	.001	.000	.247	3.663	.000
	gexp	-.036	.021	-.083	-1.676	.098

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.050	.012		-4.209	.000
	cad	-.019	.010	-.131	-1.978	.052
	gdpne	2.707	.196	.927	13.823	.000
	mfgus	.045	.058	.050	.782	.437
	cpi	.001	.000	.246	3.598	.001

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.053	.011		-4.653	.000
	cad	-.017	.009	-.116	-1.844	.069
	gdpne	2.809	.156	.962	17.958	.000
	cpi	.001	.000	.249	3.703	.000
	gexp	-.037	.021	-.085	-1.727	.088

Time Series Tests for Variable: mfgcan

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.19934
Note(3)	None
Truncation Lag(3)	4

Time Series Tests for Variable: gdpne

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.15454
Note(3)	None
Truncation Lag(3)	4

Time Series Tests for Variable: cad

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.96492
Note(3)	None
Truncation Lag(3)	4

Time Series Tests for Variable: cpi

	Values
Test(3)	Augmented Dickey-Fuller
Alternative Hypothesis(3)	Stationary
P-Value(3)	0.39025

Note(3)	None
Truncation Lag(3)	4

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
2	.902[a]	.814	.806	.00819	.814	109.299	3	75	.000	2.002

a. Predictors: (Constant), cpi, gdpne, cad

b. Dependent Variable: mfgcan

Correlations

		mfgcan	cad	gdpne	cpi
Pearson Correlation	mfgcan	1.000	-.140	.883	-.196
	cad	-.140	1.000	-.184	.622
	gdpne	.883	-.184	1.000	-.387
	cpi	-.196	.622	-.387	1.000
Sig. (1-tailed)	mfgcan	.	.109	.000	.041
	cad	.109	.	.052	.000
	gdpne	.000	.052	.	.000
	cpi	.041	.000	.000	.
N	mfgcan	79	79	79	79
	cad	79	79	79	79
	gdpne	79	79	79	79
	cpi	79	79	79	79

Time Series Tests for Variable: mfgcan

	Values
Test(1)	Phillips-Ouliaris Cointegration
	cad
Variables(1)	gdpne
	cpi
P-Value(1)	0.01
Note(1))	p-value smaller than printed p-value
Truncation Lag(1)	0
Intercept Included(1)	Yes