Exchange Rate Pass-Through and Domestic Inflation: Empirical Analysis for Canada

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Contents:

Abstract

This paper investigates the pass-through effects of exchange rate changes on domestic prices in Canada via an empirical analysis of its effects on the manufacturing industry as well as the business sector in general. Meanwhile, we also try to examine whether the inflation environment constrains the exchange rate pass-through.

In order to explore the impact of the pass-through of exchange rate changes on domestic inflation, we use a two-stage regression method and a VAR approach. First, we apply the regression on import prices to examine the relationship between the pass-through of exchange rate changes and import prices. Another regression is introduced to test the impact of import prices on domestic prices so that we can see how significant import prices are in shaping domestic prices and how the exchange rate pass-through is transferred to domestic prices. Second, a VAR model is used and the impulse response function shows the dynamic response of domestic prices to the exchange rate shocks in the two sub-industries. Empirical results of the two-stage regression and VAR analysis on the manufacturing industry and business sector show that the exchange rate changes have significant impact on domestic prices, furthermore, the speed and degree of the pass-through of exchange rate changes in the manufacturing industry is faster and larger than in the total business sector during the period from 1971 to 2000 in Canada. Additionally, evidence from the VAR analysis shows that the inflation environment does have an influence on the exchange rate

pass-through.

1. Introduction

The objective of this paper is to examine the relationship between the pass-through of exchange rate changes and domestic inflation both in the manufacturing industry and the aggregate business sector in Canada. In general, domestic prices are usually determined by import prices, unit labor cost and unit material cost. The changes in exchange rate will directly impact import prices and thus cause domestic prices to fluctuate, but domestic prices do not respond to exchange rate changes immediately and completely, especially in the short run. In recent years, researchers as John Taylor have focused on this issue and studied it in light of its implications for monetary policies. The speed and degree of the exchange rate pass-through may differ across time and change across industries even in the same country. Finding out the relationship between exchange rate pass-through and domestic prices will be helpful to adjust monetary policy and control domestic inflation. Recently many researchers pay more attention to the selection of suitable monetary and exchange rate policies, which have broad implications for the actual conduct of monetary policy, especially as it relates to such issues as macroeconomic stability, international transmission of shocks, and efforts to absorb shocks in international trade.

In order to explore the pass-through effects of exchange rate changes on domestic prices in the two sub-industries in Canada, this paper will use a two-stage regression method and a VAR approach to do the empirical research. Before the empirical analysis, we apply the Augmented Dickey-Fuller test to examine whether there is a unit root in each variable and the test results do not reject the null hypothesis of a unit root in the log form of all variables. So we adopt the first-difference form in the log values in our empirical research so that the empirical results are accurate and less biased. The reason why we use two regressions to accomplish the examination is that in the price equation we take into account the unit labor cost, which is one of the important factors having an influence on domestic prices and cannot be neglected. As for the unit material cost, another necessary component in the pricing equation, the import price may be considered a reasonable proxy from the viewpoint of imports of a particular industry. As a result, we use only the import price index and unit labor cost in the regression on the domestic prices. In the regression on the import prices, we use the exchange rate and the GDP price deflator in the U.S. as independent variables because both of them may impact on Canadian import prices directly. In addition, we use another econometric method, a VAR model to show the dynamic response of domestic prices to the exchange rate changes in the two sub-industries. In our empirical analysis, we focus on the manufacturing industry and the business sector in Canada and use the data of the period from 1971 to 2000. During this period the Canadian dollar experienced several fluctuations and its exchange rate to US dollar changed by about 50% at most in some years. So our interest in this paper is to examine how the fluctuations in the exchange rate of Canadian dollar to U.S. dollar are transmitted to domestic prices in the two sectors in Canada from 1971 to 2000. Recent empirical research shows that the exchange rate pass-through to import prices is different across sectors and time, and this difference affects significantly the behavior of domestic prices. The degree of pass-through of variations in the exchange rate depends on several factors. In the short run, it depends on the choice of invoice currency, price stickiness and monopolistic power of products [Takatoshi Ito, Yuri N. Sasaki and Kiyotaka Sato 2005]. In order to explain this problem, many recent researchers pay more attention to macroeconomic variables than to microeconomic ones. Engel and Devereux argue that movements in exchange rates and monetary aggregates of countries should influence the invoice currency in trade. In equilibrium, countries with low relative exchange rate variability or stable monetary policies would have their currencies chosen for transaction invoicing [Engel and Devereux (2001)]. Another result from the VAR analysis is that the inflation environment does have an impact on the exchange rate pass-through. The low degree of exchange rate pass-through is always accompanied by a low inflation environment.

One more thing we need to mention here is that the pass-through of exchange rate changes to domestic prices may be absorbed partially by exporters in the domestic country, because they want to maintain or increase their market shares abroad. In order to retain a certain international market share, they always try to keep the international price unchanged even though the domestic currency appreciates, which means that the export firms will lose some revenues abroad in terms of domestic currency unit. On the other hand, they will compensate their loss of revenue abroad by increasing domestic prices and respond to exchange rate changes via change in the markup of price over marginal cost. In other words, they offset the exchange rate changes by some adjustments in their price markup. Michael Knetter (1989) gave some empirical evidence showing that export unit values are sensitive to destination-specific exchange rate fluctuations for the majority of cases. In our paper we will focus on the pricing behavior of import firms and explore the exchange rate pass-through to domestic prices mainly from the viewpoint of import firms in the manufacturing industry and the broader business sector. We apply a two-stage regression method and a VAR approach and use data from 1971 to 2000 to analyze the impact of the pass-through of exchange rate changes on domestic prices in each sector. According to our empirical results in this paper, the degree and speed of the exchange rate pass-through in the manufacturing industry is stronger and faster than in the larger business sector during this period in Canada.

The rest of the paper is organized as follows: Section 2.1 gives the definition of exchange rate pass-through and section 2.2 provides an overview of the previous studies, which is accompanied by a short retrospect on the exchange rate and inflation regimes in Canada historically in section 2.3. In section 3.1, we describe the data we used in this paper and discuss their properties, while the unit root tests are carried out in section 3.2. The two regression models are set up in section 4.1 and the VAR model is given in section 4.2. We present the empirical results of the OLS regressions in the two sub-industries in section 5.1, while the VAR results are given in section 5.2. The concluding comments are to be found in section 6.

2. Theoretical background

Before we start the empirical analysis we need to first clarify what the exchange rate pass-through exactly refers to in our paper, which is very necessary for the setup of our models. Next we will review the previous studies on the exchange rate pass-through and introduce the historical exchange rate and inflation regimes in Canada so that we can know the background of these regimes.

2.1 Definition of exchange rate pass-through

The textbook definition of exchange rate pass-through is the percentage change in local currency import prices resulting from a one percent change in the exchange rate between the exporting and importing countries. In my opinion, this is a narrow definition of exchange rate pass-through. In most recent research works, a broader definition is always used instead of this narrow one since changes in import prices induced by changes in the exchange rate can inevitably be transferred to consumer prices and thus to domestic prices. Hence, in our paper, we will adopt this broader definition and try to examine the relationship between changes in the exchange rate and domestic prices.

2.2 Overview of previous studies on exchange rate pass-through

In traditional macroeconomic models of open economies, the exchange rate pass-through is scarcely analyzed, because in such models markets are characterized by perfect competition, purchasing power parity holds and prices are assumed to be fully flexible. Under these assumptions, the exchange rate pass-through is complete and immediate. But the empirical results may be inappropriate when markets are segmented and firms adopt different prices across countries, which underscores the need to introduce the role of imperfect competition and pricing to markets in the economy. Since mercantilist times, economists have recognized the role of the exchange rate mechanism in explaining domestic inflation. In the late 1980s, Paul Klemperer and Kenneth A. Froot (1989) examined the pass-through of exchange rate changes to import prices and emphasized the current market shares of firms in their model because they supposed that firms' future demands depend on their current market shares. They present evidence suggesting that import prices are more sensitive to the expected future exchange rates than to current exchange rates, which can explain why foreign firms attempt to gain more market shares when the price of domestic currency is expected to remain permanently higher. Another important conclusion from their model is that if producers regarded a particular year's appreciation as more temporary than past appreciations, the pass-through of exchange rate changes into import prices should have been lower than historical experience.

In the 1990s many further researchers made great contributions to the growth of the international literature on the exchange rate pass-through. Geoff Kenny and Donal Mcgettigan (1998) was one of them. Their study assessed the extent of exchange rate pass-through to import prices in England over the period from 1963 to 1995. One of the two noteworthy characteristics of this study is that they focused on the case of a small open economy and the other one is their recognition of the existence of strong simultaneity between import prices and domestic competing prices. Just because of these properties, their finding is somewhat different from previous studies, most of which ignored the simultaneity between import prices and domestic competing prices. According to Kenny and Mcgettigan's study, the pass-through of exchange rate changes to import unit values and domestic competing prices are very close to full pass-through, which is different from previous studies demonstrating the pass-through is less than full. While many researchers have studied much on the pass-through of exchange rate changes to import prices and producer prices in the past decades, some people paid attention to the issue of the relationship between the exchange rate pass-through and export prices. A good example is Wang Kuo-Liang and Wu Chung-Shu's paper in 1996. They based their survey on 22 petrochemical industries in Taiwan during the period from 1986 to 1992. Due to a weak pricing-to-market pattern, Taiwan's petrochemical firms absorbed only a small portion of a given weighted exchange rate change in their export prices, markup ratios and price-cost margins. However, the impact of exchange rate changes on export prices, markup ratio and price-cost margin appeared to increase from1987 to 1992. The increasing tendency can be understood as a result of the more competitive petrochemical market in the world and larger world market shares by Taiwan firms than before.

The study of the relationship between the pass-through of exchange rate changes and domestic inflation has been developed more recently by John Taylor (2000). He set up a microeconomic model under monopolistic competition hypothesis based on the U.S. data, which implied that pricing decisions are made optimally, pricing power and persistence of costs or prices are directly related. Evidence presented shows that low inflation environment in an economy will inevitably result in a decline in the pass-through of exchange rate changes. In other words, lower inflation itself caused the lower pass-through, which is a good explanation for the very low exchange rate pass-through seen in the 1990s in some low inflation countries. After the publication of John Taylor's paper, there has been a growing interest in examining the relationship between the exchange rate pass-through and inflation. McCarthy (2000), for instance, examined the influence of changes in exchange rate and import prices on domestic PPI (producer price index) and CPI (consumer price index) among eight industrialized countries. He used a VAR model and impulse response function to analyze his empirical research. His findings suggest that external shocks have different degrees of pass-through on domestic prices. In general, shocks from import prices have stronger effect on domestic inflation than shocks from exchange rate variations. Another conclusion from McCarthy, which is consistent with John Taylor's finding is that a higher degree of pass-through of the exchange rate changes is always associated with more fluctuations in the exchange rate and import prices. This demonstration was supported and consistent with Jose Manuel Campa and Linda S. Goldberg's work (2000). Campa and Goldberg provided cross-country and time series evidence on the extent of exchange rate pass-through into the import prices of twenty-three OECD countries. They focused on manufacturing industries of OECD countries and argued that countries with higher rates of exchange rate volatility are also those with higher pass-through elasticity. Besides this conclusion, they found another important thing in the study of exchange rate pass-through, i.e. the composition of imports does have an influence on the extent and degree of the pass-through of exchange rate changes.

By contrast with John Taylor's microeconomic model, Choudhri and Hakura (2001) set up an open macroeconomic model of the exchange rate pass-through under the hypothesis of imperfect competition and staggered contracts, and they emphasized the role of price inertia and expectations in their model. Although they focused on a macroeconomic model instead of a microeconomic one, the main conclusion they made is almost the same as that of John Taylor, which says that a low inflation environment may cause the degree of the exchange rate pass-through to decline and the reason is that the exchange rate pass-through reflects the expected effect of monetary shocks on current and future costs, which, in turn, are reduced by having a low-inflation regime. Their research result also implies that the relationship of the pass-through of exchange rate changes and domestic inflation should be taken into account in manipulating monetary policies.

Based on previous studies, Elke Hahn (2003) provided more external shocks instead of only exchange rate shocks in his study to analyze how external shocks impact euro area inflations. The external shocks in his study include oil price shocks, exchange rate shocks, and non-oil price shocks. One of the focuses of this paper is how the pass-through of external shocks changes along the distribution chain, i.e. import prices, producer prices and consumer prices. His analysis is based on a VAR model and used impulse response functions to capture the size and speed of the pass-through of external shocks. In addition, he used historical decompositions to obtain the size of the impact from external shocks in the euro area since the start of the European Monetary Union. His model is somewhat similar to that of McCarthy, who also analyzed the pass-through at different stages of the distribution chain. In this study, Elke Hahn concluded that the pass-through of oil prices is the largest and fastest, followed by exchange rate pass-through, while the pass-through of non-oil prices is the smallest and slowest. According to his analytical results, the pass-through of external shocks declines along the distribution chain.

More recently, the question of whether macroeconomic factors, such as the inflation environment, have an impact on the degree of exchange rate pass-through has been studied and developed further by some new researchers. This can be seen in the research of Jeannine Bailliu and Eiji Fujii (2004). They undertook empirical research on eleven industrialized countries and focused on the problem of whether a low-inflation environment induced by a shift in monetary policy results in a decline in the exchange rate pass-through to consumer prices. They used a panel-data approach of 11 industrialized countries over the period from 1977 to 2000 to do the test and the results showed that the pass-through to import prices, producer prices and consumer prices declined during the period when there were relatively stable inflation environments in many industrialized countries in the early 1990s. Although the approach they used is different from John Taylor and McCarthy's, their empirical results all support the hypothesis that exchange rate pass-through declines with a shift to a low-inflation environment brought about by a change in the monetary policy.

Another aspect of the literature in the exchange rate pass-through is how export prices react to exchange rate movements. We can see empirical evidences from Michael Knetter (1989). He built a fixed-effects model to show the relationship between exchange rates and export prices across destinations and distinguished marginal cost from markup responses to an exchange rate change. Empirical results showed that export unit values are sensitive to destination-specific exchange rate fluctuations for the majority of cases. His research result was supported and developed by Isabelle Mejean (2004). The author used a large set of industries in six OECD exporting countries thereby allowing for multidimensional comparison, and this supply-side approach and industry-based method increased the accuracy of the estimation on the pass-through. Her empirical research reveals that export prices are sensitive to exchange rate movements, but the extent and degree of the exchange rate pass-through vary from one industry to another and are different among countries. This result implies that the market structure and competitive environments that export firms face do have an influence on the exchange rate pass-through. On the other hand, the pass-through elasticity in different destination markets toward one exporter is almost homogeneous.

2.3 Historical exchange rate and inflation regimes in Canada

The Bank of Canada allowed the Canadian dollar to float after 1950, with the exception of a short period between 1962 and 1970 when the exchange rate was fixed to the U.S. dollar. The Canadian dollar appreciated sharply in the early 1970s and it reached a high of US$1.0443 on 25 April 1974. This appreciation was due to the rising prices of raw materials and large inflows of foreign capital as well as the weakness of the US dollar against all major currencies at the time when the Bretton Woods system of fixed exchange rates had collapsed. In order to control this situation and relieve the upward pressure on the Canadian dollar, the Canadian authorities lowered Canadian short-term interest rates and narrowed the interest rate gap with the United States. Throughout the 1980s, the Canadian dollar weakened sharply during the first half of the decade and then recovered by the late 1980s. The depreciation of Canadian dollar in the early 1980s was due mostly to the falling commodity prices, and perhaps to the effect of a significant appreciation of the U.S. dollar against most other major currencies. During the second half of this decade the Canadian currency was boosted by several factors. One important factor was the anti-inflationary monetary policy of Canadian authorities reflected in a significant tightening of monetary policy aiming at cooling what the authorities considered an overheating economy, and the rebound in commodity prices also played an important role in the recovery of Canadian dollar at that time. The Canadian dollar suffered a large depreciation during the 1990s, once again, with much of the depreciation of the Canadian currency being attributed to the weakened commodity prices when the financial and economic crisis in emerging markets widened and intensified. Meanwhile the U.S. dollar played a safe-haven role in the world market, which also weighed against the Canadian dollar during this decade.

As for the inflation regime, the monetary policy in Canada is guided by an inflation-control target and the target range for inflation also commits the Bank of Canada to prevent significant deflation from developing when the rate of inflation declines. The Government of Canada and the Bank of Canada agreed to target inflation for a five-year period in 1991. The initial goal was to reduce inflation to progressively low levels, first to 3 per cent, then to 2.5 per cent, and then to 2 per cent. The monetary policy of the Bank of Canada is aimed at taking advantage of the benefits of low inflation. It has been argued by the Bank of Canada that a low-inflation economic environment helps to create a positive climate for low interest rates and stabilize long-term investments. The government and the Bank of Canada agreed to extend the inflation-control target range at the end of 1998, and the target range of 1 to 3 per cent was renewed in 2001. The commitment of Canadian policy makers has been that the monetary policy will continue to be aimed at keeping inflation at the 2 per cent target midpoint. Traditionally, the inflation rate is measured by the consumer price index and is expressed as a percentage increase in average prices of goods and services over a given year. The CPI, also called cost-of –living index, is an inflation indicator that measures the change in the cost of a fixed basket of products and services, including housing, electricity, food, and transportation. But in our paper we will use the GDP implicit price deflator to account for the effects of inflation. It is the current dollar GDP divided by constant dollar GDP. Since we will examine the exchange rate pass-through into domestic inflation by focusing on the manufacturing industry and business sector instead of just the retail sector, the GDP price deflator is a better choice than the consumer price index to reflect the inflation in various sub-industries and in the aggregate business sector. We will explain the advantage that the GDP price deflator has over the consumer price index to reflect domestic inflation in our models in section 3.

3. Data and their properties

3.1 The data set

In this paper we analyze two major sectors in Canada, the manufacturing industry and the aggregate business sector. From 1971 until 2000, the exchange rate of Canadian dollar experienced several large fluctuations; hence we use annual data for this period in the two sectors to do our empirical research. The aim of this paper is to explore the relationship between the exchange rate pass-through and domestic inflation, thereby entailing a two-stage regression process; first, regression on domestic import prices and second, regression on domestic GDP price deflator on industry levels. Meanwhile, we use a VAR approach to examine the dynamic response of domestic prices to the exchange rate changes as well as the effects of inflationary environment on the exchange rate pass-through.

First, in the regression on domestic import prices, we want to focus on the issue of how changes of the exchange rate and foreign prices impact on import prices, so the corresponding variables, the domestic import prices, exchange rate and the GDP price deflator in the U.S. should be included in the first-stage regression in our empirical model.

In the second-stage regression, the variable selection is based on the consideration of the price equation, which counts for much in our empirical analysis. Although there are many price equations that we can find in recent studies, every equation emphasizes one or more variables that are deemed important to the assumption of the price determination, say, profit maximization or growth maximization. For example, Eichner (1973) extended the behavioral models of firms developed by Marris (1964) and took into account the internally financed investment in his model, where the level of investment, the sources of funds for that investment and the mark-up are all jointly determined by the marginal efficiency of investment funds relative to the marginal supply cost of those funds. In our empirical research we will use Eckstein and Wyss's price equation based on the target-return model for reference and thus take unit labor cost into account in our model. Two properties can be found in their target-return model. One is that firms can respond to changes in labor and material costs with wages changes, and the other one is that the need for profits to finance its operations and growth eventually propel the firms to run the risk to raise prices, thus subnormal earnings become the direct variable that moves prices. The price equation based on this model can be stated formally as follows:

$$P=A*K/X+ULC+UMC$$

where A is the target rate of return, K the capital stock, X the standard output, ULC the standard unit labor cost, and UMC the standard unit material cost. Since we consider the pass-through of exchange rate changes to domestic prices only from the viewpoint of import firms in sub-industries, we ignore the capital stock, target rate of return and output level, while keeping unit labor cost and unit material cost as variables in our model. Still from the viewpoint of import firms in the two sub-industries, import prices may be a reasonable proxy for unit material cost. If we treat both import prices and unit material cost as independent variables in the regression on domestic prices, a problem of possible double-counting may occur and it will lead to biased empirical results. So we omit the unit material cost in our second regression equation and thus the import price index and the unit labor cost are independent variables in the second-stage regression.

Here we choose the sub-industrial GDP price deflator as the domestic price in each sector since this ratio reflects the change in the prices of bundles of goods that make up GDP in a particular sector. Because it is not based on a fixed basket of goods and services, the GDP price deflator has an advantage over the consumer price index (CPI). Changes in consumption patterns or the introduction of new goods and services are automatically reflected in the deflator. As for the selection of the foreign country, the United States is an important exporter to Canada and it held more than 60% of the share of the Canadian import market during this period from 1971 to 2000. Consequently, the GDP price deflator in the United States instead of its CPI is a proxy of the foreign price in the empirical research because Canada imports not only the United States consumer goods but also its producers' goods.

The availability of the data for that period in the two sectors is an important issue that needs to be addressed in an empirical research, because the empirical results may be affected by the selection of the data. First, the import price index we use in the empirical analysis is the aggregate data rather than industry level data, because industry level import prices series are not available in Canada. Second, in the two sectors, unit labor cost is given by quarters, so we compute annual average data using the quarterly data from the business and manufacturing sectors. Similarly, the annual GDP price deflator in the U.S. is also computed using quarterly data. Moreover, the exchange rate adopted in this paper is the nominal effective exchange rate, expressed as the price of U.S. funds in Canadian dollars.

3.2 The unit root tests

Before setting up the empirical models, we need to test whether there is a unit root in the process of each variable in order to make sure that stationary series are adopted in our empirical research and the results based on them are accurate. If a variable is truly I(1), shocks to it will have permanent effects, which may lead to biased empirical results. Since the definition of the exchange rate pass-through requires the use of percentage changes of variables, we start with the logarithm form of all variables and then take the first-difference in the log values. The Augmented Dickey-Fuller tests for the log forms of all variables are carried out in Table 1-1 and for the first-difference forms in the log values are in Table 1-2. In the two tables, the last column in each panel is the conclusion at 95 percent significance level.

In the unit root tests for the log forms of all variables in table 1-1, there are 29 observations used in each one and the test statistics are DFt and DF_Y. For all variables in the log form, neither DFt nor DF_Y is less than the critical value –3.6 and –17.9 respectively, so we conclude that there is a unit root in each variable in the log form.

In table 1-2, the ADF tests are carried out for the first-difference forms in the log values of all variables and 28 observations are used in each one. The test results suggest that the hypothesis of a unit root can be rejected at 95% significance level for all variables except for Δ logPM and Δ logPD-bus. Although a unit root still exists in the first difference form of logPM and logPD-bus, the empirical results based on the first-difference forms in the log values of all variables can be approximately accurate and not much biased. Since the ADF tests for the log forms of all variables do not reject the null hypothesis of a unit root and, for most variables, the unit roots do not exist in the first-difference forms in the log values, we will adopt the first-difference form in the log values of all variables in the following empirical research.

4. Empirical model

4.1 Two stage regression models

In order to examine the pass-through effects of exchange rate changes on the domestic inflation, we use a two-stage regression method to analyze two important related problems. In the first-stage regression, we need to examine how changes in the exchange rate and foreign prices impact on import prices. Our regression equation for this stage is:

$$\Delta \log PM_t = \alpha_0 + \alpha_1 * \Delta \log ER_t + \alpha_2 * \Delta \log USP_t + \varepsilon_t$$

where the variables PM, ER and USP are domestic import price index, nominal effective exchange rate and the GDP price deflator in the United States. Here ε_t is the disturbance in the regression. In this model we use the exchange rate and the GDP price deflator in the U.S. as independent variables, because import prices can be influenced not only by exchange rate changes but also by changes in foreign prices. For example, in the case in which the U.S. dollar appreciates in relation to Canadian dollar, the U.S. export volume to Canada will decrease if U.S. export firms let their export prices rise. Otherwise, the export firms would have to keep their export prices stable in order to maintain their foreign market share, but they may choose to increase their domestic prices to compensate for their loss of revenue in the foreign market. In this case, the import price of Canada will definitely be influenced by the increased U.S. domestic prices as well as the exchange rate changes.

In the second stage regression, domestic price is a function of the import price and unit labor cost, so the import price and unit labor cost are independent variables and we can see how changes in import prices are passed through to domestic prices. Since the unit labor cost and the GDP price deflator are obtained at the industry level, the second stage regression model must be set up for each sector respectively. The regression equations are:

$$\Delta \log PD_{t\text{-}mnf} = \beta_0 + \beta_1 * \Delta \log PM_t + \beta_2 * \Delta \log ULC_{t\text{-}mnf} + \mu_{1t}$$

$$\Delta \log PD_{t\text{-}bus} = \gamma_0 + \gamma_1 * \Delta \log PM_t + \gamma_2 * \Delta \log ULC_{t\text{-}bus} + \mu_{2t}$$

where PD, PM and ULC are the GDP price deflator, the import price index and unit labor cost. Here μ_{1t} and μ_{2t} are the disturbances in the regression. Additionally, the subscripts mnf and bus refer to the manufacturing industry and business sector respectively.

4.2 The VAR model

In order to explore the interrelationship between the pass-through of exchange rate changes and domestic prices dynamically, we use another econometric approach, the vector autoregression (VAR) to do the empirical research in the manufacturing industry and business sector in Canada. Furthermore, the VAR approach can examine whether the inflation environment in each sector has influence on the exchange rate pass-through. The basic VAR model in our paper is expressed as follows:

$$\Delta \log PD_t = \alpha_0 + \alpha_1 * \Delta \log PD_{t-1} + \alpha_2 * \Delta \log PD_{t-2} + \alpha_3 * \Delta \log ER_{t-1} + \alpha_4 * \Delta \log ER_{t-2} + \eta_{1t}$$

$$\Delta \log ER_t = \beta_0 + \beta_1 * \Delta \log PD_{t-1} + \beta_2 * \Delta \log PD_{t-2} + \beta_3 * \Delta \log ER_{t-1} + \beta_4 * \Delta \log ER_{t-2} + \eta_{2t}$$

To trace out the time path of the effects the exchange rate pass-through and domestic inflation, we apply the impulse response function and analyze the dynamic response of the GDP price deflator to the exchange rate movements in the two sectors.

5. The empirical results

5.1 Empirical results of the regressions

5.1.1 First-stage regression (on import prices)

In the regression on import prices in both the manufacturing industry and the aggregate business sector, the empirical results show that the coefficients of the relative exchange rate of Canadian dollar to the U.S. dollar (ER), and the U.S.GDP price deflator (USP) are statistically significant at the 95% confidence level (see table 2-1). The positive coefficient of the exchange rate suggests that the incomplete exchange rate pass-through exists and the depreciation of the U.S dollar has a certain influence on Canadian import prices. The GDP price deflator in the U.S. also has a positive coefficient and the p-value is comparatively small, which says that the GDP price deflator in the United States really has an impact on Canada's import prices and we can refute the null hypothesis that the coefficient of USP is zero. Due to the close geographical proximity and strong trade relationship between Canada and the United States, the U.S. shares more than 60 percent of the Canadian import market and is the largest exporter to Canada. Hence the fluctuations of the GDP price deflator in the United States definitely influence export prices of the United States and thus make Canada's import prices move accordingly. It is also important to notice that the coefficient of USP is much larger than that of ER, which implies that fluctuations in the GDP price deflator in the U.S. have a larger impact on import prices in Canada than movements in the exchange rate.

5.1.2 Second-stage regression (on domestic prices)

(1) Manufacturing industry

As for the second-stage regression, we have to analyze the empirical results by sectors because each sector has its own GDP price deflator and unit labor cost separately. In the manufacturing industry, the empirical results of the regression on the GDP price deflator show that the coefficients of the import prices (PM) and unit labor cost (ULC-mnf) are statistically significant at the 95% confidence level (see table 2-2). The coefficients of the two variables are both positive, which implies that import prices and unit labor cost in the manufacturing industry have a positive impact on the GDP price deflator in this sector, e.g., an increase in import prices or unit labor cost will lead the GDP price deflator in the manufacturing industry to rise. Comparatively, the unit labor cost of manufacturing industry has less influence on the GDP price deflator in this sector than import prices.

By means of our two-stage regressions, we can see that changes in the exchange rate are not completely passed through to import prices, and thus are only partially transferred to the GDP price deflator of the manufacturing industry. Keeping other variables stable, a one percent change of the exchange rate will cause 0.171 percent change in the GDP price deflator in manufacturing industry. Consequently, the pass-through of the exchange rate changes to domestic prices in manufacturing industry is incomplete on an annual basis and the domestic inflation is also influenced by the U.S.GDP price deflator and unit labor cost in this sector. Similarly, keeping other variables constant, this would suggest that a one percent change of unit labor cost and of the U.S.GDP price deflator will cause 0.223 percent and 0.383 percent change respectively in the GDP price deflator in the Canadian manufacturing industry.

(2) Business Sector

In the second-stage regression of the business sector, the results show that the coefficients both of the import prices (PM) and the unit labor cost in the business sector (ULC-bus) are statistically significant at the 95% confidence level (see table 2-3). As in the manufacturing industry, the coefficients of the two variables are also positive, in which case an increase of PM and ULC-bus will cause PD-bus to rise and a decrease of PM and ULC-bus will cause PD-bus to fall. In addition, we can see that in the business sector, the import price variable has less impact on the domestic GDP price deflator, while the influence of unit labor cost on the domestic GDP price deflator is much larger than that in the manufacturing industry.

According to the results of the business sector, a one percent change in the exchange rate will lead to a 0.146 percent change in the GDP price deflator in the business sector. Similarly, a one percent change in unit labor cost in the business sector and the GDP price deflator in the U.S. will cause 0.495 percent and 0.326 percent change respectively in the GDP price deflator in this sector. Comparing this result with that of the manufacturing industry, we can see that the degree of exchange rate pass-through in the business sector is less than that in the manufacturing industry. Perhaps because of the lower proportion of non-traded goods, the GDP price deflator in the business sector reacts less than that in the manufacturing industry due to a one percent change in the exchange rate. Hence, the degree of the exchange rate pass-through in the business sector is less significant than that in the manufacturing industry. On the other hand, unit labor cost in the business sector has much greater effect on domestic prices than that in the manufacturing industry.

5.2 Empirical results of the VAR model

Figure 1 displays the response of the GDP price deflator in the manufacturing industry (PD-mnf) to an exchange rate (ER) shock. The initial impact of the exchange rate changes on PD-mnf is positive and a one percent increase in the exchange rate amounts to 0.03 percent increase in the GDP price deflator after one year. In the manufacturing industry the exchange rate pass-through accumulates to 0.06 percent after three years.

Figure 2 displays the response of the GDP price deflator in the business sector (PD-bus) to an exchange rate (ER) shock. The initial impact of ER to PD-bus is also positive, after one year it amounts to 0.01 percent increase in the GDP price deflator due to a one percent increase in the exchange rate. After four years the exchange rate pass-through accumulates to 0.04 percent in the business sector. Comparing this result with that in the manufacturing industry, the degree and speed of the exchange rate pass-through in the manufacturing industry is larger and faster than that in the business sector.

From the VAR analysis we can notice that the pass-through of exchange rate changes to domestic inflation in the two sectors during the 1970s is much higher than in other decades, in contrast, the pass-through is comparatively low from the middle 1980s to the early 1990s. This is consistent with the movements of the domestic inflation in both of the two sectors. The inflation rate in the two sectors reached the highest point during the decade of the 1970s and there was a high-inflation environment in that decade. Due to the policy of targeting a low inflation rate implemented by the Bank of Canada, the inflation rate became lower from 1985 to 2000. This relation between the variations of the exchange rate pass-through and the inflation environment shows that the pass-through of exchange rate changes may be constrained by domestic inflation. The low degree of exchange rate pass-through is always accompanied by few movements in domestic prices. In other words, a low inflation environment may limit the pass-through of exchange rate changes, which implies that domestic prices react less to exchange rate movements in a low inflation environment than in a high inflation environment. This may be so because, in a low inflation economy associated with large unused capacity, firms would be faced with a much more competitive environment, thereby facing more difficulties in shifting forward exchange rate depreciation to consumers in terms of higher domestic prices.

6. Concluding comments

This paper explores the relationship between the exchange rate pass-through and the domestic inflation in manufacturing industry and the aggregate business sector in Canada. During the period from 1971 to 2000, the value of Canadian dollar to U.S. dollar experienced several large fluctuations, so in this paper we employed the annual data during this period in the two sectors and tried to examine whether the varying performances of the exchange rate have an impact on domestic prices. In our empirical analysis, we use the first-difference form in the log values of all variables instead of the log form because the Augmented Dickey-Fuller tests do not reject the hypothesis of a unit root in each variable in their log forms. Meanwhile, a two-stage regression model and a VAR approach are used to characterize the behavior of the GDP price deflator in each sector in response to the exchange rate changes. In the regression model, we take Eckstein and Wyss's price equation for reference and introduce unit labor cost into our empirical framework and the regression results show that it has a significant impact on the GDP price deflator in each sector, especially in the business sector. According to the results of the regressions, the degree of the exchange rate pass-through in manufacturing industry is really larger than that in the business sector. From our VAR analysis, some further findings were obtained. First, strong evidence shows that the speed and degree of the pass-through of exchange rate changes to domestic inflation in the manufacturing industry is faster and stronger than that in the business sector in Canada. Second, the consistency between the movements of the exchange rate pass-through and the domestic inflation implies that the inflation environment does have an influence on the exchange rate pass-through.

The findings above have a number of important policy implications for Canada's economy. One is that the exchange rate pass-through to domestic inflation is different across industries; hence the economic status of a particular industry plays an important role in the pass-through of exchange rate changes to domestic prices. Since the response of the GDP price deflator to the exchange rate changes in the manufacturing industry is really stronger than that in the business sector, prices are more sensitive to the exchange rate changes in the manufacturing industry than in the business sector. Another one is that the degree of the exchange rate pass-through will be reduced under a credible inflation environment, and this dependence would make it more valuable for a country to implement an inflation-control policy as long as the lower inflation environment does not engender problems of lower growth that are often associated with a low-inflation economy. Hence, to summarize, from our empirical analysis in the manufacturing industry and the aggregate business sector in Canada from 1971 to 2000, the exchange rate pass-through to domestic prices differs across industries and the inflation environment does have an impact on the exchange rate pass-through.

Table 1-1: Unit Root Tests ----Log Form

(Standard errors of estimates in parentheses)

	μ	β	γ	DFt	DF γ	Conclusion
logPM	0.193084 (0.100478)	-0.000529 (0.001213)	0.935273 (0.047374)	-1.366	-1.877	Do not reject Ho
logER	0.360026 (0.223348)	0.001049 (0.000726)	0.821743 (0.112072)	-1.591	-5.169	Do not reject Ho
logUSP	0.077273 (0.080424)	-0.000457 (0.001078)	0.971330 (0.054142)	-0.529	-0.831	Do not reject Ho
logPD-mnf	0.118897 (0.026620)	0	0.948091 (0.014197)	-3.656	-1.505	Do not reject Ho
logPD-bus	0.118019 (0.053881)	-0.000486 (0.000812)	0.953170 (0.035084)	-1.335	-1.358	Do not reject Ho
logULC-mnf	0.082113 (0.080983)	-0.001180 (0.001028)	0.974843 (0.051949)	-0.484	-0.817	Do not reject Ho
logULC-bus	0.099043 (0.065991)	-0.000744 (0.000944)	0.963138 (0.043955)	-0.839	-1.069	Do not reject Ho

Table 1-2: Unit Root Tests ----First-Difference Form In Log Values

(Standard errors of estimates in parentheses)

	μ	β	γ	DFt	DF γ	Conclusion
Δ logPM	0.039110 (0.013270)	-0.001540 (0.000624)	0.381362 (0.171984	-3.597	-17.322	Do not reject Ho
Δ logER	0.004133 (0.003214)	0	0.358784 (0.180869)	-3.545	-17.954	Reject Ho at 95%
Δ logUSP	0.044037 (0.008088)	-0.001365 (0.000331)	-0.226098 (0.188334)	-6.510	-34.331	Reject Ho at 95%
Δ logPD-mnf	0.029608 (0.009300)	-0.000931 (0.000390)	0.322459 (0.179654)	-3.771	-18.971	Reject Ho at 95%
Δ logPD-bus	0.028300 (0.008893)	-0.001004 (0.000359)	0.438123 (0.164606)	-3.413	-15.733	Do not reject Ho
Δ logULC-mnf	0.032473 (0.010291)	-0.001351 (0.000491)	0.320165 (0.176496)	-3.852	-19.035	Reject Ho at 95%
Δ logULC-bus	0.033002 (0.009982)	-0.001204 (0.000426)	0.280076 (0.188028)	-3.829	-20.158	Reject Ho at 95%

Table 2-1: OLS Estimation on the import price

Dependent Variable: Δ logPM
Method: Least Squares
Date: 09/02/05 Time: 18:31
Sample: 1972 2000
Included observations: 29
Δ logPM=C(1)+C(2)* Δ logER+C(3)* Δ logUSP

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000698	0.007421	0.094077	0.9258
C(2)	0.494874	0.269292	1.837687	0.0776
C(3)	1.105037	0.315393	3.503678	0.0017
R-squared	0.390390	Mean dependent var		0.024103
Adjusted R-squared	0.343497	S.D. dependent var		0.029404
S.E. of regression	0.023825	Akaike info criterion		-4.538502
Sum squared resid	0.014758	Schwarz criterion		-4.397057
Log likelihood	68.80827	Durbin-Watson stat		1.596745

Table 2-2: OLS Estimation on domestic prices (Manufacturing Industry)

Dependent Variable: Δ logPD-mnf
Method: Least Squares
Date: 09/02/05 Time: 19:06
Sample: 1972 2000
Included observations: 29
Δ logPD-mnf=C(1)+C(2)* Δ logPM+C(3)* Δ logULC-mnf

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.009958	0.002727	3.651639	0.0012
C(2)	0.346302	0.092221	3.755145	0.0009
C(3)	0.222756	0.118805	1.874972	0.0721
R-squared	0.634823	Mean dependent var		0.022069
Adjusted R-squared	0.606732	S.D. dependent var		0.017566
S.E. of regression	0.011016	Akaike info criterion		-6.081263
Sum squared resid	0.003155	Schwarz criterion		-5.939819
Log likelihood	91.17832	Durbin-Watson stat		1.526025

Table 2-3: OLS Estimation on domestic prices (Business Sector)

Dependent Variable: Δ logPD-bus
Method: Least Squares
Date: 09/02/05 Time: 19:15
Sample: 1972 2000
Included observations: 29
Δ logPD-bus=C(1)+C(2)* Δ logPM+C(3)* Δ logULC-bus

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.005239	0.002098	2.497690	0.0192
C(2)	0.295304	0.062473	4.726918	0.0001
C(3)	0.495065	0.100188	4.941379	0.0000

R-squared	0.830766	Mean dependent var	0.022241
Adjusted R-squared	0.817748	S.D. dependent var	0.017612
S.E. of regression	0.007519	Akaike info criterion	-6.845116
Sum squared resid	0.001470	Schwarz criterion	-6.703672
Log likelihood	102.2542	Durbin-Watson stat	1.675155

Table 3-1: Vector Autoregression Estimates (Manufacturing industry)

Sample(adjusted): 1974 2000
Included observations: 27 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	Δ logPD-mnf	Δ logER
Δ logPD-mnf(-1)	0.643944	-0.320703
	(0.20486)	(0.23128)
	[3.14327]	[-1.38666]
Δ logPD-mnf(-2)	-0.170427	0.185275
	(0.20152)	(0.22750)
	[-0.84571]	[0.81439]
Δ logER(-1)	0.230759	0.409647
	(0.18633)	(0.21035)
	[1.23844]	[1.94742]
Δ logER(-2)	0.104499	-0.006896
	(0.18741)	(0.21157)
	[0.55761]	[-0.03260]
C	0.009229	0.006893
	(0.00517)	(0.00584)
	[1.78393]	[1.18033]
R-squared	0.442562	0.208440
Adj. R-squared	0.341210	0.064520
Sum sq. resids	0.004760	0.006067
S.E. equation	0.014710	0.016606
F-statistic	4.366573	1.448302
Log likelihood	78.37328	75.09904
Akaike AIC	-5.435058	-5.192521
Schwarz SC	-5.195088	-4.952552
Mean dependent	0.022148	0.006370
S.D. dependent	0.018123	0.017169
Determinant Residual Covariance		5.93E-08
Log Likelihood (d.f. adjusted)		148.0284
Akaike Information Criteria		-10.22432
Schwarz Criteria		-9.744384

Table 3-2: Vector Autoregression Estimates (Business Sector)

Sample(adjusted): 1974 2000
Included observations: 27 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	Δ logPD-bus	Δ logER
Δ logPD-bus(-1)	1.203193	-0.276661
	(0.16134)	(0.30754)
	[7.45732]	[-0.89959]
Δ logPD-bus(-2)	-0.473397	0.356241
	(0.16218)	(0.30913)
	[-2.91898]	[1.15238]
Δ logER(-1)	0.118605	0.360920
	(0.11035)	(0.21034)
	[1.07482]	[1.71589]
Δ logER(-2)	0.045690	-0.044953
	(0.10909)	(0.20793)
	[0.41884]	[-0.21619]
C	0.004349	0.002435
	(0.00301)	(0.00575)
	[1.44251]	[0.42371]
R-squared	0.792130	0.188331
Adj. R-squared	0.754335	0.040755
Sum sq. resids	0.001712	0.006221
S.E. equation	0.008822	0.016816
F-statistic	20.95882	1.276165
Log likelihood	92.17747	74.76038
Akaike AIC	-6.457591	-5.167435
Schwarz SC	-6.217621	-4.927466
Mean dependent	0.021778	0.006370
S.D. dependent	0.017799	0.017169
Determinant Residual Covariance		2.16E-08
Log Likelihood (d.f. adjusted)		161.6476
Akaike Information Criteria		-11.23316
Schwarz Criteria		-10.75322

Figure 1: Impulse Response of Δ logPD-mnf

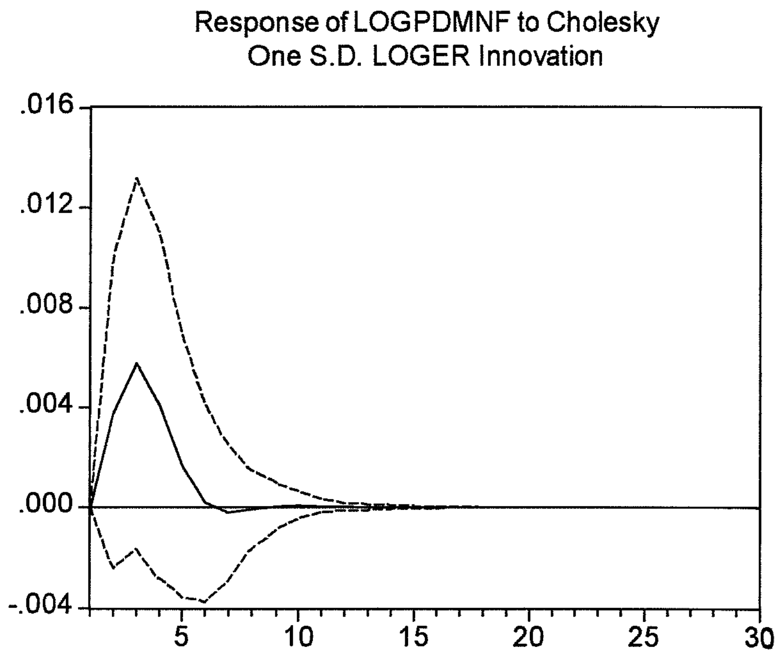


Figure 2: Impulse Responses of Δ logPD-bus

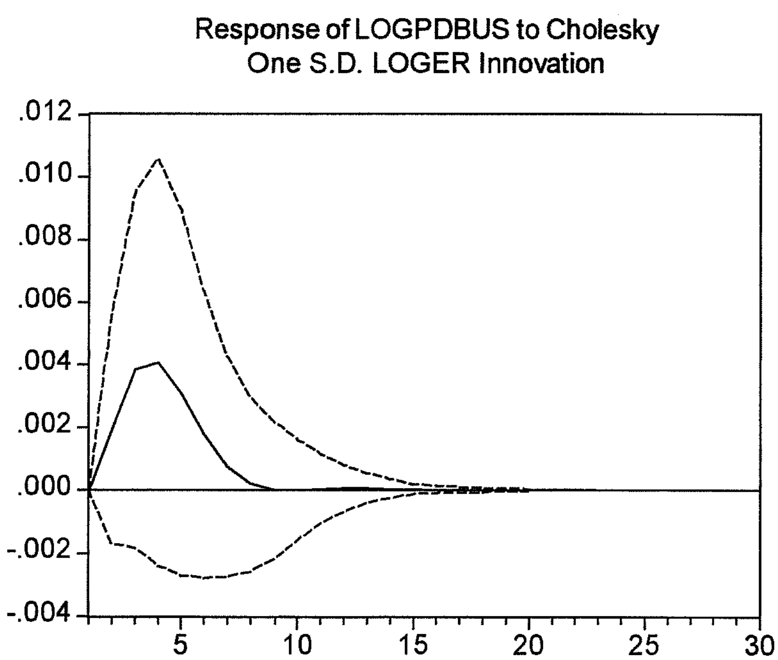


Figure 3: Inflation rate in the manufacturing industry

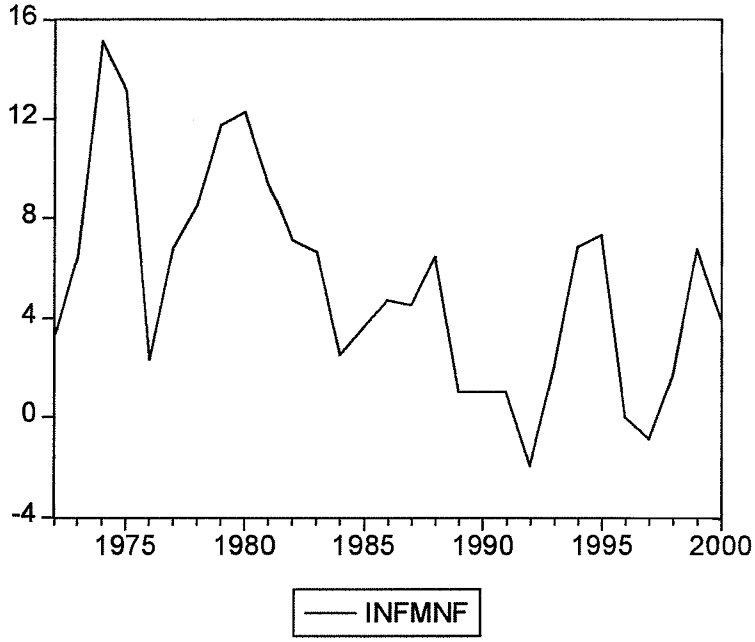
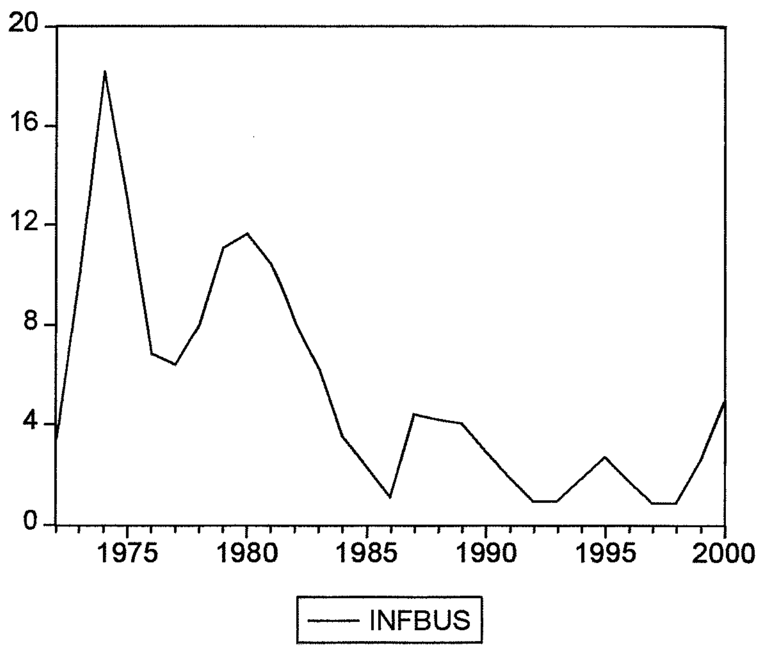


Figure 4: Inflation rate in the business sector



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Appendix:

Data Matrix 1 For Table 2-1:

Year	Δ logPM	Δ logER	Δ logUSP
1972	0.010000	-0.008000	0.018000
1973	0.037000	0.004000	0.024000
1974	0.106000	-0.010000	0.038000
1975	0.063000	0.017000	0.039000
1976	0.012000	-0.013000	0.024000
1977	0.057000	0.033000	0.027000
1978	0.055000	0.030000	0.029000
1979	0.070000	0.012000	0.035000
1980	0.081000	-0.001000	0.004000
1981	0.056000	0.011000	0.073000
1982	0.016000	0.012000	0.025000
1983	-0.002000	0.000000	0.017000
1984	0.020000	0.021000	0.016000
1985	0.014000	0.023000	0.013000
1986	0.006000	0.008000	0.010000
1987	-0.004000	-0.020000	0.011000
1988	-0.008000	-0.033000	0.015000
1989	0.000000	-0.017000	0.016000
1990	0.008000	-0.006000	0.017000
1991	-0.008000	-0.008000	0.015000
1992	0.018000	0.023000	0.009000
1993	0.027000	0.029000	0.010000
1994	0.026000	0.024000	0.009000
1995	0.014000	0.002000	0.009000
1996	-0.003000	-0.002000	0.008000
1997	0.004000	0.006000	0.008000
1998	0.014000	0.030000	0.004000
1999	-0.001000	0.001000	0.007000
2000	0.011000	0.000000	0.009000

Data Matrix 2 For Table 2-2:

Year	Δ logPD-mnf	Δ logPM	Δ logULC-mnf
1972	0.014000	0.010000	0.009000
1973	0.028000	0.037000	0.009000
1974	0.061000	0.106000	0.059000
1975	0.053000	0.063000	0.079000
1976	0.010000	0.012000	0.025000
1977	0.029000	0.057000	0.022000
1978	0.036000	0.055000	0.023000
1979	0.048000	0.070000	0.040000
1980	0.050000	0.081000	0.053000
1981	0.039000	0.056000	0.041000
1982	0.030000	0.016000	0.050000
1983	0.028000	-0.002000	0.004000
1984	0.011000	0.020000	-0.011000
1985	0.015000	0.014000	0.006000
1986	0.020000	0.006000	0.024000
1987	0.019000	-0.004000	0.009000
1988	0.028000	-0.008000	0.008000
1989	0.004000	0.000000	0.013000
1990	0.004000	0.008000	0.022000
1991	0.005000	-0.008000	0.022000
1992	-0.009000	0.018000	0.002000
1993	0.009000	0.027000	-0.016000
1994	0.028000	0.026000	-0.013000
1995	0.031000	0.014000	0.004000
1996	0.000000	-0.003000	0.014000
1997	-0.004000	0.004000	-0.005000
1998	0.008000	0.014000	0.005000
1999	0.028000	-0.001000	-0.004000
2000	0.017000	0.011000	-0.004000

Data Matrix 3 For Table 2-3:

Year	Δ logPD-bus	Δ logPM	Δ logULC-bus
1972	0.015000	0.010000	0.020000
1973	0.042000	0.037000	0.029000
1974	0.072000	0.106000	0.062000
1975	0.052000	0.063000	0.060000
1976	0.029000	0.012000	0.030000
1977	0.027000	0.057000	0.029000
1978	0.033000	0.055000	0.021000
1979	0.046000	0.070000	0.034000
1980	0.048000	0.081000	0.045000
1981	0.043000	0.056000	0.035000
1982	0.034000	0.016000	0.041000
1983	0.026000	-0.002000	0.005000
1984	0.015000	0.020000	0.003000
1985	0.010000	0.014000	0.016000
1986	0.005000	0.006000	0.018000
1987	0.019000	-0.004000	0.018000
1988	0.018000	-0.008000	0.024000
1989	0.017000	0.000000	0.022000
1990	0.012000	0.008000	0.022000
1991	0.008000	-0.008000	0.024000
1992	0.004000	0.018000	0.004000
1993	0.004000	0.027000	-0.003000
1994	0.008000	0.026000	-0.016000
1995	0.012000	0.014000	0.002000
1996	0.007000	-0.003000	0.007000
1997	0.004000	0.004000	0.009000
1998	0.004000	0.014000	0.013000
1999	0.010000	-0.001000	-0.011000
2000	0.021000	0.011000	0.016000

Original Data Set 1:

Year	PM	ER	USP
1971	100.3000	100.9811	28.90900
1972	102.6000	99.06760	30.16100
1973	111.7000	100.0090	31.84600
1974	142.5000	97.80810	34.73100
1975	164.9000	101.7151	37.99100
1976	169.3000	98.60280	40.19200
1977	193.4000	106.3441	42.74200
1978	219.2000	114.0659	45.73600
1979	257.4000	117.1424	49.54200
1980	310.7000	116.9227	50.04400
1981	353.1000	119.8903	59.12100
1982	366.2000	123.3734	62.72600
1983	365.1000	123.2412	65.19300
1984	381.6000	129.5066	67.64700
1985	394.7000	136.5507	69.70300
1986	399.7100	138.9471	71.24700
1987	396.1100	132.5983	73.18800
1988	388.9200	123.0701	75.68500
1989	389.3200	118.3972	78.55200
1990	396.5100	116.6774	81.59100
1991	389.3200	114.5726	84.44000
1992	405.7100	120.8723	86.38000
1993	431.6900	129.0088	88.37600
1994	458.4700	136.5673	90.25400
1995	473.0600	137.2445	92.10300
1996	469.4100	136.3522	93.84700
1997	474.2700	138.4598	95.41000
1998	489.4500	148.3505	96.46800
1999	488.5000	148.5707	97.86200
2000	501.3000	148.5394	99.99700

Original Data Set 2:

Year	PDMNF	ULCMNF	PDBUS	ULCBUS
1971	30.00000	31.00000	29.00000	27.40000
1972	31.00000	31.60000	30.00000	28.70000
1973	33.00000	32.30000	33.00000	30.70000
1974	38.00000	37.00000	39.00000	35.40000
1975	43.00000	44.40000	44.00000	40.60000
1976	44.00000	47.00000	47.00000	43.60000
1977	47.00000	49.40000	50.00000	46.60000
1978	51.00000	52.10000	54.00000	48.90000
1979	57.00000	57.20000	60.00000	52.90000
1980	64.00000	64.60000	67.00000	58.60000
1981	70.00000	70.90000	74.00000	63.50000
1982	75.00000	79.70000	80.00000	69.80000
1983	80.00000	80.30000	85.00000	70.70000
1984	82.00000	78.30000	88.00000	71.20000
1985	85.00000	79.50000	90.00000	73.80000
1986	89.00000	83.90000	91.00000	76.90000
1987	93.00000	85.70000	95.00000	80.20000
1988	99.00000	87.20000	99.00000	84.70000
1989	100.0000	89.90000	103.0000	89.20000
1990	101.0000	94.60000	106.0000	93.80000
1991	102.0000	99.60000	108.0000	99.10000
1992	100.0000	100.0000	109.0000	100.0000
1993	102.0000	96.40000	110.0000	99.20000
1994	109.0000	93.50000	112.0000	95.70000
1995	117.0000	94.30000	115.0000	96.10000
1996	117.0000	97.50000	117.0000	97.80000
1997	116.0000	96.30000	118.0000	99.80000
1998	118.0000	97.40000	119.0000	102.7000
1999	126.0000	96.50000	122.0000	100.3000
2000	131.0000	95.80000	128.0000	104.1000

Data Source

1. Canadian Exchange Rate----Bank of Canada (7502)
2. Canada Import Price Index----Statistics Canada (Table:228-0016,0011,0044,0014)
3. GDP price deflator (Manufacturing industry)----Statistics Canada (Table:379-0023,0004)
4. GDP price deflator (Business Sector)----Statistics Canada (Table: 379-0024,0004)
5. ULC (Manufacturing industry)----Statistics Canada (Table: 383-0005)
6. ULC (Business Sector)----Statistics Canada (Table: 383-0005)
7. U.S consumer price index----U.S. department of labor, Bureau of labor statistics