Session 4:
Exchange Rate Uncertainty, Investment, and Productivity

Exchange Rate Variability and Investment in Canada

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Introduction

This paper examines the relationship between the real exchange rate and investment. The specific question that we address is the extent to which the flexible exchange rate regime might have been detrimental to investment in Canada. It has been suggested that flexible exchange rates can lead to excessive short-term exchange rate volatility and episodic bouts of currency misalignments, hampering the continental integration that was stimulated by the Canada-U.S. Free Trade Agreement (FTA) and NAFTA and limiting profitable trade opportunities.[1] For example, Courchene and Harris (1999) argue that while floating exchange rates are a smaller problem for commodity producers, since most resource exports are already priced in U.S. dollars and currency hedging is relatively straightforward, the lack of longer-run hedging facilities can make exchange rate movements problematic for the manufacturing sector. Their point is that free trade requires stable and predictable rates of international exchange and cost calculations to support the volumes of trade and the degree of specialization

1. The effect may not be large. Gaston and Trefler (1997) estimate that tariff cuts under the 1988 Canada-U.S. FTA explain only 9 to 14 per cent of lost manufacturing jobs during 1989–93, the bulk of which could be traced to the combined effects of corporate restructuring that predated the FTA, a severe recession, and the monetary policy stance during the period.

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associated with it. In their view, flexible exchange rates provide inherently volatile and unpredictable cost structures.

Similar concerns were expressed in the decades following the collapse of the Bretton Woods exchange rate arrangements, since nominal (and real) exchange rates movements—notably the wide swings in the U.S. dollar in the early 1980s—were considerably larger than the earlier advocates of floating had expected, and the higher short-run exchange rate volatility showed no sign of declining over time. Moreover, exchange rate volatility was markedly higher under the flexible regime, despite the fact that the volatility of macroeconomic variables had not increased, suggesting that a move towards more stable exchange rates would not result in greater macroeconomic instability. Added to the mix was the observation that most exchange rate movements were unexpected, as indicated by the fragility of exchange rate forecasting models and the inability of market indicators (such as interest rate differentials and forward rates) or market surveys to anticipate major changes.

However, the fact that exchange rate changes have been larger than expected, and not very predictable, does not necessarily imply that they have been harmful. The more pronounced exchange rate movements in the post-Bretton Woods era may have been required to absorb the economic shocks that characterized the period. Moreover, the fixed exchange rate regime would not have been able to accommodate these shocks without the imposition of controls on capital movements and restrictions on trade.

Three basic issues must be considered in the analysis of how the exchange rate can affect investment decisions. The first relates to the direction of influence. In a microeconomic context, at the level of the firm, we can speak of the exchange rate affecting the firm's decisions. However, in a macroeconomic context, the relationship is more likely to be bi-directional. Thus, we present some causality tests that suggest that while the real exchange rate does not appear to have a direct effect on investment (and there is no significant impact of investment on the exchange rate), it might have an indirect effect through its impact on corporate profits.

The second issue relates to the nature of exchange rate variability. In terms of its potential impact on investment, it can be broken down into two basic types: (i) short-run volatility and (ii) currency misalignments (or significant deviations from fundamentals). To the extent that short-run volatility is relatively bounded and represents "price-seeking" behaviour by the market (or simply incompressible noise in a flexible exchange rate regime), it is unlikely to significantly influence investment decisions that require a long-term perspective. However, short-run volatility could affect the timing of investment decisions in the presence of capital-market imperfections. Thus,

we test for possible effects of short-run real exchange rate volatility on foreign direct investment (FDI) and domestic investment flows (total and for machinery and equipment (M&E)). For the three measures of investment that we consider, we find in all instances that short-run volatility does not have a noticeable short-run effect on investment flows.

Persistent real exchange rate disequilibria (i.e., misalignments) are more likely, however, to distort investment decisions, leading to both over- and under-investment. The basic problem with diagnosing misalignments, however, is that the existence, magnitude, and persistence of disequilibria are often in the eye of the beholder and can boil down to beliefs regarding the efficiency of markets. In other words, there is no consensus on how to measure real exchange rate disequilibria.[2] Despite our belief that currency markets are basically efficient and that movements in the Canadian dollar reflect economic fundamentals, we make a modest attempt to provide estimates of "misalignments," using an H-P filter and deviations from an estimated exchange rate equation. For the two cases that we consider, we find that misalignments have no significant short-run impact on investment.

The third issue is how to interpret our results to answer the initial question of whether Canada's flexible exchange rate regime has somehow been harmful to investment in Canada. First, we wish to make clear that our goal is not to determine whether investment has been misallocated (i.e., gone to the "wrong" sectors), since we focus only on aggregate investment, or whether the degree of foreign ownership has been affected, but simply to see whether exchange rate volatility or misalignments have reduced the level of investment. An examination of the impulse-response functions in the context of the vector-autoregression (VAR) specifications that we considered indicates that exchange rate shocks (in terms of levels or volatility) do not appear to have a significant impact on investment.

The outline of the rest of the paper is as follows. Section 1 provides a selective review of the literature on possible linkages between the exchange rate and FDI, reporting also on relevant empirical evidence. Section 2 does the same for domestic investment. Section 3 provides new evidence based on a VAR approach. Conclusions follow.

2. See Williamson (1994) for a discussion of the issues.

1 Foreign Direct Investment

1.1 Theories

While we focus on how exchange rate variability affects FDI, the influence could be in the other direction.[3] For instance, an exogenous inflow of capital could lead to a real exchange rate appreciation or depreciation, depending on whether the inflows are used to finance domestic spending or capital accumulation in the traded or non-traded goods sectors (Dornbusch 1973). Alternatively, an exchange rate stabilization policy might lead to a real appreciation of the currency and higher domestic interest rates, inducing greater capital inflows (Corbo 1985). An appreciation of the real exchange rate resulting in a large current account deficit might also induce foreign firms to invest in the local economy for fear of protectionist measures.

Direct investment in foreign countries will be chosen instead of exports, only to the extent that the location itself confers a substantial advantage to the firm (including lower production costs and host-country inducements).[4] Dunning (1988) integrates different perspectives in the literature, incorporating elements of the industrial organization approach, internalization,[5] and location theory. To motivate FDI, three conditions are required: (i) the firm must have some ownership advantages with respect to other firms;[6] (ii) it must be more profitable for the firm to use these advantages than to sell them or lease them to other independent firms; and (iii) it must be more beneficial for the firm to use these advantages in combination with some factor inputs located abroad, otherwise foreign markets would be served exclusively by exports.[7]

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3. See Kosteletou and Liargovas (2000) for a fuller discussion.
4. McClain (1983) and Lizondo (1990) provide insightful reviews of the literature.
5. The internalization hypothesis explains the existence of FDI as a result of firms replacing market transactions by internal transactions, notably as a way of avoiding imperfections in the markets for intermediate inputs.
6. The industrial-organization (I/O) approach argues that foreign firms possess advantages that are transferable abroad but not available to local competitors. In addition, the market for selling these advantages must be imperfect, otherwise the firm would not have an incentive to invest abroad. Market imperfections include product differentiation, marketing skills, proprietary technology, managerial skills, and discriminatory access to capital markets, economies of scale, and government-imposed market distortions.
7. Itagaki (1981) provides a theory of the multinational firm under exchange rate uncertainty. His model takes into consideration taxation, transfer pricing, repatriation of profits, intermediate inputs, intrafirm trade, royalties, choice in currency denomination, and hedging. He shows that the effects of uncertainty on production and trade volumes depend on whether exposure to exchange rate risk is positive or negative and that volumes may increase under uncertainty. Thus, uncertainty may well increase world trade and investment. Also see Itagaki (1987).

Aizenman (1992, 1994) develops a model where risk-neutral producers can diversify internationally to increase the flexibility of production in response to shocks under conditions of free entry. He shows that a fixed exchange rate regime is more conducive to FDI relative to a flexible exchange rate regime for both real and nominal shocks. Fixed exchange rates are better at insulating real wages and production from monetary shocks and are associated with higher expected profits. The higher expected income, in turn, supports higher domestic and foreign (direct) investment. In the case of productivity shocks, flexible exchange rates lead to lower volatility in employment and lower expected profits, because the exchange rate moves to moderate the shock. In this model, flexible exchange rates limit the firms' incentive to shift production to the most productive economy by absorbing productivity shocks.

FDI can also be viewed as a type of international portfolio diversification at the corporate level (i.e., investment decisions are based on risk-return characteristics of alternative projects). However, for the diversification motive to have any explanatory power for FDI, the assumption of perfect capital markets must be dropped. The market-imperfections approach provides necessary but insufficient conditions for FDI. In the absence of other imperfections, neither exchange rate risk nor disequilibrium levels of exchange rates are necessary or sufficient for the occurrence of direct investment. They can, however, be "proximate causes" for direct investment. Various arguments have been proposed in this vein.

Aliber (1970) proposes an exchange risk theory. He argues that firms from countries whose currencies command a premium have an advantage in investing abroad.[8] However, it is not clear why hedging or a diversification advantage should accrue to only the strong currency firms, or why investors show persistent ignorance or short-sightedness. Another argument is that incomplete information, which makes external financing more expensive than internal financing, can lead to a situation where wealth effects resulting from exchange rate movements will influence FDI flows (Froot and Stein 1991). By lowering the relative wealth of domestic agents, a depreciation of the domestic currency can lead to foreign acquisition of domestic assets.

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8. Even though firms receive a stream of earnings in the discounted currency by investing abroad, Aliber postulated that the market capitalizes this host-country stream of earnings differently if it is earned by a source-country firm than by a host-country firm. This could occur because investors are ignorant of the fraction of a firm's income that derives from discounted currency areas, because the source-country firm can provide the investor with a diversified portfolio at a lower cost than he can on his own or because the source-country firm is more efficient at hedging risks. Studies of FDI in the United States, the United Kingdom, Germany, France, and Canada yielded results that were consistent with this hypothesis (Agarwal 1980).

1.2 Evidence

While most of the hypotheses explaining FDI flows have some empirical support, there is not sufficient support for any single hypothesis (Lizondo 1990). I/O theories have probably gained the widest acceptance. They seem to provide a better explanation for cross-country, intra-industry investment and for uneven concentration of FDI across countries than do alternative models.

Higher exchange rate volatility was found to be associated with higher direct investment *outflows* from the United States to Canada, France, Germany, and Japan (Cushman 1985), as well as *inflows* from these countries (Cushman 1988). However, Bailey and Tavlas (1991) were unable to find any adverse impact on exchange rate volatility or misalignment on real direct investment in the United States during the floating rate period.[9] Caves (1989) examines the sensitivity of U.S. FDI in flows to the exchange rate for 15 countries over the 1977–85 period.[10] His results indicate that stronger growth in the United States fosters more FDI from other countries. An appreciation of the dollar tends to discourage FDI, but FDI flows do not seem to respond to exchange rate expectations. *Ceteris paribus*, lower (higher) stock prices in the United States (abroad) favour inward FDI. He concludes that risk-aversion considerations may well promote rather than repel foreign investment.[11] In support of their theory, Froot and Stein (1991) find that U.S. dollar depreciations were associated with additional FDI inflows over the 1978–88 period. However, Stevens (1993, 1998) found their results to be fragile. When the sample is extended to 1991, the coefficient becomes insignificant.

Goldberg and Kolstad (1995) examine the effect of short-run exchange rate variability on U.S. bilateral FDI flows with Canada, Japan, and the United Kingdom over the 1978–91 period, by testing a model based on risk-

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9. In testing a hybrid model of direct investment incorporating portfolio balance and I/O characteristics for Japanese investment in 12 U.S. industries, Mann (1989) could not find evidence that the exchange rate was a significant determinant of these investment decisions.
10. He argues that exchange rates have an impact on FDI inflows through two channels. First, they affect a firm's real costs and revenues. The net effect on FDI is ambiguous, however; it depends on the share of imported inputs and exported production. Second, exchange rates affect FDI inflows through expectations: a depreciation that is expected to be reversed will encourage FDI inflows so as to obtain a capital gain when the domestic currency appreciates.
11. McClain (1983) finds evidence that a stronger currency (in real terms) leads to more FDI outflows into the United States for some countries (four out of eight). Moreover, in the late 1970s, low-priced U.S. stocks may have been associated with direct investment into the United States by Canadian, British, Japanese, and French investors. But the results, in his view, are hardly conclusive.

aversion arguments. They find that exchange rate variability had a positive and statistically significant effect on four of the six bilateral FDI shares: real exchange rate variability increased the share of total U.S. investment capacity located in Canada and Japan and increased the share of Canadian and U.K. investment located in the United States. Moreover, the exchange rate *levels,* included as an additional variable, entered with the expected signs in all the regressions: exchange rate depreciations of the source country currency led to a reduction in investment flow shares to foreign markets. However, these effects are neither large nor statistically significant. Kosteletou and Liargovas (2000) examine the relationship between FDI flows and the real exchange rate in a simultaneous equation model for a large sample of industrial countries (but not for Canada), based on annual data over the 1960–97 period. They find that, for most countries, a real exchange rate appreciation induces greater FDI inflows.

The ambiguity of the reported empirical findings is reminiscent of those in numerous studies on exchange rate uncertainty and trade flows. The effect of greater exchange rate volatility on trade is ambiguous in theory because it creates profit-making opportunities and increases the uncertainty of profits of export sales in foreign currency. The effect of volatility depends on the degree of risk aversion and risk exposure.[12] While the notion that exchange rate volatility is detrimental to trade is intuitively appealing since it increases business risks and disturbs planning, the effect is not obvious once firms are allowed to diversify across markets, use inputs from both home and abroad, adopt flexible invoicing arrangements, or have access to hedging instruments.

It is not surprising, therefore, that surveys of the empirical literature generally indicate either the absence of a link between measured exchange rate variability and the level of trade or, at best, mixed results.[13] Concerns have also been expressed by proponents of fixed exchange rates that sizable

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12. Even if a firm is risk-averse, it does not necessarily follow that an increase in risk leads to a reduction of the risky activity. For instance, highly risk-averse firms worry about the worst possible outcome. When risk increases, they may export more to avoid a drastic decline in their revenues. The probability of making large profits also increases when exchange rates are more variable. See Côté (1994) for a fuller discussion.

13. See International Monetary Fund (1984) and Côté (1994). Klaassen (1999) argues that the reason it is difficult to get significant effects of exchange rate risk on trade flows is that the effects take time. He finds, based on U.S. bilateral trade flow data with its G-7 partners, that export decisions are most affected by the exchange rate one year later. The riskiness of the exchange rate at this horizon appears fairly constant over time. More recent work has challenged the conventional wisdom. For instance, Frankel (1997) and Rose (2000) estimate rather large trade-augmenting effects from greater exchange rate stability, notably by moving to a currency-union arrangement.

exchange rate misalignments can lead to trade hysteresis. However, the evidence does not generally support this hypothesis for the United States (Krugman 1990) or Canada (Amano, Beaulieu, and Schembri 1993).[14]

2 Domestic Investment

2.1 Theories

The effect of uncertainty on investment spending is ambiguous. Greater price uncertainty can lead competitive risk-neutral firms to increase investment (Hartman 1972; Abel 1983).[15, 16] In contrast, the literature on irreversible investment (Pindyck 1991) shows that increased uncertainty retards investment spending by risk-neutral firms if (i) the cost of reducing the capital stock exceeds the upward adjustment cost and (ii) firms operate in imperfect competition (Caballero 1991). Under these two conditions, an increase in price uncertainty causes the expected regret of having too much capital to rise relative to having too little. The firm responds by investing less.

The decision is not only *whether* to invest, but *when*. The Dixit-Pindyck model determines a zone of inactivity for the product price, within which a firm benefits by waiting (the option value of waiting), or by delaying investment decisions. Dixit calls this view of investment "a theory of optimal inertia" (Dixit 1992, 109). Firms that refuse to invest when the currently available rates of return are far in excess of the cost of capital may be waiting, based on an optimal calculation, to be more certain that these conditions are not transitory. In this model, investment proceeds if the price is above the upper thresholds of the range and is abandoned if it is below the lower bound. Thus, one has to consider how more pronounced misalignments or an increase in exchange rate volatility would affect the size of the zone of inactivity and the upper part of the price distribution (i.e., the frequency at which investment expenditures are made).

Building on this approach, Darby et al. (1998) show that more exchange rate variability uncertainty can actually increase investment. It can happen in

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14. Giovannetti and Samiei (1995) used data on manufacturing exports for the United States, Germany, and Japan over the 1975–93 period and found strong evidence of hysteresis only in the case of Japanese exports.

15. This result is due to Jensen's inequality. If the marginal revenue product of capital is convex in price, then a mean-preserving increase in price uncertainty raises the expected payoff to marginal units of capital and stimulates investment.

16. Risk aversion (Craine 1989) and credit rationing (Greenwald, Stiglitz, and Weiss 1984) have also been advanced as possible reasons to explain why greater uncertainty could reduce investment.

industries where the scrapping price of any investment is low and the risk of being stuck with an unwanted investment is high. It can also occur when the increase in uncertainty is large or the initial environment is one of low uncertainty, and the opportunity cost of waiting, rather than investing, is high. Greater exchange rate stability would encourage investment in industries with relatively lower productivity, high scrapping value, and low-opportunity costs of waiting (e.g., service industries). However, greater exchange rate stability would tend to reduce investment in industries with low scrapping prices (e.g., public utilities) or high entry costs (e.g., high-tech and R&D) or in industries with high scrapping values combined with high-opportunity costs of waiting (e.g., financial services).

The exchange rate could also affect investment by its effect on the cost of imported capital goods or, as some have suggested, by its effect on the competitive environment. Lafrance and Schembri (2000) discuss these issues in their analysis of how real exchange rate movements could have an impact on productivity growth in one country relative to another. The "exchange rate sheltering hypothesis" posits that a depreciating real exchange rate can be harmful to domestic productivity growth because it shelters domestic firms from foreign competition, thus reducing their incentive to make productivity-enhancing investments. However, this hypothesis is inconsistent with profit-maximizing behaviour and requires that capital markets be relatively inefficient.[17] Lafrance and Schembri also observe that in the 1990s the real exchange rate depreciation of the Canadian dollar, by increasing the cost of imported machinery and equipment and by lowering the cost of labour relative to capital, most likely contributed to lower productivity growth in Canada than in the United States. They note, however, that this real depreciation was driven by fundamental factors and would have occurred irrespective of the exchange rate regime in place.

2.2 Evidence

Baxter and Stockman (1989) use a post-war sample of 49 countries to compare the behaviour of output, consumption, trade flows, and real exchange rates under alternative regimes. Except for greater exchange rate variability under floating rates, they find little evidence of systematic differences in the behaviour of macroeconomic aggregates or international

17. The hypothesis assumes that managers adopt a "satisfying" rather than profit-maximizing behaviour, that shareholders are inattentive to value of the firm, and that the capital and product markets are uncompetitive.

trade flows under alternative exchange rate systems.[18] Moreover, in Canada's case, there is no indication that the changes in the variability of the trade balance were due to shifts in the exchange rate regime. Rose (1994, 1995) and Flood and Rose (1995) look at the performance of key macroeconomic variables (but not investment) under different exchange rate regimes. They find that the volatility of other macroeconomic variables is not significantly affected by the exchange rate regime, which suggests that much of the volatility of nominal exchange rates must be due to non-fundamental factors and could be eliminated at little cost.

In contrast, Caporale and Pittis (1995) find that regimes matter. They examine the behaviour of some key macroeconomic variables under alternative exchange rate regimes (using monthly data over the 1960–91 period for 18 OECD countries), by looking at persistence, volatility, and the relative importance of symmetric (worldwide) versus asymmetric (country-specific) shocks as the driving forces of business cycles. Unemployment and real interest rates are more persistent under a floating exchange rate regime, whereas industrial production and real exchange rates are less persistent. Principal components analysis indicates that the *post*-Bretton Woods era is characterized by greater international correlation of business cycles and that cyclical movements have become less country-specific.

In a series of insightful papers, José Campa and Linda Goldberg analyze how the exchange rate could affect the investment and pricing behaviour of manufacturing firms in the United States and other major economies.[19] Their basic framework is a model of investment with adjustment costs that takes into account export sales and the use of imported inputs in production, both of which expose producers to exchange rate movements. Investment is a function of the marginal profitability of capital. Exchange rate changes can affect profitability by passing through into home and export market prices and imported input prices. The impact of exchange rate movements on profitability and investment decisions depends on the firm's international orientation and the competitive structure of the industry. *Ceteris paribus*, highly competitive industries are expected to exhibit larger responsiveness

18. Note that an earlier IMF study on fixed-capital formation in the G-7 over the 1960–82 period concluded that "there is no real evidence that the rate of investment in the industrial world has been weaker during the period of floating exchange rates than it was earlier" (IMF 1984, 28).

19. Campa and Goldberg (1997) document the external orientation of manufacturing industries for Canada, Japan, the United Kingdom, and the United States. They note that, unlike U.S. manufacturing industries where the direction of external orientation has swung back and forth, Canada's manufacturing industries have moved steadily towards greater positive net external orientation (p. 60). Between 1974 and 1993, overall manufacturing export and import shares actually doubled.

to exchange rates. The sensitivity of investment to the expected marginal profitability of capital declines for industries with high depreciation rates and adjustment costs and for those that put a low weight on future expected profits.

Campa and Goldberg (1995) report that the effect of the exchange rate on investment can change as patterns of external exposure shift over time. While U.S. manufacturing sectors were primarily export-exposed in the 1970s, they became predominantly import-exposed by the early 1980s. Consequently, exchange rate appreciations reduced investment in durable goods sectors in the 1970s but stimulated investment after 1983. While exchange rate volatility depressed investment, the effects were small. Campa and Goldberg (1999) extend these results and estimate their model for the two-digit manufacturing sectors of the United States, the United Kingdom, Canada, and Japan. They find that, across countries, exchange rates tend to have insignificant effects on investment rates in high markup sectors. However, investment responsiveness to exchange rates is fairly strong in low markup sectors. Surprisingly, there is no significant effect for either low or high markup industries for Canada.

3 Testing for Exchange Rate Effects on Investment

In this section, we examine whether real exchange rate movements might have had a significant impact on investment over the recent flexible exchange rate period.

While the exchange rate can be considered as exogenous to a firm's decisions in a microeconomic context, this assumption is debatable at a more aggregate level. As our interest lies in investigating macroeconomic relationships, the exchange rate and investment should be considered as interactive variables. Moreover, given the forward-looking perspective of investment decisions, it is important to use a framework that allows for potentially rich dynamics.

To account for both feedback and dynamic effects, we chose a VAR framework for our analysis. In VAR models, all variables are considered endogenous, and the analysis of dynamic structures can take many forms. Working with the autoregressive representation, Granger causality can be tested. On the other hand, using the moving-average representation, impulse responses can be estimated to evaluate shock dynamics. Although these

properties are linked, they provide distinct and complementary information.[20]

3.1 Granger causality tests

Granger causality is a measure of the significance of one variable in forecasting another.[21] Within a VAR framework, Granger non-causality is characterized by a finite number of linear restrictions on a subset of parameters that can be easily tested. Although the characterization of causality is invariant to stationarity properties of the series, the statistical inference under non-stationary and/or cointegrated systems is driven by very irregular asymptotic properties for which the usual critical values remain valid only under special conditions (Sims, Stock, and Watson 1990; Toda and Phillips 1994).[22] To get around this problem, Toda and Yamamoto (1995) show that in non-stationary systems (where all the variables are I(1)), non-causality can be tested with variables in levels using the usual critical values.[23] This result holds whether the variables are cointegrated or not. Toda and Yamamoto make use of lag augmentation, that is, a VAR process of order $p + 1$ is fitted when the true order is p.[24] The tests are based on the estimated coefficient matrices associated with the first p lags only. Note that even though this methodology is asymptotically invariant, it can result in less powerful tests in finite samples (Yamada and Toda 1998).

Let $x_t = (x_{1t}, \ldots, x_{Nt})'$ be a vector of N time series for which we estimate a VAR of order p:

$$x_t = \sum_{k=1}^{p} \Pi_k x_{t-k} + u_t,$$

20. For example, non-zero impulse responses from one variable to another need not imply the presence of Granger causality, and vice versa (Dufour and Tessier 1993; Dufour and Renault 1998).

21. More precisely, we say that a time series Y_t causes X_t conditional on variable Z_t in the sense of Granger if the observation of Y up to time t can help to predict X_{t+1} when the corresponding observations on X and Z up to time t are also used. Given that the information set includes only past observations, we can also interpret Granger causality as a notion of temporal precedence.

22. For example, in the absence of cointegration, we can always estimate a VAR with the variables in first differences and perform the usual F-test.

23. Unit-root tests are reported in Table 1. With the exception of the real investment measures, the three tests that we use do not give a unique characterization of the series. We follow Phillips's (1998) advice in such situations and consider these series as I(1).

24. The order of the VARs that we estimate was determined by the Akaike criterion.

Table 1
Unit-root tests (1970Q1–2000Q1)

	ADF[a]	PP[a]	KPS[b]
ITOT [1]	0.0448	0.1736	1.531**
IM&E [2]	1.2280	2.0522	1.695**
FDI [3]	–1.9156	–6.9103**	0.292
LRER [4]	–1.0464	–1.0064	1.104**
MVOL [5]	–2.4747	–3.3849**	0.417*
PROF [6]	–3.4986**	–2.3450	0.488**
Critical values			
5%	–2.89	–2.89	0.463
10%	–2.58	–2.58	0.347

a. Null hypothesis is non-stationarity (unit root).
b. Null hypothesis is stationarity.
* indicates rejection of the null hypothesis at the 10 per cent level of significance.
** indicates rejection of the null hypothesis at the 5 per cent level of significance.

Augmented Dickey-Fuller (ADF) lags chosen by recursive estimation where insignificant lags are removed until a significant lag is found.

1. ITOT: ratio of total investment to GDP in real terms.
2. IM&E: ratio of M&E investment to GDP in real terms.
3. FDI: ratio of foreign direct investment to GDP.
4. LRER: real effective exchange rate.
5. MVOL: volatility of nominal exchange rate.
6. PROF: nominal profits to nominal GDP ratio.

where u_t represents the innovation process. The null hypothesis, $H_0: x_{it} \not\rightarrow x_{jt}$, is characterized by the following constraints:

$$\pi_{ji,\,k} = 0, \quad k = 1, \ldots, p,$$

where $\pi_{ji,\,k}$ is the *ji*-th element associated with the matrix Π_k. The likelihood ratio statistic is used to infer non-causality:

$$\lambda_{LR} = 2[L(\hat{\Pi}) - L(\hat{\Pi}^0)],$$

where $L(\hat{\Pi})$ and $L(\hat{\Pi}^0)$ are the log-likelihood functions evaluated at the non-constrained and the constrained value of the estimator, respectively. Under the null hypothesis, the statistic λ_{LR} is distributed as a $\chi^2(p)$, where *p* corresponds to the VAR order.

Since our main objective is to estimate the dynamic relationship between various measures of investment and the real exchange rate,[25] we initially consider several three-variable systems that include the real investment to GDP ratio, either the level of the real exchange rate (LRER) or some estimate of misalignment, and our measure of exchange rate volatility (MVOL).[26]

Three different measures of investment are considered: total investment, machinery and equipment, and foreign direct investment. The data (at a quarterly frequency) span the 1970Q1 to 2000Q1 period. Note that the domestic investment ratios show a significant upwards trend, more than doubling over the sample period (Figures 1 and 2). The sharp rise in the investment ratios from the mid-1990s reflects the surge in computer-related investment and growth of "new" economy sectors. The direct investment flows are very choppy series (Figures 3 and 4). The 1990s saw a pronounced increase in both net inflows and outflows, reflecting the growing integration of the Canadian economy with the United States following the initial implementation of the FTA in 1989 and NAFTA in 1993. At first glance, these trends suggest that it might be difficult to support the proposition that the flexible exchange rate regime has had an appreciable negative effect on investment.

Two measures are considered in the examination of real exchange rate misalignments. The first is based on deviations of the real exchange rate from an "equilibrium" path as estimated by an H-P filter (MAHP). The second considers deviations from the dynamic simulation of a more recent variant of the Amano-van Norden (1995) exchange rate equation (MASD).[27] Since the latter is defined in bilateral terms, our measures of misalignments are defined in terms of the Canada-U.S. exchange rate.[28] Volatility is

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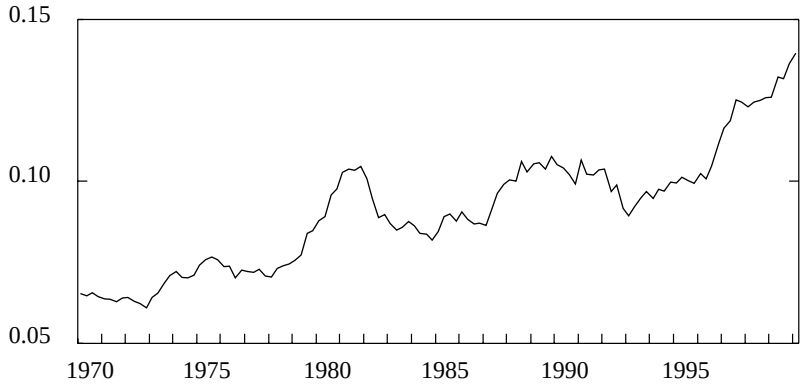
25. While the exchange rate regime refers to nominal exchange rate arrangements, real investment flows are expected, in theory, to respond to real exchange rate movements. However, our measure of volatility is defined in terms of the nominal exchange rate, since GDP deflators are not available at monthly frequencies. In practice, this distinction may not matter, given the strong observed co-movements between nominal and real exchange rate measures (Finn 1999).

26. Using the investment/GDP ratio has the advantage of removing the common trend that potentially affects these two variables. Furthermore, when investment and output are considered separately in the VAR, output accounts for almost all the investment dynamics. The strong co-movements between these variables are well understood in the literature, as noted by Shapiro (1986) among others.

27. See Djoudad, Murray, Chan, and Daw (2001) for a fuller description of the equation.

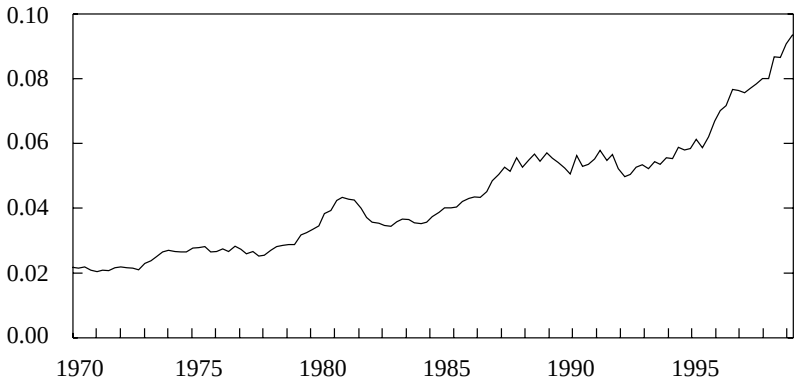
28. Since the United States has a weight of 0.86 in the G-6 trade-weighted exchange rate index, there is little difference between the bilateral and the G-6 effective exchange rates for Canada. See Antia and Lafrance (1999) for a description of the G-6 index.

Figure 1
Total investment/GDP*



* In real terms

Figure 2
Machinery & equipment/GDP*



* In real terms

Figure 3
Foreign direct investment inflows/GDP

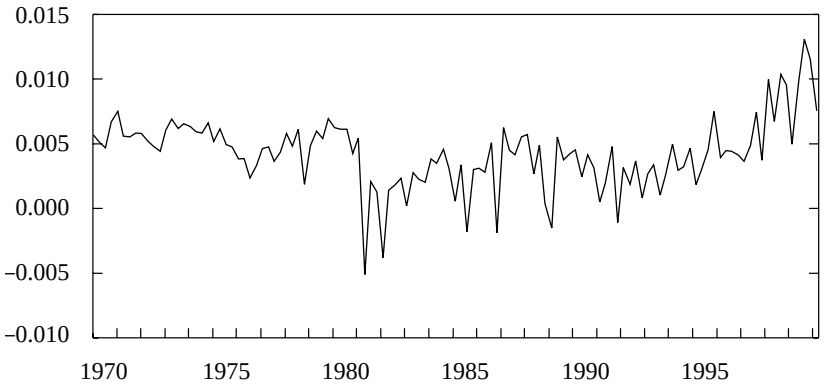


Figure 4
Foreign direct investment outflows/GDP

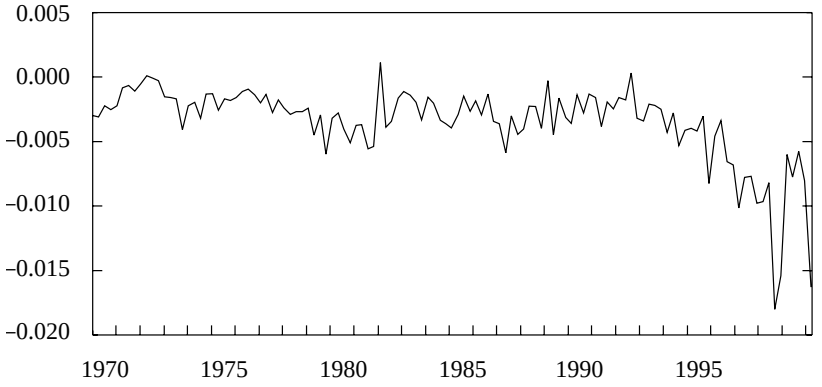
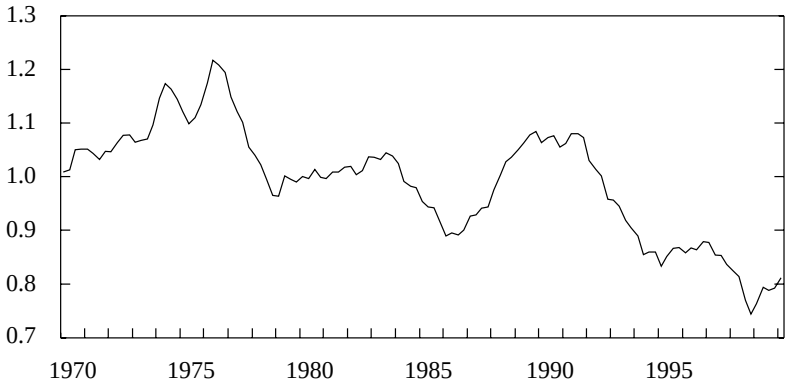


Figure 5
Real effective exchange rate (G-6)*



* Foreign currencies/Canadian dollar

Figure 6
Nominal exchange rate volatility

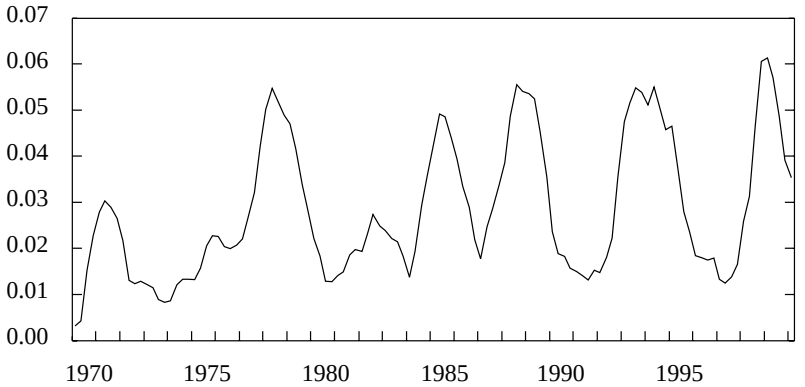


Figure 7
Misalignments

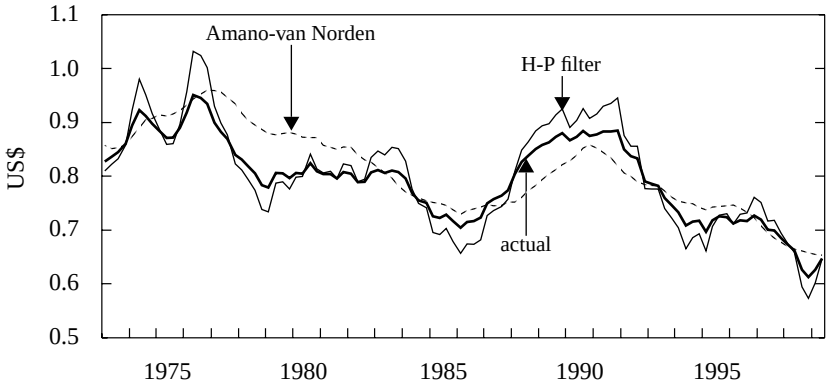
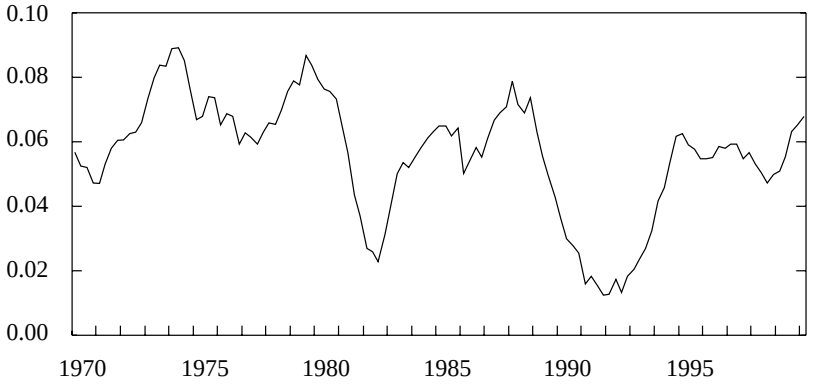


Figure 8
Profits/GDP



measured by the monthly standard deviation of the nominal effective exchange rate averaged over the previous 24 months.

Over the last 30 years, the Canadian dollar has depreciated by about 20 per cent in real effective terms, although not continually (Figure 5). The most pronounced and sustained period of depreciation occurred in the 1990s when investment ratios surged. Our measure of volatility exhibits periodic peaks and valleys, suggesting that investors might be able to set realistic bounds for the volatility of the Canadian dollar (Figure 6). The simulations of the H-P filter and the Amano-van Norden equation are shown in Figure 7. In the latter case, this is a dynamic simulation with estimates fitted over the whole sample period. Note that the two measures suggest different periods of possible over- or undervaluation of the Canadian dollar relative to the U.S. dollar, thus providing distinct ways to check for the influence of currency misalignments.

The results of the causality tests are presented in Tables 2, 3, and 4. The *p*-values indicate that, for all the VARs considered, we can never accept that volatility adds significant information content to the investment dynamics. The two measures of misalignment lead to a similar conclusion. Only the level of the real exchange rate appears to be causal, in the Granger sense, for investment. These results hold for all three measures of investment.

Granger causality considers only one-period-ahead predictability. However, given the forward-looking nature of investment decisions, testing for Granger causality over longer horizons is of interest. Dufour and Renault (1998) have generalized the notion of Granger causality to include any horizon h (up to infinity). Although testing for multi-step causality is complex, Dufour and Renault show that under special conditions, we can do multi-step tests by simply combining conventional one-period Granger causality tests.[29] Using this procedure, we find that exchange rate volatility or misalignments have no explicative power at any horizon for the investment dynamics (Tables 5 to 7).

But, as noted above, the notion of Granger causality depends on auxiliary variables that are included in the information set. Ignoring relevant variables can result in misspecifying tests and identifying spurious causality relationships (Sims 1980; Lütkepohl 1982). Thus, it is important to ensure that the results are robust to different information sets. Even though the best information set is the one that includes all the relevant variables, finite

29. In a trivariate system (X_t, Y_t, Z_t), the variable Y_t does not cause X_t conditional on Z_t for all horizons if Y_t does not cause both X_t *and* Z_t (Dufour and Renault 1998, Corollary 3.6, p. 1112).

Table 2
Three-variable VAR (I, LRER, MVOL)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$LRER \nrightarrow I$	0.02	0.01	0.05
$MVOL \nrightarrow I$	0.91	0.99	0.22

Notes: LRER = real exchange rate level.
MVOL = exchange rate volatility.

Table 3
Three-variable VAR (I, MAHP, MVOL)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MAHP \nrightarrow I$	0.38	0.12	0.51
$MVOL \nrightarrow I$	0.70	0.55	0.11

Notes: MAHP = misalignment via H-P filter.
MVOL = exchange rate volatility.

Table 4
Three-variable VAR (I, MASD, MVOL)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MASD \nrightarrow I$	0.32	0.06	0.32
$MVOL \nrightarrow I$	0.48	0.27	0.22

Notes: MASD = misalignment via dynamic simulation.
MVOL = exchange rate volatility.

Table 5
Three-variable VAR (I, MVOL, LRER)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MVOL \nrightarrow LRER$	0.38	0.37	0.45

Notes: MVOL = exchange rate volatility.
LRER = real exchange rate level.

Table 6
Three-variable VAR (I, MAHP, MVOL)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MAHP \not\rightarrow MVOL$	0.31	0.18	0.39
$MVOL \not\rightarrow MAHP$	0.33	0.34	0.18

Notes: MAHP = misalignment via H-P filter.
MVOL = exchange rate volatility.

Table 7
Three-variable VAR (I, MASD, MVOL)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MASD \not\rightarrow MVOL$	0.11	0.07	0.13
$MVOL \not\rightarrow MASD$	0.25	0.22	0.18

Notes: MASD = misalignment via dynamic simulation.
MVOL = exchange rate volatility.

Table 8
Four-variable VAR (I, LRER, MVOL, PROF)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$LRER \not\rightarrow I$	0.59	0.30	0.12
$MVOL \not\rightarrow I$	0.96	0.59	0.11
$PROF \not\rightarrow I$	0.04	0.00	0.17

Notes: LRER = real exchange rate level.
MVOL = exchange rate volatility.

Table 9
Four-variable VAR (I, MAHP, MVOL, PROF)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MAHP \not\rightarrow I$	0.68	0.27	0.49
$MVOL \not\rightarrow I$	0.94	0.84	0.06
$PROF \not\rightarrow I$	0.01	0.01	0.14

Notes: MAHP = misalignment via H-P filter.
MVOL = exchange rate volatility.

Table 10
Four-variable VAR (I, MASD, MVOL, PROF)

H_0	*p*-value		
	Total	**M&E**	**FDI**
$MASD \not\rightarrow I$	0.58	0.20	0.37
$MVOL \not\rightarrow I$	0.97	0.70	0.18
$PROF \not\rightarrow I$	0.02	0.02	0.38

Notes: MASD = misalignment via dynamic simulation.
MVOL = exchange rate volatility.

samples impose a limit on the number of variables that can be considered in VAR models.

To check the robustness of our previous results, we consider undistributed corporate profits scaled by GDP (PROF) as an additional variable, since profits can represent the return on investment as well as the scope for internal financing, both of which would have a positive impact on investment. (Figure 8 gives the profile of undistributed corporate profits, which tend to fall dramatically in recessions.) The results are reported in Tables 8 to 10. The estimated *p*-values indicate that the level of the real exchange rate no longer has an effect on investment when profits enter the picture. Profits, however, are demonstrably linked to domestic investment flows given the very low *p*-values. Moreover, our previous conclusions regarding misalignments and exchange volatility continue to hold.

3.2 Impulse function analysis

Even though Granger causality analysis is a useful tool for analyzing dynamic structures between time series, it can't provide an estimate of the direction (sign) or magnitude of the relationships of interest. This is why

Sims (1980) proposed to invert the autoregressive part of the process and to work with the underlying moving-average representation.

The VARs are similar to the ones in the previous section. However, the inversion procedure calls for a stationary VAR process, which can be set up by differencing every integrated variable included in the system. After an appropriate orthogonalization of the reduced-form residuals, we can generate the impulse responses to the orthogonalized innovations. The moving-average representation of the process takes this structural form:

$$X_t = \sum_{k=0}^{\infty} \Theta_k u_{t-k} + w_t, \tag{1}$$

where the innovation process, w_t, has an identity covariance matrix. The elements of Θ_k are interpreted as responses of the system to the innovations. More precisely, the *ji*-th element of Θ_k is assumed to represent the effect on variable *j* of a unit innovation in the *i*-th variable that has occurred *k* periods ago.

To evaluate the potential impact of different shocks on investment, we consider the following contemporaneous causality structures.[30]

$$LRER_t \rightarrow PROF_t \rightarrow I_t \quad \text{(Structure 1)}$$

$$VOL_t \rightarrow PROF_t \rightarrow I_t \quad \text{(Structure 2)}$$

For these two three-variable systems, we are interested in shocks affecting the real investment measures (total and M&E). We consider exchange rate shocks (either in level or volatility terms) and profit shocks. Once we account for the confidence bands (outlined by the shaded areas), impulse functions for investment measures resulting from exchange rate shocks (either levels or volatility) turn out to be insignificant (Figures 9 to 12). In contrast, for all cases, profit shocks appear to have a significant impact on investment, with the expected positive sign (Figures 13 to 16).

We can thus summarize our empirical results:

- For all horizons, we can never accept the hypothesis that the measures of exchange volatility or misalignments add significant information (in the Granger sense) to the investment dynamics.

30. We also tested for the reverse order, and the results are qualitatively similar.

Figure 9
Shocks on M&E investment

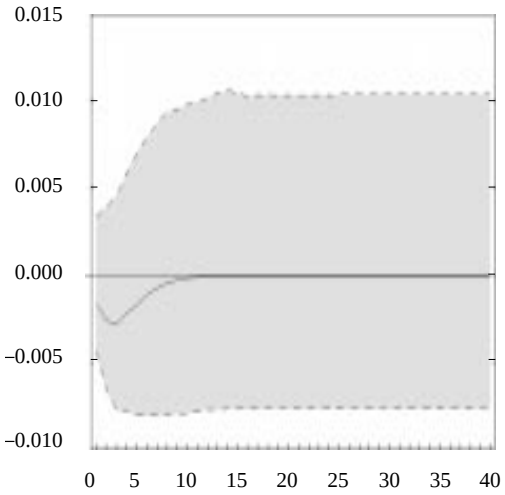


Figure 10
Shocks on total investment

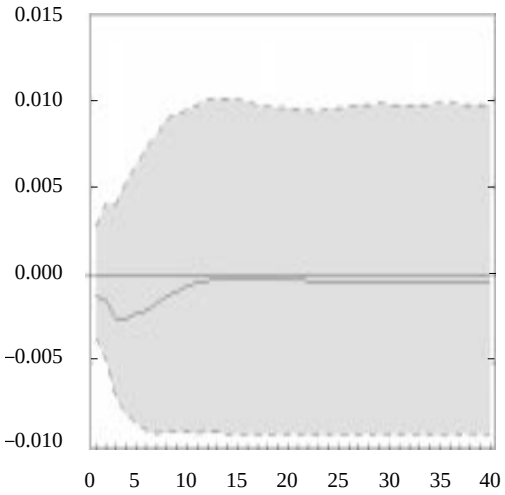


Figure 11
Shocks on M&E investment

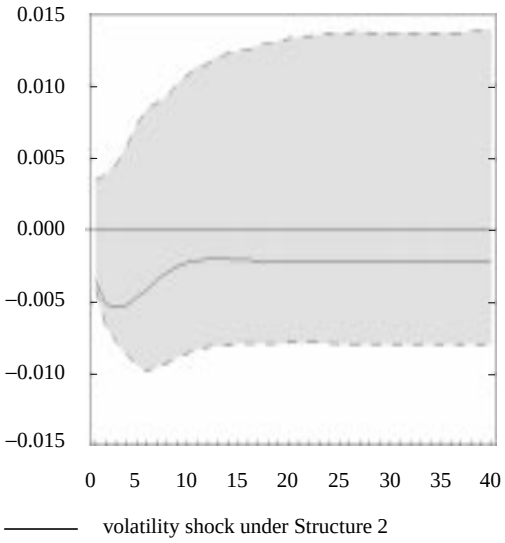


Figure 12
Shocks on total investment

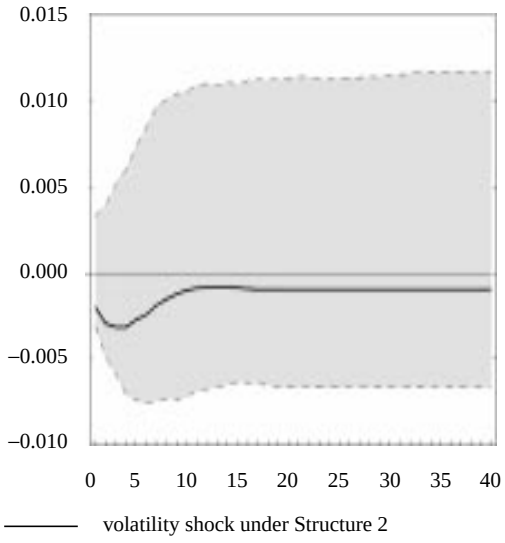


Figure 13
Shocks on M&E investment

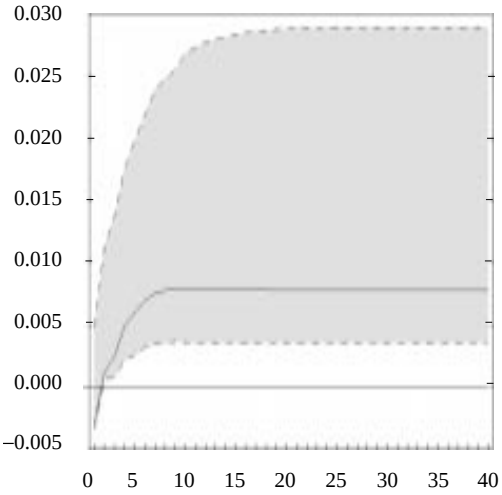


Figure 14
Shocks on total investment

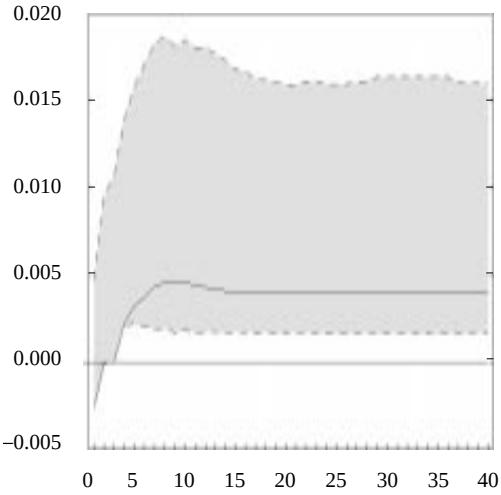


Figure 15
Shocks on M&E investment

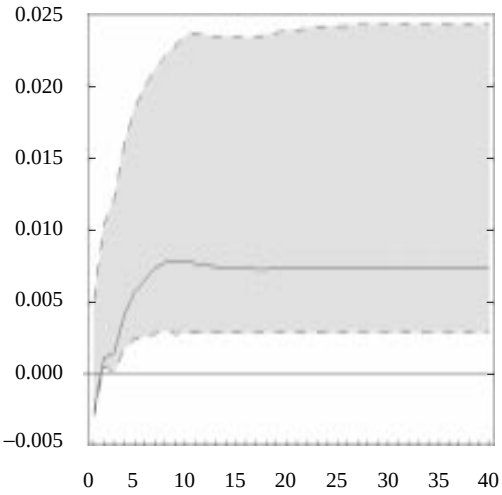
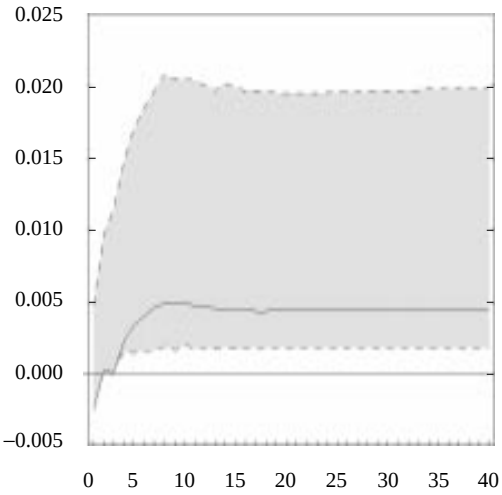


Figure 16
Shocks on total investment



- Even though the level of exchange rates appears to be causal for investment in small systems, the results are not robust to the inclusion of additional information (in our case, profits).
- These results are consistent with what we obtain from the impulse responses. All in all, we cannot find a statistically significant impact of exchange rate shocks on investment.

Conclusion

Our results do not support the position that excessive volatility or pronounced misalignments of the Canadian dollar over the more recent flexible exchange rate period have reduced in a detectable way the rate of investment in Canada or the degree of inward foreign direct investment. Our approach was to tackle this question from a macroeconomic perspective, without strong priors, using a VAR framework. The technique that we chose is admittedly simple, but it is also straightforward. By Ockham's Razor, it provides an unambiguous answer to the question that sparked this paper. Our negative results are also consistent with those of Campa and Goldberg (1999), who found, somewhat to their surprise, that the real exchange rate had no significant impact on investment for Canadian manufacturing sectors.

Even if we had found stronger and more significant effects of exchange rate variability on investment, it would still be difficult to make the case that a fixed exchange rate regime (short of a monetary union with the United States) would have produced more positive results. As IMF researchers noted some years ago, multinational firms may seek to diversify their investments across a number of markets that they serve in response to currency risk, even at some cost in terms of efficiency (IMF 1984). These long-term decisions will be based on prospective rather than current exchange rate variability. Firms will also prefer to invest in a country that has a well-established mechanism for adjusting its exchange rate, to ensure that domestic costs and prices do not get too far out of line with those abroad, rather than in a country where nominal exchange rate volatility is less but exchange rate stability results in more uncertainty about real exchange rates and, hence, profitability.

We recognize that one can never provide definite proof of a negative proposition.[31] We believe, however, that our paper adds to the body of evidence suggesting that exchange rate variability has no significant effect on investment in Canada.

Note: Following Linda Goldberg's comments at the conference, we tested for Granger causality in a three-variable VAR model that included the level of the real exchange rate, profits, and investment. For both total investment and M&E, the exchange rate did not Granger cause either profits or investment. This suggests that the exchange rate does not affect investment either directly or indirectly via its effect on profits.
—R. Lafrance and D. Tessier.

31. There is always the possibility that, under certain conditions, a negative effect on investment could be detected for other measures of volatility or misalignments for specific periods.

Appendix
Data Sources

Source: Statistics Canada, unless otherwise noted.

Private investment (in real terms)
— Non-residential structures & equipment (D14853)
— Machinery & equipment (D14855)

Nominal and real GDP
— Nominal GDP (D14840)
— Real GDP (D14872)

Foreign direct investment
— Foreign direct investment flows into Canada (D59062)
— Foreign direct investment outflows (D59052)

Exchange rate
— Real G-6 exchange rate (Bank of Canada)
— $US/$CAN (Bank of Canada)

Corporate profits
— Undistributed corporate profits (D16432)

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Discussion

Linda Goldberg

The main premise of this paper is that it is important to consider the effects of exchange rate movements on real economic activity in order to evaluate the implications of flexible exchange rates. To accomplish this task, Robert Lafrance and David Tessier focus on the responsiveness of investment activity in Canada to levels of the Canadian dollar and to the dollar's volatility. This dimension of real activity merits meticulous exploration, since investment fluctuations are an important component of levels and volatility of aggregate business cycles.

The authors have provided a well-articulated and carefully organized piece on the relationship between investment and exchange rates. Their paper begins with a thorough and thoughtful exposition of the competing arguments for profitability and investment effects arising from exchange rate movements. The authors also survey the existing evidence on this subject, noting those studies that are particularly relevant for Canada.

Beyond this literature overview, the main contribution of the paper is a detailed analysis of the link between Canadian investment and exchange rates. There are three types of aggregate investment measures examined: by manufacturing industries, by a subset of the manufacturing industries, specifically by machinery and equipment (M&E) sectors, and foreign direct investment activity, all taken relative to GDP. Although these measures will not provide a full perspective on the potential redistributive effects of exchange rates across sectors of the Canadian economy, they are appropriate for understanding aggregate investment fluctuations. A number of different exchange rate measures are also applied. They encompass the real effective exchange rate for the Canadian dollar, measures of exchange rate misalignments constructed using either a Hodrick-Prescott filter or an Amano-van Norden model, and a measure of nominal exchange rate

volatility. While Lafrance and Tessier did not consistently use real exchange rates—and this type of consistency would be appropriate—I do not expect that any of the study's key results would be significantly altered by a full-scale shift to real realignments and real exchange rate volatility.

The paper's main methodological approach uses vector autoregressions (VARs) for identifying any significant causal effects of exchange rates. Ultimately, the authors conclude that exchange rates and their volatility have not really had much of an effect on Canadian investment activity. This type of finding is central to the paper and to the theme of the overall conference, in that it is highly relevant for "revisiting the case for flexible exchange rates." Implicit in the Lafrance-Tessier conclusion is that the detrimental effects of exchange rate volatility, which are sometimes evoked in arguments against flexibility, have not been evident in Canada. Before accepting this, however, it is necessary to look more carefully at the methodology, and to ask whether, as applied, it can deliver the conclusions presented by the authors.

The VAR methodology assumes a constancy in the relationship between exchange rate measures and investment measures over the time horizon of the analysis, almost 30 years. Consequently, it is worth going deeper into the analytics of this relationship to determine whether the assumptions underlying the empirical approach are well founded. From expositing the theory and by examining some additional empirical evidence, I conclude below that the tests performed in the Lafrance and Tessier paper are biased against finding statistically significant implications of exchange rates for investment. As I will describe, the extent to which this is a valid concern could be established by the authors through additional robustness and parameter stability tests. Regardless of the outcome of those tests, their paper suggests additional puzzles that are interesting and that warrant consideration.

On the issue of parameter stability, I appeal to a formal theoretical model of the links between investment and exchange rates. The authors are quite clear that it is not their goal to test a single theory of such linkages, and I am very sympathetic to this view. Nonetheless, this formality helps provide insight into the types of conditions that would have to prevail for the VAR to capture and measure the tightness of the actual relationship between the variables in question. In this regard, the theory helps identify the dimensions in which the VARs performed by the authors are adequately addressing the important potential effects of exchange rates.

The Theory

In a series of papers, Campa and Goldberg (1995, 1999) demonstrate how real exchange rates can enter the producer maximization problem. A firm chooses investment *I* to maximize the expected present value of the stream of future profits, *V.* Capital, *K*, the only quasi-fixed factor of production, is subject to a traditional capital accumulation equation and an increasing and convex cost of installing new capital. The maximized value of the firm at time *t* is given by:

$$V_t(K_t, e_t) = max \; E\left[\sum_{\tau=0}^{\infty} \beta^{\tau}[\Pi(K_{t+\tau}, e_{t+\tau}) - c(I_{t+\tau}) - I_{t+\tau}]\,|\,\Omega_{\tau}\right], \quad (1)$$

$$\{I_t\}_{\tau=t}^{\infty}$$

where K_t is the beginning of period *t* capital stock, Π is the profit function, β is the discount rate, I_t is the investment expenditure in period *t*, *c* is the capital adjustment cost function, e_t is the period *t* exchange rate expressed in terms of domestic currency per unit of foreign currency, and $E[.|\Omega_t]$ is the expectations operator conditional on the time *t* information set Ω_t. For simplicity, it is assumed that the only source of uncertainty about the future is the exchange rate, over which the expectation operator applies.

The timing of the model is as follows. The firm observes the exchange rate at the beginning of the period. The firm then chooses its variable inputs and output level for the period and observes the current profits. Given profits this period and expected future profits, the firm chooses its investment level. The new capital resulting from this investment becomes productive at the beginning of next period, i.e., under the assumption of a one-period time-to-build lag.

Suppose, too, that producer profits at any time *t* are driven by revenues from some domestic market sales—wherein the producer might face import competition—and by revenues from export sales abroad. Moreover, profits may be exposed to currency fluctuations through producer reliance on imported inputs into production.

Campa and Goldberg have derived the specific elasticity of a producer's investment with respect to exchange rates as proportional to:

$$\frac{\partial I_t}{I_t} \infty \left[\begin{array}{l} \left(\eta_{p,e} - \eta_{MKUP,e} \right)(1 - X_t) \\ + \left(1 + \eta_{p^*,e} - \eta_{MKUP^*,e} \right) X_t - \left(1 + \eta_{w^*,e} \right) \alpha_t \end{array} \right] \frac{\partial e_t}{e_t}, \qquad (2)$$

where $\eta_{p,e}$ and $\eta_{p^*,e}$ are exchange rate pass-through elasticities in domestic and foreign markets; $\eta_{MKUP,e}$ and $\eta_{MKUP^*,e}$ are markup elasticities with respect to exchange rate changes; X_t represents the share of total revenues associated with foreign sales ($(1 - X_t)$ is the share associated with domestic sales); and α_t, the share of imported inputs in production costs, is multiplied by the elasticity of these input costs with respect to exchange rates, $(1 + \eta_{w^*,e})$. The link between investment and exchange rates is tighter for exchange rate movements that are perceived as permanent.

Observe that the exchange rate affects expected profitability and therefore investment activity through three channels: (i) export market revenues, (ii) imported input costs, and (iii) home-market revenues. This third channel is intended to capture the possibility of import competition or the existence of wealth effects that potentially shift the demand schedule for domestically produced goods. These channels matter for interpreting the exercise of the Lafrance and Tessier paper. The profitability effects of exchange rates and consequent investment response could potentially be eliminated in the event that revenue effects are fully offset by import input cost effects. It is possible, but not at all guaranteed, that such a situation could arise when exporting occurs alongside a preponderance of multinational production activity or outsourcing activities and reliance on imported inputs. More generally, however, the relationship between exchange rates and investment (through the profitability channel) will vary over time to the extent that net external orientation varies. Here, producer net external orientation is the difference between revenue exposure and cost exposure. An absence of a relationship between investment and the exchange rate should be the exception, rather than the rule, for an externally exposed economy.

The Evidence

What do we know about Canadian net external orientation? As an indicator of net external orientation, consider the difference between the export share and imported input share of the subsets of Canadian manufacturing

Figure 1
Net external orientation:
Total manufacturing industries

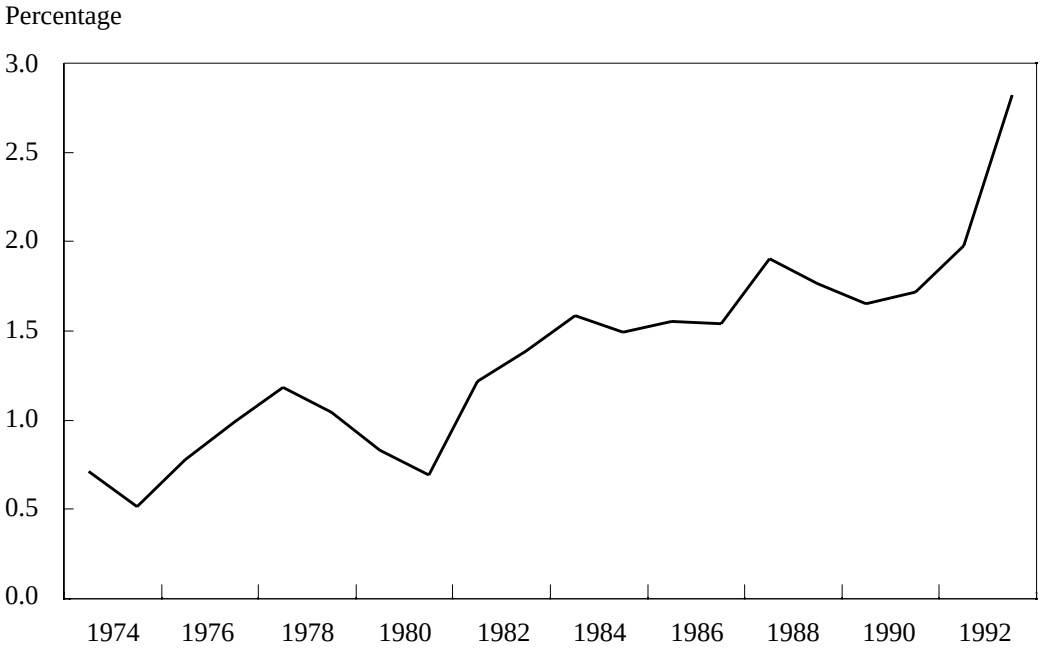
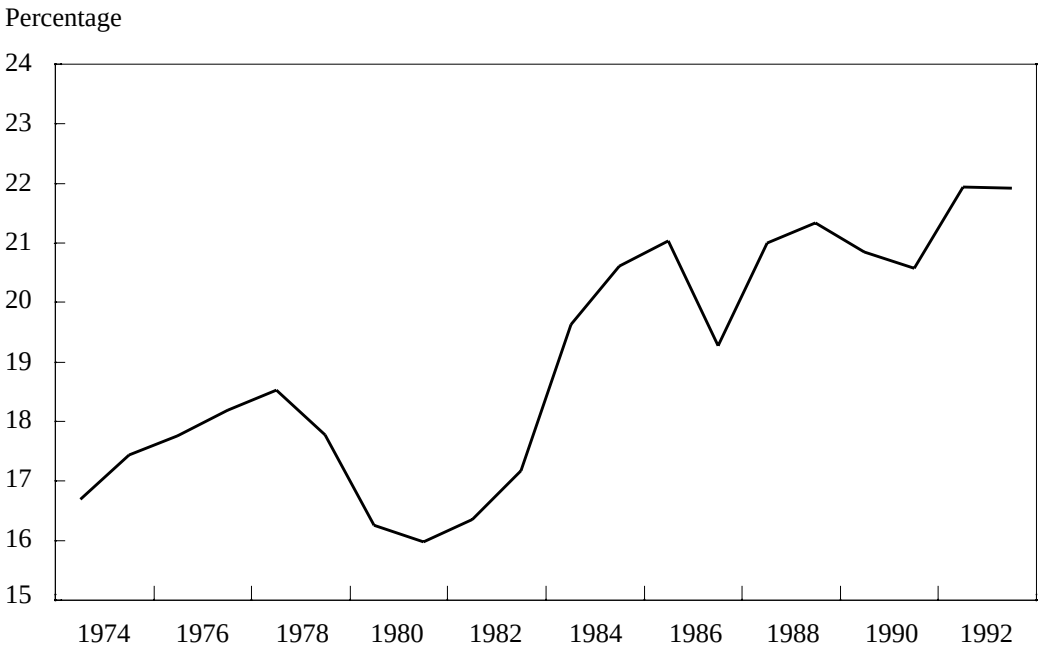


Figure 2
Machinery and equipment shipments
within total manufacturing shipments



considered by Lafrance and Tessier, i.e., all manufacturing and the M&E sectors within manufacturing (Figures 1 and 2).[1]

Observe that the net external exposure of Canadian manufacturing industries has more than tripled since the early 1970s. When the M&E sectors are considered, this indicator doubled by the early 1990s. Because of these extensive movements over time, from equation (2) we would expect that the effects of exchange rates on producer profitability and on investment would also be rising over time in Canada. Thus, a methodology that assumes a constant relationship—such as the VARs used in the paper—may understate the significant and evolving effects of exchange rates on Canadian investment.

This criticism still does not prove that in the data there exists a significant and identifiable link between exchange rates and investment in Canada. However, caution should be used in interpreting the current results, and further exploration of the data would be valuable. Additional and more extensive robustness checks are also warranted.

If the Lafrance and Tessier conclusions hold true—indeed, Campa and Goldberg (1999) also couldn't find significant effects of Canadian exchange rates on industry-level investment—a broader puzzle exists for Canada. Consistent with the VAR structure of Lafrance and Tessier, exchange rates should drive profits, which, in turn, should drive investment. If the link between exchange rates and investment is insignificant, how can this be explained? Is it because exchange rates don't matter for the profitability of Canadian manufacturers—an outcome I would find highly unlikely—or is it because profitability does not matter for Canadian investment? If the authors were to argue that exchange rates can affect producer investment above and beyond the profitability channel, they could explore these questions conceptually and empirically.

Concluding Remarks

The authors have put together a very insightful and thought-provoking discussion of whether the behaviour of the Canadian dollar has significant effects on Canadian investment spending. While the jury is still out on the final answer to this question, the authors have made important progress towards its resolution. If, as currently concluded, the answer is "no," then

1. Campa and Goldberg (1997) provide a more extensive discussion of the exposure of specific Canadian manufacturing industries. The data from that paper were used for creating Figures 1 and 2.

other puzzles emerge. Indeed, it would be surprising if investment in as open an economy as Canada were truly insulated from exchange rates.

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