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International Interest Rate Linkages and Monetary Policy: A Canadian perspective

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TABLE OF CONTENTS

ABSTRACT

This paper examines the implications of increased international capital mobility and asset substitutability for domestic monetary policy in a small open economy such as Canada. Alternative definitions of international financial market integration are presented and tested in the context of two popular macro models. In the main, results suggest that interest rate relationships in Canada have not changed significantly in recent years and that the implementation and effectiveness of monetary policy have not been affected by the increased financial market integration that has taken place in overseas economies.

RÉSUMÉ

Dans cette étude, les auteurs examinent les incidences que peuvent avoir sur la politique monétaire d'une petite économie ouverte comme le Canada une plus grande mobilité des capitaux et une plus grande substituabilité des actifs à l'échelle internationale. Ils présentent et testent, en tirant parti de deux modèles macro-économiques bien connus, diverses définitions du concept de l'intégration internationale des marchés financiers. En gros, les résultats donnent à penser que les relations entre les taux d'intérêt au Canada n'ont guère changé ces dernières années et que l'intégration accrue des marchés financiers des économies d'outre-mer n'a influencé ni la mise en oeuvre ni l'efficacité de la politique monétaire.

INTRODUCTION

This paper examines the increasingly integrated nature of world financial markets, looking at consequences for both domestic interest rate relationships and domestic monetary policy in Canada.

The paper is divided into five sections. Section 1 begins with a brief description of Canadian capital markets and examines trends in foreign investment and borrowing activity over the past twenty years. Particular attention is given to the absence of controls on international capital movements and exchange transactions, as well as the relatively deregulated nature of domestic capital markets.

Section 2 examines the implications of increased international capital mobility and asset substitutability for domestic monetary policy in a small open economy such as Canada, operating under a flexible exchange rate system. Alternative definitions of international financial integration are presented in the context of two popular macro models.

Section 3 discusses the behaviour of real and nominal interest rate differentials in Canada and other major industrial countries, and tests for changes in capital mobility and asset substitutability over time. Sections 4 and 5 relate these empirical results to the theoretical models presented in Section 2 and draw some tentative conclusions regarding the importance of recent developments for macroeconomic stabilization from a Canadian monetary policy perspective.

In the main, the results suggest that interest rate relationships in Canada have not changed significantly in recent years, and that the implementation and effectiveness of monetary policy have not been affected by increased financial market integration. Canadian lenders and borrowers have enjoyed virtually unrestricted access to U.S. capital markets for many years, with Canadian and U.S. instruments regarded as near-perfect substitutes. Though increased capital mobility and asset substitutability in other countries have reduced the relative importance of gross investment flows between Canada and the United States and altered the currency composition of Canada's net external financing, they have not exerted an important independent influence on Canadian-U.S. interest rate relationships or the manner in which the Bank of Canada conducts monetary policy.

1. BACKGROUND

Canada has traditionally been an important net borrower in world capital markets, relying on foreign savings to help finance a significant proportion of its domestic spending. Its net international indebtedness in 1987 amounted to Can.$214.1 billion, or approximately 39 per cent of GNP (See Table 1). While this ratio of net indebtedness to GNP is relatively high compared to that of many other developed countries, it has not been regarded as a serious problem to date since most foreign capital inflows have been directed towards productive private investments, which are by assumption essentially "self-servicing."[1] Moreover, the current debt ratio is much lower than the average level recorded in Canada over the 1900-65 period.

As one might imagine, the majority of these capital inflows have come from the United States, given its size and proximity to Canada. It is important to note, however, that not all of the investment flows between the two countries have been in one direction. Canadians account for a substantial portion of foreign direct and portfolio investment in the United States. The absence of capital and exchange controls in these two countries over most of the post-war period has contributed to their growing financial interdependence. Unlike other industrial countries, Canada was exempt from the Interest Equalization Tax and other restrictive measures that the United States imposed in the 1960s and early 1970s to discourage foreign investment by Americans. Canada for its part has imposed relatively few restrictions on foreign investment inflows or outflows, whether they involved Americans or residents of other countries. This liberal approach was not merely a reflection of Canada's reliance on foreign savings, but a recognition of the extent to which its welfare, as a major international investor and trader, was dependent on an open world economy.[2]

Recently, two new trends have emerged in Canada's international borrowing and lending activities. The first concerns the growing importance of countries other than the United States as major sources of external financing, in particular Japan and various countries in continental Europe (Table 1). This has resulted in a greater number of Canadian securities being issued outside Canada and the United States, and in currencies other than Canadian and U.S.

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1. See Clinton and Longworth (1982).

2. This is not to suggest that Canada has maintained a completely open border with regard to trade in goods, services and financial assets. On the investment side there have been a number of notable exceptions -- all involving direct investment. These include: legislation introduced in 1967 to limit foreign ownership of Canadian banks and securities firms; the Foreign Investment Review Agency (FIRA) established in 1973 to monitor foreign takeovers of domestic non-financial corporations; and the National Energy Program (NEP) implemented in the late 1970s to promote Canadian ownership in the energy sector. All of these programs have now either been eliminated or significantly restructured, reflecting a more open approach to foreign direct investment.

With regard to domestic capital outflows, there is only one restriction that might be noted, which concerns the activities of trusteed pension plans in Canada. Since 1972 they have been prevented from investing more than 10 per cent of their portfolios in foreign securities. This is not believed to have had a significant effect on capital outflows, however, as other investment options have been available to private savers wanting to purchase foreign securities.

Table 1

CANADA'S INTERNATIONAL INVESTMENT POSITION

(in billions of dollars)

	1965	1970	1975	1980	1985	1987
Assets						
Direct investment	3.5	6.2	10.5	27.0	49.9	59.9
Portfolio investment[1]	1.9	2.8	4.2	8.9	16.6	19.9
Other[2]	7.5	13.0	19.1	34.0	62.7	72.1
Total	12.9	22.0	33.8	69.9	129.2	151.9
Liabilities						
Direct investment	17.4	26.4	37.4	61.7	83.5	103.1
Portfolio investment	10.1	14.9	28.2	69.7	136.0	178.9
Other	7.4	10.7	17.9	44.8	77.8	54.0
Total	34.9	52.0	83.5	176.2	297.3	366.0
Net investment position						
United States	- 20.3 (92%)[3]	- 28.9 (96%)	- 48.3 (97%)	- 83.1 (78%)	- 101.7 (60%)	- 102.0 (53%)p
Other countries	- 5.0 (23%)	- 5.8 (19%)	- 6.8 (14%)	- 28.0 (26%)	- 71.1 (42%)	- 122.8 (52%)p
Official reserves	3.3 (15%)	4.7 (16%)	5.4 (11%)	4.8 (5%)	4.6 (3%)	10.7 (5%)
Total	- 22.0	- 30.0	- 49.7	- 106.3	- 168.2	- 214.1
% of GDP	- 38.2	- 33.7	- 29.0	- 34.3	- 35.1	- 38.9

1. Includes equities and bonds.
2. Includes banks' net foreign currency position, money market securities and other miscellaneous investments.
3. Percentage of total net investment position.

p = Preliminary.

Sources: Statistics Canada, *Canada's International Investment Position*, catalogue No. 67-202, Ottawa, 1985; *Quarterly Estimates of the Canadian Balance of International Payments, Fourth Quarter 1987*, catalogue No. 67-001, Ottawa, 1988.

dollars (see Charts 1-3).[3] The second major trend concerns the growing importance of Canadian governments -- most notably the federal government -- as major borrowers in international capital markets. This has produced a sharp increase in the proportion of external debt held in the form of long-term portfolio investments and a corresponding decline in the relative importance of direct investments.

These trends can be explained in part by changing savings and investment patterns in Canada, as well as by the increased importance of Japan in the world economy, the emergence of Eurocurrency and Eurobond markets, and, to varying degrees, the removal of foreign investment and exchange restrictions in many overseas countries. In the past few years, countries such as Japan, Germany, the United Kingdom, France and, more recently, Italy, have removed official controls that previously restricted international and domestic financial activities. In this regard their capital markets have become more like those in Canada.[4]

Deregulation in world capital markets and recent financial innovations have produced a marked increase in capital mobility and a probable (though not certain) increase in asset substitutability.[5,6] As a consequence, interest rates in different countries have tended to move in a more synchronous fashion at both short and long ends of the yield curve (see Charts 4 and 5 and Tables 2 and 3).[7] Notice, however, that while international interest rate changes and levels are now more highly correlated, interest rate differentials have not been completely eliminated and continue to display significant variation over time.

3. Notice that the relative importance of institutional investors has not changed appreciably over time (see Chart 1).

4. See Section 4.

5. These terms are defined in Section 2.

6. See Caramazza et al. (1986). Though the removal of foreign exchange and capital restrictions, together with the introduction of new financial instruments such as interest rate swaps, foreign exchange and interest rate options, futures contracts, note issuance facilities (NIFs) and floating rate notes (FRNs), have no doubt helped investors avoid some of the risks associated with foreign investment, it is not clear that asset substitutability has increased over time. The greater volatility observed in exchange rates and interest rates may have reduced investor willingness to move funds between assets dominated in different currencies.

7. It is worth noting that not all of the synchronous movement of interest rates can be attributed to the liberalization of financial markets abroad. Growing economic interdependence through trade in goods and services and the coincident actions of fiscal and monetary authorities in different countries to common external shocks probably account for much of this behaviour. See Kuszczak and Murray (1987).

Table 2

NOMINAL RATES OF RETURN: MEANS (AND STANDARD DEVIATIONS)

	1973Q3 - 1979Q4	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada	8.20%	11.55%	10.08%
	(1.68)	(3.53)	(3.30)
US	7.87%	10.25%	9.20%
	(2.65)	(3.53)	(3.36)
Overseas	8.19%	8.07%	8.12%
	(2.20)	(2.06)	(2.10)
Short-term differentials			
Canada/US	0.33%	1.31%[1]	0.88%[1]
	(2.62)	(1.71)	(2.19)
Canada/overseas	0.02%	3.48%[1]	1.96%[1]
	(2.85)	(2.42)	(3.12)
US/overseas	- 0.32%	2.18%[1]	1.07%[1]
	(2.59)	(2.30)	(2.72)
Long-term rates			
Canada	9.10%	12.06%	10.75%
	(0.75)	(2.05)	(2.18)
US	7.99%	11.01%	9.68%
	(0.82)	(2.23)	(2.30)
Overseas	10.02%	9.24%	9.59%
	(1.17)	(1.82)	(1.60)
Long-term differentials			
Canada/US	1.11%[1]	1.05%[1]	1.08%[1]
	(0.36)	(0.65)	(0.54)
Canada/overseas	- 0.92%[1]	2.82%[1]	1.17%[1]
	(1.43)	(0.94)	(1.17)
US/overseas	- 2.03%[1]	1.76%[1]	0.09%
	(1.59)	(1.10)	(2.32)

1. Indicates that the interest differential is significantly different from zero at $\alpha = 0.05$.
2. Means (and standard deviations) of representative 90-day money market and long-term bond rates from Morgan Guaranty Trust. Overseas numbers are a weighted average of rates for France, Germany, Italy, Japan and the United Kingdom.

Table 3

NOMINAL RATES OF RETURN: CORRELATIONS*

	1973Q3 - 1979Q4	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada/US	0.33	0.88	0.78
Canada/overseas	- 0.06	0.75	0.40
US/overseas	0.44	0.78	0.59
Long-term rates			
Canada/US	0.90	0.96	0.97
Canada/overseas	- 0.06	0.89	0.35
US/overseas	- 0.25	0.87	0.34

* See notes to Table 2.

Some observers have argued that increased financial integration may ultimately force national interest rates to converge and to move in a lock-step fashion, particularly at the long end of the yield curve where monetary authorities presumably have less control over interest rate movements. The end result, they suggest, could be reduced independence with regard to domestic policy setting and increased sensitivity to world interest rate shocks. These issues are examined in greater detail in the remaining sections of the paper.

2. MONETARY POLICY WITH PERFECT INTERNATIONAL CAPITAL MOBILITY AND ASSET SUBSTITUTABILITY

2.1 Alternative Definitions of Capital Mobility

Before turning to the empirical evidence on interest rate relationships and the effectiveness of monetary policy in a more integrated world financial system, it may be helpful to review some of the theories and concepts underlying the analysis. Since different interpretations are often given to "capital mobility" and "asset substitutability" in the literature, it is important to assign specific definitions to these terms to avoid unnecessary confusion.

The section begins with a brief discussion of the classic Mundell-Fleming model, which has provided the basis for most subsequent work on capital mobility and stabilization policies in open economies. It is particularly relevant for the present analysis since certain features of the model may be responsible for common misperceptions concerning what capital mobility does and does not imply about interest rate relationships and the effectiveness of monetary policy. The analysis will show that increased financial market integration need not reduce the effectiveness of monetary policy, even if as a consequence domestic and foreign interest rates are assumed to be identical. Indeed, for a relatively small open economy such as Canada, operating under a flexible exchange rate, a move toward greater financial market integration is likely to enhance rather than diminish the short-run impact of domestic monetary policy actions on both prices and output. In addition, the analysis will show that identical foreign and domestic interest rates are not an inevitable consequence of perfect capital mobility. Real interest rates can be expected to differ over the short to medium run, while nominal interest rates can differ even in the long run when countries experience different steady-state rates of inflation.

These results can be demonstrated with a simple model such as the following:

$$m - p = \gamma y - \alpha r \qquad (1)$$

$$y = -\beta r + \lambda y^* + \mu(e + p^* - p) + g \qquad (2)$$

$$p = \bar{p} \qquad (3)$$

$$r = r^* \qquad (4)$$

where,

- m = money stock
- r = interest rate (real and nominal)
- y = real output
- e = price of foreign exchange
- p = domestic price level
- g = government spending

All variables, with the exception of r and r*, are expressed in logarithms, and * is used to denote a foreign variable.

Assuming that domestic prices are held constant at p (equation 3) and r is set equal to r* because of perfect international capital mobility[8] (equation 4), the level of y will depend only on m.[9] Increases in m produce large changes in y, even though r remains unchanged, since they are accompanied by a depreciation in e. An easier monetary policy (represented by a rightward shift of the LM curve in Figure 1) puts downward pressure on r. This in turn leads to large incipient capital outflows from the domestic economy because of an (assumed) infinitely elastic response of international investments to differences between r and r*. The latter cause e to depreciate, assuming exchange rates are flexible, and produce an attendant increase in net exports and output (represented by a rightward shift in IS).[10]

If e had been unable to move because the country was operating under a fixed exchange rate system the effects of a monetary expansion would have been quite different. As domestic interest rates started to decline and capital began to flow out of the country, the central bank would have been forced to sell some its foreign exchange reserves to defend its currency.

Since this exchange market intervention would have to be non-sterilized in order to be effective, the money stock would return to its original level. As a result there would be no net stimulative effect on output. Though perfect capital mobility plays an important role in this outcome, it is the combination of perfect capital mobility and a fixed exchange rate that is responsible for the resulting ineffectiveness of monetary policy.

Many of the assumptions embedded in the Mundell-Fleming model are obviously extreme and inconsistent with observed real-world behaviour. Wealth effects and portfolio considerations are ignored; inflation and expected changes in the exchange rate are set equal to zero; p, the domestic price deflator, is insensitive to changes in e; and aggregate supply effects and capacity constraints are ignored. In this sense the model is very Keynesian.

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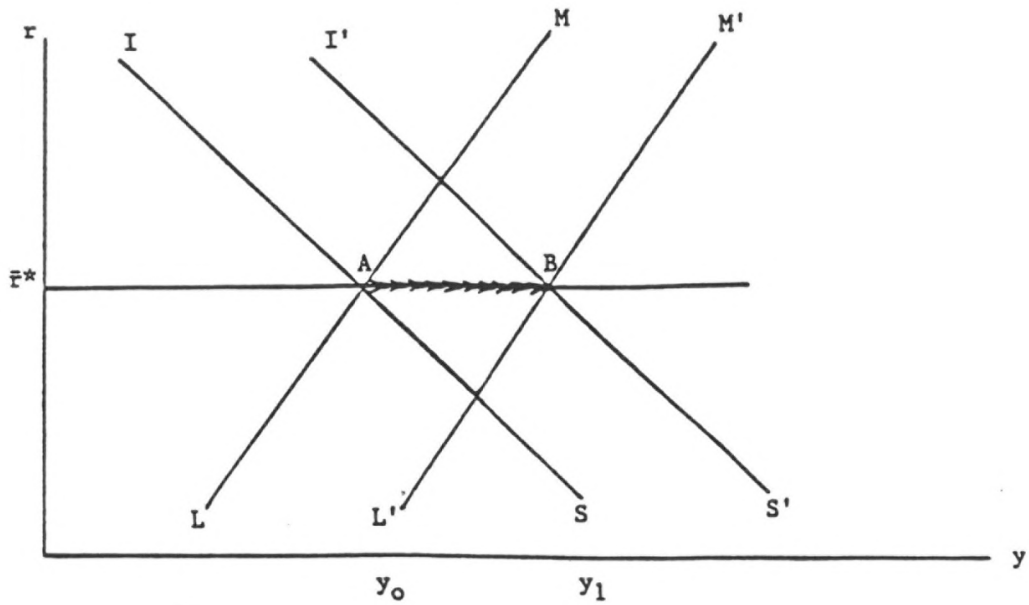
8. The distinction that is made in subsequent sections between perfect capital mobility and perfect asset substitutability is not relevant in the context of the basic Mundell-Fleming model described here. Since expected exchange rate changes are zero by assumption and prices are held constant, domestic and foreign interest rates (real and nominal) must all be identical provided capital is perfectly mobile.

9. Foreign variables r^*, y^* and p^* are assumed to be exogenous and fixed.

10. Fiscal policy changes, on the other hand, are completely neutralized. Increases in g raise domestic demand and shift the IS curve to the right, putting upward pressure on r as the IS curve moves along the LM curve. The resulting capital inflow causes e to appreciate and depresses export sales to the point where the additional stimulus provided by g is just offset by lower net exports, returning the IS curve to its original position. Output stays at its initial level but its composition will have shifted away from exports and towards increased production of government goods and services.

Figure 1

MUNDELL-FLEMING MODEL



Incorporating more realistic assumptions alters some of the results, moderating the output effects of changes in monetary policy and granting fiscal policy a role (albeit modest) with regard to macroeconomic stabilization under flexible exchange rates. For the most part, however, the main qualitative results described above concerning the relative strengths of monetary and fiscal policies under flexible versus fixed exchange rates are remarkably robust to these kinds of adjustments.

What is perhaps of greater significance in the context of the present paper, is the effect that alternative assumptions have on the mechanisms by which changes in monetary policy are transmitted to the economy. While domestic interest rates have no independent role in the transmission of monetary policy in the Mundell-Fleming model, and move only in response to changes in r*, this is not the case in other models and is unlikely to hold in real-world situations. Typically a combination of (real) exchange rate and interest rate effects will be involved in any monetary policy move, though the relative importance of the former will likely increase with the degree of capital mobility.

Somewhat surprisingly, given much of the popular discussion surrounding these issues, one can show that perfect capital mobility and perfect asset substitutability (defined below) do not preclude independent movements in both real and nominal domestic interest rates vis-à-vis "world" interest rates in the short to medium run.[11] More critical to the synchronous movements of domestic and foreign interest rates is the manner in which domestic price and

11. They do have implications for the ability of policymakers to use foreign exchange intervention as an independent policy tool, however. See Obstfeld (1988).

exchange rate expectations are formed, as well as the extent to which arbitrage in tradeable goods (as distinct from financial assets) ensures that purchasing power parity (PPP) conditions are satisfied. These issues are examined below in some detail with reference to four different definitions of international capital mobility, ranked in descending order according to their "narrowness" or specificity.[12]

2.1.1 Capital mobility and covered interest parity

The narrowest definition of capital mobility considers only the ease with which investors can shift funds between international financial markets. In the absence of transactions costs, tax distortions, "political risk,"[13] exchange controls and investment restrictions, one would expect the returns on comparable assets trading in different markets to be equalized through arbitrage.

This condition, known as covered interest parity, is usually tested in one of two ways: either by examining the covered interest differentials on instruments denominated in different currencies, or by simply comparing the yields on domestic and Euromarket instruments issued in the same currency.[14]

(a) Covered Interest Differential

$$i - i^* - (f-e) = \delta \qquad (5)$$

(b) Domestic-Euromarket Differential

$$i - i_e = \delta \qquad (6)$$

where,

- i = domestic (* foreign) nominal interest rate
- i_e = Eurocurrency rate
- $(f-e)$ = forward premium (discount)
- δ = covered interest differential

Values of δ significantly different from zero indicate a lack of capital mobility according to this narrow definition.[15] Notice that there is no presumption that domestic and foreign nominal interest rates, i and i*, should be equal.

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12. For a more detailed discussion see Frankel (1988b).

13. Aliber (1973) coined this term to describe the risks associated with discriminatory taxes, controls and regulations that governments might be tempted to impose on foreign investors and investment income in future periods. Uncertainty over future government actions could cause investors to demand a "political risk premium" on certain investments even though no existing barriers or taxes were in place.

14. It is important that the instruments be comparable in terms of credit risk and maturity.

15. Conversely, values of δ equal to zero indicate "perfect capital mobility" according to this narrow definition.

According to (5) they can differ by (f-e) and still be consistent with perfect capital mobility. Similarly, there is no presumption that domestic and foreign real interest rates should be equated, unless (f-e) happens to correspond to the difference between expected rates of inflation at home and abroad.

2.1.2 Perfect asset substitutability (uncovered interest parity)

A somewhat broader definition of capital mobility, which assumes that the covered interest parity condition is satisfied, focusses on the willingness of investors to shift funds between uncovered assets denominated in different currencies. At the limit, perfect asset substitutability obtains if investors treat two otherwise equivalent instruments that are denominated in different currencies as perfect substitutes and demand the same expected rate of return on each. No exchange risk premiums are required to induce investors to shift funds between foreign and domestic currency assets.

$$i - i^* - (\hat{e}-e) = \varepsilon = 0 \qquad (7)$$

where,

$\hat{e}$ = expected future price of foreign exchange
ε = exchange risk premium

Condition (7) is often referred to as uncovered interest parity, to distinguish it from covered interest parity and the narrow definition of perfect capital mobility described by condition (6). If both perfect capital mobility and perfect asset substitutability obtain, the forward premium (or discount) on covered transactions will equal the expected rate of depreciation (appreciation),

$$i - i^* = (f-e) = (\hat{e}-e) \qquad (7)'$$

As is evident from (7)', neither covered interest parity nor uncovered interest parity requires foreign and domestic interest rates to move in a lock-step fashion, though a closer relationship might be expected between the rates than would exist if foreign and domestic capital markets were completely segmented.

2.1.3 Ex ante and ex post real rates of interest at home and abroad

Some researchers implicitly assume that real interest rate differentials on domestic and foreign currency assets become progressively smaller, and at the limit zero, as international capital markets become more highly integrated. Though the logic underlying this argument is questionable, it is useful nevertheless to examine the restrictive conditions that must be satisfied to produce identical real interest rates across countries.

Provided uncovered interest parity holds, one can ensure that ex ante real rates of interest are equated on domestic and foreign currency assets by imposing an additional (and much stronger) condition on (7)', related to international trade in goods and services. This condition is known as "ex ante purchasing power parity" and implies that the expected change in the real exchange rate is zero. It can be satisfied in one of two ways. First, nominal exchange rates can be assumed to change one-for-one in response to differences in domestic and foreign inflation,

$$(\hat{e}-e) = (\pi-\pi^*) \qquad (8)$$

where,
π = domestic (*foreign) inflation rate

This is sometimes referred to as relative purchasing power parity. An alternative, and less restrictive, condition assumes simply that expected real exchange rates follow a random walk,

$$(\hat{e}-e) - E(\pi-\pi^*) = \sigma \qquad (9)$$

where,
E = expectations operator
σ = random, white noise, error term

While (9) might appear to take an unduly agnostic view of exchange rate behaviour, researchers have had difficulty rejecting it as an empirical proposition. Critics have countered that this is simply a reflection of the limited discriminatory power of the unit root tests which have been applied in most studies to date.

Ex ante PPP, together with perfect capital mobility and perfect asset substitutability, is sufficient to guarantee,

$$E(r-r^*) = E(i-\pi) - E(i^*-\pi^*) = 0 \qquad (10)$$

This can be demonstrated by rewriting (10) as,[16]

$$E(r-r^*) = (i-i^*) - E(\pi-\pi^*)$$

$$= [i-i^* - (f-e)] + [(f-e) - (\hat{e}-e)]$$

$$+ [(\hat{e}-e) - E(\pi-\pi^*)] \qquad (10)'$$

The first term on the right-hand side of (10)' is zero, provided perfect capital mobility obtains; the same is true of the second term, assuming perfect asset

16. See, for example, Longworth (1986) or Frankel and MacArthur (1987).

substitutability. Finally, condition (9) ensures that the third term is zero.[17]

While it is possible that the average value of $E(r - r^*)$ might equal zero over time, one would be surprised if all of these conditions were met consistently in international goods and capital markets. The elimination of ex post real interest differentials seems even more remote, since ex ante rates of inflation in each country would have to be identical to their respective ex post values. This would demand incredibly prescient behaviour on the part of economic agents and perfect international arbitrage in all goods markets.[18]

2.1.4 Zero Investment-Savings Correlations

Some authors, such as Feldstein and Horioka (1980), favour a final and much broader definition of capital mobility -- one which comes much closer to the spirit of the simple Mundell-Fleming model described above (Section 2.1). They suggest that if capital markets are perfectly integrated internationally, one should observe low or zero correlations between national savings and investment rates. Increased (decreased) demand for investment financing in a given country should be accommodated automatically by a capital inflow (outflow) from abroad, leaving domestic real interest rates and savings (private plus government) unchanged. Alternatively, the correlation between the current account and domestic investment, where both are expressed as a ratio of GNP, should be approximately one.

$$(I/Y) = \psi + \Phi(S/Y), \qquad \Phi = 0 \qquad (11)$$

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17. It is interesting to note that once taxes are introduced into the analysis it may be impossible to equate net real rates of return across countries and simultaneously satisfy ex ante PPP and uncovered interest parity -- even if foreign and domestic tax rates, τ and τ^*, are identical (see Howard and Johnson 1982).

Ex ante PPP requires,

$$(\hat{e}-e) = E(\pi-\pi^*) = 0 \qquad (9)'$$

But in order to equate net real rates of return internationally and ensure that the nominal interest rates adjust to expected changes in inflation (the "Fisher Effect"), the following condition must also hold,

$$i = E(r+\pi)/(1-\tau) = i^* = E(r^*+\pi^*)/(1-\tau^*) \qquad (9)''$$

which can be rewritten as,

$$E(r-r^*) = (i-i^*)^*(1-\tau) - E(\pi-\pi^*) \qquad (9)'''$$

$$= (i-i^*)^*(1-\tau) - (\hat{e}-e), \quad \tau = \tau^*$$

Condition (9)''' is inconsistent with uncovered interest parity, however, unless $E(r - r^*)$ is non-zero.

18. Implicitly, all agents would have to have identical consumption bundles. Moreover, all commodities would have to be tradeable and satisfy the law of one price.

or,

$$(CA/Y) = \alpha - ß(I/Y), \quad ß = 1 \qquad (12)$$

In order to satisfy (11), it is necessary for domestic real rates of return on all classes of real and financial assets to be equated with (exogenous) real rates of return on comparable foreign assets -- not simply a subset of tradeable assets such as short-term money market instruments or government bonds. In addition, the domestic investment rate (I/Y) must depend on r, now defined as an average effective cost of capital, and not on any other variables that are correlated with domestic saving.[19]

$$(I/Y) = \gamma - \Theta r + \mu$$

$$= \gamma - \Theta r^* - \Theta(r-r^*) + \mu \qquad (13)$$

where,

μ = random error term uncorrelated with r or S/Y

The condition shown in (11) can be expressed in terms of covariances as:

$$cov(I/Y,S/Y) = cov(\mu,S/Y) - \Theta cov(r^*,S/Y) - \Theta cov(r-r^*,S/Y)$$

$$= 0 \qquad (14)$$

A zero value can be obtained for the third and final term, cov(r-r*,S/Y), provided condition (10) is satisfied and r-r* is always zero. In order to ensure that cov(I/S,S/Y) = 0, however, two additional conditions must also be met that go well beyond ex ante PPP, perfect capital mobility and perfect asset substitutability. First, the national savings rate must be uncorrelated with μ. This is unlikely for several reasons given the endogenous nature of these variables. One factor that has received particular attention in recent empirical work is the so-called "policy reaction" effect in which policymakers are assumed to systematically offset large balance of payments deficits and surpluses through adjustments to government expenditures and taxes, thereby reducing the importance of international capital flows as an adjustment mechanism. Second, S/Y must be uncorrelated with r*. This implies that the country is small enough that changes in its saving rate will not influence world real interest rates.[20]

19. Dooley, Frankel and Mathieson (1988).

20. Technically, S/Y must also be insensitive to changes in r*. This additional condition is ignored for purposes of the present analysis, since empirical studies have typically failed to uncover a systematic and significant relationship between real interest rates (domestic or foreign) and national savings rates.

Once again it is doubtful whether all of the conditions noted above will actually be met in the real world, yet this is what many observers have implicitly assumed when they speak of capital mobility and the limitations it is expected to impose on the behaviour of domestic interest rates.

2.2 The Dornbusch "Overshooting" Model

New models have been developed in recent years that reproduce the major results of the Mundell-Fleming model, most notably the enhanced effectiveness of monetary policy, but manage to avoid some of the more contentious capital market conditions presented above (Sections 2.1.3 and 2.1.4). In addition, the models incorporate (somewhat) more realistic assumptions concerning expectations formation and the intertemporal adjustment of prices, interest rates and exchange rates. One of the best known is the Dornbusch (1976) "overshooting" model.

The Dornbusch model assumes: (i) perfect capital mobility and perfect asset substitutability; (ii) instantaneous adjustment of financial variables; (iii) sticky prices in goods markets; (iv) forward-looking expectations (perfect foresight); and (v) long-run money neutrality.

A stylized version of the model can be written as:

$$m - p = \gamma y - \alpha i \qquad (15)$$

$$y - \bar{y} = -\beta r + \lambda(y^* - \bar{y}^*) + \mu(e + p^* - p) + g \qquad (16)$$

$$\pi = \pi(y - \bar{y}) \qquad (17)$$

$$i - i^* = \Delta e \qquad (18)$$

$$\Delta e = \sigma(\bar{e}-e) = \bar{e} - (1/\alpha\sigma)(p-\bar{p}) \qquad (19)$$

where,

$\bar{e}$ = long-run equilibrium exchange rate

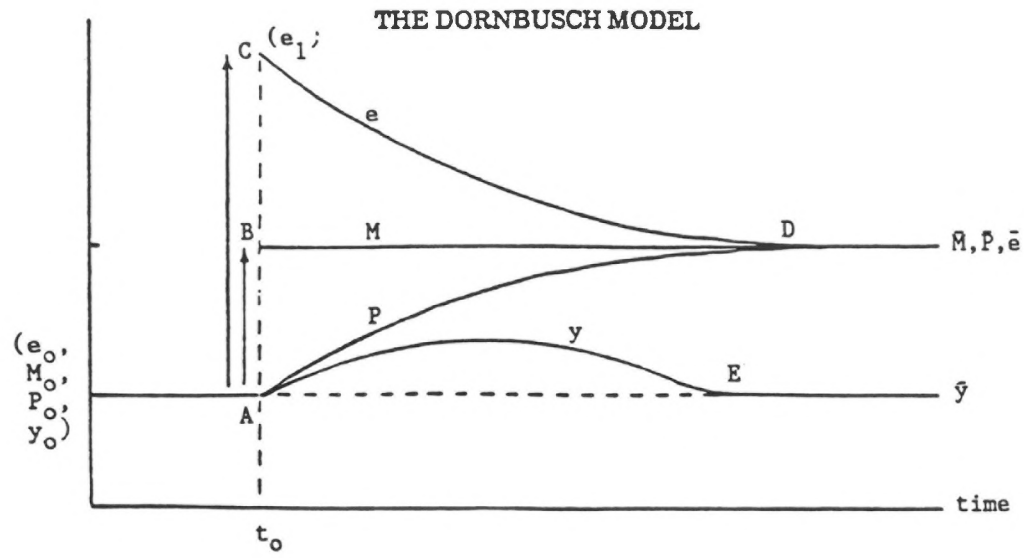
$\bar{p}$ = long-run equilibrium price level

σ = partial adjustment parameter

$\bar{y}$ = trend output

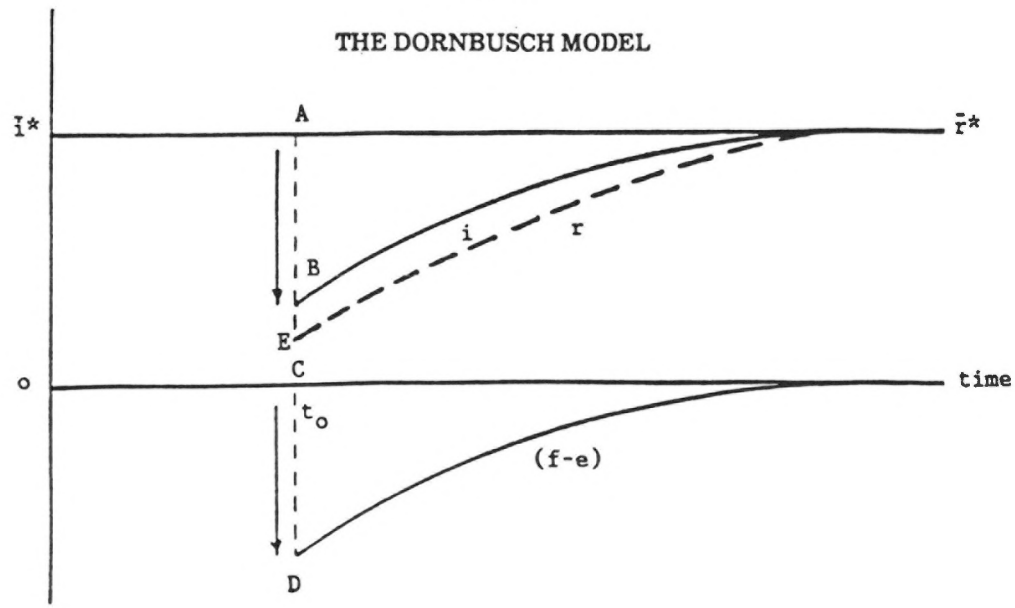
Equations (15) and (16) simply repeat equations (1) and (2) in the Mundell-Fleming model. Domestic prices are no longer assumed constant, however, and (3) has been replaced by (17), with the rate of inflation now related to excess demand in the goods market. Uncovered interest parity is imposed in (18) in place of $r = r^*$, and (19) describes the lagged adjustment of nominal exchange rates to a long-run equilibrium consistent with PPP.

Figure 2



Unlike the Mundell-Fleming model, monetary policy in the Dornbusch model is transmitted through both exchange rate and interest rate channels and affects aggregate prices. Increases in m cause i to fall (see Figures 2 and 3). Since domestic prices are slow to adjust, this also results in lower real interest rates, r. In order to preserve uncovered interest parity, e must overshoot its long-run equilibrium value, e, and depreciate immediately from e_0 to e_1, after which it appreciates gradually to $\bar{e}$. Eventually the real and financial sectors of the economy return to equilibrium. Prices move from p_0 to $\bar{p}$, proportional to the increase in m, and y returns to $\bar{y}$. In the interim y remains above its steady state value, stimulated by lower real interest rates and a depreciated currency.

Figure 3



(perfect capital substitutability, $i = \bar{i}^* + (f - e)$)

Although the Dornbusch model includes only a single short-term interest rate i, the story would remain essentially unchanged if longer-term interest rates were added. Changes in current and expected future short-term rates would be reflected in long-term rates, provided long-term and short-term instruments were substitutable and long-term rates were driven by forward looking expectations. An easier monetary policy, for example, would reduce nominal and real short-term interest rates, as well as real long-term interest rates.[21] Movements in the latter would clearly be much smaller, however, and decrease monotonically with the maturity of the instrument. A similar relationship would exist with regard to forward exchange rates, implicitly linking them to current and expected future values of the spot rate.

Three major points emerge from the preceding analysis:

(1) Given a flexible exchange rate system, greater integration of international capital markets does not diminish the effectiveness of monetary policy as a stabilization tool, whether one's frame of reference is the simple Mundell-Fleming model or a more sophisticated variant.

(2) Perfect capital mobility and perfect asset substitutability do not imply coincident domestic and foreign interest rates. Other assumptions must be made to bring this about.

(3) Nominal and real domestic interest rates at both long and short ends of the yield curve can respond to changes in monetary policy much the way they would in a closed economy setting,[22] assuming domestic goods prices are sticky and domestic assets are highly substitutable.

21. Nominal long-term interest rates could rise or fall depending on the behaviour of expected future inflation rates. Though the original Dornbusch model assumed stable long-run prices, Frankel (1979) has extended it to incorporate steady state inflation.

22. This does not imply that short and long-term interest rates will move by equivalent amounts. Indeed, one would expect to observe less movement in long-term rates, whether in a closed or open economy setting, since they represent an average of both current and expected future short-term interest rates.

3. EMPIRICAL TESTS OF CAPITAL MOBILITY AND ASSET SUBSTITUTABILITY IN CANADA

Recent empirical work on capital mobility and asset substitutability in Canada is examined in this section, to see if financial developments during the past 10 to 20 years have had a significant effect on domestic interest rate relationships. Previous published work has been updated where appropriate with more current data and is reported along with the results from a number of new econometric tests. The empirical results are presented in the same order as the material in Section 2, beginning with the narrowest definition of capital mobility and proceeding to more inclusive definitions of international financial market integration.

3.1 Capital Mobility

Perfect international capital mobility, as defined in Section 2.1.1, has been tested in numerous studies for each of the major industrialized countries, including Canada, and cannot be rejected, except in those cases where official controls or regulations have created an artificial wedge between domestic and off-shore returns.[23] Other factors such as transactions costs and "political risk" which were previously thought to limit capital mobility do not appear to have had a significant effect on investment decisions and cannot account for the large covered interest differentials that are recorded for some countries.[24]

Representative results for Canada are shown in Chart 6 and Table 4, based on observed differences between 90-day Eurocurrency rates and comparable 90-day domestic money market rates. Similar calculations were also performed on Eurocurrency and domestic money market (or interbank) rates for Germany and Japan to compare differences in capital mobility across countries and over time.[25]

The sample period in each case was divided at 1979Q4. This seemed appropriate for a number of reasons.[26] First, the period 1979-80 corresponds to the start of the EMS and the introduction of revised monetary control procedures at the U.S. Federal Reserve. The latter, together with subsequent U.S. monetary policy initiatives, are often blamed for the sharp increase in interest rate and exchange rate volatility observed after 1979. Second, several countries, including Germany, the United Kingdom and Japan, were in the process of removing their capital controls during this period. Third, 1979-80

23. See, for example, Boothe et al. (1985) and Caramazza et al. (1986), as well as the references cited therein.

24. See Clinton (1988) and Caramazza et al. (1986).

25. The three-month gensaki rate was used in the calculations for Japan; a three-month interbank rate for Germany; and a three-month finance company paper rate for Canada.

26. See Caramazza et al. (1986).

marks the approximate midpoint of the current flexible exchange rate period. Preliminary tests were run on data beginning in 1973Q3, coincident with the move to floating exchange rates in most industrial countries,[27] but data problems and some unusual results forced us to shift the starting point for Canada and Germany to 1974Q2. In the case of Japan, reliable data were not available prior to 1975Q3.

The mean interest differentials reported in Table 4 for Canada are effectively zero in both subperiods, 1974Q2-79Q4 and 1980Q1-88Q1.[28] In addition, there is no evidence of systematic movement or trending in the differentials over time, and their variability as measured by the estimated standard deviations is extremely small (less than 25 basis points throughout the sample).

Table 4

90-DAY INTEREST DIFFERENTIALS:

EURO-MARKET RATE MINUS DOMESTIC RATE

	Mean	Standard deviation	T statistic for mean = 0
Canada			
1974Q2 - 1979Q4	- 0.0186	(0.224)	- 0.392
1980Q1 - 1988Q1	- 0.0000	(0.222)	- 0.001
1974Q2 - 1988Q1	- 0.0076	(0.221)	- 0.259
Germany			
1974Q2 - 1979Q4	- 0.2764	(0.190)	- 6.980
1980Q1 - 1988Q1	- 0.2371	(0.182)	- 7.468
1974Q2 - 1988Q1	- 0.2533	(0.185)	- 10.254
Japan			
1975Q3 - 1979Q4	- 1.154	(1.195)	- 4.092
1980Q1 - 1988Q1	0.159	(0.330)	2.775
1975Q3 - 1988Q1	- 0.304	(0.978)	- 2.219

27. Canada, in contrast, began floating in 1970Q3.

28. The interest differentials for Canada would have been somewhat higher if interbank rates had been used in place of money market rates. Domestic banking regulations such as reserve requirements and mandatory contributions to deposit insurance lower the interest rates that banks can offer on deposits and typically produce positive Eurocurrency-domestic interest differentials.

The results for Germany and Japan differ from one another and those of Canada in several respects. First, the mean interest differentials are significantly different than zero in both subperiods, though they tend to diminish towards the end of the sample, indicating increased capital mobility. Second, in the case of Germany, the deviations (Eurocurrency rate minus the domestic rate) are all negative, suggesting that the controls were intended primarily to prevent capital inflows rather than to restrict capital outflows. Similar, though more dramatic, results were obtained for Japan from 1975Q3 to 1979Q4.[29] Thereafter, interest differentials alternated between positive and negative values, with a mean value of + 16 basis points. Were it not for the large positive values reported in 1980, the mean would have been much closer to zero, reflecting Japan's decision to eliminate many of its capital controls in 1981.

Other authors have reported similar results for these three countries. When the same tests are applied to wider group of countries, including: France, Italy, the United Kingdom and the United States, in addition to Germany, Japan and Canada, perfect capital mobility is typically rejected in every case -- except for the United States and Canada. All of the other countries show significant interest differentials over some portion of the 1974-1988 period.[30]

3.2 Asset Substitutability

3.2.1 Money market instruments

Unlike capital mobility, asset substitutability cannot be tested directly as exchange rate expectations are unobservable. As a result, researchers have been forced to test the relationship between $(i - i^*)$ and the expected change in the exchange rate $(\hat{e} - e)$ conditional on a specific expectations hypothesis. In most analyses, rational expectations and perfect capital mobility are assumed, allowing the following relationship to be estimated,

$$(e_t - e_{t-1}) = a + b({}_{t-1}f_t - e_{t-1}) + \varepsilon_t \,, \qquad (20)$$

The change in the exchange rate in period t is expected to equal the forward premium (discount) recorded in t-1, implying $a = 0$, $b = 1$. Unfortunately, repeated testing over different sample periods and countries typically yields negative and/or statistically insignificant estimates of b, suggesting that at least one of the elements in the joint hypothesis is not supported by the data. Estimates for Canada, over the period 1973M7 to 88M3, are shown in Table 5.

29. Notice the difference in scaling on the charts for Germany and Japan.

30. See Frankel and MacArthur (1987).

Table 5

ASSET SUBSTITUTABILITY IN CANADA

	a	b	S.E.E.	D-W
1973.7 - 1988.3	0.002 (2.12)[1]	- 1.42 (2.14)[2]	0.013	2.17
1973.7 - 1979.12	0.002 (1.31)	- 0.23 (0.24)[2]	0.013	2.14
1980.1 - 1988.3	0.003 (1.93)[1]	- 2.60 (2.77)[2]	0.013	2.28

(t statistic)

1. Significantly different from 0 at $\alpha = 0.05$.
2. Significantly different from 1 at $\alpha = 0.05$.

Economists with a predisposition for efficient markets argue that the perverse behaviour is caused by exchange risk premiums and that perfect asset substitutability does not hold. Others, who favour the perfect asset substitutability hypothesis, suggest that the problem is "irrational expectations."

Three alternative approaches have been taken in the literature to try to resolve this issue. The first is based on optimal portfolio diversification models that relate the exchange risk premium, $[(e_t - e_{t-1}) - ({}_{t-1}f_t - e_{t-1})]$, to conditional exchange rate variances. This approach is attractive conceptually and has considerable intuitive appeal as it seems unlikely that investors are either risk neutral with respect to exchange rate variability or able to obtain a "natural hedge" through portfolio diversification and adjustments to their consumption/production behaviour. Nevertheless, early tests of these models, using estimated variance-covariances and alternative values of relative risk aversion, could still not explain deviations as large as those observed in equation (20).[31] More recent work based on ARCH models, which allow the conditional variance of exchange rates to vary over time, produces estimates that are large enough to explain the forward bias, but does not provide any direct evidence of a positive relationship between exchange rate variability and the bias in forward rates.

31. Frankel (1986).

A second approach, adopted by Frankel and Froot (1986), relies on survey data and tries to identify directly the separate effects of exchange rate expectations and exchange risk premiums. Using data for the United States, Germany and Japan, the authors find that they "cannot reject the hypothesis that all of the bias [in the forward discount] is attributable to systematic expectational errors." In short, their results are consistent with perfect asset substitutability. Though these tests have not been applied to Canadian data, the same general conclusions have been reached using a third approach described below.

The third approach, based on portfolio-balance models, involves adding asset stock and wealth variables to the right-hand side of (20) and testing to see if they add any explanatory power to the equation. If risk premiums exist, one would expect them to move in response to changes in domestic and foreign wealth and the outstanding stock of financial assets.

Estimates for Canada have been obtained by Caramazza et al. (1986) using a modified version of equation (20). The authors have rewritten (20) in "risk premium form" and have included three additional explanatory variables: (i) Canadian government debt as a ratio of world wealth $[(B/e)/W]$; (ii) Canadian wealth as a ratio of world wealth $[(W_c/e)/W]$; and (iii) U.S. wealth as a ratio of world wealth (W_{us}/W),[32]

$$(i - i^*) - (e_t - e_{t-1}) = a + b[(B/e)/W] + c[(W_c/e)/W] + d(W_{us}/W),$$

$$b > 0,\ c < 0,\ d > 0 \qquad (21)$$

Significant and correctly signed coefficients on the relative debt and wealth variables could be taken as evidence that perfect asset substitutability does not hold for Canada. The results for 1973M7 to 84M12 are shown in Table 6.

Table 6

RISK PREMIUM EQUATIONS

	a	b	c	d	S.E.E.	D-W
1973.7 - 1979.12	0.03 (1.16)	- 1.33 (1.78)	0.28 (0.97)	0.07 (1.69)	0.013	2.05
1980.1 - 1984.12	- 0.05 (0.65)	0.85 (0.42)	- 0.96 (0.90)	0.80 (1.10)	0.014	2.25
1973.7 - 1984.12	0.12 (0.62)	- 0.73 (1.49)	0.04 (0.17)	0.06 (1.78)	0.014	2.11

(t-statistics)

None of the coefficients is significant at $\alpha = 0.05$.

32. Domestic wealth series, W_c and W_{us}, were constructed by adding asset stocks (outstanding government debt and private fixed investment) to the cumulated current accounts of Canada and the United States, respectively. Aggregate world wealth was obtained by summing the domestic wealth series for Canada, the United States, France, Germany, Japan and the United Kingdom.

Table 7

CANADIAN LONG-TERM INTEREST RATE EQUATIONS

Variable	1973.7 - 1984.12		
constant	1.41 (2.30)	- 0.39 (2.14)	0.13 (1.16)
i^{L}_{us}	0.72 (11.94)	0.70 (11.91)	0.67 (10.97)
$i^{L}_{us,-1}$	- 0.25 (2.97)	- 0.28 (3.38)	- 0.33 (3.95)
i_c	0.11 (2.88)	0.14 (4.01)	0.14 (3.86)
$i_{c,-1}$	- 0.02 (0.49)	- 0.02 (0.61)	- 0.01 (0.16)
i_{us}	0.02 (0.71)	0.01 (0.32)	0.04 (1.27)
$i_{us,-1}$	- 0.09 (2.80)	- 0.12 (3.77)	- 0.12 (3.71)
(B/W)	- 36.89 (0.61)		
$(B/W)_{.1}$	45.43 (0.73)		
(W_c/eW)	56.19 (0.80)		
$(W_c/eW)_{.1}$	- 71.31 (1.04)		
(W_{us}/W)	0.84 (0.37)		
$(W_{us}/W)_{.1}$	- 2.31 (0.93)		
π_c	0.70 (1.20)	- 0.05 (0.87)	
$\pi_{c,-1}$	0.12 (2.17)	0.09 (1.74)	
π_{us}	0.22 (3.35)	0.20 (3.17)	
$\pi_{us,-1}$	- 0.19 (2.98)	- 0.20 (3.16)	
$i^{L}_{c,-1}$	0.52 (6.66)	0.60 (8.43)	0.64 (8.85)
$i^{L}_{c,-2}$	- 0.01 (0.16)	- 0.02 (0.35)	- 0.03 (0.52)
$\bar{R}^2$	0.989	0.989	0.988
D-W	2.13	2.18	2.16
S.E.E.	0.254	0.257	0.269

On the basis of this evidence, it would appear that exchange risk premiums have not played a very important role in explaining the behaviour of uncovered interest differentials. None of the coefficients is statistically significant.

3.2.2 Long-Term Bonds

All of the results that have been reported to this point have involved short-term assets. Similar relationships should also hold for long-term assets provided certain arbitrage conditions are met.

$$i^L - i^{L*} - \Delta_t e_{t+n} = a + b[(B/e)/W] + c[(W_d/e)/W] + d(W_{us}/W) \quad (21)'$$

It is possible to test for perfect asset substitutability at the long end of the bond market using an equation like (21)′ and by proxying the expected change in e with the exchange rate change that is actually observed n periods later, $\Delta_t e_{t+n}$. Unfortunately very few degrees of freedom would be left for estimation if this procedure were followed, since n could extend for 10 or 20 years. As an alternative, authors such as Beenstock and Longbottom (1981), and Bisignano (1983) have constructed proxies for $\Delta_t e_{t+n}$ using lagged values of short and long-term interest rates on domestic and foreign assets, and lagged values of domestic and foreign inflation.

$$\begin{aligned} i^L = a &+ \sum_{j=0}^{l} b_j i^{*L}_{t-j} + \sum_{j=0}^{l} c_j i_{t-j} + \sum_{j=0}^{l} d_j i^*_{t-j} \\ &+ \sum_{j=0}^{l} e_j[(B/e)/W]_{t-j} + \sum_{j=0}^{l} f_j[(W_c/e)/W]_{t-j} \\ &+ \sum_{j=0}^{l} g_j[W_{us}/W]_{t-j} + \sum_{j=0}^{l} h_j \pi_{t-j} + \sum_{j=0}^{l} k_j \pi^*_{t-j} \\ &+ \sum_{j=1}^{l} m_j i^L_{t-j} \end{aligned} \quad (22)$$

Estimated coefficients for (22) are reported in Table 7.[33] Once again the parameter values on the government debt and wealth ratio variables are all insignificant, supporting the hypothesis of perfect asset substitutability on

33. The parameter estimates and summary statistics are taken from Caramazza et al. (1986), Appendix B.

long-term bonds.[34] Zero restrictions can also be accepted on the domestic inflation terms in (22), reducing the equation to a simple stock adjustment specification with current and lagged values of i^L_{us}, i_{us}, and i_c. Though U.S. interest rates clearly exert an important, if not predominant, influence on Canadian long-term interest rates, Canadian short-term rates also have significant explanatory power, consistent with the discussion in Section 2 concerning the scope for independent interest rate movements in a small open economy.

To test the stability of the Canadian term structure relationship and to identify any break points, equation (22) was reestimated and the sample extended to 1987M12.[35] The results are reported in Tables 8 and 9.

No evidence of instability was uncovered over the period 1973M7 to 1979M12, using standard F-tests. However, two significant breaks were identified in later periods, beginning in .1980M1-M12 and 1982M1-M12, respectively.[36] Comparing parameter estimates across the various subperiods, it appears that the long-run effects of i^L_{us} and i_{us} have tended to decline over time, while the influence of i_c has tended to increase.[37]

Though one might be tempted to attribute these breaks and the attendant decline in U.S. influence to increased financial market integration and the elimination of capital controls in other industrial countries, subsequent testing casts doubt on this interpretation. The introduction of additional foreign interest rates into the equation after 1980 did not improve its explanatory power or remove the instability. This is not surprising, however. Indeed, if two assets are perfect substitutes, and one (in this case the U.S.) is clearly dominant in the sense that i* can be treated as exogenous, it is not obvious that the presence of other perfect or imperfect substitutes would be expected to alter the term structure relationship. At best the additional variables would be perfectly collinear with U.S. interest rates; at worst, simply irrelevant (from a Canadian perspective).

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34. Given these results one can understand why researchers have been unable to find significant supply effects in domestic term structure equations. See, for example, Boothe (1987) and Poitras (1988). If Canadian and U.S. government bonds are regarded as perfect substitutes, changes in the outstanding stock of government debt, in total or at specific maturities, would be unlikely to have any systematic or permanent effect on interest rates. This does not imply that short and long-term bonds are perfect substitutes, just that the term premiums (if they exist) would be determined in international markets.

35. Notice that the asset stock and wealth variables have been dropped, and that a second lag has been added to the foreign interest rate variables.

36. Bisignano (1983) and Pesando and Plourde (1988) have also reported significant breaks in the Canadian term structure relationship between 1979-80 and 1982-83.

37. i_{us} was the only variable to have its parameter estimates reverse sign and become statistically insignificant.

Table 9

IMPACT (I) AND LONG-RUN (L) COEFFICIENTS OF CANADIAN INTEREST RATE EQUATIONS

	i^{L}_{us}		i_c		i_{us}		$i^{L}_{c,-1}$	(c - us)		i^{L}_{ov}	
	I	L	I	L	I	L		I	L	I	L
1973.7 - 1987.12	0.87 (10.89)	0.64 (7.55)	0.20 (4.82)	0.41 (5.57)	0.03 (1.19)	- 0.14 (1.90)	0.52 (6.51)				
1973.7 - 1982.12	0.97 (8.64)	0.92 (9.45)	0.15 (2.64)	0.25 (3.93)	0.01 (0.44)	- 0.15 (3.04)	0.49 (4.67)				
1983.1 - 1987.12	0.79 (6.41)	0.32 (2.53)	0.20 (3.40)	0.35 (2.68)	0.26 (3.12)	0.18 (1.19)	0.35 (2.24)				
1973.7 - 1979.12	0.40 (2.86)	0.79 (3.20)	0.32 (5.13)	0.21 (2.64)	0.02 (0.64)	- 0.12 (2.46)	0.69 (5.07)				
1980.1 - 1987.12	0.90 (8.29)	0.56 (4.81)	0.19 (3.32)	0.50 (4.27)	0.06 (1.39)	- 0.19 (1.40)	0.44 (3.85)				
1980.1 - 1987.12	0.92 (8.55)	0.63 (7.37)	0.22 (3.72)	0.50 (5.80)	0.03 (0.79)	- 0.27 (2.58)	0.37 (3.11)	0.09 (1.94)	0.23 (2.32)		
1980.1 - 1987.12	0.92 (8.10)	0.55 (5.00)	0.19 (3.06)	0.49 (4.49)	0.06 (1.31)	- 0.24 (1.61)	0.42 (3.62)			- 0.08 (0.36)	0.09 (0.59)

While it is difficult to make any precise statements concerning the economic factors that might be driving these reduced-form equations and their observed structural instability, we suspect that divergent inflation expectations in Canada and the United States over the turbulent 1980-87 period may be responsible for the changing parameter values. When the Canada-U.S. inflation differential is added to the equation after 1980, its estimated coefficient is large and statistically significant in contrast to earlier periods. The stability of the relationship prior to 1980 might reflect an expectation on the part of market participants that Canadian and U.S. monetary authorities would follow roughly similar policies. Changes in operating procedures at the U.S. Federal Reserve in 1979 and 1982 may have altered inflation and exchange rate expectations in the two countries. This in turn would have affected the behaviour of the interest rate variables that were included in the equations to capture these expectations effects.

3.3 International Equality of Real Interest Rates

The evidence surveyed in previous sections suggests that perfect capital mobility and perfect asset substitutability cannot be rejected for Canada and the United States. Nevertheless, as our earlier discussion demonstrated, it is still possible for real interest rates in the two countries to diverge. As a practical matter, however, one would be surprised if the differences were very large given the strong real and financial linkages connecting these economies and their similar inflation performance over the post-war period (see Charts 7 and 8).

Tables 10 and 11 present quarterly ex post estimates of real rates of return on short-term and long-term securities in Canada, the United States and the five major overseas economies.[38] The numbers were obtained by subtracting the actual percentage changes in each country's GDP deflator from representative short and long-term nominal interest rates published by Morgan-Guaranty.[39]

Several consistent patterns can be seen in the results. First, correlations among real interest rates tend to increase over time and are higher for long-term rates than for short-term rates.[40] Second, real interest differentials tend to be higher on long-term rates and, in the case of Canada and the United States, become more pronounced in later periods. Third, though real interest differentials are much smaller than those on nominal rates, they are typically significant (from a statistical if not an economic standpoint). Certainly there is no convincing evidence that Canadian-U.S. real interest differentials have narrowed over time. In this respect the results are very similar to those reported for nominal interest rates in Tables 2 and 3.

By implication it would appear that the ex ante PPP condition necessary to equate expected real interest rates has not been satisfied for Canada and the United States over most of the 1973-1988 period.[41] The results for other country comparisons are less informative since it is likely that the capital

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38. The significance tests that are reported for the ex post real interest rate differentials in Table 9, implicitly assume expectations are rational and test the following restriction,

$$(i_{t+1} - i^*_{t+1}) - (\pi_t - \pi^*_t) = a + \varepsilon_t, \quad a = 0 \qquad (24)$$

An alternative set of ex ante real interest rate calculations is reported in the Appendix. The rational expectations assumption is dropped and simulated values from ARIMA models are used to proxy price expectations over a ten-year horizon.

39. IMF and OECD inflation forecasts for 1989-99 were combined with actual inflation data to help calculate ex post long-term rates over the 1978-88 period.

40. The one exception is the correlation between Canadian and overseas money market rates, which declines in the 1980:1-88:1 period in both ex post and ex ante calculations.

41. Direct estimates of the ex ante purchasing power parity condition reported by Longworth (1986) support this conclusion.

Table 10

REAL (EX POST) RATES OF RETURN: MEANS (AND STANDARD DEVIATIONS)

	1973Q3 - 1979Q4	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada	0.37% (3.43)	6.27% (2.68)	3.67% (6.70)
US	0.30% (2.03)	5.68% (2.39)	3.31% (3.49)
Overseas	- 0.80% (2.35)	4.85% (1.48)	2.36% (3.40)
Short-term differentials			
Canada/US	0.08% (3.93)	0.59%* (1.72)	0.37% (2.89)
Canada/overseas	1.18% (3.10)	1.42%* (2.89)	1.32%* (2.96)
US/overseas	1.10% (3.18)	0.83% (2.57)	0.95%* (2.83)
Long-term rates			
Canada	2.47% (1.56)	8.38% (1.96)	5.78% (3.45)
US	2.06% (1.55)	7.27% (2.31)	4.97% (3.29)
Overseas	4.26% (1.09)	6.51% (1.55)	5.52% (1.76)
Long-term differentials			
Canada/US	0.42%* (0.52)	1.11%* (0.75)	0.80%* (0.74)
Canada/overseas	- 1.78%* (1.11)	1.87%* (1.02)	0.26% (2.11)
US/overseas	- 2.20%* (1.32)	0.76%* (1.18)	- 0.54%* (1.93)

* Ex post real rates on long-term bonds at time t were obtained by subtracting actual (GNP) inflation rates for the next ten years from long-term nominal interest rates. Forecast values for inflation over the period 1989-99 were used to calculate real rates from 1979-88.

mobility and asset substitutability conditions which are critical components of the real interest parity relationship were also violated.

Table 11

REAL (EX POST) RATES OF RETURN: CORRELATIONS

	1973Q3 - 1979Q1	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada/US	0.03	0.78	0.73
Canada/overseas	0.48	0.13	0.72
US/overseas	- 0.05	0.18	0.66
Long-term rates			
Canada/US	0.94	0.95	0.98
Canada/overseas	0.70	0.85	0.86
US/overseas	0.54	0.89	0.88

3.4 Investment, Savings and the Current Account

The final section of our empirical analysis reviews the evidence on investment, savings and current account relationships in Canada and the United States. In a widely cited paper published in 1980, Feldstein and Horioka drew attention to the fact that U.S. savings and investment ratios were highly correlated, contrary to what one would expect in a highly integrated world capital market. During the past 8 years international economists have spent considerable time and energy trying to explain two puzzling empirical regularities that emerged from this work. First, savings-investment correlations appeared to be higher among industrialized countries with well-developed capital markets than among less developed countries with limited access to domestic or international financing. Second, savings-investment correlations tended to increase over time, suggesting that countries had become more and not less dependent on domestic savings to finance government deficits and private investments.

Both these results run counter to the predictions of the simple Mundell-Fleming model in which greater international capital market integration weakens the relationship between aggregate absorption and output, as current account balances move to automatically accommodate any excess domestic demand or supply. Taken at face value, the results indicate that the level of international capital mobility is rather limited and has diminished over time. In response, economists have offered a number of econometric and economic arguments to

Table 12

SAVINGS, INVESTMENT AND CURRENT-ACCOUNT RELATIONSHIPS

	a	b	R^2	D-W	Corr.*
Ordinary least squares					
Canada					
1962-73	0.035 (1.27)	0.809 (5.49)	0.726	1.11	0.852
1974-87	0.071 (2.14)	0.666 (3.69)	0.492	1.22	0.701
1962-87	0.064 (2.51)	0.679 (4.90)	0.480	0.90	0.693
United States					
1962-73	0.029 (1.29)	0.786 (5.68)	0.740	1.23	0.860
1974-87	0.092 (3.65)	0.454 (2.79)	0.344	1.10	0.587
1962-87	0.094 (4.90)	0.418 (3.48)	0.369	0.90	0.646
Instrumental variables					
Canada					
1962-73	0.033 (1.04)	0.815 (4.69)	0.656	1.32	0.810
1974-87	0.045 (1.46)	0.808 (4.81)	0.630	1.04	0.794
1962-87	0.009 (0.27)	0.976 (5.06)	0.497	0.81	0.704
United States					
1962-73	0.026 (0.58)	0.808 (2.98)	0.417	1.88	0.646
1974-86	0.012 (2.89)	0.298 (1.17)	0.029	1.69	0.170
1962-86	0.133 (4.12)	0.171 (0.85)	0.000	1.45	0.000

* Corr. is the simple correlation between (I/Y) and (S/Y).

explain why these results might occur.[42] They include, among others, biases introduced because of the endogeneity of investment and savings flows, the "large country effect," and political risk factors (see Section 2.1.4).

Table 12 reports parameter estimates and summary statistics for a series of simple bivariate investment-savings equations using annual Canadian and U.S. data from 1962 to 1987,

$$(I/Y) = a + b(S/Y) + \varepsilon \qquad (11)'$$

where, I = gross private fixed investment
Y = gross national output
S = domestic savings (private plus public)

As noted earlier, parameter b is expected to equal 0 if the conditions for perfect capital mobility, as defined by Feldstein and Horioka, are satisfied.

The ordinary least squares results shown in Table 12 are notable in that the investment-savings correlations are generally higher for Canada than for the United States, contrary to what one might have expected given the smaller size and greater openness of the Canadian economy. In addition, the correlations for both countries seem to be falling towards the end of the sample period, contrary to most earlier estimates. The inclusion of more recent data may be important in this regard, particularly in the case of the United States, where the weaker relationship between savings and investment is somewhat more evident. Correlations on the order of 0.80 to 0.90 were obtained over the floating rate period when the sample was shortened to 1974-84, thereby excluding the large U.S. current account deficits that were recorded in 1985-87.[43]

To ensure that the results were not biased by any simultaneity between investment and savings flows, the regressions were reestimated using instrumental variables on the savings ratios.[44] This adjustment actually raised the parameter estimates and savings-investment correlations in the case of Canada, but produced a significant drop in the U.S. numbers. Over the 1974-87 and 1962-87 periods one cannot reject the hypothesis of a zero correlation

42. See Harberger (1980), Obstfeld (1986), Tobin (1983), Caprio and Howard (1984), Dooley and Isard (1980), Feldstein (1983), Feldstein and Horioka (1980), and Dooley, Frankel and Mathieson (1988).

43. OLS estimates for the U.S. over the 1974-84 period were

$$(I/Y) = \underset{(0.85)}{0.028} + \underset{(4.06)}{0.836}(S/Y), \quad R^2 = .647 \quad Corr(I/Y,S/Y) = .804$$

44. Fitted values for the savings ratio in the United States were estimated using the following variables as instruments: the proportion of dependents to working-age individuals in the population; military expenditures as a fraction of GNP; and lagged values of the savings ratio. In the case of Canada, total government expenditures on goods and services as a proportion of GDP were substituted for military expenditures.

between U.S. savings and investment ratios. Though this may simply reflect the choice of the instrumental variables used in the regressions, as opposed to a marked increase in capital mobility, similar results have also been reported by Frankel (1988b) in a recent working paper.

In many respects, the results for Canada are more troublesome than those for the United States. It is not clear how one can explain the exceptionally high correlations that are obtained between savings and investment ratios in a country that by most other measures is very open. The "large country effect" is not applicable since it is doubtful whether changes in the savings (investment) behaviour of a country the size of Canada could ever influence world interest rates. As well, the potential simultaneity bias created by endogenous savings and investment behaviour has presumably been controlled for via the instrumental variables technique. The only remaining explanation, as demonstrated above in equation (10)', is the existence of a systematic real interest differential on domestic and foreign investments, indicative perhaps of imperfect asset substitutability across certain classes of assets.

The tests of capital mobility and asset substitutability that were presented in earlier sections all involved marketable government securities and liquid short-term instruments. When one analyzes savings and investment relationships, however, recognition must be given to other types of assets that play an important role in real investment activity and which may not be as mobile or substitutable as government securities. Dooley, Frankel and Mathieson (1988) have examined the relationships that might exist among domestic and foreign assets using a schema similar to the one shown on the next page.

It is possible to reconcile the seemingly inconsistent results obtained in alternative tests of capital mobility and asset substitutability once the heterogeneous nature of real and financial assets is recognized. Although domestic and foreign fixed-term securities may be near-perfect substitutes (see above), this is unlikely to be true in the case of equities and fixed-capital assets. Studies of average real rates of return on capital in Canada and the United States generally find significant differences in the rates, especially in the short run.[45] This is not surprising given the distinctive characteristics of these assets, the different institutional features of the two countries (e.g. personal and corporate taxes, and regulations), and the long adjustment lags associated with real investment activity.[46] The impediments to foreign direct investment

45. See Gilson (1984) and Tarasofsky et al. (1981).

46. Murray (1982) has found that direct investment flows between Canada and the United States are sensitive to differences in the real after-tax cost of capital, and that the adjustment lags can extend well beyond 5 years.

activity that were introduced by Canada during the 1973-85 period may have also contributed to the high correlations observed on Canadian savings and investment ratios.

Domestic assets		Foreign assets
money	←imperfect substitution→	**money***
↓		↓
(imperfect substitution)		(imperfect substitution)
↓		↓
Short-term assets	←(perfect substitution)→	**Short-term assets***
↓		↓
(imperfect/perfect substitution)		(imperfect/perfect substitution)
↓		↓
Long-term bonds	←(perfect substitution)→	**Long-term bonds***
↓		↓
(imperfect substitution)		(imperfect substitution)
↓		↓
equities	←(imperfect substitution)→	**equities***
↓		↓
(imperfect substitution)		(imperfect substitution)
↓		↓
real assets	←(imperfect substitution)→	**real assets***

4. IMPLICATIONS FOR MONETARY POLICY

The preceding analysis would suggest that recent international financial market developments have not had a significant effect on domestic interest rate relationships in Canada or the implementation of monetary policy. Capital mobility and asset substitutability among domestic and foreign fixed-term assets have been very high throughout the post-war period, owing to the absence of capital controls between Canada and the United States and the strong commercial ties that have bound the two economies. Liberalization in overseas markets has changed the currency composition and geographic distribution of Canada's international assets and liabilities, but has not had any discernible effect on interest rate or exchange rate behaviour.

As a consequence, the Bank of Canada has not been forced to modify the manner in which it conducts monetary policy to any significant degree. Though the Bank found it necessary to abandon announced monetary targets in 1982, because the demand for narrow M1 had become unstable, this instability was not related to currency substitution effects or other international influences.[47] Rather, it was driven by domestic financial innovations that were proceeding for reasons unrelated to the international developments noted above.[48]

The transmission of monetary policy in Canada can be described in a very straightforward manner and follows a process similar to that outlined in Section 2 in connection with the Dornbusch overshooting model. If the Bank of Canada wants to ease or tighten monetary policy it first adjusts the monetary base, typically by drawing down or re-depositing the government's cash balances at chartered banks. This puts pressure on both real and nominal short-term interest rates, assuming goods prices are sticky, as banks try to adjust their reserve positions. Since domestic short-term and long-term instruments are highly, if not perfectly, substitutable in Canadian capital markets, these interest rate changes are reflected to varying degrees across the entire maturity spectrum. As interest rates begin to move they put pressure on the exchange rate, which also adjusts in real as well as nominal terms. The pattern and size of these exchange rate and interest rate movements will depend on a number of factors, including the speed with which domestic prices and output are expected to respond and any anticipated future policy

47. Authors, such as Alexander (1981), Poloz (1982), Arango and Nadiri (1981) and Daniel and Fried (1983), have found evidence of currency substitution in the demand for M1. The effects are not large enough to account for the instability that has been observed in M1 over the 1975-88 period, however.

48. See Freedman (1983).

actions. As a result it is often difficult to predict which of the two transmission mechanisms will dominate, though the general direction of their movements and their impact on the economy are usually evident.

Higher real interest rates, for example, affect durable expenditures, housing and investment by raising the cost of financing and depressing the market value of household wealth. Both effects have been incorporated in the Bank of Canada's quarterly forecasting model RDXF. The wealth and interest rate effects embedded in consumption equations yield an interest elasticity of approximately 0.1 per cent. The reaction of non-residential investment to changes in interest rates has been somewhat harder to quantify. Attendant changes in income and the response of the investment accelerator have tended to overwhelm the interest rate effects in most econometric studies. Nevertheless, current estimates for the interest elasticity of investment centre around 0.15 per cent.

Exchange rate movements have a more immediate impact on prices and output. Reduced form equations and large structural models of the Canadian economy indicate that a one per cent change in the real exchange rate is roughly equivalent to a 50 basis point change in real interest rates, in terms of its long-run effects on output. Moreover, this 2:1 relationship appears to have been reasonably stable over time.

Because debt management techniques and selective credit controls have not played a role in domestic monetary policy for many years, Canadian policymakers (unlike some of their foreign counterparts) have not had to worry about the effects that greater international financial integration might have on their ability to influence monetary conditions.[49] The elimination of interest rate ceilings in the mid-1960s, the deepening of domestic capital markets over the post-war period, and the ready availability of U.S. capital markets have increased asset substitutability to the point where changes in the maturity structure of Canadian debt have no discernible effect on the yield curve. Though some empirical studies have reported significant supply effects, the results are seldom economically significant or robust, and are often based on old or questionable data.[50] Other studies have detected a reverse causal relationship in which changes in interest differentials on short and long-term instruments appear to influence the maturity composition of Canadian debt. Interestingly, the authors find that the proportion of long-term debt seems to rise when long-term rates are relatively low, suggesting that policymakers have

49. See speech by J. Crow, Governor of the Bank of Canada (1988).

50. See, for example, Christofides (1975), Dobson (1973) and Masson (1978). Freedman (1970) has found evidence of "digestion effects" in Canadian capital markets, but these quickly disappear and do not have any lasting effect on the term structure.

pursued a cost minimization strategy. If supply effects were operating in the normal manner, one would have expected a positive relationship between the proportion of debt financed at a particular maturity and the interest rates in that segment of the yield curve.

Much the same story can be told for exchange market intervention activities. Because portfolio balance and exchange rate risk considerations are relatively unimportant, sterilized intervention can have at best a temporary influence on exchange market conditions, and does not represent a very potent macroeconomic tool except to the extent that it might alter market expectations.[51]

5 CONCLUSION

The empirical evidence and theoretical arguments surveyed in this paper suggest that very little has changed in Canada over the last 15 years with regard to interest rate relationships and the transmission of monetary policy. The early development of Canadian capital markets, the absence of discriminatory and burdensome financial restrictions, our early adoption of flexible exchange rates and our close economic ties with the United States, created an environment that anticipated many of the changes that are now affecting other economies. Although these developments have limited the ability of Canadian policymakers to influence monetary conditions via selective credit controls, exchange market intervention and debt management techniques, we have no desire to reverse the process. Greater capital mobility and asset substitutability in domestic and international markets have presumably enhanced the effectiveness of traditional monetary policy measures and have improved economic welfare through increased efficiency.

51. Jurgensen Report (1983), Longworth et al. (1983) and Obstfeld (1988).

APPENDIX

Table 10'

REAL (EX ANTE) RATES OF RETURN: MEANS (AND STANDARD DEVIATIONS)

	1973Q3 - 1979Q4	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada	0.58% (2.35)	5.82% (2.45)	3.51% (3.55)
US	0.59% (2.13)	5.41% (1.90)	3.28% (3.13)
Overseas	- 0.13% (1.41)	4.27% (1.00)	2.33% (2.50)
Short-term differentials			
Canada/US	- 0.12% (3.16)	0.41% (1.65)	0.22% (2.42)
Canada/overseas	0.70% (1.80)	1.55%* (2.14)	1.17%* (2.02)
US/overseas	0.71% (2.34)	1.14%* (1.45)	0.95%* (1.89)
Long-term rates			
Canada	1.39% (2.33)	5.33% (1.97)	3.60% (2.90)
US	1.11% (1.52)	5.43% (1.84)	3.52% (2.74)
Overseas	1.73% (1.36)	3.62% (1.16)	2.79% (1.56)
Long-term differentials			
Canada/US	0.28% (1.94)	- 0.09% (1.17)	0.07% (1.56)
Canada/overseas	- 0.34% (2.49)	1.71%* (1.78)	0.81%* (2.34)
US/overseas	- 0.62% (1.73)	1.80%* (1.64)	0.73% (2.06)

* Ex ante rates of return are based on inflation forecasts derived from ARIMA models.

Table 11'

REAL (EX ANTE) RATES OF RETURN: CORRELATIONS

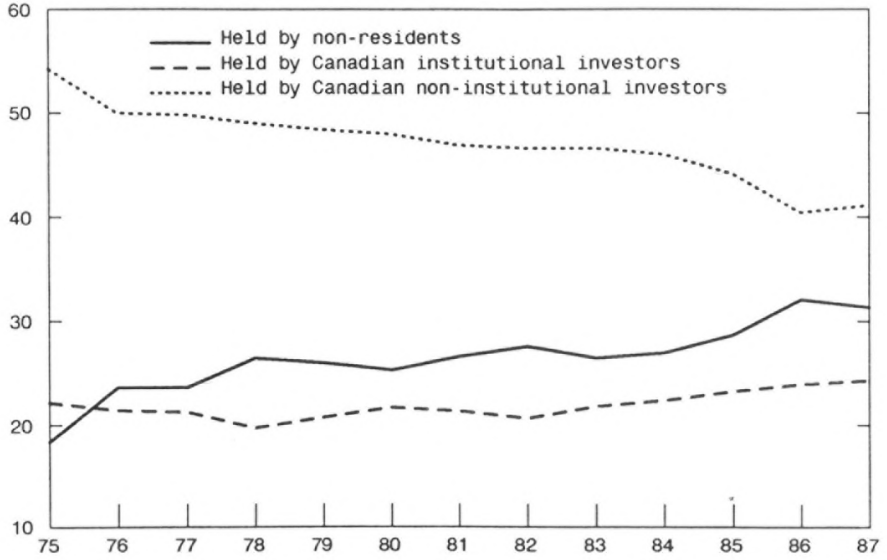
	1973Q3 - 1979Q4	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada/US	0.03	0.74	0.74
Canada/overseas	0.64	0.49	0.83
US/overseas	0.17	0.66	0.80
Long-term rates			
Canada/US	0.56	0.81	0.85
Canada/overseas	0.18	0.45	0.59
US/overseas	0.29	0.48	0.67

CORRELATIONS BETWEEN EX ANTE AND EX POST RATES

	1973Q3 - 1979Q4	1980Q1 - 1988Q1	1973Q3 - 1988Q1
Short-term rates			
Canada	0.57	0.81	0.85
US	0.51	0.82	0.87
Overseas	0.46	0.16	0.82
Long-term rates			
Canada	0.57	0.69	0.82
US	0.38	0.67	0.84
Overseas	0.17	0.79	0.71

Graph 1

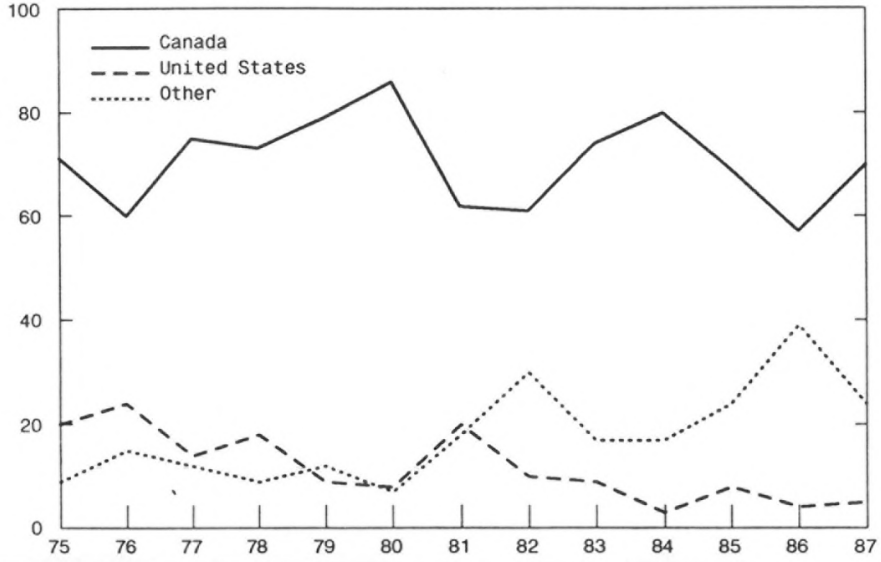
PERCENTAGE DISTRIBUTION OF CANADIAN BONDS OUTSTANDING



Graph 2

PERCENTAGE DISTRIBUTION OF GROSS NEW ISSUES OF CANADIAN BONDS

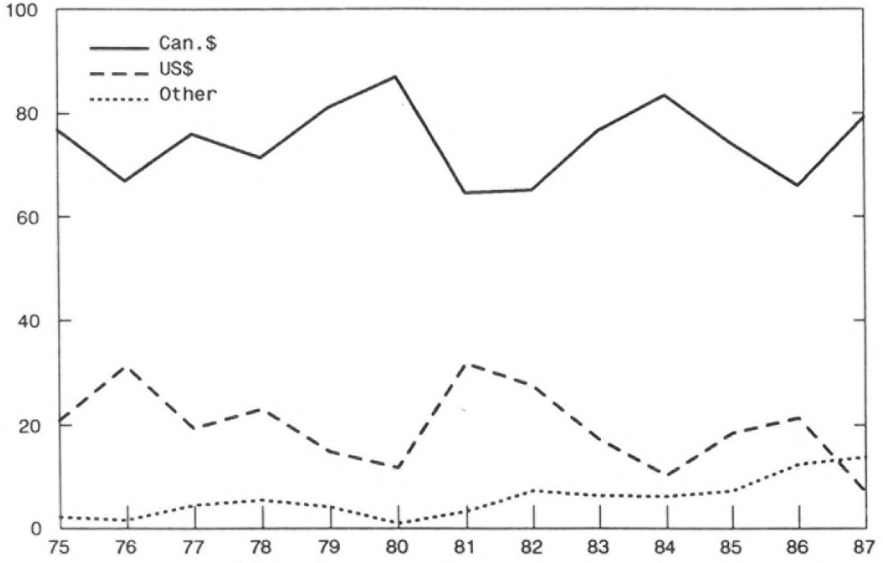
(by country)



Graph 3

PERCENTAGE DISTRIBUTION OF GROSS NEW ISSUES OF CANADIAN BONDS

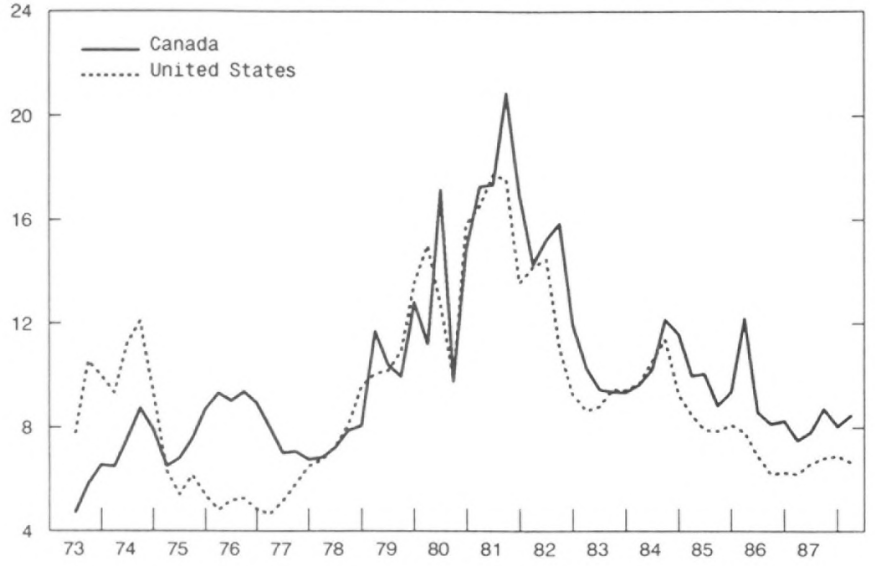
(by currency)



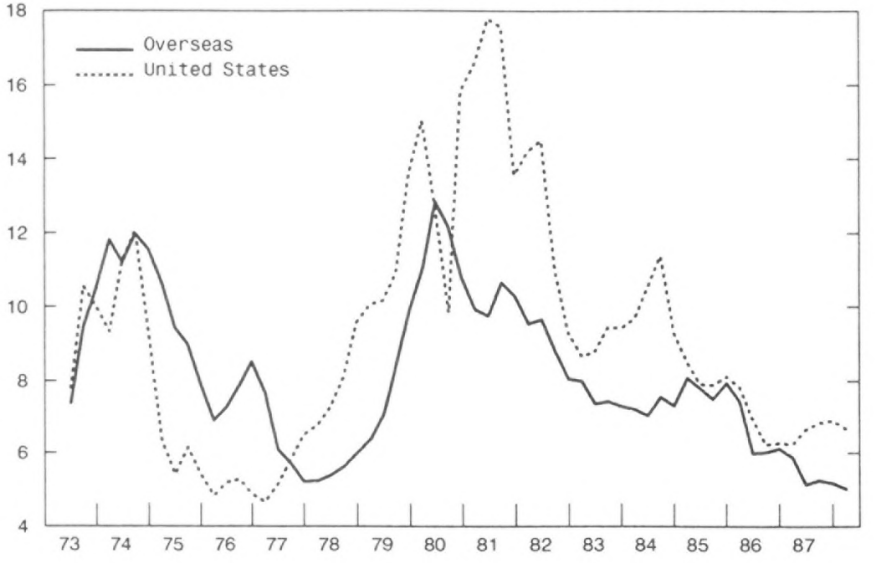
Graph 4

SHORT-TERM NOMINAL INTEREST RATES

CANADA AND THE UNITED STATES



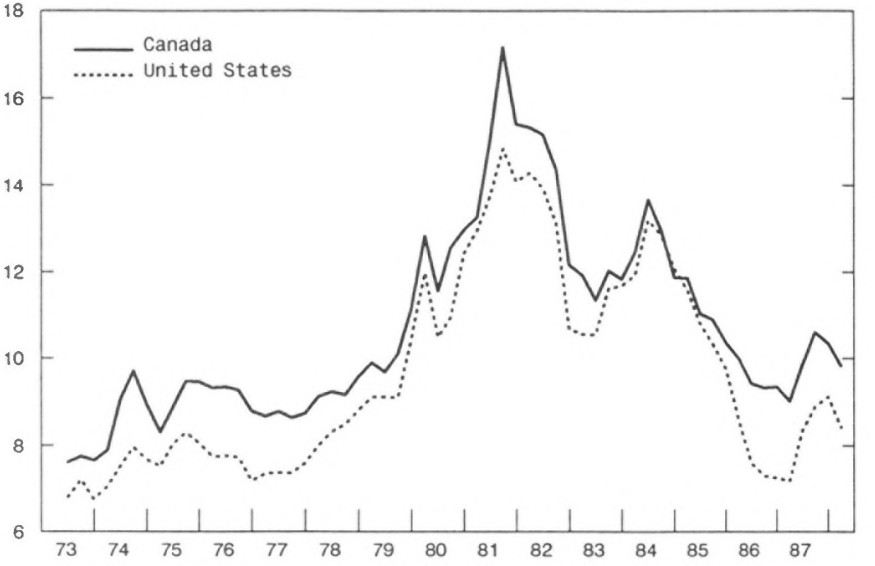
THE UNITED STATES AND OVERSEAS COUNTRIES



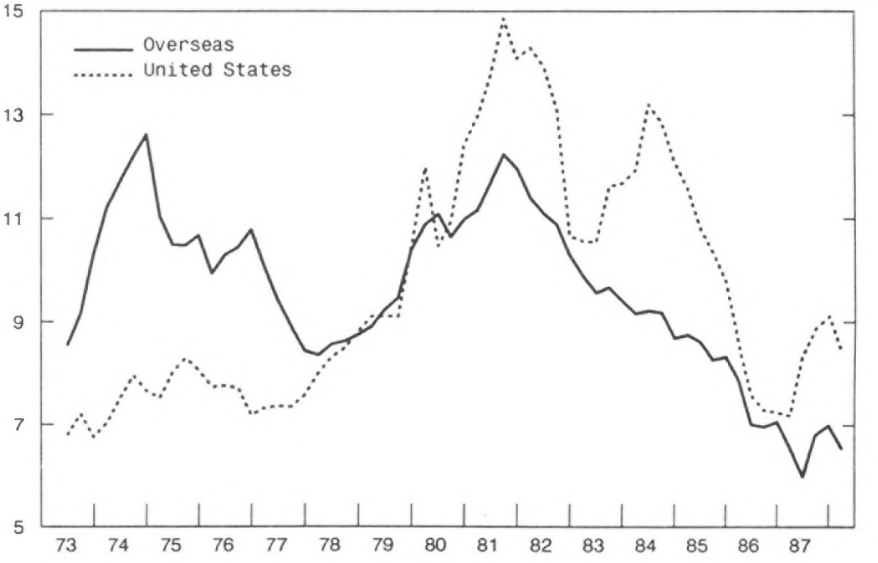
Graph 5

LONG-TERM NOMINAL INTEREST RATES

CANADA AND THE UNITED STATES

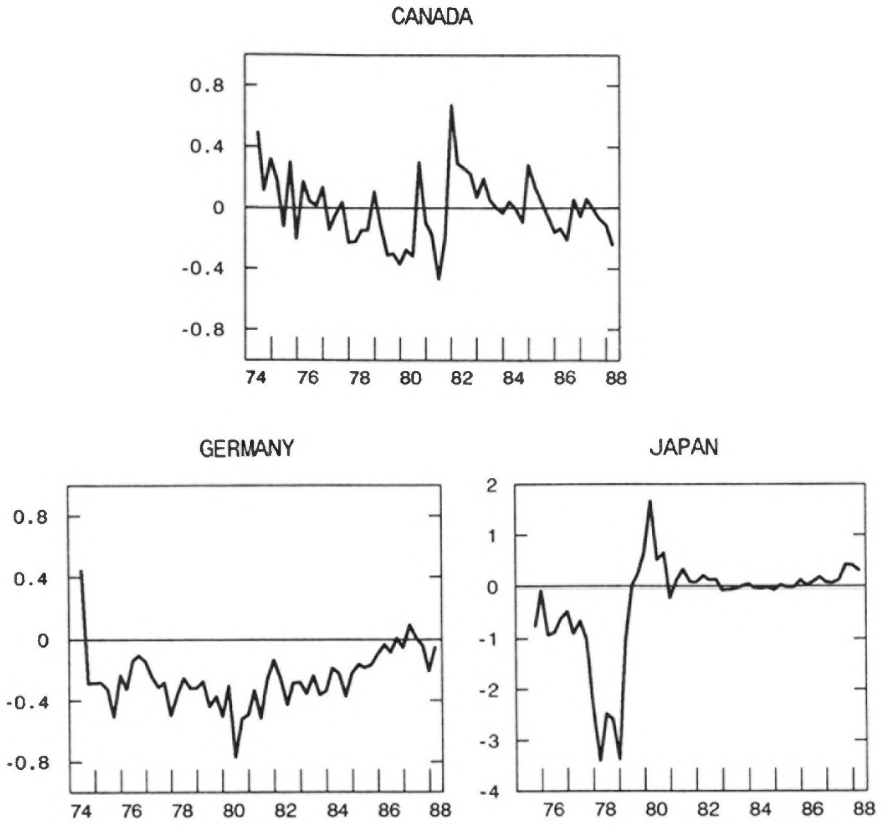


THE UNITED STATES AND OVERSEAS COUNTRIES



Graph 6

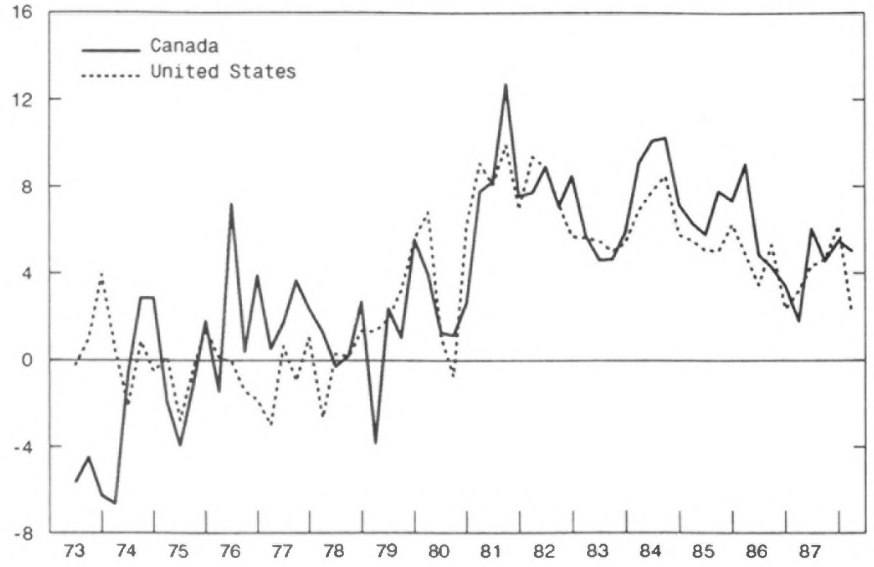
EURO-MARKET - DOMESTIC INTEREST DIFFERENTIALS



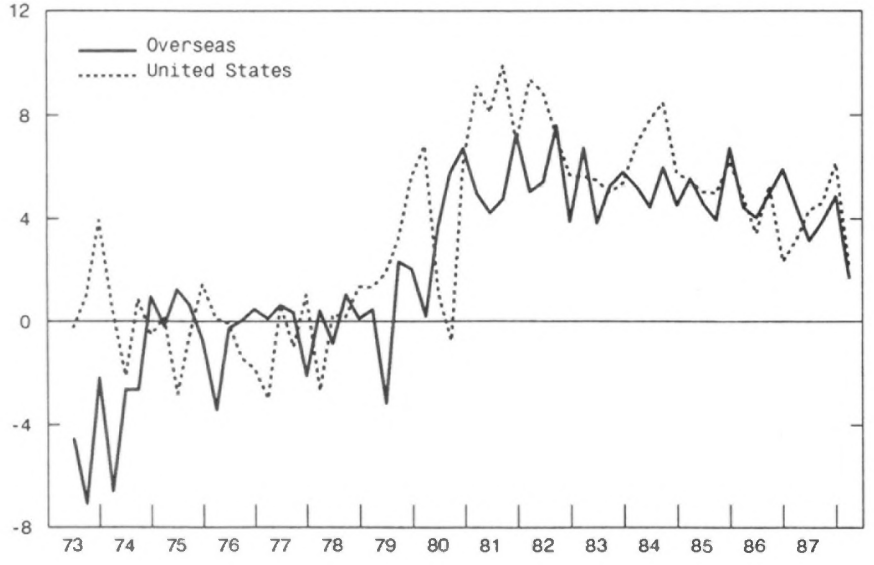
Graph 7

SHORT-TERM REAL INTEREST RATES (EX POST)

CANADA AND THE UNITED STATES



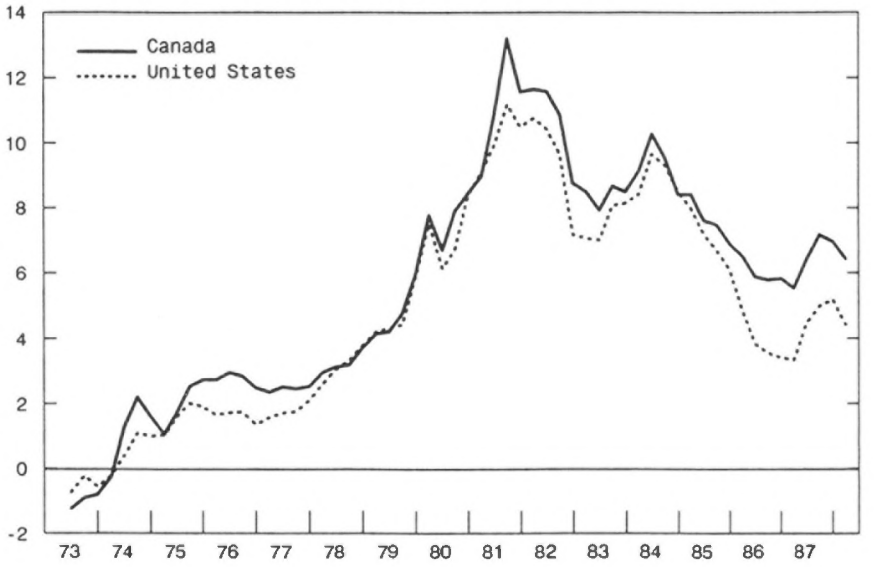
THE UNITED STATES AND OVERSEAS COUNTRIES



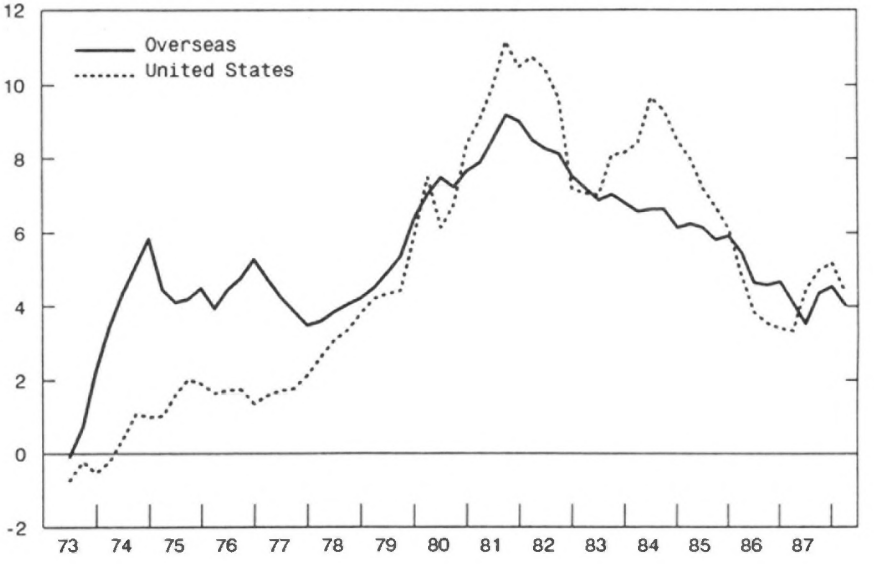
Graph 8

LONG-TERM REAL INTEREST RATES (EX POST)

CANADA AND THE UNITED STATES



THE UNITED STATES AND OVERSEAS COUNTRIES



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