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EXCHANGE RATE EXPECTATIONS AND INTERNATIONAL CAPITAL FLOWS

by

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This paper develops a model of international short-term capital flows that includes exchange rate expectations as endogenous to a model of monetary equilibrium in an open economy. The approach takes as a starting point the Kouri and Porter portfolio equilibrium model (1974), which is a synthesis of the stock equilibrium approach to capital flows and the monetary approach to the balance of payments.

I have expanded the model to include a more complete foreign exchange sector and to add a simple formulation for exchange rate expectations that is a function of levels of and changes in real economic variables within the model. This specification implies that the "offset coefficient" (and other estimated multipliers) of the Kouri and Porter model are affected by the parameters of the expectations function. It is then shown that the capital flow equation will be different from one time period to another to the extent that expectations of future exchange rates change between periods.

The empirical sections estimate the capital flow equation and the expectations function for both the fixed and flexible exchange rate experience for Canada. These relationships are estimated for four short-run periods in order to demonstrate the extent to which both the capital flow equation and the expectations function differ over time and to show how these functions behave in light of our model.

Capital flow equations such as those estimated by Kouri and Porter can then be viewed in some sense as only an average of the response to monetary variables over the observed period. The inclusions of dummy variables to represent speculative flows of capital do not capture the extent to which the offset coefficients are significantly different over short-run periods. There is also evidence in many cases that the interference of officials into foreign exchange markets (especially the forward market) induces expectations of a type that actually reinforce domestic monetary policies.

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1. THE KOURI AND PORTER MODEL

The Kouri and Porter model, as summarized in their table 1 (1974, p. 449), is reproduced briefly here for convenience (the notation and equation numbers are theirs).

They assume the demand for money ($M_D$) and the demand by domestic residents for domestic bonds ($B_D$) and foreign bonds ($B_F$) are a function of domestic income ($Y$) and wealth ($W$), the domestic and foreign interest rate ($R$ and $R^*$ respectively), and an exogenous vector of risk factors ($E$):

$$M_D = L(Y, W, R, R^*, E) \quad L_Y, L_W > 0; \quad L_R, L_R^* < 0,$$

$$B_D = H(Y, W, R, R^*, E) \quad H_W, H_R > 0; \quad H_R^* < 0; \quad H_Y < 0,$$

$$B_F = J(Y, W, R, R^*, E) \quad J_W, J_R > 0; \quad J_R < 0; \quad J_Y < 0.$$

The demand by foreign residents for domestic bonds ($B_D^*$) is a function of foreign income ($Y^*$) and wealth ($W^*$):

$$B_D^* = F(Y^*, W^*, R, R^*, E) \quad F_R > 0; \quad F_R^* < 0; \quad F_{Y^*}^*, F_{W^*}^* < 0.$$

They break down the total supply of money ($M_S$) into a domestic component ($NDA$) that can be changed by official purchases ($\Delta B_C < 0$) or sales ($\Delta B_C > 0$) of government bonds and a foreign component ($NFA$) that is changed by a balance of payments deficit or surplus:

$$M_S = NFA + NDA$$

$$\Delta NDA = -\Delta B_C \text{ (open market operations)}$$

$$\Delta NFA = TC + CAB$$

$$TC = \Delta R_D^* - \Delta B_F^*,$$

where the net short-term capital inflow ($TC$) is the net change in the holding of bonds between residents and nonresidents during the period. $CAB$ is the current account balance (including long-term capital flows) and is exogenous.

There is a domestic wealth constraint:

$$L(\cdot) + H(\cdot) + J(\cdot) = W.$$

Equilibrium in domestic money and bond markets is then defined to be:

$$M_D = M_S,$$

$$B_D + B_D^* + B_C.$$
Exogenous variables other than those already specified are domestic and foreign income and wealth, the foreign interest rate, and open market operations.

The comparative static solution to the model then yields the result that short-term capital inflows and changes in the domestic interest rate are a function of changes in the exogenous variables ($\Delta R^*, \Delta Y, \Delta W, \Delta Y^*, \Delta W^*, CAE, \Delta DDA$).

2. THE INTRODUCTION OF ENDOGENOUS EXCHANGE RATE EXPECTATIONS

Before expanding the model in equations (4)-(14) above to include exchange rate expectations, note that by invoking the small country hypothesis (i.e., foreign bonds are in infinitely elastic supply at $E^*$) I have eliminated equation (7) in my model. Kouri and Porter include it only because of "the specific risk attached to domestic securities." Its inclusion adds nothing substantive to the conclusions (and, in fact, the exogenous variables peculiar to this demand function—foreign wealth and income—are dropped in the empirical analysis of the Kouri-Porter study).

To include exchange rate expectations, markets for spot and forward exchange are added to the model above in what has by now become a standard representation (see Tsaiang 1958, 1959; Grubel 1963). It is assumed that there are four groups participating in the markets for spot and forward exchange. There are traders dealing both in the movement of goods and services and long-term capital flows, whose purchases and sales are assumed to be entirely in spot currency. There are domestic residents demanding foreign bonds who are always assumed to cover their exchange risk in the forward exchange market. The third group is composed of those assuming an open position with respect to exchange risk—speculators. The fourth participant is the central authority, which can interfere in either or both of the forward and spot markets to peg the exchange rate or to smooth fluctuations in exchange rate movements. There exists then a market for spot exchange where the participants are traders, interest arbitragers, and officials, and a forward exchange market composed of interest arbitragers, speculators, and officials.

By representing traders as dealing only in spot exchange, we are assuming that their hedging decisions in the forward market are a function of their expectations on future spot prices and not on their current account transactions. Uncovered capital flows are treated as a simultaneous arbitrage and speculative transaction (see Tsaiang 1959).

The excess demand for spot domestic currency by interest arbitragers ($S^A$) will be equal in magnitude but opposite in sign to the foreign bonds demanded by domestic residents ($E^D$). (Henceforth, all references to "demand" for currencies will in actuality be excess demand where a negative excess demand is an excess supply. Similarly, all references to "currency" should be read "domestic currency," unless specifically referred to as foreign currency.) If we ignore earnings from interest
(profit remittances), the assumption that all interest arbitragers cover their exchange risk implies that the excess demand for forward domestic currency by arbitragers \((f^A)\) will be equal in magnitude but opposite in sign to the excess demand by arbitragers for spot exchange:

\[
S^A = -F^A = -B_F.
\]  

(15)

Note that the demand for currency by arbitragers (and later by speculators, traders, and authorities) is a flow demand. These "flow" demands are envisioned to condense changes in stocks from the beginning of the period to the end into one point in time so that they are equivalent to stock demands, as expressed in (15) above. Such an analytical distinction between stocks and flows and the "period" of adjustment has been used previously by Hicks (1939).

From (6) and (15) above, it follows that:

\[
-S^A = F^A = J(y, w, R, R^C),
\]

(16)

where

\[
R^C = \frac{X^*(R^*)}{X^*},
\]

where \(X\) is the spot exchange rate and \(X^*\) is the forward rate in terms of domestic currency per unit of foreign currency, and where \(J^*, J_x > 0, J_x' < 0.\)

The short-term capital inflow in any given period is equal to the negative of the change in the equilibrium stock demand for foreign bonds by domestic residents from the previous to the present period:

\[
-(B_F - B_{F-1}) = TC = S^A + F^A.\]

(17)

This last expression in (17) above states that short-term capital inflows equal the present excess demand for spot exchange by arbitragers plus the net forward position by arbitragers in the previous period (which is identically equal in magnitude but opposite in sign to arbitragers' previous net position in the spot market, ignoring profit remittances). As an example, suppose all old bond contracts were continually renewed so that there were no capital flows (ignoring profits). Then, 

\[-B_F = -B_{F-1} = S^A = S^A_{-1} = -F^A = -F_{-1},\]

and all foreign exchange contracts would be continually turned over. In this case: \(TC = -(B_F - B_{F-1}) = S^A + F_{-1} = 0,\) and net indebtedness would continually remain equal to \(B_F.\)

Exporters and importers are assumed to operate only in the market for spot exchange. Exports \((E)\) therefore are a decreasing function of the spot exchange rate:

\[
E = E(S).\]
\[ E = E(X), E_X > 0. \] (18)

Imports \( (M) \) are specified as an increasing function of the spot rate and the domestic level of income:

\[ M = M(X, Y), M_X, M_Y > 0. \] (19)

Speculators are assumed to hold some expectations on future spot exchange rates. It is assumed that these expectations are not held with certainty, that speculators have limited funds available for speculation, and that all speculators do not have identical expectations. Any one of these assumptions by itself implies that speculative demand is not infinitely elastic at the expected future spot price.

Speculators purchase forward exchange when the spot rate they expect to prevail in the future \( (X^e) \) is greater than the present forward rate and then realize their profit (or loss) when their forward contract matures by selling spot currency to cover their foreign exchange liability. Alternatively, speculators will sell forward currency if \( X^e < X' \). Speculators' excess demand for forward currency is therefore an increasing function of the expected level of the future spot rate and a decreasing function of the forward rate:

\[ F^S = S(X', X^e), S_X', S_X^e > 0. \] (20)

When their forward contracts mature and speculators sell or buy spot exchange to realize their profit (or loss), there is a net demand for spot exchange equal in magnitude but opposite in sign to speculators' excess demand for forward exchange in the previous period \(-F^S_{t-1}\) when the forward commitments were contracted.

Because of the "discontinuity in behavior" of speculative capital flows, Kouri and Porter handled exchange rate expectations through dummy variables. This has been standard in past treatments of these flows; most studies treat speculative flows either as dummy variables or through exogenous (or sometimes lagged endogenous) variables used as proxies (see, e.g., Arndt 1968; Kesselman 1971; Grubel 1963; Stein and Tower 1967; Stoll 1968; Black 1969, 1973; Fieke 1972). This model includes an endogenous expectations function representing the expected future exchange rate as a function of real economic variables within the model (as does Argy and Porter 1972).

It is assumed that the expected deviation of the future price (in the next period, say ninety days) of domestic currency from the present spot price can be expressed as a function of the current change in the level of the spot price \( (AX) \), the relative monetary policies in domestic and foreign
markets (as represented by the change in the short-term international interest rate differential $(\Delta R - \Delta R^*)$), the change in the level of official reserve holdings of foreign exchange and gold $(\Delta NFA)$, and exogenous changes in expectations $(e)$:

$$x^e - x = \alpha(\Delta x) + \beta(\Delta R - \Delta R^*) + \gamma(\Delta NFA) + e.$$  \hspace{1cm} (21)

Where $\alpha$, $\beta$, and $\gamma$ are scalars represent the response of speculators' expectations to changes in the spot rate, interest rate differentials, and the official reserve position, respectively.

The coefficient $\alpha$ determines the response of expectations to current changes in the spot rate (see Argy and Porter 1973). It is hypothesized that exchange rate expectations are of a very short-run nature and that it is immediate changes in prices that dominate the formation of expectations; in addition, the expectations function may be stable (in the sense that the values of $\alpha$, $\beta$, and $\gamma$ are constant) for only very brief periods of time. Therefore, a lengthy, mechanistic (and therefore exogenous) distributed lag expectations function was not specified in (21) above, and expectations are represented as being a function of immediate (i.e., one period) changes in spot rates.

If $\alpha$ is positive speculators expect current spot rate changes to continue into the future. On the other hand, if $\alpha$ is negative current exchange rate changes are expected to be temporary and to reverse themselves, returning (at least partially) to previous levels. A value for $\alpha$ of minus one indicates that any current changes in the spot rate, ceteris paribus, are expected to be completely reversed in the subsequent period. If $\alpha$ is zero, any current changes in the spot rate do not have any impact on expected future spot rates.

It is further hypothesized that current monetary conditions affect expectations on future exchange rates. In this model, changes in domestic short-term interest rates (relative to changes in foreign rates) are seen as affecting these expectations in two ways. In the first place, relative changes in interest rates will directly affect the movement of spot rates through the generation of short-term capital flows. To the extent that speculators see rising relative domestic interest rates as attracting short-term capital, they will expect future spot rates to be higher than at present (i.e., $\beta$ will be positive).

Relative monetary conditions as expressed by relative interest rate changes have a second effect upon exchange rate expectations in their role as an indicator of economic activity. To the extent that speculators see rising domestic interest rates as indicative of tighter monetary policy implying relatively low rates of future domestic inflation, they will expect spot rates to rise due to rising demand for their increasingly more competitive exports and falling demand for foreigners'
increasingly less competitive exports. This situation, characterized by \( \beta > 0 \), is then one of the "Keynesian" expectations. On the other hand, in a "Fisherian" world speculators view rising interest rates as reflecting a rise in inflationary expectations and \( \beta \) would be negative. That is, the faster domestic interest rates are rising relative to foreign interest rates, the greater are implied inflationary expectations and the lower are corresponding expected future spot rates.

The distinction between "Keynesian" and "Fisherian" expectations in this model is whether liquidity effects or inflationary expectations dominate. This specification is somewhat different than that used in many other models, where "Keynesian" expectations are often viewed as reflecting stable price expectations. For short-term analysis where inflation might not be expected to affect the foreign exchanges for quite some time, "Keynesian" expectations may be the correct specification.

These hypotheses imply that \( \beta \) will be negative when expectations are concerned with inflation in either domestic or foreign markets. Alternatively, \( \beta \) will be positive when short-term capital flows are particularly responsive to changing interest rate differentials.

The coefficient \( \gamma \) is a "confidence" parameter. If speculators have confidence in the authorities' ability to force the price of spot exchange lower through sales of domestic currency, \( \gamma \) will be negative. That is, as reserves of foreign exchange and gold are rising, \( \gamma < 0 \) implies that speculators expect the spot rate to fall as officials successfully put downward pressure on the spot rate through official purchases of foreign exchange. On the other hand, if speculators have no confidence in the authorities' ability to peg (or support) the price of spot exchange, they will see the accumulation of reserves as a signal that the spot rate will rise despite official pegging (i.e., \( \gamma > 0 \)). It is expected that \( \gamma \) would be positive and large during highly speculative periods (either for or against a currency) and slightly negative (or zero) during "normal" periods.

Note that the current position of officials in exchange markets (ANFA) is probably not known with certainty. However, those taking risky positions in foreign exchange markets have a knowledge of market participation that transcends the availability of official data. The speculator (or bank foreign exchange dealer) who depends on officially published exchange intervention data to formulate his impressions of markets where quick decisions are necessary and profit margins extremely small is likely to be quickly eliminated from active participation in the market.

The form of the exchange rate regime would affect the specification of the expectations function in (21) above. In fact, with a purely fixed exchange rate system, \( \Delta X = 0 \) and \( \alpha \) would not exist. In this case, except during exchange rate crises, \( \beta = \gamma = e = 0 \), and \( X^e = X \). With purely flexible rates, there would be no official intervention (ANFA = 0), and \( \gamma \) would not exist.
In reality however, fixed exchange rates normally allow for a support band around the rate, and with flexible rates there is some degree of official intervention (i.e., a "dirty float"). Thus, even with a fixed exchange rate there is a role for exchange rate expectations—even without an exchange crisis. It would be expected, however, that speculation would play a greater role in a flexible rate system where both fluctuations and exchange risk are greater (except during a crisis within a pegged regime).

Flow equilibrium conditions can now be specified for the markets for forward and spot exchange. The flow demand for forward exchange is composed of the excess demand for forward exchange by arbitrages, speculators, and government pegging operations ($F^S$), which in equilibrium must be zero:

$$F^A + F^S + F^G = 0. \tag{22}$$

In an exchange rate system where the forward rate is fixed, $F^G$ is endogenous. It is not a policy variable, but is determined in equilibrium as the amount of forward exchange the authorities must purchase (or sell) to fix the forward rate.

The demand for spot currency is composed of excess demand by arbitrages, traders, speculators realizing their profits (or losses) through spot transactions when their forward commitments from the previous period mature ($-F^S_{-1}$), and official demand ($S^G$), which must sum to zero in equilibrium:

$$S^A + CAB - F^S_{-1} + S^G = 0. \tag{23}$$

$S^G$ (as $S^G$ above) is endogenous and not considered to be a policy variable in a fixed exchange rate regime.

Lagging equation (22) one period, substituting for ($-F^S_{-1}$) in (23) above, and rearranging yields:

$$S^A + F^A_{-1} + CAB = -S^G - F^G_{-1} = \Delta NFA. \tag{24}$$

This is the balance of payments identity, that short-term capital inflows ($S^A + F^A_{-1}$, from (17) above) plus the current account balance must equal the change in the level of gold and foreign exchange held at the central bank:

$$TC + CAB = \Delta NFA. \tag{25}$$

Note that the increase in official holdings of gold and foreign exchange ($\Delta NFA$) is identical to official sales of spot exchange in this period ($-S^G$) plus maturing official sales of forward exchange from the previous period ($-F^G_{-1}$).
After substituting in (4) to (25) above and using the wealth identity, the fixed exchange rate model can be expressed in four equations over the four unknown variables \( B_p, R, S^g, F^g \):

\[
S^A + B_p = 0
\]  

\[
B_p + F^S + F^g = 0
\]  

\[
M_{OD} - NDA - NFA = 0
\]  

\[
TC + CAB + S^g + F^g_{-1} = 0.
\]

The model for flexible exchange rates differs only in that \( S^g = F^g = F^g_{-1} = \Delta S^g = \Delta F^g = 0 \), and the dependent variables then become \( B_p, R, X, X' \).

The only effect of the endogenous exchange rate expectations in a purely fixed exchange rate regime is upon the direction and magnitude of official intervention in the forward exchange market, which insulates the other variables completely from exchange rate expectations. These expectations would not be a factor in a system of rigidly pegged spot and forward exchange rates except when they manifest themselves as short-run speculative runs on a currency during an exchange rate crisis.

A fixed exchange rate regime is then introduced where exchange rate expectations could exist by assuming analytically that the spot rate is pegged over the period of time under analysis, but the forward rate is allowed to fluctuate. This exchange regime can be viewed as being equivalent to a fixed rate regime where the rate is allowed to fluctuate in a narrow band around a parity rate in that endogenous exchange rate expectations have an impact on the model, while capital flows continue to be an offsetting factor to monetary policy as a result of official intervention in the spot market.

Clearly, if such an exchange rate policy (i.e., rigidly fixing the spot rate while allowing the forward rate to fluctuate) actually existed, in time speculative pressure would force the forward rate to equal the spot rate \( (X^f = X) \). The intent here, though, is to introduce an analytical specification that allows the model to introduce endogenous exchange rate expectations into a fixed exchange rate context.

Equation (30) and table 1 present the resulting relationships for this exchange rate regime.

(The comparative static results for both the fixed and flexible regime are much more complicated than in the Kouri and Porter model. The solutions are presented in the appendix.)

\[
T_C = f_1(\Delta Y, \Delta W, \Delta R^*, \text{CAB, ANDA, AR}_{-1}, \Delta R_{-1}, \Delta NFA_{-1}, \Delta e)
\]

\[
\Delta R = f_2(\Delta Y, \Delta W, \Delta R^*, \text{CAB, ANDA, AR}_{-1}, \Delta R_{-1}, \Delta NFA_{-1}, \Delta e)
\]

\[
S^g = f_3(\Delta Y, \Delta W, \Delta R^*, \text{CAB, ANDA, AR}_{-1}, \Delta R_{-1}, \Delta NFA_{-1}, \Delta e)
\]  

\[
\Delta X' = f_4(\Delta Y, \Delta W, \Delta R^*, \text{CAB, ANDA, AR}_{-1}, \Delta R_{-1}, \Delta NFA_{-1}, \Delta e).
\]
Table 1
MULTIPLIERS FOR FIXED SPOT RATES—FORWARD RATES FLEXIBLE

<table>
<thead>
<tr>
<th>ΔY</th>
<th>ΔN</th>
<th>ΔR*</th>
<th>CAB</th>
<th>ΔNDA</th>
<th>ΔR*-1</th>
<th>ΔR-1</th>
<th>ΔNFA*-1</th>
<th>Δe</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>β</td>
<td>-β</td>
<td>-γ</td>
</tr>
<tr>
<td>ΔR</td>
<td>?</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-β</td>
<td>β</td>
<td>γ</td>
</tr>
<tr>
<td>-sG</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>β</td>
<td>-β</td>
<td>-γ</td>
</tr>
<tr>
<td>ΔN'</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>β</td>
<td>-β</td>
<td>-γ</td>
</tr>
<tr>
<td>ΔMoS</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>β</td>
<td>-β</td>
<td>-γ</td>
</tr>
</tbody>
</table>

The signs for the relevant multipliers in the fixed exchange rate system are presented in table 1. In tables 1 and 2 a "+" indicates that a positive value for the exogenous variable at the top of that column is associated, ceteris paribus, with a positive value for the endogenous variable at the beginning of the row. Similarly, a "-" or "?" is associated with a negative or an ambiguous sign of the multiplier, respectively; an "0" is associated with there being no relationship between the exogenous and endogenous variable. An "α", "β", or "γ" implies that the multiplier has the same sign as the relevant expectations parameter, whereas a "-α", "-β", "-γ" implies the opposite.

Table 2
MULTIPLIERS FOR FLEXIBLE EXCHANGE RATE REGIME

<table>
<thead>
<tr>
<th>ΔY</th>
<th>ΔN</th>
<th>ΔR*</th>
<th>ΔNDA</th>
<th>TC-1</th>
<th>ΔR*-1</th>
<th>ΔR-1</th>
<th>ΔNFA-1</th>
<th>Δe</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>β</td>
<td>-β</td>
<td>-α</td>
</tr>
<tr>
<td>ΔR</td>
<td>?</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-β</td>
<td>β</td>
<td>α</td>
</tr>
<tr>
<td>ΔN</td>
<td>?</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>β</td>
<td>-β</td>
<td>-α</td>
</tr>
<tr>
<td>ΔN'</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>β</td>
<td>-β</td>
<td>-α</td>
</tr>
<tr>
<td>ΔMoS</td>
<td>?</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-β</td>
<td>β</td>
<td>α</td>
<td>-</td>
</tr>
</tbody>
</table>

The variables appearing through the expectations function have an impact on short-term capital flows, the domestic interest rate, and official activity in the foreign exchange market, in general taking on a sign in direct relation to the relevant expectations parameter. In addition, the parameters in the expectations function directly affect the relationships between the endogenous and
exogenous variables through the comparative static multipliers. As an example, the effects of open market operations on the domestic money supply, the domestic interest rate, and short-term capital flows are:

\[
\frac{\partial R}{\partial \text{NDA}} = -X^c + J_R \left( \frac{1 - \gamma S}{X^c} \right) < 0, \tag{31}
\]

\[
\frac{\partial \text{MoS}}{\partial \text{NDA}} = -X^c \left( \frac{1 - \gamma S}{X^c} \left( L_{X^f} - L_R \right) - S X^c \left( \beta L_{X^f} + L_R \right) \right) / \Omega > 0, \tag{32}
\]

\[
\frac{\partial R}{\partial \text{NDA}} = -X^c \left( 1 + \beta \right) / \Omega > 0, \tag{33}
\]

where \( \Omega = -X^c \left[ (1 - \gamma S) \left( L_{X^f} - L_R \right) + (1 + \beta) S X^c \right] + S X^c \left( \beta L_{X^f} + J_R \right). \)

It is clear by inspection that the effectiveness of open market operations is significantly affected by exchange rate expectations. If, as is hypothesized in this study, exchange rate expectations are not stable for long periods of time, then the ability of domestic monetary authorities to change domestic monetary conditions without inducing large offsetting capital outflows (33) will depend upon the parameters of the endogenous exchange rate expectations function.

In the case of open market operations, the higher \( \beta \) or \( \gamma \), the greater are capital outflows and the smaller is the effect on the domestic interest rate and the money supply as a result of a given quantity of open market purchases. (In fact, it is even conceivable if \( \beta \) or \( \gamma \) is large enough and speculative pressure is great enough that the signs of the multipliers could be reversed so that, for example, open market purchases could lead to a rise in the domestic interest rate and a fall in the domestic money stock.) On the other hand, the more "Fisherian" are exchange rate expectations upon changing interest rate differentials \( \beta < 0 \), the more powerful are open market operations' effects on the domestic interest rate and the less are offsetting capital outflows. When \( \beta \) and \( \gamma \) are positive (and, as a result, open market operations are less effective), open market operations are more powerful the less elastic are exchange rate expectations (i.e., the lower in absolute value are \( S_x^c \) and \( S_x^b \)). That is, when speculative flows reduce the power of the monetary authority, the smaller is the speculative activity the less it reduces that power. On the other hand, when \( \beta \) and \( \gamma \) are negative, open market operations are a more powerful tool the more elastic are speculative responses.
As an example, assume the monetary authority enters the market and purchases securities to ease monetary conditions. The initial effect is to lower the domestic interest rate, inducing a short-run capital outflow and forcing the foreign exchange authority to intervene by buying spot exchange (S^8 > 0) to prevent the spot rate from falling. As a result of the outward arbitrage, the forward rate begins to rise, reducing the return on foreign assets. The capital outflow reduces the impact of the open market operations upon both the interest rate and the money supply. Thus, the standard conclusion--the more elastic are capital flows the less effective is monetary policy.

Now assume that exchange rate expectations can be characterized as "Fisherian" (β < 0) and as reflecting confidence in the ability of the exchange authority to continue to peg the exchange rate (γ < 0); that is, falling interest rates and falling levels of gold and foreign exchange induce a rise in the level of the expected future spot exchange rate. Speculators will then begin to purchase forward exchange, putting upward pressure on the forward rate and decreasing the attractiveness of foreign short-term assets. The resulting speculative inflow of capital will tend to offset at least partially the interest-induced capital outflows, thus offsetting the initial reduction in the effectiveness of the open market purchases. If exchange rate expectations become highly elastic, then the speculative inflow of capital in response to the rise in the expected rate will be very large, further reducing (and perhaps even reversing) the impact of the interest-induced capital outflows. The more elastic speculative responses the more powerful are open market operations. (A more complete analysis of the effects of the parameters in the expectations function upon the offset coefficients appears in Kohlhagen 1973.)

With a freely floating exchange rate regime the model permits no official interference in either the spot or forward exchange markets. With such a policy, monetary authorities now regain control over the domestic money supply and are given greater freedom of control over domestic interest rates since both the spot and forward rate are free to fluctuate against capital flows. Whereas short-term capital flows reduce the power of monetary authorities with a fixed rate, they allow monetary authorities to affect the level of domestic activity through the current account under a flexible regime. Therefore, the greater capital flows with flexible exchange rates, the greater are the powers of monetary authorities over domestic activity without losing any control over the supply of money. The authorities' control over the domestic rate of interest, however, is reduced the greater the induced capital flows.

With a flexible exchange rate regime the endogenous variables are functions of the exogenous and lagged endogenous variables as shown in (31). The signs of the multipliers are presented in table 2 (assuming speculative flows are moderate).
TC = f_5(\Delta Y, \Delta W, \Delta R^*, \Delta K, \Delta \text{ND}, \Delta \text{K}, \Delta \text{R}^*_1, \Delta \text{R}_1, \Delta \text{X}_1, \Delta \varepsilon)

\Delta R = f_6(\Delta Y, \Delta W, \Delta R^*, \Delta K, \Delta \text{ND}, \Delta \text{K}, \Delta \text{R}^*_1, \Delta \text{R}_1, \Delta \text{X}_1, \Delta \varepsilon)

\Delta X = f_7(\Delta Y, \Delta W, \Delta R^*, \Delta K, \Delta \text{ND}, \Delta \text{K}, \Delta \text{R}^*_1, \Delta \text{R}_1, \Delta \text{X}_1, \Delta \varepsilon)

\Delta X^* = f_8(\Delta Y, \Delta W, \Delta R^*, \Delta K, \Delta \text{ND}, \Delta \text{K}, \Delta \text{R}^*_1, \Delta \text{R}_1, \Delta \text{X}_1, \Delta \varepsilon).

Long-term capital flows (\Delta K) are now the only exogenous component of the balance of payments, as the current account is endogenous. Again, exchange rate expectations are a major influence in determining the sign and magnitude of the multipliers; as an example, the effects of open market operations on the domestic interest rate, money supply, and short-term capital flows are presented:

\[
\frac{\partial R}{\partial \text{ND}} = \frac{\alpha J S}{R} K e - \frac{\text{CAR}(S e - J_R)}{\psi} < 0, \tag{32}
\]

\[
\frac{\partial \text{MO}_S}{\partial \text{ND}} = 1, \tag{33}
\]

\[
\frac{\partial B_F}{\partial \text{ND}} = \frac{-J_R \text{CAR} X e (1 + \beta)}{\psi} > 0, \tag{34}
\]

where \(\psi = J_R (\text{CAR} X e (L_X^* - L_R) - \text{CAR} X e (\beta X e + L_R)). \beta \) plays the same role as in the fixed spot rate/forward rate case, but because there is no official interference in foreign exchange markets, \(\gamma \) has no effect on the multipliers.

The higher \(\alpha\) (the parameter measuring the response of expectations to changes in the spot exchange rate) the greater are capital outflows as a result of any given amount of open market purchases; that is, the more speculators see falling spot rates as an indication of further spot rate decreases, the less control monetary authorities have over the domestic interest rate, but the greater is their impact on the current account when expectations induce further capital outflows and exchange depreciation. Similarly, when expectations are such that present spot rate changes are expected to be reversed (\(\alpha < 0\)), then the monetary authorities' control over the interest rate is strengthened while its control over domestic activity through the current account is reduced. Similarly, the greater \(\alpha\) and the lower \(\beta\) the greater will be the response of the system to an exogenous change in the foreign interest rate.
3. ESTIMATES OF CAPITAL FLOWS UNDER ALTERNATIVE EXCHANGE RATE REGIMES

For the reasons that Kouri and Porter enumerated (p. 452) we have also estimated the reduced form of the capital flow equation (as opposed to the structural equation) for Canada for both the fixed and flexible exchange rate periods. We then estimate the following capital flow equations for the fixed and flexible regimes respectively:¹

\[
TC = b_0 + b_1 \Delta Y + b_2 \Delta R^* + b_3 \Delta A + b_4 \Delta NDA + b_5 \Delta i + b_6 (\Delta R_{-1} - \Delta R^*_{-1}) + b_7 \Delta NFA_{-1} + u
\]  

(35)

\[
TC = b_0 + b_1 \Delta Y + b_2 \Delta R^* + b_3 \Delta A + b_4 \Delta NDA + b_5 \Delta (R_{-1} - R^*_{-1}) + b_6 (TC_{-1}) + b_7 \Delta X_{-1} + u
\]  

(36)

where \( b_5, b_8 > 0, b_2, b_3, b_4 < 0, \) and \( b_9, b_6, \) and \( b_7 \) have the opposite sign of \( \alpha, \beta, \) and \( \gamma \) respectively. The sign of \( b_1 \) is ambiguous due to the ambiguity of the sign of the income elasticity of domestic demand for bonds. The more interest-elastic are capital flows the closer to \(-1\) are \( b_3 \) and \( b_4 \). Note that the discount rate \((i)\) has been included for the fixed rate period because of the significance of the discount mechanism in Canada during this period. During the flexible exchange rate period (November 1956 to May 1962) the Bank of Canada set the discount rate equal to the Treasury Bill rate plus 0.25 percent, and therefore \( \Delta i \) has been dropped from the estimates during the flexible regime.

Table 3 presents the econometric estimates of the capital flow equations \((t\)-ratios are in parentheses).² The fixed exchange rate regime was from January 1963 to March 1970 and the flexible regime was from March 1951 to June 1961. (See table 3 on page 19.)

The results for the fixed regime indicate a low offset coefficient on changes in net domestic assets \((17\%)\) with a significantly larger offset of \(74\%)\) for changes in foreign assets. The coefficient on changes in domestic income is negative although not significant, indicating a positive income elasticity of demand for foreign bonds. The coefficient on changes in the United States short-term interest rate is not significant.

¹The estimate for the flexible exchange rate regime includes the trade balance as an exogenous variable despite the fact that I previously assumed it to be endogenous. This change has been made because of the limited fluctuations in the exchange rate actually observed for Canada during this period.

²Since these equations represent the reduced form model and all explanatory variables are either exogenous or lagged endogenous, the estimates used are OLSQ unless there is evidence of serial correlation in the residual. With serial correlation in the residual, it was necessary to use the Cochrane and Orcutt iterative techniques in conjunction with 2SLS where the lagged endogenous variables were treated as endogenous. The cases where this estimation procedure were necessary are readily identifiable in tables 3 and 6 because they include the estimates \((t\)-ratio) for \( \rho \). In these cases all variables including the instruments were transformed by creating a new variable \((i.e., y' = y_t - py_{t-1}). \) (Where \( u_t = \rho u_{t-1} + e.) \) See Fair (1970).
These results compare favorably to those of Kouri and Porter (1972) for the same period. They estimated the following capital flow equation:

\[ TC = 29.0 - 0.181 \Delta \text{M} - 0.736 \text{ CAB} - 0.034 \Delta Y + (0.32)(-2.29) (-11.98) (-2.29) \]

\[ 32.98 \Delta R^* - 156.4 \Delta R^* - 0.135 \Delta \text{M} - 2 - 449.1 \text{ DUM} \]

\[ (2.92) (-4.18) (-1.59) (-6.45) \]

\[ R^2 = .895, \text{ D.W.} = 1.64 \]

(where \( \Delta M^* \) is the change in base money in the United States, and "DUM" is a dummy variable representing speculation as a result of the 1968 British monetary crisis).

Kouri and Porter were puzzled by the fact that the offset coefficient on \( \text{CAB} \) is larger than the offset coefficient on \( \Delta \text{M} \) but offered no hypothesis to explain this paradox. It is possible that both models are misspecified. To the extent that short-term trade credits are granted in current account transactions and appear as short-term capital flows in balance of payments statistics, the offset coefficient on \( \text{CAB} \) will reflect the granting of the short-term trade credit rather than any short-term capital flow generated by trade balance-induced changes in domestic liquidity conditions. As long as there is some trade credit extended and the actual offset to changes in domestic money is not 100 percent, the offset coefficient on \( \text{CAB} \) will be greater than that on \( \Delta \text{M} \).

There is no ready explanation why the coefficient on \( \Delta R^* \) is significant for their estimates but not for ours, except for differences in data. The inclusion of \( \Delta \text{G}_{-2} \) and "DUM" to capture speculative flows of capital is at best an unsatisfactory solution to the problem as Kouri and Porter acknowledge.

The responsiveness of capital flows to domestic monetary conditions were not as strong with flexible rates. Theoretically, spot and forward rates should respond significantly to changes in the system to reduce capital flows.

The estimates in table 3 indicate that changes in the domestic monetary base through either the trade balance or the net domestic component induced significant short-term capital outflows (although only significant at the .9 level for the net domestic monetary base). Whereas responses to changes in the foreign trade component were not significantly different from the fixed exchange rate regime, capital flows were significantly less responsive to changes in the net domestic monetary base with flexible rates.
4. ESTIMATION OF THE EXPECTATIONS FUNCTION

This section presents the econometric estimates of equilibrium in the market for forward Canadian dollars over the past two decades. Equations (22), (15), (20), and (21):

\[ p^A + p^S + p^E = 0, \text{ where} \]
\[ p^A = f^A, \]  
\[ p^S = S(X', X^e), \quad \text{and} \]
\[ X^e - X = \alpha(\Delta X) + \beta(\Delta R - \Delta R^*) + \gamma(\Delta NFA) + e. \]  

(22) \hspace{4cm} (15) \hspace{4cm} (20) \hspace{4cm} (21)

No data are available on official purchases of forward exchange \((p^E)\). To omit the variable as has been done in previous studies, e.g., Kesselman (1971), may bias the coefficients on the other variables due to the specification error.\(^3\) If \(p^E\) is exogenous—that is, it is not correlated with the other explanatory variables in (22)—then the estimated coefficients on those variables are unbiased. Of course, the coefficient on \(p^E\) may be biased because we constrain it to be zero by omitting \(p^E\).

Alternatively, one could specify the official demand for forward exchange as a function of other available time series. We could assume that changes in official demand for forward exchange may be expressed as a decreasing (linear) function of changes in the forward exchange rate:

\[ \Delta p^E = \phi + \lambda \Delta X'
\]

(33)

where \(\phi\) would be expected to be zero in the long-run (although it might well be positive or negative over short-run periods if officials were attempting to discourage capital outflows or inflows, respectively), and \(\lambda\) would be negative. This specification would have no effect on the identifiability of the parameters in (40).

Taking first differences of equation (22), substituting from (15), (20), and (21), and solving for changes in the forward exchange rate \((\Delta X')\) yields:

\[ \Delta X' = -\frac{S^e}{S_X} \Delta \epsilon - \frac{1}{S_X} + (1-\alpha)S^e \Delta X + \frac{\alpha S^e}{S_X} \Delta X_{-1} - \frac{BS^e}{S_X} \Delta (\Delta R - \Delta R^*) - \frac{\gamma S^e}{S_X} \Delta (\Delta NFA). \]

(39)

The following "expectations" equation is then estimated:

\[ \Delta X' = a_0 + a_1 (TC) + a_2 \Delta X + a_3 \Delta X_{-1} + a_4 \Delta (\Delta R - \Delta R^*) + a_5 \Delta (\Delta NFA) + u. \]

(40)

---

\(^3\)See Goldberger (1966, pp. 194-97).
Monthly time series are available for all but short-term capital inflows. Due to the unavailability of monthly data, a monthly time series was constructed for short-term capital flows (and for the income variable (Y) used in the capital flow estimates).\footnote{4}

From (39) and (40) above:

\[ a = -\frac{a_3}{a_2 + a_3}, \]
\[ \beta = \frac{a_4}{a_2 + a_3}, \]
\[ \gamma = \frac{a_5}{a_2 + a_3}, \]
\[ S_{X_e} = -\frac{a_2 + a_3}{a_1}, \quad \text{and (assuming } S_{X_e} = -S_{X'} \text{)} \]
\[ \Delta e = a_0. \]

It is therefore possible to identify \( a, \beta, \) and \( \gamma \) from the estimation of (40). If the hypothesis that the coefficient for short-term capital inflows \( (a_1) \) is significantly different from zero cannot be rejected, then it is also possible to calculate the responsiveness of speculative forward purchases to changes in expectations \( (S_{X_e}) \).

Since all but one of the variables in (40) are endogenous to the model presented above, the OLSQ estimates of this equation are inconsistent. It has been necessary therefore to estimate (40) using a 2SLS procedure with the exogenous variables from the model above used as the instruments in the first stage of estimating the endogenous explanatory variables.\footnote{5}

The results for both exchange rate periods are presented in table 4 (t-values are in parentheses). The tests for the flexible regime begin in March 1951 because data are not available for

\footnote{4}Monthly data were constructed through a time-series interpolation of quarterly GNP and capital flows upon quarterly total Manufacturing Production in a way consistent with the suggestions by Friedman (1962). The data for interest rates are monthly average 90-day Treasury Bill rates and the data on exchange rates are monthly averages of Canadian exchange rates provided by the Bank of Canada.

\footnote{5}Only \( \Delta X_{-1} \) is not explicitly endogenous, and it is a lagged endogenous variable. In those cases where the Durbin-Watson statistic indicated significant serial correlation, it was necessary to treat \( \Delta X_{-1} \) also as endogenous so as to avoid inconsistent estimates. In such cases the Cochran and Orcutt iterative technique was used in conjunction with 2SLS estimates, and the resulting estimates (and t-values) for \( p \) will appear in the tables below. (See footnote 2 above.)
earlier periods. The period from June 1961 through December 1962 has been excluded from the sample because it was a period of transition from a flexible to a fixed exchange rate regime and was marked by considerable official interference (officials had begun interfering heavily in the foreign exchanges a full year before officially pegging the rate). March 1970 marked the end of the fixed exchange rate regime of the 1960s.

These results imply that in the long run the expected future Canadian dollar spot rate has been equal to the prevailing spot rate at the time (i.e., $\alpha = \beta = \gamma = 0$). A standard F-test shows that the hypothesis that the parameters in the expectations function are significantly different from zero can be rejected.

5. ESTIMATES FOR SELECTED SHORT-RUN PERIODS

It was hypothesized in section 2 that the expectations function introduced in (21) was not "stable" in the long run. That, in fact, the parameters $\alpha$, $\beta$, and $\gamma$ might be significantly different from one period of time to another. I have concluded that changes in $\alpha$, $\beta$, and $\gamma$ will directly affect the determination of capital flows and domestic interest rates, and the effectiveness of monetary policy. This section presents the results of some tests of that hypothesis by estimating the expectations function for the Canadian dollar over selected short-run periods and comparing these to the estimates of the capital flow equation for the same periods.

Table 5 presents the estimates of the expectations function, and table 6 presents the estimates of the capital flow equation for the comparable short-run period. The implied expectations functions for these periods are then:

July 1953–December 1954: $X^e = X + 0.225\Delta x + 0.00042(\Delta R - \Delta R^*) - 0.000067(\Delta NPA)$,

September 1959–December 1960: $X^e = X - 0.1\Delta x + 0.00045(\Delta R - \Delta R^*) + 0.0000035(\Delta NPA)$,

October 1962–October 1965: $X^e = X + 0.097\Delta x - 0.00006(\Delta R - \Delta R^*) - 0.0000034(\Delta NPA)$,

April 1964–April 1965: $X^e = X + 0.154\Delta x - 0.0029(\Delta R - \Delta R^*) - 0.0000045(\Delta NPA)$.

Where ($\dagger$) denotes that the hypothesis that the relevant structural coefficient is not significantly different from zero may be rejected at the 0.95 confidence level, and where ($\times$) indicates that the null hypothesis for the structural coefficient may be rejected only at the 0.9 confidence level.
### TABLE 3
**ESTIMATES OF THE CAPITAL FLOW EQUATION**

<table>
<thead>
<tr>
<th>Exchange Regime</th>
<th>Dep. Var.</th>
<th>ρ</th>
<th>C</th>
<th>ΔY</th>
<th>ΔR*</th>
<th>CAB</th>
<th>ANDA</th>
<th>Δ1</th>
<th>(ΔR−ΔR* )</th>
<th>ΔNPFA</th>
<th>TC−1</th>
<th>ΔX−1</th>
<th>R²</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(.654)</td>
<td>(-1.104)</td>
<td>(.558)</td>
<td>(-.9.232)</td>
<td>(-3.4.55)</td>
<td>(-1.382)</td>
<td>(-1.231)</td>
<td>(.145)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Flexible TC</td>
<td>-.244</td>
<td>-.7.26</td>
<td>-.0001</td>
<td>-19.049</td>
<td>-.85</td>
<td>-.07</td>
<td>--</td>
<td>-.494</td>
<td>--</td>
<td>.085</td>
<td>1005.4</td>
<td>.566</td>
<td>2.046</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-.2.791)</td>
<td>(.296)</td>
<td>(-.008)</td>
<td>(-1.3.66)</td>
<td>(-11.399)</td>
<td>(-1.797)</td>
<td>(.025)</td>
<td>(.797)</td>
<td>(1.254)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 4
**ESTIMATION OF THE EXPECTATIONS FUNCTION UNDER ALTERNATIVE EXCHANGE RATE REGIMES, 1951–1970**

<table>
<thead>
<tr>
<th>Period</th>
<th>Exchange Regime</th>
<th>ρ</th>
<th>Const.</th>
<th>TC</th>
<th>ΔX</th>
<th>ΔX−1</th>
<th>Δ(ΔR−ΔR* )</th>
<th>Δ(ΔNPFA)</th>
<th>R²</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. March 51–June 61</td>
<td>flexible</td>
<td>-.000013</td>
<td>.0000077</td>
<td>.943</td>
<td>.031</td>
<td>.00063</td>
<td>.000005</td>
<td>.967</td>
<td>2.28</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.1.16)</td>
<td>(.861)</td>
<td>(17.816)</td>
<td>(.791)</td>
<td>(1.587)</td>
<td>(.971)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Jan. 63–Mar. 70</td>
<td>fixed</td>
<td>-.0000089</td>
<td>-.0000004</td>
<td>.91</td>
<td>.055</td>
<td>-.00038</td>
<td>.0000003</td>
<td>.887</td>
<td>1.363</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.1.46)</td>
<td>(-.496)</td>
<td>(5.882)</td>
<td>(.856)</td>
<td>(-1.397)</td>
<td>(.147)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5
**ESTIMATION OF THE EXPECTATIONS FUNCTION FOR SELECTED SHORT-RUN PERIOD**

<table>
<thead>
<tr>
<th>Period</th>
<th>Exchange Regime</th>
<th>ρ</th>
<th>Const.</th>
<th>TC</th>
<th>ΔX</th>
<th>ΔX−1</th>
<th>Δ(ΔR−ΔR* )</th>
<th>Δ(ΔNPFA)</th>
<th>R²</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. July 53–Dec. 54</td>
<td>flexible</td>
<td>-.000041</td>
<td>.000025</td>
<td>1.23</td>
<td>- .226</td>
<td>.00042</td>
<td>-.000067</td>
<td>.959</td>
<td>2.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.101)</td>
<td>(1.847)</td>
<td>(10.735)</td>
<td>(-1.996)</td>
<td>(.54)</td>
<td>(-2.572)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Sept.59–Dec. 60</td>
<td>flexible</td>
<td>-.000033</td>
<td>-.000009</td>
<td>.968</td>
<td>.108</td>
<td>.00048</td>
<td>.0000038</td>
<td>.992</td>
<td>2.31</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.673)</td>
<td>(-2.945)</td>
<td>(25.309)</td>
<td>(3.003)</td>
<td>(1.289)</td>
<td>(.657)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Oct.62–Oct.65</td>
<td>fixed</td>
<td>.375</td>
<td>.000004</td>
<td>.0000015</td>
<td>.986</td>
<td>-.087</td>
<td>-.00005</td>
<td>-.0000031</td>
<td>.932</td>
<td>1.98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.428)</td>
<td>(.334)</td>
<td>(1.27)</td>
<td>(14.946)</td>
<td>(-1.758)</td>
<td>(-.101)</td>
<td>(-2.703)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Apr.64–Apr.65</td>
<td>fixed</td>
<td>-.000083</td>
<td>.00000001</td>
<td>.882</td>
<td>-.118</td>
<td>-.0022</td>
<td>-.0000034</td>
<td>.984</td>
<td>1.94</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.027)</td>
<td>(.01)</td>
<td>(11.517)</td>
<td>(-1.881)</td>
<td>(-2.398)</td>
<td>(-1.0102)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The hypothesis that there has been no structural change in the expectations function or in the capital flow equation between periods can be rejected. Even a casual glance at these results indicates that the coefficients in the capital flow equation and the parameters in the expectations function are not well defined or constant over different periods.

The period represented by the first equation was a period of short-term capital outflows and significant efforts by the exchange authority to depress the exchange rate despite the existing flexible exchange regime. Note the implied lack of confidence (α > 0) reflected both in the capital flow coefficient on lagged changes in the spot rate (ΔX -1) and in the estimates of the expectations function. Such lack of confidence in the authority's pegging operations was shown in section 2 to imply a larger response by capital flows to exogenous disturbances, which is indicated in the estimated capital flow equation. Note, however, that

6The hypothesis throughout this paper has been that structural changes in these relationships are attributable to changes in endogenous exchange rate expectations. It is, of course, possible that other structural relationships change from period to period as well. For example, Clinton (1973) has shown that if a broad definition of money is used, the demand for money function in Canada shows evidence of structural change over subperiods. His subperiods are, however, quite long (over five years) and do not relate directly to this study. A money demand function which showed the significant shifts of coefficients shown in table 6 would not be very useful. The results here are at least suggestive of the fact that flows of capital respond differently to changes in exogenous variables from one period to another and that a major portion of this may well be due to exchange rate expectations.
direct reactions to official interference in the foreign exchange market reflected confidence in the authority's ability to lower the spot rate \( (\gamma < 0) \). These results indicate that speculators tempered their destabilizing expectations \( (\alpha > 0) \) induced by rising spot rates to the extent they reacted to official sales of Canadian dollars \( (\gamma < 0) \).

The second short-run period (September 1959 to December 1960)—also during the flexible exchange rate regime—was characterized by a falling spot rate and large sales of foreign exchange by officials in support of the spot rate. This interference by officials had the effect of reducing speculative pressures somewhat, because this is the only short-run period where capital flows had a significant effect upon the determination of the forward rate.

Speculative responsiveness was less than infinite (in fact, \( S^e = 119556 \), indicating that a one-cent change in the expected future spot rate led to a $1,2-billion change in the quantity of forward exchange demanded by speculators). Similar response elasticities can be generated for the other periods, but since \( \alpha_1 \) is not significantly different from zero the elasticities are not significantly different from infinite (see (40) above). In addition, changes in the spot rate were expected to reverse themselves (i.e., \( \alpha = -0.1 < 0 \)), which is also reflected in the positive coefficient on \( \Delta S_{-1} \) in table 6. The implied mechanism here is that increases in domestic liquidity induce capital outflows that put downward pressure on spot rates; with \( \alpha = -0.1 \), falling spot rates imply rising future spot rates and induce capital inflows as a result of upward pressure on the forward rate. Note that in this period of stabilizing expectations officials were interfering in support of the Canadian dollar (despite the flexible exchange rate). The capital flow response to changes in \( \gamma, R^e, \) and \( NDA \) was not significant, supporting theoretical contentions that capital will be less responsive when \( \alpha < 0 \).

The remaining short-run periods took place during the fixed exchange rate regime. From October 1962 to October 1965 (equation 3) Canadian officials interfered in the forward exchange market by selling Canadian dollars forward in an attempt to induce capital outflows and prevent the spot rate from rising. The expectations function for this period reflects confidence in the authority's ability to succeed in a policy of preventing spot rate increases \( (\gamma = -0.0000034) \). To the extent that capital outflows did result from official pressure on the forward rate, the resulting fall in the spot rate appeared to have generated even larger capital outflows and put even further downward pressure on the expected future spot rate through the expectations function \( (\alpha = 0.097, \) although only significantly different from zero at the .9 level). It is noteworthy that there was consistent pressure from the official supply of forward currency during this period that may have affected expectations \( (\gamma < 0) \).
and was therefore able to succeed in encouraging capital outflows. Note in table 6 that the offset coefficient on CAB is less (but not significantly so) than for the fixed exchange rate period as a whole and the offset coefficient on ΔMEA is not significantly different from zero. Lower offset coefficients would be expected during a period of confident expectations. The negative coefficient on \((\Delta R - \Delta R^*)\) \_1 indicates a positive value for \(\beta\) that is not reflected in the estimate of the expectations function.

The year from April 1964 to April 1965 preceded a period in which inflationary pressures were a large factor in Canadian-United States capital markets. The estimation of the expectations function in equation 4 reflects expectations of this inflation in the movements of short-term capital and the behavior of speculators in the foreign exchange markets during this period (\(\beta = -0.0029\); i.e., for every percentage point the domestic interest rate rises relative to the foreign interest rate, the expected future spot rate falls 29 cents). Expectations of this nature (\(\beta < 0\)) were characterized as "Fishelian" in section 2; their presence indicates that relatively high domestic interest rates are seen as reflecting high expected levels of domestic inflation with resulting declines in the future spot exchange rate. The presence of Fishelian expectations in a period preceding a major inflationary period is significant.

This result is also reflected in table 6, where the coefficient on \((\Delta R - \Delta R^*)\) \_1 is positive, implying a negative value for \(\beta\). We concluded that a negative \(\beta\) would reduce the impact of exogenous variables on induced capital flows. It is seen here that in fact all coefficients but the trade balance variable are not significantly different from zero. These results imply that during an inflationary period (or when inflation is anticipated) short-term capital flows from the inflationary to the deflationary country rather than being generated by our monetarist model. The fact that the offset coefficient on CAB is not significantly different from unity is not adequately explained by this interpretation of the results.

6. CONCLUSIONS

The expectations function that I have presented is simple, but permits both a theoretical and an empirical analysis of the implications of exchange rate expectations without resorting to highly mechanistic, ad hoc, and/or exogenous representations of speculation. The model presented in section 2 demonstrates that the parameter values of this expectations function determine the responsiveness of capital flows to domestic monetary policies and external disturbances. These empirical results imply that international capital flows do not have a well-defined, stable relationship with the exogenous
variables of such a model and suggest that part of the reason lies in the variability of exchange rate expectations.

Two major conclusions emerge from the empirical work. First of all, if the April 1964 to April 1965 period can be used as an indication, then international capital flows cannot be explained very well by our model during an inflationary period. In fact, what we find (at least when expectations reflect concern with inflation) is that capital flows to avoid the inflationary economy rather than in response to monetary disequilibrium of the sort modeled. The implications of this for the world economy of the 1970s are important and merit further research.

In addition, one generalization that can be made from estimates of expectations is that quite often the very act of interference on the part of Canadian authorities was enough to generate expectations reflecting confidence—expectations that I have shown induce capital flows that reinforce monetary policies. The obvious policy implication of this result is that a monetary authority can significantly increase his control over the domestic money supply and interest rates during a fixed exchange rate regime by inducing stabilizing "speculative" capital flows as a result of discrete activities in the foreign exchange market.
REFERENCES


APPENDIX

The Comparative Static Solutions to the Model:

A. Fixed spot rate/flexible forward rate, $\Delta X = F^g = 0$,

$$
\begin{bmatrix}
1 - J_R & 0 & -J_X'
\end{bmatrix}
\begin{bmatrix}
\Delta X
\end{bmatrix}
= 
\begin{bmatrix}
(+J_R \Delta Y + J_X' \Delta X + J_R' \Delta R^*)
\end{bmatrix}
$$

$$
\begin{bmatrix}
1 \beta S_X' e^{-\gamma S_X' e} & S_X'
\end{bmatrix}
\begin{bmatrix}
\Delta R
\end{bmatrix}
= 
\begin{bmatrix}
(\beta S_X' e^{[\Delta R - \Delta R^* - \Delta R^*_{-1}]} - S_X' e^{\Delta e + \gamma S_X' e \Delta NFA_{-1}})
\end{bmatrix}
$$

$$
\begin{bmatrix}
1 L_R & 0 & L_X'
\end{bmatrix}
\begin{bmatrix}
S^g
\end{bmatrix}
= 
\begin{bmatrix}
(-I_R \Delta Y - L_R \Delta W - L_X' \Delta R^* + \Delta NDA + CAB)
\end{bmatrix}
$$

and:

$$
\begin{bmatrix}
\Delta X'
\end{bmatrix}
= 
\begin{bmatrix}
1 & 2 & 3 & 4
\end{bmatrix}
\begin{bmatrix}
1 & 5 & 9 & 13
2 & 6 & 10 & 14
3 & 7 & 11 & 15
4 & 8 & 12 & 16
\end{bmatrix}
\begin{bmatrix}
\Delta B_R
\Delta R
S^g
\Delta X'
\end{bmatrix}
$$

where:

1. $1 = -\beta S_X' e^{-\gamma S_X' e} L_R' + S_X' L_R > 0$
2. $2 = -J_R L_X' + J_R' L_R > 0$
3. $3 = -S_X' (\beta S_X' + J_R') > 0$
4. $4 = -\gamma S_X' (J_R' L_X' - J_X' L_R) = \gamma$
5. $5 = L_X' - S_X' - L_X' \gamma S_X' > 0$
6. $6 = -I_X' - J_X' > 0$
7. $7 = S_X' + J_X' (1 - \gamma S_X' e) < 0$
8. $8 = -\gamma S_X' (J_X' + L_X') = \gamma$
9. $9 = S_X' L_R - BS_X' e L_X' > 0$
10 = -J_δ L_{X^r} + J_X L_R > 0

11 = -J_X \delta S_{X^e} + J_R S_{X^r} > 0

12 = S_X L_{X^r} - \delta S_{X^e} L_X - J_R L_X + J_X L_R - J_\delta S_{X^e} + J_R S_{X^r} > 0

13 = -L_R + \delta S_{X^r} + \gamma S_{X^e} L_R > 0

14 = L_R + J_R < 0

15 = -\delta S_{X^e} - J_R + J_\delta S_{X^e} > 0

16 = \gamma S_{X^e} (L_R + J_R) = -\gamma

\Delta = -J_R (1 - \gamma S_{X^e}) (I_{X^r} - L_R) + (1 + \delta S_{X^e}) S_{X^e} (\delta L_{X^r} + L_R) > 0

Where "\(=\)" denotes "has the same sign as."

The signs of the resulting multipliers are presented in table 1.

B. Flexible exchange rates, \(F = S = 0\),

\[
\begin{array}{cccc|c|c}
1 - J_R & -J_X & -J_{X^r} & \Delta R_F & (+J_X \Delta Y + J_\delta \Delta W \\
\delta S_{X^e} & (1 + \alpha) S_{X^e} & S_{X^r} & \Delta R & = (\delta S_{X^e} (\Delta R^* + \Delta R_{-1} - \Delta Z_{-1}^*) \\
& & & + \alpha S_{X^e} (\Delta X_{-1} - S_{X^e} \Delta e) \\
0 & L_R & L_X & L_{X^r} & \Delta X & (-L_X \Delta Y - L_\delta \Delta W \\
-1 & 0 & \text{CAR}_X & 0 & \Delta X^r & (-L_R \Delta Y - \Delta X - \Delta R_F - 1) \\
\end{array}
\]

\[
\begin{array}{c|c|c|c|c}
\Delta R_F & 1 & 2 & 3 & 4 \\
\Delta R & = \frac{1}{\delta}, & 5 & 6 & 7 & 8 \\
\Delta X & 9 & 10 & 11 & 12 \\
\Delta X^r & 13 & 14 & 15 & 16 \\
\end{array}
\]
where:

1' = \text{CAB}_X (l_R S_X - L_X + B S e_X) < 0

2' = -\text{CAB}_X (j_R l_X - L_R s_X) < 0

3' = -\text{CAB}_X S e_X (\beta l_X + j_R) < 0

4' = -L_R (L_X (1 + \alpha) S e_X - B S (j_X L_X - j_X l_X)) - L_R (j_X (1 + \alpha) S e_X - j_X s_X) = -\alpha

5' = L_X I_X (CAB_X + (1 + \alpha) S e_X) - S_X L_X < 0

6' = L_X (CAB_X + j_X) - j_X l_X > 0

7' = \alpha L_X S e_X - CAB_X (S e_X - j_R) > 0

8' = (L_X (1 + \alpha) S e_X - L_X S e_X) - (j_X L_X - j_X l_X) = \alpha

9' = S_X l_R - B S e_X l_X > 0

10' = -J_R l_X + j_X l_R > 0

11' = J_R S e_X - B S e_X j_X > 0

12' = (S_X l_R - B S e_X j_X) - (j_R l_X - j_X l_R) > 0

13' = -L_R CAB_X + B S e_X - L_R (1 + \alpha) S e_X

14' = L_R CAB_X - J_X l_X + j_X l_R > 0

15' = -\text{CAB}_X (B S e_X + j_R - j_X S e_X) (1 + \alpha + B) ?

16' = (B S e_X - L_R (1 + \alpha) S e_X - (j_X l_X - j_X l_R) > 0

\Delta = -J_X (\text{CAB}_X + \alpha S e_X) (L_X - L_R) + \text{CAB}_X S e_X (B l_X + L_R) < 0

The signs of the resulting multipliers are presented in Table 2.