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**International Capital Flows in Finland 1975—1990:
The Role of Expectations**

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Abstract

Financial markets in Finland have undergone important structural changes over the 1980's. Most important have been the emergence of a well-functioning short-term money markets and the relaxation of most of the foreign exchange controls. These elements have created a situation where the economy is increasingly dependent on the developments in the rest of the world. The present study may be viewed as an extension to Hämäläinen and Kovanen (1991). The purpose is to examine how income and exchange rate expectations influence the determination of international capital flows. Theoretical foundations are supported by empirical evidence. Exchange rate expectations have a statistically significant role to play in the adjustment process, in particular during the final years of 1980's. Also income expectations are important for the adjustment of the demand for money. A somewhat less important, but nevertheless interesting, result concerns the possibility of short-run overshooting in the net capital flows in response to changes in domestic credit in the short run.

Tiivistelmä

Suomen rahamarkkinat ovat muuttuneet merkittävästi 1980-luvulla. Erityisesti toimivien kotimaisten rahoitusmarkkinoiden luominen yhdessä pääoman liikkuvuutta hidastavien esteiden poistamisen kanssa ovat lisänneet talouden riippuvuutta ulkoisista tekijöistä. Tämä on osaltaan vähentänyt mahdollisuuksia harjoittaa itsenäistä, ulkoisista tekijöistä riippumatonta rahapolitiikkaa. Tämä tutkimus on jatkoa Hämäläisen ja Kovasen (1991) tutkimukselle. Oheisessa tarkastelussa analysoidaan tulo- ja valuuttakurssiodotusten vaikutuksia pääomavirtoihin. Empiiriset tulokset osoittavat, että tulo- ja valuuttakurssiodotuksilla on tilastollisesti merkittävä vaikutus sopeutumisprosessissa. Valuuttakurssiodotukset osoittautuivat merkittäviksi erityisesti 1980-luvun loppuvuosina. Empiiriset tulokset tukevat myös oletusta, että tulo-odotukset vaikuttavat rahan kysyntään. Lisäksi on mahdollista, että pääomavirrat ylireagoivat kotimaisen rahan tarjonnan muutoksiin lyhyellä aikavälillä. Estimointitulokset implikoivat, että pääomavirrat saattavat ylireagoita muutoksiin kotimaisessa rahantarjonnassa lyhyellä aikavälillä.

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1 Introduction

Financial markets in Finland have undergone important structural changes in the 1980's. Most significant are the emergence of well-functioning short-term money markets and the relaxation of many of the foreign exchange rate controls¹. These changes underline the role of interest rates in the process of achieving equilibrium in the money markets. The integration of domestic financial markets with the rest of the world together with the ongoing European integration process has increased the dependence of domestic interest rates on international developments. Thus the integration has reduced domestic monetary autonomy in Finland.

The effects of financial liberalization on capital flows and domestic interest rates in Finland have been studied by several authors. See, among others, Hämäläinen (1984), Hämäläinen and Kovanen (1991), and Starck (1988)². Most of these studies have emphasized that deregulation mainly influenced the offset coefficient, i.e. the degree to which changes in the domestic credit are offset by international capital flows. If the offset coefficient increases due to liberalization, the importance of domestic monetary policy declines because it becomes more difficult to influence interest rates through changes in domestic monetary base. Recently, Hämäläinen and Kovanen (1991) reported that the offset coefficient has remained remarkable stable during the period of 1975–1990, even though the estimation period covered the transition of Finnish money markets from a highly regulated system into a well-developed financial regime. They also examined how liberalization affected the sensitivity of international capital flows in response to changes in the yield differential between domestic and foreign assets. The conclusion was that financial liberalization has mainly influenced the interest rate sensitivity of international capital flows so that the estimated interest rate semi-elasticity has increased considerable in the middle of 1980's. Thus liberalization has opened a channel for speculative capital movements across national borders which were prohibited during the regulated period.

A weakness in these studies, and many others, is that the effects of expectations on the net capital flows are not examined. One reason why

¹ A remaining restriction prohibited foreign currency borrowing by the household sector. It was eliminated in the Fall of 1991. Domestic markets for bonds are still fairly undeveloped in Finland.

² A number of studies have used the Bank of Finland econometric model to analyze the offset coefficient. See e.g. Tarkka (1984) and Tarkka and Willman (1990).

the role of expectations in the adjustment process is ignored is that expectations are difficult to measure in practice. Therefore economists often circumvent the problem by making ad hoc assumptions concerning the formation of expectations, e.g. static expectations have been used commonly.

This study may be viewed as an extension to Hämäläinen and Kovanen (1991). Here the role of income and exchange rate expectations on international capital flows are emphasized. The demand for broad money is influenced by the anticipated income, rather than the actual income, while the net capital flows are determined by the yield differential between domestic and foreign assets adjusted for the expected depreciation of the spot exchange rate. When different assets are denominated in different currencies, their expected returns are comparable only if the returns are expressed in units of a common currency. Here the returns are measured in units of domestic money, hence expected foreign currency returns must be converted into units of domestic money by making necessary adjustments for anticipated changes in the foreign exchange rate. In section 3 we make explicit the assumptions concerning the formation of income and exchange rate expectations. Moreover, quarterly data on Finnish economy is used to estimate dynamic equations for expectations. The reduced-form equation for the net capital flows is estimated in section 4 where the fitted values of income and exchange rate expectations from section 3 are incorporated. Furthermore, we also analyze a number of alternative specifications for exchange rate and income expectations. Section 5 provides a summary of results.

2 The Model

Domestic economy is assumed to be small, at least from the financial side, in the sense that international capital flows influence domestic money supply and short-term interest rates. Domestic and foreign interest-bearing assets are perceived as imperfect substitutes by the public. Hence the yield differential between them generates capital inflows and outflows. The model features two equilibrium conditions: one for the domestic money markets and the other for the net capital inflows. Together these equilibrium conditions determine simultaneously domestic short-term interest rate and net capital inflows.

Suppose that the demand for broad money, which includes currency in circulation and all domestic deposits, excluding the deposits of certificates, as a share of nominal wealth depends on the difference between short-term money market and time-deposit rates of interest. The difference measures the opportunity cost of holding money.

$$\frac{M^*}{Y_{-1}} = k - c(i - i_d) \quad (1)$$

where M^* = desired holdings of broad money, Y_{-1} = lagged nominal GDP which serves as a proxy for nominal wealth, i = domestic short-term interest rate and i_d = domestic time-deposit rate of interest.

We assume that in the short-run the actual holdings of broad money may deviate from the desired holdings because of rigidities in the payment systems, e.g. time-deposits cannot be withdrawn before their maturity. Then the actual holdings of money balances adjust only gradually to their desired levels where the adjustment follows a simple stock-adjustment process.

$$\Delta M = h(M^* - M_{-1}) + d\Delta Y^e \quad (2)$$

The adjustment is also influenced by anticipated changes in the nominal income, $\Delta Y^e = E[\Delta Y|I_{t-1}]$. Hence anticipations about the future are relevant for the demand for broad money.

The components of broad money supply, M , are domestic credit³, DC , and foreign currency reserves, R . In the difference form the money supply may be written as $\Delta M = \Delta DC + \Delta R$. Foreign currency reserves, assuming a regime of fixed exchange rate, are adjusted for changes in the current account, CA , and the capital account, KA , balances. Therefore the change in the broad money supply becomes:

³ Domestic credit includes central bank credit and credit generated by the banking sector.

$$\Delta M = \Delta DC + \Delta CA + \Delta KA \quad (3)$$

Net capital inflows as a share of total nominal wealth depend on the change in the yield differential between domestic and foreign assets which represent the risk premium paid on domestic assets. In order to compare the returns to domestic and foreign assets, foreign currency returns are adjusted for the expected change in the spot exchange rate. Since domestic and foreign assets are perceived as imperfect substitutes by the public, an increase in the return differential implies that a higher premium is paid on domestic assets which induces capital inflows. A constant term, denoted by v , is added to account for shifts in the net capital inflows due to changes in nominal wealth.

$$\frac{\Delta KA}{Y_{-1}} = b\Delta\left[i - \left(i_f + \frac{\Delta E^e}{E}\right)\right] + v \quad (4)$$

where i_f = foreign short-term interest rate and E = actual spot exchange rate, i.e. the price of foreign currency measured in units of domestic money, and E^e = expected future spot exchange rate. The term $\frac{\Delta E^e}{E} \equiv E\left[\frac{\Delta E^e}{E} \mid I_t\right]$ measures the expected rate of depreciation in the spot exchange rate.

The model may now be utilized to determine simultaneously changes in the domestic short-term interest rate, Δi , and the net capital inflows $\Delta KA/Y_{-1}$. We only display the reduced-form solution for the net capital inflows which is obtained by using eqs. (1) through (4).

$$\begin{aligned} \frac{\Delta KA}{Y_{-1}} = & k_1 + k_2\Delta\left[i_d - \left(i_f + \frac{\Delta E^e}{E}\right)\right] + k_3\Delta\left(\frac{M}{Y}\right)_{-1} \\ & + k_4\Delta\left(\frac{\Delta Y^e}{Y_{-1}}\right) - k_5\left[\frac{\Delta DC + \Delta CA}{Y_{-1}} - \left(\frac{\Delta Y_{-1}}{Y_{-2}}\right)\left(\frac{M}{Y}\right)_{-1}\right] \end{aligned} \quad (5)$$

All coefficients in the above equation are nonnegative. Notice that an increase in domestic credit, $\Delta DC > 0$, generates capital outflows, the degree of which depend on the size of the offset-coefficient. The capital flow equation employed here is similar to Kouri and Porter (1974) and the coefficient k_5 may be interpreted as the offset coefficient. It measures how large percentage of the change in domestic credit is offset by international capital flows. If the offset coefficient equals unity, domestic monetary policy becomes completely ineffective. Studies using Finnish data indicate that the estimated offset coefficient for the Finnish economy in the late 1980's is indeed very high.

3 Expectations

Let us begin by examining an arbitrary stochastic process, denoted by x_t , which may be decomposed into transitory and stationary (or permanent) components.

$$x_t = x_t^t + x_t^s$$

where $x_t^t = \mu_t^t$ is the transitory component while the stationary component is given by $x_t^s = (1-a)\sum_{j=0}^{\infty} a^j x_{t-1-j} + \mu_t^s$. Both components are influenced by transitory shocks, μ_t^t and μ_t^s respectively, which are distributed normally $N(0, \sigma(\mu^k))$ with $k = t,s$. Moreover, the stationary component also depends on the lagged polynomial of x_t . The stochastic process may now be written as

$$x_t = (1-a)\sum_{j=0}^{\infty} a^j x_{t-1-j} + \mu_t ; \mu_t \equiv \mu_t^t + \mu_t^s \quad (6)$$

Expectations are formed rationally, that is $x_t^e = E[x_t | I_{t-1}]$ where I_{t-1} denotes the information set of the public at the time of expectations formation. Hence the prediction errors are caused by unanticipated shocks. In the following we interpret x_t as the evolution of either $\Delta Y/Y_{-1}$ or $\Delta E/E_{-1}$. In equation (5) the net capital inflows are influenced by changes in $\Delta Y/Y_{-1}$ and $\Delta E/E_{-1}$. Hence we express x_t in the difference form.

$$\Delta x_t = -a\sum_{j=0}^{\infty} a^j \Delta x_{t-1-j} + \mu_t \quad (7)$$

Next we will estimate eq. (7) for the spot exchange rate and nominal income, respectively. These results give us the estimates for the exchange rate and income expectations which are then inserted into the net capital flow equations, eq. (5). The estimations are carried out by using quarterly data of the Finnish economy from the period 1975:1–1990:4.

Table 1. **Dependent variable is the change in $\Delta E/E_{-1}$**

Lag	Coefficient	T-statistic
1	-0.6218	-5.0850
2	-0.2636	-2.1557
$R^2 = 0.2956$	$\sigma = 0.9051$	DW = 2.09

Table 2

Dependent variable is the change $\Delta Y/Y_{-1}$

Lag	Coefficient	T-statistic
1	-0.7833	-8.3851
2	-0.8984	-11.4468
3	-0.6394	-6.9246

$R^2 = 0.7019$ $\sigma = 0.02356$ $DW = 2.23$

In Tables 1 and 2 the optimal lag-length for each variable is determined by using Schwarz information criteria and F-test⁴. The estimation results are consistent with our theoretical specification and all parameter estimates receive their expected signs. In the case of exchange rate expectations the fit is not very good which is somewhat surprising given the fixed exchange rate regime in Finland.

⁴ In the estimations the residuals were consistent with the standard assumptions for the OLS, except in the case of the exchange rate equation where the residuals were not distributed normally.

4 Estimation of the Capital Flow Equation

Here we employ eq. (5), which is the reduced-form equation for the net capital inflows, to estimate the parameters of the structural model. We have incorporated the estimated equations for the exchange rate and income expectations into eq. (5). We do not restrict the parameter estimates of the exchange rate expectations, $\Delta(\Delta E^e/E)$, and the interest rate differential, $\Delta(i_d - i_f)$, to be identical ex ante as indicated by the theoretical model.

Table 3 **Dependent variable is the net capital inflow**

Variable	Estimate	T-statistic
$\Delta(i_d - i_f)$; 84-90	0.0183	3.2842
75-83	0.0002	0.0080
$\Delta(\Delta E^e/E)$; 84-90	0.0330	2.6731
75-83	-0.0021	-0.4711
$\Delta(M/Y)_{-1}$	0.8082	10.5150
$\Delta(\Delta Y^e/Y_{-1})$	0.1439	1.4897
VV	-0.9092	-20.0016
DUMMY88	0.1329	8.4310
$R^2 = 0.9002$	$\sigma = 0.0181$	DW = 2.49

The sample period has been divided into two subperiods to account for the increase in the interest-rate semielasticity in the middle of 1980's⁵. The results in Table 3 indicate that the estimated equations for the income and exchange rate expectations do not perform well in the reduced-form equation. Even though the exchange rate expectations receive statistically significant parameter estimate for the period 1984-1990, the sign is not correct. The Durbin-Watson statistic indicates that there is positive autocorrelation in the residuals. The estimated offset coefficient is statistically significant and very close to unity.

To improve estimation results, we re-estimated the net capital inflow equation by using different lag structures for $\Delta(\Delta Y^e/Y_{-1})$ and $\Delta(\Delta E^e/E_{-1})$ which replaced the estimated equations for the exchange rate and income

⁵ In tables 3-5 VV accounts for those terms which are associated with the coefficient $k(5)$ in equation (5).

expectations. It turned out that only the current change in the rate of exchange rate depreciation yielded significant parameter estimate which indicates that exchange rate expectations are primarily influenced by the most recent information. On the other hand, the current change in the growth rate of nominal income did not receive statistically significant parameter estimate, thereby supporting the view that anticipated changes in income are more relevant for the adjustment of the money holdings than the actual changes. Hence, lagged values of the income growth provided significant parameter estimates.

Table 4 **Dependent variable is the net capital inflow**

Variable		Estimate	T-statistic
$\Delta(i_t - i_t^e)$	84-90	0.0153	2.9031
	75-83	0.0001	0.0244
$\Delta(\Delta E/E_{t-1})$	84-90	-0.0151	-2.2694
	75-83	-0.0010	-0.4544
$\Delta(M/Y)_{t-1}$		0.5852	5.4183
$\Delta(\Delta Y/Y_{t-1})$	1 LAG	-0.5230	-3.7758
	2 LAG	-0.2913	-2.8487
	3 LAG	-0.1895	-2.5558
VV		-0.9475	-22.3190
DUMMY88		0.1162	7.4755
$R^2 = 0.9166$		$\sigma = 0.1682$	DW = 2.15

The results in Table 4 have several important implications. First, the interest rate differential displays statistically significant effect on the net capital inflows only during the period of financial liberalization, i.e. after 1984⁶. The same holds for the exchange rate expectations, measured by the current change in the rate of exchange rate depreciation, which yields statistically significant impact on the net capital inflows only in the period after 1984. Secondly, the parameter estimates of the interest rate differential and the exchange rate expectations are identical (in absolute terms) which is consistent with the theoretical model. The results support the view that income expectations are formed on the basis of information provided by the past changes in the nominal GDP growth. Hence the public adjusts their money holdings on the basis of past information. All parameter estimates have expected signs and the fit has improved. Also the autocorrelation in residuals has been reduced.

⁶ This was also reported in Hämäläinen and Kovanen (1991)

Next we examine how the effects of the interest rate differential and the exchange rate expectations differed during periods 1984–1987 and 1988–1990. The periods have been chosen somewhat arbitrarily but we should notice that towards the end of 1980's the role of short-term money markets became more apparent and the dependency upon external factors increased considerable. All this contributed to the increased volatility of international capital flows. Furthermore, the final year of 1980's marked a period of exceptionally strong output growth in the Finnish economy during which domestic credit expanded and the net foreign borrowing of the private sector grew considerable.

Table 5 **Dependent variable is the net capital inflow**

Variable		Estimate	T-statistic
$\Delta(i_d - i_f)$;	88–90	0.0121	1.6090
	84–87	0.0194	2.6652
	75–83	-0.0001	-0.0531
$\Delta(\Delta E/E_{-1})$;	88–90	-0.0182	-2.5195
	84–87	0.0065	0.3398
	75–83	-0.0011	-0.5025
$\Delta(M/Y)_{-1}$		0.5663	5.1689
$\Delta(\Delta Y/Y_{-1})$;	1 LAG	-0.5535	-3.8656
	2 LAG	-0.3108	-2.9652
	3 LAG	-0.1824	-2.3950
VV		-0.9655	-21.5490
DUMMY88		0.1177	7.4232
$R^2 = 0.9194$		$\sigma = 0.01685$	DW = 2.13

In Table 5 the overall fit of the capital inflow equation is not markedly different from the previous estimation. The interesting outcome concerns the interest rate differential and the exchange rate expectations. During 1984–1987 exchange rate expectations, did not have a significant impact on the net capital inflows while during 1988–1990 they influenced the net capital flows significantly. The liberalization therefore made the capital flows increasingly sensitive to exchange rate movements. The interest rate differential, $i_d - i_f$, received statistically significant parameter estimate only during 1984–1987.

Before departure we examine the long-term impact on the net capital inflows of a change in the domestic credit. In eq. (5) only the immediate impact-effect is explicitly present. By rewriting the term $\Delta(M/Y)_{-1}$ differently we are able to reveal new information about the dynamics of

the net capital inflows and, more importantly, the value of the long-term offset-coefficient in the Finnish economy.

$$\Delta\left(\frac{M}{Y}\right)_{-1} = \frac{\Delta KA_{-1}}{Y_{-2}} + \left[\frac{\Delta DC + \Delta CA}{Y_{-1}}\right]_{-1} - \left(\frac{\Delta Y_{-1}}{Y_{-2}}\right)\left(\frac{M}{Y_{-1}}\right) \quad (8)$$

Here the decomposition of the left-hand side variable reveals the lagged dependent variable and the lagged domestic credit component, respectively. Now it is easy to calculate the long-term steady-state value of the offset coefficient based on the estimation results in Table 4. The long-term offset coefficient is -0.8734 which is slightly smaller (in absolute terms) than -0.9475 which is the short-term offset coefficient. The difference may not be statistically significant but points to an interesting possibility, i.e. the net capital inflows display short-term overshooting.

5 Conclusions

This paper has examined the importance of income and exchange rate expectations on the net capital flows. We found that exchange rate expectations, measured by the current rate of depreciation of the spot rate, exerted a significant impact on the capital flows, in particular, during the final years of 1980's. The result shows that as the dependency of the domestic economy upon international developments increased, speculative movements in the spot exchange rate began to influence the capital flows. We also found that the demand for broad money was influenced by income expectations.

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