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MONETARY POLICY REACTION FUNCTIONS AND SAVING-INVESTMENT CORRELATIONS: SOME CROSS-COUNTRY EVIDENCE***

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ABSTRACT

Keeping the finding of Feldstein and Horioka (1980) - that countries' investment rates are highly correlated with their national saving rates - as a starting point this paper examines the possibility that monetary policy reactions to target the current account might explain saving-investment correlations. The OLS, robust and variable-parameter estimates of the linear reaction functions with quarterly data from Germany, Italy, Japan and the United States suggest - the United States being an exception - that the current account deficit leads to tighter money, ceteris paribus. The threshold estimation results indicate, however, that the reaction functions are non-linear in terms of the current account variable; monetary policy reacts stronger to deficits than to surpluses. Moreover, allowing for asymmetricity makes the performance of the reaction functions better and parameter estimates more precise. We are tempted to interpret findings as giving considerable support for the notion that current account has been a significant target for monetary policy in Germany, Italy and Japan. This in turn might explain the high saving-investment correlations even in the presence of highly mobile international capital movements.

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1 INTRODUCTION

The finding of Feldstein and Horioka (1980) that countries' investment rates are highly correlated with their national saving rates has now been confirmed by many subsequent studies using both cross-section and time-series regressions over different sets of countries and time periods (see e.g. Dooley, Frankel and Mathieson (1988) for a survey of the literature). But there is currently very little agreement on explanations of this apparent empirical regularity. Three broad sets of explanations for these high correlations have emerged: (a) low international capital mobility, (b) private sector behaviour and (c) government targeting of the current account.[1)]

Despite other evidence, for various reasons - like information constraints, exchange risk with risk aversion, exchange controls etc. - international capital mobility may be very low. This was the original explanation proposed by Feldstein and Horioka (1980) and reaffirmed by Feldstein (1983) and Feldstein and Bacchetta (1989).[2)] The interpretation (a) has been challenged by a number of people. On the one hand it has been argued that even though capital mobility would be perfect, national saving and investments are correlated because they both react to some common shocks, like business cycle shocks, productivity shocks and/or population growth (see e.g. Obstfeld (1986)). But there are problems with this interpretation (b); it has been argued by Summers (1988) and by Feldstein and Bacchetta (1989) that evidence does not support the "spurious factor" explanation for the close association of national savings and investment rates (for an attempt to use newly-developed co-integration techniques to study the issue, see Miller (1988)). On the other hand, it has been argued that the close association between national savings and investment rates may in fact due to the possibility that governments have used fiscal and monetary policy to target the current account (see e.g. Tobin (1983) and Summers (1988) for this kind of interpretation of the evidence).

Under the government targeting of the current account interpretation capital is not in fact immobile, but only appears so because countries pursue policies, which ultimately bring savings and investments into balance. Recently, Summers (1988) has interpreted saving-investment correlations as being due to fiscal policy reactions; according to the "maintained external balance" hypothesis fiscal policy - measured by budget deficit - reacts to saving-investment gap. The budget deficit is not, however, be a good summary measure of fiscal policy; it is not entirely under the control of the government given that it is likely to be affected by growth and other factors. Moreover, it is not totally clear how this kind of evidence should be interpreted (see e.g. Feldstein & Bacchetta (1989)).

Somewhat surprisingly, the possibility that monetary policy reactions to target the current account might explain saving-investment correlations, has not been studied with the exception of a preliminary research by Artis and Bayomi (1989). Clearly this possibility, however, deserves a more thorough analysis, which is done in this paper.

We start by postulating a simple linear dynamic reaction function for the short-term interest rate, which includes some potential external and internal targets of monetary policy - current account, domestic inflation and output growth - as explanatory variables. But there is no reason to suppose that the reaction function would be linear; there may be some non-linearities owing to the possibility that monetary authorities react asymmetrically to the (internal and/or external) target variables depending on whether the actual values of the variables are below or above the target values. These possible non-linearities are analyzed using the so-called threshold models (see Tong (1983) for an overview of the earlier literature).[3] The state of the current account is an obvious threshold variable, to which monetary authorities may react asymmetrically depending on whether there is a current account deficit or surplus. We also scrutinize the possibility that the domestic inflation rate would have this threshold property. The empirical analysis makes use of quarterly data from four countries: Germany, Italy, Japan and the United States. The sample period varies somewhat from country to country the longest period being 1960Q3 - 1989Q2. A brief background and the empirical results are presented in section 2, and some concluding remarks follow in section 3.

2 BACKGROUND AND EMPIRICAL RESULTS

2.1 On the Specification of Monetary Policy Reaction Function

Let us start by assuming that the monetary authorities behave as if they maximize an intertemporal "welfare function" subject to an implicit perceived (econometric) model of the economy. This process is assumed to yield a dynamic policy reaction function relating the policy instrument to a set of internal and external (current and lagged) target variables, such as inflation, output growth and current account. These objectives, while not exhaustive, quite likely encompass the major policy targets. An intertemporal "welfare function" is meant to take account of the potential delayed effects of policy. This method of using a reduced form equation with a policy instrument as the dependent variable and (current and lagged) targets as independent variables has been widely used (see e.g. Joyce (1986) for a survey about the derivation on and estimation of reaction functions for the monetary and fiscal policies of different nations). In particular, the policy reaction function specification, which is adopted, is of the following type

$$(1) \qquad \Delta r_t = b_0 + b_1 p_t + b_2 p_{t-1} + b_3 y_t + b_4 y_{t-1} + b_5 ca_t + b_6 ca_{t-1} + e_t,$$

where r is the interest rate, p the rate of inflation, y the growth rate of industrial production, ca the current account surplus (in relation to GDP) and e the error term. Interest rates are either the three-month treasury bill rates (RS) or the discount rates (RD), and the consumer price index is used for p. Both industrial production and the current account are seasonally adjusted. The whole data are derived from the OECD Main Economic Indicators tape.

This equation states that the authorities behave so as to raise or lower the interest rate depending upon the recent behaviour of three target variables, namely the inflation, output growth and the size of the current account relative to GDP. Obviously, higher inflation and higher output growth would be expected to lead to tighter money, ceteris paribus. A current account deficit would also lead to tighter money, _if_ the authorities want to encourage foreign borrowing to finance the deficit _or if_ they simply adopt an expenditure- reducing policy for external reasons. Under these circumstances the expected signs on these targets would be: $b_1 + b_2 > 0$, $b_3 + b_4 > 0$ and $b_5 + b_6 < 0$.

There are some issues associated with the policy reaction function specification (1), which should be discussed before the estimation. The first is the possible endogeneity of the policy variable; if the chosen interest rate is not fully under the control of the monetary authorities, then the estimated coefficients may reflect endogenous behaviour rather than policy reactions. From the point of view of controllability the official discount rate would seem to be a natural dependent variable. What makes it a bit problematic, however, is the fact that a considerable portion of the observations are just zeroes so that the OLS estimates are not very efficient. Moreover, it is after all somewhat moot what should be used as the dependent variable; to the extent that open market operations constitute the main monetary policy instrument, it might be appropriate to use the treasury bill rate as the dependent variable. A detailed investigation of this issue lies beyond the scope of this paper. In what follows in order to check the robustness of results we have estimated reaction functions by using both the discount rate and the treasury bill rate as dependent variable in (1).

The second issue has to do with the functional form of the reaction function (1). There is no particular reason - except simplicity - why the reaction function should be linear across the domain of various target variables. The monetary authority may not treat the deviations of actual values of the target variables from their desired levels in a symmetrical way. In particular, there may be asymmetricity so that while domestic ownership of foreign assets is regarded as "acceptable", foreign ownership of domestic assets is not regarded so.

Under these circumstances the monetary authority may react differently depending on whether the current account is in deficit or in surplus and on whether the deficit is huge or not. And in principle, analogous behaviour may hold in the case of other target variables as well. Postulating this sort of asymmetric loss function means also that exogenous uncertainty about future development of the economy should affect the policy instrument. In what follows this has not been tried to control for.[4)]

A way to account for potential asymmetricities mentioned above is to use the so-called threshold models. Applying threshold specification means that the coefficients of the independent variables are allowed to vary depending on their level. A simple way to account for this kind of switching phenomenon in the context of the current account variable ca is to fit the following type of non-linear specification to data

(2)

$$\text{(i)} \quad \Delta r_t = b_0 + b_1 p_t + b_2 p_{t-1} + b_3 y_t + b_4 y_{t-1} + b_5^* ca_t^* + b_6^* ca_{t-1}^* + e_t \qquad \text{if} \qquad ca < ca'$$

and

$$\text{(ii)} \quad \Delta r_t = b_0 + b_1 p_t + b_2 p_{t-1} + b_3 y_t + b_4 y_{t-1} + b_5^{**} ca_t^{**} + b_6^{**} ca_{t-1}^{**} + e_t \qquad \text{if} \qquad ca > ca'$$

Thus there is supposed to be some threshold value ca' so that if ca < ca', then ca = ca* and (2i) holds, while in the case of ca > ca = ca** and (2ii) holds. The optimal threshold value - i.e. the value which gives the smallest residual variance - is obtained by using a simple search procedure.

This kind of piecewise-linear threshold specification might also be justified in Bayesian terms as follows: Suppose that the policy maker is uncertain about the effects of policy instruments on targets and tries to approximate this uncertain relationship by using a linear model with uncertain, but normally distributed coefficients. To decide whether the linear model is an acceptable approximation the policy maker uses the loss function - which captures his (or her) tolerance to differences between the true and linear model - and makes a decision so as to minimize the expected loss function. Under certain quite natural assumptions this leads to a piecewise-linear threshold rule, according to which the policy-maker is resorted to a different approximating model - connecting the policy and target variables - depending on the values of target variables (for an account of this idea, see Tong (1983), p. 66 - 70, and Smith and Harrison and Zeeman (1981) for some other possibilities and further analyses).

2.2 OLS and Threshold Estimation Results

The OLS estimation results for the specification (1) for alternative dependent variables are reported in Table 1.[5] They suggest that the linear reaction function specification performs reasonably well. In most cases coefficients of the target variables are of expected sign, though not always very precisely estimated. Anyway, the estimation results does not prevent the interpretation according to which the monetary authorities in the respective countries react to output growth, inflation and current account deficits by raising the interest rate or by behaving so that interest rates increase. This lies in conformity e.g. with the results reported in Artis and Bayomi (1989).

Naturally, this is something one might expect. Notice also that the results for the short-term market rate and the discount rate differ only marginally. Although their variability is somewhat different in all countries of the data sample the coefficient estimates are typically of the same sign and magnitude.

But as we suggested earlier, the linear specification (1) may be inappropriate after more careful considerations. More specifically, we would like to know whether the coefficient estimates are stable over time, and in particular, whether there are signs of non-linearities in the specification. The battery of test statistics, which are reported in Table 1, gives conflicting evidence on both of issues.[6] This verdict does not seem to depend on the choice of the dependent variable.

TABLE 1 OLS Estimates of the Reaction Function (1)

	FRG	Italy	Japan	USA	FRG	Italy	Japan	USA
Constant	.188	-.503	-.157	-.437	-.268	-.506	-.070	-.372
	(0.56)	(0.78)	(0.71)	(2.96)	(1.51)	(1.49)	(0.46)	(3.78)
p	-.217	.757	.046	.413	.127	.327	-.002	.275
	(1.04)	(2.95)	(0.61)	(2.90)	(1.14)	(2.44)	(0.03)	(3.11)
p(-1)	.054	-.682	.078	-.186	.041	-.188	.049	-.061
	(0.24)	(2.63)	(0.97)	(1.22)	(0.36)	(1.39)	(0.89)	(0.65)
y	.050	.104	-.011	.269	.060	.078	.030	.167
	(0.72)	(1.15)	(0.20)	(5.37)	(1.64)	(1.66)	(0.81)	(5.39)
y(-1)	.217	.255	.099	-.028	.158	.131	.039	.008
	(3.32)	(3.05)	(1.87)	(0.60)	(4.53)	(3.01)	(1.08)	(0.28)
ca	-.048	-.334	-.509	.313	-.014	-.178	-.321	.363
	(0.29)	(1.14)	(2.72)	(1.23)	(0.16)	(1.17)	(2.51)	(2.31)
ca(-1)	-.094	.092	.404	-.292	-.002	.061	.232	-.337
	(0.53)	(0.31)	(2.23)	(1.15)	(0.02)	(0.39)	(1.87)	(2.14)
R2	.184	.336	.276	.303	.286	.315	.231	.339
SEE	1.053	2.072	.766	.800	.561	1.082	.523	.496
DW	1.380	2.350	1.391	2.006	1.574	2.511	1.471	2.076
T_0	68Q3	71Q3	67Q2	60Q3	68Q3	71Q3	67Q2	60Q3
TREND	.556	.285	.927	.288	.853	.401	.896	.857
RESET	.791	1.000	.921	.080	.663	.976	.959	.717
RB	.982	.985	1.000	1.000	.940	.402	1.000	1.000
DIF	.987	.225	.997	.997	.653	.962	.998	.999
IMT	.867	.974	.989	1.000	.908	.880	.991	.999
NORMAL	.999	1.000	1.000	1.000	.772	1.000	1.000	.990
NONLIN	.847	.673	.985	.594	.947	.080	.922	.870
TSAY	.646	.664	.819	.956	.795	.012	.345	.940
CHOW	.710	.345	.617	.820	.586	.306	.657	.977
WDp	1.000	.996	.999	1.000	.990	1.000	.991	1.000
WDp(-1)	1.000	1.000	.983	1.000	.995	.951	.940	1.000
WDy	.591	.997	.346	1.000	.977	.939	.450	1.000
WDy(-1)	.802	1.000	.381	.396	1.000	.918	.335	.327
WDca	.829	.539	.800	.247	.549	.939	.583	.245
WDca(-1)	.647	1.000	.666	.281	.475	1.000	.374	.375
HCca	.993	.469	1.000	.323	.975	.507	.988	.497
HCca(-1)	.898	.784	1.000	.155	.777	.776	.910	.351
OL	3.82	9.32	4.07	4.78	2.786	5.664	5.635	3.874
Dep.var.	RS	RS	RS	RS	RD	RD	RD	RD

Numbers in parentheses are t-statistics. T_0 denotes the first observation. The last observation is 69Q1 for Germany and Japan, 88Q4 for Italy and 89Q2 for USA. TREND is a test for linear trend in the data, RESET is a test for correctness of the functional form (the powers 2 and 3 of the estimated endogenous variables are used as auxiliary regressors), RB is Utts' Rainbow test, DIF is the Plosser-Schwert-White differencing test, IMT is White's information matrix test, NORMAL is the Jarque-Bera test for normality of residuals, NONLIN is a test for the addition of squared values of the explanatory variables to the model, TSAY is Tsay's (1987) non-linearity tests based on one-step-ahead forecast errors, CHOW is Chow's stability test, WDx is the Watson-Davis test for each parameter HCx is the Harvey-Collier Psi-test for functional misspesification in terms of the variable x and OL is the test for the Presence of outliers (the approximate 5 per cent critical value of the test is here 3.60). The null hypothesis in the latter test is that the parameter is constant, and the alternative is that the parameter varies over time according to a first order autoregressive process. The probability figures reported for TREND, RESET, RB, DIF, IMT, NORMAL, NONLIN, TSAY, CHOW, WDx and HCx denote points of cumulative probability distribution. Hence, for instance, .950 is the threshold for significance at the level .05.

First, as far as the parameter stability is concerned, the CHOW test statistics suggest that the parameters are stable in terms of the midpoint split of the data sample. On the other hand the Watson-Davis and Harvey-Collier test statistics give conflicting evidence, particularly in terms of the current account variables. The coefficients of these variables are reasonably stable if we rely on the Watson-Davis test statistics, but far from constant over time, if the Harvey-Collier test statistics are consulted.

Second, as for the nonlinearities, the NONLIN and TSAY[7)] test statistics fail to exceed the standard significance levels with one exception. This lies in contrast with the evidence from the RESET and RB (Utts' Rainbow test), which indicate the existence of significant nonlinearities. Moreover, the Plosser-Schwert-White differencing test and White's information matrix test statistics can also be interpreted as supporting the existence of nonlinearities.

In the light of this somewhat conflicting evidence both on parameter stability and particularly on non-linearities we decided to estimate the piecewise-linear threshold specification for the reaction function by using the current account and the inflation rate alternatively as the threshold variable. Quite obviously, this specification does not exactly correspond to the alternative hypothesis in the stability and nonlinearity tests reported above. The idea of a threshold is not aimed to be a general remedy for instabilities and/or nonlinearities in the estimating specifications. A purpose of the threshold specification is to try - particularly in terms of the current account variable - to capture potential asymmetric reactions of the monetary authorities to current account deficits and surpluses. Not surprisingly, experiments did not indicate any meaningful threshold in terms of the inflation rate. With the exception of Italy, the sample split - which may formed by minimizing the residual variance - allocated less than 10 % of observations to the smaller sample.[8)] It is at least equally reasonably to consider these observations as mere outliers than as realizations of different policy regimes.

Clearly, the possible existence of outliers is a problem with the estimated reaction functions. In fact, OL-test statistics for the presence of outliers, presented in Table 1, suggest that there are indeed outliers in the data sample. Hence, we also estimated the reaction function (1) for each country by using the robust estimation technique. The robust estimation results are reported in Appendix 1. While there are some differences in the size and precision of coefficient estimates, the general picture is that they are very much similar to the OLS estimation results. In particular, the sum of the coefficients of inflation, output growth and the current account surplus seems to follow the same qualitative pattern.

Earlier we noticed that the parameter instability of the reaction function in terms of the inflation rate - reported in Table 1 - cannot be naturally understood by using the threshold specification. Therefore, in order to scrutinize this parameter instability a bit further, we also estimated for each country a variable parameter model, in which the coefficient of the inflation rate variable were allowed to vary over time according to AR(1) process, which assumption is consistent with the alternative hypothesis in the Watson-Davis test (see Watson and Engle (1985)). The corresponding estimation results are presented in Appendix 1. Again, while there are some differences in the size and precision of coefficient estimates, on the whole the results follow the same qualitative pattern than what is indicated by the OLS estimates. From the qualitative results we want to stress that both OLS, robust and variable-parameter estimates all indicate that (with the exception of USA) the current account deficit leads to tighter money, ceteris paribus.

After reporting the outlier and variable-parameter experiments of the reaction function let us now turn to consider the threshold model estimation results with the current account being the threshold variable. These estimation results of the specification (2) with one threshold value for each country are reported in Table 2. The following features of results merit attention. First, and perhaps most important, the existence of one threshold with respect to the current account variable is clearly confirmed, with USA being a sort of marginal case. The F-statistics computed for the threshold model - the null hypothesis being the linear model - indicate that the hypothesis

TABLE 2 Threshold Model Estimates of the Reaction Function

	FRG	Italy	Japan	USA	FRG	Italy	Japan	USA
Constant	-.015	-.466	-.410	-.344	.500	-.589	.166	-.327
	(0.05)	(0.81)	(2.20)	(1.54)	(2.86)	(1.84)	(1.19)	(2.35)
p	-.187	.600	-.033	.409	.165	.409	-.059	.281
	(0.98)	(2.46)	(0.51)	(2.92)	(1.64)	(3.13)	(1.25)	(3.23)
p(-1)	.220	-.589	.050	-.206	.089	-.212	.042	-.075
	(1.08)	(2.56)	(0.73)	(1.39)	(0.84)	(1.67)	(0.85)	(0.81)
y	.085	.145	.013	.255	.076	.062	.027	.158
	(1.34)	(1.80)	(0.29)	(5.17)	(2.28)	(1.51)	(0.27)	(5.13)
y(-1)	.257	.256	.083	-.028	.174	.127	.033	.008
	(4.20)	(3.48)	(1.88)	(0.61)	(5.74)	(3.11)	(1.03)	(0.29)
ca*	-.281	.422	-1.368	.670	-.403	-.328	-.976	.551
	(1.57)	(1.07)	(4.85)	(1.95)	(2.37)	(1.48)	(5.07)	(2.67)
ca**	.169	-.682	-.255	-.091	.056	-.164	.011	.107
	(0.49)	(1.87)	(1.42)	(0.25)	(0.56)	(0.92)	(0.08)	(0.43)
ca(-1)*	-.096	-.978	.316	-.630	.130	.383	.502	-.516
	(0.54)	(2.44)	(1.12)	(1.85)	(0.87)	(1.60)	(3.00)	(2.56)
ca(-1)**	-.194	.667	.296	.009	.006	-.059	-.038	-.126
	(0.53)	(2.13)	(1.72)	(0.03)	(0.05)	(0.35)	(0.27)	(0.53)
R2	.270	.441	.482	.316	.436	.429	.423	.395
DW	1.39	2.45	0.73	2.00	1.63	1.48	0.69	1.11
100*ca'	2.90	-1.10	-.40	-.40	.80	-1.90	.00	-.20
F(ca')	7.62	9.10	19.76	4.01	9.84	6.09	13.11	4.93
	(.999)	(1.000)	(1.000)	(.979)	(1.000)	(.996)	(1.000)	(.991)
F(0)	6.95	4.08	18.26	3.39	8.87	4.00	13.11	4.75
	(.998)	(.978)	(1.000)	(.963)	(1.000)	(.977)	(1.000)	(.989)
n1:ca < ca':n	67:83	24:70	10:88	39:116	47:83	13:70	21:88	47:116
dep.var.	RS	RS	RS	RS	RD	RD	RD	RD

The numbers in paretheses are asymptotic t-ratios. F denotes the F test statistic for the hypothesis that the parameter values for ca* and ca** as well as ca(-1)* and ca(-1)** are equal. F(0) is the same test statistic but now the threshold value ca' is set to 0. The values of cumulative PD are in parentheses.

according to which the coefficient estimates of the current account variable are equal below and above the threshold can be rejected at the standard significance level. The power of these F-tests here is somewhat unclear, hence some caution is needed in interpreting the corresponding test results. Second, and related, the explanatory power of the reaction function is now in each case higher than what is obtained for the linear reaction function (1). Moreover, the coefficient estimates are now considerably more precise. Notice that imprecise coefficient estimates were a problem in OLS estimation results of (1). Finally, as far as the size of coefficient estimates are concerned, it is of interest to scrutinize the sums of the coefficients of the current account variables ca* and ca(-1)* (and ca** and ca(-1)**). These sums turn out to be the following (the values for the discount rate are in parentheses):

	FRG	Italy	Japan	USA
optimal threshold				
ca < ca'	-.376	-.556	-1.052	.040
	(-.444)	(.055)	(-.473)	(.035)
ca > ca'	-.025	-.015	.041	-.082
	(.062)	(-.222)	(-.027)	(-.019)
threshold = 0				
ca < ca'	-.705	-.412	-1.000	.043
	(-.330)	(-.113)	(-.473)	(.037)
ca > ca'	.038	-.033	.044	-.009
	(.088)	(-.121)	(-.027)	(-.025)

Clearly, these numbers make a lot of sense. As one would expect, the current account variables affect the dependent variable considerably stronger in the case of deficits than in the case of surpluses the United States (and in the case of the discount rate, also Italy) being an exception to this general pattern. An obvious, though not a very satisfactory explanation, may lie in the fact that the monetary policy in the United States has not paid very much attention to the current account development due to the relative "closeness" of the economy compared with other countries of the data sample.

We also estimated for each country an extended threshold model with two threshold and thereby with three regimes, where the treasury bill rate was used as the dependent variable. Mostly, the explanatory power of the equations became better. This was reflected in the fact that the F test statistics for the hypothesis that are two thresholds instead of one turned out to be: 1.50 for Germany, 30.74 for Italy, 4.82 for Japan and 6.70 for the United States. Thus only the value for Germany fails to exceed the standard levels of significance. A major problem with "two threshold-three regime" reaction functions seems to be that typically it is difficult to interpret them meaningfully. Only in the case of Italy the "corridor" between the two thresholds is located around the zero current account. In other cases the threshold just seemed to pick up positive and negative extreme - outlier - observations. This conclusion is supported by the parameter estimates; they did not follow any systematic pattern. Thus we do not report them (for various specification of and tests for threshold models, see Tong (1983) and Luukkonen (1990)).[9)]

Overall, the results are encouraging. Both the OLS, robust and variable-parameter estimates of the reaction function suggest that the current account deficit lead to tighter money, ceteris paribus, with the United States being an exception. The threshold estimation results show, however, that the reaction function is non-linear in terms of the current account variable; monetary policy - proxied by the discount rate or by the treasury bill rate - reacts stronger to deficits than to surpluses and the coefficients relating to the current account become more precise when this asymmetricity is allowed. We are tempted to interpret findings as giving considerable support for the notion that - with the exception of USA - the current account has been a significant target for monetary policy over the observation period. Since the major effect of monetary policy is probably on private sector saving and investment, rather than on government balance, these data do not provide support for the hypothesis of Summers (1988) that it is fiscal policy that has been used to target the current account (see also Feldstein and Bacchetta (1989).

3 CONCLUDING REMARKS

Keeping the finding of Feldstein and Horioka (1980) - that countries' investment rates are highly correlated with their national saving rates - as a starting point, this paper has scrutinized the possibility that monetary policy reactions to target the current account might explain saving-investment correlations.

The OLS, robust and variable-parameter estimates of the linear reaction functions with quarterly data from Germany, Italy, Japan and the United States suggest - with the United States being an exception - that the current account deficit leads to tighter money, ceteris paribus. The threshold estimation results indicate, however, that the reaction function is non-linear in terms of the current account variable: allowing for non-linearity makes the performance of the reaction function better and parameter estimates more precise. Moreover, there is an asymmetricity in the following sense; interest react stronger to deficits than to surpluses. This is turn suggests that empirical policy reaction functions are more complicated than what is customary assumed in the literature. The generally rather poor results, which has been obtained with these functions, may just result from misspecification of the functional form. We are tempted to interpret findings as giving considerable support for the notion that the current account has been a significant target for monetary policy and might explain the high saving-investment correlations even in the presence of mobile international capital movements.

There is obviously room for further research in the area. The reaction functions should be estimated to a larger set of countries in order to check the robustness of results. Also with potential asymmetricities the issue of how uncertainty affects policy reactions would seem to be a worthwhile subject for empirical investigation.

FOOTNOTES

1) Naturally, in terms of policy implications it matters very much which explanation is adopted. With low international capital mobility interpretation (a) policies to promote domestic saving should also raise domestic investments. But if correlations reflect private sector behaviour in the presence of high international capital mobility, then policy-induced changes in domestic saving will tend to flow abroad. The possibility that governments have been targeting the current account not only raises the question of optimality of such a policy, but also makes it difficult to analyze the effects of e.g. various tax policies.

2) It is difficult to provide direct tests for the low international capital mobility explanation. A piece of evidence against the hypothesis of capital immobility is that saving-investment correlations are higher for industrial countries with rather well-functioning capital markets than for the developing countries (see e.g. Dooley, Frankel and Mathieson (1988). Moreover, it is useful to point out that the perfect capital mobility alone does not necessarily imply a negligible effect of autonomous shifts in domestic saving on domestic investments. The additional assumption that the country is small relative to the world capital market is also needed. If the country is large enough, then e.g. a rise in her domestic saving will decrease the world interest rate and thereby increase investments. Thus in terms of saving-investment correlations there should be some distinction between groups of large and small countries. Murphy (1984) provides some - though far from conclusive - evidence in favour of "country-size hypothesis".

3) Recently, Black (1983) has also estimated monetary policy reaction functions for ten industrial countries by relying to a sort of threshold regression technique suggested originally by Dagenais (1969), (1975). The idea is that the dependent variable is equal to some linear function of observable variables plus a disturbance if a change in the value of the dependent variable exceeds some critical value. Otherwise, the dependent variable is unchanged. A motivation for this technique is that policy variables often undergo discrete changes and then remain fixed for a time until another discrete change occurs. One other difference between Black (1983) and our paper is that Black uses monthly data from the early 1960's to the late 1970's, while we use quarterly data. Moreover, we estimate the reaction functions by using both the official discount rate - as in Black (1983) - and the three-month treasury bill rate as the dependent variable.

4) For implications of asymmetric less functions, see Waud (1970) and Hosomatsu (1980).

5) For a review of most of the tests, which are reported in the context of Table 1, see Krämer and Sonnberger (1986).

6) For the TSAY (1987) test, see e.g. Petruccelli (1990).

7) The threshold estimations with inflation as the threshold variable gave the following sample split of observations, when the residual variance was minimized: Germany 8/83, Italy 24/70, Japan 9/88 and USA 3/116.

8) A complete set of results is available from the authors upon request.

9) See footnote 8.

APPENDIX 1

Robust Estimation Results of the Reaction Function

	FRG	Italy	Japan	USA	FRG	Italy	Japan	USA
Constant	.420	-.527	-.065	-.398	-.264	-.337	-.121	-.376
	(1.49)	(1.68)	(0.36)	(3.78)	(1.63)	(1.36)	(1.02)	(4.27)
p	-.343	.369	-.004	.348	.128	.196	-.00	.281
	(1.93)	(3.00)	(0.06)	(3.67)	(1.26)	(2.01)	(0.04)	(3.55)
p(-1)	-.141	-.234	.071	-.106	.037	-.134	.055	-.057
	(0.77)	(1.88)	(1.06)	(1.05)	(0.36)	(1.35)	(1.27)	(0.68)
y	.037	.089	.004	.179	.059	.050	.025	.161
	(0.64)	(2.06)	(0.10)	(5.39)	(1.76)	(1.45)	(0.87)	(5.80)
y(-1)	.180	.121	.075	.034	.156	.105	.042	.010
	(3.24)	(3.02)	(1.72)	(1.11)	(4.89)	(3.29)	(1.49)	(0.40)
ca	-.118	-.068	-.491	.218	-.016	-.201	-.300	.348
	(0.84)	(0.48)	(3.17)	(1.29)	(0.20)	(1.81)	(2.99)	(2.47)
ca(-1)	-.055	-.150	.379	-.201	.000	.082	.234	-.323
	(0.36)	(1.05)	(2.53)	(1.18)	(0.00)	(0.72)	(2.41)	(2.28)
R2	.158	.280	.270	.283	.286	.307	.229	.339
SEE	1.080	2.232	.771	.817	.561	1.103	.525	.497
D-W	1.295	2.135	1.304	2.005	1.571	2.368	1.461	2.076
Dep.var.	RS	RS	RS	RS	RD	RD	RD	RD

Huber's (1964) M-estimator is used. Numbers in parentheses are asymptotic Huber (1973) t-ratios. The tuning constant is 1.345 for all countries.

Variable Parameter Estimates of the Linear Model

	FRG	Italy	Japan	USA	FRG	Italy	Japan	USA
b_0	.161	-.352	-.192	-.315	-.377	.457	-.147	-.251
	(.271)	(.319)	(.193)	(.082)	(.146)	(.238)	(.120)	(.061)
a_{1p}	.307	.326	.610	.023	-.341	-.145	.421	-.190
	(.337)	(.221)	(.161)	(.381)	(.254)	(.145)	(.161)	(.364)
a_{op}	-.166	.264	-.041	.173	.083	.307	-.003	.128
	(.135)	(.164)	(.046)	(.112)	(.118)	(.173)	(.039)	(.091)
var(q)	.210	.02	.084	.102	.063	.065	.068	.017
	(.123)	(.053)	(.035)	(.050)	(.035)	(.030)	(.022)	(.019)
$a_{1p}(-1)$	.537	.026	.354	.107	.712	.008	.553	.140
	(.252)	(.163)	(1.036)	(.254)	(.124)	(4.502)	(.438)	(.178)
$a_{op}(-1)$	.048	-.301	.063	.054	.075	-.148	.025	.082
	(.106)	(.216)	(.108)	(.098)	(.054)	(.699)	(.031)	(.063)
var(q(-1))	.289	.282	.000	.190	.128	.000	.006	.084
	(.151)	(.087)	(.014)	(.059)	(.051)	(.020)	(.009)	(.026)
b_y	.037	.066	.035	.105	.042	.065	.034	.078
	(.048)	(.060)	(.042)	(.030)	(.025)	(.040)	(.027)	(.029)
$b_{y(-1)}$	.103	.068	.077	.044	.087	.116	.036	.048
	(.043)	(.059)	(.045)	(.025)	(.022)	(.035)	(.029)	(.020)
b_{ca}	-.126	-.327	-.275	.151	-.107	-.193	-.080	.172
	(.110)	(.184)	(.148)	(.162)	(.057)	(.133)	(.092)	(.111)
$b_{ca(-1)}$	.057	.082	.233	-.113	.143	.037	.034	-.128
	(.121)	(.175)	(.142)	(.165)	(.065)	(.133)	(.088)	(.114)
var(e)	.173	.001	.173	.029	.026	.291	.046	.028
	(.072)	(.162)	(.043)	(.017)	(.014)	(.139)	(.016)	(.011)
R2	.262	.252	.461	.186	.178	.342	.160	.215
DW	1.747	1.953	1.638	1.874	1.864	2.208	1.867	2.051
Dep.var.	RS	RS	RS	RS	RD	RD	RD	RD

Numbers in parentheses are asymptotic standard errors. The coefficients of the inflation rate variables p and p(-1) are specified as follows: $b_{p,t} = a_{op} + a_{1p}b_{p,t-1} + q_t$.

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