Are Preliminary Monetary Announcements in Switzerland Rational?

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I. Introduction

Each month the Swiss National Bank (SNB) releases preliminary figures of the monetary stock. These figures provide a vital source of information for SNB decisionmaking. As is commonly known, these preliminary figures are subject to uncertainty or error. In particular cases first published data are revised at a later date in which errors can be observed and corrected. In other instances the error remains in the final figure. Consequently, there exists the danger that, because of error or uncertainty, the central bank will misjudge a preliminary figure and therefore take inappropriate action, or fail to take appropriate action.

The issue of examining the news content of the preliminary figures is especially important for Switzerland because of its policy of monetary targeting.[1] In particular we are interested in determining whether the preliminary estimates satisfy the criteria of efficient forecasts or observations with random measurement errors. Previous studies by *Mankiw, Rundle* and *Shapiro* (1984) and *Milbourne* and *Smith* (1989) find for the U.S. and Canada that the revision is forecastable using unformation available at the time the preliminary announcement is made. Seasonal components and interest rates are found to be a leading indicator of the revisioned monetary aggregates.

The structure of the paper is as follows. A brief overview of how the preliminary figures for $M1$, $M2$ and $M3$ are constructed is presented in section two. Section three tests the errors-in-variables hypothesis. The hypothesis states that the preliminary figure is viewed as the true value plus an error or

[1] Since 1973 the SNB has always conducted a policy of base targeting even during the 1975 - 1979 period when $M1$ was the official target variable (see *Rich* and *Beguelin*, 1985). Although $M2$ and $M3$ have not played a prominent role in the discussion of Swiss monetary policy, it is of interest to examine the viability of the other aggregates.

revision term which is uncorrelated with the true value. Section four tests whether the preliminary monetary stocks are rational forecasts. Lastly, section five concludes the paper.

II. Publication Schedule and Construction of the Preliminary Estimates

The preliminary estimates for $M1$, $M2$ and $M3$ are released monthly and are published in the SNB's "Monatsbericht".[2] The revision process of the monthly figures is carried out once a year. Since 1985 the figures occasionally undergo more than one revision. Reliable monthly figures of the monetary stocks date back only to 1975. The examined period from 1975:1 to 1987:12 uses the first published and final revised figures. All data are monthly and non-seasonally adjusted.

The SNB calculates the preliminary monetary figures from the monthly balance sheets of 69 banks and from the annual balance sheets of all banks registered in Switzerland.[3] The share of the 69 banks of the total banks is determined for all the relevant components of the various monetary stocks based on the annual balance sheets of the previous year. To estimate the preliminary figures, the sum of the 69 monthly balance sheets is extrapolated with the (inverse of the) respective weight. To determine the final monthly values of the monetary aggregates, the SNB compares December's preliminary estimate with the components derived from the annual balance sheets from all the registered banks. The difference in the components of the monetary stock is then linearly interpolated to render the final value.

The introduction of new information is one reason why monetary aggregates are revised. A further reason stems from the fact that the SNB occasionally changes the definition of a particular aggregate. Three definitional changes in the monetary aggregates occurred on December 1984. The first change concerns the inclusion of Fürstentum Liechtenstein into the Swiss franc currency domain. Liechtensteinian banks were already aggregated as a part of the SNB's bank statistic and therefore no changes in the monetary aggregates were required. The deposits of Liechtensteinians in Switzerland, however, needed to be added to the individual monetary aggregates. These

[2] As of 1986 the Swiss money stocks are defined as follows: $M1$ = Currency in circulation plus sight deposits in Swiss francs (without precious metals) held by the resident non-bank public. $M2$ = $M1$ plus time deposits in Swiss francs held by the resident non-bank public. $M3$ = $M2$ plus savings deposits (including salary accounts) held by the resident non-bank public.

[3] Originally there were 71 banks, since 1975 two mergers have taken place.

additions mounted to an increase in $M1$ by a half of a percent and $M3$ by two percent.

The second definitional change in the monetary aggregates concerns the proper accounting of salary accounts. Swiss banks first introduced these highly liquid and interest bearing accounts in the early 1960s. The introduction of these accounts created a problem for the monetary aggregates in so far that banks elected to define them either as sight (i.e. belonging to $M1$) or as savings deposits (i.e. belonging to $M3$). This problem of inconsistent accounting was exacerbated over the years because banks themselves often changed their accounting procedures. It was only at the end of 1984 that the SNB classified all salary accounts as a component of $M3$ (see *Birchler,* 1985).

Ideally monetary aggregates should only include accounts which are denominated in Swiss domestic currency. The elimination of foreign currency accounts was the last important definitional change. In 1984 foreign currency (sight and terminal) accounts were a part of $M2$ and $M3$. The elimination of these accounts from the monetary aggregates resulted in a reduction of 15 and 7 percent in $M2$ and $M3$.[4]

The actual and preliminary series are plotted in (log) levels for the three monetary aggregates in figures 1 - 3. Figure 1 shows that actual and preliminary $M1$ move closely together both at the seasonal frequency (a strong end of year pattern exists) and in the long run. The effects of the 1984 revision are identifiable in figures 2 and 3. The preliminary estimates for $M2$ and $M3$ drop sharply at the end of 1984. The large differences particularly between actual and preliminary $M2$ stems from the fact that the true monetary series were recalculated taking into account the 1984 revisions, whereas the preliminary estimates were not. In our hypothesis tests, a definitional change may show up as a persistent error in the money stock, but it need not show up as an error in the rate of money growth.

[4] For further discussion of the definitional changes, see SNB (1985), SNB (1982), and SNB (1975).

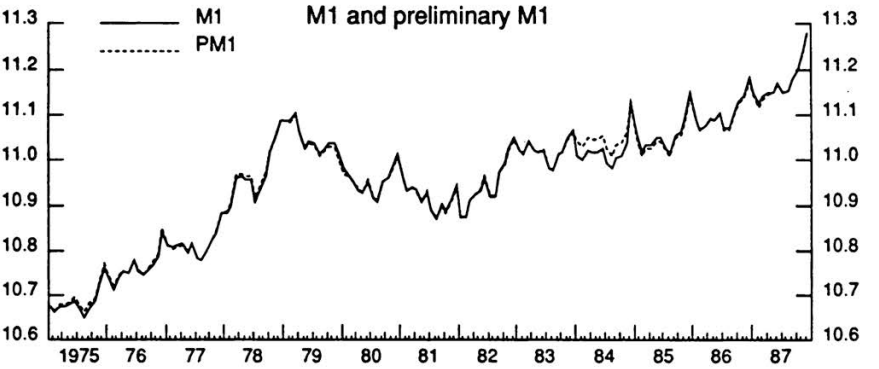

Figure 1

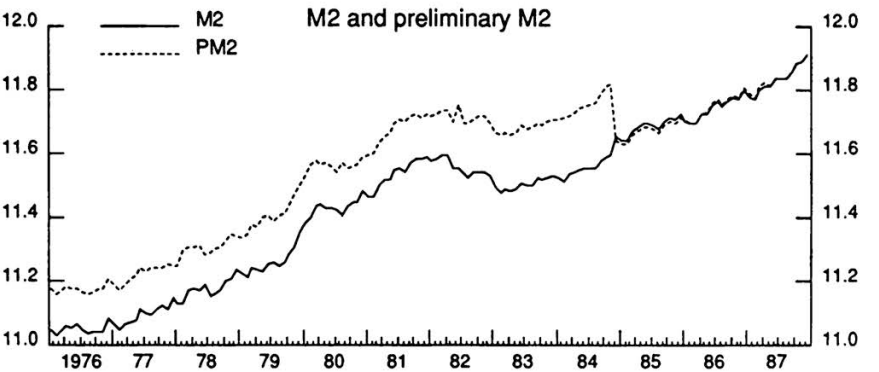

Figure 2

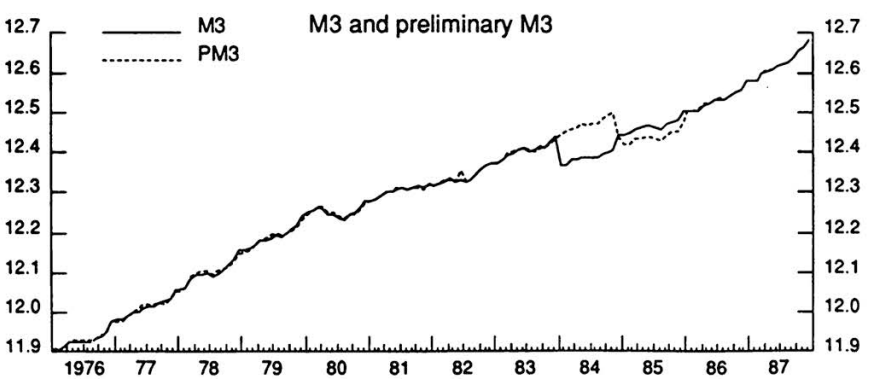

Figure 3

III. Testing the Errors-In-Variables Hypotheses

In *Mankiw, Rundle* and *Shapiro* (1984) and *Milbourne* and *Smith* (1989), the errors-in-variables hypothesis is defined as the joint hypothesis:

$$RM_t = M_t^* + \nu_t , \tag{1}$$

$$RM_t = M_t . \tag{2}$$

where M_t^* denotes the true value of the monetary aggregate, RM_t defines the estimate of the variable suggested by available past information and M_t is the announced preliminary figure. In equation (1) the error term is assumed to be random and uncorrelated with the true figure.[5] Equating equations (1) and (2) then implies (with a constant added) regression (3):

$$M_t = \alpha_0 + \alpha_1 M_t^* + \varepsilon_t , \tag{3}$$

with the restriction

$$H_o : \alpha_0 = 0, \ \alpha_1 = 1, \tag{4}$$

under the null hypothesis of errors-in-variables.[6]

Money stock series generally follow a unit root process. Hence if they are non stationary with a unit root, inference under the normal distribution is no longer valid for equation (3). Two types of unit root tests were conducted to determine whether one needs to perform the tests in first differences or levels. The results of the *Dickey Hasza Fuller* (1984) test for a seasonal (monthly) unit root and the Augmented *Dickey Fuller* (1981) test for unit roots are given in Table 1. The test for seasonal unit roots, denoted by DHF (p), rejects the null hypotheses of a 12th-order unit root for each series. The Augmented Dickey Fuller [ADF(p)] test, however, is unable to reject the null hypothesis of unit roots. As a further test is to see whether M_t and M_t^* move closely together over time, cointegration tests were performed. The presence of measurement error will obviously weaken the cointegration test

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[5] Generally, one cannot identify, whether the bank announces its forecast RM_t or some combination of RM_t and other information (W_t)

$$RM_t = \lambda M_t + (1 - \lambda) W_t .$$

Since we know with certainty that $\lambda = 1$, this equation can be excluded from the hypothesis.

[6] The preliminary figure for each month appears the following month. For matters of simplicity, M_t and M_t^* refer to the preliminary and final figure of the money stock at time t.

(see *Fischer* 1990). Cointegration is found for $M1$, but not for $M2$ and $M3$ reconfirming the behavior of the monetary aggregates depicted in figures 1 - 3. These results imply that one needs to estimate the errors-in-variables hypothesis in growth rates rather than levels.[7] The growth-rate formulation results in a loss of power since H_o could hold in growth rates with $\alpha_0 \neq 0$ in levels.

Table 1: Unit Root Tests

	M1	M1 prov	M2	M2 prov	M3	m3prov	C.V.
DHF(p)	-4.71(1)	-4.79(1)	-5.61(1)	-8.59(1)	-4.54(1)	-4.45(2)	-4.11
ADF(p)	-0.83(3)	-0.82(1)	-0.16(4)	-0.85(0)	-0.82(0)	-0.52(1)	-3.11
EG(p)	-3.65(1)		-2.15(2)		-2.81(1)		-3.51

Notes: The *Dickey Hasza Fuller* test, the Augmented *Dickey-Fuller* test and the *Engle Granger* Cointegration test (with a pth-order lag) are denoted by DHF(p), ADF(p) and EG(p).

The use of first differenced data can introduce a MA(1) error in equation (3). In the presence of a MA process, OLS is consistent, though not efficient. The standard correction procedure derives a consistent estimate of the true variance-covariance matrix following the *Hansen* (1982) GMM procedure. Before implementing this procedure in an ad hoc manner, we test for the presence of a MA(1) process in the residuals of $\Delta M^*_t - \Delta M_t$. These results are summarized in Table 2.

The coefficients for the MA(1) and MA(2) processes are all insignificant for $M1$ and $M3$. Their coefficients are denoted by $B(1)$ and $B(2)$ in Table 2. To test the sensitivity of our sample, two breakpoints were selected. The first covers the period before the definitional changes in the monetary aggregates were introduced in December 1984. The second sub-sample from 1980:1 to 1987:12 covers the period when the SNB officially targeted the monetary base. The Ljung Box test does not detect any higher-order serial correlation for $M1$. Serial correlation at the higher orders is present for $M3$, suggesting that seasonality may be a problem. For $M2$ the MA(1) coefficients are highly significant particularly for the 1976:2 - 1984:11 period. Based on these results only for $M2$, covering the 1976:2 - 1984:11 period, is the GMM correction implemented for hypothesis testing.

[7] The fact that cointegration arises does not exclude the possibility of estimating equation (3) in levels (see *Fischer*, 1989). *Banerjee* et al. (1986) and *Stock* (1987), however, show that strong coefficient biases exist even when the sample size increases.

Table 2: MA Specification Tests

M1	B(1)	B(2)	Ljung Box (18)
1975:2-1987:12	-0.058		19.20
	(0.083)		
	-0.059	0.018	20.03
	(0.083)	(0.083)	
1975:2-1984:11	0.018		7.54
	(0.098)		
	0.022	0.057	7.29
	(0.097)	(0.097)	
1980:1-1987:12	-0.023		18.04
	(0.102)		
	-0.022	0.028	18.26
	(0.102)	(0.102)	
M2			
1976:2-1987:12	0.148		12.73
	(0.086)		
	0.139	0.063	11.83
	(0.086)	(0.087)	
1976:2:-1984:11	0.677**		27.97
	(0.073)		
	0.664**	0.007	27.65
	(0.098)	(0.092)	
1980:1-1987:12	0.103		2.99
	(0.101)		
	0.098	0.043	2.84
	(0.101)	(0.101)	
M3			
1976:2-1987:12	-0.075		32.56*
	(0.083)		
	-0.081	0.047	32.57*
	(0.083)	(0.083)	
1976:2-1984:11	0.052		9.54
	(0.097)		
	0.048	0.052	9.55
	(0.097)	(0.097)	
1980:1-1984:12	-0.077		24.70
	(0.102)		
	-0.084	0.050	25.56
	(0.101)	(0.101)	

Notes: $B(1)$ and $B(2)$ are the coefficients from the MA process. Standard errors are given in parentheses. The Box Ljung test is distributed chi-square (18) and tests for the presence of 18th order serial correlation. ** and * denote significance at the 1 and 5 % level.

The empirical results for the errors-in-variables hypothesis are summarized in Table 3. An F-Test denoted by F is used to test the restrictions given in (4). At the 5 percent significance level, the data clearly reject the hypothesis that the preliminary values can be viewed as final values plus an uncorrelated error term. The errors-in-variables hypothesis is rejected for all three aggregates for all the sub-periods. The errors-in-variables hypothesis is particularly unsatisfactory for $M2$ and $M3$.

Table 3: Empirical Results for the Errors-In-Variable Hypothesis

Regressand	Regressor	α_0	α_1	DW	R^2	se	F	sample
$\Delta m1_t$	$\Delta m1^*_t$	0.00023	0.93817	1.93	.97	0.41	15.4**	1975:2-1987:12
		(0.00035)	(0.02852)					
$\Delta m1_t$	$\Delta m1^*_t$	0.00036	0.96348	2.11	.96	0.38	5.7**	1975:2-1984:11
		(0.00053)	(0.02638)					
$\Delta m1_t$	$\Delta m1^*_t$	0.00031	0.91693	1.87	.96	0.39	13.3**	1980:1-1987:12
		(0.00042)	(0.03860)					
$\Delta m2_t$	$\Delta m2^*_t$	0.00307	0.34172	2.11	.07	2.13	17.1**	1976:2-1987:12
		(0.00119)	(0.26521)					
$\Delta m2_t$	$\Delta m2^*_t$	0.00414	0.49601	2.34	.27	1.47	21.8**	1976:2-1984:11
		(0.00178)	(0.08817)					
$\Delta m2_t$	$\Delta m2^*_t$	0.00230	0.33567	2.08	.05	2.39	10.28**	1980:1-1987:12
		(0.00160)	(0.44059)					
$\Delta m3_t$	$\Delta m3^*_t$	0.00382	0.29422	1.66	.09	0.96	29.4**	1976:2-1987:12
		(0.00189)	(0.33046)					
$\Delta m3_t$	$\Delta m3^*_t$	0.00417	0.43163	2.17	.31	0.69	23.0**	1976:2-1984:11
		(0.00330)	(0.53904)					
$\Delta m3_t$	$\Delta m3^*_t$	0.00397	0.15390	1.87	.30	0.02	36.8**	1980:1-1987:12
		(0.00166)	(0.33745)					

Notes: lower-case letters denote natural logarithms. The standard errors are given in parentheses. The standard errors are corrected using the GMM procedure for the 1976:2 - 1984:11 period for $M2$. F denotes an F-test, under the null hypothesis $\alpha_0 = 0$ and $\alpha_1 = 1$. Significance at the 1 and 5 % level is denoted by ** and *.

IV. Testing the Rational Forecast Hypothesis

To the test hypothesis that M_t, is a rational forecast, tests for unbiasedness and efficiency are conducted. The test for unbiasedness is performed by running the following regression:

$$\Delta M^*_t = \beta_0 + \beta_1 \Delta M_t + \mu_t , \tag{5}$$

with the null hypothesis that

$$H_o : \beta_0 = 0, \ \beta_1 = 1. \tag{6}$$

Under the null hypothesis of unbiasedness the revision is uncorrelated with the preliminary figure.[8]

Table 4 presents the results of the tests for unbiasedness. Again, an F-test is used to test the joint restrictions of $\beta_0 = 0$ and $\beta_1 = 1$. The null hypothesis is not rejected for $M1$ at the 5 percent significance level. The preliminary estimates for $M2$ and $M3$ are found to be biased and they over-predict the final values for all the selected sample periods.

Table 4: Empirical Results for the Test of Unbiasedness

Regressand	Regressor	β_0	β_1	DW	R^2	se	F	sample
$\Delta m1^*_t$	$\Delta m1_t$	-0.00014	1.04006	1.94	.97	0.43	2.11	1975:2-1987:12
		(0.00035)	(0.02043)					
$\Delta m1^*_t$	$\Delta m1_t$	-0.00031	1.02398	2.04	.99	0.39	1.46	1975:2-1984:11
		(0.00040)	(0.01590)					
$\Delta m1^*_t$	$\Delta m1_t$	-0.00026	1.03861	1.90	.97	0.35	3.02	1980:1-1987:12
		(0.00051)	(0.03330)					
$\Delta m2^*_t$	$\Delta m2_t$	0.00494	0.21116	2.21	.07	2.13	76.9**	1976:2-1987:12
		(0.00354)	(0.06377)					
$\Delta m2^*_t$	$\Delta m2_t$	0.00196	0.53165	2.54	.27	1.43	34.6**	1976:2-1984:11
		(0.00254)	(0.12789)					
$\Delta m2^*_t$	$\Delta m2_t$	0.00511	0.15606	2.10	.05	2.39	75.8**	1980:1-1987:12
		(0.00440)	(0.54672)					
$\Delta m3^*_t$	$\Delta m3_t$	0.00376	0.30820	2.05	.97	0.96	35.6**	1976:2-1987:12
		(0.00094)	(0.39022)					
$\Delta m3^*_t$	$\Delta m3_t$	0.00070	0.71657	2.09	.89	0.68	36.1**	1976:2-1984:11
		(0.00087)	(0.11451)					
$\Delta m3^*_t$	$\Delta m3_t$	0.00386	0.16432	2.12	.02	0.02	35.2**	1980:1-1987:12
		(0.00305)	(0.45399)					

Notes: Lower-case letters denote natural logarithms. The standard errors are given in parentheses. The standard errors are corrected using the GMM procedure for the 1976:2 - 1984:11 period for $M2$. F denotes an F-test, under the null hypothesis $\beta_0 = 0$ and $\beta_1 = 1$. Significance at the 1 and 5 % level is denoted by ** and *.

[8] The test of unbiasedness and errors-in-variables is mutually exclusive only when the preliminary estimate is efficient.

If M_t, is an efficient estimate of M_t^*, then the prediction error $(M_t^* - M_t)$ should be uncorrelated with any information available at the time when M_t is formed. To test whether M_t is efficient, the following regression is performed:

$$(7) \qquad (\Delta M_t^* - \Delta M_t) = \gamma_1' \Delta W_t + \gamma_2' \Delta W_{t-1} + \nu_t ,$$

where W_t is a vector of variables known to be related to M_t^*. If M_t is efficient, the orthogonality constraint $\gamma_1 = \gamma_2 = 0$ holds.[9] In the rational expectations literature, equation (7) is often called the test for semi-strong efficiency.

The results of the efficiency tests are summarized in Table 5 (only the *F*-tests are given). Studies by *Mankiw, Rundle,* and *Shapiro* (1984) and *Milbourne* and *Smith* (1989) find that seasonal components are an important source of information for predicting the final revision. We also find this to be an important factor for $M2$ and $M3$. The seasonal dummies are significant for several subperiods. The orthogonality test for seasonality in $M1$ is significant for the 1980:1 - 1987:12.

Other variables such as prices, interest rates and exchanges rates were also considered in the orthogonality tests. Price changes and short-term interest rates were found to be insignificant for all aggregates. The change in the dollar/Swiss franc exchange rate and its forward premium along with the long-term interest rate were found to be significant factors in predicting the final revisions of $M2$ for the period up to 1984. This result can be partially explained by the fact that foreign accounts were eliminated after the 1984 revision.

V. Conclusions

The empirical findings give rise to several conclusions. The fact that preliminary estimates of $M1$ are rational forecasts suggests that they provide timely and reliable information for the Swiss monetary authorities. Had $M1$ continued to have been the targeted variable during the 1980s, the SNB would have made relatively few policy mistakes due to conflicting signals between the preliminary and final revised figures. Hence the switch in operating procedures from $M1$ to base targeting in 1980 did not stem from a lack of reliability of the preliminary estimates, but due to the SNB's desire to seek a target which is directly controllable.

[9] Implicitly we are imposing the unbiasedness condition in (7). Empirically, whether we regress (7) or $\Delta M_t^* = \Delta M_t + \gamma_1' \Delta W_t + \gamma_2' \Delta W_{t-1} + \nu_t$ has no bearing on our results of the efficiency tests.

Table 5: Empirical Results of the Orthogonality Tests

Regressand	Regressor	F_{m1}	F_{m2}	F_{m3}	sample
$\Delta m^*_t - \Delta m_t$	Monthly seasonals	1.77	2.99*	2.49*	1975:2-1987:12
	(S1,S2,...S11)	1.44	4.01*	2.57*	1975:2-1984:11
		2.50*	1.43	1.27	1980:1-1987:12
$\Delta m^*_t - \Delta m_t$	Inflation	0.73	1.52	0.82	1975:2-1987:12
		0.55	0.92	0.49	1975:2-1984:11
		0.85	1.73	0.48	1980:1-1987:12
$\Delta m^*_t - \Delta m_t$	Δp_t	0.25	0.32	0.04	1975:2-1987:12
		0.85	1.16	0.75	1975:2-1984:11
		0.02	0.37	0.02	1980:1-1987:12
$\Delta m^*_t - \Delta m_t$	change in	0.75	2.69	0.60	1975:2-1987:12
	Long-term Interest Rates	0.91	6.36**	0.65	1975:2-1984:11
		0.38	1.19	0.12	1980:1-1987:12
$\Delta m^*_t - \Delta m_t$	change in	0.56	0.93	0.01	1975:2-1987:12
	short-term interest rates	0.68	1.03	0.04	1975:2-1984:11
		0.14	0.28	0.01	1980:1-1987:12
$\Delta m^*_t - \Delta m_t$	change in	0.26	0.47	0.21	1975:2-1987:12
	sfr./dollar exchange rate	0.90	9.34**	1.06	1975:2-1984:11
		0.17	0.01	0.18	1980:1-1987:12
$\Delta m^*_t - \Delta m_t$	change in	0.26	0.20	0.16	1975:2-1987:12
	forward premium	0.11	4.68**	0.71	1975:2-1984:11
	sfr./dollar exchange rate	0.66	0.22	0.05	1980:2-1987:12

Notes: All variables except interest rates were transformed into logs. The inflation variable was derived using the Swiss CPI. The short-term interest rate is the 3-month Euro rate. The long term rate is a 5-government bond. All variables were taken from the SNB data bank. The sample length for $M2$ and $M3$ begins 1976:2. The standard errors are corrected using the GMM procedure for the 1976:2 - 1984:11 period for $M2$. Significance at the 1 and 5 % level is denoted by ** and *. F_{m1}, F_{m2}, F_{m3} denote F-tests, under the null hypothesis $\gamma_1 = 0$ and $\gamma_2 = 1$ for the respective aggregates.

The preliminary estimates for $M2$ and $M3$ suffer from problems of bias and efficiency. Structural information can improve these preliminary forecasts, particularly for the pre 1984 period. The inclusion of interest rates, seasonal components and exchange rates can increase the efficiency of the forecasts, and thereby reduce the danger of inappropriate policy action on the part of the SNB in misjudging the preliminary figures.

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Zusammenfassung

Sind vorläufige geldpolitische Ankündigungen in der Schweiz rational?

Es werden für die Schweiz mehrere Hypothesen bezüglich des Informationsgehalts von vorläufigen Schätzwerten für die Geldmengenziele $M1$, $M2$ und $M3$ untersucht. Unsere Tests erlauben es uns nicht, die rationale Schätzhypothese für den vorläufigen $M1$-Wert zu verwerfen. Die Hypothesen sowohl für die in den Variablen enthaltenen Fehler als auch für rationale Prognosen werden für die vorläufigen Werte für $M2$ und $M3$ unter Hinweis darauf abgelehnt, daß diese Schätzungen ineffizient sind. Saisonale Faktoren, langfristige Zinssätze und Wechselkurse werden als Leitindikatoren für eine Revision der Geldmengenziele $M2$ und $M3$ erkannt.

Summary

Are Preliminary Monetary Announcements in Switzerland Rational?

Several hypotheses regarding the information content of preliminary $M1$, $M2$ and $M3$ estimates are examined for Switzerland. Our tests are unable to reject the rational forecast hypothesis for the preliminary $M1$ figures. Both the errors-in-variables and rational forecast hypotheses are rejected for the preliminary figures of $M2$ and $M3$, suggesting that these estimates are inefficient. Seasonal factors, long-term interest rates and exchange rates are found to be a leading indicator for $M2$ and $M3$ revisions.

Résumé

Les annonces provisoires monétaires en Suisse sont-elles rationelles?

Plusieurs hypothèses concernant le contenu des informations sur les estimations provisoires de $M1$, $M2$ et $M3$ sont examinées ici pour la Suisse. Nos tests sont incapables de rejeter l'hypothèse de prévision rationelle pour les chiffres provisoires de $M1$. Aussi bien les variables d'erreurs («errors-in-variables») que les hypothèses de prévision rationelles sont rejetées pour les chiffres provisoires de $M2$ et $M3$, insinuant que ces estimations sont inefficaces. Des facteurs saisonniers, les taux d'intérêt à long terme et les cours de change sont considérés comme un indicateur principal pour des révisions de $M2$ et $M3$.