Asymmetric Effects of Monetary Policy in Switzerland

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1. INTRODUCTION

One strand of the literature on real effects of monetary policy focuses on asymmetries in the response of output to money-supply shocks. In particular, theoretical and empirical work suggests that output reacts asymmetrically to monetary expansions and contractions and that the magnitude of the monetary shocks as well as the current state of the economy contribute to this asymmetry. The idea that monetary policy has asymmetric effects on real activity has a long tradition[1] and is usually attributed to a convex aggregate supply curve resulting from downwardly rigid nominal wages and prices. This traditional view predicts that positive monetary shocks are neutral, whereas negative shocks have a contractionary effect on output.

More recently, the theoretical underpinnings of the convex shape of the aggregate supply have been studied in greater detail. This line of research has produced models with costly price adjustment and trend inflation. In standard menu-cost models, like that of MANKIW (1985), relatively small monetary shocks do not lead to nominal price adjustments and, therefore, induce real effects. This is different if the shocks are big, as the cost of keeping nominal prices unchanged is higher than the price adjustment costs. These type of models therefore imply asymmetric effects of small vs. large shocks. Going one step further, BALL and MANKIW (1994) developed a dynamic menu-cost model with trend inflation which predicts that only small negative shocks have real effects. The reason for this is that in the presence of trend inflation the gap between desired and actual relative prices is larger after positive shocks than after negative shocks. Therefore, firms incur the cost of adjusting prices in the case of positive shocks even if these are small.

The empirical literature on asymmetric effects of monetary policy has tested for the presence of the above-mentioned types of asymmetries in a variety of ways. COVER (1992) and DELONG and SUMMERS (1988) find that in the U.S. negative money-supply shocks have a stronger effect on output than positive money-supply shocks. They define monetary shocks as unanticipated changes of monetary aggregates. A similar approach is used by KARRAS (1996) who also finds asymmetry in a panel of 38 countries.

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1. See MORGAN (1993) for an overview of the history on asymmetric effects.

Some authors measure monetary policy differently. Using the Boschen-Mill index as an indicator of the stance of monetary policy, MORGAN (1993) shows that tight money has stronger effect on real output than loose money. MACKLEM et al. (1996) find that asymmetric effects are also present in Canada. Their results are based on the yield spread as a measure of the stance of monetary policy.

Extending the framework to allow the asymmetry to depend on expected inflation RHEE and RICH (1995) confirm the predictions of BALL and MANKIW (1994), their results point to a positive relation between the degree of asymmetry and the level of trend inflation. The results of RAVN and SOLA (1996) point to a similar conclusion as they find that only small negative monetary shocks have real effects. It is worth mentioning that in contrast RHEE and RICH (1995), who use M1 as the monetary variable, RAVN and SOLA (1996) find that their results depend critically on choosing the federal funds rate to measure monetary policy.

With two exceptions,[2] the empirical work on asymmetric effects has largely concentrated on U.S. data. It is therefore useful to ask whether the same results hold for Switzerland where the monetary authority generally uses different policy instruments from those used in the U.S. and operates in a very different setting with respect to the openness of the economy and its institutional environment. This is the objective of this work. In order to identify positive and negative monetary shocks and to assess the degree of asymmetry of their effects in Switzerland, this study uses the methodology proposed by COVER (1992). This amounts to estimating simultaneously the output and money-supply processes through use of a nonlinear interactive variable representing the positive and negative money-supply shocks. The stability of the results with respect to two different formulations of the money-supply equations is evaluated with the result that asymmetric effects are only found when net exports enter the money-supply process.

The rest of the paper is organized as follows. Section 2 discusses some issues in estimating money-supply processes and presents the equations used for estimation. The empirical results are presented in Section 3 and Section 4 draws conclusions.

2. ESTIMATING THE MONEY-SUPPLY AND OUTPUT PROCESSES

It is useful to begin the empirical analysis of monetary effects on real activity with a discussion of some issues concerning the measurement of monetary policy. The question about which variables can be used to measure monetary policy actions and what the correct approach to identify these actions would be has not yet found a clear answer in the literature. The answer to this question depends at least on two factors: (1) the views about whether only unexpected or also expected monetary policy influences real output and (2) the operating procedure of the central bank in the considered country.

2. Besides MACKLEM et al. (1996) who investigate the Canadian case, it is KARRAS (1996) who, in addition to his panel study, tests for asymmetry in each country separately.

Most results in the empirical literature on asymmetric effects are derived under the assumption that only unexpected monetary policy has real effects. That is, monetary shocks are measured as innovations to a regression of a monetary aggregate on its own lagged values and a set of other variables which are assumed to predict the monetary aggregate. This is the approach used by MISHKIN (1982) in his investigation about the policy ineffectiveness proposition. However, MISHKIN himself, and more recently, BERNANKE and MIHOV (1995), find that anticipated money can have effects on real output. This has led MACKLEM et al. (1996) to test for asymmetric effects of both anticipated and unanticipated monetary policy. They find that the asymmetry in the response of real output holds for both components of monetary policy.

Some authors, like RAVN and SOLA (1996) argue that due to the structural instability in the demand for monetary aggregates like M1 and M2 in the U.S., it is preferable to use the federal funds rate as the independent variable in an equation that measures monetary innovations. The main argument in favor of this approach is that the U.S. Federal Reserve System has implemented policy changes mainly through changes in the federal funds rate.[3] RAVN and SOLA (1996) test for asymmetric effects using both M1 and the federal funds rate to estimate unexpected money-supply shocks. They find that using M1 only small shocks (independently of their sign) have real effects whereas using the federal funds rate this is only true for small negative shocks.

In the present case I assume that only unexpected money-supply shocks have an effect on real output. The main rationale for this assumption is to make the results comparable to those obtained in other studies and to check whether they carry over to the Swiss case. In addition, I concentrate on a monetary aggregate in order to measure money-supply shocks. This is in line with the policy of the Swiss National Bank which has followed a money supply rule targeting M1 from 1975 to 1978 and the monetary base since 1980.[4] Because of the structural break in the monetary base series after 1988 I use M1 as the monetary variable.

Taking into account these considerations I estimate two different money-supply equations. The first one includes the growth rates of M1 (Δm_t), real output (Δy_t), and the monetary base (Δb_t) as well as the changes in the government bond yields (Δr_t) and in net exports (Δnx_t) :

$$\Delta m_t = \alpha_0 + \alpha_1(L)\Delta m_{t-1} + \alpha_2(L)\Delta y_{t-1} + \alpha_3(L)\Delta b_{t-1} + \alpha_4(L)\Delta r_{t-1} + \alpha_5(L)\Delta nx_{t-1} + \varepsilon_t \qquad (1)$$

The included variables are basically the same as in other studies dealing with the U.S.[5] with the exception of net exports. The inclusion of net exports in the money-supply

3. See e.g. BERNANKE and BLINDER (1992).
4. See WASSERFALLEN and KÜRSTEINER (1994) and the citations therein for an account of the policy of the Swiss National Bank since 1975.
5. COVER (1992), following MISHKIN (1982) and BARRO and RUSH (1980), additionally includes variables representing fiscal policy and the unemployment rate. Preliminary testing suggested that these variables have no explanatory power in Switzerland.

equation is motivated by the findings of an earlier study (JORDAN and LENZ, 1995). Using a structural VAR framework we found there that the explanatory power of the IS-LM model for Switzerland depends crucially on the inclusion of net exports in the vector of variables. This might reflect that the Swiss National Bank reacts to changes in net exports because of the importance of the export sector in Switzerland.

In order to check for the sensitivity of the results with respect to neglecting net exports as an explanatory variable for money-supply, I estimate a second money-supply equation without net exports:

$$\Delta m_t = \beta_0 + \beta_1(L)\Delta m_{t-1} + \beta_2(L)\Delta y_{t-1} + \beta_3(L)\Delta b_{t-1} + \beta_4(L)\Delta r_{t-1} + \varepsilon_t \qquad (2)$$

The exact specification of equations (1) and (2) with respect to the choice of number of lags is based on OLS estimation of both money-supply equations with all possible combinations of one to four lags for each explanatory variable. This was done keeping intermediate lags and the specifications were chosen on the basis of the highest $\overline{R}^2$ subject to the restriction that the equations are well-specified. The results of this exercise are presented in the next section.

The output process is specified as follows:

$$\Delta y_t = \gamma_0 + \gamma_1(L)\Delta y_{t-1} + \gamma_2(L)\Delta y_{t-2} + \gamma_3(L)\Delta r_t + \gamma_4(L)\mathrm{pos}_t + \gamma_5(L)\mathrm{neg}_t + \varepsilon_t \qquad (3)$$

where $\mathrm{pos}_t = \max(\varepsilon_t, 0)$ and $\mathrm{neg}_t = \min(\varepsilon_t, 0)$. That is, following the approach suggested by COVER (1992), the positive and negative innovations to the money-supply process are assumed to represent positive and negative money-supply shocks. Note that the contemporaneous change in the government bond yield enters the output equation without lags, it is therefore assumed to be exogenous. Following COVER (1992) this can be motivated by assuming the presence of both, IS and LM shocks in aggregate demand. These two type of shocks can then be separated assuming that changes in the government bond yield capture the effect of IS shocks whereas the unexpected money terms represent the LM shocks.

In the next section I present the results of a joint estimation of equations (1) and (3) as well as (2) and (3). The estimation is carried out using non-linear least squares following the method suggested by MISHKIN (1982). Three different cases with respect to the number of lags of the money-supply shocks are considered. This allows to assess the effects arising from the inclusion of net exports in the money-supply equation and to check whether positive and negative money-supply shocks affect output immediately or with a certain time lag.

3. EMPIRICAL RESULTS

The sample period considered in this study covers the flexible exchange rate period in Switzerland. The effective sample is 1975:1–1994:1, since the equations include some lagged variables. The data source is the IMF International Financial statistics and the variables used are M1 (m), real GNP (y), the monetary base (b), the government bond yield (r), and real exports minus real imports (nx).

Table 1 presents the OLS estimates of the money-supply processes (1) and (2). Excluding net exports from the money-supply equation has some impact on the specification with respect to the other variables: the second lag of M1 instead of the first one and the first lag of the government bond yield are included in the money-supply process. Note that the coefficients on net exports are significant at the five percent level at all lags and therefore the inclusion of net exports in the money-supply process yields a better fit.

It is interesting that the better fit is basically due to a reduced variance of the negative money supply shocks, as Figure 1 shows. The money-supply process without net exports yields positive and negative shocks with approximately the same variance: their standard errors are 1.307 and 1.305, respectively. On the other hand, including net exports leads to a substantial reduction of the variability of the negative shocks, whereas the variability of the positive shocks remains unaffected, the corresponding standard errors are 1.026 and 1.312.

Another feature of the money-supply shocks depicted in Figure 1 is worth mentioning. During the sample period there are three occasions where the Swiss National Bank departed from the money-supply rule described in Section 2. The first one was in the second half of 1978 when the Swiss National Bank intervened in the foreign exchange market to fight the ongoing appreciation of the Swiss Franc. This led to an increase of the monetary base and giro accounts which were reduced to their former levels in the beginning of 1979. The corresponding money-supply shocks clearly show up in Figure 1 and it is striking how net exports reduced the prediction error of the negative shock. The second was the stock-market crash of 1987 where the Swiss National Bank increased money-supply in order to avoid liquidity problems. According to Figure 1 this was the single most important money-supply shock in the sample period. The third occasion where a departure from the money-supply rule can be identified was the reduction of liquidity requirements together with the installation of the Swiss Interbank Clearing system in 1988. This led to a substantial reduction in the demand for money which the Swiss National Bank counteracted by reducing the money-supply from 1988 to 1990. Again, this negative supply shocks appear in Figure 1. I interpret this coincidence of identifiable events with the estimated shocks as providing some evidence for the validity of the choice of the money-supply processes.

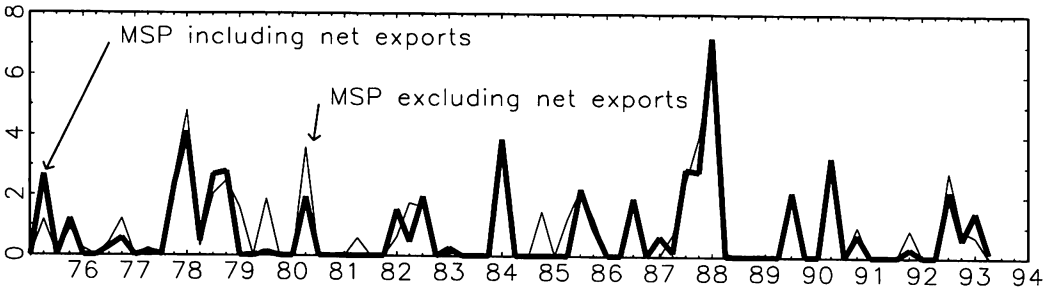
Table 1
Money Supply Processes: OLS Estimates (75:1–94:1)

	Including Net Exports	Excluding Net Exports
constant	0.689**	0.791**
	(0.303)	(0.316)
Δm_{t-1}	0.155	-
	(0.125)	
Δm_{t-2}	-	0.123
		(0.138)
Δy_{t-1}	-0.542**	-0.587**
	(0.226)	(0.249)
Δy_{t-2}	0.334	0.351
	(0.238)	(0.246)
Δb_{t-1}	0.276***	0.237**
	(0.104)	(0.098)
Δb_{t-2}	-0.063	-0.073
	(0.089)	(0.106)
Δb_{t-3}	0.050	0.010
	(0.085)	(0.093)
Δb_{t-4}	-0.245***	-0.220**
	(0.086)	(0.092)
Δr_{t-1}	-	-0.049
		*(0.033)
Δr_{t-2}	-0.061*	-0.071**
	(0.031)	(0.033)
Δr_{t-3}	0.051*	0.059*
	(0.029)	(0.031)
Δr_{t-4}	-0.075***	-0.068**
	(0.027)	(0.029)
Δnx_{t-2}	0.248**	-
	(0.105)	
Δnx_{t-3}	-0.217**	-
	(0.108)	
Δnx_{t-4}	0.238**	-
	(0.108)	
$\bar{R}^2$	0.394	0.272
S.E.	2.174	2.383

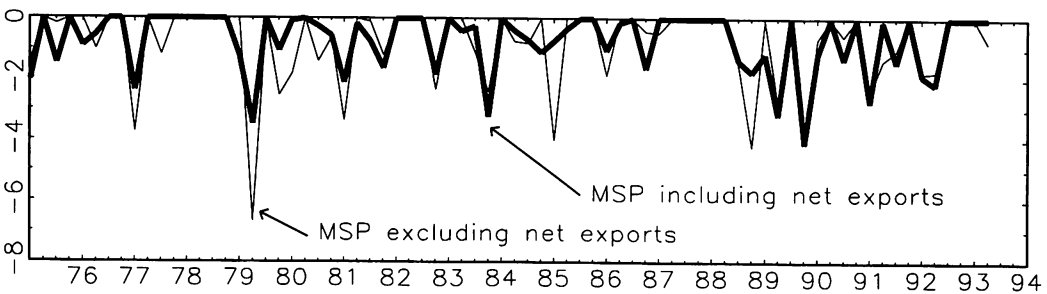
Standard errors are in parentheses.
*, **, and *** denote significance at the 10, 5, and 1% levels, respectively.

Figure 1

Positive Money Supply Shocks



Negative Money Supply Shocks



Tables 2 to 4 present the results of estimating each of the money-supply processes jointly with the output equation. In order to preserve space, only the coefficients for the output processes are presented. The coefficients of the money-supply equations obtained from the joint estimation do not differ substantially from those in Table 1.

The results for the output equation without lagged monetary shocks are presented in Table 2. The coefficients on the shocks for the money-supply process without net exports are not significant. The Wald test for equality of the coefficients supports this finding as the null hypothesis cannot be rejected. In the case of the money-supply process including net exports the picture is different. The coefficient on the positive shock is significant at the ten percent level but it has the wrong sign. On the other hand, the coefficient on the negative shock has the expected sign and is significant at the one percent level.

Table 2
Output Equation: NLLS Estimates (75:1–94:1)
0 Lags of Monetary Shocks

	MSP includes Net Exports	MSP excludes Net Exports
constant	0.778**	0.553***
	(0.164)	(0.162)
Δy_{t-1}	-0.115-	0.127
	(0.088)	(0.086)
Δy_{t-2}	0.178**	0.193**
	(0.080)	(0.085)
Δr_t	0.050***	0.050***
	(0.011)	(0.011)
pos_t	-0.148*	-0.051
	(0.087)	(0.095)
neg_t	0.368***	0.136
	(0.117)	(0.088)
$\bar{R}^2$	0.400	0.333
sd (ε_m)	1.977	2.212
sd (ε_y)	0.864	0.910
pos = neg[a]	9.251***	1.487

Standard errors are in parentheses. sd (ε_m) and sd (ε_y) are the standard deviations of the disturbances in the money and output equations, respectively.

[a]Wald test of the hypothesis that the coefficient on pos equals that on neg.

*, ** and *** denote significance at the 10, 5, and 1% levels, respectively

The conclusion that in this case there are asymmetric effects of monetary shocks is supported as the Wald test clearly rejects the hypothesis of equality of the coefficients.

Table 3 shows that the same findings emerge, if two lags of monetary shocks are included in the output equation. Only the coefficient on the negative contemporaneous shock from the money-supply process including net exports is significantly different from zero. The Wald tests for the hypothesis that the coefficients are jointly zero support this finding. Furthermore, the joint equality of the coefficients on the positive and negative shocks is rejected. The tests for the sums of coefficients lead to the same conclusions: the cumulative effects of the negative shocks sum to a positive number which is significantly different from zero whereas the same effect of the positive shocks is insignificantly negative. It is therefore not surprising that the asymmetry is also present in the cumulative effects. Using the shocks of the money-supply equation without net exports alters the results substantially. None of the shocks has a coefficient which is significantly different from zero. The Wald tests support the implication that without monetary effects whatsoever there cannot be any asymmetry.

Finally, Table 4 presents the results of estimating the output equation jointly with both money-supply processes including the current and four lags of the money-supply shock. In the case where net exports enter the money-supply equation there is only weak evidence for asymmetry. This is due to positive shocks having real effects as the coefficient on the positive shock at lag four is positive and significant at the ten percent level. In the case of the negative shocks the coefficient on the contemporaneous shock is again highly significant. The Wald tests confirm that in the present case the evidence for asymmetry is weaker: the coefficients on the negative shocks are jointly significant from zero but only at the ten percent level. The same is true for the sum of the negative coefficients. However, the hypothesis that the coefficients on the positive and negative shocks are equal cannot be rejected independently of carrying out the test jointly or for the sum of the coefficients. Excluding net exports from the money supply process yields again different results. As opposed to the results with less lags of the monetary shocks, the coefficient on the positive shock at lag four is highly significant. However, this effect is not very strong as the equality of the coefficients on positive and negative shocks cannot be rejected.

Table 3
Output Equation: NLLS Estimates (75:1–94:1) 2 Lags of Monetary Shocks

	MSP includes Net Exports	MSP excludes Net Exports
constant	0.862***	0.533**
	(0.262)	(0.263)
Δy_{t-1}	-0.130	-0.130
	(0.089)	(0.088)
Δy_{t-2}	0.194**	0.191**
	(0.083)	(0.086)
Δr_t	0.052***	0.051***
	(0.011)	(0.012)
pos_t	-0.132	-0.058
	(0.089)	(0.096)
pos_{t-1}	-0.063	0.032
	(0.092)	(0.094)
pos_{t-2}	0.031	0.013
	(0.089)	(0.094)
neg_t	0.365***	0.143
	(0.117)	(0.091)
neg_{t-1}	0.117	0.096
	(0.122)	(0.015)
neg_{t-2}	-0.008	-0.012
	(0.117)	(0.092)
$\bar{R}^2$	0.407	0.336
$sd(\varepsilon_m)$	1.974	2.213
$sd(\varepsilon_y)$	0.858	0.908
pos = 0[a]	2.937	0.481
neg = 0[a]	9.906**	2.547
pos = neg[b]	9.153**	1.713
sum(pos)[c]	-0.165	-0.013
sum(neg)[c]	0.474**	0.147
sum(pos) =sum(neg)[d]	4.066**	0.312

Standard errors are in parentheses. $sd(\varepsilon_m)$ and $sd(\varepsilon_y)$ are the standard deviations of the disturbances in the money and output equations, respectively.

[a]Wald test of the hypothesis that the coefficients on pos (neg) are jointly zero.

[b]Wald test of the hypothesis that the coefficients on pos are jointly equal to those on neg.

[c]Sum of the coefficient on pos (neg).

[d]Wald test of the hypothesis that the sum of the coefficients on pos equals the sum of the coefficients on neg.

*, ** and *** denote significance at the 10, 5, and 1% levels, respectively.

Table 4
Output Equation: NLLS Estimates (75:1–94:1) 4 Lags of Monetary Shocks

	MSP includes Net Exports	MSP excludes Net Exports
constant	0.668**	0.188
	(0.306)	(0.316)
Δy_{t-1}	-0.098	-0.119
	(0.086)	(0.086)
Δy_{t-2}	0.220***	0.234***
	(0.079)	(0.081)
Δr_t	0.041***	0.036***
	(0.012)	(0.012)
pos_t	-0.103	0.009
	(0.082)	(0.087)
pos_{t-1}	-0.047	-0.051
	(0.087)	(0.089)
pos_{t-2}	0.029	0.155*
	(0.083)	(0.088)
pos_{t-3}	-0.003	-0.088
	(0.083)	(0.088)
pos_{t-4}	0.162*	0.273***
	(0.083)	(0.087)
neg_t	0.326***	0.122
	(0.109)	(0.084)
neg_{t-1}	0.096	0.033
	(0.116)	(0.087)
neg_{t-2}	-0.055	-0.117
	(0.115)	(0.087)
neg_{t-3}	-0.055	-0.030
	(0.110)	(0.087)
neg_{t-4}	0.144	0.093
	(0.110)	(0.081)
$\bar{R}^2$	0.475	0.485
sd (ε_m)	1.981	2.264
sd (ε_y)	0.808	0.800
pos = 0[a]	6.210	12.589***
neg = 0[a]	10.866*	5.607
pos = neg[b]	7.855	6.352
sum(pos)[c]	0.038	0.299*
sum(neg)[c]	0.456*	0.101
sum(pos) =sum(neg)[d]	1.187	0.313

Standard errors are in parentheses. sd (ε_m) and sd (ε_y) are the standard deviations of the disturbances in the money and output equations, respectively.
[a], [b], [c], [d], see notes to Table 3.
*, ** and *** denote significance at the 10, 5, and 1% levels, respectively.

4. CONCLUSIONS

The present paper tests for the presence of asymmetric real effects of money-supply shocks in Switzerland under floating exchange rates. I find that the results depend on the inclusion of net exports in the money-supply process: if net exports enter the money-supply equation as an explanatory variable there is evidence for asymmetric effects, otherwise monetary shocks have no real effects.

Overall, I conclude that there is support for the hypothesis that only negative monetary shocks affect output. However, this result depends critically on the specification of the money-supply process, in particular with respect to the inclusion of net exports as an explaining variable for M1. The case for asymmetric effects is stronger if one is willing to accept that net exports should enter the money-supply process. Taking into account the results in the earlier paper by Jordan and myself, and given the openness of the Swiss economy, this is not completely unplausible. In addition, the reduced variability of negative vs. positive shocks due to the inclusion of net exports in the money-supply process points to the confirmation of the hypothesis that only small negative shocks have real effects.

Concerning monetary policy, the results of this paper suggest that there are benefits from a steady money-supply because negative shocks have negative effects and positive shocks are neutral. Taking into account that smaller negative shocks produce stronger effects than bigger ones there might also be a case for a cold turkey procedure to reduce inflation. To investigate these issues more precisely future work should study the relationship between monetary policy, real output, and the inflation rate in greater detail.

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ABSTRACT

This study examines whether positive and negative money-supply shocks have asymmetric effects on output. The empirical evidence for Switzerland is in general consistent with the findings for other countries: negative shocks affect output more strongly in absolute terms than positive shocks. However, the results depend on the assumptions about the money-supply process, in particular with respect to the inclusion of variables representing foreign trade. The results therefore suggest that the degree of asymmetric effects of monetary policy on output depends on the openness of the economy.

ZUSAMMENFASSUNG

Diese Arbeit untersucht, ob positive und negative Geldangebotsschocks asymmetrische Wirkungen auf den Output haben. Die empirischen Resultate für die Schweiz bestätigen im allgemeinen die Ergebnisse für andere Länder: Negative Schocks haben einen stärkeren absoluten Einfluss auf den Output als positive Schocks. Es ist indes zu beachten, dass die Resultate von den Annahmen über den Geldangebotsprozess abhängig sind, und zwar insbesondere davon, ob Variablen, die den Aussenhandel repräsentieren, in diesen Prozess einfliessen. Die Resultate lassen daher darauf schliessen, dass das

Ausmass der asymmetrischen Wirkungen der Geldpolitik auf den Output von der Offenheit einer Volkswirtschaft abhängen.

RESUME

Cet article analyse si les chocs monétaires positifs et négatifs ont des effets asymétriques sur le PIB. Les résultats pour la Suisse confirment en général ce qu'on a trouvé dans autres pays: les chocs négatifs ont un effet absolu plus prononcé sur le PIB que les chocs positifs. Néanmoins, il faut tenir compte du fait que les résultats dépendent des suppositions sur le processus de l'offre monétaire, en particulier de l'inclusion des variables représentant le commerce extérieur. Les résultats permettent donc de conclure que les effets asymétriques de la politique monétaire sur le PIB dépendent du degré d'ouverture de l'économie.