The Dynamic Relationship Between Interest Rates and Inflation: 
An Empirical Investigation \(^{1}\)

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Summary: In this paper the dynamic relationship between short term interest rates and inflation is analyzed for five countries (U.S.A., UK, France, Germany and Switzerland), covering the period 1974–1980.

The framework of analysis is the bivariate autoregressive representation of the interest and the inflation rate, which allows to test the traditional approach (interest rate as distributed lag of inflation) as well as the novel approach of Fama (the inflation rate as function of the one period lagged interest rate). In general, the hypotheses of both approaches are rejected by the data. An analysis of the variability of the real interest rate suggests that it contributes strongly to the variation of the nominal interest rate and that the nominal interest rate and inflation help to predict the ex ante real interest rate.

There are many empirical studies on the relationship between nominal interest rate and inflation. Most of them are based on the pioneering work of Fisher [1930], who proposed the splitting up of the interest rate into the ex ante real rate and the expected inflation rate. One of the crucial problems of these studies consists in the empirical treatment of the expected inflation rate. The earlier papers, which are surveyed by Roll [1972], modelled expected inflation as distributed lag of the actual inflation rate. Therefore, regressions of the interest rate on the current and lagged inflation rate (and in some studies on additional variables) were run. Recently, Fama [1975] reversed this traditional approach by relating the actual inflation rate to the short term interest rate available for the same period, i.e. the inflation rate is regressed on the corresponding one period lagged short term interest rate. The justification for this novel approach is given by the two assumptions that (a) the inflation rate is rationally expected in the sense of Muth [1961] by the market participants and (b) the ex ante real interest rate is constant. In this case all variations of the short term interest rate are attributed to inflationary expectations, which are the best predictor for the subse-

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\(^{1}\) This paper was written in the context of a project on the foreign dependencies of the Swiss economy focusing on the role of Switzerland in Western Europe. Financial support was received from the National Science Foundation (Grant Nr. 4.357-0.79.09) and Prognos AG, Basle.

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0377-7332/82/3-40125-137$2.50 © 1982 Physica-Verlag, Vienna.
quent inflation. Therefore, this approach suggests that the short term interest rate leads the inflation rate. This stands in sharp contrast to the empirical findings of the earlier studies, which often reported a relatively slow adjustment of interest rates to past inflation rates.

The paper of Fama presents some evidence that his novel approach is appropriate for US-inflation (consumer prices) and short term interest rates (treasury bills) for the period 1953–1971. However, subsequent papers reported results which raise some doubts as to the validity of the joint hypothesis of rational expectations and a constant ex ante real interest rate: Nelson/Schwert [1977] and Garbade/Wachtel [1978] present empirical results pointing to substantial variation of the US-ex ante real interest rate for the data considered by Fama. Moreover, Carlson [1977] argues that Fama’s results are only brought about by the rigidity of his simple regression tests and the common trend of the inflation and interest rate from 1953 to 1971. More recently, Katz [1980] applied the somewhat extended regression tests of Fama to four countries (U.S.A., U.K., Canada, Belgium) for the period 1959–1979. Although the three-month treasury bill rate remains a rather good predictor for quarterly US-consumer price inflation, the regression results reported lead to the rejection of the joint hypotheses of a constant ex ante real interest rate and rational expectations for all countries.

In this paper the dynamic relationship between short term interest rates and inflation is analyzed for five countries (U.S.A., U.K., France, Germany and Switzerland) for the period 1974–1980. This time span is of some interest for the present purpose as inflation and interest rates show marked variations which are not dominated by a trend. The framework of analysis is the bivariate autoregressive representation of the interest and the inflation rate. In this way a general model is received which incorporates the traditional as well as the novel approach to interest rate/inflation modelling as special cases. The model is fitted by a slightly modified variant of the step-wise modelling approach suggested by Hsiao [1979, 1981]. The contents of this paper are as follows: In Section 2 the basic model and the estimation method used are briefly discussed. The empirical results are given in Section 3. In Section 4 some results on the variability and the predictability of the ex ante real interest rate are reported. Finally some conclusions are presented in Section 5.

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Let \( \pi_t \) be the actual inflation rate and \( r_t \) the short term interest rate for a financial asset of one period maturity. Both variables are measured at the end of the period \( t \). Now consider the following autoregressive representation of the two variables, which are assumed to be stationary:

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\begin{align*}
    r_t &= a_{01} + \sum_{j=1}^\infty a_{11j} r_{t-j} + \sum_{j=1}^\infty a_{12j} \pi_{t-j} + u_t \\
    \pi_t &= a_{02} + \sum_{j=1}^\infty a_{21j} r_{t-j} + \sum_{j=1}^\infty a_{22j} \pi_{t-j} + v_t ,
\end{align*}
\]