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Bankruptcies and Aggregate Economic Fluctuations*

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Abstract

This paper explores the determinants of aggregate economic fluctuations in Finland. The analysis makes use of aggregate monthly time series for some financial and non-financial variables covering the period 1922–1990. In particular, we scrutinize the role of bankruptcies in the propagation mechanism of aggregate economic shocks. In analyzing the role of bankruptcies we also try to find out whether money or credit helps more in predicting the movements in corporate failures and overall economic activity. The empirical analyses indicate that bankruptcies constitute an important ingredient as regards the determination of other variables. It also turns out that overall liquidity and firm failures are closely related. In comparing money and credit the former appears to be much more important as regards the propagation mechanism. We also find that the basic relationships are strikingly stable over long periods. Finally, we find some evidence of non-linearities in the financial and non-financial time series.

Keywords: Business cycles, bankruptcy, time series models

Contents

	Page
Abstract	3
1 Introduction	7
2 Analytical Framework for the Time Series Analysis	8
3 Empirical Results with Aggregate Bankruptcy Data	9
4 Concluding Remarks	15
Footnotes	17
References	18
Figures	19

1 Introduction

This paper explores the determinants of aggregate economic fluctuations in Finland. The analysis makes use of aggregate time series for some financial and non-financial variables. The set of variables includes the (real) exchange rate, prices, industrial output, money, credit, a stock index and bankruptcies. The presence of bankruptcies – as well as alternative money and credit aggregates – should be emphasized here. The role of these variables can be rationalized by some recent findings which suggest that financial – or, more precisely, financial intermediation – variables play an important role in the propagation mechanism determining the behaviour of bankruptcies and some key macroeconomic variables.

Obviously, the role of bankruptcies has two aspects: the determination of bankruptcies and the effects of bankruptcies. Thus, basically, we need a more general model in which both channels are taken into account. One framework which can be utilized in this context is the theory of financial intermediation (see e.g. Williamson (1987) for an overview of this literature). The theory of financial intermediation has many obvious applications. For instance, one might argue that the propagation mechanism of the Great Depression can be seen as an application of this theory (see Bernanke (1983), who vigorously demonstrates the importance of the credit allocation process and corporate failures in aggravating the severity of a depression). The role of bankruptcies can also be analyzed in the "equilibrium credit rationing" framework (see e.g. the seminal paper by Stiglitz and Weiss (1981) in which the credit supply is affected by the riskiness of the banks' customers). Lastly, the analysis can be carried out in the modern version of the credit rationing framework (see e.g. Gertler and Gilchrist (1991)). There is a growing body of evidence suggesting that particularly small firms face liquidity constraints and that these constraints affect at least their investment activity (see e.g. Morgan (1991)).

Our empirical analysis examines the following main questions: First, what are the main determinants of aggregate economic fluctuations in Finland? Second, do bankruptcies constitute an essential ingredient in the propagation mechanism of aggregate shocks? Third, are bankruptcies only a real phenomenon, i.e. dependent only on demand conditions, profitability and so on, or are they also affected by financial variables such as liquidity, interest rates and the stock market? Fourth, is it money (narrow money or broad money) or credit which determines both bankruptcies and other real activity?

It is obvious that these kinds of questions cannot really be analyzed using standard structural models. Thus, we have to use an unrestricted Vector Autoregressive (VAR) model. In our application the model is estimated from monthly Finnish data covering the period 1922M1–1991M12. This very long period also includes the Great Depression and it is used to examine whether the basic relationships are invariant with respect to different institutional settings and policy regimes. Secondly, the large data sample is required to analyze the potential nonlinearities in the financial and non-financial times series. If such nonlinearities were to exist, they would, of course, completely change the way in which bankruptcies can be predicted.

We start by presenting the analytical framework for the empirical analysis in Section 2. Empirical results are presented in Section 3 and some concluding remarks follow in Section 4.

2 Analytical Framework for the Time Series Analysis

As mentioned above, our analysis makes use of the VAR model framework. The main reason for this is simply that it is far from obvious how the structural equations linking bankruptcies to the other variables should be specified. The same argument applies to the role of money and credit. So far, almost all analyses dealing with the effects of these variables have been carried out in the VAR framework. In fact, this is also true for (competing) business cycle theories. The use of the VAR framework may also be justified here by the fact we have an exceptionally large body of data available, running from January 1922 to December 1991. Thus, altogether there are 840 observations. These data make it possible to have a very general dynamic specification in terms of all variables. A priori, it is precisely the dynamic adjustment path which seems important when considering the role of bankruptcies in an economy.

The set of variables used here is the following:

- number of bankruptcies, b
- (real) industrial production, y^r
- the consumer price index, p
- the (real) exchange rate, e^r
- the money supply (m1, or alternatively m2)
- the UNITAS stock index for the Helsinki stock exchange, s
- bank lending, l
- the discount rate, r
- the terms of trade index, tt
- the wholesale price index, ph

Because of data availability issues we have to use seasonally adjusted data. More precisely, this means that the time series of b, y^r, m1 (m2), and l are seasonally adjusted using the conventional X–11 adjustment procedure. In the subsequent empirical analysis all variables are expressed in logarithmic level form (see Virén (1992) for other details of the data).

As far as the bankruptcy series are concerned, we also used two alternative measures for bankruptcies: 1) total debt of bankrupt firms (at constant prices) and 2) bankruptcies in relation to all companies. Unfortunately, there are some serious data problems with these latter definitions. The series for debt and number of companies are available on an annual basis only and even then the data are deficient to some extent. Still, if one compares, for instance, the time series of the number of bankruptcies and the total debt of bankrupt firms, the difference is relatively small. This suggests that the size distribution of bankruptcies has not changed very much over time.

One may ask why level form data are used. It is quite clear that none of the series are stationary, and some or all of them may have unit roots. The conventional way to proceed would be to formulate an error-correction type model where the system is estimated in first differences and where the error-correction structure corresponds to the long-run restrictions of the model which are derived from the co-integration analysis. We did not, however, follow this route. This is partly because with monthly data the first differences are very noisy, with some outlier-type observations dominating the variability. Another reason, which is perhaps more important, is the fact that given our exceptionally large data set we can still obtain consistent results both in terms of the parameter estimators and the t and F tests – including the Granger causality test (with some caveats, however). This has been pointed out in the recent paper by Sims, Stock and Watson (1990). Moreover, the possible cointegration constraints among our variables will be satisfied (cf. Engle and Granger (1987)).

The empirical analysis follows some steps which are more or less regularly taken in the course of a VAR model analysis. Thus, the model is first estimated in the autoregressive form and then a Cholesky decomposition is carried out in order to examine the variance decompositions and impulse responses of the model (see e.g. Hakkio and Morris (1984) for an exposition of the VAR model analysis). In this connection, we also pay attention to the stability properties of the model, recalling the regime changes which have taken place in the capital market (and also in the determination of exchange rates, and presumably in the determination of prices and wages).

This stability analysis can also be extended to examine the existence of possible nonlinearities in the set of variables. To be more precise, one may examine whether the time irreversibility property applies to the data. Quite recently, it has been argued in several studies that this property may not hold in all economic and financial data. If this is indeed the case, one might argue that the time series reflect some chaotic (bubble) behaviour. If this is so we should approach the forecasting issue from a completely different angle (see e.g. Ramsey (1990) for further details of this irreversibility issue).

The variance decompositions give us a concrete measure of the importance of each variable in explaining the variability of these variables over different time horizons. The impulse responses serve the same purpose but they also provide information on the qualitative nature of the results. In essence, this means the sign pattern of effects.

3 Empirical results with aggregate bankruptcy data

Let us now turn to the empirical results. Table 1 contains the multivariate causality test statistics for a set of some competing VAR models. Table 2 contains the variance decompositions for a VAR model with the alternative variable orderings: $\{e^r, p, y^r, m1, b, s\}$ and $\{e^r, p, y^r, l, b, s\}$.[1] Table 3 contains the long-run impulse responses for the six variables. The whole impulse response path is reported only for the bankruptcy variable, see Figure 1. In this figure, the impulse responses show how a (positive) innovation (of the size of one standard deviation) in the respective shocked variable affects bankruptcies.

Finally, the results for the non-linearity (time irreversibility tests) are presented in Figure 2.

We start from Table 1, which contains multivariate causality test statistics for the variables included in each of the models. The models are estimated using a constant and 12 lags for each variable and, in addition, 5 dummies for the war years 1939–1944. The test statistics indicate that prices, money and/or credit, bankruptcies and the stock index are essential ingredients of the model while the role of the real exchange rate is more marginal, although definitely not trivial, and, finally, that the role of industrial output is almost completely insignificant. Also, the discount rate and the terms of trade turn out to be completely insignificant irrespective of the choice of other variables.[1] Therefore, the latter two variables are already dropped at this stage of the study. The same could also have been done for industrial output. It is, however, the most important cyclical indicator and we want to keep it in the model to see at least how the shocks in other variables affect it.

Although money and credit seem to be important, this does not apply to the broad money concept (m2). It is clearly inferior to narrow money (as well as bank lending). Although narrow money clearly outperforms broad money, one cannot say the same as regards narrow money and credit (i.e. bank lending) on the basis of the causality test statistics. Therefore we have to scrutinize the variance decompositions and the impulse responses to settle this horse race. This result is reinforced by the variance decompositions reported in Table 2.

Table 1. **Multivariate causality tests for various VAR models**

Model variable	e^r	p	y^r	m1	b	s	l	r
Marginal significance level	0.057	0.000	0.511	0.005	0.029	0.001	0.025	0.968
Model variable	e^r	p	y^r	m1	b	s	r	
Marginal significance level	0.029	0.001	0.148	0.001	0.000	0.080	0.375	
Model variable	e^r	p	y^r	m1	b	s	l	
Marginal significance level	0.115	0.000	0.442	0.000	0.019	0.001	0.001	
Model variable	e^r	p	y^r	m1	b	s		
Marginal significance level	0.055	0.000	0.181	0.001	0.000	0.039		
Model variable	e^r	p	y^r	m2	b	s		
Marginal significance level	0.045	0.001	0.678	0.080	0.000	0.152		
Model variable	e^r	p	y^r	l	b	s		
Marginal significance level	0.086	0.000	0.792	0.000	0.002	0.002		
Model variable	e^r	ph	y^r	m1	b	s		
Marginal significance level	0.146	0.001	0.290	0.009	0.000	0.037		
Model variable	e^r	p	y^r	m1	b	s	tt	
Marginal significance level	0.001	0.000	0.372	0.000	0.000	0.013	0.260	

Multivariate Granger-Sims causality tests are employed. The null hypothesis for these tests is that the lags of one variable do not enter into the equations for the remaining variables.

The variance decompositions seem to favour (narrow) money in comparison to credit (bank lending). This is true both for the composite model including both m1 and l and for the competing models including either m1 or l reported in Tables 2a and 2b. Thus credit is almost impotent in terms of other variables while money has a nontrivial effect on all other variables. One could say on the basis of this evidence that m1 is, in fact, the relevant monetary aggregate and we should concentrate on analyzing it only. Before we make the final verdict we ought, however, to scrutinize the impulse responses. Otherwise, the variance decompositions are, in general, intuitively appealing. Thus, the strong link between the real exchange rate and industrial output can be discerned, it can be seen that money is not impotent as other variables (including real variables) and, finally, it can be seen that stock market prices are related to other variables in a reasonable way (even though the stock market is not a very important causal factor in our model).

As far as bankruptcies are concerned, there seem to be several important interactions between this variable and the other five variables. Perhaps this is the reason why our empirical model is not dichotomous as it has been in many similar models (but which do not include the bankruptcy variable). Thus, the nominal and real variables are not independent of each other, nor are the financial and non-financial variables. In particular, bankruptcies seem to have a strong effect on the real exchange rate, the price level and the money supply. On the other hand, bankruptcies are affected by money and stock prices (the latter probably serving as a leading indicator). By contrast, there seems to be only a very weak link between industrial production and bankruptcies, which suggests that the latter variable is not determined solely by demand considerations.

In order to gain more insight into the qualitative nature of various effects we have to scrutinize the impulse responses. They are reported in Table 3 and Figure 1 (for bankruptcies only) together with the confidence intervals (i.e. ±2· standard errors; Figure 1). The standard errors are so small that the impulse responses are in almost all cases different from zero at the conventional 5 per cent level of significance. As the number of observations is so large this is not very surprising. Perhaps, one should, in a case like this, have a more conservative interpretation of the proper level of statistical significance. In our case, this would not, however, make much difference.[2]

When the response estimates are scrutinized it turns out that, except for a few cases, the values clearly make sense. The only thing is that the short-run and long-run effects are strikingly different – even the signs change in several cases – and one cannot really say what is exactly right and what is exactly wrong. Another problem concerns the difference between the "money" and "credit" models. Results with these two models are quite different and it is not self-evident which model should be preferred. Although the variance decompositions strongly favour the m1 version of the VAR model, this preference order is not equally obvious on the basis of the impulse responses. Despite this ambiguity, one might still prefer the m1 version. If one compares how innovations in other variables affect money and credit, some effects on credit are perverse. This is particularly true for the price level and bankruptcy effects.

Table 2a. **Variance decomposition for a VAR model for the vector $y_t = (e^r_t\ p_t\ y^r_t\ m1_t\ b_t\ s_t)'$**

		Innovation in					
	k	e^r	p	y^r	m1	b	s
e^r	1	100.0	0.0	0.0	0.0	0.0	0.0
	3	98.6	0.4	0.3	0.2	0.0	0.5
	6	97.7	0.4	0.4	0.5	0.2	0.9
	12	95.5	1.3	0.5	0.8	0.9	1.1
	24	79.5	5.6	0.5	2.1	6.7	5.5
	60	61.1	8.4	4.8	2.8	14.8	8.0
	120	52.5	6.9	10.1	5.0	18.8	6.7
p	1	0.0	100.0	0.0	0.0	0.0	0.0
	3	1.1	97.9	0.0	0.1	0.5	0.4
	6	2.7	93.1	0.1	0.1	1.5	2.5
	12	2.9	85.0	0.3	0.6	6.1	5.1
	24	4.3	70.2	0.3	5.7	14.1	5.4
	60	6.7	28.7	0.6	33.0	28.5	2.4
	120	8.1	9.8	0.3	48.4	32.4	1.0
y^r	1	0.0	0.0	100.0	0.0	0.0	0.0
	3	0.1	0.1	99.4	0.0	0.1	0.3
	6	0.8	1.0	96.4	0.2	0.3	1.4
	12	2.1	4.5	86.3	0.4	1.0	5.6
	24	12.0	4.6	72.7	0.9	2.2	7.6
	60	34.5	2.7	47.7	8.4	1.5	5.2
	120	38.8	1.4	35.9	17.3	2.1	4.5
m1	1	0.0	0.0	0.0	100.0	0.0	0.0
	3	0.4	0.2	0.0	98.2	0.1	1.1
	6	0.8	0.2	0.1	96.5	0.6	1.8
	12	1.3	0.2	0.0	90.0	4.7	3.7
	24	3.0	0.2	0.2	71.6	15.7	9.2
	60	11.5	0.1	0.4	56.9	25.7	5.3
	120	15.1	0.2	1.5	55.4	25.6	2.2
b	1	0.0	0.0	0.0	0.0	100.0	0.0
	3	0.2	0.9	0.3	0.2	98.2	0.2
	6	0.9	1.4	0.6	0.7	95.9	0.5
	12	0.9	1.2	1.7	1.3	94.4	0.6
	24	1.5	1.7	1.5	4.4	89.9	1.0
	60	2.1	3.8	1.1	12.3	71.7	8.9
	120	2.2	4.5	1.2	13.6	68.4	10.1
s	1	0.0	0.0	0.0	0.0	0.0	100.0
	3	1.0	2.4	0.1	0.4	0.5	95.6
	6	0.5	1.6	0.0	0.7	2.0	95.0
	12	0.4	5.8	0.4	1.4	3.6	88.4
	24	1.5	13.0	0.7	1.9	2.8	80.0
	60	3.5	17.5	0.8	6.4	2.9	69.0
	120	8.5	14.1	2.1	14.1	4.7	56.5

k denotes the prediction horizon in months.

Table 2b. **Variance decomposition for a VAR model for the vector $y_t = (e^r_t\ p_t\ y^r_t\ l_t\ b_t\ s_t)'$**

		Innovation in					
	k	e^r	p	y^r	l	b	s
e^r	1	100.0	0.0	0.0	0.0	0.0	0.0
	3	98.4	0.5	0.2	0.0	-0.0	0.8
	6	97.3	0.6	0.3	0.1	0.1	1.6
	12	95.9	1.4	0.4	0.3	0.8	1.3
	24	89.8	5.2	0.5	0.3	0.7	3.4
	60	64.6	10.6	2.2	3.1	10.2	9.3
	120	41.9	10.9	5.2	4.1	27.9	10.1
p	1	0.0	100.0	0.0	0.0	0.0	0.0
	3	1.1	97.8	0.0	0.0	0.6	0.4
	6	2.5	91.4	0.1	0.2	2.9	3.0
	12	3.4	75.8	0.2	0.3	13.1	7.1
	24	5.6	50.2	0.3	0.2	34.8	8.9
	60	9.1	19.7	0.8	0.1	60.6	9.7
	120	9.6	9.6	2.1	0.0	66.9	11.7
y^r	1	0.0	0.0	100.0	0.0	0.0	0.0
	3	0.1	0.1	99.4	0.0	0.1	0.3
	6	0.6	1.0	96.3	0.4	0.4	1.3
	12	1.9	4.8	86.2	1.2	0.9	5.1
	24	14.8	4.5	67.8	1.3	2.8	8.9
	60	38.1	3.9	38.1	1.0	13.9	5.1
	120	42.3	2.8	25.4	2.0	24.8	2.8
m1	1	0.0	0.0	0.0	100.0	0.0	0.0
	3	1.0	1.0	0.1	97.7	0.2	0.0
	6	2.2	1.3	0.4	95.1	0.2	0.8
	12	2.5	1.2	0.2	89.1	0.5	6.5
	24	5.4	0.5	0.2	62.9	7.8	23.2
	60	18.4	0.5	0.1	22.6	34.0	24.3
	120	19.9	1.8	0.2	8.3	53.8	16.0
b	1	0.0	0.0	0.0	0.0	100.0	0.0
	3	0.3	1.5	0.3	1.2	96.5	0.2
	6	1.6	2.6	0.4	1.8	92.8	0.8
	12	2.8	2.2	1.1	1.6	90.7	1.6
	24	6.8	2.3	0.8	2.5	84.7	2.8
	60	10.7	2.2	0.6	3.4	80.3	2.6
	120	10.7	2.1	1.0	3.7	79.9	2.7
s	1	0.0	0.0	0.0	0.0	0.0	100.0
	3	1.2	2.4	0.1	0.1	0.9	95.3
	6	0.8	1.6	0.1	0.0	3.3	94.1
	12	1.5	4.1	0.7	0.2	5.2	98.2
	24	5.1	6.7	1.0	0.1	5.5	81.6
	60	9.6	6.1	0.9	0.1	6.4	76.8
	120	11.9	5.7	0.7	0.5	18.1	62.9

k denotes the prediction horizon in months.

Table 3. Eventual impulse responses for various VAR models

	Innovation in					
	e^r	p	y^r	m1	b	s
e^r	0.097	0.781	0.238	0.718	−0.009*	0.310
	(0.575)	(0.482)	(0.009)	(0.080)	(−0.010)*	(0.029)
p	0.017	−0.200	−0.021	−0.129	0.012	0.003*
	(−0.134)	(1.337)	(0.071)	(−0.040)	(0.004)*	(−0.753)
y^r	0.133	0.227	0.183	0.024	−0.011*	0.162
	(−0.035)	(0.071)	(0.131)	(0.024)	(−0.089)	(−0.174)
m1	−0.116	2.044	0.208	1.369	−0.016	0.447
	(0.075)	(0.269)	(0.007)*	(0.795)	(−0.075)	(0.061)
b	0.165	−1.508	−0.070	−0.913	0.009*	−0.247
	(0.215)	(−0.544)	(−0.015)	(−0.303)	(0.334)	(−0.102)
s	−0.024	−0.232	−0.079	−0.209	0.024	−0.024
	(−0.162)	(0.399)	(0.176)	(0.266)	(−0.052)	(1.309)
e^r	−0.018	1.136	0.235	2.395	0.013*	0.360
	(0.685)	(0.676)	(0.020)	(0.220)	(−0.100)	(0.232)
p	−0.081	0.398	0.007*	0.476	0.007*	0.114
	(−0.161)	(1.323)	(0.071)	(−0.121)	(−0.030)	(−0.695)
y^r	0.127	−0.511	0.097	−0.110	0.017*	−0.003*
	(−0.035)	(0.077)	(0.128)	(−0.071)	(−0.093)	(−0.206)
l	0.123	−0.297	0.052	0.230	0.012*	0.006
	(−0.008)*	(0.001)*	(0.053)	(1.569)	(0.082)	(−0.088)
b	0.308	−2.952	−0.217	−4.214	0.007*	−0.629
	(−0.013)*	(−0.966)	(−0.003)*	(−0.243)	(0.383)	(−0.210)
s	−0.162	1.435	0.024	1.920	−0.010*	0.280
	(−0.068)	(0.595)	(0.169)	(0.809)	(−0.107)	(1.435)

Positive one standard deviation shocks are used. Responses are in terms of fractions of standard deviations; the response of a variable is divided by the standard deviation of its residual. Starred values are not significant at the five per cent level of significance. The prediction horizon is 120 months (12 month). Standard errors for the point estimates are computed using Bayesian methods and Monte Carlo integration (see Klock and Van Dijk (1978)). The number of drawings is 1000.

Although there are substantial differences between these two versions of the VAR model, the effects as regards bankruptcies are strikingly similar in these models. Thus, the real exchange rate and share price innovations affect positively and the price level, output and money (or credit) innovations affect bankruptcies negatively (see Figure 1 for details). Thus, monetary policy may indeed affect bankruptcies. In other words, bankruptcies are not only determined by output and price developments. The fact that share prices affect bankruptcies (postively) makes sense but if is not equally obvious how the real exhange rate should behave in this respect. The impulse responses suggest that the immediate effect of devaluation is negligible or even negative while the long-run effect is clearly negative. Certainly, the latter result is somewhat puzzling, at least from the point of view of the "small open economy" model.

Our data sample covers an exceptionally long period and thus one might doubt that the estimated relationships are stable over time. If, moreover, some important variables were left out of our model, this would show up in inconstancies. This does not seem to be too much of a problem, however. There are only a very few changes in the long-run variance decompositions when the model is estimated from various subperiods. (Also, the explanatory power of the models seems to be quite invariant over different estimation periods.[3]

Finally, a few words about the nonlinearity test results, which were already discussed in Section 2. The plots of the G irreversibility statistics suggested by Ramsey (1990) are presented in Figure 2.[4] Comparing these test statistics with the computed benchmark values of the standard deviations indicates that there are some nonlinearities as regards time irreversibility in univariate models.

At least, the following critical points should be mentioned: the real exchange rate with a lag of 60 or 70 months, the consumer price index with a lag of 20 or 40 months (notice here the difference between consumer and wholesale prices), all money and credit series, and the share prices with a very short lag (1–2 months). If one compares the behaviour of the G statistic for the money and credit series, there seems to be a rather clear difference between the m1 series, on the one hand, and the m2 and bank lending series, on the other hand. There is very little systematic behaviour in the irreversibility coefficient of m1 while there are rather clear and systematic changes over time in the irreversibility coefficients of m2 and l. In particular, the coefficients of bank lending (l), experience a strong downward drift with lag length k. One may speculate here that the difference between the time-series properties of m1 and l may indeed show up in the estimation results. The generally inferior performance of bank lending in the VAR model may reflect the fact that the effects of the latter variable operate (only) in a nonlinear way and that these nonlinear effects cannot be captured by the standard linear VAR model.

It is noticeable that the behaviour of both bankruptcies and industrial production does not reflect clear nonlinearities. Thus, one cannot really argue in favour of asymmetric (real) business cycles. Rather, one may argue that the institutional setting as regards price and wage formation, as well as the capital market, have changed over time, presumably in an abrupt way in some cases. Unfortunately, we cannot arrange a very powerful test for nonlinearities due to lack of proper distribution values for the irreversibility test statistic. Hopefully, we will be able to correct this deficiency on some latter occasion.

4 Concluding Remarks

This study has demonstrated that bankruptcies play a very important role in the determination of key (macro)economic variables, both financial and non-financial. The importance must at least partially be due to the effects firm failures have on banks' behaviour and thus on the supply of credit and liquidity. Moreover, it seems that liquidity itself has a strong impact on bankruptcies both in the case of money and credit, so that one can really speak about potential destructive effects of a "credit crunch".

As far as the choice between money and credit is concerned, our results favour the former variable. Money seems to have a clearly more important quantitative effect on all other variables. Also, the respective qualitative effects seem to make more sense. If this result is consistent with evidence from other countries the results for the interest rate effects are not. We found the interest rate (i.e. the discount rate) to be completely insignificant.

Our final remark concerns estimation problems. We have used extraordinary long time series in the vector autoregressive model framework to find the relevant short- and long-run effects. Although these data give us a huge number of degrees of freedom, some problems do arise. In this setting testing becomes very tedious: basically "everything becomes significant" at standard levels of statistical significance. So, which hypotheses should be rejected and which not? A more important problem concerns, however, various changes in institutions and regimes. It may well be that these changes do not show up in conventional stability tests because these changes are genuinely nonlinear and therefore these tests do not show any effect but, instead, some alarming values of nonlinearity may be obtained for the latter type of tests. Of course, it is always possible that the underlying model is nonlinear as well. Irrespective of the source of nonlinearities we have to acknowledge that the existence of nonlinearities would completely change the way in which we specify and estimate our models.

Footnotes

1 The poor performance of the interest rate is somewhat surprising because there is a lot of international evidence suggesting that its role is far from nontrivial (see, e.g. the seminal paper of Sims (1980)). An obvious reason for this poor performance is the fact that during the course of financial market liberalization the practical importance of the discount rate has clearly decreased, or even vanished.

2 Results with the broad money concept, m2, were qualitatively similar to the reported results, except that the explanatory power decreased somewhat when this alternative measure was used. Because of this, and also because of lack of space, these results are not displayed here. As far as the variable ordering is concerned, we experimented with some alternative orderings. The residuals did not turn out to be uncorrelated and therefore the results were slightly but not crucially sensitive to the ordering of variables. Thus, the following statistically significant correlation coefficients were obtained in the case of a seven variable VAR model for the vector $y = (e^r, p, y^r, m1, b, s, l)$: e^r:p –.178, p:s .171, l:b –.112, y^r:m1 .101 and m1:s .077. (the asymptotic standard deviation of the correlation coefficients is .035). We cannot defend our choice very strongly, but the chosen ordering seems to be the most obvious in terms of the so-called "small open economy" model.

3 See Starck and Virén (1992) for details of the stability analysis. It is interesting to compare this result with recent results by Friedman and Kuttner (1992) with U.S. data. They find that the most recent data completely destroys the evidence supporting the close relationship between money (or credit) and income and prices.

4 The G statistic for variable x is defined as

$$G_{ij}^{k} = \sum_{t=1}^{n}\left(\frac{1}{n}\right)[(x_t)^i(x_{t-k})^j - (x_t)^j(x_{t-k})^i], \quad k = 1,2,\ldots,K.$$

Here, following Ramsey (1990), we assume that i=2 and j=1. The (maximum) lag length K is set at 120. For all the time series in Figure 2, the log difference transformation is used to induce stationarity. The standard deviations for the G statistic are computed here assuming that x is independently and identically distributed according to the normal distribution. Thus, they can be derived from the following formula (see Ramsey and Rothman (1988) for details):

$$\sigma = \sqrt{\left\{\left(\frac{4}{(n-1)}\right)\cdot\sum_{t=1}^{n}\left(\frac{1}{n-1}\right)\cdot\left(x_t^2\cdot x_{t-1}^2\cdot x_{t-2}^2\right)\right\}}.$$

Obviously, these assumptions are not valid here and, therefore, the reported standard deviations should be considered as some sort of crude benchmark only. It should be emphasized that these benchmark values may not be very good. Unfortunately, it is not at all clear how the standard deviations should be computed. At least it is sure that computing is very cumbersome. For further details see the extensive Monte Carlo simulations by Ramsey and Rothman (1988).

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Figure 1. **Impulse responses for bankruptcies**

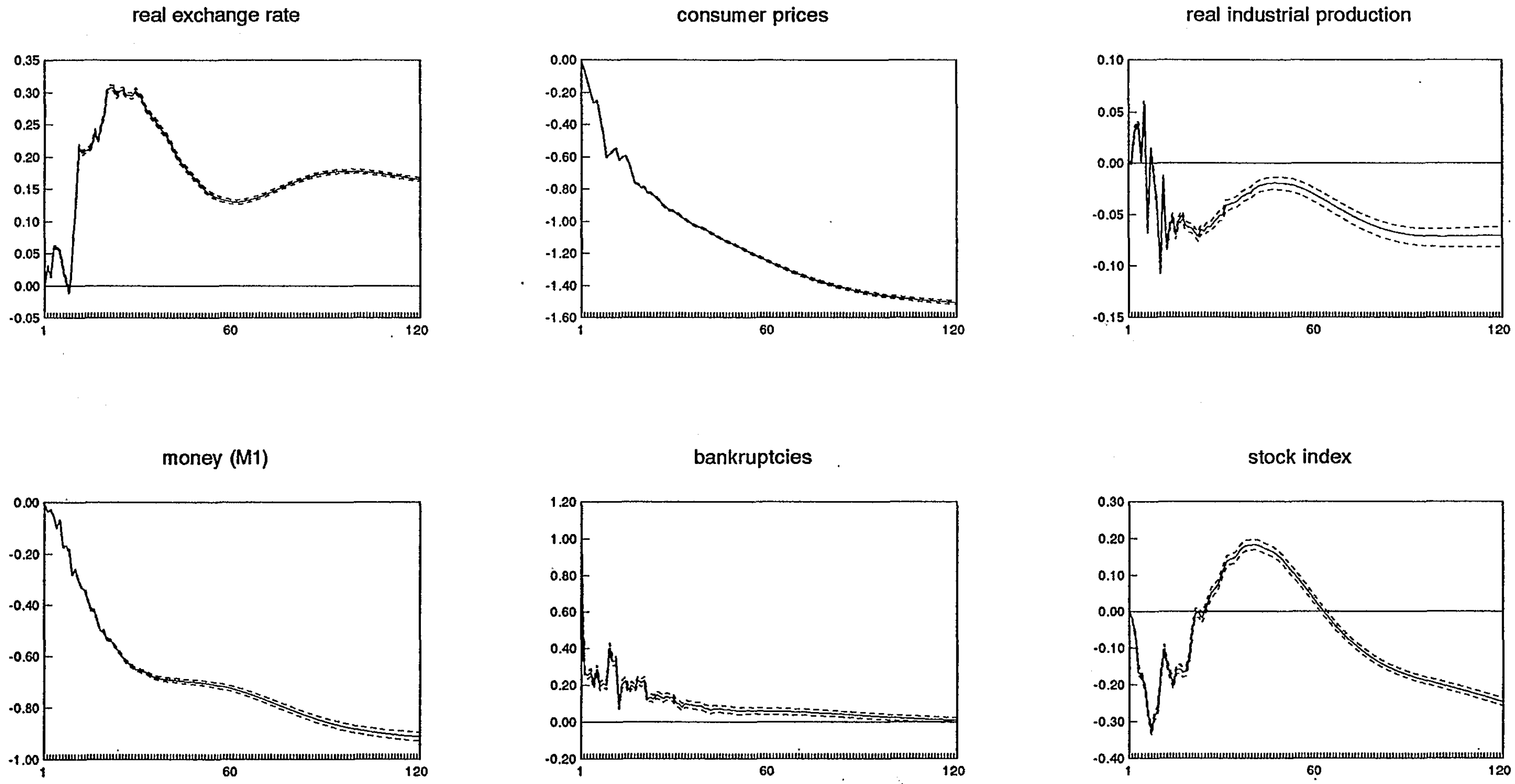
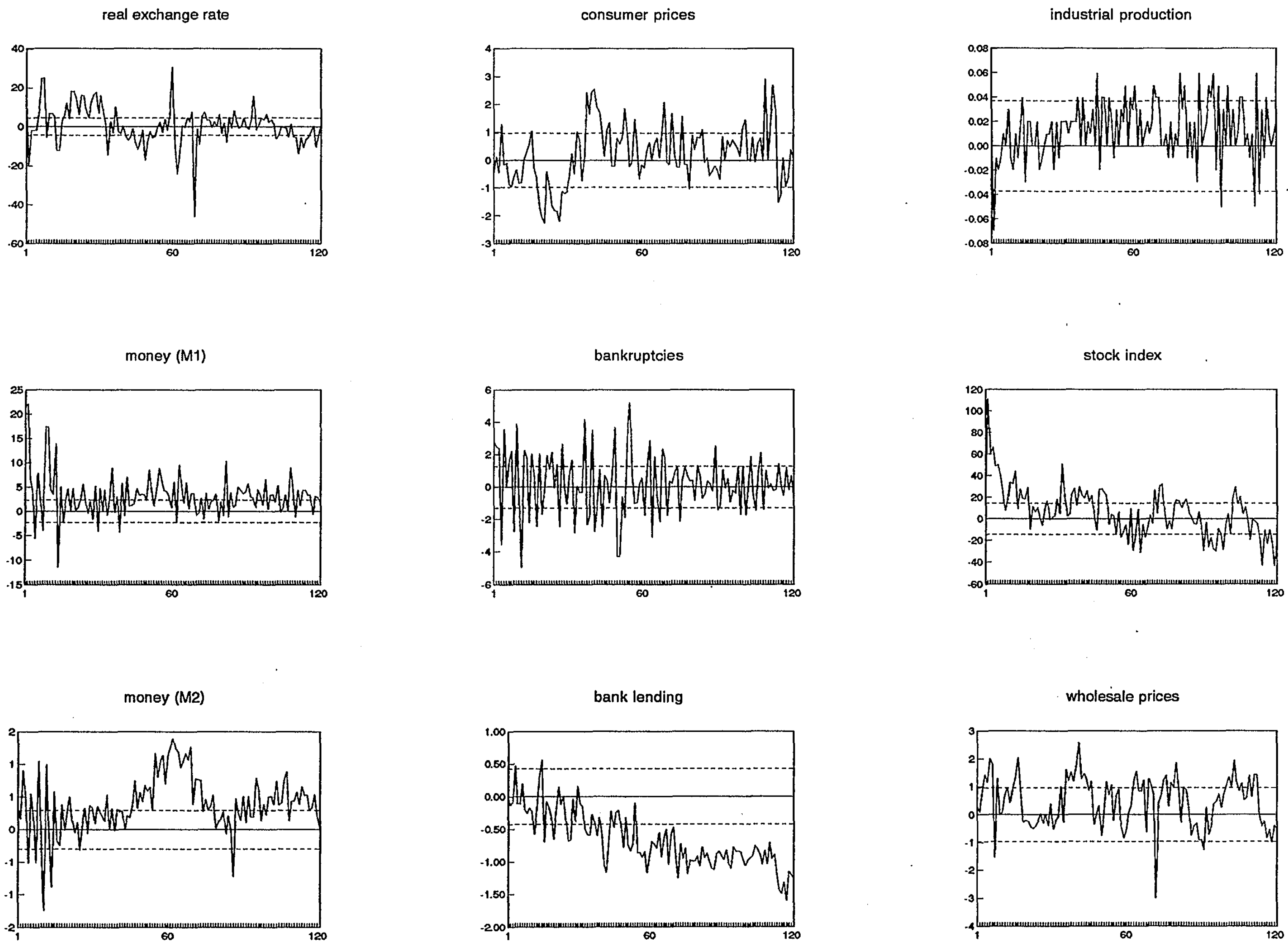


Figure 2. **Plot of the irreversibility test coefficients**



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