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Financial Factors and the Macroeconomy

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Suomen Pankki
Bank of Finland
P.O.Box 160, SF-00101 HELSINKI, Finland
☎ + 358 0 1831

Carolina Sierimo* and Matti Virén**

Research Department
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* Graduate assistant, University of Helsinki, Helsinki
** Professor of economics, University of Turku, Turku
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Abstract

This paper examines the relationships between financial and nonfinancial variables in three Nordic countries (Finland, Norway and Sweden). We try to find out whether there exists some kind of dichotomy between these two sets of variables, both in terms of levels of variables and the respective volatilities. In particular, we scrutinize the role of the stock market (stock prices and stock market turnover) in this respect. The analysis makes use of standard time series analytical tools, cointegration analysis, analysis of Granger causality and cross-spectral analysis. The results of these empirical analyses suggest that, although the behaviour of the financial variables has been quite similar, there are important differences between these three countries. Still, in all countries important relationships between these sets of variables are detected. However, in most cases causality seems to be bidirectional or instantaneous.

Tiivistelmä

Tutkimuksessa tarkastellaan rahoitusmarkkinamuuttujien ja muiden makrotaloudellisten muuttujien välisiä riippuvuuksia Suomessa, Norjassa ja Ruotsissa. Tarkoituksena on selvittää, vallitseeko näiden muuttujien (mukaan lukien volatiilisuuden) välillä ns. dikotomia-ominaisuus. Erityisen huomion kohteena ovat pörssimarkkinat – pörssikurssit ja pörssin vaihto. Analyyseissa hyödynnetään tavanomaisia aikasarja-analyyttisia välineitä, yhteisintegroituvuusanalyysia, Grangerin kausaalisuustarkasteluja ja spektrianalyysiä. Empiiriset tulokset viittaavat siihen, että vaikka rahoitusmarkkinamuuttujat ovatkin kehittyneet samalla tavalla, maiden välillä on melkoisia eroja erityisesti reaalimuuttujia koskevien riippuvuuksien suhteen. Useita selviä riippuvuuksia toki ilmenee. Useimmissa tapauksissa kausaalisuus on kuitenkin luonteeltaan kaksisuuntaista tai välitöntä.

Contents

1 Introduction

This paper deals with the financial markets in three Nordic countries – Finland, Norway and Sweden. More precisely, we examine the relationships between financial and nonfinancial variables. Basically, we are concerned with the question of whether there exists some kind of dichotomy between these two sets of variables.[1] Putting the question in this way obviously means that our analysis represents a data description rather than a formal test of some specific hypothesis. Clearly, there is no clear-cut alternative to the basic hypothesis. The problem is even more difficult when we analyze the short-run phenomena. Then it is essential what kind of assumptions are made concerning expectations formation and expectation errors. By contrast, it is much easier to formulate hypotheses in terms of long-run behaviour, for instance, in terms of long-run parities between certain variables. In this case, the Fisher Parity, the Purchasing Power Parity and the (Uncovered) Interest Rate Parity could be such hypotheses and, in fact, they are also informally scrutinized in this study.

We pay special attention in this study to the stock market, stock prices and the volume of stock market transactions. The basic question is, of course, whether there are any important linkages between the stock market and the macroeconomy. This question is by no means a new one but – somewhat surprisingly – very little is known about possible linkages.

There are several analyses which have tried to distinguish the effects of, say, the exchange rate, inflation and the current account on the behaviour of stock returns.[2] For instance, Fama (1981) found a positive relationship between stock returns and future output growth and a negative relationship between returns and expected inflation, on the one hand, and bankruptcies and unemployment, on the other hand. Several studies have tried to distinguish the effects of money supply (and some other data announcement) surprises on stock returns (see, e.g., Pierce and Vance (1985) and Harouvelis (1987)).[3] It is a rather hard to summarize the results from these studies but it seems that some – albeit weak – evidence has been found on the stock return effects of these "surprise" variables.

Rather than looking at stock returns, one could instead scrutinize the volatility of these returns and the role which various macroeconomic shocks play in terms of this volatility. A fairly large number of studies have dealt which this problem. Perhaps, the most notable is the paper by Schwert (1989), which scrutinizes changes in U.S. stock market volatility over time relating the volatility to interest rates, inflation, money growth and industrial production. Schwert's study shows that stock market volatility is quite clearly related to the

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[1] Dichotomy is often encountered in VAR analyses with macroeconomic data. See, e.g., Eichenbaum and Singleton (1986) and Friedman and Kuttner (1992). In particular, the nonexistence of any relationship applies to monetary aggregates. With interest rates (and interest spreads), the results have been somewhat different (indicating that interest rates do indeed matter).

[2] Of course, the whole ATP literature is relevant in this context but to summarize it is beyond the scope of this article.

[3] See also Sadeghi (1992), Ali and Hasan (1993).

volatility of the above-mentioned variables in a cyclical terms and somewhat less clearly in other terms. In addition these macroeconomic variables, as too stock market trading volume, turned out to be strongly (positively) related to stock market volatility in Schwert's (1989) study (and also in several subsequent empirical studies). The existence of this kind of relationship is something one might expect given the typical features of the trading process, distribution of market participants and their information set (for empirical evidence, see also Liljeblom and Stenius (1993)).

As far as the implications of stock market behaviour for the macroeconomy are concerned, the analyses do not follow any uniform framework. Typically, stock prices are used as some kind of leading indicators of the state of the macroeconomy, reflecting, for instance, firms' income expectations. Alternatively, they are used in deriving measures of asset wealth. Thus, stock prices could have some explanatory power in terms of consumption and investment behavior (as, indeed, seems to be the case; see, e.g., Hall (1978)). One could also argue that stock prices also affect bankruptcies via various solidity requirements (see, e.g., Takala and Virén (1995) for empirical evidence on this hypothesis). Finally, one could point out that in the financial markets there is some kind of trade-off between stocks and other financial instruments (bonds, for instance) which may show up in interest rate movements.

The subsequent empirical analyses try to shed some light on these open questions by means of some standard time-series analytical tools. Thus, we first examine some basic descriptive statistics for the time series. We then scrutinize the sationarity properties of these series and make tests for cointegration. Cointegration tests obviously give us some information on the causality structure of the financial and nonfinancial variables. Causality (more precisely Granger non-causality) is also investigated by means of cross-correlation analysis and conventional Granger non-causality test statistics. We also analyze the cross-spectra of the relevant variables (stock prices vs the macroeconomic variables). More precisely, we compute the sample coherency and phase spectra to find out the importance of these bivariate relationships and also to detect possible lead-lag relationships in the frequency domain.

The above-mentioned analyses concern the direct relationships between the variables. Obviously, there is no need to limit the analyses to the levels (or first differences) of the data; it might also be worthwhile to examine the relationships between the volatilities of the series. Consequently, we also perform analyses with the squared differences and absolute values of the data to see whether there exists any causality between variables in terms of volatilities. In fact, we could also say that this analysis might reveal possible long-memory properties of the data. The existence of these properties might be important because they would tell something about (capital) market efficiency.

2 The data

The empirical analyses make use of monthly time series data from three Nordic countries: Finland, Norway and Sweden. The data cover the following periods: 1922M1–1995M5 in the case of Finland, 1933M1–1995M4 for Norway and 1929M1–1995M4 for Sweden. The number of observations is quite large; for

instance in the case of Finland, it is 880. The following variables appear in the analyses:

- stock price index (index)
- turnover in stock exchange (vol)
- government bond yield (bond)
- consumer price index (cpi)
- industrial production (ip)
- number of unemployed persons (unemp)
- number of bankruptcies (bankr)
- exchange rate against the US dollar. (exchr)

The data also include money and credit series but unfortunately the series for Norway and Sweden only cover the period 1960–1995, and to preserve comparability of results these series are not included in the subsequent empirical analyses.

A detailed description of the data (see Figure 1 for the graphs of the time series) and the data sources are explained in the data appendix.

3 Results from empirical analyses

3.1 Descriptive data

We start by scrutinizing the time series graphs (in Figure 1[4]) and descriptive statistics (Table 1) for the above-mentioned series. These data suggest that the behaviour of the financial variables has been quite similar while more dissimilarities are encountered with the nonfinancial (real) variables. Looking at stock prices first, we may note that both the sample means and standard deviations for the first log differences (see Table 2) are remarkably similar, especially in real terms.[5] The rate of change in real stock market prices in Sweden has been slightly higher than in Finland and Norway but the difference may well be due to differences in the sample period. Real stock returns have been only a little higher than the real interest rate (in Norway, actually lower (?)). Because the series do not include dividends, this does not necessarily refute the so-called "equity premium puzzle" (which is related to question of why the average stock return is so high in relation to the average return on short debt; see, e.g. Mehra and Prescott (1985)). We do not yet have a complete

[4] The graphs in Figure 1 are STAMP trends (the bond yield and exchange rates series are untransformed, however).

[5] One could also note that the stock market capitalization rates in these countries are quite similar. Thus, both in Finland and Sweden the corresponding rates (in relation to the GDP) are about 36 %.

series of dividend returns for these three countries so that we cannot say exactly by how much stock returns exceed (riskfree) interest rates.[6]

In Finland, inflation has been notably higher than in Norway and Sweden (to large extent because of developments in the late 1940s). As for result, the rate of (currency) depreciation has also been higher in Finland. In terms of output growth, Finland has the best performance while in Sweden long-run growth has remained very low.

As far as volatility is concerned, there are perhaps fewer intercountry differences. Thus, for instance, stock price and stock market trading volatility are almost the same in all three countries. Volatility differences are somewhat higher as regards the nonfinacial series. Note, for instance, the very low variability of all real series (output, unemployment and bankruptcies) in Sweden.

3.2 Cointegration and causality

The first step in testing the nature of the relationship between financial and nonfinancial variables is to examine the stationarity properties of the data. This is done here by carrying out a conventional set of unit root tests. The tests include the augmented Dickey-Fuller test, the Philips-Perron test and the weighted symmetric τ test. When testing cointegration in a bivariate setting between stock prices and other variables, the Johansen trace test is also computed. The purpose of cointegration tests is not only to examine the properties of the data and find long-run relationships but also to motivate the analysis of causality. Weak exogeneity necessarily requires cointegation between the relevant variables.

If individual variables are scrutinized, it can be easily seen that almost all variables are of I(1)-type. There is one obvious exception to this rule, that is the interest rate. Real interest rates already seem to be stationary in terms of levels, although the Finnish nominal rate can also be characterized as a I(0) variable (see Tables 3 and 4). The only puzzling result concerns the Finnish stock price (index) variable. Unit root tests suggest that even the nominal rate is of I(0) type, a result which is quite hard to swallow. A closer look at the variable reveals, however, that the I(0) assumption should be treated with great caution. The series fulfills all symptons of a nonstationary series (just see Figure 1). In particular, it turns out that the spectrum goes to infinity (of course, not strictly speaking) at zero frequency.

The Engle-Granger and Johansen tests for the cointegrating vectors (see Table 5) produce quite different results for the three countries. In the case of Finland the results show quite clearly that stock prices and the macrovariables are cointegrated. Thus, there is no unit root in the estimated cointegrating vector and one can reject the hypothesis that the number of cointegrating vectors is zero. In the case of Sweden and even more so in the case of Norway, empirical support for bivariate cointegration appears to be weak. Thus, using the Engle-Granger testing procedure as a point of reference suggests that there

[6] In recent (recession) years the average values have been relatively low. Thus, for instance, in Finland the average dividend yield for the early 1990s is only about 1.6 %.

is no long-run relationship between the Norwegian stock index (nominal or real) and all the other variables. Not surprisingly, a similar result emerges when we compute the cross-correlations and Granger causality tests as well as the cross-spectral measures.

There is no self-evident explanation for the country differences. One possible explanation is the rate of inflation. In (relatively) high inflation countries, like Finland, all nominal series probably tend to increase in a similar way. By contrast, in a low inflation country, like Norway, the series do not include any important common inflationary factors. The results in Table 5 seem to consistent with this interpretation, although there are several exceptions. Thus, the common inflationary component explanation may not be the whole truth.

We now turn to the analysis of causality, starting with the cross correlations, which are presented in Figure 2. Correlations are computed for log differences of the series (which are reasonably stationary according to the unit root tests; consequently, the interest rate series is expressed as levels). The number of lags and leads is 30.

The sign pattern of correlations is quite mixed. In many cases leads and lags are of different sign, which in itself is not, of course, necessarily an error. Some correlations, like the correlations with respect to the bankruptcy and industrial production variables are, however, so unsystematic and low that one cannot argue in favour of any clear lead-lag relationship. In the case of stock prices and trading volume, the relationship for all countries seems to be instantaneous (and positive) which is intuitively acceptable. Exchange rates behave in a similar fashion. A similar instantaneous (but negative) relationship seems to exist in terms of the interest rates, indicating that an increase in interest rates has a negative impact on stock prices (which is well in accordance with the present value formulae for firms' future profits). In the case of Finland, the relationship is, in fact, negative but not necessarily instantaneous.

As far as the price level is concerned, the results for the three Nordic countries are quite different from each other. In the case of Norway, there is no relationship, in the case of Sweden there is a positive correlation but no lead-lag relationship while in Finland there is quite a clear lead-lag relationship with a different sign pattern. Stock prices are positively related to lagged consumer prices and negatively related to leading consumer prices. Thus, prices (the price level) affect(s) stock prices positively and stock prices affect the price level negatively. The former effect is intuitively obvious but latter is somewhat obscure.

All in all, we cannot really conclude that stock prices either lead or lag the other variables in any of the sample countries. Somewhat similar results emerge when we scrutinize the Granger causality test statistics, which are computed with the stock prices index (nominal or deflated) as the reference variable or, alternatively, with nominal and real interest rates.[7] The main result of this analysis is very systematically that Granger causality – if there exists any causality – is bidirectional. The cases where causality is unidirectional (at

[7] We may mention here that Lutkepohl and Reimers (1992) show that in a bivariate case conventional Granger causality tests maintain their usual asymptotic properties even if we dealt with cointegrated processes.

standard significance levels) are easy to mention: the exchange rate in the case of Norway and Sweden and bankruptcies in the case of Finland and Sweden. Clearly, these results may simply represent some exceptional episodes and measurement errors.

In the case of interest rates, the pattern of causality is somewhat similar. In particular, this is true for Sweden: unidirectional causality runs from interest rates to consumer prices and bankruptcies. Unfortunately, the results for Finland, and to some extent for Norway, are quite different. Thus, in the case of Finland, consumer prices, employment and bankruptcies all seem to cause the interest rate movements. In the case of real interest rates, this might, of course, reflect the fact that both unemployment and bankruptcies could affect the rate of inflation, which has earlier dominated movements in nominal rates. In the case of Norway, there is not much evidence of causal relationships. The scant evidence which is obtained suggests that nominal (but not real) rates are causal factors rather than endogenously determined variables.

This lack of evidence of causality leads us to believe that there may be a difference between short and long-run cyclical effects and, therefore, the case can better be understood by analyzing the relationship between financial and nonfinancial variables in the frequency domain. Thus, we now turn to this analysis.

3.3 Analysis in the frequency domain

The results from this analysis are presented in Figures 3 and 4, which contain the graphs for coherencies between both stock prices and nominal and real interest rates, on the one hand, and the other variables, on the other hand. These data have been computed using the Bartlett window, with the window parameter being equal to 40 and experimenting with various window sizes. In the case of coherencies, the 5 per cent significance level (for the null hypothesis of zero coherency) was computed by Monte Carlo simulation (with 100 replications). The critical value 0.233 turned out to be quite close to the tabulated value in Koopmans (1974). The data have been (log) differenced to make them stationary. The cycle length in figures is measured in months.

When analyzing the coherencies one may readily conclude that again there is quite a clear difference between Finland and Sweden, one the one hand, and Norway, on the other hand. The Norwegian values turned out to be significant only marginally while some important relationships showed up for the other two countries. A feature common to all countries is the fact that stock prices and stock market turnover are highly related at low frequencies (i.e., at long cycles). Further, the exchange rate relationship is common to all countries although it is very difficult to say what is the typical frequency for the relationship. Obviously, the timing of discrete devaluations vary from country to country creating "different" devaluation cycles.

Perhaps the most interesting results are those concerning the interest rate and the price level. Bond yields and stock prices are correlated, especially at low frequencies, roughly at the business cycle frequencies. The relationship does not, however, carry over to zero frequency, suggesting lack of a long-run (cointegation) relationship. This might be an obvious result (due to different

time series properties of stock prices and interest rates) but it is somewhat surprising that a similar result emerges with respect to consumer prices in Finland and Norway. The coherency pattern for Sweden is somewhat obscure because the main peak corresponds to an semiannual frequency, which may tell something about seasonal pattern of taxes and tariffs or a January-effect type phenomenon.

The coherencies for the remaining macroeconomic variables are somewhat difficult to interpret although one may still discern some relationship at the business cycle frequency. For instance, in the case of Sweden, this result applies both to industrial output, bankruptcies and unemployment. All in all, one may say that the cyclical relationship seems to make sense although all results cannot be easily interpreted.

As for the coherencies between interest rates and other variables, one may note that the values are somewhat lower than in the case of stock returns. Thus, the null hypothesis of zero coherency can hardly be rejected for most of the variables (at the 5 per cent level of significance). The significant peaks in coherency spectra do not follow any clear pattern, which makes it rather difficult to believe that there are strong and systematic relationships between these variables.

Somewhat surprisingly, we found that the coherencies are rather low at low frequencies (long cycles). Take, for instance, the coherency between consumer prices and the nominal interest rate. In the case of Finland, the pattern is consistent with the Fisher hypothesis but in the case of Norway the coherency pattern is of opposite type (the series are related only at very high frequencies). In the case of Sweden, the significant peak represents a half-year cycle, which obviously cannot be easily interpreted. Anyway, the pattern is not well in accordance with the Fisher hypothesis either.

As the coherencies are quite low it is obviously rather hard to interpret the lead-lag relationships in the frequency domain. In fact, it turned out that the phase spectra were quite erratic, making it very difficult to draw an unambiguous conclusion about the nature of the result. Thus, we try to summarize the main findings in a somewhat informal way using the following qualitative assessments of these relationships (the statement "leads" means that the stock price index leads the respective variable while "lagging" obviously means that it lags).

The results are somewhat systematic in terms of stock market turnover and the interest rates. Otherwise, one cannot really draw any conclusions about the lead-lag relationship.[8] The fact that stock prices seem to lead most nonfinancial variables is nevertheless worth mentioning because it suggests that stock prices have some value as leading indicators. The lead seems to apply not only to short cycles but also to relatively long cycles.

[8] Phase spectra do not follow any clear pattern in terms of fixed angle lag or fixed time period lag for any variable. Of course, the interpretation of phase spectra is not very easy because we have to exclude, for instance, possible feedback effects and simply assume that causation is unidirectional. (Rational) expectatios represent another serious obstacle. See, e.g., Granger (1969) for further details.

	Finland	Norway	Sweden
Stock prices			
Turnover volume	lagging	lagging	lagging
Exchange rate	leads	..	lagging
Bond yield	leads	leads	leads
Real interest rate	leads	lagging	leads
Consumer prices	leads	..	..
Industrial production	leads	lagging	leads
Unemployment	..	lagging	..
Bankruptcies	leads	lagging	leads
Nominal interest rates			
Turnover volume	lagging	lagging	..
Exchange rate	leads	leads	lagging
Consumer prices	lagging	leads	..
Industrial production	leads	leads	lagging
Unemployment	leads	leads	leads
Bankruptcies	leads	leads	leads
Real interest rates			
Industrial production	lagging	..	..
Bankruptcies	lagging	leads	..

.. indicates that the phase spectrum is too complicated to be interpreted.

As for interest rates, interpretation is perhaps somewhat easier. It seems that a common feature of the results is that nominal interest rates seem to lead production, unemployment and bankruptcies. This result does not, however, carry over to real rates. In fact, the evidence is somewhat contrary, suggesting that the behaviour of nominal rates and inflation have been quite different in these three Nordic countries. During periods of capital market restrictions and regulation, very low nominal rates could coexist with a very high rate inflation. Recently, however, nominal rates have been very high by historical standards while the rate of inflation has been exceptionally low.

3.4 Testing relationships between volatilities

As mentioned above, we still have to look at the relationship between volatilities of different series to see whether volatilities or uncertainties are somehow related and whether the relationships just concern variances or higher order moments or whether these relationships can be characterized by some nonlinearities. To address this latter alternative, we scrutinize the relationships between absolute differences of the respective variables.

An analysis of volatilites obviously makes sense only if we can say that volatilities have changed over time. This is, in fact, the case, as one can see from Table 7, which shows the standard deviations of the first log differences of the time series computed over 10 year periods. Volatility has clearly

increased, at least during the last ten or fifteen years (after capital market liberalization one might say).

Now, if one relates these variables to each other, it turns out that there is much higher correlation between squared differences and, in particular, with absolute values of these variables. Thus, if one scrutinizes Table 8 with these correlation coefficients, it turns out in the case of Finland that with differenced data only 10 out of 36 correlations are significant (at the 5 per cent level) while the corresponding number for squared terms is 14 and for absolute values as high as 24. The numbers for Norway and Sweden are quite similar: Norway: 8/4/12; Sweden 11/14/19. A similar result was obtained by Ding, Granger and Engle (1993) with U.S. stock market prices. They interpreted this result as evidence of a "long memory" property, which means that the data generating process is probably genuinely nonlinear. Thus result also means that we should not take it for granted that an ARCH or GARCH process is the proper way of modelling the time series behaviour of the volatility (compare, e.g., with Hsieh (1991)).[9]

Thus, there are good grounds for studying the relationship between volatilities a little bit more closely. With this aim in mind we computed Granger causality test statistics for this transformed set of series. The results are presented in Table 9. They clearly show that there are causal relationships between squared and absolute values of stock prices and various macroeconomics variables.

Again, the relationships are much stronger in Finland and Sweden than in Norway. Another common, although not very strong, feature of the results is the fact that causation seems to run from macroeconomic series to stock prices rather than vice versa. Not surprisingly, this is particularly true with absolute values of the differenced data. Anyway, the results accord well with analyses which show that financial market volatility is caused by macroeconomic shocks (see, e.g. Schwert (1989)).

In accordance with this assertion, one may notice that real interest rates behave slightly differently from stock prices and nominal interest rates. Thus, scruting of the cases where there is unidirectional causality with respect to squared and absolute values of the differences of the respective variables reveals that causation seems to run from real interest rates to the other variables. Unfortunately, we have to rely on the expost real interest rate. This may well reflect the actual rate of inflation, which in a small open economy is highly dependent on global price stability, which, in turn, is clearly an exogenous element. Thus, inflation shocks caused for instance by oil crises may indeed cause profound changes in the volatility environment of financial and nonfinancial variables.

Finally we may note that, when the correlations between squared and absolute values of different variables are scrutinized, bankruptcies represent an essential ingredient in the sense that the correlations are rather high, in some cases very high. Causality seems be bidirectional but this may merely reflect the fact that bankruptcies represent an important element in the propagation

[9] Clearly, the results suggest that further testing for nonlinearities in worthwhile with these data. In fact, some analysis with Finnish data give strong support to the notion that the time series are characterized by nonlinearities (but not by chaos; see Takala and Virén (1995b) for further details.

mechanism of financial and nonfinancial shocks (see, e.g Takala and Virén (1995a) for further discussion and evidence).

4 Concluding remarks

The comparative analysis with Nordic data has shown that there are many important differences between the three countries analyzed. In the case of Norway, we found very weak relationships between financial variables, especially stock prices, and (nonfinancial) macroeconomic variables. In the case Finland and Sweden, the relationships were much stonger.

Although we found some important relationships we could not really detect any clear causal relations, neither in the time nor the frequency domain. Thus, it seems that even if we use relatively high frequency data, most relationships still look instantaneous or bidirectional. In the case of volatilities, we may conclude that causation rather runs from macroeconomic variables to stock prices rather than vice versa.

Finally, it seems that there are cyclical relationships which are probably related to business cycles. By contrast, the long-run relationships seem to be much weaker. This result even applies to the relationship between consumer prices, on the one hand, and stock prices and interest rates, on the other hand. This is not very surprising if we bear in mind that over the last 60 or 70 years vast institutional and structural changes have taken place. Against this background, the quality of these results is actually quite astonishing.

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Tables:

Table 1. **Annualized sample means of the time series, %**

	Finland	Norway	Sweden
Stock index	8.4	5.5	6.7
Deflated stock index	1.6	0.3	1.9
Trading volume	15.1	15.9	13.3
Deflated trading volume	8.3	10.7	8.5
Bond yield	7.6	6.9	6.5
Real interest rate	0.9	1.8	1.8
Consumer prices	6.8	5.2	4.7
Industrial production	4.5	3.4	1.5
Unemployment	8.8	1.2	4.7
Bankruptcies	2.9	3.8	2.2
Exchange rate	2.8	−0.1	1.2

All variables (except the interest rate series) are expressed as 1200 times first log differences. Interest rates are expressed as levels. The sampling period for Finland is 1922M2–1995M4, for Norway 1933M2–1995M3 and for Sweden 1929M2–1995M3.

Table 2. **Annualized sample standard deviations of the time series**

	Finland	Norway	Sweden
Stock index	18.0	15.6	14.9
Deflated stock index	18.0	15.6	15.2
Trading volume	104.6	147.7	120.4
Deflated trading volume	104.8	147.6	120.4
Bond yield	1.7	2.8	3.3
Real interest rate	10.3	4.3	4.0
Consumer prices	5.2	2.4	2.1
Industrial production	20.4	17.6	3.1
Unemployment	53.6	60.2	20.4
Bankruptcies	127.0	40.2	24.2
Exchange rate	11.1	10.0	8.0

Annualized values are obtained by multiplying the corresponding monthly log difference values by $100*\sqrt{12}$. Interest rates are again expressed as (untransformed) annualized levels.

Table 3. **Unit root tests (levels)**

Finland

	Wtd.sym.	D-F	Phillips
INDEX	0.017	0.006	0.050
RINDEX	0.020	0.057	0.231
VOL	0.722	0.731	0.231
RVOL	0.808	0.836	0.302
BOND	0.031	0.241	0.052
RBOND	0.052	0.093	0.005
CPI	0.999	0.479	0.824
IP	0.122	0.270	0.051
UNEMP	0.025	0.061	0.037
BANKR	0.879	0.851	0.000
EXCHR	0.848	0.800	0.801

Norway

	Wtd.sym.	D-F	Phillips
INDEX	0.926	0.823	0.590
RINDEX	0.948	0.595	0.384
VOL	0.866	0.847	0.288
RVOL	0.833	0.815	0.179
BOND	0.973	0.791	0.771
RBOND	0.046	0.002	0.001
CPI	0.988	0.795	0.946
IP	0.819	0.887	0.283
UNEMP	0.069	0.034	0.126
BANKR	0.972	0.202	0.000
EXCHR	0.741	0.753	0.621

Sweden

	Wtd.sym.	D-F	Phillips
INDEX	0.991	0.239	0.531
RINDEX	0.583	0.105	0.244
VOL	0.998	0.906	0.594
RVOL	0.995	0.895	0.433
BOND	0.896	0.420	0.264
RBOND	0.013	0.010	0.007
CPI	1.000	0.602	0.894
IP	0.662	0.261	0.538
UNEMP	0.784	0.832	0.939
BANKR	0.811	0.492	0.831
EXCHR	0.055	0.131	0.156

Wtd. sym. = Weighted symmetric unit root test, D–F = Dickey-Fuller (τ) unit root test and Phillips = Phillips-Perron nonparametric (z) unit root test. All values are marginal probabilities, the lag length is selected by means of the Akaike Information Criterium.

Table 4. **Unit root tests (differences)**

Finland

	Wtd.sym.	D-F	Phillips
INDEX	0.000	0.000	0.000
RINDEX	0.000	0.000	0.000
VOL	0.000	0.000	0.000
RVOL	0.000	0.000	0.000
BOND	0.000	0.000	0.000
RBOND	0.000	0.000	0.000
CPI	0.000	0.000	0.000
IP	0.000	0.000	0.000
UNEMP	0.000	0.000	0.000
BANKR	0.000	0.000	0.000
EXCHR	0.000	0.000	0.000

Norway

	Wtd.sym.	D-F	Phillips
INDEX	0.000	0.000	0.000
RINDEX	0.000	0.000	0.000
VOL	0.000	0.000	0.000
RVOL	0.000	0.000	0.000
BOND	0.000	0.000	0.000
RBOND	0.000	0.000	0.000
CPI	0.000	0.000	0.000
IP	0.000	0.000	0.000
UNEMP	0.000	0.000	0.000
BANKR	0.000	0.000	0.000
EXCHR	0.000	0.000	0.000

Sweden

	Wtd.sym.	D-F	Phillips
INDEX	0.000	0.000	0.000
RINDEX	0.000	0.000	0.000
VOL	0.000	0.000	0.000
RVOL	0.000	0.000	0.000
BOND	0.000	0.000	0.000
RBOND	0.000	0.000	0.000
CPI	0.001	0.001	0.000
IP	0.000	0.000	0.000
UNEMP	0.000	0.000	0.000
BANKR	0.001	0.002	0.000
EXCHR	0.000	0.000	0.000

Table 5. **Engle-Granger and Johansen cointegration tests**

Finland

	E-G INDEX	J. r=0 INDEX	J. r>0 INDEX	E-G RIND	J. r=0 RIND	J. r>0 RIND
VOL	−3.377	23.072	1.638	−3.369	14.804	3.047
	0.130	0.011	0.196	0.132	0.143	0.076
RVOL	−4.070	16.644	0.601	−2.744	15.193	1.832
	0.022	0.083	0.455	0.388	0.128	0.172
EXCHR	−4.149	22.827	2.430	−4.319	27.969	2.399
	0.018	0.012	0.111	0.010	0.003	0.114
BOND	−4.019	26.135	8.718	−3.341	22.196	10.206
	0.026	0.005	0.003	0.140	0.014	0.001
RBOND	−4.126	26.791	9.033	−3.358	25.549	10.629
	0.019	0.004	0.002	0.135	0.006	0.001
CPI	−4.209	21.272	4.509	−4.209	21.272	4.509
	0.015	0.018	0.031	0.015	0.018	0.031
IP	−4.106	24.589	6.102	−3.373	25.777	8.814
	0.020	0.007	0.012	0.131	0.005	0.002
UNEMP	−3.830	27.260	8.571	−3.119	19.819	6.156
	0.044	0.003	0.003	0.215	0.028	0.012
BANKR	−4.399	24.413	1.569	−3.394	24.584	2.199
	0.008	0.008	0.208	0.125	0.007	0.132

Norway

	E-G INDEX	J. r=0 INDEX	J. r>0 INDEX	E-G RIND	J. r=0 RIND	J. r>0 RIND
VOL	−1.786	22.304	8.122	−2.034	24.795	6.170
	0.850	0.014	0.004	0.757	0.007	0.011
RVOL	−1.757	20.915	7.419	−2.023	23.699	6.042
	0.858	0.020	0.005	0.762	0.009	0.012
EXCHR	−1.344	6.931	2.458	−2.291	10.771	3.238
	0.946	0.728	0.109	0.634	0.404	0.068
BOND	−1.579	35.185	11.818	−2.270	33.470	8.735
	0.905	0.0004	0.0004	0.645	0.001	0.003
RBOND	−1.868	27.342	3.882	−2.142	28.413	5.907
	0.822	0.0003	0.046	0.708	0.003	0.013
CPI	−2.026	19.915	5.114	−2.026	19.915	5.114
	0.761	0.027	0.021	0.761	0.027	0.021
IP	−2.551	16.589	1.383	−2.224	14.189	2.099
	0.492	0.084	0.247	0.668	0.169	0.142
UNEMP	−1.444	17.799	2.727	−1.790	19.018	4.541
	0.931	0.057	0.091	0.848	0.037	0.030
BANKR	−2.229	14.009	1.797	−1.996	14.692	2.732
	0.665	0.178	0.176	0.773	0.148	0.091

Sweden

	E-G INDEX	J. r=0 INDEX	J. r>0 INDEX	E-G RIND	J. r=0 RIND	J. r>0 RIND
VOL	−3.737	16.892	0.799	−3.148	13.551	0.423
	0.056	0.076	0.397	0.205	0.201	0.508
RVOL	−3.781	17.592	1.278	−3.488	13.894	0.547
	0.050	0.061	0.271	0.102	0.183	0.471
EXCHR	−3.413	21.783	3.682	−3.787	26.582	4.770
	0.120	0.016	0.052	0.049	0.004	0.026
BOND	−2.392	19.009	6.196	−3.093	21.203	5.550
	0.580	0.037	0.011	0.225	0.019	0.017
RBOND	−2.926	25.889	7.001	−2.929	26.693	8.269
	0.297	0.005	0.007	0.296	0.004	0.003
CPI	−3.257	25.747	3.689	−3.257	25.747	3.689
	0.166	0.005	0.052	0.166	0.005	0.052
IP	−2.634	14.257	2.920	−3.058	15.711	3.277
	0.447	0.166	0.082	0.239	0.111	0.066
UNEMP	−3.813	16.868	0.357	−3.655	15.932	0.346
	0.046	0.077	0.528	0.069	0.104	0.531
BANKR	−2.749	14.644	4.572	−3.496	15.402	4.043
	0.385	0.150	0.030	0.100	0.121	0.041

INDEX denotes the nominal stock price index, RIND the corresponding deflated (INDEX/CPI) measure. E–G = Engle-Granger unit-root cointegration test for the cointegrating vector, J. = Johansen's trace test for $r = 0$ and $r > 0$, respectively. The test statistics are shown in the first row. The corresponding marginal probabilities are shown in the second row.

Table 6. **Granger causality tests**

Finland

	INDEX		RINDEX		BOND		RBOND	
VOL	7.419	8.354	6.185	8.404	1.577	1.645	2.247	1.053
	0.000	0.000	0.000	0.000	0.086	0.068	0.007	0.398
RVOL	7.776	8.074	7.253	9.349	–	–	–	–
	0.000	0.000	0.000	0.000	–	–	–	–
EXCHR	5.316	3.263	4.313	2.169	0.689	0.758	10.084	4.222
	0.000	0.000	0.000	0.009	0.775	0.706	0.000	0.000
BOND	1.497	1.334	1.648	1.689	–	–	–	–
	0.112	0.187	0.067	0.058	–	–	–	–
RBOND	3.710	5.202	4.553	3.216	–	–	–	–
	0.000	0.000	0.000	0.000	–	–	–	–
CPI	5.680	6.482	5.843	3.857	1.793	0.252	1840.7	1389.3
	0.000	0.000	0.000	0.000	0.040	0.997	0.000	0.000
IP	0.976	1.128	0.872	0.700	0.976	1.304	1.399	1.365
	0.473	0.331	0.583	0.764	0.473	0.204	0.153	0.170
UNEMP	2.495	2.533	2.248	2.446	0.919	1.25	2.789	1.379
	0.002	0.003	0.007	0.003	0.533	0.239	0.001	0.163
BANKR	1.864	1.696	1.587	1.501	1.608	0.859	4.682	1.465
	0.031	0.057	0.083	0.111	0.077	0.597	0.000	0.125

Norway

	INDEX		RINDEX		BOND		RBOND	
VOL	13.49	14.063	12.608	13.456	1.209	1.534	1.589	1.088
	0.000	0.000	0.000	0.000	0.268	0.0998	0.083	0.366
RVOL	13.446	14.026	12.832	13.727	–	–	–	–
	0.000	0.000	0.000	0.000	–	–	–	–
EXCHR	2.000	1.041	2.077	1.093	0.469	2.266	1.155	0.448
	0.019	0.410	0.014	0.362	0.942	0.0064	0.309	0.951
BOND	3.347	2.280	3.474	2.352	–	–	–	–
	0.000	0.006	0.000	0.000	–	–	–	–
RBOND	0.414	0.515	0.952	1.950	–	–	–	–
	0.965	0.916	0.498	0.022	–	–	–	–
CPI	1.211	1.535	2.035	2.343	0.639	1.644	944.4	560.53
	0.267	0.100	0.016	0.005	0.822	0.069	0.000	0.000
IP	0.631	1.001	0.724	1.110	0.844	2.095	4.469	1.109
	0.829	0.448	0.740	0.347	0.614	0.013	0.000	0.348
UNEMP	0.598	0.915	0.602	0.897	0.239	0.313	0.677	0.638
	0.857	0.537	0.854	0.556	0.997	0.990	0.787	0.823
BANKR	0.659	0.542	0.740	0.444	0.431	0.772	1.382	3.338
	0.804	0.899	0.724	0.953	0.959	0.691	0.162	0.000

Sweden

	INDEX		RINDEX		BOND		RBOND	
VOL	7.066	10.643	6.934	9.974	2.072	2.402	0.971	0.962
	0.000	0.000	0.000	0.000	0.014	0.004	0.478	0.487
RVOL	7.012	10.516	7.035	10.11	–	–	–	–
	0.000	0.000	0.000	0.000	–	–	–	–
EXCHR	2.056	1.944	1.876	1.342	0.667	0.885	1.001	0.714
	0.015	0.023	0.030	0.183	0.787	0.569	0.448	0.751
BOND	3.515	5.960	3.715	6.980	–	–	–	–
	0.000	0.000	0.000	0.000	–	–	–	–
RBOND	1.016	1.994	1.484	1.850	–	–	–	–
	0.434	0.019	0.117	0.033	–	–	–	–
CPI	0.834	1.376	2.402	2.929	1.531	2.105	438.16	305.39
	0.624	0.165	0.004	0.004	0.101	0.012	0.000	0.000
IP	2.078	2.346	2.136	2.382	3.197	2.641	1.107	0.804
	0.014	0.005	0.011	0.004	0.000	0.001	0.349	0.657
UNEMP	0.357	1.201	0.344	1.421	0.464	0.455	1.738	0.845
	0.982	0.274	0.985	0.144	0.944	0.949	0.049	0.612
BANKR	0.857	1.953	1.008	1.902	1.316	2.082	1.588	0.985
	0.599	0.022	0.442	0.027	0.198	0.013	0.083	0.465

The first of the two columns contains the F-test statistics for the hypothesis that the coefficients of the lagged macroeconomic series are equal to zero. The second column contains the corresponding statistics for the stock or interest rate market variables. The first row contains the test statistics, the second the marginal probabilities. BOND denotes the nominal interest rate (bond yield), RBOND the corresponding ex post real rate.

Table 7. **Monthly standard deviations of the data for different time periods**

Finland

	INDEX	VOL	EXCHR	BOND	RBOND	CPI	IP	UNEMP	BANKR
–29(12)	0.036	0.295	0.021	0.174	1.587	0.014	0.068	0.138	0.203
–39(12)	0.032	0.375	0.037	0.183	1.136	0.011	0.077	0.163	0.272
–49(12)	0.083	0.393	0.061	0.232	4.362	0.030	0.083	0.263	0.654
–59(12)	0.049	0.234	0.021	0.351	1.758	0.012	0.080	0.214	0.458
–69(12)	0.035	0.163	0.018	0.164	1.296	0.009	0.032	0.105	0.354
–79(12)	0.041	0.237	0.015	0.222	0.723	0.006	0.038	0.085	0.271
–89(12)	0.042	0.334	0.025	0.310	0.543	0.005	0.020	0.029	0.194
–95(4)	0.084	0.333	0.033	0.567	0.710	0.003	0.021	0.042	0.150

Norway

	INDEX	VOL	EXCHR	BOND	RBOND	CPI	IP	UNEMP	BANKR
–39(12)	0.034	0.568	0.022	0.111	1.014	0.008	0.036	0.200	0.270
–49(12)	0.029	0.526	0.026	0.152	1.342	0.010	0.062	0.367	0.512
–59(12)	0.023	0.308	0.001	0.083	1.180	0.008	0.039	0.107	0.341
–69(12)	0.024	0.444	0.001	0.163	0.600	0.005	0.046	0.088	0.437
–79(12)	0.054	0.411	0.051	0.231	0.889	0.007	0.065	0.073	0.243
–89(12)	0.067	0.356	0.025	0.296	0.505	0.006	0.042	0.051	0.203
–95(3)	0.065	0.322	0.044	0.314	0.423	0.003	0.059	0.042	0.127

Sweden

	INDEX	VOL	EXCHR	BOND	RBOND	CPI	IP	UNEMP	BANKR
–39(12)	0.047	0.417	0.030	0.109	0.475	0.004	0.003	0.049	0.054
–49(12)	0.032	0.386	0.027	0.053	0.790	0.007	0.005	0.049	0.062
–59(12)	0.025	0.288	0.002	0.101	0.977	0.006	0.004	0.099	0.118
–69(12)	0.028	0.291	0.005	0.142	0.634	0.004	0.005	0.070	0.001
–79(12)	0.041	0.268	0.021	0.164	0.806	0.006	0.010	0.041	0.001
–89(12)	0.056	0.424	0.025	0.394	0.738	0.006	0.015	0.031	0.093
–95(3)	0.067	0.302	0.033	0.498	1.159	0.009	0.014	0.028	0.078

The standard deviations are computed for first log differences of the time series. The first column indicates the sample period. Thus, for instance, "–29(12)" indicates a sample period of 1922/1 to 1929/12.

Table 8. **Correlation matrices for transformed data**

Finland: 1922 (2) to 1995 (4)

	INDEX	VOL	EXCHR	BOND	RBOND	CPI	IP	UNEMP	BANKR
Differences									
INDEX	1.000								
VOL	**0.247**	1.000							
EXCHR	**0.130**	0.062	1.000						
BOND	**–0.075**	0.032	–0.011	1.000					
RBOND	**–0.137**	0.009	**–0.252**	**0.147**	1.000				
CPI	**0.138**	–0.025	0.052	0.032	**–0.599**	1.000			
IP	–0.013	0.036	**0.077**	–0.006	–0.031	0.038	1.000		
UNEMP	–0.048	0.047	0.023	0.039	0.035	–0.016	0.003	1.000	
BANKR	–0.016	0.011	0.034	0.007	–0.025	0.052	**0.077**	0.023	1.000
Absolute values of differences									
INDEX	1.000								
VOL	**0.115**	1.000							
EXCHR	**0.175**	0.061	1.000						
BOND	**0.080**	0.037	**0.093**	1.000					
RBOND	**0.194**	0.065	**0.228**	0.028	1.000				
CPI	**0.161**	0.057	**0.297**	–0.046	**0.632**	1.000			
IP	–0.031	**0.082**	–0.032	**–0.073**	**0.128**	**0.146**	1.000		
UNEMP	0.045	**0.120**	–0.022	**–0.089**	**0.118**	**0.095**	**0.289**	1.000	
BANKR	**0.102**	0.025	–0.020	**–0.113**	**0.183**	**0.224**	**0.163**	**0.178**	1.000
Squared differences									
INDEX	1.000								
VOL	0.065	1.000							
EXCHR	**0.270**	**0.066**	1.000						
BOND	0.021	–0.008	0.001	1.000					
RBOND	**0.305**	0.049	**0.369**	0.001	1.000				
CPI	**0.368**	0.032	**0.478**	–0.016	**0.732**	1.000			
IP	–0.021	**0.146**	0.014	–0.036	0.033	0.060	1.000		
UNEMP	0.049	**0.186**	0.023	–0.023	0.022	0.017	**0.269**	1.000	
BANKR	**0.156**	0.024	0.054	–0.028	**0.139**	**0.185**	**0.196**	**0.133**	1.000

The data are expressed as first log differences. Bold figures indicate significant values at the 5 per cent level.

Table 8 continued..

Norway: 1933 (1) to 1995 (3)

	INDEX	VOLYM	EXCHR	BOND	RBOND	CPI	IP	UNEMP	BANKR
Differences									
INDEX	1.000								
VOL	**0.319**	1.000							
EXCHR	0.027	**0.254**	1.000						
BOND	**–0.140**	**–0.099**	–0.048	1.000					
RBOND	–0.014	–0.020	0.036	0.193	1.000				
CPI	0.032	0.008	–0.036	0.065	**–0.586**	1.000			
IP	0.022	**0.177**	0.004	–0.005	0.013	–0.028	1.000		
UNEMP	–0.024	–0.042	0.050	–0.006	–0.022	–0.018	**–0.119**	1.000	
BANKR	–0.004	–0.004	–0.005	–0.005	–0.009	0.004	0.047	–0.012	1.000
Absolute values of differences									
INDEX	1.000								
VOL	**0.171**	1.000							
EXCHR	**0.082**	0.012	1.000						
BOND	**0.158**	0.031	0.013	1.000					
RBOND	–0.030	**0.071**	–0.034	0.062	1.000				
CPI	0.014	0.017	–0.011	0.053	**0.504**	1.000			
IP	0.008	**0.188**	–0.021	0.039	–0.039	0.017	1.000		
UNEMP	**–0.082**	0.036	–0.024	**–0.082**	0.043	–0.023	**0.094**	1.000	
BANKR	**–0.118**	–0.026	–0.033	**–0.108**	0.047	–0.014	0.022	**0.137**	1.000
Squared values of differences									
INDEX	1.000								
VOL	**0.095**	1.000							
EXCHR	**0.107**	–0.007	1.000						
BOND	0.017	–0.001	–0.012	1.000					
RBOND	–0.020	0.053	–0.012	0.027	1.000				
CPI	–0.021	0.008	–0.004	0.031	**0.666**	1.000			
IP	–0.010	**0.199**	–0.016	–0.004	–0.027	–0.004	1.000		
UNEMPL	–0.019	0.007	–0.003	–0.017	0.003	–0.006	0.049	1.000	
BANKR	–0.039	–0.009	–0.041	–0.038	0.010	–0.020	0.037	0.049	1.000

Table 8 continued ..

Sweden: 1929 (1) to 1995 (3)

	INDEX	VOL	EXCHR	BOND	RBOND	CPI	IP	UNEMPL	BANKR
Differences									
INDEX	1.000								
VOL	0.261	1.000							
EXCHR	**0.070**	0.010	1.000						
BOND	**–0.192**	**–0.137**	–0.001	1.000					
REALB	0.005	–0.044	–0.036	**0.215**	1.000				
CPI	0.022	0.006	0.049	**0.101**	**–0.572**	1.000			
IP	0.023	0.052	–0.055	0.037	–0.035	–0.003	1.000		
UNEMPL	–0.054	0.004	0.031	–0.016	–0.002	0.006	–0.114	1.000	
BANKR	–0.033	–0.045	0.063	–0.050	**–0.091**	0.069	–0.128	0.047	1.000
Absolute values of differences									
INDEX	1.000								
VOL	**0.123**	1.000							
EXCHR	**0.197**	**0.118**	1.000						
BOND	**0.227**	**0.087**	**0.200**	1.000					
REALB	**0.098**	0.026	0.054	**0.158**	1.000				
CPI	**0.159**	0.031	**0.068**	**0.118**	**0.486**	1.000			
IP	**0.132**	0.029	**0.163**	**0.194**	0.024	**0.070**	1.000		
UNEMPL	**–0.084**	–0.042	**–0.131**	**–0.120**	**0.072**	–0.002	**–0.165**	1.000	
BANKR	0.031	0.058	0.034	**0.113**	**0.113**	0.051	**0.106**	–0.017	1.000
Squared values of differences									
INDEX	1.000								
VOL	**0.148**	1.000							
EXCHR	**0.128**	**0.071**	1.000						
BOND	**0.160**	**0.138**	**0.069**	1.000					
REALB	–0.003	0.039	–0.012	**0.104**	1.000				
CPI	0.046	0.027	–0.007	0.057	**0.551**	1.000			
IP	0.020	0.014	0.014	0.053	–0.013	–0.006	1.000		
UNEMPL	–0.046	–0.007	–0.034	–0.046	0.029	0.001	–0.017	1.000	
BANKR	0.022	**0.183**	**0.076**	**0.081**	**0.159**	**0.098**	–0.013	**0.096**	1.000

Table 9. **Granger causality tests for squared differences and absolute differences of the data: stock prices**[1]

	Squared terms		Absolute terms	
Finland				
VOL	1.420	1.717	1.795	1.604
EXCHR	72.948	17.092	10.421	2.740
BOND	0.769	0.713	0.803	1.100
RBOND	10.279	30.805	2.120	7.137
CPI	17.307	51.091	2.989	5.882
IP	0.465	0.366	1.280	0.658
UNEMP	16.240	0.660	1.872	1.029
BANKR	3.348	4.365	0.612	1.543
Norway				
VOL	0.915	0.908	3.299	2.660
EXCHR	1.076	0.915	2.698	1.269
BOND	0.286	0.387	1.377	1.688
RBOND	0.262	0.582	1.038	1.099
CPI	0.355	0.816	0.676	1.406
IP	0.702	0.827	1.788	0.731
UNEMP	0.371	0.113	1.109	0.513
BANKR	0.383	0.233	1.017	1.083
Sweden				
VOL	6.190	0.823	2.314	1.703
EXCHR	6.933	1.188	2.107	1.477
BOND	2.739	1.716	2.735	2.317
RBOND	0.484	0.536	0.635	1.464
CPI	1.615	0.781	1.815	1.341
IP	0.696	0.233	1.879	0.807
UNEMP	0.172	0.234	0.759	0.823
BANKR	1.283	0.924	1.082	1.200

[1] The first of the two columns contains the F-test statistics for the hypothesis that the coefficients of the lagged macroeconomic series are equal to zero. The second column contains the corresponding statistics for the stock index or the interest rate series. The 5 per cent critical value is about 1.750.

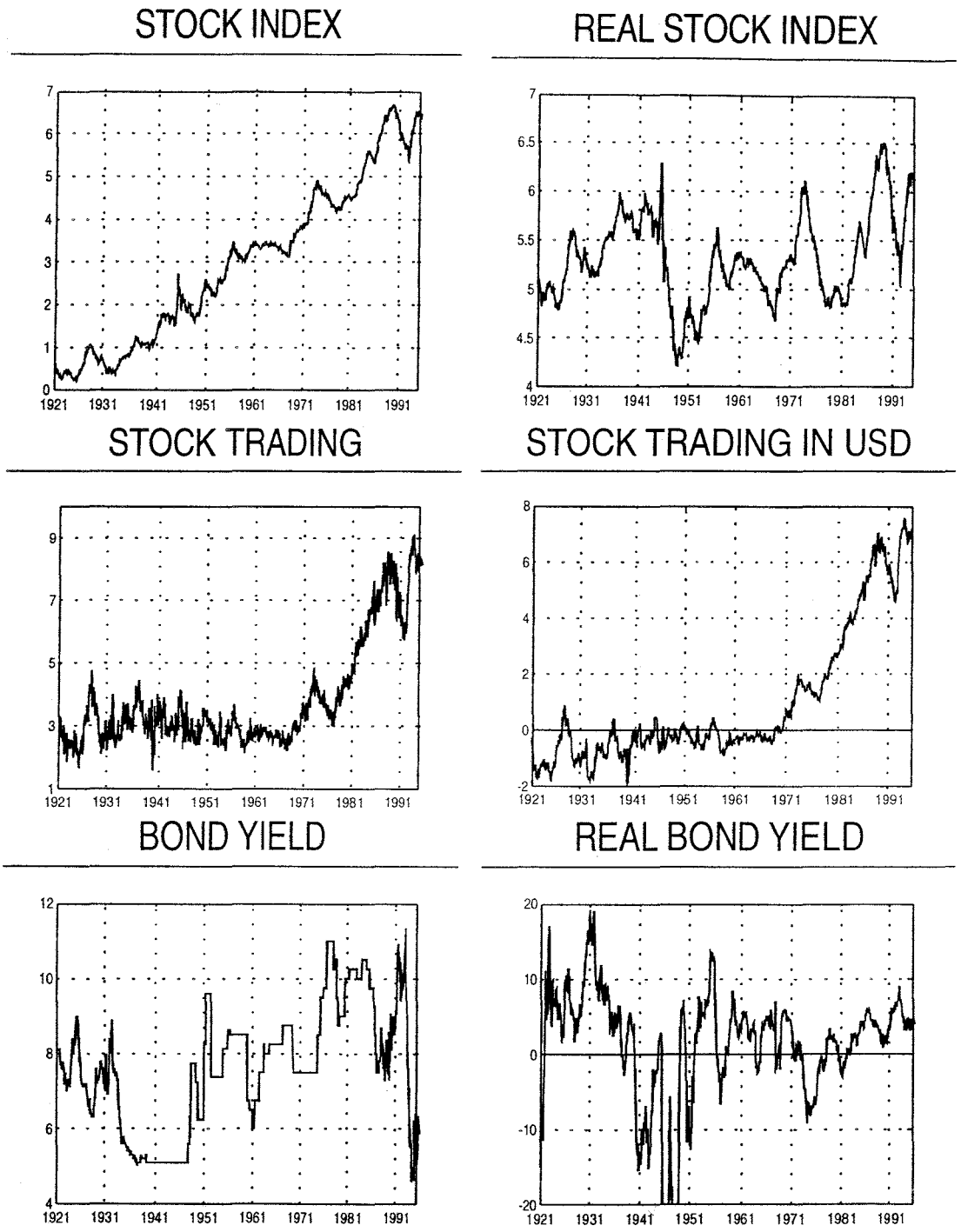
Table 9 continued: **Granger causality results for interest rates**

	Squared terms				Absolute terms			
	nominal rates		real rates		nominal rates		real rates	
Finland								
VOL	0.142	0.414	1.566	1.515	0.569	0.957	1.960	0.734
EXCHR	0.199	0.025	75.55	25.73	0.405	0.727	12.799	4.586
CPI	0.638	0.323	803.7	560.9	0.793	0.519	84.98	53.30
IP	2.536	1.945	0.709	0.326	1.453	0.659	2.440	1.320
UNEMP	0.206	1.023	19.327	0.466	0.881	1.217	7.095	0.964
BANKR	0.254	2.315	4.334	2.460	0.889	0.886	2.669	2.107
Norway								
VOL	0.184	0.135	10.912	1.841	0.352	0.675	2.227	1.065
EXCHR	0.114	2.523	0.389	0.099	1.419	0.560	0.300	0.260
CPI	0.142	0.521	165.8	114.6	0.583	0.954	31.24	20.11
IP	0.150	1.381	10.073	2.421	0.289	2.179	2.723	1.405
UNEMP	0.111	0.049	0.065	0.210	0.506	0.120	0.450	0.832
BANKR	0.410	0.262	1.433	3.109	0.971	0.836	1.365	1.801
Sweden								
VOL	2.255	24.73	0.492	0.774	1.272	3.505	0.294	0.532
EXCHR	0.641	0.380	0.341	1.027	1.452	1.025	1.239	0.882
CPI	1.349	0.742	48.65	31.28	1.842	1.232	28.05	16.45
IP	2.954	2.803	0.978	2.292	3.654	2.670	1.787	1.182
UNEMP	0.472	0.228	0.393	0.404	0.690	0.858	0.932	1.711
BANKR	0.762	3.104	1.330	2.154	1.817	1.946	0.914	0.870

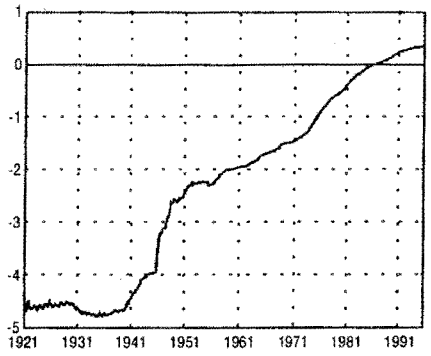
The 5 per cent critical value is again about 1.750.

Figure 1. **Graphs of the time series:**

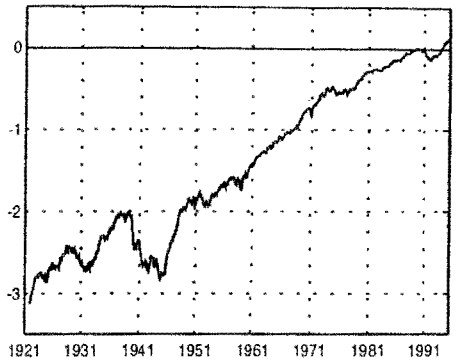
Finland



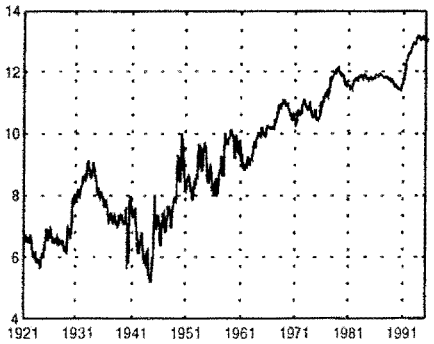
CONSUMER PRICE INDEX



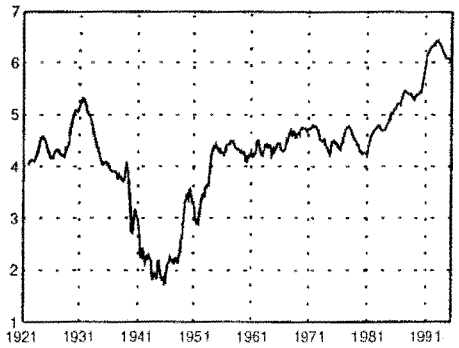
INDUSTRIAL PRODUCTION



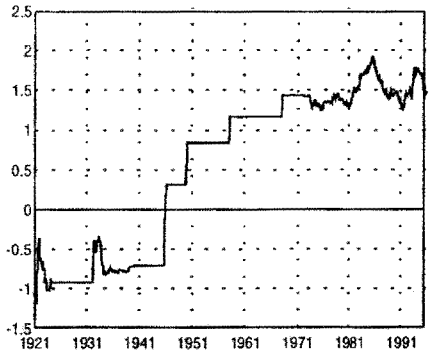
UNEMPLOYED PERSONS



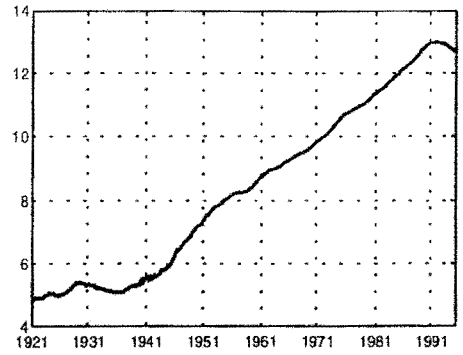
BANKRUPCIES



USD EXCHANGE RATE

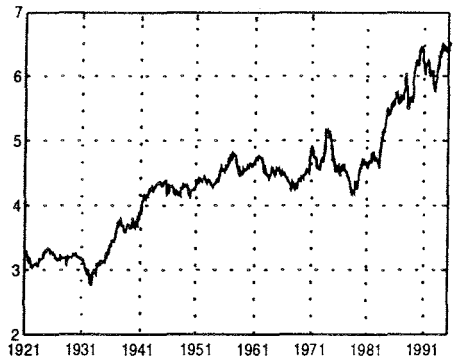


CREDIT SUPPLY

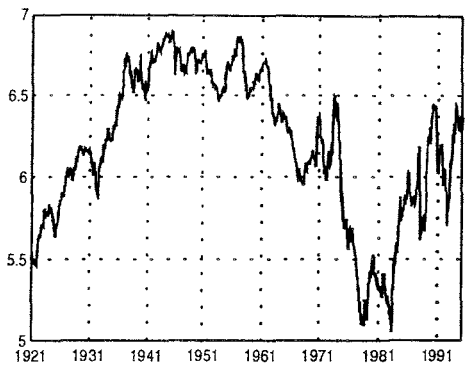


..continued, Norway

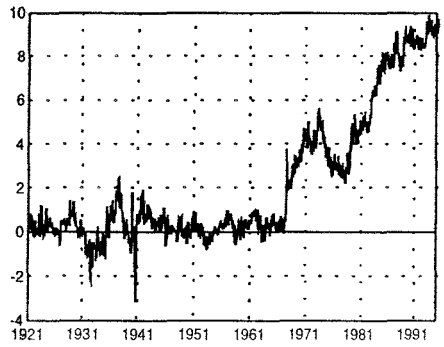
STOCK INDEX



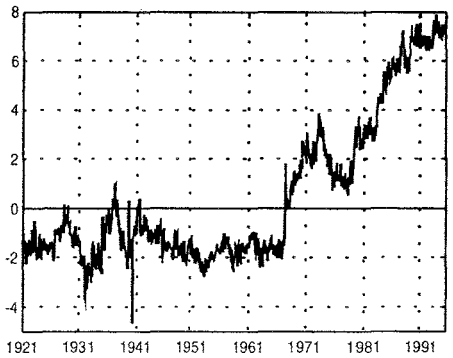
REAL STOCK INDEX



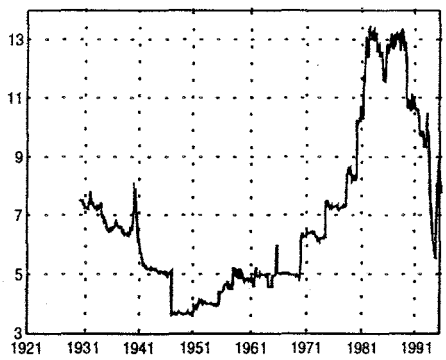
STOCK TRADING



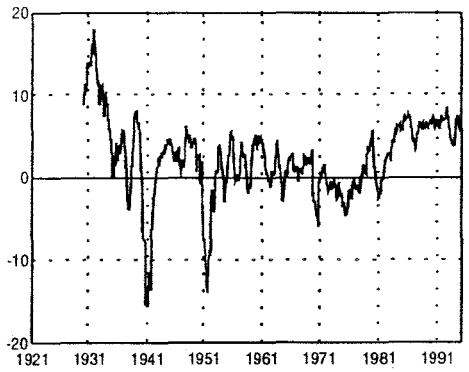
STOCK TRADING IN USD



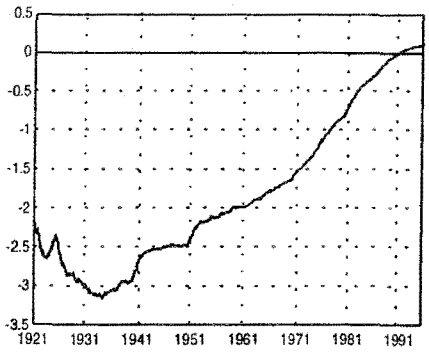
BOND YIELD



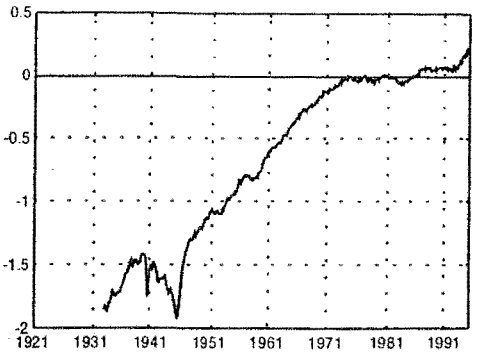
REAL BOND YIELD



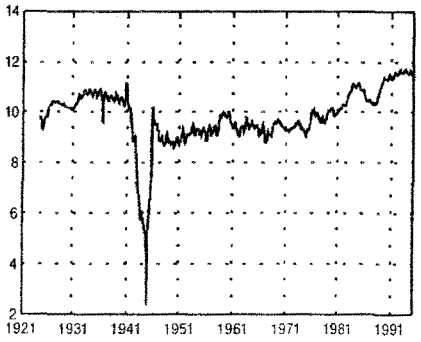
CONSUMER PRICE INDEX



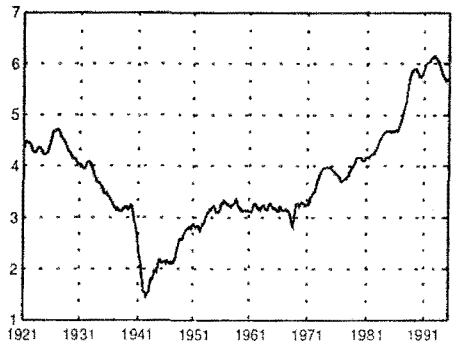
INDUSTRIAL PRODUCTION



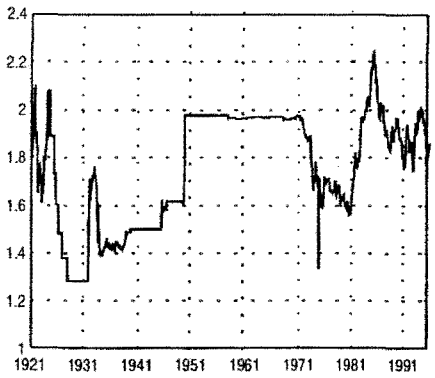
UNEMPLOYED PERSONS



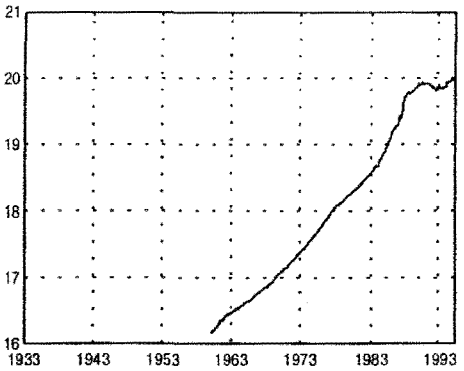
BANKRUPCIES



USD EXCHANGE RATE

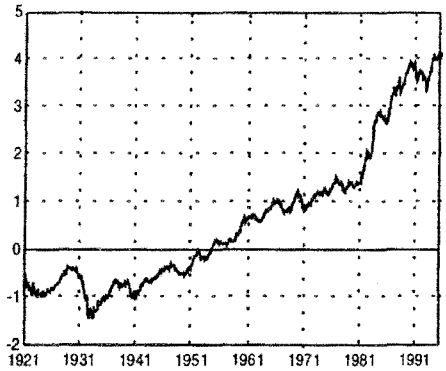


CREDIT SUPPLY

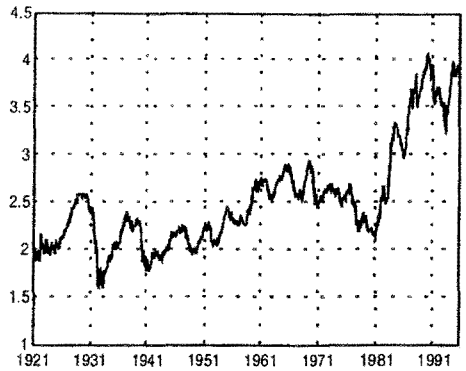


..continued, Sweden

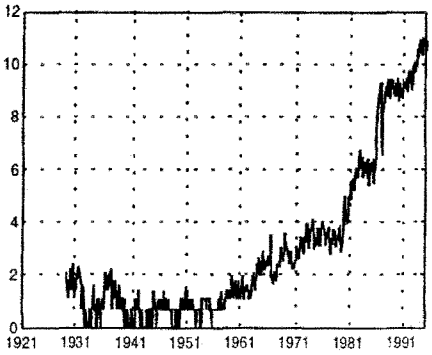
STOCK INDEX



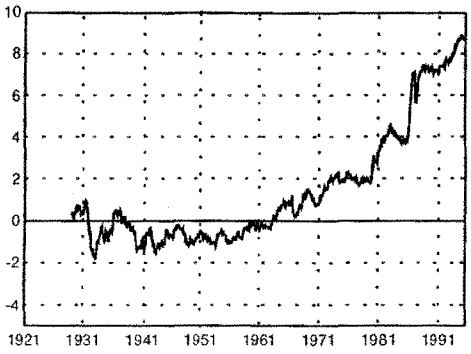
REAL STOCK INDEX



STOCK TRADING

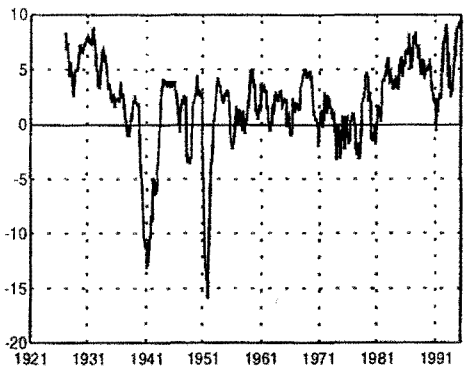


STOCK TRADING IN USD

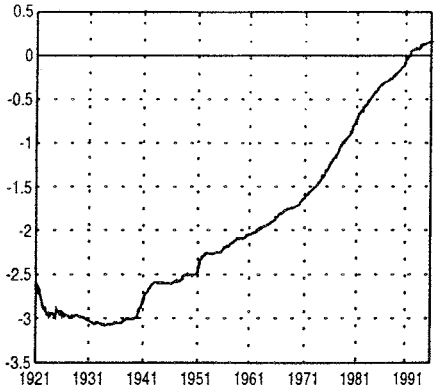


BOND YIELD

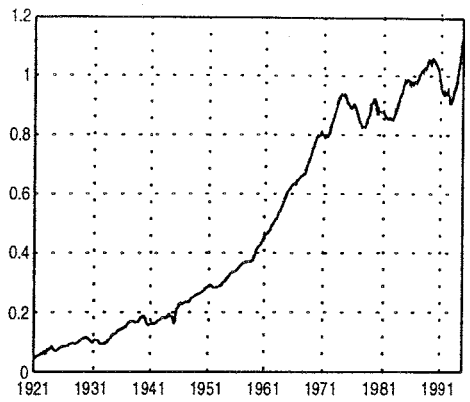
REAL BOND YIELD



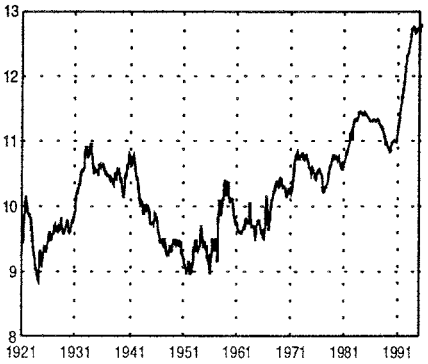
CONSUMER PRICE INDEX



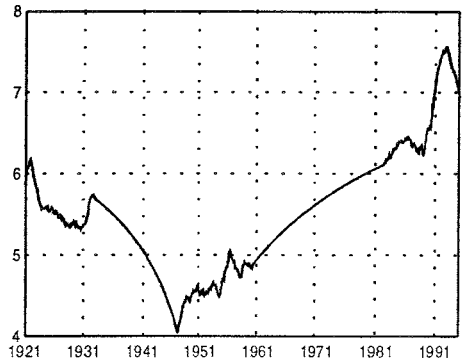
INDUSTRIAL PRODUCTION



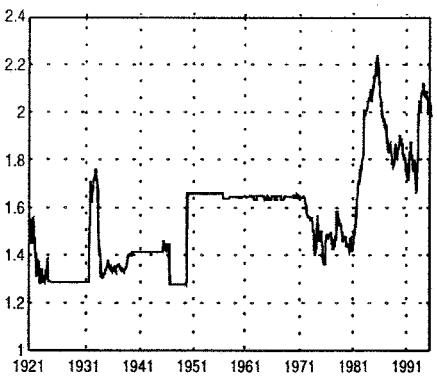
UNEMPLOYED PERSONS



BANKRUPCIES



USD EXCHANGE RATE



CREDIT SUPPLY

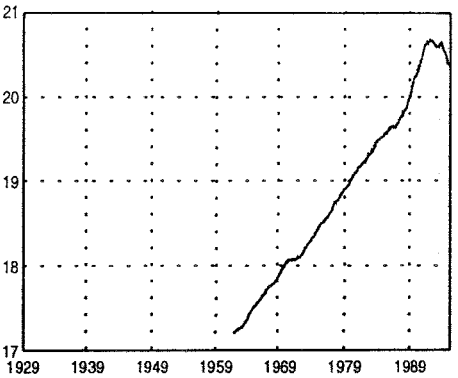
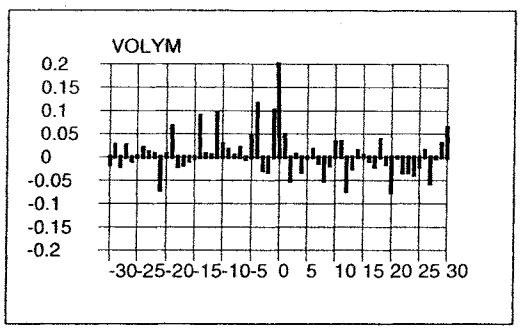
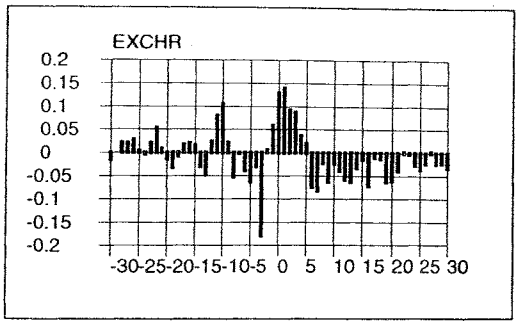
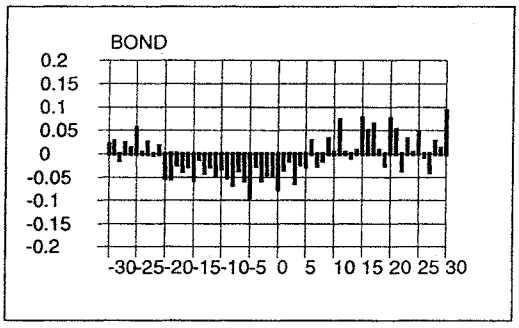


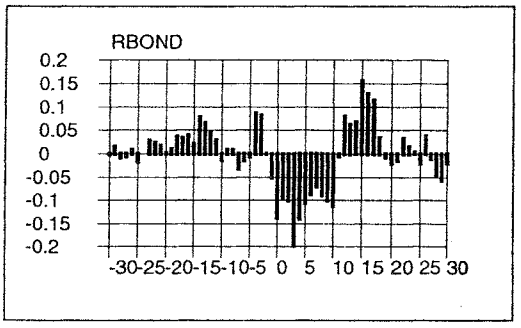
Figure 2. **Cross correlations against the general stock index**

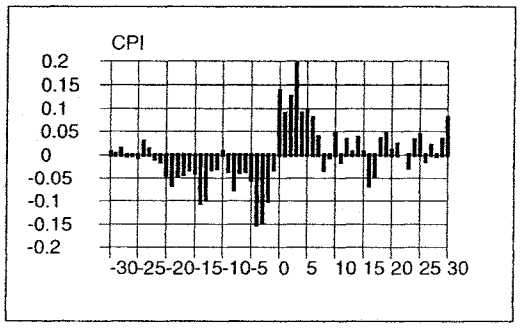
Finland

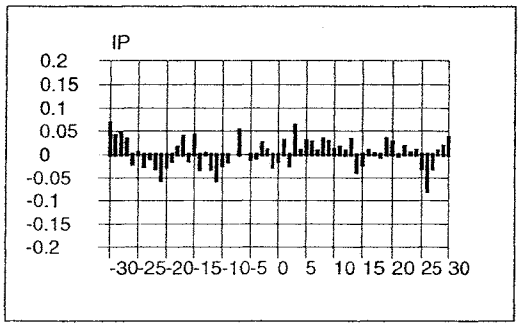


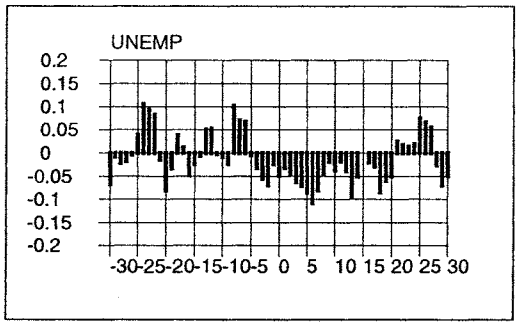


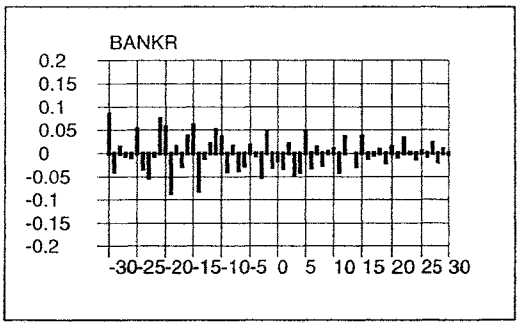




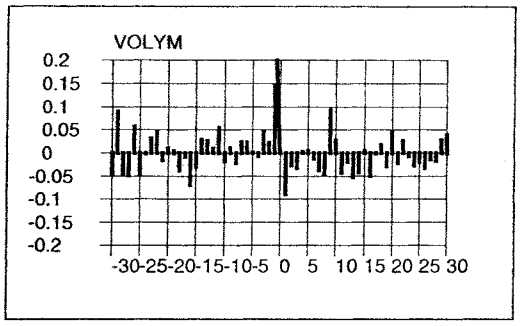


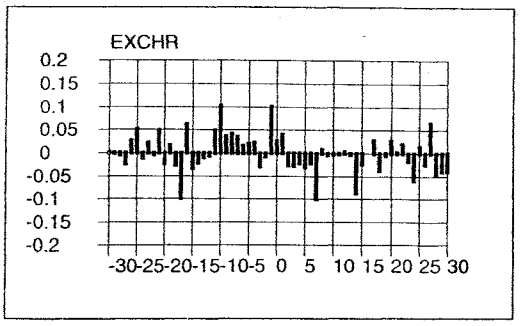


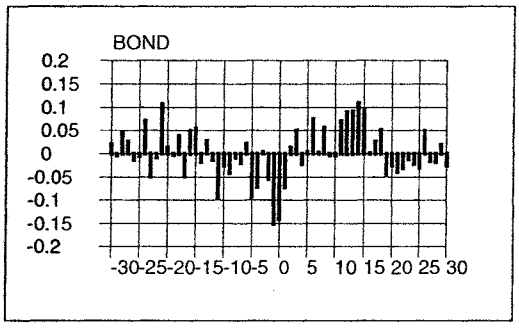


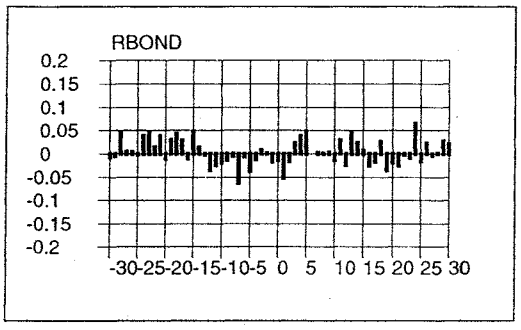


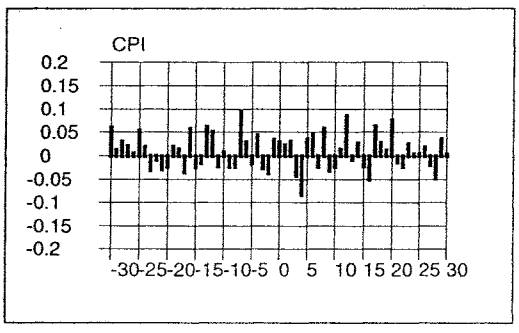
..continued, Norway

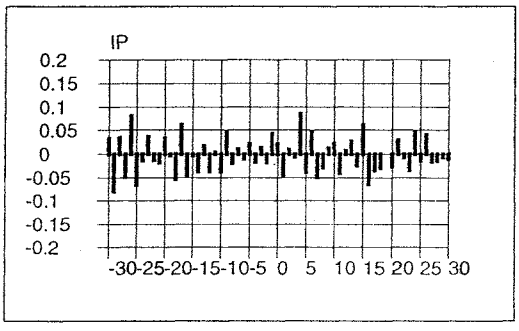


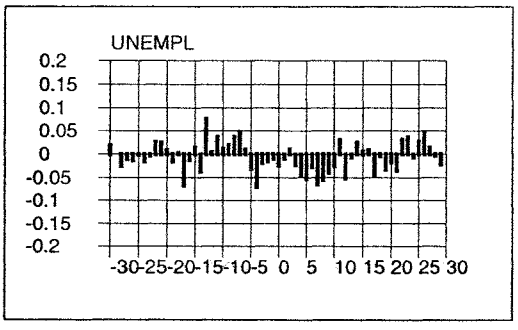


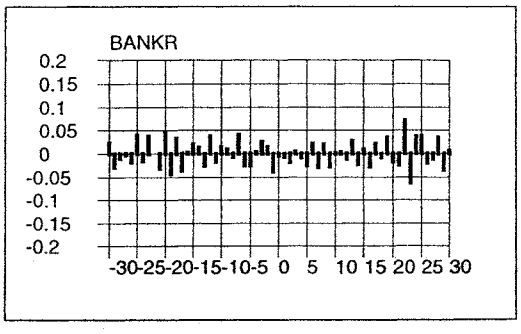




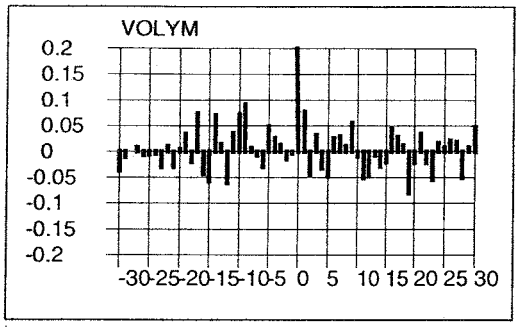


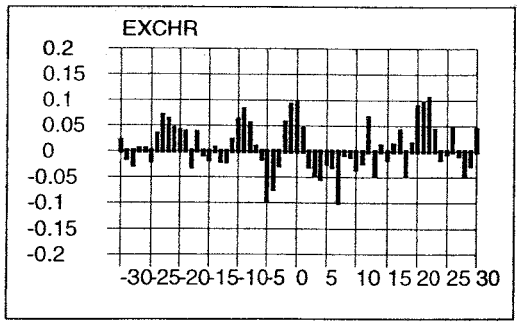


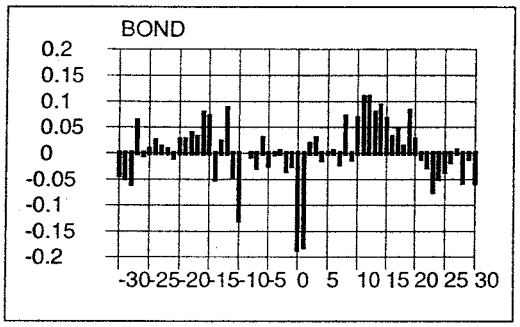


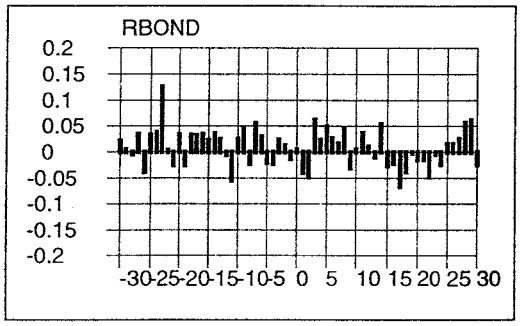


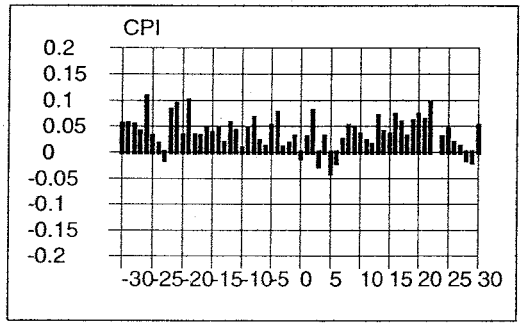
..continued, Sweden

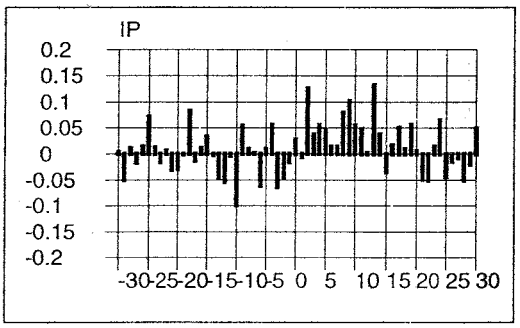


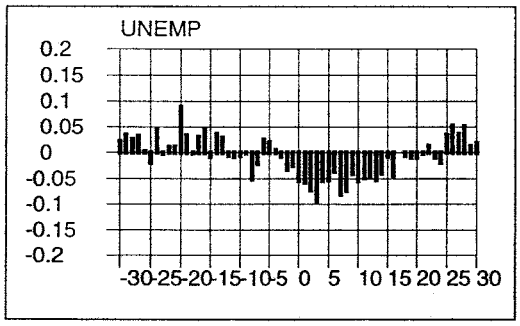












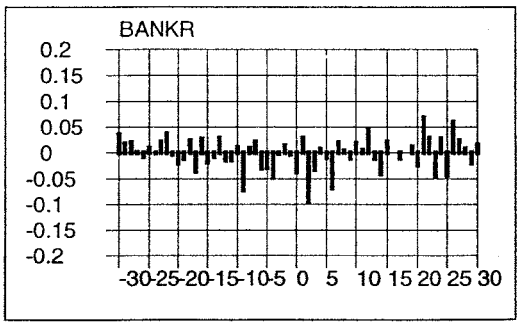
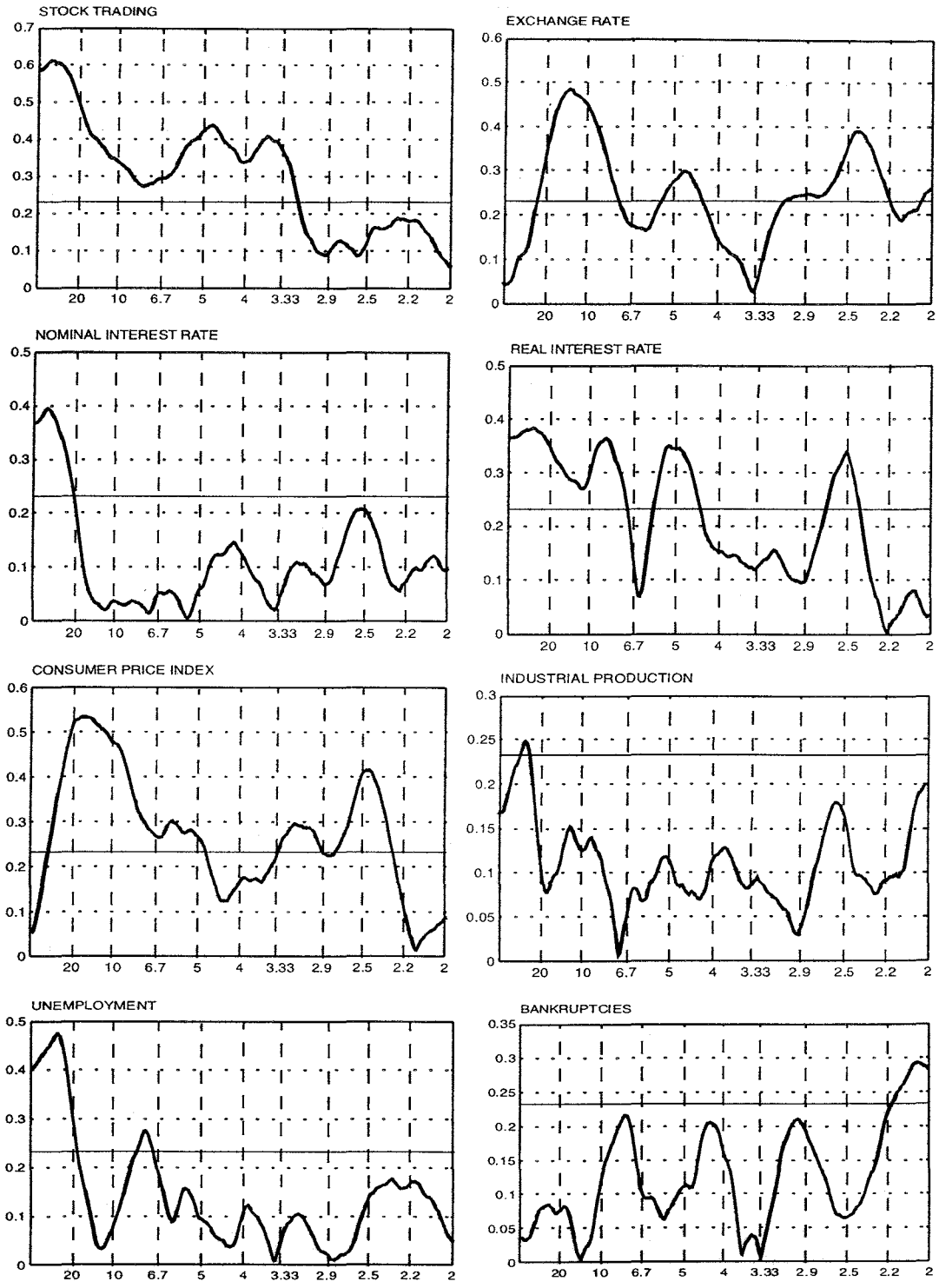
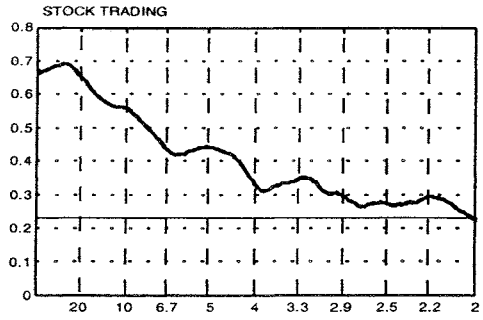


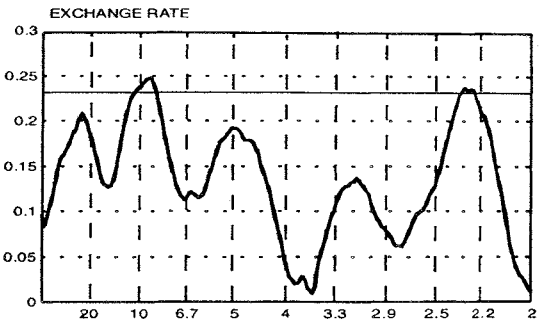
Figure 3. **Coherencies with respect to stock prices**

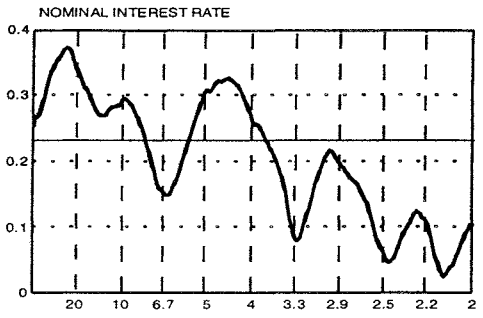
Finland

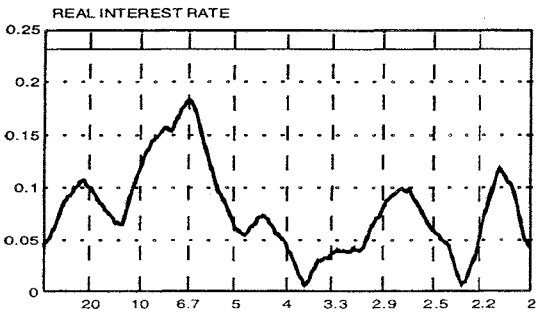


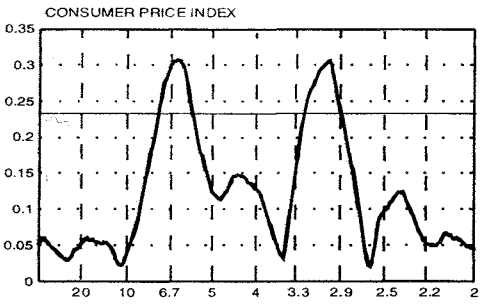
..continued, Norway

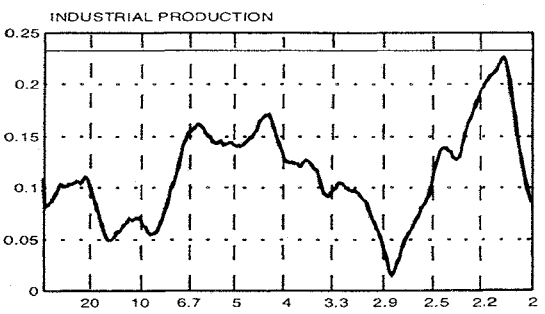


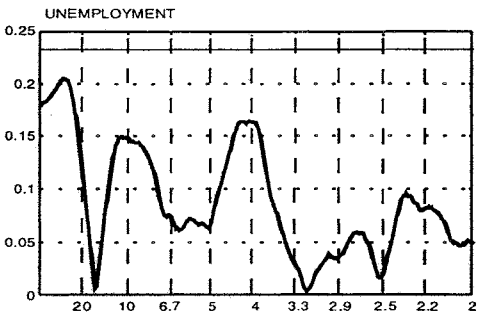


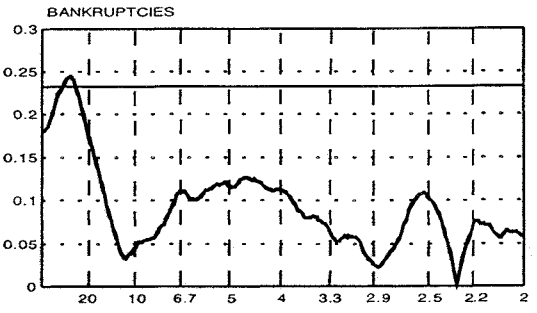




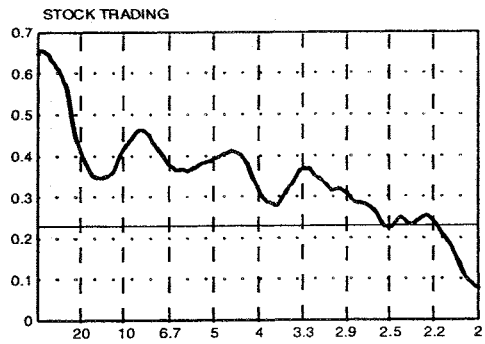


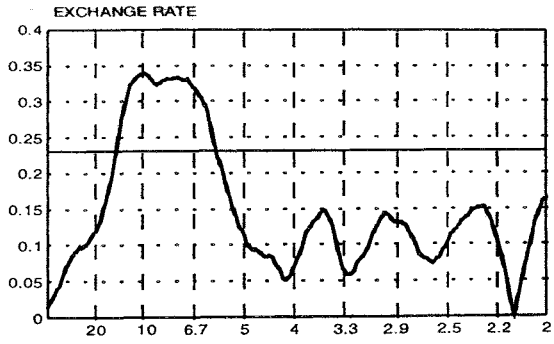


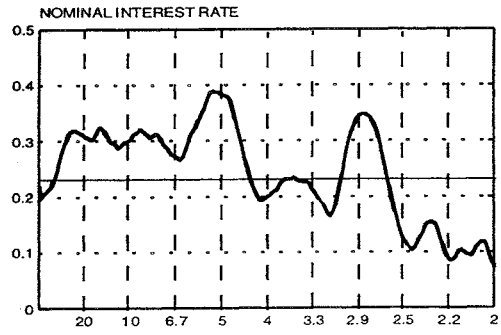


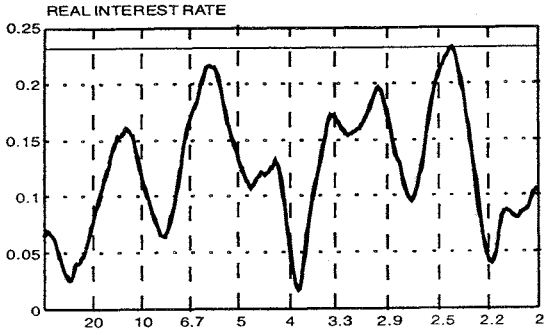


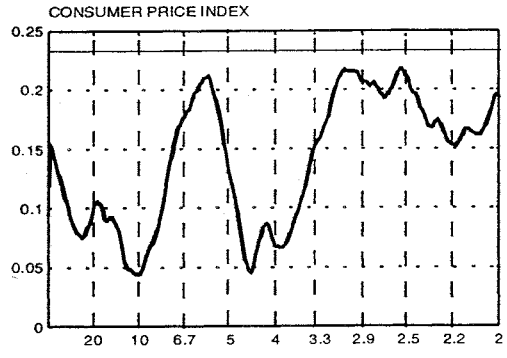
..continued, Sweden

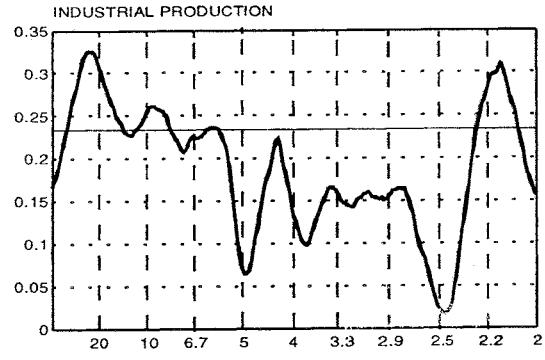


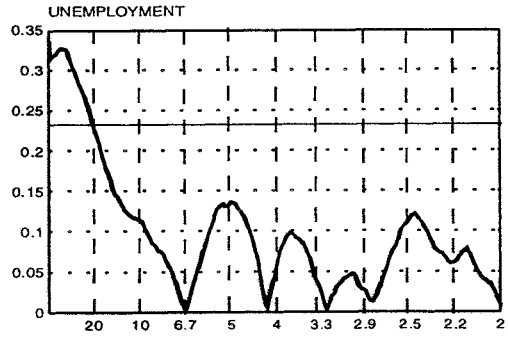












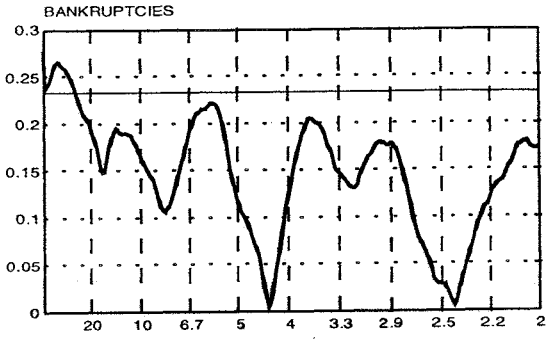
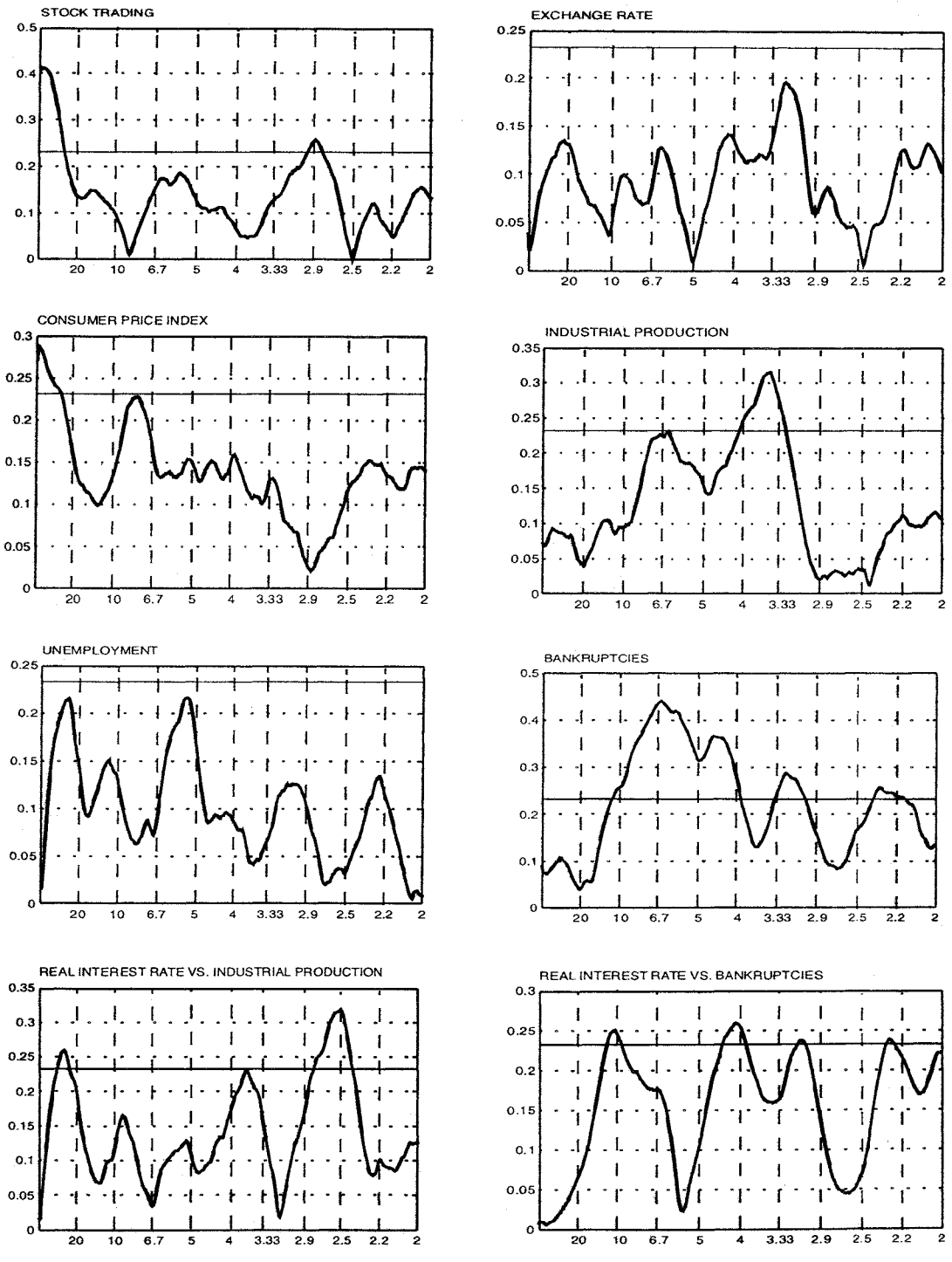


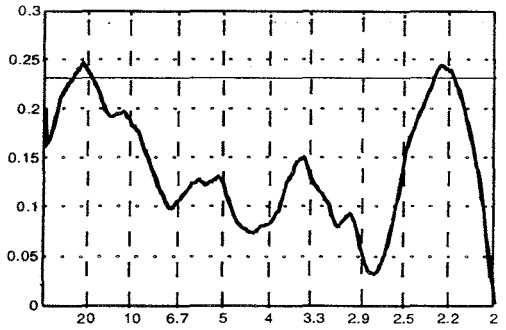
Figure 4. **Coherencies with respect to nominal and real interest rates**

Finland

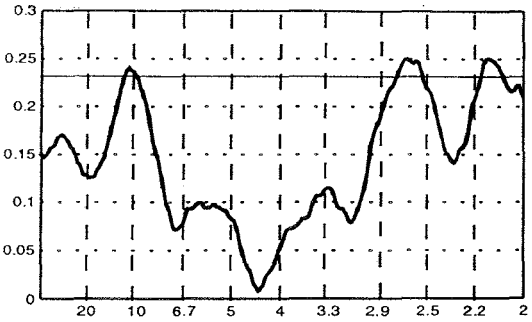


..continued, Norway

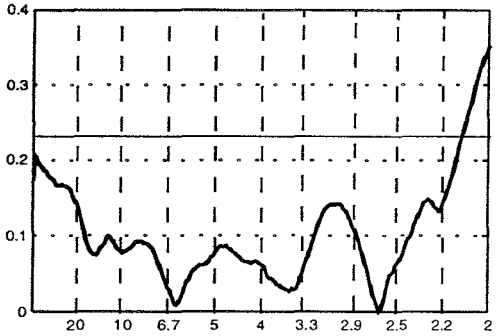
STOCK TRADING



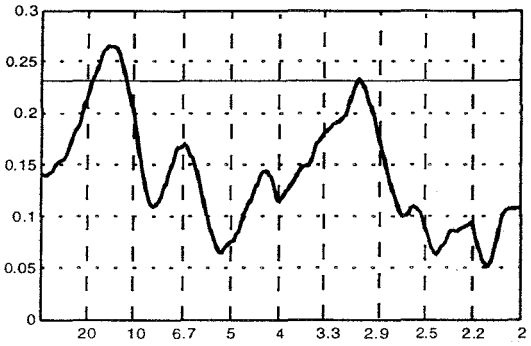
EXCHANGE RATE



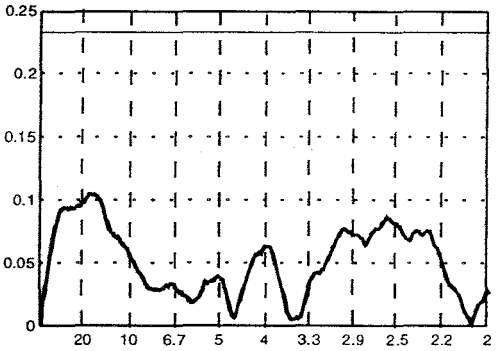
CONSUMER PRICE INDEX



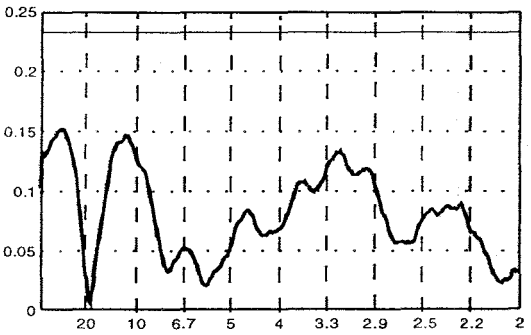
INDUSTRIAL PRODUCTION



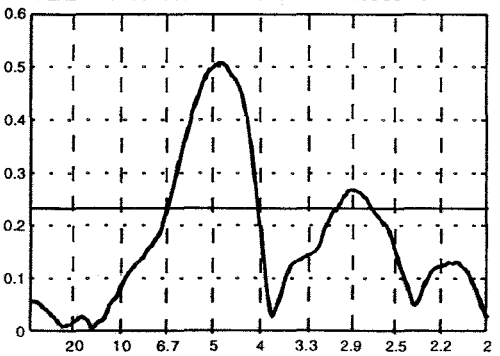
UNEMPLOYMENT



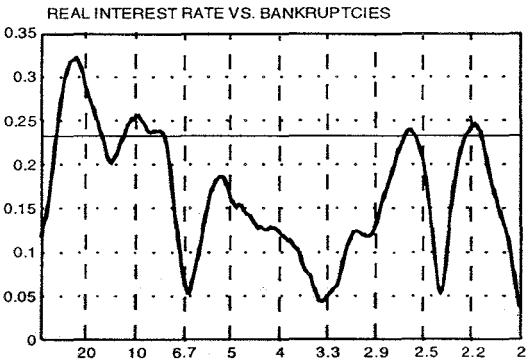
BANKRUPTCIES



REAL INTEREST RATE VS. INDUSTRIAL PRODUCTION

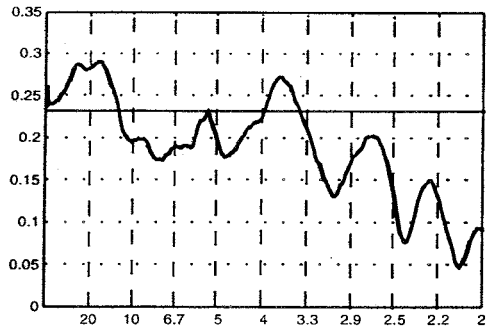


REAL INTEREST RATE VS. BANKRUPTCIES

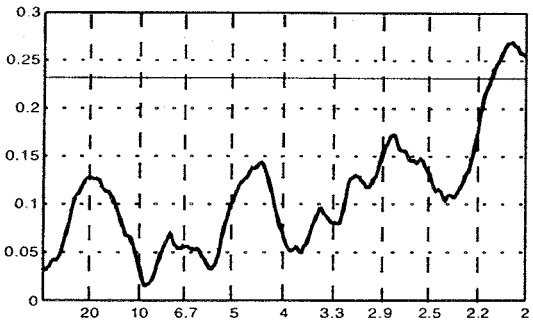


..continued, Sweden

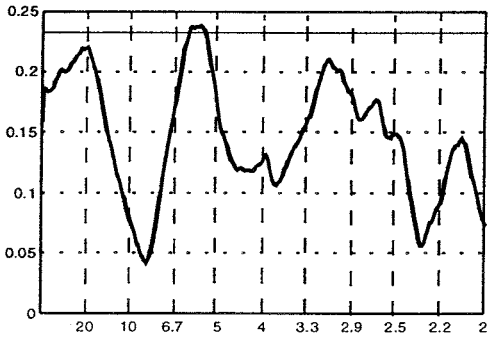
STOCK TRADING



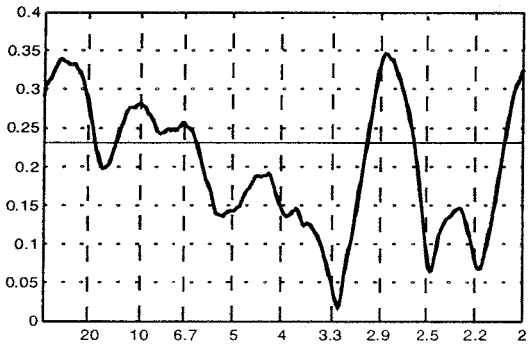
EXCHANGE RATE



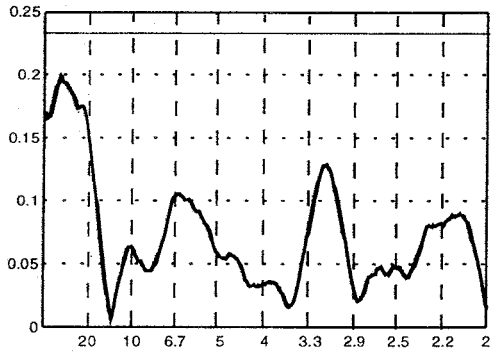
CONSUMER PRICE INDEX



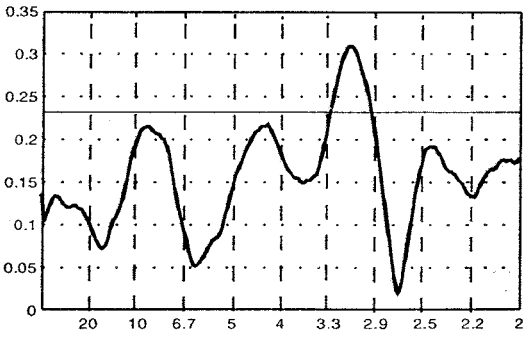
INDUSTRIAL PRODUCTION



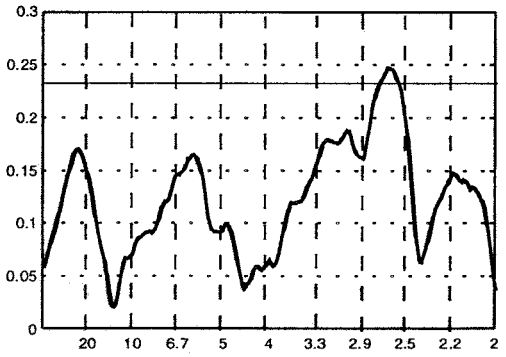
UNEMPLOYMENT



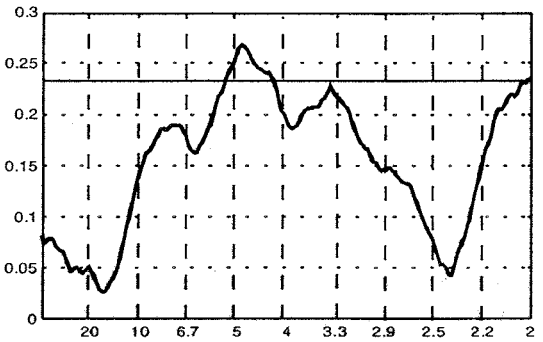
BANKRUPTCIES



REAL INTEREST RATE VS. INDUSTRIAL PRODUCTION



REAL INTEREST RATE VS. BANKRUPTCIES



Data appendix:

Stock market general index (INDEX)

Finland 1920/1–1995/6
The Unitas index for 1920/1–1990/12, after that the HEX index; end-of-month data. Dividends are not included. Data sources: Mercator, Unitas and the Bank of Finland data bank.

Sweden 1918/12–1995/6
1918/12–1995/6: Capital gains from index computed by Frennberg and Hansson, Lund University, Sweden. See also Frennberg and Hansson (1992). Computation of a Monthly Index for Swedish Stock Returns 1919–1989. Scandinavian Economic History Review XL, No. 1, pp. 3–27.

Norway 1921/1–1995/5
The Oslo Stock Exchange (1.1.1983 = 100). Missing observations 1940/4–1940/6 replaced by 5.181, 5.166 and 5.151 (and Jan 93). Data before 1993/1 comparable with the rest of the data after being multiplied by 0.23494.

Real stock market general index (RINDEX)

The stock price index deflated by the consumer price index.

Trading at the stock exchange (VOL)

Finland 1920/1–1995/6
Data sources: Mercator, Unitas and the Bank of Finland data bank.
Missing observation 1939/12 replaced by –2.65.

Sweden 1929/1–1995/6
1929/1–1963/12: Sweriges Riksbank, Trading volume at the stock exchange; end-of-month data, thousands of SEK. (Kapitalmarknaden: Tab. 47. Riksbankens aktieindex vid varje månads slut samt aktieomsättningen på Stockholms fondbörs i medeltal per börsdag för varje månad åren 1929– . Aktieomsättning, tusen kr.)
1964/1–1982/12: Sweriges Riksbank, monthly trading volume at the stock exchange.
(Kapitalmarknaden: Tab. 67. Aktieomsättningen samt obligations-omsättningen på Stockholms fondbörs, totalt för varje månad åren 1954–1982.)
1983/1–1985/12: Veckans affärer. Trading volume, daily averages (Omsättning, genomsnitt/dag, Mkr.)
1986/1–1987/12: Stockholms Fondbörs, trading volume. (Omsättning aktier, Mkr. (Ulf Persson.)

1988/1–1995/6: Månadsrapport från Stockholms fondbörs, December 1988 – June 1995 (Monthly report of the Stockholm stock exchange). Total trading volume (omsättning, totalt, Mkr (Ulf Persson).)
The data between 1983/1–1985/12 have been calculated from weekly data based on daily (Wednesday) obsevations. The data before 1964/1 are comparable with the rest of the data after being multiplied by 17.003. The data before 1983/1 are comparable with the rest of the data after being multiplied by 0.00614. Data between 1986/1–1987/12 are comparable with the latest data after being multiplied by 0.081; data before 1986/1 have been multiplied by 0.000324.

Norway 1921/1–1995/5
Data source: Eva Liljeblom (Svenska Handelhögskolan, Helsinki).
Missing observations 1953/12–1956/6 replaced by the fitted trend (STAMP).

Real trading at the stock exchange (RVOL)

Nominal trading deflated by consumer price index.

Long-term government bond rates (BOND)

Finland 1920/1–1995/5
Effective rate on government bonds (4–5 years) effective rate (valtion obligaatiot (4–5 v.) efektiivinen tuotto). The data have been constructed by Päivi Valkama, Sampo Alhonsuo and Juha Tarkka. Data source: The Bank of Finland data bank.

Sweden 1927/1–1994/12
1927/1–1940: Statistical Yearbook of the League of Nations. Table: Actual percentage yield of bonds, 7 government bonds (official).
1940–1945: Ekonomisk översikt (jan 1942), table: Penningväsende och kapitalbildning, series: Effektiv ränta å fastastatsräntelån (medeltal, %). Konjukturinstitutet.
1946–1955 Statsräntelån: (Actual yield on the Government's 3 % perpertual loan of 1934 (monthly average). Svenska statens obligationslån med 5 års återstående löpetid. Kreditväsen.
1955 – Yield on long-term government bonds (per cent per annum, end of period) as in Main Economic Indicators.
Variables before 1955/1 are comparable with the rest of the data after being multiplied by 1.0537.

Norway 1930/1–1995/4
1930–1940: Statistical Yearbook of the League of Nations. Table: Actual percentage yield of bonds: miscellbonds (official).
1940–1956/7: Statistisk meddelelser/Statistiska Centralbyrå. Oyeblikkelig rente på obligasjoner.
1956/7–1961/10: OECD Main Economic Indicators,
Historical statistics. Yield on Government bonds: 4 % 1955–1975.

1961/11 – Main economic indicators.
Years 1930 – 1931: Missing observations replaced by previous quarter's values.
Variables before 1956/7 are comparable with the rest of the data after being multiplied by 1.3981 and before 1961/10 by 1.049.

Real long-term government bond rates (RBOND)

Nominal rates deflated by consumer price index:
{BOND – 100*log(CPI/CPI[–12])}.

Consumer price index (CPI)

Finland 1920/1–1995/5
Monthly reports of Statistics Finland. The base year is 1980.

Sweden 1918/12–1995/4
1918/12–1991/12: Frennberg & Hansson (1992). Computation of a Monthly Index for Swedish Stock Returns 1919–1989. Scandinavian Economic History Review XL, No. 1, pp. 3–27.
1992/1–1994/8: Statistical Yearbook of Finland.
1994/9–1995/4: The OECD Main Economic Indicators tape.
Data between 1992/1–1994/8 comparable with the rest of the data after being multiplied by 0.8558. Data before 1994/9 multiplied by 0.0841.

Norway 1921/1–1995/4
1921/1–1992/12: Eva Liljeblom
1993/1–1994/8: Tilastollinen vuosikirja (Statistical Yearbook of Finland)
1994/9–1995/4: The OECD Main Economic Indicators tape.
Data have been transformed so that they are comparable with the OECD data.

Industrial production (IP)

Finland 1922/1–1995/4
1922/1–1927/12: constructed by Virén (1992).
1928/1–1947/12: Unitas.
1948/1–1995/4: Statistics Finland. The data are seasonally adjusted and is adjusted for the number of working days.

Sweden 1918/12–1995/3
1918/12–1991/10: Frennberg & Hansson (1992). Computation of a Monthly Index for Swedish Stock Returns 1919-1989. Scandinavian Economic History Review XL, No. 1, pp. 3–27.
1991/11– : Bank of Finland.
Data before 1991/11 have been multiplied by 0.00881.

Norway 1933/1–1995/3
1933/1–1993/1: Eva Liljeblom (Svenska Handelhögskolan, Helsinki).
1993/1–1995/3: Bank of Finland
Data before 1993/1 are comparable with the rest of the data after being multiplied by .00163. Data have been seasonally adjusted by STAMP for the whole time period.

Unemployment (UNEMP)

Finland 1920/1–1995/6:
TILASTOLLINEN VUOSIKIRJA (Statistical Yearbook of Finland).
1938–1944 Public employment exchange 1907-1947: The total number of employees seeking jobs at employment exchanges.
1944–1946 Tilastokatsaus (Statistical reports): The number of employees seeking jobs at public employment exchanges at the end of the month.
1947–1955 Public employment exchange: The total number of employees seeking jobs at employment exchanges.
1956 Based on the estimated variation of the year 1957.
1957–1960 The missing observations of the previous series are replaced on the basis of the variation of the series Statistical reports (Tilastokatsauksia): Unemployment and number of people employed under "Government employment programme".
1960/1–1960/12 OECD Main Economic Indicators, Historical statistics 1960–1979.
1961/1–1970/12 Unemployment in years 1960–. Total number of unemployed workers seeking jobs.
1971– Statistics Finland.
The different parts of this time series are comparable with each other after being multiplied by: the year 1960 is multiplied by .4539 and the data before 1960 are multiplied by 0.3868.

Sweden 1918/1–1995/4
Insured unemployment.
1918–1926/6: Union unemployment years 1916–1947 at the end of the month. Statistisk årsbok.
1926/7–1938/12: Statistical Yearbook of the League of Nations: Statistics of unemployment (trade unionists)
1939/1–1950/12: Union unemployment years 1916–1947 at the end of the month. Statistisk årsbok.
1951/1–1956/9: Statistiske Meldinger. Norway: Statistisk Sentralbyrå. Unemployed union workers, 1000 persons.
1957/1–1959/12: Insured unemployed persons between November 1956 and December 1959. (Arbetsmarknadsstatistik utgiven av Kungl. Arbetsmarknadsstyrelsen. Table: 10: "Vid arbetsförmedlingen anmälda arbetslösa samt arbetslösforsäkrade med korttidsarbete november 1956 – december 1959. Arbetsförsäkrare arbetslösa, summa.")
1956/10–1975: Main Economic Indicators: Historical Statistics. Insured unemployment

1975/1–1994/12: Main Economic Indicators. Insured unemployment
1995/1– : OECD Main Economic Indicators tape.
The League of Nations data are comparable with the series based on Statistisk Årsbok after being multiplied by 1.0146. Data before 1956/12 are comparable with the rest of the data after being multiplied by .512 (the rest of the series is the number of insured unemployed). Data after 1994/12 have been multiplied by 1.086. Missing observations 1938/12 replaced by 10.485, 1953/7 by 9.335, 53/9 by 9.79, 53/11 by 9.47, 54/1 by 9.48, 54/3 by 9.39, 54/5 by 9.32, 54/7 by 9.315, 54/9 by 9.26, 54/11 by 9.215, 55/1 by 9.21, 55/3 by 9.125, 55/5 by 9.085, 56/1 by 9.49, 56/3 by 9.385, 56/5 by 9.295, 56/7 by 9.31 and 1956/9 by 9.345 in PCGIVE-data.

Norway 1924/1–1995/4
1924–1939/12 The Bank of Norway: Unemployed persons (overskuddet av arbeidssoekende).
1940: Okonomiske månedstall. Total number of unemployed persons from all communes. (Arbeidsledighetsoppgaver. Fra alle kommuner. Helt arbeidslose, i alt.)
1941–1948/3 Statistisk meddelelser, Statistiska Centralbyrån: Public employment exchanges: number of men and women seeking employment. (Offentl. arbeidskontorer, arbeidssoekende menn og kvinner.)
1950–1964: Norges Bank, Bulletin. Table XVI. Labour market applicants for work.
1965/1–1994/11: Registered unemployed. Main economic indicators. OECD.
1994/12– : OECD Main Economic Indicators tape.
Year 1940 comparable with the later observations after being multiplied by 1.386. Years before 1940 comparable with the rest of the data after being multiplied by 1.4399.

Bankruptcies (BANKR)

Finland 1922/1–1995/6
1922M1–1969M12 and 1987M1–1995M4: Statistical Yearbook of Finland.
1971M1–1986M12: raw data collected by Statistics Finland. The series have been constructed by Virén (1991).

Sweden 1918/1–1995/3
1918/1–1932/11: Det ekonomiska läget. Number of bankruptcies. (En svensk likviditetsindex: Antal konkurser, utom urarvakonkurser.)
1947/1–1959/10: Kreditväsen. Number of bankruptcies.
1982/1–1995/3: Statistiska Centralbyrån: Monthly number of bankruptcies.
Data from missing periods have been replaced by estimated trend component (STAMP).

Norway 1920/12–1995/5
Statistisk Sentralbyrå (Thomas Bettum): Monthly number of bankruptcies (åpnede konkurser etter måned.)

Because of a change in the way personal bankruptcies are counted, it is not possible to compare the number of bankrupties from 1994 onwards with previous years.

Exchange rate (EXCHR)

Finland 1920/1–1995/5, Sweden 1920/1–1995/5 and Norway 1920/1–1995/5
The data have been collected by J. Autio (Bank of Finland). Source: the Bank of Finland. data bank.

M1/M2 (MONEY)

Finland 1920/1–1995/5
1920/1–1947/12: Haavisto.
1948/1–1995/4: The Bank of Finland data bank.

Sweden 1960/1–1995/4
M1 + quasi money, 1 000 000 kronor. OECD Main Economic Indicators tape.

Norway 1960/1–1995/3
M1, 1 000 000 kronor. OECD Main Economic Indicators tape.

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