Series A: Discussion Paper 2001-04

Does the Stock Market Still Lead Real Activity? - An Investigation for the G-7 Countries

Mathias Binswanger

February 2001

Solothurn University of Applied Sciences Northwestern Switzerland

Solothurn University of Applied Sciences Northwestern Switzerland offers at the School of Management majors in Economy such as Controlling, Human Resource Management, Marketing, and Information and Knowledge Management. In addition, it offers both a full-time and part time course of study in Information Systems.

It is well-known for its further education activities ranging from conferences, seminars, and examination preparation to full-fledged graduate studies. The institute offers graduate programs in Non-Profit Organisation, Logistics, Corporate Design Management, and Personnel Management.

Solothurn University of Applied Sciences Northwestern Switzerland is active in widely varied areas of economics research. The most noteworthy topics of research are in the areas of Industry, Innovation and Strategic Management, Human Resource Management, and Information and Knowledge Management. The results of this research are presented in our publication series and research seminars.

Publication Series

In this series, Solothurn University of Applied Sciences Northwestern Switzerland, publishes the results of this research, with the aim of ensuring that colleagues as well as the public are informed on research activities and their ensuing results.

Abstract

According to the discounted-cash-flow valuation model stock prices should lead measures of real activity as stock prices are built on expectations of these activities. Several empirical studies show that, indeed, a substantial fraction of the changes in growth rates of real activity can be explained by past aggregate stock return variations in the US as well as in other G-7 countries from the 1950s to the 1990s. However, the results presented in Binswanger (2000) suggest that the traditionally strong relation between stock returns and subsequent growth rates of real activity has disappeared in the United States around 1984. This paper investigates whether the breakdown in the traditional relation between stock returns and growth rates of real economic activity in the United States can also be found in the other G-7 countries (Canada, France, Germany, Italy, Japan, UK). The results strongly suggest that a similar breakdown occurred in Japan. Temporary breakdowns possibly also occurred in Canada and Germany, while the evidence speaks against a breakdown in the UK. The results for France and Italy are inconclusive.

JEL-Classification: E44, G12

Author

Prof. Dr. Mathias Binswanger

Mathias Binswanger is Professor of Economics at the University of Applied Sciences of Northwestern Switzerland in Olten. He graduated in economics from the University of St. Gallen, Switzerland and received his PhD from the University of Kassel, Germany. Thereafter, he worked as a consultant to the Department of Environmental Affairs of Volkswagen AG in Wolfsburg, Germany. During the years of 1993 and 1994, Mathias Binswanger conducted a research project on Sustainable Structural Change for the Swiss National Science Foundation and taught at the University of St. Gallen. Subsequently, he was a Visiting Scholar at the University of Tennessee in Knoxville (1995) and at Columbia University in New York (1996-1997). During this period, he worked on his „Habilitation-project „Stock Markets, Speculative Bubbles and Economic Growth, which was submitted to the University of St. Gallen in Switzerland in 1998. He has published books, articles and discussion papers in the fields of environmental economics, monetary economics and financial markets.

Contents

1 Introduction

According to the discounted-cash-flow valuation model stock prices should reflect investors‘ expectations of future real economic activity. The fundamental value of a firm's stock will equal the expected present value of the firm's future payouts (dividends). And future payouts must ultimately reflect real economic activity as measured by industrial production or GDP (see e.g. Morck et al., 1990; Shapiro, 1988). Consequently, stock prices should lead measures of real activity as stock prices are built on expectations of these activities.

Several studies (e.g. Barro, 1990; Choi et al., 1999; Fama, 1990; Schwert, 1990) found that, indeed, a substantial fraction of quarterly and annual aggregate stock return variations can be explained by future values of measures of aggregate real activity in the United States. Peiro (1996) and Choi et al. (1999) confirm this result for several other industrial countries. Furthermore, Domian and Loutan (1997) find evidence for an asymmetry in the predictability of industrial production growth rates by stock returns. According to their results, negative stock returns are followed by sharp decreases in industrial production growth rates, while only slight increases in real activity follow positive stock returns. This conclusion is also supported by Estrella and Mishkin (1996), who find stock prices to be especially powerful in predicting recessions particularly one to three quarters ahead.

Most of the studies on the relation between stock returns and real economic activity use data that starts in the 1950s and ends in the 1980s or 1990s.[1] Therefore, the stock market movements in the 1980s and 1990s do not exert a large influence on the regression results. However, the results reported in Binswanger (2000) suggest that the traditionally strong relation between stock returns and subsequent growth rates of real activity has disappeared in the United States around 1984. Since then, the stock market does not lead real economic activity as regressions fail to establish any significant relation between stock returns and growth rates of industrial production or GDP. This structural break in regressions of stock returns on growth rates of real economic activity coincides with the start of the second large stock market boom after World War II (the first boom lasted from the late 1940s until the mid 1960s) that dominated the stock market since the early 1980s. Therefore, the results could also be interpreted as evidence for the emergence of a speculative bubble that ended the role of the stock market as a leading indicator of real economic activity.

This paper investigates whether the breakdown in the traditional relation between stock returns and growth rates of real economic activity in the United States can also be found in the other G-7 countries (Canada, France, Germany, Italy, Japan, UK) by looking at data from 1960 to 1999. As there is strong evidence for an increasing correlation between stock market movements in the US and other industrial countries (see, for example. Meric and Meric, 1997; Oertmann and Zimmermann, 1998; Wu and Su, 1998) it would not be surprising if a similar breakdown could be detected in other countries as well.

However, there are reasons why such a breakdown may not be as easily detected as in the United States. First, some G-7 economies are small as compared to the US economy and many

[1] Schwert (1990) uses data that goes back to 1889, which confirms a significant relation between stock returns and real economic activity over a time span of one hundred years.

of the large companies that are included in the stock indices partially produce goods and services abroad. Therefore, investors' expectations of future payouts are traditionally less related to the expected development of domestic real activity. Second, in spite of the increasing correlation between stock markets, the stock market booms in some other industrial countries during the 1980s and 1990s are less pronounced than in the US and more difficult to identify. For these reasons it may prove to be more difficult to derive a conclusion concerning a possible breakdown in the relation between the stock market and real activity in these countries.

The paper is organized as follows. Section 2 describes the variables used in the following regressions and explains the choice of the regression periods. Section 3 shows the results of unit root tests and cointegration tests and explains why based on these results the OLS method is used in the regressions presented in Section 4, which additionally also presents CUSUM tests. Section 5 concludes and offers some interpretations of our findings.

2 Variables and Sample Periods

The standard discounted-cash-flow model implies that stock prices lead real economic activity if investors' expectations about firms' future payouts are correct on average. On an aggregate level, the expected future payouts must ultimately also reflect the anticipated development of the real economy as expressed by industrial production, GDP or investment. Most of the previous studies concentrate on industrial production as the variable representing real economic activity, mainly because it is readily available on a monthly basis. However, as economic development in industrial countries is characterized by a shrinking industry-sector share of GDP since decades, industrial production may not be the best choice for a variable representing aggregate real economic activity. Therefore, all of the tests presented in Section 4 use industrial production as well as GDP because using GDP instead of industrial production may lead to different results.

Binswanger (2000) tested whether the traditionally close relation between GDP, industrial production and stock prices in the US over time horizons up to two years, that had been found in Barro (1990), Fama (1990) and Schwert (1990) and that, again, is confirmed in Choi et al. (1999) still holds up during the most recent stock market boom on the US stock market. In this paper we will run regressions with data from all G-7 countries in order to find out whether the structural break in the relation between stock returns and the growth rates of real economic activities reported in Binswanger (2000) can also be found in the other G-7 countries. First, we will test, whether stock prices lead real economic activities in each country over the whole sample period which ranges from 1960 till 1999. This sample period is similar to the one investigated by Choi et al. (1999), who run their regressions with data ranging from 1957 till 1996 and find that stock returns significantly correlate with growth rates of industrial production in all G-7 countries with the exception of Italy. Then, we will run separate regressions for recent boom periods in each country and test whether the result is significantly different over these periods if compared to the results for the whole sample and for a subsample covering the period before the recent stock market boom.

The data used in this paper are from the International Financial Statistics of the IMF and consist of the aggregate stock price indices, industrial production indices, consumer price indices and nominal GDPs for the G-7 countries. All data series are available from 1960 to 1999 with the exception of Germany, where the aggregate stock price index starts in 1970. The nominal stock price indices and GDP are converted into real data by dividing by the consumer price index for each country. Growth rates are the log differences of quarterly observations and real stock returns are continuously compounded quarterly returns.

Fama (1981, 1990) finds the degree of correlation between stock returns and production growth rates to be increasing with the length of the time period for which growth rates and returns are calculated. The explanation offered by Fama (1990) is that information about a certain production period is spread over many previous periods. Therefore, short horizon returns only explain a fraction of future production growth rates but this fraction gets the larger the longer is the time horizon of returns. The argument simply takes care of the fact that not all information about future production becomes publicly known over a short time period. Information is rather disseminated over longer time periods as production activities actually take place. And indeed, results in Fama (1990) as well as in Binswanger (2000) suggest that monthly stock returns possess only little explanatory power for subsequent growth rates in real activity.

Consequently, evidence concerning the relation between stock returns and real economic activity mainly comes from regressions using quarterly and annual observations. In this paper we will concentrate on regressions using quarterly observations. We do not use annual observations because some of the investigated subsample periods are rather short and we would be forced to use overlapping quarterly observations in those regressions as in Fama (1990) and Binswanger (2000). However, international comparisons of regressions using overlapping observations based on statistical measures such as R^2 and the F-test could be misleading in this case because the error term will be serially correlated and lead to biased estimates of these statistics.[2]

Figures 1 and 2 show the development of quarterly real stock prices from 1960 till 1999 in each of the G-7 countries.

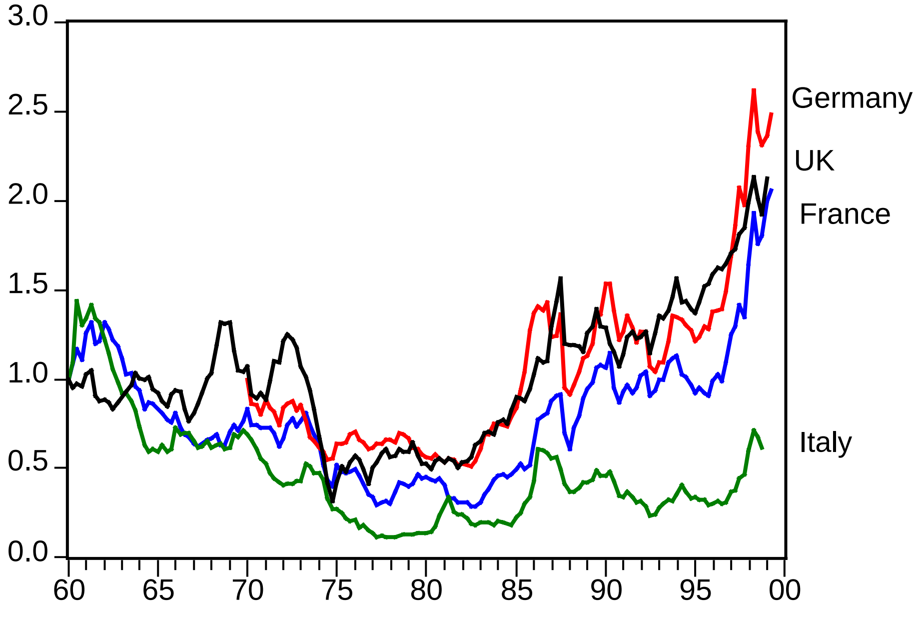

Figure 1: Real stock prices in European G-7 countries (1960 = 1)

Note: Data are from the International Financial Statistics of the IMF and the aggregate stock price index is deflated by the consumer price index in each country.

---

2 This is also true if the standard errors of the estimated coefficients are adjusted for residual autocorrelation by, for example, using the method developped by Newey and West (1987).

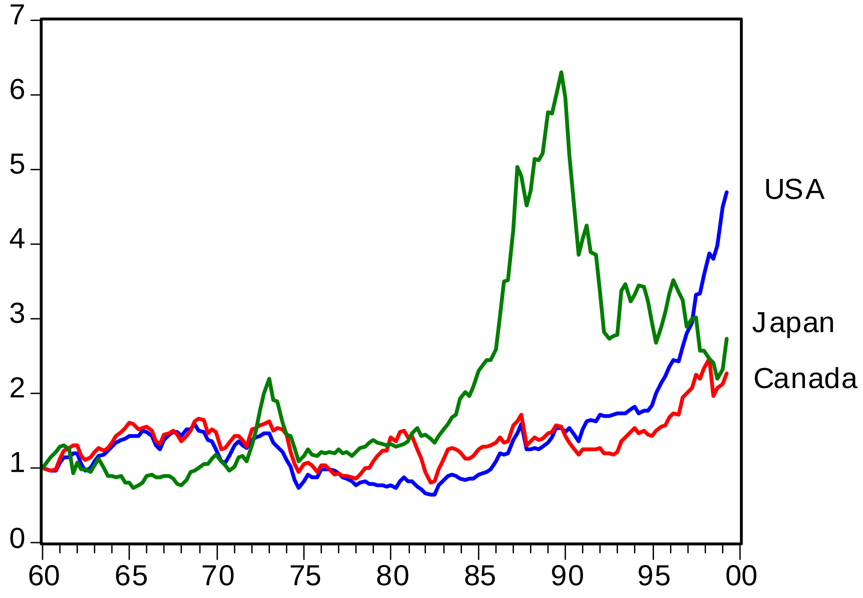

Figure 2: Real stock prices in the non-European G-7 countries (1960 = 1)

Note: Data are from the International Financial Statistics of the IMF and the aggregate stock price index is deflated by the consumer price index in each country.

It can clearly be seen that real stock prices were increasing in all countries since 1983 but the actual patterns of real stock price development vary quite a lot among the G-7 countries. The boom is most prevalent in the US, where real stock prices steadily increased between 1983 and 1999 with only a short interruption in 1987. Of course, Japanese stock prices grew even more during the 1980s but they continuously declined again since 1990 when the boom suddenly came to an end, which makes Japan a rather special case. Stock market booms over the 1983-1999 period can also be detected in France, Germany and the UK, although these booms are not as steady as in the US. On the other hand, booms are less obvious in Canada and Italy.

As real stock prices started raising in all countries in 1983 with the exception of Italy (where they started raising in 1985), we take the first quarter of 1983 as the starting point of the current stock market boom and divide the 1960-1999 sample in two subsamples which cover the time periods from 1960 to 1982 and 1983 to 1999 respectively. However, because the results of regressions over the 1983-1999 subsample could be driven by the stock market crash in 1987, results probably look different if we exclude the 1983-1988 episode. Therefore, we also run regressions over a 1989-1999 subsample

Tables 1 and 2 show the contemporaneous correlations among stock returns in all G-7 countries over the periods from 1960 to 1983 and from 1983 to 1999.

	Canada	France	Germany	Italy	Japan	UK	USA
Canada	1.00						
France	0.51	1.00					
Germany	0.44	0.46	1.00				
Italy	0.31	0.33	0.06	1.00			
Japan	0.48	0.37	0.49	0.25	1.00		
UK	0.49	0.50	0.49	0.21	0.52	1.00	
USA	0.76	0.48	0.50	0.29	0.58	0.65	1.00

Table 1: Contemporaneous correlations of quarterly stock returns from 1960 to1982

	Canada	France	Germany	Italy	Japan	UK	USA
Canada	1.00						
France	0.58	1.00					
Germany	0.56	0.70	1.00				
Italy	0.36	0.63	0.61	1.00			
Japan	0.40	0.33	0.17	0.33	1.00		
UK	0.67	0.62	0.57	0.47	0.42	1.00	
USA	0.79	0.66	0.59	0.44	0.28	0.74	1.00

Table 2: Contemporaneous correlations of quarterly stock returns from 1983 to 1999

Not surprisingly, correlations among quarterly real stock returns tend to be higher during the 1983-1999 period than during the 1960-1983 period. Correlations seem to have increased especially after the 1987 crash among European stock markets as well as between European stock markets and the US stock market (Meric and Meric, 1997). The only exception is the Japanese stock market where stock returns show lower correlation with other stock markets during the 1983-1999 period, but this is caused by the special development of the Japanese stock market during this period. The contemporaneous correlation is especially high among Canada, the US and the UK. But also the correlation of US stock returns to stock returns in France and Germany is quite high during the 1983-1999 period.

3 Testing for Cointegration

Most of the previous studies examining the relation between stock returns and real economic activity use the OLS method and regress stock returns on contemporaneous and lagged growth rates of industrial production or of GDP. Choi et al. (1999) argue that this in fact represents a misspecification if the levels of the time series are non-stationary but cointegrated as in this case an error correction model should be used instead of standard OLS regressions.

In their own tests, Choi et al. (1999) find that the log levels of industrial production and real stock prices are non-stationary, while the first differences (growth rates) appear to be stationary in all countries showing that industrial production and real stock prices are both I(1). Furthermore, the log levels of industrial production and real stock prices are cointegrated in each of the G-7 countries at either monthly, quarterly or annual frequencies over the period from 1957 to 1996 according to the results presented in Choi et al. (1999). Consequently, we also test for cointegration between real stock prices and industrial production as well as between real stock prices and real GDP in each of the G-7 countries, in order to find out whether using an error correction model would be more appropriate than using OLS regressions.

We first have to test whether the time series under investigation are actually non-stationary and to what degree they are integrated if the null hypothesis of non-stationary cannot be rejected. Table 3 shows the results of the Augmented Dickey-Fuller unit root test for the levels as well as for the first differences of real stock prices, industrial production and real GDP over the full sample period (Germany 1970-1999).

The test includes 4 lags, an intercept, and a trend

Sample: 1960 - 1999

Country	Stock prices		Industrial production		Real GDP	
	Levels	First differences	Levels	First differences	Levels	First differences
USA	-2.65	-3.62*	-1.89	-5.28**	-3.02	-4.85**
Canada	-1.39	-5.91**	-2.69	-5.24**	-2.30	-5.02**
France	-0.44	-4.95**	-2.01	-6.05**	-2.15	-5.05**
Germany	-1.93	-4.37**	-2.58	-5.67**	-2.38	-4.26**
Italy	-2.98	-5.70**	-2.98	-6.57**	-2.74	-6.82**
Japan	-2.04	-4.96**	-2.10	-5.89**	-2.21	-4.10**
UK	-1.08	-5.87**	-3.01	-5.61**	-2.39	-4.56**

Table 3: Augmented Dickey-Fuller unit root tests

Notes: *(**) Rejection of the null hypothesis of non-stationarity at the 5 (1) percent level. Neither excluding the time trend nor changing the number of lags significantly alters the results of the ADF statistics.

The unit root tests show that all variables are I(1) and, therefore, non-stationary at their levels but stationary at their first differences. Consequently we can test for cointegration, which we do by using Johansen's VAR-based cointegration test that uses a vector error correction specification including p lags of the following form

$$\Delta z_t = a + bd_t + \Pi z_{t-1} + \sum_{k=1}^{p-1} \Gamma_k \Delta z_{t-k} + \varepsilon_t \qquad (1)$$

where z_t is the 2 x 1 vector of the I(1) variables, which are either real stock prices and industrial production or real stock prices and real GDP, d_t is a time trend; ε_t is a white noise error; and the vectors and matrices of parameters (a, b, Π, Γ_k) are dimensioned conformably. The hypothesis of cointegration between the variables is formulated as a test of the rank of Π, which equals the number of cointegrating vectors. It can be decomposed into $\Pi = \alpha\beta'$, where β is a matrix of long-run coefficients and α is a matrix of speed of adjustment coefficients. Thus, βz_{t-1} represents the cointegrating relationship and α provides information on the short-run response of stock prices and real activity. The results using the Johansen methodology are displayed in Table 4.

The test includes 4 lags and assumes a linear deterministic trend in the data. The test statistic shown in the Table is the likelihood ratio (trace statistic).

Sample: 1960 - 1999

Country	Stock prices and industrial production	Stock prices and real GDP
USA	21.99**	21.51**
USA (1960-1987)	13.10	11.86
Canada	3.69	2.72
France	10.81	10.10
Germany	7.42	5.71
Italy	18.57*	14.79
Japan	5.86	8.97
UK	5.54	4.44

Table 4: Johansen cointegration tests

Notes: *(**) Rejection of the null hypothesis of no cointegration at the 5 (1) percent level.Altering the test assumptions or the number of lags does not significantly alter the test statistics.

The results of our cointegration tests stand in sharp contrast to the results reported in Choi et al. (1999).[3] According to our results the null hypothesis of no cointegration at quarterly frequencies cannot be rejected in most countries. The only exceptions are the US, where a cointegrating relation seems to exist between stock prices and industrial production and real GDP, and Italy, where a cointegrating relation possibly exists between stock prices and industrial production. But even the positive result for the US has to be interpreted with caution. If we test for cointegration in samples that end before the second quarter of 1998, the null hypothesis of no cointegration cannot be rejected even at the 5 percent level. The test result appears to be very sensitive with respect to the chosen endpoint of the sample and our test results would not suggest a cointegration relationship between stock prices and real economic activity in the US for the sample period used in Choi et al. (1999). Based on our own cointegration tests we assume that there is no cointegration between real stock prices and real economic activity. Therefore, we will not use an error correction model in the following tests and instead use OLS regressions as in Binswanger (2000).[4]

[3] Choi et al. (1999) use the Engle-Granger methodology instead of the Johansen methodology which can lead to different results as indicated in Dickey et al. (1994, p. 36). However, even if we use the Engle-Granger methodology our results hold up and the null hypothesis of no cointegration cannot be rejected in any of the G-7 countries.

[4] Actually, the lack of cointegration between stock indices and real economic activity already indicates that a stable relationship between these variables probably does not exist and that a breakdown may have occurred between 1960 and 1999.

4 Regressions of Growth Rates of Real Economic Activity on Contemporaneous and Past Stock Returns

In this Section we will present the results of the OLS regressions of quarterly growth rates of industrial production and of quarterly growth rates of real GDP on quarterly real stock returns. The estimated equations are

$$g_t = a + \sum_{k=0}^{4} b_k r_{t-k} + \varepsilon_t \qquad (2)$$

where g_t stands for the quarterly growth rate of real activity from t - 1 to t, and r_{t-k} stands for the real stock return from $t - k - 1$ to $t - k$. We include the same amount of lags of real stock returns in the regressions as Fama (1990) and Binswanger (2000) in order to make our results directly comparable to the results of the previous research on the US economy. All regressions are estimated for four different sample periods, which are 1960-1999, 1960-1982, 1983-1999, and 1989-1999. Table 5 shows the results of the regressions using the growth rate of industrial production as the dependent variable and Table 6 does the same for regressions using growth rates of real GDP.

Country		1960-1999	1960-1982	1982-1999	1989-1999
US	Adj. R^2	0.26	0.39	0.10	0.04
	S.E.	0.01	0.02	0.01	0.01
	F-statistic (p-value)	0.00	0.00	0.04	0.27
	Chow-test (p-value)	0.00			
Canada	Adj. R^2	0.23	0.36	0.06	0.18
	S.E.	0.02	0.01	0.02	0.01
	F-statistic (p-value)	0.00	0.00	0.11	0.03
	Chow-test (p-value)	0.49			
France	Adj. R^2	0.00	0.01	0.04	0.09
	S.E.	0.03	0.03	0.01	0.01
	F-statistic (p-value)	0.41	0.36	0.20	0.13
	Chow-test (p-value)	0.40			
Germany	Adj. R^2	0.06	0.26	0.00	0.32
	S.E.	0.02	0.02	0.02	0.01
	F-statistic (p-value)	0.04	0.00	0.43	0.00
	Chow-test (p-value)	0.06			
Italy	Adj. R^2	0.03	0.01	-0.00	0.13
	S.E.	0.03	0.03	0.02	0.02
	F-statistic (p-value)	0.21	0.21	0.44	0.08
	Chow-test (p-value)	0.34			
Japan	Adj. R^2	0.20	0.32	0.15	0.06
	S.E.	0.02	0.02	0.01	0.01
	F-statistic (p-value)	0.00	0.00	0.01	0.20
	Chow-test (p-value)	0.00			
UK	Adj. R^2	0.10	0.10	0.02	0.17
	S.E.	0.02	0.02	0.01	0.01
	F-statistic (p-value)	0.00	0.02	0.29	0.05
	Chow-test (p-value)	0.71			

Table 5: Regressions of quarterly growth rates of industrial production on quarterly stock returns

Notes: Adj. R^2 stands for the adjusted R-squared, S. E. stands for the standard error of the regression, F-statistic gives the significance level at which the null hypothesis that all coefficients are zero can be rejected, The Chow-test refers to the Chow breakpoint test and gives the significance level of the F-test at which the null hypothesis of no subsample instability can be rejected for the first quarter in 1983.

Country		1960-1999	1960-1982	1982-1999	1989-1999
US	Adj. R^2	0.15	0.27	0.03	0.07
	S.E.	0.01	0.01	0.01	0.01
	F-statistic (p-value)	0.00	0.00	0.23	0.16
	Chow-test (p-value)	0.01			
Canada	Adj. R^2	0.13	0.19	0.13	0.30
	S.E.	0.01	0.01	0.01	0.01
	F-statistic (p-value)	0.00	0.00	0.02	0.00
	Chow-test (p-value)	0.01			
France	Adj. R^2	-0.03	-0.05	-0.04	0.08
	S.E.	0.02	0.02	0.01	0.01
	F-statistic (p-value)	0.95	0.93	0.78	0.16
	Chow-test (p-value)	0.51			
Germany	Adj. R^2	0.02	0.19	-0.00	0.08
	S.E.	0.01	0.01	0.02	0.02
	F-statistic (p-value)	0.19	0.02	0.45	0.14
	Chow-test (p-value)	0.34			
Italy	Adj. R^2	0.01	0.03	0.02	-0.05
	S.E.	0.01	0.02	0.01	0.01
	F-statistic (p-value)	0.33	0.19	0.28	0.69
	Chow-test (p-value)	0.04			
Japan	Adj. R^2	0.05	0.09	0.01	-0.10
	S.E.	0.02	0.02	0.01	0.01
	F-statistic (p-value)	0.02	0.03	0.35	0.91
	Chow-test (p-value)	0.02			
UK	Adj. R^2	0.03	0.01	0.05	0.09
	S.E.	0.01	0.02	0.01	0.01
	F-statistic (p-value)	0.09	0.34	0.17	0.15
	Chow-test (p-value)	0.87			

Table 6: Regressions of quarterly growth rates of GDP on quarterly stock returns

Notes: Adj. R^2 stands for the adjusted R-squared, S. E. stands for the standard error of the regression, F-statistic gives the significance level at which the null hypothesis that all coefficients are zero can be rejected, The Chow-test refers to the Chow breakpoint test and gives the significance level of the F-test at which the null hypothesis of no subsample instability can be rejected for the first quarter in 1983.

The results for the US confirm the results reported in Binswanger (2000) where the full sample ranged from 1953 till 1997. No matter whether we use industrial production growth rates or real GDP growth rates as the dependent variable, there is a breakdown in the relation between stock returns and growth rates of real activity in the early 1980s. Stock returns clearly correlate with growth rates over the full sample and this relation is especially strong over the 1960-1982 subsample. However, the correlation is absent if we test for the 1983-1999 as well as the 1989-1999 subsample as can be seen from the estimated values of the adjusted R^2- and the F-statistic. A result that would be even more obvious if we would test for a subsample that starts in 1984 instead of 1983, because, as mentioned in Binswanger (2000), regression diagnostics and Chow breakpoint tests suggest a structural break in the US in the third quarter of 1984 rather than in the first quarter of 1983.

The results for the other six G-7 countries are quite mixed. For some countries (Canada, Germany, Japan) the results indicate a similar although less pronounced breakdown in the correlation between stock returns and subsequent real activity. However, only in Japan the correlation is absent in the 1983-1999 as well as in the 1989-1999 subsample. On the other hand, the results for the 1983-1999 and the 1989-1999 subsample are quite different in Canada and Germany. The results suggest that in these countries the relation only disappeared temporarily during the 1983-1988 episode, while stock returns correlate again with growth rates of real activity thereafter.

For the other remaining three countries (France, Italy, UK) an interpretation of the results is more difficult. In the UK, the correlation between stock returns and real activity appears to be somewhat stronger than in France and Italy, but weaker than in the other G-7 countries. The results indicate a pattern similar to the one observed in Canada and Germany, but the correlation is also quite weak over the 1960-1982 subsample, which makes an interpretation rather difficult. As far as France and Italy are concerned, no significant correlation between stock returns and growth rates of real activity can be detected no matter whether one tests for the full sample or any of the subsamples.[5]

In all countries, the correlation between stock returns and growth rates of industrial production are more significant than the correlation between stock returns and growth rates of real GDP. Therefore, our interpretation of the results is largely based on the results of the regressions using the growth rate of industrial production as the dependent variable. However, the correlation between stock returns and growth rates of real GDP is much stronger if quarterly stock returns are regressed on annual growth rates of GDP instead of quarterly growth rates as shown in Binswanger (2000) and Fama (1990).

The test statistics of the OLS regressions presented in this Section emphasize an ex-post view of the correlation between stock returns and growth rates of real activity (in-sample analysis). In further tests we adopt a more ex-ante perspective by additionally estimating the recursive least squares by using equation (2) again. In recursive least squares the equation is estimated repeatedly, using ever larger subsets of the sample data. If there are k coefficients to be estimated in the b vector, then the first k observations are used to form the first estimate of b. The next observation is then added to the data set and $k + 1$ observations are used to compute the second estimate of b. This process is repeated until all the sample points T have been used, yielding $T - k + 1$ estimates of the b vector. At each step the last estimate of b can be used to predict the next value of the dependent variable. The one-step ahead forecast error resulting from this prediction, suitably scaled, is defined to be a recursive residual.

In the following Figures, we will present the results of the CUSUM test (Brown, Durbin, and Evans, 1975) of the OLS regressions with the growth rate of industrial production as the dependent variable. The CUSUM test is based on the cumulative sum of the recursive residuals. Figures 3 to 9 plot the cumulative sum together with the 5% critical lines for each country. The test finds parameter instability if the cumulative sum goes outside the area between the two critical lines.

---

[5] This finding is partially confirmed by the error correction model estimated by Choi et al. (1999), where no significant corrrelation can be found for Italy over the 1957-1996 period, while the results still suggest a significant correlation for France.

The CUSUM test is based on the statistic,

$$W_t = \sum_{i=k+1}^{t} \frac{w_i}{s} \qquad t = k + 1, \ldots, T \qquad (3)$$

where w is the recursive residual, s is the standard error of the regression fitted to all T sample points.

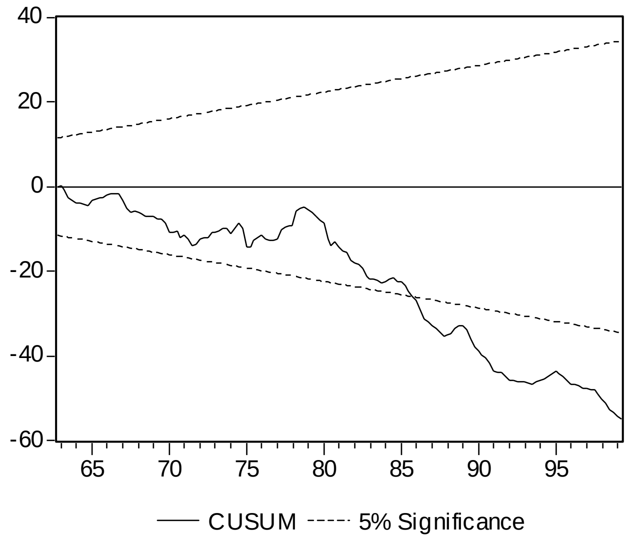

Figure 3: CUSUM test for the US

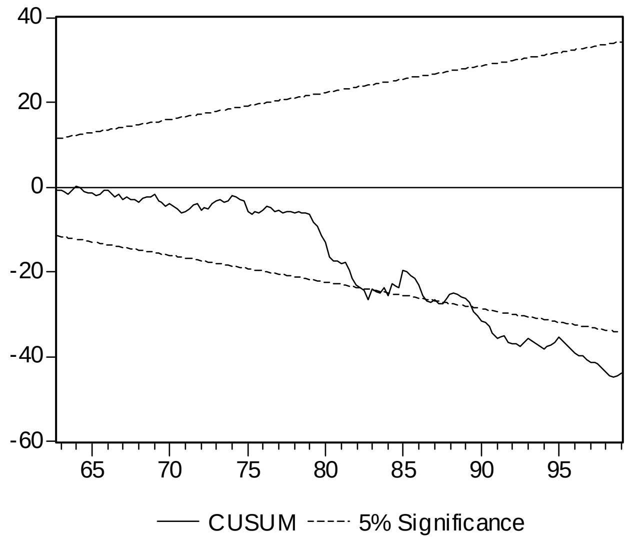

Figure 4: CUSUM test for Canada

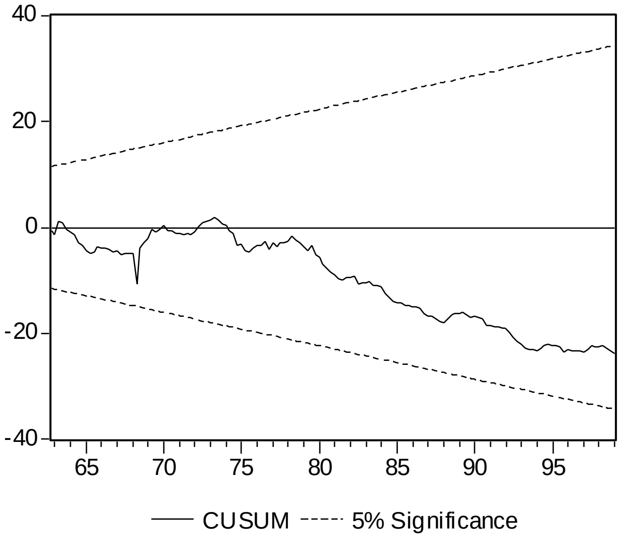

Figure 5: CUSUM test for France

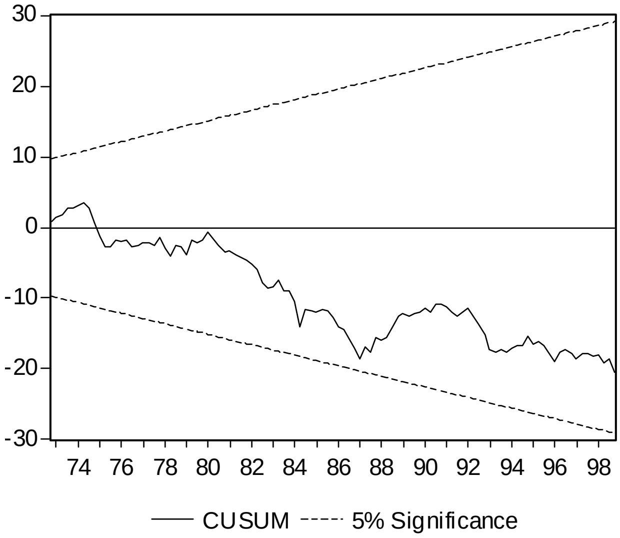

Figure 6: CUSUM test for Germany

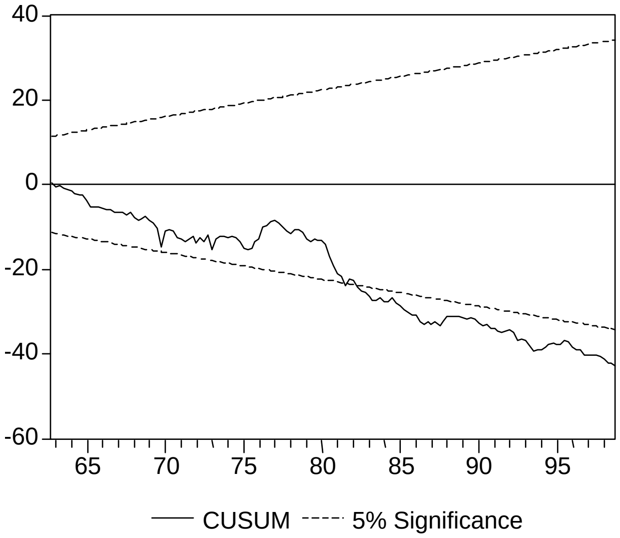

Figure 7: CUSUM test for Italy

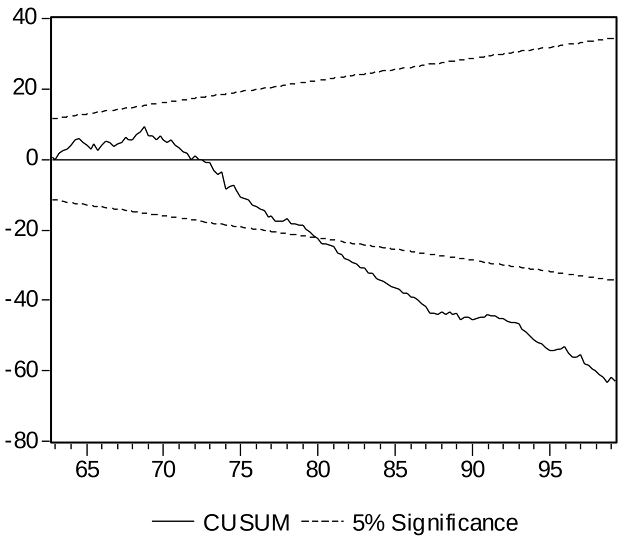

Figure 8: CUSUM test for Japan

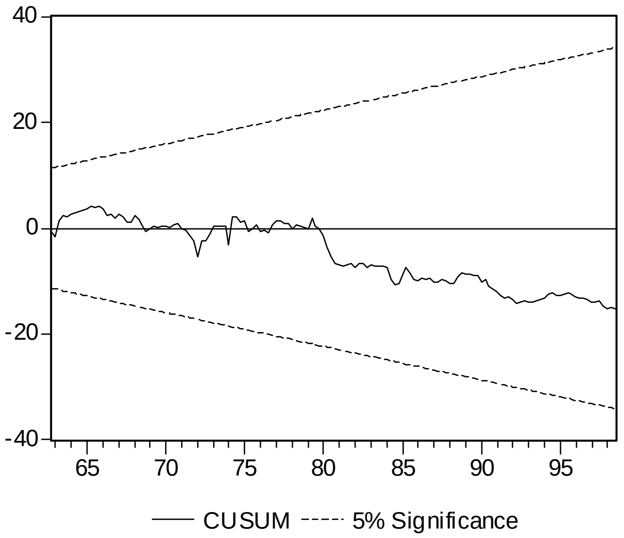

Figure 9: CUSUM test for the UK

The CUSUM test provides evidence for coefficient instability in the US, Canada, Italy and Japan, where W_t moves outside the critical 5 percent line in the early 1980s. This movement is most evident in the tests for the US and Japan, which strongly confirms the results from the OLS regressions shown in Table 5. No coefficient instability can be found in France, Germany and the UK. However, the result for Germany has to be interpreted with caution as this sample starts in 1970 and W_t would possibly also move outside the critical line if the sample would have started in 1960.

Summing up, our results of the OLS regressions and the CUSUM test provide strong evidence for a breakdown in the relation between stock returns and growth rates of real activity in the early 1980s in the US and Japan, and possibly also in Canada and Germany. However, in the latter two countries the stock market seems to lead real activity again during the 1990s and the relation disappeared only temporarily. No evidence for a breakdown can be found in the UK. And in France and Italy there has never been a significant relation between the stock market and real activity since the 1960s and the stock market never provided significant information about subsequent real activity.

5 Conclusion

In this paper we investigated whether the breakdown in the traditional relation between stock returns and growth rates of real economic activity in the United States, that according to Binswanger (2000) occurred in the early 1980s, can also be found in the other G-7 countries (Canada, France, Germany, Italy, Japan, UK). The test statistics of the estimated OLS regressions as well as the CUSUM test based on the estimation of recursive residuals suggest that a similar breakdown occurred in Japan. No more significant relation between stock returns and real activity can be found in the US and Japan, no matter whether one uses a 1983-1999 subsample or a 1989-1999 subsample, which excludes the 1987 crash. A breakdown possibly also occurred in Canada and Germany, although the results are less obvious than the results for Japan and the US. However, in Canada and Germany, the correlation between stock returns and real activity seems to be back in the 1990s, as indicated by the results of tests for the 1989-1999 subsample, which differ from the results of regressions over the 1983-1999 subsample.

The tests do not suggest a subsample instability in the UK, where, however, the correlation between stock returns and real activity is not very strong. And, finally, the results indicate that there never was a significant relation between the stock market and real activity in France and Italy since the 1960s. Neither regressions over the 1960-1999 sample, nor regressions over the 1960-1982, 1983-1999, and 1989-1999 subsamples lead to significant results for these countries.

It is not surprising that the correlation between stock returns and growth rates of real activity in other G-7 countries are generally less pronounced than in the US. These economies are characterized by a higher degree of openness and, consequently, stock returns are less related to domestic real activity. For example, the production sites of larger companies, that usually dominate the national stock indices, are many times abroad and, therefore, changes in production do not influence domestic industrial production although they can affect domestic stock prices. Furthermore, the stock market in these countries may show a higher degree of risk exposure to international risk factors such as exchange rate risk that are not related to domestic real activity but again influence domestic stock returns. Consequently, the correlation between stock prices and domestic real activity can be weak in these countries.

A possible explanation of the observed breakdown of the relation of the stock market and real activity in some countries is the deviation of stock prices from fundamental values due to the emergence of bubbles (Binswanger, 1999). This hypothesis is supported by research of the Bank of International Settlements. In the 69th annual report (BIS, 1999, p. 85) the BIS made an attempt to compute fundamentally warranted stock prices for all of the G-7 countries and plotted them against the actual stock prices in these countries.[6] The calculation of the fundamental value is based on the assumption that investors extrapolate a weighted average of past dividend growth rates in to the future, which, over a longer time period from 1880 till the late 1980s explains the development of stock prices in the US quite well as shown in Barsky and De Long (1993).

---

[6] In general, the existence or nonexistence of bubbles or fads in stock markets is a highly controversial issue. Numerous bubble tests that have been done since the early 1980s mainly proved one thing: it is a futile attempt to test directly for bubbles because fundamental values are unobservable and, consequently, bubbles cannot be distinguished from unobserved fundamentals (Hamilton and Whiteman, 1985).

According to the data presented in the BIS report there emerged a huge gap between actual stock prices and the calculated fundamental values in the US since the early 1980s, which strongly suggests the existence of a speculative bubble. A similar pattern can also be observed in Japan, where the stock market boomed during the 1980s. But during the 1990s actual stock prices continuously came down again and almost returned to their fundamental level towards the end of the 1990s. Furthermore, the BIS data also shows the emergence of a gap between actual stock prices and the fundamental values in France and Germany in the early 1980s, but in Germany this gap narrowed again during the 1990s. In Canada actual stock prices start to diverge from fundamental values not before the early 1990s. And in Italy and the UK actual stock prices never significantly diverged from their fundamental values.

If we accept the existence of bubbles as an explanation of the empirical findings in this paper, our results combined with the BIS computation of fundamental values strongly suggest the emergence of a speculative bubble in the US as well as in Japan in the early 1980s, which dominated the development of these stock markets over the 1980s and 1990s. The difference is, of course, that the Japanese bubble burst in 1990, while the American bubble survived the 1990s and even gained further momentum over this decade. For the other G-7 countries the results are less clear as far as the possible existence of bubbles is concerned. The results indicate that there also emerged a temporary bubble on the German stock market from 1983 till 1988, but during the 1990s, the stock market was again driven by market fundamentals. Furthermore, the evidence speaks against the existence of a bubble in the UK during the 1980s and 1990s, while the results for Canada, France and Italy do not allow for any conclusion in this respect.

6 References

BARRO, R. (1990)
The stock market and investment, Review of Financial Studies, 3: 115-131.

BARSKY, R. AND B. DE LONG (1993)
Why does the stock market fluctuate? Quarterly Journal of Economics, 108: 293-311.

BINSWANGER, M. (1999)
Stock Markets, Speculative Bubbles and Economic Growth, Aldershot: Edward Elgar.

BINSWANGER, M. (2000)
Stock market booms and real economic activity: Is this time different?, International Review of Economics and Finance, 9: 387-415.

BIS (1999),
Bank for International Settlements - 69th annual report, Basel.

BROWN, R.L., J. DURBIN, AND J.M. EVANS (1975)
Techniques for testing the constancy of regression relationships over time, Journal of the Royal Statistical Society: Series B, 37: 149–192.

CHOI, J.J., HAUSER, S. AND K. KOPECKY (1999)
Does the stock market predict real activity? Time series evidence from the G-7 countries, Journal of Banking & Finance, 23: 1771-1792.

DICKEY, D., JANSEN, D. AND D. THORNTON (1994)
"A Primer on cointegration with an application to money and income", in Rao, B. (ed.): Cointegration for the Applied Economist. New York: St. Martin's Press

DOMIAN, D. AND D. LOUTON (1997)
A threshold autoregresive analysis of stock returns and real economic activity, International Review of Economics and Finance, 6: 167-179.

ESTRELLA, A. AND F. MISHKIN (1996)
Predicting U.S. recessions: financial variables as leading indicators, Federal Reserve Bank of New York Research paper No. 9609.

FAMA, E. (1981)
Stock returns, real activity, inflation, and money, American Economic Review, 71: 545-565.

FAMA, E. (1990)
Stock returns, expected returns, and real activity, Journal of Finance, 45: 1089-1108.

HAMILTON, J. AND WHITEMAN, C. (1985)
The observable implications of self-fulfilling expectations, Journal of Monetary Economics, 16: 353-74.

MERIC, I. AND G. MERIC (1997)
Co-movements of European equity markets before and after the 1987 crash. Multinational Finance Journal 1: 137-152.

MORCK, R., SHLEIFER, A. AND R. VISHNY (1990)
The stock market and investment: is the market a sideshow?, Brookings Papers on Economic Activity, 1: 157-202.

NEWEY, W. AND K. WEST (1987)
A simple, positive semi-definite, heteroscedasticity and autocorrelation consistent covariance matrix, Econometrica, 55: 703-708.

OERTMANN, P. AND H. ZIMMERMANN (1998)
'Systematische Risiken steigen.' Schweizer Bank 98/2: 33-35.

PEIRO, A. (1996)
Stock prices, production and interest rates: comparison of three European countries with the USA, Empirical Economics, 2: 221-234.

SCHWERT, W. (1990)
Stock returns and real activity: a century of evidence, Journal of Finance, 45: 1237-1257.

SHAPIRO, M. (1988)
The stabilization of the U.S. economy: evidence from the stock market, American Economic Review, 78,:1067-1079.

WU, C. AND Y. SU (1998)
Dynamic relations among international stock markets, International Review of Economics and Finance, 7: 63-84.

Publications to date:

In Series A 'Discussion Papers' of Solothurn University of Applied Sciences Northwestern Switzerland, the following publications have appeared:

No. 98-01 THOMAS M. SCHWARB (July 1998)
«Ich verpfeife meine Firma»... Einführung in das Phänomen «Whistle-Blowing».

No. 98-02 MATHIAS BINSWANGER (December 1998)
Stock Market Booms and Real Economic Activity: Is this Time different?

No. 98-03 GÜNTER SCHINDLER (December 1998)
Unscharfe Klassifikation durch kontextbasierte Datenbankanfragen.

No. 99-01 MATHIAS BINSWAGER (January 1999)
Co-Evolution Between the Real and Financial Sectors:
The Optimistic «New Growth Theory» View versus the Pessimistic «Keynesian View».

No. 99-02 MATHIAS BINSWANGER (June 1999)
Die verschiedenen Rollen des Finanzsektors in der wirtschaftlichen Entwicklung.

No. 99-03 LORENZ M. HILTY (June 1999)
Individuenbasierte Verkehrssimulation in Java.

No. 99-04 ALBERT VOLLMER (June 1999)
Mobile Arbeit in der Schweiz – Telearbeit und Desksharing.

No. 99-05 NAJIB HARABI (July 1999)
The Impact of Vertical R&D Cooperation on Firm Innovation: an Empirical Investigation.

No. 99-06 MAIKE FRANZEN (July 1999)
Konstruktives Lernen mit dem E-Book. Entwicklung einer Lernumgebung für konstruktives Lernen.

No. 99-07 MATHIAS BINSWANGER (December 1999)
Technological Progress and Sustainable Development: Different Perspectives on the Rebound Effect.

No. 2000-01 LORENZ M. HILTY, THOMAS RUDDY, DANIEL SCHULTHESS (January 2000)
Resource Intensity and Dematerialization Potential of Information Society Technologies.

No. 2000-02 LORENZ M. HILTY, ALBERT VOLLMER, DANIEL SCHULTHESS, THOMAS RUDDY (February 2000)
Lifestyles, Mobility and the Challenge of Sustainability: A Survey of the Literature.

No. 2000-03 LORENZ M. HILTY, THOMAS RUDDY (May 2000)
The Information Society and Sustainable Development.

No. 2000-04 ROLF MEYER, NAJIB HARABI (June 2000)
Frauen Power unter der Lupe. Geschlechtsspezifische Unterschiede der Jungunternehmerinnen und -unternehmer. Ergebnisse einer empirischen Untersuchung.

No. 2000-05 ROLF MEYER, MARION ALT, KERSTIN HÜFFMEYER, NAJIB HARABI (June 2000)
Selbständigerwerbende und ihre jungen Unternehmen – 9 Fallbeispiele.

No. 2000-06 NAJIB HARABI, ROLF SCHOCH, FRANK HESPELER (August 2000)
Einführung und Verbreitung von Electronic Commerce. Wo steht die Schweiz heute im internationalen Vergleich? Ergebnisse einer empirischen Untersuchung.

No. 2000-07 NAJIB HARABI (December 2000)
Employment Effects of Eco-Innovations: An Empirical Analysis.

No. 2001-01 ROLF MEYER, NAJIB HARABI, RUEDI NIEDERER (January 2001)
Der Einfluss der Beratung, Weiterbildung und des Beziehungsnetzes auf den Erfolg junger Unternehmen.

No. 2001-02 NAJIB HARABI (January 2001)
Introduction and Diffusion of Electronic Commerce –
What is Switzerland's position in an international comparison? Results of an empirical study

No. 2001-03 NAJIB HARABI, HESPELER FRANK (February 2001)
Electronic Commerce in der Schweiz: Lehren aus Einzelfallstudien

No. 2001-04 BINSWANGER MATHIAS (February 2001)
Does the Stock Market Still Lead Real Activity? - An Investigation for the G-7 Countries

In Series B 'Reprints' of Solothurn University of Applied Sciences Northwestern Switzerland, the following publications have appeared:

No. 98-01 NAJIB HARABI (October 1998)
Channels of R&D spillovers: An Investigation of Swiss Firms.
Reprinted from: Technovation, 17 (11/12) (1997) 627–635.

No. 98-02 MAX ZUBERBÜHLER (October 1998)
Virtualität – der zukünftige Wettbewerbsvorteil.
Reprinted from: io Management, 67 (1998), 18–23.

No. 98-03 NAJIB HARABI (October 1998)
Les facteurs déterminants de la R&D.
Reprinted from: Revue française de gestion, n° 114, 1997, p. 39–51.

No. 98-04 NAJIB HARABI (December 1998)
Innovation through Vertical Relations between Firms, Suppliers and Customers:
a Study of German Firms.
Reprinted from: Industry and Innovation, Volume 5, Number 2, pp. 157–178.

No. 99-01 CHRISTOPH MINNIG, RUEDI NIEDERER, THOMAS SCHWARB (January 1999)
Imagestudie Erziehungsdepartement des Kantons Solothurn. Schlussbericht.

No. 99-02 NAJIB HARABI (January 1999)
Der Beitrag von Profit- und Nonprofit-Organisationen zum technischen Forstschritt: Ergebnisse aus der Schweiz.
Reprinted from: Wagner, R. (1997). Festschrift zum 60. Geburtstag von Antonin Wagner. Zürich: Turicum.

No. 99-03 LORENZ M. HILTY, KLAUS TOCHTERMANN, JÖRG VON STEINAECKER (July 1999)
The Information Society and the Environment – A Survey of European

Activities.
Reprinted from: Proc. 1st International Environmental Management Systems Conference, Vienna/Austria 1998.

No. 99-04 THOMAS M. SCHWARB (August 1999)
Das Arbeitszeugnis als Instrument der Personalpraxis.
Reprinted from the dokumenation at the conference „Arbeitszeugnis“ at Solothurn University of Applied Sciences Northwestern Switzerland, Olten.

No. 99-05 THOMAS M. SCHWARB, ALBERT VOLLMER (December 1999)
Telearbeit
Reprinter from: Schwarb Th. M. (ed.) (1999) Erfolgsfaktor Human Resource Management, Zürich: Weka.

No. 2000-01 NAJIB HARABI, ROLF MEYER (February 2000)
Die neuen Selbständigen
A Study by order of NEFU (Netzwerk für Einfrau-Unternehmerinnen) Switzerland.

No. 2000-02 RUEDI NIEDERER, STEFANIE GREIWE, CHRISTOPH MINNIG, THOMAS SCHWARB (March 2000)
Projektmanagement – Praxis und Ausbildung.
A Study by order of Universities of Applied Sciences and SwissPM.

No. 2000-03 THOMAS SCHWARB, STEFANIE GREIWE, CHRISTOPH MINNIG, RUEDI NIEDERER (March 2000)
Olten ist eigentlich schön, aber ...
A Study of Attraktivity and Image of Olten by order of the Project Olten Plus.

No 2000-04 THOMAS SCHWARB, ALBERT VOLLMER, RUEDI NIEDERER (March 2000)
TA-Studie „Mobile Arbeitsformen: Verbreitung und Potenzial von Telearbeit und Desksharing“
A Study by order of Swiss Science and Technology Council and Commission for Technology and Innovation.

No. 2000-05 THOMAS SCHWARB, STEPHANIE GREIWE, CHRISTOPH MINNIG, RUEDI NIEDERER (NOVEMBER 2000)
Olten ist eigentlich schön, aber...
A Study of the Attractiveness of Olten as a Residential and Industrial Location and of the Image of Olten under Contract from the Project Olten Plus (POP).

No. 2000-06 THOMAS SCHWARB, STEPHANIE GREIWE, CHRISTOPH MINNIG (NOVEMBER 2000)
Ich gehe nach Olten einkaufen, wenn ...
A Study of Shopping in Olten under Contract from the Project Olten Plus (POP).

No. 2000-07 THOMAS SCHWARB, STEPHANIE GREIWE (January 2001)
Zofingen unter der Lupe.
Study of the Situation of Shopping in Zofingen.

In Series C 'Guest Lectures' of Solothurn University of Applied Sciences Northwestern Switzerland, the following publications have appeared:

No. 99-01 PATRIK DUCREY, BARBARA HÜBSCHER (July 1999)
Aktuelle Probleme der Wettbewerbspolitik
Lectured at University of Applied Sciences Solothurn Northwestern Switzerland on May 31st 1999.

No. 2000-01 ANDY STURM (April 2000)
Grundlagen der schweizerischen Geldpolitik
Lectured at University of Applied Sciences Solothurn Northwestern Switzerland on April 14th 2000.

No. 2000-02 PATRICIA SCHULTZ (September 2000)
Von Männern und Frauen in Arbeitswelt und Privatleben
Lectured at University of Applied Sciences Solothurn Northwestern Switzerland on February 22nd 2000.

No. 2000-03 NILS GOLDSCHMIDT (September 2000)
Auf dem Weg zu einem kommunitaristischen Wohlfahrtsstaat. Ethische und ökonomische Anmerkungen zu einem nicht ganz neuen Leitbild
Lectured at University of Applied Sciences Solothurn Northwestern Switzerland on March 3rd 2000.

No. 2000-04 ELISABETH JORIS (September 2000)
History and Herstory
Lectured at University of Applied Sciences Solothurn Northwestern Switzerland on November 30th 1999.