Inflation and the dividend policy of US firms

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Abstract

Purpose – The purpose of this paper is to analyse the dividend policy of firms from a macroeconomic perspective. In order to do so inflation and real growth are also considered.

Design/methodology/approach – The paper examines the relationship between dividends, corporate earnings, real growth and inflation in the USA by applying cointegration techniques. In this framework, impulse response analysis is used to test the two most popular theories of dividend determination.

Findings – The data indicate three cointegration relations among the four-time series. Impulse response analysis then shows some interesting dynamics. Dividend smoothing seems to be a relevant phenomenon. Furthermore, inflation has a positive effect on dividends.

Research limitations/implications – The most important finding of this paper is the indication of a positive relationship between inflation and dividend payments. This can be interpreted in two different ways: managers may try to follow a dividend policy, which is perceived to be optimal, believing that there is a desirable level of real dividend income to be paid to their investors. On the other hand, inflation may simply increase the nominal value of corporate earnings and therefore the dividends paid. Independently from the interpretation of the results, inflation should definitely be considered analysing dividend policy.

Practical implications – Managers should also examine the inflationary environment formulating an adequate dividend policy for their firm.

Originality/value – The paper provides an as of yet widely ignored link between the micro- and macroeconomic sphere examining one of the most important problems of financial economics. Neglecting the effects of inflation on dividends may, among others, be one reason for the mixed empirical findings testing theories of dividend determination.

Keywords United States of America, Dividends, Inflation, Stock markets, Financial economics

Paper type Research paper

1. Introduction

Recent experiences in the USA and other countries have shown that inflation is not dead at all. Owing to high energy costs prices on different stages of measurement (e.g. consumer price indexs and producer price indexs) have increased considerably in the first half of 2008. In the second half the falling oil price has dampened inflationary pressures dramatically. Until recently, some observers even seemed to believe that there was the danger of an emerging deflation due to the financial crisis and the deleveraging process of the global banking system. As a consequence, the yield on ten year US Treasuries temporarily fell to about 2 per cent in December 2008. However, because of aggressive interest rate cuts implemented by the Federal Reserve and other central banks fears that inflation rates will accelerate again in the medium- and long-term have returned.

Combined with large fiscal stimulus packages interest rate cuts obviously increase inflationary risks. Therefore, it is probably no surprise that the year on year per cent change in the US consumer price index has returned to positive territory in the end of 2009.

Inflation quite clearly is a macroeconomic phenomenon which has major consequences for capital markets and affects a wide range of important financial variables (e.g. interest rates and corporate earnings). This paper provides empirical evidence regarding the relationship between dividend policy and inflation in the USA by using techniques of cointegration analysis thereby providing a new perspective on two very important problems of financial economics – namely, why firms decide to pay dividends and whether stocks are a useful hedge against inflation. The paper is organized as follows: Section 2 briefly reviews the optimal dividend policy issue. Section 3 then discusses the relationship between inflation and the stock market. Section 4 describes the data sets examined, discusses some methodological issues and also provides some details of a preliminary analysis of the data sets. Section 5 presents the results of impulse response analysis of the vector error correction model (VECM). Based on the theoretical considerations presented in Sections 2 and 3, the final section concludes by discussing the implications of the empirical findings.

2. Some thoughts about dividend policy
In a famous and very controversial paper Miller and Modigliani (1961) have noted that the dividend policy followed by a firm does not affect its value. According to this so-called dividend irrelevancy hypothesis changes in dividend payments have no economic implications. As a consequence, Miller and Modigliani have concluded, that there is no optimal dividend policy for a firm. This theory is based on a number of assumptions. Most importantly, there exist no taxes and capital markets are assumed to be perfect. Under these circumstances and with a given investment policy, higher dividends result in lower capital gains. Assuming that investors do not prefer dividends to capital gains or vice versa, decisions about dividend payouts have no economic relevance at all. Nevertheless, managers in many firms still seem to believe that there exists an optimal dividend policy. According to Miller and Modigliani this fact is hard to explain. Moreover, there are even strong arguments against dividend payments because the tax laws of many countries penalize dividend income by taxing dividends more heavily than capital gains. Thus, there seems to be some kind of a dividend puzzle.

The most popular justifications for the existence of dividend payments are based on agency theory and problems of asymmetrically distributed information between the management and investors. Corporate finance theory suggests that the management of a firm can use dividend changes to overcome information asymmetries by trying to signal revised earnings expectations to its investors. This is the so-called signalling hypothesis. Agency theory does have further interesting implications for dividend policy. Most importantly, principal agent problems between the owners and the management of a firm may affect dividend policy when there is a separation of ownership and control. Gugler (2003), for example, has argued convincingly that higher dividends constrain the management of a firm by reducing free cash flow and by forcing the management to obtain more outside funds from investors trying to finance additional investment projects. Moreover, it is often assumed that managers are reluctant to cut dividends and therefore increase dividend payments only gradually with rising earnings. This is the so-called smoothing hypothesis of dividend determination which predicts

that dividend increases are carried out rather cautiously because firms try to avoid significant dividend cuts when corporate earnings fall. Therefore, it could be quite complicated to correctly identify this strategy in an inflationary environment, as inflation also may cause dividends to grow steadily in nominal terms, making it difficult to identify dividend smoothing in empirical studies.

Goddard *et al.* (2006) have argued that the signalling and smoothing hypotheses make antipodal predictions about the temporal relationship between dividends and corporate earnings. While the smoothing hypothesis suggests that earnings lead dividends the signalling hypothesis predicts the opposite. Those observations may be even more distorted as clientele effects could also be of importance. In fact, numerous firms do tailor their dividend payouts to suite particular groups of investors. Given the tax laws of many countries family-controlled firms may, for example, have an incentive to avoid dividend payments at all. In these firms, there is no separation of ownership and control. Consequently, there is also no principal agent problem and no need to constrain the management.

Even though some econometricians suggest that dividend signalling might have influence under certain circumstances, DeAngelo *et al.* (2000) have noted that the relevance of dividend signalling might in general be overestimated. An excellent survey of the relevant literature has been provided by Allen and Michaely (1995). More recently, Gugler (2003) has examined data from Austria searching for clientele effects and has argued that the ownership structure does influence a firm's dividend policy. He has noted that family-controlled enterprises have lower payout target ratios and are more likely to cut dividends while state-owned firms are most reluctant to do so. These findings are consistent with solutions of the dividend puzzle that are based on agency theory. Moreover, analysing data from the UK Goddard *et al.* (2006) have reported some evidence supporting the signalling hypothesis. However, they have argued that the relationship between dividends, corporate earnings, and stock prices is very complex and therefore cannot be explained by a single theory of dividend determination. Other researchers have produced even less convincing empirical evidence testing the signalling hypothesis (DeAngelo *et al.* (2000) and Bernhardt *et al.* (2005)).

In fact, most economists interested in corporate finance theory seem to believe that additional empirical evidence is needed. Bhattacharyya (2007), for example, has noted that properly conducted empirical research should account for all implications of the underlying economic theories of dividend policy. Our paper therefore also focuses on macroeconomic aspects which are often ignored. Most importantly, we also examine the role of inflation. This possibly important variable is usually neglected, though Modigliani (1982) has noted that the earnings-payout ratio is increased by inflation while stock prices might not change due to different leverage of those effects, giving an obvious motivation to include inflation in empirical work analyzing dividend policy. Furthermore, it may also be helpful to add real economic activity as additional variable.

3. Inflation and the stock market
There is a common belief that the equity market can act as an effective hedge against inflation because stocks are claims on real capital. Accepting this argument, inflation should lead to higher stock prices by increasing the nominal value of real capital. Additionally, inflation magnifies the revenues of the corporate sector leading to higher earnings and an increase of stock prices. These simple theoretical considerations are

intuitively appealing. However, empirical evidence seems to indicate the existence of a negative contemporaneous correlation of stock returns and inflation (Bodie, 1976; Fama and Schwert, 1977; Schwert, 1981).

The theory of finance has problems to explain this negative correlation. It is sometimes argued that the corporate sector may be unable to pass on higher prices. Moreover, Feldstein (1982) has noted that in the US inflation has increased the real tax burden of firms. There is also a macroeconomic dimension of the problem since inflation distorts the price system and increases transaction costs. As a consequence, high inflation rates may retard economic growth (Barro, 1996; Faria and Carneiro, 2001). This would, of course, hurt the stock market as well. Generally speaking, higher inflation rates may simply be a sign for the existence of other major macroeconomic problems. In fact, Fama (1981) has suggested that the observed negative relationship between inflation and stock returns originates from a positive relationship between stock returns and future economic growth and an inverse relationship between future economic growth and inflation. Accepting this point of view, inflation would only be a proxy for economic growth and the relationship between inflation and stock returns should be interpreted as a more or less spurious one. This is the so-called proxy hypothesis.

Moreover, following Campbell and Shiller (1988) it has been argued by Schotman and Schweitzer (2000) that two countervailing trends are present. First of all – and as already discussed – corporate earnings scale with inflation. Therefore, inflation could increase expected dividend payments in the future. This is positive for stock returns. But there is a second important effect. Higher inflation also tends to increase inflation expectations leading to a higher discount rate thereby reducing stock prices. The existence of these two opposing effects may help to explain why the empirical evidence reported in the literature is mixed. As a matter of fact, while quite a number of empirical studies do suggest that inflation rates and stock returns are negatively related in the short run this is not necessarily true for the long run. In spite of the negative contemporaneous correlation of stock returns and inflation rates inflation may even have a positive effect on stock returns in the long run. Most notably, Boudoukh and Richardson (1993) and Kolari and Anari (2001) have provided empirical evidence indicating that stocks can indeed serve as a long-term inflation hedge.

4. Data, methodology and an initial analysis
Our measure of inflation is the US GDP price deflator which is reported by the Department of Commerce. This price index is a broad gauge of inflation. It is published on a quarterly basis. Taking a macroeconomic perspective, we do not focus on the dividend payments of individual firms but examine the aggregated dividends paid by the S&P 500 members using the dividend per index share concept. The S&P 500 Index is quite commonly used as a proxy for the performance of the US stock market and therefore is also a common benchmark for US equity funds. This index consists of the 500 leading companies in the USA and seems to be the generally accepted measure for US stock market activity. Bloomberg provides data on the volume of dividends paid by the index constitutes of the S&P 500 (dividend per index share). In order to test whether dividend signalling or dividend smoothing are relevant phenomena, we use a methodology suggested by Goddard *et al.* (2006) and therefore also have to consider corporate earnings. Given our measure of dividend payments the S&P 500 earnings per index share seems to be an appropriate variable. This time series is also provided by Bloomberg.

Furthermore, because of the fact that the proponents of the proxy hypothesis believe that there is a relationship between inflation and real growth we additionally do include a measure of real economic activity in the USA as fourth variable of the model (namely US real GDP). Adding real output to the VECM is also useful in order to examine the two main drivers of earnings growth. In fact, Berner (2002) recently has argued that econometricians should focus more strongly on the analysis of corporate profits. Therefore, our approach seems to be promising. We examine data from Q1 1980 through Q4 2008 focusing on the experiences after Paul Volcker's appointment as Chairman of the Federal Reserve Board. Thereby, we do hope to avoid possible problems with structural breaks which are known to cause major problems testing for cointegration (Gregory and Hansen, 1996).

Visual inspection clearly shows that the time series examined do not seem to be I(0). Testing for unit roots on the differences is performed after controlling for structural breaks. We therefore use the procedure suggested by Lanne *et al.* (2002). In this approach, first of all the deterministic components and nuisance parameters are estimated and the series then adjusted using those parameters. While applying the test to the first differences, an impulse dummy is used, as suggested by the aforementioned authors. The respective results (Table I) signal quite clearly that all examined time series are integrated of order one (in levels). The break in the dividend time series occurs rather late, leaving only very few data points after the occurrence. Thus, it is also tested without a breakpoint; the results are included in Table I as well.

Structural breaks are – as already noted – a potential problem using cointegration tests. Even more so due to the test procedure suggested by Lanne *et al.* (2002) showing some empirical evidence for structural change. Numerous papers have been devoted to the subject of cointegration and structural breaks (Gregory and Hansen, 1996; Johansen *et al.*, 2000). One possible approach to cope with the difficulties arising from structural change could be testing for structural breaks in bivariate cointegration models and then switch to a multivariate setting. In the case examined here, this is not necessary. In fact, structural breaks quite clearly bias cointegration tests towards rejection even if in reality some form of cointegration relationship between the time series examined does exist. However, given that the results of the Johansen (1991) cointegration tests reported in Table II suggest that there exist three cointegration

Variable	D (dividends)	D (earnings)	D (deflator)	D (real growth)
Test' statistic (without break)	− 8,8082 − 8,9367	− 4,5696	− 3,7893	− 2,9856
Level of confidence	>99% >99%	>99%	>99%	>95%
Date of break	2007Q4 None	1998Q3	2002Q1	2002Q2

Table I.
Lanne test results
(on adjusted
differentiated time series)

H0	0	1	2	3
Likelihood ratio	79.34	48.75	24.43	3.62
p-value	0.0000	0.0007	0.0110	0.4830

Table II.
Johansen test statistics

relationships among the four variables examined here structural breaks seem to be no major problem[1]. Moreover, the results are robust if including the break points deduced by the procedure suggested by Lanne *et al.* (2002). Therefore, we have to conclude that according to our tests the time series follow stable common trends and that there exists a long-term equilibrium relationship between the variables dividends (US_Dividends), corporate earnings (US_Earnings), real economic activity (US_GDP_Real) and the price level (US_GDP_Defl)[2].

The critical values for the test statistics are taken from Doornik (1998). We have considered eight time lags. This is the optimal lag length of the model according to the Akaike information criterion. Dummy variables are used to account for seasonality. The LM tests reported in Table III do not reject the hypothesis of serial correlation in the VECM residuals possibly causing problems regarding the ordering of the variables, as we are going to use the Cholesky decomposition for impulse response analysis. This will be explained in more detail in the following section. To further examine the problem, the cross-correlations of the residuals up to eight lags are inspected. While there are no significant correlations on the residuals, the squared residuals show strong serial correlation (cross- and auto-correlation) resulting in non-biased but inefficient estimators. Thus, a two stage, generalized least squares, approach is utilized. The impulse-response functions discussed in the following are robust to a change of the estimation technique (ordinary least squares (OLS) to generalized least squares), clearly indicating the findings to be consistent.

5. Impulse response analysis

The dynamics of the model are analysed by computing impulse response functions using the Cholesky decomposition. The ordering of variables is selected according to economic theory, as the Cholesky decomposition is not ordering invariant. The macroeconomic variables quite clearly should be more exogenous than the variables from the financial sphere. Moreover, dividends are paid from earnings. This leaves two possible orderings of variables (US_GDP_Defl → US_GDP_Real → US_Earnings → US_Dividends and US_GDP_Real → US_GDP_Defl → US_Earnings → US_Dividends). The resulting impulse response functions for the OLS estimation are shown in Figures 1 and 2. The confidence intervals are obtained using Efron (Efron and Tibshirani, 1993) bootstrap techniques (95 per cent level). Both orderings lead to remarkably similar results – at least with respect to the financial variables which are at the centre of this empirical investigation, indicating robustness under reordering[3].

Following Goddard *et al.* (2006) our empirical findings quite clearly imply that dividend smoothing is a relevant phenomenon because corporate earnings lead dividends. There is no empirical evidence for dividend signalling. Turning to the relationship between macroeconomic and financial variables both orderings give unequivocal support for the hypothesis that corporate earnings and dividends react positively to a shock to real economic activity. This is no surprise at all. Explaining the statistically significant

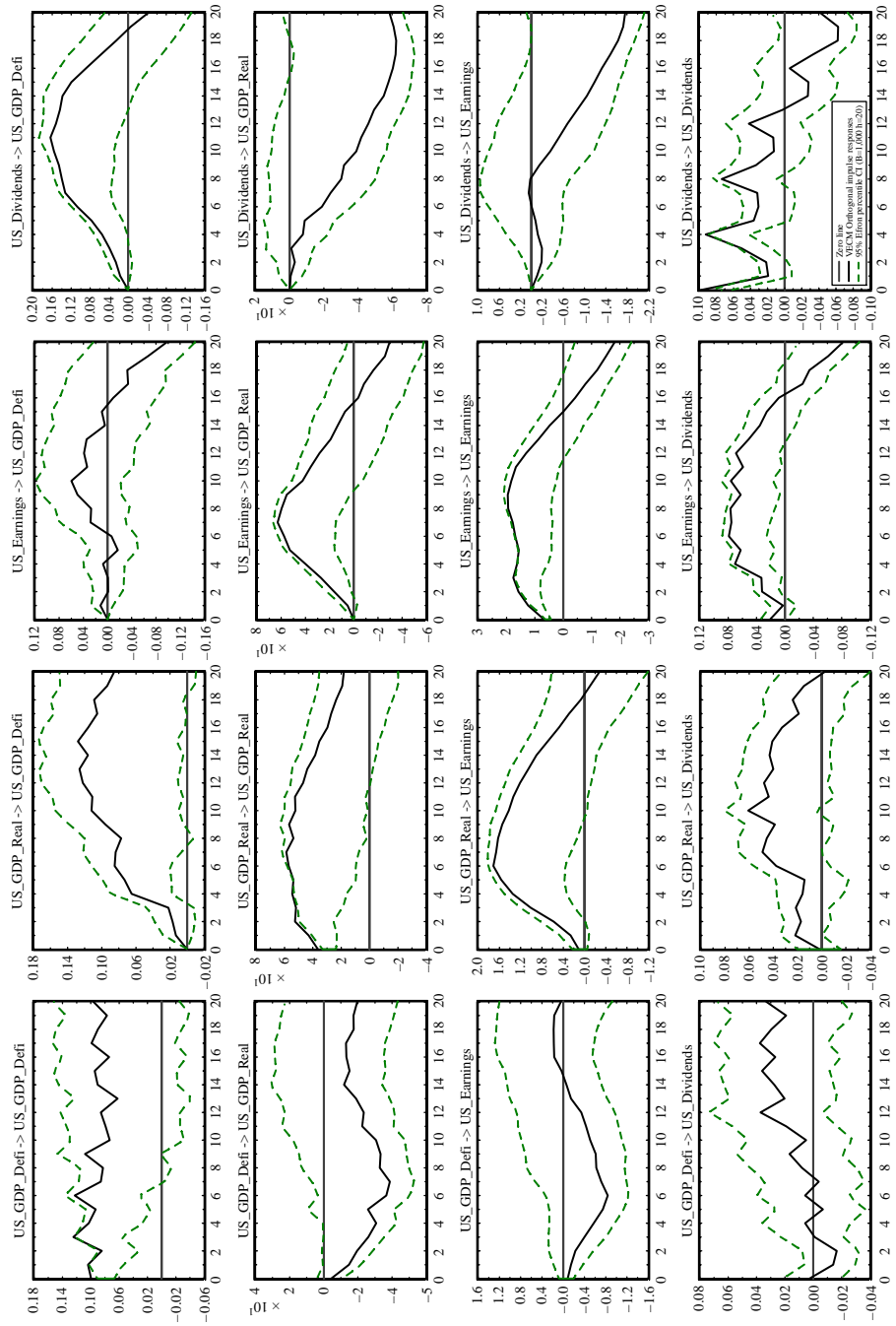| Lags	1	2	3	4	5	6	7	8	9
LM statistic	31.2	63.0	94.3	113.1	137.6	161.3	188.1	223.4	300.2
p-value	0.0129	0.0009	0.0001	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000

Table III.
LM autocorrelation test
results

Figure 1.
Impulse responses
(ordering US_ GDP_
Defl → US_ GDP_
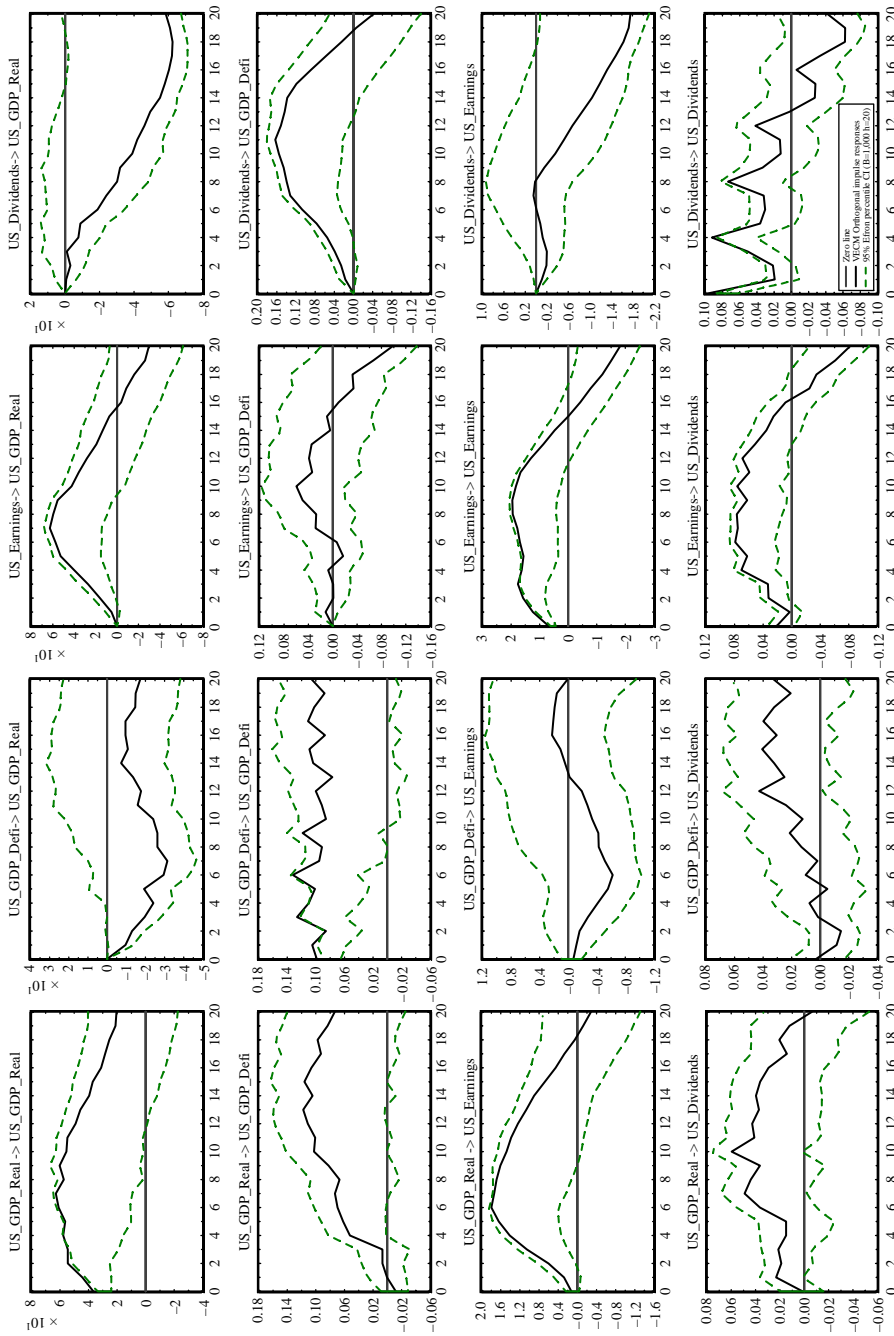Real → US_Earnings
→ US_Dividends)

Figure 2.
Impulse responses
(ordering US_ GDP_
Real → US_ GDP_
Defl → US_ Earnings →
US_ Dividends)

negative reaction of real economic activity to an increase in dividend payments is less easy. An exogenous positive shock to dividend may, for example, signal less attractive investment opportunities of the corporate sector and – as a consequence – lower future economic growth. The statistically significant negative reaction of dividends to a shock to corporate earnings to be observed after 16 quarters probably has to be put in this context.

There also is an at least marginally statistically significant positive reaction of dividends to inflation. Dividends are only one source of stock market returns. Therefore, this result does not necessarily imply that stocks are a good hedge against inflation. However, the empirical findings reported above quite clearly do suggest that inflation is indeed contributing to dividend growth. There are different possibilities to interpret these empirical findings. US firms may assume that there is a desirable level of real dividend income to be paid out to their investors. This would imply that the corporate sector does believe in the existence of some sort of optimal dividend policy in real terms. A second interpretation of our results would require a by far less active role of management, as inflation may simply increase the nominal volume of corporate earnings and – given that dividends are paid as a percentage of earnings – thereby also the volume of dividends. Obviously, both explanations are compatible with our empirical findings and have similar implications (higher inflation leads to higher dividends). However, there are some obvious differences. Most importantly, the first explanation requires the management to formulate an optimal real dividend payout policy. Therefore, additional empirical evidence supporting this hypothesis clearly could be interpreted as a further hint suggesting that managers and investors "really" care about dividends. In fact, this hypothesis can even be seen as some kind of new theory of dividend determination which is based on the assumption that investors have a preference for a stable source of continuous real income. Irrespective of these interpretations of the empirical results reported above the findings of this paper do have consequences for econometricians planning to test theories of dividend determination. Most importantly, increases to the volume of dividend payments arising from higher inflation rates could be falsely identified as empirical evidence in favour of dividend smoothing.

6. Conclusion
The empirical evidence reported above indicates that in the USA there is a stable long-run equilibrium relationship between dividend payments, corporate earnings, real economic activity and the price level. Moreover, impulse response analysis reveals some interesting facets of dividend policy. There is clear evidence for dividend smoothing. Furthermore, we have established the existence of a positive relationship between dividends and inflation. Interpreting these results is not that easy. First of all, this finding does not necessarily mean that stocks are a useful hedge against inflation. However, it still is noteworthy that companies seem to increase their dividend payments more strongly in an inflationary environment. There are at least two possible explanations for this behaviour. First of all, the management could believe that there is some sort of optimal dividend policy in real terms. As a consequence, there may be an incentive to ceteris paribus stabilize the real value of dividend income. On the other hand, inflation may simply increase the nominal volume of corporate earnings and therefore dividend payouts. Analysing whether firms formulate their payout policy in real terms would be interesting. In any case, higher inflation seems to be a major driver of dividend growth. This finding does have a number of interesting implications.

Most importantly, a gradual increase of dividend payments due to higher inflation rates could be falsely identified as empirical evidence supporting the dividend smoothing hypothesis. Therefore, the results reported above are of special importance because we have controlled for inflation. Moreover, a higher variability of inflation may distort the ability of firms to use dividend changes to signal revised earnings expectations to their investors – this would be just another facet of the well documented informational costs of inflation.

The usual negligence of macroeconomic factors may indeed be an important reason why empirical tests often fail to support specific theories of dividend determination. Therefore, the results reported above imply that econometricians studying dividend policy have to consider the effects of inflation. Moreover, given that inflation rates are more volatile in economies classified as emerging markets our findings may also be an additional explanation for the observation that firms in these regions seem to have less stable dividend payments (Adaoglu, 2000; Aivazian *et al.*, 2003). Further empirical research examining data from emerging markets could therefore also be helpful.

This study has some additional implications for further research. In particular, it would certainly be interesting to examine the negative relationship between dividend shocks and real economic activity in more detail. Moreover, it should also be analysed how corporate earnings react to inflation shocks and to shocks to real output. Sharpe (2002), for example, has argued that inflation is negative for stock prices because it lowers expected real earnings growth and increases the real required return. Furthermore, it would be important to include monetary policy as additional variable. On the one hand, monetary policy is a function of real economic activity and the general price level; on the other hand, monetary policy also affects real growth and inflation. Therefore, this is a potentially relevant variable. It would, for example, be possible to combine the approach suggested here with the empirical model of Belke and Polleit (2006) who examine the long-run relationship between dividend growth and monetary policy. Both studies seem to fit together like pieces in a puzzle because the activities of firms commonly called "dividend policy" analysed here are a disturbance in Belke and Polleit (2006) while the activities of central bankers which are usually called "monetary policy" are not observed here.

Notes

1. We also could have used the ARDL approach. The main advantage of this method is that it is not necessary to a priori determine the order of integration of the examined time series (Bahmani-Oskooee and Ng, 2002; Belke and Polleit, 2006). However, we are quite confident that all four variables in the model are I(1). Therefore, we have used the approach suggested by Johansen. This technique still is the most popular multivariate method estimating a cointegration relationship. This popularity mainly is a result of a simulation study by Gonzalo (1994) indicating the favourable characteristics of the multivariate cointegration test suggested by Johansen.

2. Yet, it may be interesting to note that bivariate cointegration tests quite clearly suggest the existence of a massive structural break in the cointegration relationship between the volume of dividend payments and the general price level in 2000. The empirical evidence for structural change corresponds with the bursting of the dot-com bubble. The test has been performed using the critical values from Johansen *et al.* (2000). However, this finding quite obviously is the result of a missing variable problem. The drop in dividends to be observed

can be explained by a combination of falling earnings and a reduction of real economic growth. In order to preserve space, we will not report any details of the tests.

3. We have also tested the robustness of the results with regard to different data sets examined. Cointegration among dividend payouts, corporate earnings and macroeconomic variables is a very common phenomenon which can be found analyzing data from many different countries and time periods. It can also be observed examining specific industry sectors (e.g. European insurance companies or German car manufacturers). The following brief discussion of the results of impulse response analysis focuses on dividends per index share and earnings per index share of the members of the Dow Jones Industrial Average in the period Q1/1993-Q4/2009. By analysing this sample, we exclude the experiences of the savings and loan crisis; this prolonged banking crisis quite clearly was an extraordinary event. The 30 firms that comprise the Dow Jones Industrial Average are very large firms that are of special interest for investors and the stock market in general. Consequently, many financial analysts cover these firms. While the smallest firm in the Dow is currently actively covered by 20 analysts according to Bloomberg (using the ANR function) only six analysts follow the smallest member of the S&P 500. A larger number of analysts covering a firm quite clearly helps to increase transparency – which is a key concept with regard to dividend policy issues as the most popular explanations for the existence of dividend payments are based on agency theory. Therefore, it could be assumed that dividend signalling and dividend smoothing are less important for the members of the Dow Jones Industrial Average. Using four time lags and estimating the VECM with the variables real growth, inflation, corporate earnings and dividend payments the impulse response functions show clear evidence of a positive reaction of dividends and earnings to a shock to inflation. Moreover, in this case, there is also no empirical evidence indicating that dividend signalling is a relevant phenomenon. Therefore, it can be concluded that these findings are very similar to the results examining the earnings and dividends of the S&P 500 members. However, there are no signs for dividend smoothing. This deviating result is no surprise and seems to be in accordance with the transparency conjecture derived from economic theory as discussed above. Also note that there is some empirical evidence in favour of dividend smoothing examining the members of the Dow Jones Industrial Average when the variable real growth is neglected.

References

Adaoglu, C. (2000), "Instability in the dividend policy of Istanbul Stock Exchange corporations: evidence from an emerging market", *Emerging Markets Review*, Vol. 1, pp. 252-70.

Aivazian, V., Booth, L. and Cleary, S. (2003), "Do emerging market firms follow different dividend policies from US firms?", *Journal of Financial Research*, Vol. 26, pp. 371-87.

Allen, F. and Michaely, R. (1995), "Dividend policy", in Jarrow, R., Maksimovic, V. and Ziemba, W.T. (Eds), *Handbooks in Operations Research and Management Science: Finance*, Vol. 9, Elsevier, Amsterdam, pp. 793-837.

Bahmani-Oskooee, M. and Ng, R.C.W. (2002), "Long-run demand for money in Hong Kong: an application of the autoregressive distributed lag (ARDL) model", *International Journal of Business and Economics*, Vol. 1, pp. 147-55.

Barro, R.J. (1996), "Inflation and growth", *Federal Reserve Bank of St. Louis Review*, Vol. 78, pp. 153-69.

Belke, A. and Polleit, T. (2006), "Monetary policy and dividend growth in Germany: long-run structural modelling versus bounds testing approach", *Applied Economics*, Vol. 38, pp. 1409-23.

Berner, R.B. (2002), "Corporate profits: critical for business analysis; and not just for Wall Street", *Business Economics*, Vol. 37, pp. 7-14.

Bernhardt, D., Douglas, A. and Robertson, F. (2005), "Testing dividend signalling models", *Journal of Empirical Finance*, Vol. 12, pp. 77-98.

Bhattacharyya, N. (2007), "Dividend policy: a review", *Managerial Finance*, Vol. 33, pp. 4-13.

Bodie, Z. (1976), "Common stocks as a hedge against inflation", *Journal of Finance*, Vol. 31, pp. 459-70.

Boudoukh, J. and Richardson, M. (1993), "Stock returns and inflation: a long-horizon perspective", *American Economic Review*, Vol. 83, pp. 1346-55.

Campbell, J.Y. and Shiller, R.J. (1988), "Stock prices, earnings, and expected dividends", *Journal of Finance*, Vol. 43, pp. 661-76.

DeAngelo, H., DeAngelo, L. and Skinner, D.J. (2000), "Special dividends and the evolution of dividend signalling", *Journal of Financial Economics*, Vol. 57, pp. 309-54.

Doornik, J.A. (1998), "Approximations to the asymptotic distributions of cointegration tests", *Journal of Economic Surveys*, Vol. 12, pp. 573-93.

Efron, B. and Tibshirani, R.J. (1993), *An Introduction to the Bootstrap*, Chapman & Hall, New York, NY.

Fama, E.F. (1981), "Stock returns, real activity, inflation, and money", *American Economic Review*, Vol. 71, pp. 545-65.

Fama, E.F. and Schwert, G.W. (1977), "Asset returns and inflation", *Journal of Financial Economics*, Vol. 5, pp. 115-46.

Faria, J.R. and Carneiro, F.G. (2001), "Does high inflation affect growth in the long and short run?", *Journal of Applied Economics*, Vol. 4, pp. 89-105.

Feldstein, M. (1982), "Inflation, capital taxation and monetary policy", in Hall, R.E. (Ed.), *Inflation: Causes and Effects*, University of Chicago Press, Chicago, IL, pp. 153-67.

Goddard, J.A., McMillan, D. and Wilson, J.O.S. (2006), "Dividend smoothing versus dividend signalling: evidence from UK firms", *Managerial Finance*, Vol. 32, pp. 493-505.

Gonzalo, J. (1994), "Five alternative methods of estimating long-run equilibrium relationships", *Journal of Econometrics*, Vol. 60, pp. 203-33.

Gregory, A.W. and Hansen, B.E. (1996), "Residual-based tests for cointegration in models with regime shifts", *Journal of Econometrics*, Vol. 70, pp. 99-126.

Gugler, K. (2003), "Corporate governance, dividend smoothing, and the interrelation between dividends, R&D, and capital investment", *Journal of Banking & Finance*, Vol. 27, pp. 1297-321.

Johansen, S. (1991), "Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models", *Econometrica*, Vol. 59, pp. 1551-80.

Johansen, S., Mosconi, R. and Nielsen, B. (2000), "Cointegration analysis in the presence of structural breaks in the deterministic trend", *Econometrics Journal*, Vol. 3, pp. 216-49.

Kolari, J.W. and Anari, A. (2001), "Stock prices and inflation", *Journal of Financial Research*, Vol. 24, pp. 587-602.

Lanne, M., Luetkepohl, H. and Saikkonen, P. (2002), "Comparison of unit root tests for time series with level shifts", *Journal of Time Series Analysis*, Vol. 23, pp. 667-85.

Miller, M.H. and Modigliani, F. (1961), "Dividend policy, growth, and the valuation of shares", *Journal of Business*, Vol. 34, pp. 411-33.

Modigliani, F. (1982), "Debt, dividend policy, taxes, inflation and market valuation", *Journal of Finance*, Vol. 37, pp. 255-73.

Schotman, P.C. and Schweitzer, M. (2000), "Horizon sensitivity of the inflation hedge of stocks", *Journal of Empirical Finance*, Vol. 7, pp. 301-15.

Schwert, G.W. (1981), "The adjustment of stock prices to information about inflation", *Journal of Finance*, Vol. 36, pp. 15-29.

Sharpe, S.A. (2002), "Reexamining stock valuation and inflation: the implications of analysts' earnings forecasts", *Review of Economics and Statistics*, Vol. 84, pp. 632-48.

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