

# Crash Test: The American Stock Market

Although we are expecting American companies to show slightly increased earnings for 1990 and 1991, the risk of miscalculation cannot be excluded. But in the same way that the automobile industry crash-tests a car to analyse its effects on the occupants, we will attempt to define the influence which diminishing profits – if they do occur – could have on the market in general. It is analogous to an automobile accident, unexpected though not impossible. The main question is that of diminishing profits, and if they necessarily mean a negative performance for the market. Or could a bullish market even result?

To answer this question, we will first refer to financial theory. In a second step we will compare the historical relationship between earnings and the stock market, examining specifically whether declining profits have ever been accompanied by a rising stock market. And finally, based on the experience of past periods of declining profits, we will try to define the probable reaction of the market in case earnings, contrary to our expectations, should indeed drop.

## Is it theoretically possible for the market to rise in spite of falling profits?

Financial theory states, that the value of any investment corresponds to the present value of all future payments. The Dividend Discount Model (DDM) is the most well known model based on this principal. It discounts the future dividend by a factor consisting of the difference between the prevailing interest rate and the expected growth rate of the dividend. The DDM can be illustrated as follows:

$$p = \frac{D_1}{k-g} \quad \text{or} \quad \frac{G_1 \times A}{k-g}$$

in which: p = Price  
 D<sub>1</sub> = Dividends for coming year  
 G<sub>1</sub> = Profit for coming year  
 k = Discount rate  
 g = Dividend growth  
 A = Dividend-payout-ratio (dividend/earnings)

Let us assume that the S+P 500 earnings remain at an unchanged US\$ 22.90 for the coming year, and that the dividend-payout-ratio corresponds to the historical average of 51%. The expected dividend growth over the next five years is 5% and the yield on government bonds (discount or interest rate k) is 8.5%. The following result is obtained as a theoretically justified level for the S+P 500:

$$S+P500 = \frac{22.90 \times 0.51}{0.085 - 0.05} = \frac{11.67}{0.035} = 333.4$$

Despite lowered earnings, how is it now theoretically possible to maintain an unchanged S+P 500? From the above equation it becomes apparent that with a smaller divisor, for instance one resulting from lower interest rates, the theoretical value of the stock market rises. Let us assume that earnings for the coming year are 5% lower, and that interest rates based on a general economic weakening decrease as well to a level of 8.3%:

$$S+P500 = \frac{0.95 \times 22.90 \times 0.51}{0.083 - 0.05} = \frac{11.10}{0.033} = 336.36$$

In this scenario, it is theoretically possible for the S+P 500 to rise from 333.4 to 336.4 (+0.8%) in spite of a five percent reduction in profits. *Financial theory thus assumes a dependence of the stock market upon both interest rates and profit. In the case of decreasing profits a drop in the stock market can fail to appear, or the market can even go up, provided that interest rates fall sufficiently.*

Let us now examine the validity of the above statements in reality. First let us clarify whether or not the stock market is indeed dependent upon earnings and interest rates. We will then determine whether there has ever been a case of a rising stock market combined with decreasing profits.

## In reality, to what extent is the stock market influenced by interest rates and earnings?

To examine this, the correlation coefficients<sup>1</sup> between profits<sup>2</sup>, the S+P 500, and interest rates must first be calculated. In theory, the stock market is dependent not upon current but upon future earnings. We have taken this into

consideration in our calculation, and have used profits with a three quarters lead (+3Q). The correlation coefficient between the S+P 500 and profit is thus maximized. This means that the S+P 500 is dependent upon current interest levels and the expected earnings three quarters hence. It becomes clear that present earnings have no direct influence on the S+P 500.

The results show that between 1950 and 1989 the S+P 500 was simultaneously dependent upon interest rates and earnings:

**Table 1** Correlation coefficients of the percentage changes

	S+P500	Earning (+3Q)	Bond Index
S+P500	1	0.32	0.40
Earning (+3Q)		1	0.01
Bond Index			1

Q = Quarters

Having determined that interest rates and earnings have an influence on the S+P 500, the nature of this relationship should be examined more precisely. The next step is a regression analysis:

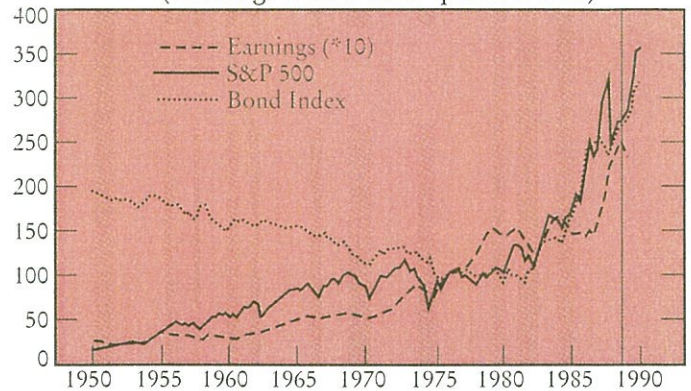
$$\text{Change S+P500} = 0.0258 + (0.6728 \times \text{Change bond index}) + (0.5687 \times \text{Change earnings } [+3Q])$$

For the time being, it is important that all coefficients are statistically significant<sup>3</sup>. From this we can conclude that interest rates and profits have a statistically significant influence on the development of the S+P. The positive sign which precedes the equation in both cases is also of importance. In other words, under the assumption of unchanged interest rates, increasing profits will have a positive influence on the market, and reduced earnings will have a negative one. The + before the bond index indicates that a positive development of the bond index, resulting from reduced interest rates, will lead to a rise in the S+P 500. In reverse, a negative bond index implies a price loss for the stock index. The results based on the Dividend Discount Model are thus confirmed: *Interest rates and earnings influence the stock market. Falling (rising) interest rates have a positive (negative) influence, and rising (falling) profits have a positive (negative) influence.*

## Has the stock market ever advanced when earnings fall?

Figure 1 shows the general development of the three indexes between 1950 and 1989. The graph illustrates the data used above for correlations and regressions. Earnings with a three quarters lead have been used again. It should not be forgotten that a declining bond index is synonymous with increasing interest rates<sup>4</sup>. The per share earnings have been multiplied by a factor of 10 in order to align the curve with that of the S+P 500. "Profit recessions"<sup>5</sup> are shaded.

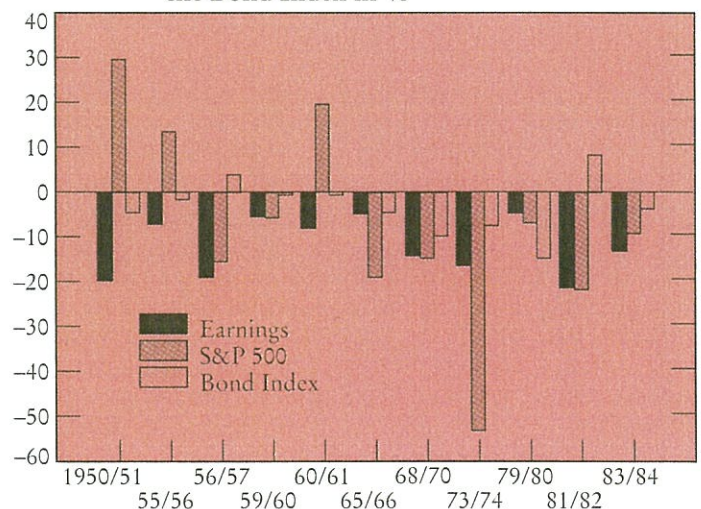
**Figure 1: Index development**  
(Earnings with a three quarters lead)



In looking at figure 1, it becomes apparent that on the one hand there is a relatively close relationship between earnings and the S+P 500, and on the other hand that the bond index has pursued a contrary course until the late 60's. This means that despite the falling bond index (i.e. increasing interest rates), the stock market soared. According to the Dividend Discount Model, this can be explained by the fact that profit growth was sufficient to over-compensate for increasing interest rates.

Let us now turn our attention to "profit recessions". In figure 2, we have plotted the development of earnings, the S+P 500, and the bond index for all periods with declining profits.

**Figure 2: Changes in Earnings, S&P 500, and the Bond Index in %**



The graph shows that in three instances a higher valuation of the stock market resulted in spite of falling profits. To return to our Dividend Discount Model, this would only have been possible when the interest rates decreased, i.e. the bond index increased. However in all three cases, which occurred between 1950 and 1961, the graph shows a falling bond index, i.e. rising interest rates. The result is surprising and cannot be explained on the basis of the factors which have been examined. It is well possible that there were special conditions in these years which do not allow for a comparison with succeeding periods. In other words, we are assuming that there was some sort of structural break in about 1962. A statistical test<sup>6</sup> of this hypothesis confirms a break in the structure which makes the

50's and 60's irrelevant to our study. The fact that after the Second World War the P/E's amounted to only 6-7 out of fear of a renewed depression could be one explanation. At the beginning of the 50's, supported by the outbreak of the Korean War, fears also quickly gave way to a more positive valuation. In spite of falling profits, the P/E's increased to 10-11. In the middle of the 50's, investors came to the conclusion that profit growth in the future would be strong and stable, and that temporary profit decreases were of little significance. Their euphoria led to a renewed substantial gain in the price earnings ratio, reaching a new high of 23x at the beginning of the 60's. Because of the statistically proven structural break, we are limiting the period to be examined for this study from 1962 to 1989.

In the "profit recessions" (1962-1989) which are relevant for us, the correlations shown in figure 2 can concretely be depicted as follows:

Table 27

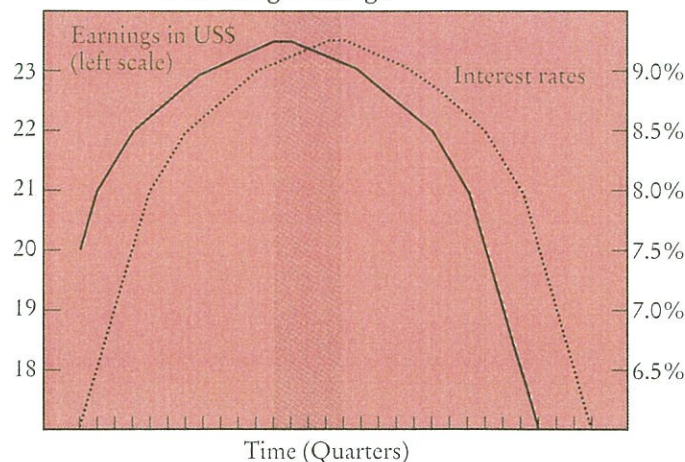
Years	Length of the profit recession	Performance		
		Earnings in %	S+P500 in %	Bond Index in %
1965/66	3Q	- 4.61	-18.84	- 4.26
1968/70	5Q	-13.82	-14.74	- 9.64
1973/74	4Q	-16.04	-53.44	- 7.51
1979/80	2Q	- 4.34	- 6.84	-14.55
1981/82	5Q	-21.25	-21.57	+ 8.62
1983/84	4Q	-13.01	- 9.29	- 3.54

Q = Quarters

Thus in periods of a negative earnings comparison - adjusted by the time deferment factor - the stock market always fell. And consequently it was not possible to offset the earnings reduction by a reduction in interest rates. In looking at the development of the bond index in table 2, it becomes clear that, with the exception of 1981/82, interest rates have never fallen in a time of "profit recession". In 1981/82 interest rates decreased, but not sufficiently to provide support for the market.

The result, that interest rates in a "profit recession" do not normally drop, can be explained by means of the time leads between stock market, development of interest rates, and anticipated earnings: symptoms of over-heating often appear at the end of a cycle and in turn lead to an increase in inflation and with it the nominal interest rates rise. Simultaneously however, the earnings which are anticipated three quarters hence are already falling. In other words, there is a situation of increasing interest rates and decreasing expected earnings which represents the worst of all possible configurations for the stock market. Recessionary pressure only begins to recede after a few quarters. With it interest rates begin to fall, and in so doing lend support to the market. The relationship is graphically illustrated in figure 3.

Figure 3: Increasing interest rates and decreasing earnings



Theoretically, to what extent must the bond index rise to prevent a fall of the S+P 500? A new regression equation for the relevant time period from 1962 to 1989 has been calculated for this purpose<sup>8</sup>:

$$\text{Change S+P500} = 0.0185 + (0.8439 \times \text{Change bond index}) + (0.6399 \times \text{Change earnings [+3Q]})$$

The equation can be solved in assuming an unchanged S+P 500 and by taking into consideration the change in earnings of the respective "profit recession" as listed in the "Bond Index Changes". The results are listed in table 3. They compare the actual development of the bond index with the theoretically necessary alterations to maintain an unchanged S+P 500:

Table 3

Time period	Development of earnings in %	Development of bond index (actual) in %	Estimated necessary development of the bond index in %
1965/66	- 4.61	- 4.26	+ 1.30
1968/70	-13.82	- 9.64	+ 8.29
1973/74	-16.04	- 7.51	+ 9.97
1979/80	- 4.34	-14.55	+ 1.10
1981/82	-21.25	+ 8.62	+13.92
1983/84	-13.01	- 3.54	+ 7.67

From this we can see that interest rates have never fallen sufficiently (if indeed at all) to prevent a negative development of the S+P 500.

### What can be expected in the 1990's if earnings, contrary to our expectations, should decrease?

To answer this question, we will basically apply the same method, but use the period from 1981 to 1989 for the regression. Implicitly we assume that the past nine years are representative for the immediate future, and that there will be no significant change in the relationships. A new regression equation is obtained<sup>9</sup>:

$$\text{Change S+P500} = 0.0157 + (0.8526 \times \text{Change bond index}) + (0.8150 \times \text{Change earnings [+3Q]})$$

Because the coefficient for the bond index (+0.8526) is larger than that for earnings (+0.815), it becomes obvious that interest rates had a greater influence on the S+P 500 between 1981 and 1989 than did earnings. We can also deduce from the equation that from a statistical point of view, an earnings decrease of up to 1.9% – even with an unchanged bond index – will not in turn alter the S+P 500.

Based on this equation, to what extent must the bond index increase to maintain an unchanged S+P 500, and what is the probability of such a bond rally occurring? Taking again the period 1981–1989, table 4 lists various earning changes with their probability factors, the real development of the bond index necessary to maintain an unchanged S+P 500, and the probabilities for this change in the bond index<sup>10</sup>.

Table 4

Profit changes in %	Statistical probability in %	Necessary development of the bond index to maintain an unchanged S+P500 in %	Statistical probability in %
- 2.5	33	+ 0.55	60
- 5.0	15	+ 2.94	44
- 7.5	6	+ 5.33	29
-10.0	2	+ 7.72	16
-12.5	~0	+10.11	8
-15.0	~0	+12.50	3

The results are encouraging because the probability for interest rates to fall is larger than the probability for earnings to be reduced. Statistically seen, a reduction in earnings can be offset by a reduction of interest rates<sup>11</sup>.

Table 4 also indicates that the probability of maintaining or raising the S+P 500 level increases the smaller the profit decrease. Nevertheless, in the case of a more than 5% profit reduction, the chances are clearly against the investor. When earnings are reduced by more than 10%, there is an 84% chance that the S+P 500 will fall.

In summarizing it can be said that although it is theoretically possible for a profit reduction to be offset by a reduction in interest rates, the likelihood of this happening is small.

The statistical probabilities of the required changes in the bond index being attained in a period of profit recession were higher for 1981–1989 than for 1962–1989. This is true because both the average real yield for bonds and their standard deviation have risen.

Returning to our car analogy, we can say the following. The lesser the speed of impact (profit reduction), the greater the chances of remaining uninjured. Although the possibility of leaving the accident uninjured is enhanced (higher yield and standard deviation of interest rates), the odds remain against the passenger. Defensive driving (smaller percentage invested in shares) is thus recommended.

## Conclusion

The influence of earnings and interest rates on the stock market, proposed in theory, can also be proven empirically. In the period from 1962 to 1989, the S+P 500 never went up at a time when profits were falling because interest rates were not lowered, or only insufficiently. Should earnings in the early 90's drop, it would be possible to compensate for their fall with a simultaneous reduction of interest rates. The chances are greater than they were in earlier years. However with a 10% profit reduction, they are less than 16%. Thus for the investor who anticipates falling profits despite our expectations, we recommend that the stock market be avoided.

## Notes

- <sup>1</sup> For definitions and explanations see "Begriffserklärung zur Modernen Portfolio-Theorie", Investment Research SBG, January 1989. For all regressions and correlations, we have used the real changes in percent on a quarterly basis. These changes represent a "total yield" and thus contain the current yield (coupon payments/dividends) and capital gains as adjusted for inflation. A bond index for U.S. treasury bonds with long-term maturity has been used to calculate the percentage change in interest rates. All data showing more than 3 standard deviations from the average have been considered "outliers" and eliminated.
- <sup>2</sup> Profit is defined as the sum of the reported quarterly earnings for the last four quarters (four quarters trailing earnings).
- <sup>3</sup> The T Test reveals significant results for all coefficients at the 95% level, r squared = 26. The relatively low r squared signifies that the relationships between the variables were not constant and/or that additional factors which have not been examined here had an influence on the development of the S+P 500. Another problem is that the market reacts to the expected earnings, and these seldom correspond exactly to the effective earnings. We have regressed the S+P 500 with the effective earnings.
- <sup>4</sup> A simple example: 1000 \$ bond at 100% with a 9% coupon, or an interest payment of \$ 90. The direct yield is 9%. If the price of the bond increases to 110%, the direct yield becomes  $90/1100 \$ = 8.18\%$ . It is obvious that when the direct yield increases from 8.18% to 9%, the bond price falls from 110 to 100.
- <sup>5</sup> A profit recession can be defined as at least two successive quarters with declining earnings. At least one quarter of increased earnings determines the end of the recession.
- <sup>6</sup> The introduction of a so-called Dummy Variable D in our regression equation gives a statistically significant result for D at the 95% level.
- <sup>7</sup> The earnings peak is put forward to correspond to the peak of the S+P 500.
- <sup>8</sup> All coefficients are significant at the 95% level. r squared=0.39.
- <sup>9</sup> With the exception of the intercept, all coefficients are significant at the 95% level. r squared = 0.62.
- <sup>10</sup> Probability is according to the standard normal distribution table.
- <sup>11</sup> The reason is that interest rates, in comparison to earnings, show a higher mean value and a higher standard deviation.