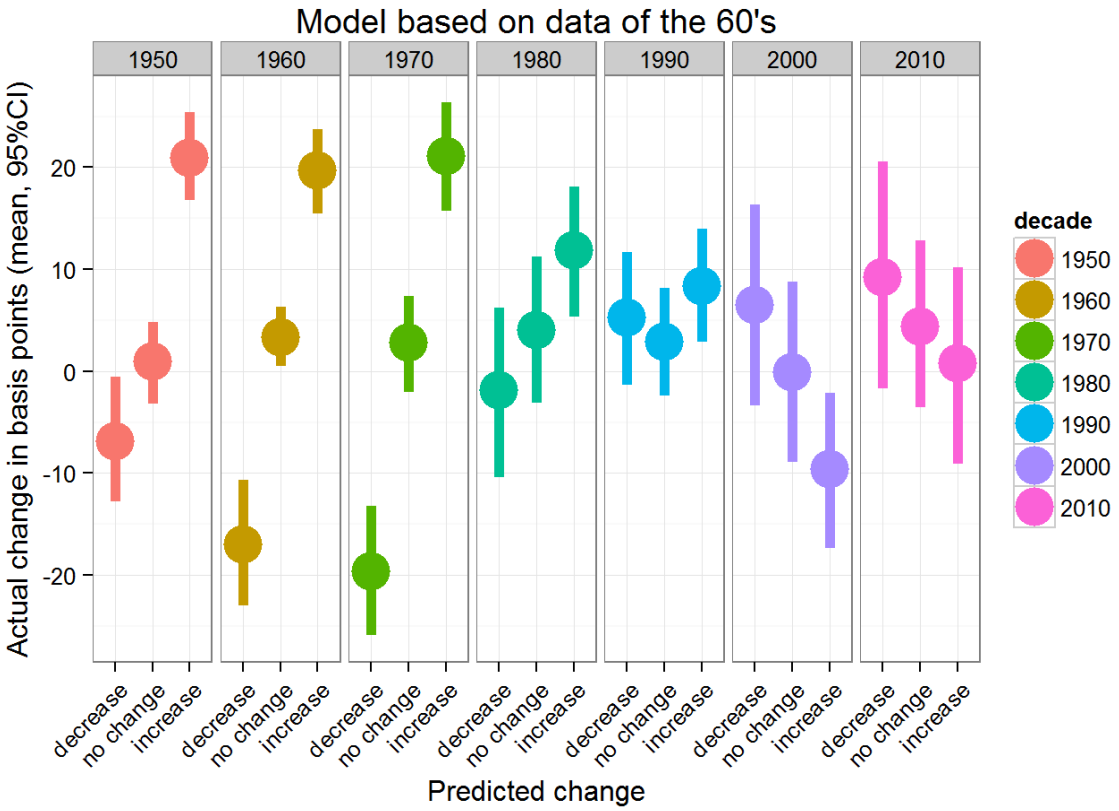
Historical autocorrelations in stock prices[1]

Christian Bartels, January 2015, Allschwil

Autocorrelations in stock prices have been identified in the past; possibly suggesting that the efficient market hypothesis has limitation (E.g., Bernard and Thomas, 1990[2]). Being 25 years later and having available public accessible stock data (e.g., quandl) and public accessible advanced model building tools (e.g., gamlss[3]), it is temptingly easy to revisit these findings[4].

Downloading the data of SP 500 Index and using a minor modification of a model proposed in the documentation of the gamlss.la() function , it can be confirmed that the autocorrelations existed and continue to exist, but it is also found that the autocorrelation patterns change over time. The code is available at figshare http://dx.doi.org/10.6084/m9.figshare.1287230.

Fitting the model to the index data of the 1960's, it is seen that information of the last 20



days of the index is predictive for the expected price at the close of the next day - for the data of the 1960's used to fit the model, but also for the data of the 1950's and the 1970's which was not used to fit the model. The information on the future present in the past price

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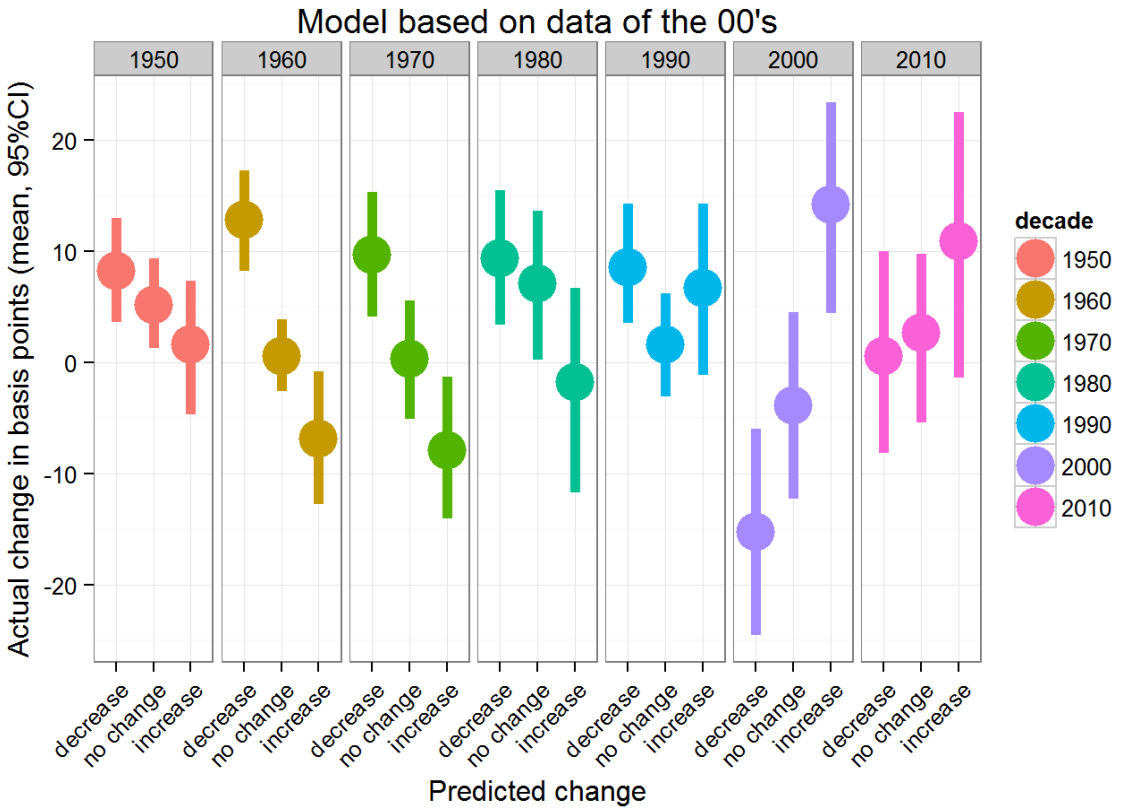
[1] Cite as: Christian Bartels. figshare. http://dx.doi.org/10.6084/m9.figshare.1287224

[2] Bernard, Victor L, and Jacob K Thomas. "Evidence that stock prices do not fully reflect the implications of current earnings for future earnings." *Journal of Accounting and Economics* 13.4 (1990): 305-340.

[3] Stasinopoulos, D Mikis, and Robert A Rigby. "Generalized additive models for location scale and shape (GAMLSS) in R." *Journal of Statistical Software* 23.7 (2007): 1-46.

[4] Code available at figshare. http://dx.doi.org/10.6084/m9.figshare.1287230

data is significant, both statistically and as compared to the average daily increase in the SP 500 of about 2 basis points. Days predicted to increase had an actual average increase of 20 basis points, days predicted to decrease had an actual average change of -20 basis points. In the 1980's the pattern of information that existed in the 1960's stars to disappear, is not present anymore in the 1990's and seems to be reversed after 2000.
Fitting the model to the index data of the years 2000 to 2009, gives a somewhat different but still compatible picture:



The model fitted to the two-thousands (2000-2009) predicts the actual changes in the two-thousands well, if measured on the average increase of the index per day, which was somewhat over 2 basis points during this decade. Predictions were statistically significant as judged by the fact that the 95% CI of the days predicted to decrease are well separated from the 95% CI of the days predicted to increase. The predictions for the nineteen-nineties and the twenty-tenths are less informative to the point that the model may not be useful. But at least the predictions do not contradict the model with the trend going in the predicted direction (twenty-tenths) or with confidence intervals that are overlapping (ninety-nineteens). Interestingly, there is a clear anti-correlation of the predictions for the data of the nineteen-sixtieth and nineteen-seventieth. The days predicted to decrease do actually increase on average and vice-versa.
Thus, autocorrelations in daily stock prices clearly exist and continue to exist, but the autocorrelation patterns change over time.
The efficient market hypothesis may well be - in one or the other of its forms - a good approximation of reality, provided that it is acknowledged that the ability of the markets to estimate and anticipate future earnings has changed in the past and will change over time - be it within days, decades or microseconds. The daily changes of the anticipations will

give raise to the autocorrelation patterns with prices of past days being predictive for future prices. The changes of the anticipations of the autocorrelation patterns leads to the change of these patterns themselves as is evident from the comparison of the patterns over decades.