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Abstract

This experimental study presents evidence for the golden mean fallacy. It is the tendency of a considerable part of the subjects (≈46%) to steer an irrational middle course when faced with two meaningful alternatives. A pointless middle course is often (≈29%) also followed in cases where the subject is faced with a meaningful alternative on the one hand and a meaningless hint towards another alternative on the other. The golden mean fallacy can – among other things – make an important contribution towards explaining the largely closed ranks in time series of financial market forecasts.

Keywords: Experiments; behavioral anomaly; decision-making under risk; financial market forecasting; financial analysts

1. Introduction

Marshall Rooster Cogburn and the young Texas Ranger La Boeuf are pursuing Tom Chaney and his gang. The bandits already have a lead of several hours. La Boeuf reads their tracks in the sandy earth of the prairie. The pursuers come to a fork in the trail: The tracks reveal that the gang split up here. One half took the left fork heading in a north-westerly direction. The other half took the right fork and rode in a north-easterly direction. More than anything else, Cogburn and La Boeuf want to capture Chaney. Which group did he go with? Did he take the

left fork or the right fork? Either possibility is equally probable. Cogburn and La Boeuf take a while to make their decision. Finally they choose the middle trail, which leads north.

This is extremely surprising. The decision is actually completely meaningless, because it is clear that none of the bandits has taken this trail. We would not have expected such nonsense from either Cogburn or La Boeuf. If this situation is transferred to an economic environment, however, it can be seen that this type of meaningless decision often occurs. Almost half of the subjects tend to choose the middle course in such a situation.

The golden mean fallacy (also known as the fallacy of moderation, fallacy of compromise or the fallacy of middle ground) has been familiar to psychologists for a long time (see Gula, 2002, p. 102, for example). In the field of behavioral finance, however, this behavioral anomaly has not yet been investigated. Particularly it was never examined if the subjects incline toward the golden mean fallacy in situations in which it obviously is irrational. In this study we show that subjects often follow meaningless middle courses when dealing with economic forecasting.

The next chapter describes the experimental design. The chapter after next presents the results. The golden mean fallacy can contribute towards explaining the largely closed ranks seen in financial market forecast time series. This is discussed in the last chapter but one. The last chapter contains a summary.

2. Experimental design

Each subject has to solve four tasks. The goal is to make forecasts for two fictitious shares, a fictitious share index and a fictitious exchange rate. The subjects have between 9 and 19 price alternatives to choose from. They know that one of these alternatives will occur in each case.

They have one or two forecast models at their disposal whose reliability varies between 9% and 20%. The other price alternatives each have lower and corresponding probabilities of occurrence. In two tasks, irrelevant additional information is provided. The subjects have to work their way through the four tasks consecutively. They only receive the next task when the previous one has been collected by the supervisor. There is no time limit. The use of a pocket calculator is allowed.

Task 1: The future price of the share XY has to be forecast. The future price lies between € 390 and € 560. The price alternatives are offered in steps of ten euros (390, 400, 410 … 550, 560). The subjects have two forecast models at their disposal which each have a reliability of 10%. The first forecast model recommends a forecast of € 470. The second forecast model recommends a forecast of € 490. The 16 other alternatives each have a probability of 5%. If the subject decides rationally, he or she has to forecast either € 470 or € 490. All other forecasts have a significantly lower probability of success.

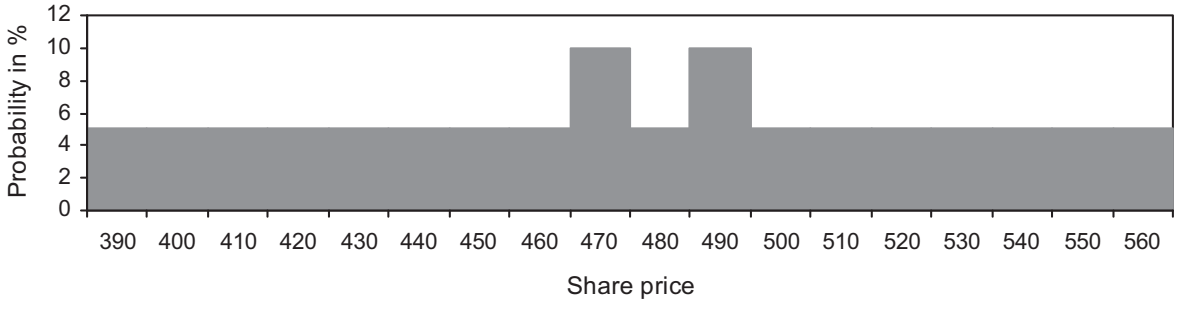

Fig. 1. Distribution of probability for Task 1

Task 2: The future price of share YZ has to be forecast. The future price lies between € 160 and € 330. The price alternatives are offered in steps of ten euros. The subjects have two forecast models at their disposal. The first forecast model has a probability of 9%, the second one a probability of 11%. The first forecast model recommends a forecast of € 220. The second forecast model recommends a forecast of € 260. The 16 other alternatives each have a probability of 5%. If the subject decides rationally, he or she has to forecast € 260. All other forecasts have a recognizably lower probability of success.

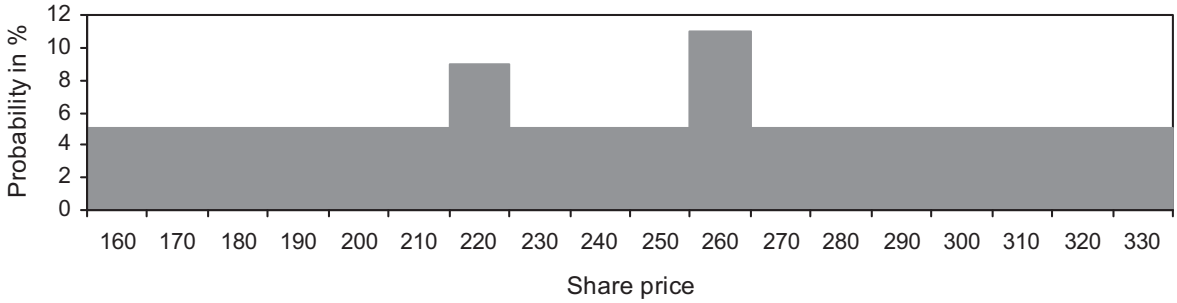

Fig. 2. Distribution of probability for Task 2

Task 3: The future level of a fictitious share index (PHANTAX) has to be forecast. The future index level lies between 2,300 and 4,100 points. The alternatives are offered in steps of one hundred points (2,300, 2,400, 2,500 … 4,000, 4,100). The subjects have a forecast model at their disposal which has a reliability of 10%. The forecast model recommends a forecast of 3,400 points. The 18 other alternatives each have a probability of 5%. It is pointed out, however, that the index is currently at 3,200 points (see the black arrow in Fig. 3). However, it is recognizable that this information has no significance for the probabilities of occurrence. If the subject decides rationally, he/she has to forecast a level of 3,400 points. All other forecasts have a significantly lower probability of success.

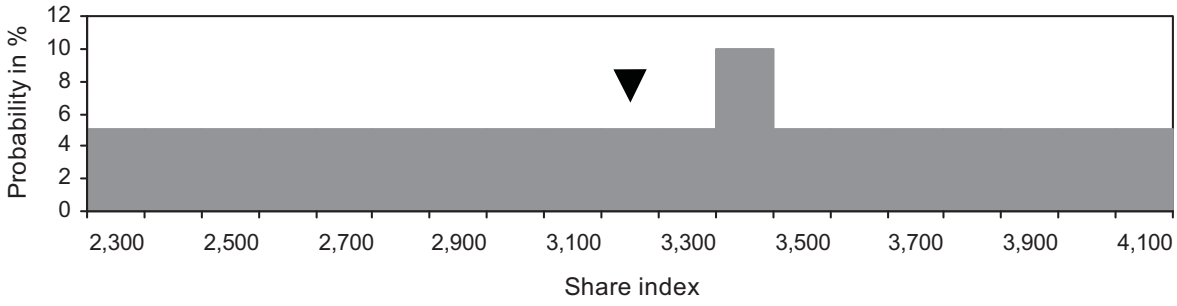

Fig. 3. Distribution of probability for Task 3

Task 4: The future level of a fictitious exchange rate (Piri-Piri-$ / Kuru-Kuru-$) has to be forecast. The future exchange rate lies between 2.10 and 2.90. The exchange rate alternatives are offered in steps of ten cents (2.10, 2.20, 2.30 … 2.80, 2.90). The subjects have a forecast model at their disposal which has a reliability of 20%. The forecast model recommends a forecast of 2.40 points. The 8 other alternatives each have a probability of 10%. It is pointed out, however, that an unknown banker is of the opinion that the exchange rate will reach the level of 2.60 (see the black arrow in Fig. 4). However, it is recognizable that this information has no significance for the probabilities of occurrence. If the subject decides rationally, he/she has to forecast a level of 2.40 points. All other forecasts have a significantly lower probability of success.

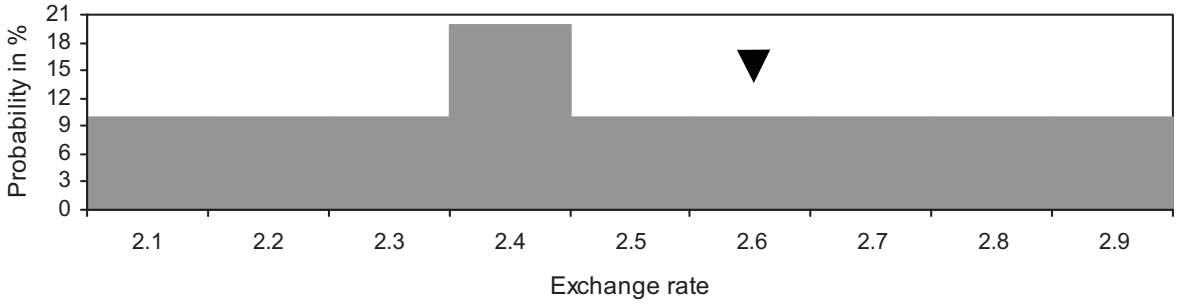

Fig. 4. Distribution of probability for Task 4

The experiments were carried out with students of the Wolfsburg University of Applied Sciences. They were students of business administration who were close to graduating and had a sound knowledge in the area of probability theory. The experiments (all four tasks) took just under an hour to complete on average. The success-related compensation for the students was 12 bonus points for a later examination. This is equivalent to a maximum possible compensation of just under € 58 (≈US$ 80). The equivalent value of the bonus points in terms of money was estimated on the basis of an earlier survey (Spiwoks, Bizer and Hein, 2007). The subjects felt that this was a considerable incentive and were obviously highly motivated. Selten, Abbink, Buchta and Sadrieh (2003) have underlined the effectiveness of bonus points as an incentive.

3. Results

The tasks can be solved without a great deal of reflection. The subjects have to choose between several alternatives. The alternatives exhibit varying probabilities of success. It is rational to select the alternative with the highest possible probability of success, because it has the highest expected value in terms of the pay off.

In Task 1 it is rational to forecast either € 470 or € 490. The probability of success – and thus also the expected value of the pay off – is twice as high here as in all the other alternatives. In spite of this, 60% of the subjects decided differently. 48.75% of the subjects chose the middle course – the golden mean. Just under half of the subjects obviously cherished the illusion that the forecast of € 480 would somehow combine the probabilities of success of € 470 and € 490. However, the formulation of the task makes it clear that the alternative of € 480 has a probability of success which is only half as high as € 470 or € 490.

A loaded dice is characterized by the fact that some numbers come up more often than others. If one observes that 3 and 5 come up particularly often (>1/6), whereas all the other numbers come up correspondingly seldom (<1/6), then it obviously makes no sense to bet on the 4. However, many subjects succumb to the temptation to do precisely that – at least in decision-making situations in connection with capital market forecasts.

Table 1.
Overview of the results

Task	Rational decisions	Irrational decisions	
		Golden mean	Others
1	40.00%	48.75%	11.25%
2	48.57%	42.86%	8.57%
3	45.71%	25.71%	28.58%
4	51.43%	31.43%	17.14%
ø	46.43%	37.14%	16.43%

Task 2 has a somewhat different character. Once again there are two alternatives whose probability of success is clearly higher than that of all the other alternatives. However, in this case the two alternatives are further apart and their probabilities of success are different. The rational decision in Task 2 is to forecast € 260. The probability of success of this forecast is recognizably higher than for the alternative € 220. And it is more than twice as high as that of all the other alternatives. Just under half of the subjects (48.57%) succeeded in making a rational decision in this task. 42.86% of the subjects succumbed to the temptation of choosing a middle course (€ 230 – 250). However, the expected value of the pay off for this middle course decision is not even half as high as that of the alternative of € 260.

Task 3 is fundamentally different from the first two tasks. Only one of the alternatives has a higher probability of success than the others. A subject who acts rationally would have to forecast 3,400 index points. All of the other alternatives lead to an expected value of the pay off which is only half as high. The subjects are also informed that the current index level is 3,200 points. However, the formulation of the task makes it clear that this information has no significance for the probability of success of this alternative. In spite of this, about every fourth subject (25.71%) feels the need to choose the golden mean (3,300) between the meaningful forecast (3,400) and the current index level (3,200). This percentage is considerably lower than in the first two tasks. In spite of this, the result is remarkable. In the first two tasks, meaningless middle courses were chosen between two meaningful alternatives. It now becomes clear that a middle course between a meaningful alternative and an alternative which is highlighted by an item of completely meaningless information also appears highly promising to many subjects.

The number 4 comes up particularly often (>1/6) when a loaded dice is thrown. All the other numbers come up equally more seldom (<1/6). The previous throw was a 6. It obviously does not make sense to bet on the number 5 for the next throw. Nevertheless, a quarter of the subjects act in this way in Task 3.

Task 4 is similarly structured to Task 3. The forecast alternative of 2.40 has a probability of success which is twice as high as that of all the other alternatives. A rational subject would thus have to select this alternative. Once again, an irrelevant piece of information is added. Somebody expresses the opinion that 2.60 is the correct forecast. An experiment by DiFonzo and Bordia (1997) showed that investment decisions can be significantly influenced by rumors. However, the formulation of the task makes it clear that the expression of this opinion does not result in an increase in the probability of the event occurring. In spite of this, just

under a third of the test persons (31.43%) decide to take the middle course (2.50) between the rational solution (2.40) and the irrelevant information (2.60).

Subjects select the middle course particularly often when they are confronted with two alternatives whose probabilities of success stand out from the other alternatives (Tasks 1 and 2). They obviously imagine that a golden mean decision can combine the outstanding probabilities of success. The subjects involved are also not deterred from this strategy by the fact that the probability of success of the middle course is clearly low.

If the alternatives with a particularly high probability of success are close to each other, and if they additionally exhibit concurring probabilities (Task 1), then 48.75% of the subjects choose the meaningless middle course. If the alternatives are somewhat further apart and differ with regard to their probabilities of success (Task 2), 42.86% of the subjects then choose a meaningless middle course.

If only one alternative with an outstanding probability of success is presented and a further irrelevant item of information is added (Tasks 3 and 4), an average of 28.57% of the subjects still decides in favor of the meaningless middle course between the relevant and the irrelevant information.

On average, 37.14% of all decisions are characterized by the golden mean fallacy. That is a considerable percentage, which can contribute towards explaining various economic phenomena. An example is examined in the following chapter.

4. Concurring behavior by financial market analysts

In capital market forecasts, it can often be observed that the forecast time series of different analysts exhibit very similar courses, although the forecasts are obviously not successful.

Considerable weaknesses are shown in forecasts for the US bond market (Fig. 5). The analysts did not expect the interest rate low of autumn 1993 to come about until the end of 1994. However, by that time there was already another interest rate high. The analysts, though, had not expected this interest rate high until the end of 1995. Similarly, the interest rate low in autumn 1998 was only forecast for the end of 1999.

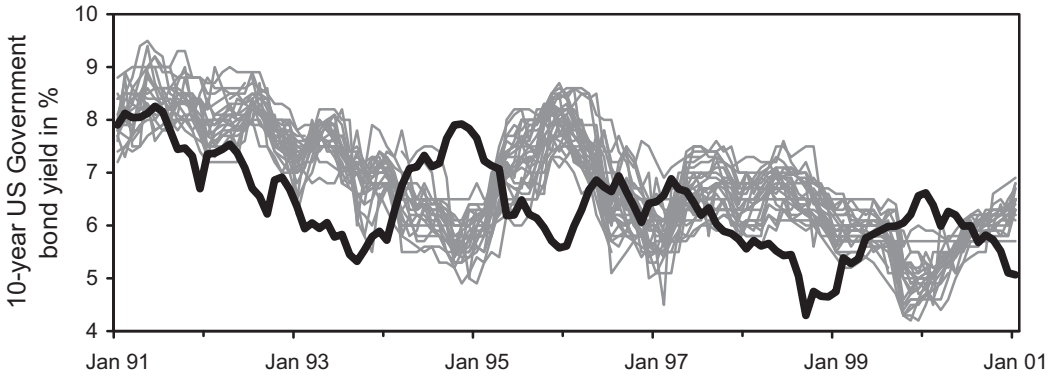

Fig. 5. Ten-year US Government bond yield (bold black line) and respective forecast time series with a forecast horizon of twelve months (thin grey lines) from January 1991 to January 2001; *Source*: Consensus Forecasts and Data Stream.

A very similar situation is also shown in the forecasts for the British and the German bond market (Figures 6 and 7). The same circumstances occur in forecasts for Japanese, Canadian, French, Italian, Spanish, Swiss, Dutch and Swedish interest rate trends: The forecasts have to be viewed as largely failed. In spite of this, they do concur on the whole. That is surprising because there are always many ways of coming to a mistaken forecast. The question thus arises as to why the analysts all fail in the same way.

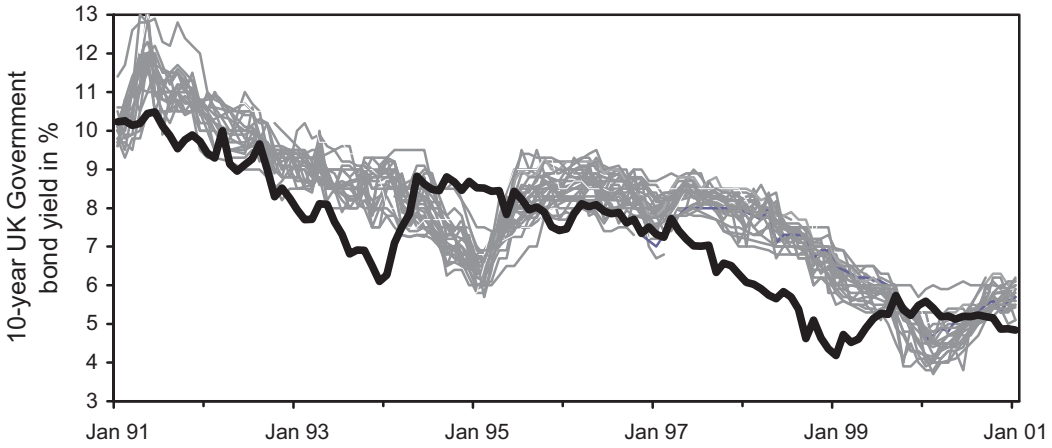

Fig. 6. Ten-year UK Government bond yield (bold black line) and respective forecast time series with a forecast horizon of twelve months (thin grey lines) from January 1991 to January 2001; *Source*: Consensus Forecasts and Data Stream.

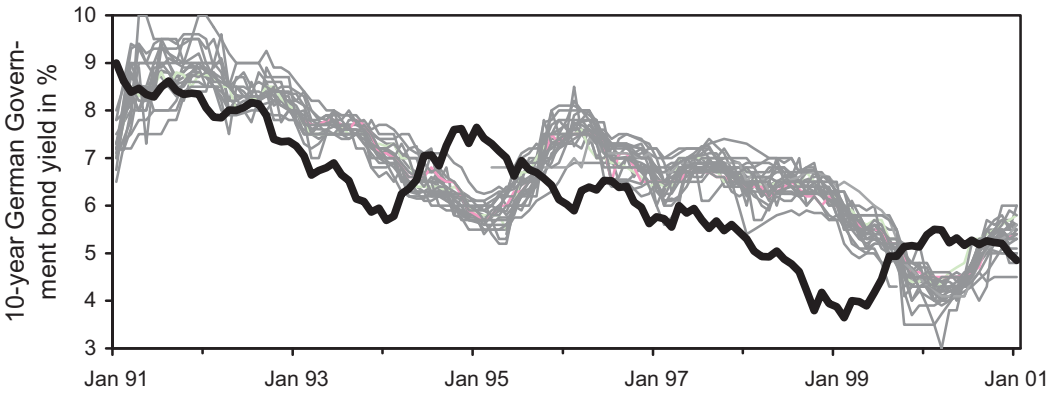

Fig. 7. Ten-year German Government bond yield (bold black line) and respective forecast time series with a forecast horizon of twelve months (thin grey lines) from January 1991 to January 2001; *Source*: Consensus Forecasts and Data Stream.

It is undoubtedly a multi-dimensional phenomenon. Extensive evaluations of forecast data (Spiwoks, Bizer and Hein, 2005) and the results of experiments (Bedke, Bizer and Spiwoks, 2007) reveal that a major part of the agreements between different forecast time series can be traced back to rational herding behavior on the part of the analysts. However, part of these agreements are certainly also a result of the golden mean fallacy.

Let us assume, for example, that the analysts have two forecasting approaches at their disposal (e.g. fundamental analysis and technical analysis), which at least occasionally lead to differing estimations of the future (similarly to that in Tasks 1 and 2). This could lead to a split in the analysts' community. Whereas a part of the analysts expect increases in interest rates, the others predict the opposite. This type of split could not be observed in a single case in the above-mentioned bond markets. One of the reasons why it did not occur is presumably because part of the analysts succumb to the golden mean fallacy and take a middle course between the two sets of results.

Or let us assume that many analysts not only take the result of their own forecasting model into consideration, but also the opinion of a colleague (as in Task 4). If the two assessments are different, the golden mean fallacy can contribute to the actual forecasts of the two analysts diverging significantly less than if they had only followed their own private signal.

Finally, many analysts compare the results of a forecasting process with the current situation in the financial markets (as in Task 3). If they succumb to the golden mean fallacy in the process, this not only contribute to their forecasts diverging less – it can also lead to forecasts being influenced by the current situation in the financial markets. The forecast time series is then to a considerable extent a delayed reflection of reality. This phenomenon is referred to as topically orientated trend adjustment behavior (Andres and Spiwoks, 1999; Bofinger and Schmidt, 2003). This situation is obviously present in all the forecast time series observed here (see Figures 5 to 7).

The forecasting efforts observed in figures 5 to 7 failed. There are innumerable different ways of making mistaken predictions of the future. In spite of this, the forecasts are highly similar. This can be presumably traced back to several factors. Rational herding plays a role, as do irrational factors (e.g. conformity preference or the golden mean fallacy). It is difficult to weight the individual influences, because they presumably fluctuate over the course of time.

Arnold Gehlen pointed out that the orientation of subjects towards codes of conduct and rules of decision-making depends on the situation and is fundamentally instable. In any case, the golden mean fallacy is an important contribution towards a better understanding of frequently occurring agreements in the behavior of financial analysts.

5. Conclusion

This experimental study explores the golden mean fallacy. The subjects have to make forecasts for fictitious financial market situations. Tasks 1 and 2 each offer two alternative forecasts whose probability of success is significantly higher than that of the other alternatives. It is revealed that 46% of all the subjects choose a middle course between the two meaningful alternatives. The subjects clearly hope that by choosing a middle course they can combine the increased probabilities of success of the meaningful forecasts. They do this in spite of the fact that the formulation of the task makes it clear that this middle course leads to a clearly lower probability of success.

The golden mean fallacy also arises to a lesser extent if there is only one forecast alternative with an outstanding probability of success but at the same time an obviously meaningless item of information about another alternative is provided (Tasks 3 and 4). In this situation, around 29% of the subjects still tend to choose a middle course between the meaningful alternative and the alternative which has been highlighted by irrelevant information.

This study highlights a further behavioral anomaly to the field of research of behavioral finance. Again it is revealed that even with an extremely simple task, only a part of the subjects (in this case around 46%) are prepared to use the available information in a meaningful way. The concept of homo economicus is repudiated once again.

In addition, it is shown that the golden mean fallacy can contribute towards explaining concurring behavior by financial analysts. Diverging results of different methods of analysis are leveled out. Differences between the results of one's own analyses and the assessments of colleagues also often lead to middle courses being chosen. The golden mean between the analyst's private information and the current situation in the financial markets can contribute towards topically orientated trend adjustment behavior. The golden mean fallacy occurs in around 37% of all cases. This is not sufficient for it to be considered the sole cause of the high degree of agreement in behavior among financial analysts. However, the golden mean fallacy undoubtedly contributes towards a better understanding of the synchronous nature of forecast time series.

Appendix: The formulation of the tasks using the examples of Task 1 and Task 4

Task 1:

Imagine you are a financial analyst and have to make regular forecasts about the development of the price of a specific share (XY). You have two forecasting models at your disposal. You know that you will make a correct forecast in exactly 10% of all cases when you follow FM-1, your first forecasting model. You also know that you will make a correct forecast in exactly 10% of all cases when you follow FM-2, your second forecasting model. The other forecast alternatives do not differ with regard to the probability of occurrence.

You should now forecast the price of the share XY for the end of December 2007. Your forecasting model FM-1 leads to the prediction that the price of share XY will be EUR 470 at the end of December 2007. Your forecasting model FM-2 leads to the prediction that the price of share XY will be EUR 490 at the end of December 2007.

If you make a correct forecast, you receive 3 bonus points for your examination!

Only the following forecast alternatives are available. One of these figures will actually be correct. Mark your forecast with a cross.

O 390 O 400 O 410 O 420 O 430 O 440 O 450 O 460 O 470

O 480 O 490 O 500 O 510 O 520 O 530 O 540 O 550 O 560

Task 4:

Imagine you are a financial analyst and have to make regular forecasts about the development of a specific exchange rate (PiriPiri dollar / Kuru-Kuru dollar). You have a forecasting model at your disposal. You know that you will make a correct forecast in exactly 20% of all cases if you follow your forecasting model. The other forecast alternatives do not differ with regard to the probability of occurrence.

You should now forecast the Piri-Piri dollar / Kuru-Kuru dollar exchange rate for the end of December 2007. Your forecasting model leads to the prediction that the exchange rate at the end of December 2007 will be 2.40 Piri-Piri dollars per Kuru-Kuru dollar. During a train journey you hear a banker mention in a conversation on his cell phone that the exchange rate at the end of December 2007 will be 2.60 Piri-Piri dollars per Kuru-Kuru dollar.

If you make a correct forecast, you receive 3 bonus points for your examination!

Only the following forecast alternatives are available. One of these figures will actually be correct. Mark your forecast with a cross.

O 2.10 O 2.20 O 2.30 O 2.40 O 2.50 O 2.60 O 2.70 O 2.80 O 2.90

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