Class 9

Team Assignment

Coffee Commodity Risk Management at Atlantic Grupa

(Solutions)

General instructions

- This assignment is covered under the Honor Code of the Fuqua School of Business at Duke University.
- This assignment is due by the deadline listed on the course website. Except for the submission deadline, there is no time limit to complete the assignment.
- This is a team assignment. The work for this assignment is to be your team's effort alone, without consultation or assistance from anyone who is not a member of your team. Each team is to work independently.
- Each member of the team receives the same grade on the assignment.
- This assignment is open books and open notes. You can only access the material that is intended for this course and that is made available through the course website and the course packet, as well as your notes. You are not permitted to obtain any course materials (including handouts, readings, assignments, etc.) or any solutions from other Fuqua students or any other source.
- You may use a laptop in performing calculations. However, when requested by the question, you are expected to inlcude intermediate steps as well as references to the formulas used.
- Your answers must be succint, yet clear and articulated. Justfications that support your conclusions are required. There is no need to rewrite the assignment statements and questions. Make sure, however, to indicate to which question each of your answers refers to.
- Your submission must consist of one pdf document **(2 pages max)** with a detailed header including
  - course name,
  - section and team numbers, and
  - the names and the NetIDs of all team members listed in alphabetical order by last name.
- The submission is online on the course website.
- Late or missing submissions will receive no credit.

Coffee Commodity Risk Management at Atlantic Grupa

(Solutions)

Assignment

Read the case *Coffee Commodity Risk Management at Atlantic Grupa* and use the data provided in the file `AtlanticGrupaCoffeeRisk-Prices&ForecastsData` to answer the following questions. Your answers should provide clear and unambiguous recommendations. Please provide explanations for your answers and any outputs that you feel are needed to support your argument.

Solution. Details on the calculations below are available in the file `AtlanticGrupaCoffeeRisk-Solutions`.

1. (12 points) Based on the available data, which of the experts would you suggest the Coffee Team not to retain? Why? How can regression analysis be used to justify your answer?

   Solution. The standard deviations of the forecast errors for the three forecasters are 8.271 for Gabriela Rodrigues, 8.392 for Neil Stevens, and 21.942 for Mario Illy. Also, the regression outputs for the three models predicting the PRICE of green coffee as a function of the forecasts of each of the three experts yields a standard error of regression of 7.881 for Gabriela Rodrigues, 8.104 for Neil Stevens, and 19.345 for Mario Illy (see worksheets PRICE∼RODRIGUES, PRICE∼STEVENS, and PRICE∼ILLY or the worksheet Model Summaries).

   If two experts were to be terminated, and you could only retain one expert, then clearly you would terminate Mario Illy and keep either Gabriela Rodrigues or Neil Stevens, probably Gabriela Rodrigues. Whether we work with the raw forecasts from the three forecasters or with the forecasts "calibrated" by regression, Gabriela Rodrigues and Neil Stevens are considerably more accurate than Mario Illy, and Gabriela Rodrigues is slightly more accurate than Neil Stevens.

   However, if only one expert is not to be retained then the appropriate way to view the problem is not to ask which expert is the "worst," but which combination of two experts is most useful for Atlantic Grupa. If we run regressions predicting PRICE as a function of the forecasts of Neil Stevens and Gabriela Rodrigues (worksheet PRICE∼RODRIGUES+STEVENS), of Mario Illy and Gabriela Rodrigues (worksheet PRICE∼RODRIGUES+ILLY), and of Neil Stevens and Mario Illy (worksheet PRICE∼STEVENS+ILLY), the most accurate regression forecasts (lowest standard error of regression) are those based on Gabriela Rodrigues and Mario Illy.

   Furthermore, if we run a regression with forecasts from all three experts as independent variables (worksheet PRICE∼RODRIGUES+STEVENS+ILLY), the standard error of regression is actually higher than when we use just Gabriela Rodrigues and Mario Illy, and in the 3-independent-variable

regression, Neil Stevens has a coefficient of -0.047 which is not statistically different from zero (p-value equal to 0.552).

If Mario Illy is not as accurate as Neil Stevens, why is the Gabriela Rodrigues/Mario Illy combination much better than the Gabriela Rodrigues/Neil Stevens combination? Because Gabriela Rodrigues and Neil Stevens are highly correlated to the point where once we see Gabriela Rodrigues's forecast, Neil Stevens's forecast is, for practical purposes, redundant. Gabriela Rodrigues and Mario Illy's forecasts are less highly correlated. (See Correlation Matrix tab in the worksheet PRICE∼RODRIGUES+STEVENS+ILLY.)

If we look at the correlations of the errors in the errors worksheet, we see that Gabriela Rodrigues and Mario Illy actually have quite a high negative correlation.

Even though Mario Illy is less accurate than Gabriela Rodrigues and Neil Stevens, he brings a different viewpoint to the table (perhaps he uses a different method or some other data). This illustrates the value of diversification in an example other than an investment problem; instead of a portfolio of investments, we are considering a portfolio of forecasters here. For an investment analogy, suppose you wanted to invest in two stocks from among Chevron, ExxonMobil and IBM. A combination of either Chevron, or ExxonMobil with IBM would provide better diversification than a portfolio of Chevron and ExxonMobil.

2. (4 points) Suppose instead that the Coffee Team decides not to retain Ms. Gabriela Rodrigues. How should the future forecasts of Mr. Neil Stevens and Mr. Mario Illy be combined into a single forecast? For example, if Neil Stevens predicts USD 210.15c and Mario Illy predicts USD 250.20c, what would you predict?

Solution. From the regression using Neil Stevens's forecasts and Mario Illy's forecasts as independent variables, we can plug in USD 210.15c for Neil Stevens and USD 250.20c for Mario Illy, yielding a composite forecast from the regression of 214.783, with a standard error of 7.696. (See Fcst#1 in the worksheet PRICE∼STEVENS+ILLY.)

3. (4 points) What qualitative advice would you give to someone who is hiring experts (like the experts in this case, or professionals work on a project, or basketball players, etc.), when no past performance data are available?

Solution. That you should try to have a diversity of backgrounds and viewpoints. Diversification is the key here. If you are assembling a basketball team, having five shooting guards on the court will not be a good idea, no matter how good they are as individual players. (Five centers likely won't perform any better, either.) If you are going to hire two economists, don't hire two Chicago economists or two LSE economists unless you have strong reason to believe that they will look at economic problems from differing points of view. Nor should you hire experts because they agree with your own point of view. In general, surrounding yourself with people of the same opinion may make decision making easier but not necessarily better.

Related issues. The literature on the combination of forecasts (whether from experts or models or both) suggests that combining forecasts from multiple sources tends to increase accuracy a bit, although the major gain is a reduction in the risk of a really awful forecast that could be devastating if it drives your decisions. Also, we focused on regression in the Atlantic Grupa case. When forecast errors are highly correlated, using regression to combine forecasts sometimes performs poorly because of multicollinearity. Simple averages of forecasts do quite well and are extremely robust. If you analyzed the Atlantic Grupa case in terms of simple averages, you would wind up with the same result: terminate Neil Stevens, and average the forecasts of Gabriela Rodrigues and Mario Illy. Finally, this discussion of combining forecasts considers only the mechanical combination of forecasts; other interesting issues involve the possibility of having the forecasters exchange information (face-to-face or via computer, anonymously or not anonymously, with or without discussion) and revise their forecasts after the exchange, or even attempt to come up with a single "combined" forecast behaviorally.

Coffee Commodity Risk Management at Atlantic Grupa

Atlantic Grupa (ticker symbol: ATGR; Zagreb Stock Exchange) is a vertically integrated, fast-moving consumer goods multinational operating primarily in southeastern Europe. The company product portfolio is organized through five Strategic Business Units: Beverages, Coffee, Snacks, Savory Spreads, and Pharma and Personal Care. In 2018, Atlantic Grupa revenue was 5.33B Croatian kunas (HRK), corresponding to approximately USD 820M. The earnings before interest, tax, depreciation and amortization (EBITDA) were HKR 546M, approximately equal to USD 84M. Atlantic Grupa's coffee business had the greatest impact on the 2018 financial results. It contributed to 21.4% of the company's revenues and to 47.6% of the company's EBITDA.

The coffee business became prominent for Atlantic Grupa only recently, following the acquisition of Droga Kolinska in 2010.[1] As a result of the acquisition, Atlantic Grupa inherited the leadership in the coffee market in Serbia where it owns the brands Grand Kafa and Bonito. Similarly, in Slovenia, Atlantic Grupa controls Barcaffe which is the country's strongest coffee brand with approximately 60% of the market share. The coffee markets in Serbia and Slovenia account for nearly three quarters of the revenues of Atlantic Grupa's coffee business. The remaining one quarter is realized in the neighboring markets with Barcaffe in Croatia, and Grand Kafa in Bosnia and Herzegovina and in the Republic of Northern Macedonia. Overall, the company sold over 23,000 tons (i.e., more than 50 million pounds) of coffee in 2018, and it is now among the largest green coffee buyers in Europe, just behind multinationals like Nestle and Strauss.

Figure 1: Atlantic Grupa's main coffee brands.

Coffee is one of the most traded commodities in the world, yet it is notoriously difficult for a coffee business to manage risks, due to the volatility of the price of green coffee combined with the idiosyncratic needs of the markets in which the coffee business operates. Each coffee crop is unique with regard to its characteristics. Price setting criteria are mostly quality (what is the quality of a given coffee or origin) and availability (how much or how little is being offered of a particular type of coffee) which both vary substantially over time and are impacted by weather. Furthermore, customer taste and preferences vary regionally and different blends are produced by mixing different kinds of coffee beans (such as Arabica and Robusta) taking into account their acidity, bitterness, and caffeine levels. For instance, the Arabica beans that are essential for Atlantic Grupa's coffee products are mostly grown in Brazil and require specific bitterness, making the company's risk management quite challenging.

Throughout years, Atlantic Grupa contemplated several ways of managing its coffee commodity risk. For example, the company considered to buy plantations in Brazil and to hedge using stocks of global market leaders such as Starbucks. However, these risk management strategies were evaluated as too expensive and

[1] This was one of the largest merger and acquisition deals in southeastern Europe at the time, with the total value of the deal around USD 478M.

of limited impact in view of the company's scale and of the idiosyncratic demand in the company's top coffee markets.

The exposure to the coffee commodity risk became the central topic of the Board discussions shortly after the acquisition of Droga Kolinska. Financial estimates for 2011 suggested that the cost of green coffee would be around USD 80M. The company's Chief Financial Officer warned that the volatility in green coffee prices could seriously jeopardized Atlantic Grupa's overall profitability,[2] regardless of the performance of all other business units. It then became clear to the entire Board that managing the coffee commodity risk was not only important for Atlantic Grupa's newly acquired coffee business. It was an issue critically impacting the results of the overall company, thereby becoming a central post-acquisition challenge.

To address the challenge, Atlantic Grupa formed the Coffee Team. The team was led by the Director of the Coffee Strategic Business Unit, and it included the Director of Central Purchasing, the Director of Supply Chain, the Head of Treasury, the Finance Director of the acquired Droga Kolinska, and a few of other coffee business executives. The team was charged with the urgent task of developing and implementing a coffee risk management strategy. The team was also required to meet at least once a month to evaluate and adjust all of the coffee purchasing decisions and to inform Atlantic Grupa's Chief Financial Officer on a regular basis, and especially when significant adjustments in purchasing decisions were required.

The Coffee Team was well aware that timing green-coffee purchases was essential because of their price volatility. Such price is directly related to the price of the composite indicator of the International Coffee Organization (ICO),[3] which provides an overall benchmark for the spot price of green coffee of all major origins and types and it is considered to be the best available measure of levels of green coffee transactions on a global basis. During the eighteen months that followed the acquisition of Droga Kolinska, the price of the ICO composite indicator ranged between USD 125c per pound to USD 250c per pound. Facing such extreme fluctuations, identifying price movements ahead of time was very valuable.

As a part of the coffee purchasing process, the company has been retaining the services of Ms. Gabriela Rodrigues (Brazilian Coffee Consortium), Mr. Neil Stevens (Advanced Commodity Analytics), and Mr. Mario Illy (European Coffee Organization) as outside experts in the coffee industry. The three experts had a life-long career in the industry and were affiliated with leading coffee-analytics companies and organizations. They were among the very best on the market and had accesses to both proprietary and publicly available information about specific coffee farms, production regions, and the overall coffee market. Their services were quite expensive, but Droga Kolinska started using them during the turbulent 2008 crisis, when proper risk management (and avoiding risk mismanagement) became the question of survival. Facing continual volatility in green coffee prices, Atlantic Grupa continued to retain their services after the acquisition of Droga Kolinska.

Whenever needed, the Coffee Team at Atlantic Grupa would request forecasts from all three experts for the price of its green coffee mix three months ahead, and relied on such forecasts to optimize the company's coffee purchase decisions. The team also monitored the performance of the expert forecasts by discussing their accuracy and their usefulness. The team members had access to reports such as the ones provided in Exhibits 1-3 below. Exhibit 1 shows the expert forecasts in forty different instances. Exhibit 2 displays their forecast errors with respect to the company's green coffee prices, and Exhibit 3 sorts and plots these errors for each of the three experts.

At its May 2012 meeting, the Coffee Team discussed the possibility of not retaining one of the experts

[2] The overall Atlantic Grupa's EBITDA in 2011 was reported at USD 85M.

[3] *Rules on Statistics Indicator Prices*, ICC-105-17, International Coffee Organization, London U.K., available at `http://dev.ico.org/documents/icc-105-17e-rules-indicator-prices-final.pdf`

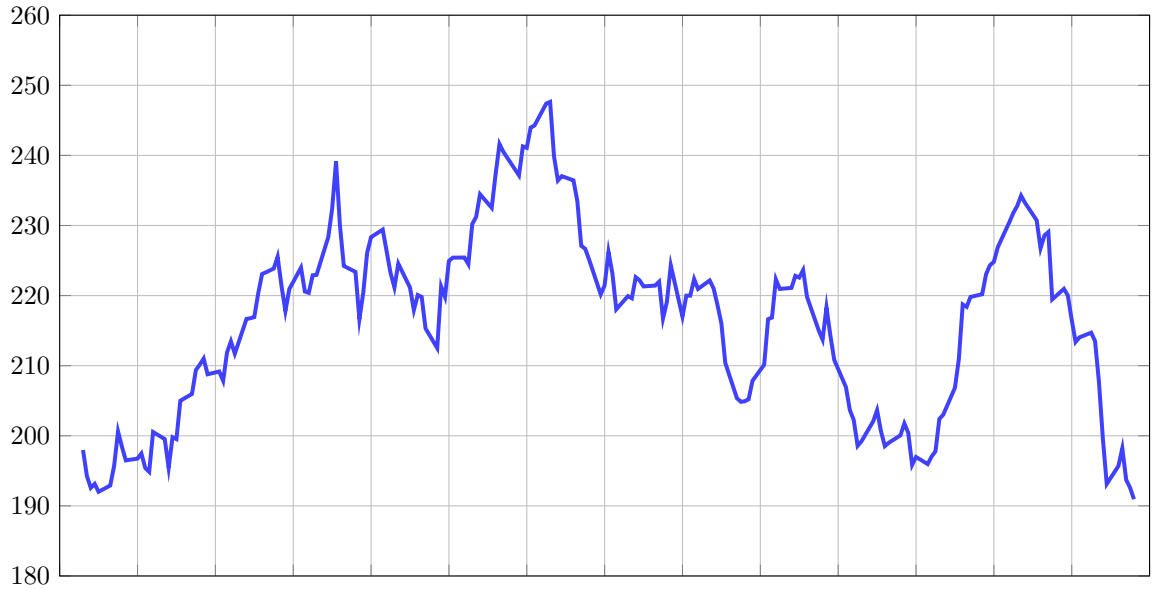

Figure 2: Price fluctuations for the ICO Composite Indicator (January-September 2011).

going forward. Some of the team members persuasively argued that if the company were to carefully choose the expert not to retain, then the cost benefit of such a decision would outweigh the possible loss in the quality of the forecasts in the sense that the financial resources that would become available could be more effectively utilized in managing other risks (such as the currency risk and the operational risk to which Atlantic Grupa would continue to be exposed). For these reasons, at the conclusion of its May 2012 meeting the Coffee Team unanimously decided to reallocate some of the expert expenditures and to stop seeking the services of one of the three experts. The team also unanimously decided that Mr. Mario Illy was not to be retained because of the widest spread of his errors (see also Exhibit 3).

Exhibit 1

EXPERT FORECASTS FOR THE ICO COMPOSITE INDICATOR

(in USD cents/lb)

Forecast #	Gabriela Rodrigues Forecast	Neil Stevens Forecast	Mario Illy Forecast
1	164.48	165.09	166.40
2	159.87	166.07	183.49
3	194.66	186.97	142.23
4	186.84	179.82	164.13
5	185.91	177.40	196.71
6	193.43	204.12	194.45
7	203.88	193.76	180.24
8	214.46	218.19	227.59
9	211.91	220.99	225.33
10	201.92	205.13	217.45
11	215.26	215.94	211.43
12	233.34	224.80	229.48
13	217.99	219.74	270.61
14	233.15	207.13	183.47
15	224.09	234.25	200.76
16	195.91	201.09	206.73
17	177.30	198.23	186.06
18	160.92	164.90	198.64
19	165.19	161.70	150.12
20	164.36	161.55	168.95
21	171.79	166.12	122.91
22	149.91	157.12	168.41
23	147.85	145.57	119.26
24	139.08	128.41	95.40
25	125.41	122.74	112.33
26	117.15	133.70	169.15
27	134.81	130.65	98.70
28	112.52	114.50	155.81
29	119.88	110.21	120.45
30	121.72	115.55	109.13
31	103.59	111.26	163.79
32	109.36	112.98	125.37
33	98.96	108.83	138.06
34	115.56	107.89	101.32
35	108.01	111.00	121.31
36	127.98	132.56	85.72
37	113.60	120.16	105.40
38	110.17	100.60	85.67
39	104.55	110.41	122.05
40	104.09	98.09	98.74

Exhibit 2

FORECAST ERRORS

(GREEN COFFEE PRICE - FORECASTED VALUE in USD cents/lb)

Forecast #	Gabriela Rodrigues Error	Neil Stevens Error	Mario Illy Error
1	4.02	4.63	5.94
2	−7.90	−1.70	15.72
3	12.37	4.68	−40.06
4	−2.06	−9.08	−24.77
5	−3.11	−11.62	7.69
6	−0.23	10.46	0.79
7	9.98	−0.14	−13.66
8	1.42	5.15	14.55
9	−0.28	8.80	13.14
10	−8.44	−5.23	7.09
11	−0.32	0.36	−4.15
12	5.37	−3.17	1.51
13	−13.25	−11.50	39.37
14	8.82	−17.20	−40.86
15	8.06	18.22	−15.27
16	−1.44	3.74	9.38
17	−6.96	13.97	1.80
18	−12.98	−9.00	24.74
19	3.63	0.14	−11.44
20	0.75	−2.06	5.34
21	14.33	8.66	−34.55
22	−3.50	3.71	15.00
23	5.65	3.37	−22.94
24	10.98	0.31	−32.70
25	−1.48	−4.15	−14.56
26	−8.15	8.40	43.85
27	11.44	7.28	−24.67
28	−14.33	−12.35	28.96
29	−5.08	−14.75	−4.51
30	2.05	−4.12	−10.54
31	−17.50	−9.83	42.70
32	−7.04	−3.42	8.97
33	−18.49	−8.62	20.61
34	2.66	−5.01	−11.58
35	−11.04	−8.05	2.26
36	4.93	9.51	−37.33
37	1.99	8.55	−6.21
38	4.30	−5.27	−20.20
39	−3.05	2.81	14.45
40	−4.30	−10.30	−9.65

Exhibit 3

SORTED FORECAST ERRORS

(sorted from the smallest to the largest for each expert)