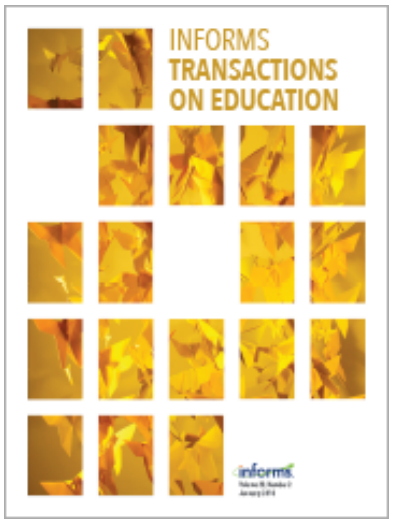

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Case

Forecasting Beer Demand at Anadolu Efes

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Forecasting Beer Demand at Anadolu Efes

Efes Beverage Group is the beverage division of Anadolu Holding, one of Turkey's leading conglomerates. Anadolu Holding was founded in 1969 and has principal interests in the beverage, automotive, finance, restaurant chain management, and office supplies sectors. Efes Beverage Group produces and markets beer, malt, and soft drinks across a geography that consists of Turkey, Russia, the CIS countries, Southeast Europe, and the Middle East. Anadolu Efes (or Efes in short) is the beer division under the Efes Beverage Group (see http://www.anadoluefes.com).

As of 2006, Efes was one of the leaders of the beer industry in the region with its 16 breweries, 6 malt plants, and 1 hops processing facility in six countries. Efes has a brewing capacity of 3.3 billion liters and a malt production capacity of 236,500 tons annually.

Efes has a share of about 78% in the Turkish beer market. Efes Pilsen, Efes Light, Efes Dark, Efes Extra, Efes Ice, Marmara Kirmizi, Marmara Gold, Ritmix, and Gusta are the popular flavors supplied by Efes. Additionally, it brews and supplies Miller Genuine Draft, Beck's, and Foster's under licence agreements. Efes also offers a wide variety of local brands with different tastes and appeals in international markets. Stary Melnik, Sokol, Bely Medved, and Krasny Vostok are the local brands and Warsteiner, Amsterdam Navigator, Zlatopramen, Sol, and Bavaria are the brands Efes brews under licence agreements in Russia.

Information about the beer production process, history of beer, and alcohol consumption in Turkey are given in Figures 1–3.

Forecasting Beer Demand

As a part of their yearly planning efforts, Efes forecasts the monthly demand for the coming year during the fall of the current year. Historically, high-level sales managers, based on input from their sales personnel, have done this forecasting mostly subjectively. Because they have been in the sector for a long time, their estimates have been pretty accurate in the past. There have been cases where the estimates were off but these were rare instances. They already made their forecasts in the Fall of 1993. In January 1994, they are discussing how they could formalize this process.

The Managing Director, Serdar Bölükbaşı, mentioned his desire to come up with a more formal way of forecasting to Levent Tomaç, the Vice President of Marketing. He explained that such a study would be useful to test their intuitions on the factors they thought had a significant effect on beer demand. Levent agreed immediately. He explained that he had been thinking on this subject as well and they could still use their judgments after the formal analysis if they thought some aspects had been overlooked. They remembered the young employee in the Logistics department, Selin Baydar, who recently did a great job studying the distribution of beer and the location of new breweries.

Figure 1 The Beer Production Process

Beer Production

Beer is produced by the fermentation of carbohydrates in cereals, such as wheat, corn, rice, and most commonly, barley. The main ingredients of beer are water, malted barley, hops, and yeast. Malted barley is the processed grain that has begun germination by being soaked in water, and provides beer its body and color. Hops is used in small amounts as a preservative agent. It also gives beer a bitter flavour and a pleasant aroma. Yeast is composed of microorganisms that convert sugar in malt juice to alcohol and carbon dioxide. From the start of the production process, it takes approximately 21 days until the beer is ready for consumption.

Figure 2 A Brief History of Beer

History of Beer

Beer is one of the world's oldest alcoholic beverages. As early as 6,000 B.C., people were brewing beer in Mesopotamia, the land between the Tigris and Euphrates, rivers that originate in southeast Anatolia. The Hittites, one of the most sophisticated civilizations 4,000 years ago in Anatolia, were drinking beer in daily life as well as in sacred rituals. Ancient Egyptians used beer as a remedy for various maladies. In the dark ages when Europe was in the throes of various epidemics, beer saved many lives as a safe and nourishing drink.

By the seventh century A.D., beer was produced by European monasteries. Today, the brewing industry is a huge business worldwide. The global beer consumption was approximately 155 billion litres in 2005.

Figure 3 Alcohol Consumption in Turkey

Alcoholic Beverages

Turkey has a diverse culture. It has been a secular state since the establishment of the Republic in 1923 and there is no restriction on alcohol consumption. Even during the Ottoman Empire, the restrictions depended on the attitude of the reigning sultan. Sultan Suleyman the Magnificent (1520–1566) was a strict prohibitionist, for instance. On the other hand, Sultan Ahmed III (1718–1730) permitted alcohol consumption.

Surveys indicate that around 48% of the adult population in Turkey consume alcoholic beverages, and around 42% of those who do not drink state that religious beliefs are the main reason for abstaining. Many individuals stop drinking alcoholic beverages during the month of Ramadan, an Islamic fasting month.

Raki is a traditional hard liquor produced and consumed in large amounts. Wine and beer are other popular alcoholic beverages.

Selin was excited about her new assignment. She had studied food engineering before taking a job at Efes in the Production department. After working for several years, she completed a part-time MBA program and started working in the Logistics department. Oddly, to many of her friends' tastes, she always enjoyed studying and is currently enrolled in a Masters program in an Industrial Engineering department. She appreciates learning the details of many approaches and having the opportunity to experiment with large-scale models. She recently worked on large-scale regression case studies in a statistics course. She thought that regression would be useful in trying to understand and forecast beer demand. She had not been much of a beer drinker, but having worked for Efes for four years, she had some idea about what affects beer demand. Tourism, the relative prices of beverages that could be substituted for beer (hard liquor and soft drinks), increasing trend because of increasing population and increase in beer drinking habits, and Ramadan (the month of fasting in Islam; see Figure 4 for further information) were some of the factors she immediately thought of. After some discussions with her colleagues, she further developed the specifics of some of the factors (see Tables 1–4).[1] Colleagues have observed and some surveys supported over the years that many consumers would substitute soft drinks for beer and vice versa, especially when it came to quench their thirst. They thought that this substitution occurred between canned packages of soft drinks and beer. Hard liquor (especially the traditional Turkish drink Raki) was also considered to be a substitute for beer. The claim was that, in restaurants and pubs, people would substitute draft beer and Raki for each other. There were indications that these consumers were price sensitive in their substitutions. Another issue regarding the price was the timing of price changes. Because of relatively high inflation, Efes (as well as other companies) occasionally adjusted their prices. The real prices, hence, would go down for several months, and then go back up after the price adjustment.

Figure 4 The Month of Ramadan

Ramadan

It is considered the most blessed month of the Islamic year and is linked to the lunar calendar. Many Muslims fast during the month of Ramadan. Those who fast refrain from eating, drinking, and smoking during the day. At the end of Ramadan, a three-day feast starts when friends and relatives visit each other, and candies, sweet pastries, and sweet liquors are served.

Selin was now ready for the meeting.

Serdar Bölükbaşı: I understand you made some plans about formalizing our beer forecasting.

Selin Baydar: Multiple regression is one of the widely used statistical tools for forecasting. I have some experience with this and I think it would be useful in explaining beer demand to a large extent.

[1] Tables 3 and 4 are in the supplementary Excel file Tables 3–4.xls.

Table 1 First and Last Days of Ramadan in Years 1987–1994*

Year	First day of Ramadan	Last day of Ramadan
1987	April 29th	May 28th
1988	April 18th	May 16th
1989	April 7th	May 5th
1990	March 28th	April 25th
1991	March 17th	April 15th
1992	March 6th	April 3rd
1993	February 23rd	March 23rd
1994	February 12th	March 12th

*http://www.diyanet.gov.tr.

Selin explained what she had in mind and mentioned the factors she thought of using. They agreed to use the total monthly demand figures of the whole country for the period 1987–1993. Efes had a huge market share (approximately 78%). Other companies had similar policies in terms of price adjustments, marketing of different beer types, etc. They decided not to differentiate between different types and packages and defined an aggregated litre of beer to define the consumption amounts. They agreed to use appropriate weights to calculate average prices. Selin explained her difficulties in quantifying effects of tourism, population, and substitutable beverages.

Table 2 Average per Capita Beer Consumption of Some Countries

Country	Beer consumption (liters/capita)*
Czechoslovakia	163
Germany	138
Denmark	126
Austria	118
Ireland	113
Belgium	108
United Kingdom	100
Luxembourg	104
Australia	96
United States	86
The Netherlands	85
Finland	86
Venezuela	77
Canada	71
Sweden	64
Spain	67
Portugal	64
Japan	56
South Africa	55
Norway	50
Mexico	47
Columbia	41
France	39
Korea	34
China Hong Kong	28
Italy	25
China Taiwan	23
China	10

*Approximate values as of 1993.

Levent Tomaç: We previously got some detailed information from the Ministry of Tourism for some other purpose. They collect data on the number of tourists coming from each country and produce information on number of tourist nights spent in Turkey by citizens of different countries during each month. We have these results for five major countries and the rest are summed up under the "others" category.

Serdar: That is great! Average beer consumption statistics of each country is known and we can come up with a weighted factor for these five countries. We can then take the tourist nights of "others" and treat it as the sixth country weighting with the average of the average beer consumptions of others. You know which country's tourists I would like to see in Turkey most. Several Czechs could consume a lot of beer!

Levent: Using weighted number of tourists is a good idea. We will come up with a variable that stands for the approximate amount of beer we expect tourists to consume in a given month. However, I am a little sceptical about the claim on the substitution of soft drinks for beer. I would be surprised if this amounts to anything sizeable but let us try and see. For the substitute beverage effects, we could directly use their prices relative to our prices.

Selin: I think those would work well. Do you have any suggestions on how to incorporate the population?

Serdar: I think increase in population and increase in beer drinking habits might have similar effects. In Turkey, there has been a steady growth in both. I don't see why that would change in the near future.

Selin: Great, I can use a trend factor that may capture those effects. I think I am ready to try these ideas.

Serdar: Let us know as soon as you get some meaningful results.

After a week of hard work, Selin obtained her first results. Though the factors she used seemed to explain a significant part of the variation in the monthly beer demand, the residual graphs did not look perfect. She wanted to see if some transformations would work better to justify the assumptions of linear regression. After some transformations, she had alternative models that seemed to approximately satisfy the assumptions. She thought it was time to present her results to Serdar Bölükbaşıand Levent Tomaç. Selin briefly explained the results and talked about how she checked the assumptions of regression. To her surprise, the bosses were interested even in these details.

Serdar: These are enlightening. We have always thought that people drink more beer when it is hot. Our sales figures do increase in summer months. Did your model verify this observation?

Selin: Oops! How could I totally ignore this fact?

Levent: Don't worry. This is why we have these meetings. Sometimes one gets too carried away with details.

Selin: I will figure out a way to incorporate this seasonality effect.

Serdar: I like this "seasonality effect" term. Shall we postpone our meeting for tomorrow then?

Selin: Sure, I should be able to resolve this quickly.

Serdar: I would like to see a detailed explanation of how you checked those assumptions of regression you mentioned. I learned about these years ago and this will be a good refresher for me.

Selin was still embarrassed about overlooking the seasonality. She decided to do a detailed analysis to see the relative effect of each season. She thought she had sufficient data points and she could even test the seasonality on a monthly basis if she wanted to do so. She quickly incorporated the necessary variables and solved the model. The results cheered her up. The model seemed to explain a high percentage of the variation in beer demand. She was now ready for the meeting.

Serdar: Things are looking great. I look forward to getting your final report soon. Then we can have our different departments discuss it. Hopefully, we will be able to incorporate this in our forecasting activities starting from this year. Perhaps we will eventually be able to use these as a decision tool as well by testing how beer demand might be affected when we change the prices a little bit.

Selin: I hope so too. This was a quick meeting. I better start writing immediately.

Selin prepared her report explaining the dependent and independent variables in detail. She explained how she conducted the experiments to exclude the variables that turned out to be statistically insignificant. She discussed the meaningful variables and the magnitudes of their effects. She discussed and demonstrated how the assumptions of linear regression were approximately satisfied. She explained how the results could be used and she demonstrated some predictions and prediction intervals.

After finishing her report, Selin was tired but satisfied that the project turned out to be meaningful. She could not wait to see the model put to use.[2]

Supplementary Files

An electronic companion to this paper is available at http://ite.pubs.informs.org/.

Acknowledgments

This case won first prize in the 2007 Case Competition of the Institute for Operations Research and the Management Sciences (INFORMS).

Reference

Efes Beverage Group, Anadolu Efes. Accessed on January 22, 2010, http://www.anadoluefes.com.

[2] The company and beer market information are accurate as collected and cited from various references. Serdar Bölükbaşıand Levent Tomaç are the real managers at the positions mentioned in the case. We would like to thank them for their comments about the case and for kindly allowing us to use their names. The story developed for the case is realistic but fictional.