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Case

Beijing Opera Mask Sales in Four Cities in the United States

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1. Beijing Opera Background

1.1. Overview

Beijing Opera (also known as Jingju), a traditional form of Chinese theatre, has been a popular form of entertainment in China for 200 years. The Beijing Opera of China is considered a national treasure and was developed during the Qing Dynasty through a combination and integration of several forms of opera including Kunqu, Yiyang, Hanju, and Luantan.

The performances depict stories that engage the audience in fairy tales of preceding dynasties, important historical events, emperors, ministers and generals, and other important Chinese traditions and cultural events. Some of the performances are even adapted from literature and classic novels well known to the public. The combination of music, vocal performance, mime, dance, acrobatics, and elaborate and colorful costumes creates an amazing spectacle that brings the stories to life.

1.2. The Music

Looking more closely at the components of Beijing Opera, the music performed is known for its graceful melodies and harmonious rhythms. The melodies can be classified into two main groups that include “Xipi” and “Erhong,” which follow guided, original, and both slow and fast-paced random patterns. The main instruments used to accompany the show are wind, percussion, and stringed instruments. The instruments include the jinghu, a two-stringed bowed instrument with a high register; the yueqin, a four-stringed plucked instrument with a full-moon-shaped sound box; the Sanxian, a three-stringed plucked

instrument; the Suona horn; flute drum; big-gong; cymbals; and other smaller gongs.

1.3. The Costumes and Masks

The costumes are usually made with handcrafted embroidery and are graceful and brilliant in color, pattern, and style. The facial makeup used to accompany the costumes is rich in color and variety and allows the performers to depict different characters and provides astonishing images on stage. The main color of the facial makeup symbolizes the nature and personality of each character. For example, gold and silver colors are usually used to depict gods and spirits, and red symbolizes devotion, courage, and loyalty. The masks are shown in Figure 1.

1.4. The Characters

The characters depicted in Chinese opera can be classified into four main categories: Sheng, the male role; Dan, the female role; Jing, the painted face male; and Chou, the comedy role. Any role from these categories can be the leading role, but females are only allowed to play a role in the Dan category. The names of the categories were selected to create opposition to the characteristics of the roles being played. For example, Sheng means “rare,” but the male role is the character most seen during a performance. Dan translates to “masculine” for a role played by women. Jing is known as being “clean,” but the paintings used on stage make this character look unclean. Lastly, Chou means “cow,” which is seen as a slow and sluggish animal. Chou characters are usually very active and quick on stage.

Figure 1 Examples of Masks Used in Beijing Opera



1.5. Stage Design and Orientation

Most stages in Chinese theatres consist of square platforms that are exposed to the audience on three sides with an embroidered curtain hung over the platform that divides the stage into two parts, the back stage and the stage. A table with musical instruments usually rests in front of the curtain with the musicians sitting nearby, completely visible to the audience. There are even some theatres that expose the audience to all four sides of the platform so that the show can be seen from the back.

2. Demand Management Issues of Beijing Opera

Jia, now an international businesswoman from the United States, had first heard about the Beijing Opera several years ago in a business class as a graduate student. She was so moved by her professor’s description of the opera that soon after obtaining her MBA she decided she wanted to try getting involved with a Beijing Opera theatre company.

Jia was lucky enough to meet with the theatre company, Art in Motion Ltd., at a career fair through her school’s business department. She discovered that Art in Motion traveled to many cities around the globe and had even been to the United States. Art in Motion was planning another tour of the United States and was looking to hire someone as a retail manager for their shows. The retail manager would be in charge of ordering and selling two types of Beijing Opera masks after the shows that represent the different characters portrayed on stage. One mask was marketed toward the younger audience members because

it was a wearable accessory. The other mask was created for adult clientele as a display piece. The souvenirs would be ordered from a Chinese wholesaler before upcoming shows.

The Chinese Opera is a one-time showing in each city. Any masks left after each show will be sold back to the Chinese wholesaler. The wholesaler has warehouses located in the United States and takes care of the shipping and storage of the masks. Art in Motion places orders for the show in the next city right after the previous show. The wholesaler charges are in Table 1.

Table 1 Shortage and Excess/Leftover Cost of Masks

- Mask Gift 1 (wearable):
- Price from the Wholesaler: \$7 each
 - Price for customer: \$11 each
 - Refund for unsold items: \$4 each



- Mask Gift 2 (display):
- Price from the wholesaler: \$9 each
 - Price for customer: \$14 each
 - Refund for unsold items: \$7 each



Note that the refund price is lower than the wholesale price because of the wholesaler's increasing setup costs and administration costs with the masks. Each time an order is placed, it must be initiated and processed. The shipment must be received, put into storage, and loaded into a computerized information system that monitors the inventory status. All of these steps require time and energy from the wholesaler's employees. Also, setup costs accrue from other factors such as telephone calls, order forms, and shipping costs.

Therefore, it is clear to Jia that this job is important and challenging. If the retail manager orders too few masks from the wholesaler, there will be a shortage of masks, and Art in Motion loses sales. On the other hand, if the retail manager orders too many masks from the wholesaler, Art in Motion will still lose profit by receiving less money in return for leftover masks compared to what was originally paid when the masks were ordered.

After listening to the job description and talking to Art in Motion's liaison, Jia decides to submit her resume in the hope of becoming involved with this amazing cultural experience. A few days later, she is called for an interview and soon after discovers she is on her way to realizing her dream career!

Seven years later . . .

It has now been seven years since Jia was first hired as the retail manager for Art in Motion. She still enjoys reflecting back on the excitement she first experienced when she was hired right out of graduate school. She cannot believe how fast the time has flown by. As the retail manager of the Beijing Opera theatre company, she has seen her business grow throughout the years. The Beijing Opera had gained extensive recognition in the United States because of touring that reached many cities in various locations and because of the popularity of the souvenir masks.

Two of the locations that Jia enjoys working with the most are the Steppenwolf Theatre in Chicago, Illinois and the Purple Rose Theatre in Chelsea, Michigan. The Steppenwolf Theatre can hold 515 audience members, whereas the Purple Rose can seat 168. Even though Chelsea is not a typical location for the theatre company because of its small size, they decided to try the location because Jia had seen a show there while vacationing in Michigan, and she guaranteed that the show would be a success because of the devoted theatergoers in and around the town. It turns out that Jia was correct, and Art in Motion has been setting Chelsea as a destination ever since. Art in Motion comes to Chicago and Chelsea every spring, summer, fall, and winter for a one-time show. Therefore, four shows have been put on each year in each location over the span of Jia's seven-year employment. Jia was able to obtain information on the demand for the masks for

Table 2 Demand Data for Both Mask Gifts in Chicago and Chelsea

Mask Gift 1 demand in Chicago	Mask Gift 2 demand in Chicago	Mask Gift 1 demand in Chelsea	Mask Gift 2 demand in Chelsea
205	163	113	65
229	160	120	72
193	160	106	67
231	155	97	63
202	123	91	67
198	157	83	69
195	120	80	76
214	129	67	64
170	133	71	60
212	96	114	69
233	151	72	73
214	130	67	65
196	166	61	70
226	120	62	83
217	143	98	69
212	112	89	64
207	154	101	80
194	148	64	61
195	179	116	71
182	118	63	74
209	128	89	68
201	136	61	76
178	185	99	63
212	127	92	65
194	160	95	59
199	117	67	77
221	132	97	67
229	194	74	53

the twenty-eight shows between the two locations, which appears in Table 2.

In addition, when Jia was in Michigan last year, Art in Motion tried selling mask gift 1 at one of their new venues, the Wharton Center in East Lansing, Michigan. The decision was made to only sell the wearable mask because it had been the most popular souvenir for a majority of the past performances, and the company wanted to test the market. So far, Art in Motion has only hosted one show at the Wharton Center. The records show that the 400 seats were all full, and the demand for mask gift 1 was 90 during the first run. Since the show was such a success, Art in Motion Ltd. decided to continue to host the opera in East Lansing in the future. Since there is not enough historic demand data for the Wharton Center, the demand needs for the next show in East Lansing are to be estimated. With the help of local experts, the Opera has come up with the following rough probabilities of demand for East Lansing:

This year, Art in Motion plans to try a new location in the United States. They discovered that Grand Rapids, Michigan has been hosting an international art competition throughout the city for the past two years known as Art Prize Exhibition. It surely appears to be a community that will embrace the artistically

extravagant Beijing Opera. The location will, in all probability, be the Circle Theatre.

Even though Jia truly enjoys most aspects of her job, there is one question that tends to present major issues—how many masks should Art in Motion order for each show? Currently, Jia orders masks based on the demands from previous shows in each location. Jia wonders whether the current order policy is sufficient. If not, how will she decide the best order quantity? Jia cannot think through this problem, nor does she feel competent enough to develop reliable estimates of the demand for masks. Therefore, she decides to contact one of her professors that served as a mentor while she attended graduate school to obtain her MBA. She knows that she is currently living in the Grand Rapids area, so she wants to get some tips on how many masks to order for the upcoming Grand Rapids show. After an exchange of email messages and some laughter over the phone, the professor agrees to meet at a local coffee shop to discuss the best course of action.

3. Record of Discussions of the Meeting

Jia enters the professor's office, and after a quick exchange of a handshake and some reminiscing, cuts right to the chase. She begins by explaining previous trends in mask sales and her company's overall situation. After reviewing data about mask sale demands from previous shows in Chelsea and Chicago, Jia explains that Art in Motion had experienced a shortage of masks and leftover masks from the different venues on several occasions. Jia is adamant about not running out of masks for the theatergoers but is also worried about having any leftover masks, because in the past she had been refunded a lower price from the wholesaler than what Art in Motion had originally paid.

After listening to Jia, the professor looks at the demand table provided by Jia (Table 2) and asks, "When you have some leftovers, the number of masks you sold is your demand. But when you have shortage, the number of items you sell is less than your demand. Did you realize that?"

"Yes." Jia looks proud as she further explains, "I have already thought through this question. We have the best salesmen. If a certain mask is sold out, our representatives will record how many more are needed for the customers and report it to me. I have already adjusted the sales data by the shortage, so our data reflects the actual demand from the customers."

"Oh, that is great! Then you have data for seven years from four seasons each year for Chicago and

Chelsea. That is enough for us to figure out the demand pattern. How many masks did you order each year for Chicago and Chelsea in the past?"

"I am afraid we follow a rather naïve policy. We order the masks to correspond with the demands from the previous show in the same city," Jia replies.

"Okay. We can begin from there. We can calculate the optimal order quantity for both types of masks and then compare the profits from your previous order sizes and the new order quantity." The professor takes out the sheet and looks at the data. "The data is from 28 shows in four years, so it is important for you to first check if it has time series pattern and seasonal effect."

"How?" Jia asks.

"An easy way to check is to draw the plots of the data against time. Let me show you." The professor quickly inputs the data into her computer and plots the data against time using Excel. She shows the plots to Jia. "You see, the data are pretty random and do not show any obvious upper or down trend or any seasonal patterns. Therefore, we can roughly say that there are not obvious time-series effects. If you are not sure, commonly used statistics software like SAS provides several procedures to check time-series effects. Next, we should find a distribution that best describes the data." The professor grabs a pen and begins to write down a series of steps and formulas. After a while, she stops, looks at her sheet, and explains, "In this step, I suggest that you use a standard software package to analyze the demand pattern. EasyFitXL, an Excel add-in, is perhaps one of the best packages that provide all the information and analysis necessary for easy and useful decision making."

"What's that?" Jia asks.

"This is very simple and straightforward software, which automatically or manually fits your data to a large number of distributions. For example, after you input the data, this software provides relative comparisons between 55+ commonly used distribution types and an absolute measure of each distribution's acceptability within seconds, which saves programming time and multiple steps operations compared to using other software. Then, the distributions with the corresponding estimated parameters, the corresponding goodness-of-fit tests results, and the fitting graph are provided and ranked according to the rank of the fitness. It can be used as either a stand-alone application or with Microsoft Excel, enabling you to solve a wide range of business problems with only a basic understanding of statistics. Actually, SAS, SPSS, Stat::Fit, and some other statistics software can also provide similar functions.

"Sounds great! What next?" Jia asks eagerly.

“After you find the distribution pattern of the demands, you can calculate the stocking level of your orders.” The professor further explains, “Stocking level is calculated by placing unit shortage cost over the sum of unit shortage cost and unit leftover cost. It represents the optimal probability of having enough, or more than enough, products to supply. After you get stocking level and the distribution with parameters, you can then come up with an order quantity.”

“That sounds great. I will ask the director if we can install this software to our computer.” Jia puts both hands on her chest and sighs with relief. “Thank goodness! I should have come earlier. I don’t want to come across as greedy, but do you have any suggestions for the sales in East Lansing? We only had one show there.” Jia opens her briefcase, brings out the document about the show in East Lansing (Table 3), and passes it to the professor.

The professor looks down at the document about the sales in East Lansing and asks, “Let me test you first. How can you calculate cumulative frequencies for this discrete distribution?”

“It is easy; the cumulative frequencies for each demand level are the summation of the frequencies on and before that level,” Jia says without a second thought.

In response, the professor states, “The cumulative frequency for a certain amount indicates the percentage of time that demand is less than or equal to that amount. You should stock at the amount for which the stocking level is just above the corresponding cumulative frequency.” The professor pauses and smiles at Jia. “I will leave the calculation to you as your homework.”

Jia returns the smile and confidently replies, “No problem, I love a good challenge!”

Table 3 Estimates of the Demand and Their Probabilities at the Wharton Center

Demand D	Probability, $f(D)$
60	0.00
65	0.02
70	0.07
75	0.08
80	0.15
85	0.12
90	0.20
95	0.15
100	0.10
105	0.03
110	0.04
115	0.02
120	0.02
125	0.00

4. The Forecasting Option

“We are on a roll!” Jia exclaims. “If you are not too busy, do you think we can continue for a little bit longer to tie up some loose ends?”

“Well...since we are on a roll, we might as well continue until you feel comfortable with the situation. Just make sure to write to your ol’ professor once in a while to keep me updated. Deal?”

“You have my word,” Jia replies.

Jia begins to discuss with the professor about the order in Grand Rapids. The professor explains to Jia that when sufficient historical data is not available, i.e., for a new business or a less-established market environment like the mask sales in Grand Rapids, judgmental forecasting methods may be employed. Jia’s mentor then offers the benefits and shortcomings of four commonly used judgmental forecasting methods: the sales force opinions, executive opinions, consumer surveys, and the Delphi method.

First, the professor explains that collaborating with sales staff who directly work with the customers are great sources of information because they are often aware of plans the customers may have for future purchases. The professor further explains that there are several setbacks. These include distinguishing between what customers would like to do and what they actually will do and compensating for customers being overly influenced by recent experiences, which can cause sales staff to be pessimistic during low sale periods and too optimistic during high sale periods. Lastly, a conflict of interest arises because it benefits sales staff to provide low estimates in forecasting for sales quotas.

“Another option would be to listen to the opinions of executive staff members such as managers in marketing, operations, and finance.” Jia listens as the professor describes the benefit of this approach: “It brings together the knowledge and talents of the various managers; however... ” “I saw that coming,” Jia replies with a laugh. The professor continues with a smile, “However, there is the risk that the opinion of one person will reign over the rest, and spreading out the responsibility for the forecast throughout the group could create less pressure to develop a high-quality forecast.”

“Let’s move on to consumer surveys. Do you want the good or the bad news first?” asks the professor. “It’s all the same to me,” Jia replies. “Fair enough. For starters, it makes sense to gain direct input from the customer because they determine the demand. In some situations, every customer or potential customer can be contacted. In other cases, there are usually too many customers to contact, and it becomes extremely difficult to identify potential customers.

Therefore, surveys are necessary to sample consumer opinions. That's the good news. Sadly, it's already time for the bad news. Expertise is required when developing and administering the surveys, and it can become a very expensive and time-consuming venture. Not to mention the possibility of fluctuations in behavior patterns that can throw off results."

"So it sounds to me like we are zero for three so far on suggestions. This certainly isn't making me feel any better about my current situation," Jia replies with a worried look on her face. "Oh don't worry," assures the professor, "all of these methods have their downfalls and benefits. The key to success is to find which one works best for your company's current situation." "For some reason I don't believe you, but go ahead. I'm all ears," Jia utters with a small grin.

"It is time you learn about the consensus forecast known as the Delphi method. It involves circulating a series of questionnaires among people who have the know-how to contribute in a meaningful way. All responses are kept anonymous, which creates an environment for honest feedback and tends to reduce the risk of one person's opinion overshadowing the others." "So far this all sounds good to me," Jia says with a surprised tone. "I told you not to worry. Each questionnaire builds off information from previous ones to enlarge the scope on which participants can establish their decisions." "However..." Jia says with anticipation. "I see that you are taking the words right out of my mouth. Just remember, you must decide which method will be the most beneficial to you," assures the professor. "The Delphi method becomes difficult because they are difficult to perform well. A lot of attention must be given to selecting participants, questionnaires take careful planning and testing to avoid uncertainty, and multiround studies take time. Some people just stop participating because it is such a time-consuming task!"

"Thanks a lot, Professor. Now I feel more lost than before. No offense."

"None taken. Just be patient, and the best fit will reveal itself to you," says the professor.

"Thanks for the pep talk. I hope you're right," Jia replies.

"I don't have a Ph.D. for nothing!" laughs the professor. "Before we adjourn, I want to see if you have taken any of this to heart," says the professor. "As of right now, what thoughts are going through your head?" "Well," replies Jia, "the customer survey may be difficult to pull off because we are in a little bit of a time crunch, and it sounds like it might get expensive to administer. Also, I think some of the higher up executives will compete to have their voices heard, so..." "This is a good place to stop," declares the

professor, "my work here is done. You are ready! Good day to you!"

5. A Suggestion of Cutting the Leftover Costs

The following day, Jia and the professor meet again over lunch. The professor has come prepared. She says, "I have a suggestion for cutting some of your company's costs. Right now you are selling masks in four cities, which are not far from each other. The show first stops in East Lansing, then Chelsea, then Chicago, and then Grand Rapids. Is that right?"

"Yes," Jia answers.

"Since you sell the same two types of masks in these cities, why not take the leftovers from Chicago to Chelsea, take the leftovers from Chelsea to Grand Rapids, and from Grand Rapids to East Lansing instead of returning the masks to the wholesaler each time? Have you asked for truck prices for shipments? It is quite possible that it will be cheaper than letting the wholesaler charge high commissions from you," the professor says.

Jia pats her head and sighs, "Why didn't I think of this before? I will bring the shipping cost back to you tomorrow."

The next day...

Jia meets her professor in her office and shows her the price quote from a reliable local transportation company—FastTransit LLC. FastTransit charges a fixed rate of \$10, plus \$1 for each mask shipped between any two of these cities. They also require that a contract be signed before each show if Jia plans to use their services to ship to the next city. The professor thinks for a while and mentions, "This is not bad. Let's see if shipping the masks from city to city saves the most money. First, you must understand that this question can be a very complicated one, but in this special case the question can be pretty simple by turning it into classic newsvendor problems for these four cities. You may wonder how this is possible. Well, when you ship some products from city A to city B, the shipping cost between A and B can be considered as the leftover cost of the order in city A. When we place orders for city B, the leftover from city A will be deducted from the total order quantity in city B if the leftover quantity from city A does not exceed the total order quantity in city B. You must look at the demand data. The demand for masks increases from city to city along the Opera's tour on its way to Chicago. Grand Rapids is also a big city and the demand will not be low. Therefore, it is almost certain that the leftover quantity from city A will not exceed the optimal order quantity in city B, and we can make inventory decisions for these cities one by one..."

Jia laughs, “Then I guess it is time for a new homework assignment? I will make sure to pass with flying colors, 100%!”

6. A New Challenge from the Potential Cost Changes

With help from the professor, Jia comes close to finishing her report about the mask sales. A few days later, Jia watches an increase in the exchange rate from U.S. dollars to Chinese yuan on TV and new concerns arise. She decides it would be in her best interest to consult with the professor once more. This time, the two meet up at a local park to soak in some sun in the hope that the fresh air will clear their thoughts. Jia is better prepared this time around. She has made sure that her concerns are laid out as clear as the cloudless sky overhead.

“I hope you’re ready for this,” Jia says as the professor approaches the park bench.

“I was born ready. Let’s hear what you’ve got.”

Jia puts all of her issues on the table. “You already know my concerns from before, but I’ve got some new ones for you. Enjoy.” First, she admits that the wholesaler has mentioned several times this year that if the exchange rate from U.S. dollars to Chinese yuan keeps dropping, they will have to charge more for the wholesale price. She shows the professor the current exchange rate trends as of 2010–2011 to highlight how the rate continues to drop as shown in Figure 2.

The wholesaler has already indicated that the increase in the wholesale price can be as high as 15%.

Figure 2 2 USD to Chinese Yuans (2010–2011)



Jia also explains that Art in Motion does not want to change the selling prices of the masks because the fixed prices allow them to set an exact budget in advance and maintain consistency. In addition, it allows Art in Motion to charge a high upfront cost that can be agreed upon with customers so that they are not shocked by a possible need for price increases in the future, which could lead to arguments over the validity of the pricing. “In such a situation, how should we respond? Should we always keep the order quantity the same no matter how the wholesaler changes the wholesale price?” Jia asks.

“I know you know the answer,” the professor responds.

“We also need to change our order quantity, but how?” Jia asks.

“Well, let’s run a sensitivity analysis of how the order quantities rely on the wholesale prices and draw the plots. Then you will have a more clear idea.” The professor says.

“Ok. I can do that. Is this another assignment for me?” Jia jokes.

The professor smiles and says, “You bet it is!”