Case Study 2

Production Ordering for Sport Obermeyer

By Group 4 - Joseph Paul, Tyler Reid, and Manfei Xie

Content

- Production Ordering Policy

    Hong Kong

    Mainland China

- A Risk Measure for Ordering Policy

- Recommendations for Operational Changes

- Sourcing in Hong Kong vs Mainland China

    Short-term

    Long-term

1. Production Ordering Policy

1.1 Ordering Problem

- When – November 1992

- Decision maker – Wally Obermeyer (vice president)

- Where – Sport Obermeyer (skiwear manufacturer), Colorado, U.S.

- What – initial production ordering for 10 styles?

The Initial Phase of Production **+** The Second Phase of Production **=** Overall Production
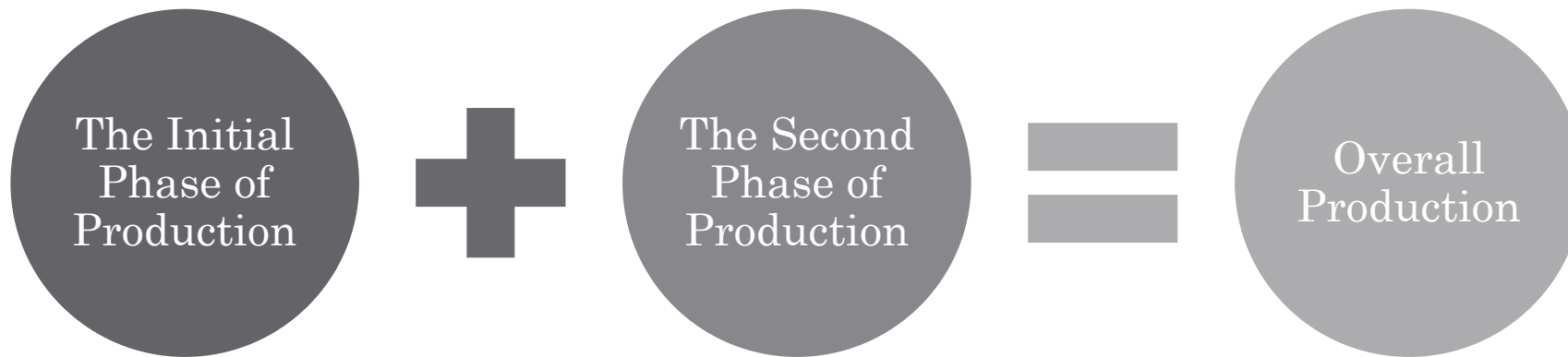
$$The\ Initial\ Production\ Order = \frac{Overall\ Production\ Order}{2}$$

1. Production Ordering Policy

1.2 Seller and Buyer

```
┌──────────────┐  Wholesale   ┌──────────────┐   Retail    ┌──────────────┐
│    Sport     │  price       │              │   price     │              │
│  Obermeyer   │  ───────►    │   Retailers  │  ───────►   │  Customers   │
│              │              │              │             │              │
└──────────────┘              └──────────────┘             └──────────────┘
```

1. Production Ordering Policy

1.3 Production Ordering and Sale Timeline

Nov 92, place initial production order

Mar 93, place second production order

Las Vegas Show, receive 80% of retailers' orders

Apr 93 – May 93 Remaining nonreplenishment retailers' orders

Sep 93

Dec 93 – Jan 94 Replenishment retailers' orders

Retail skiwear selling season
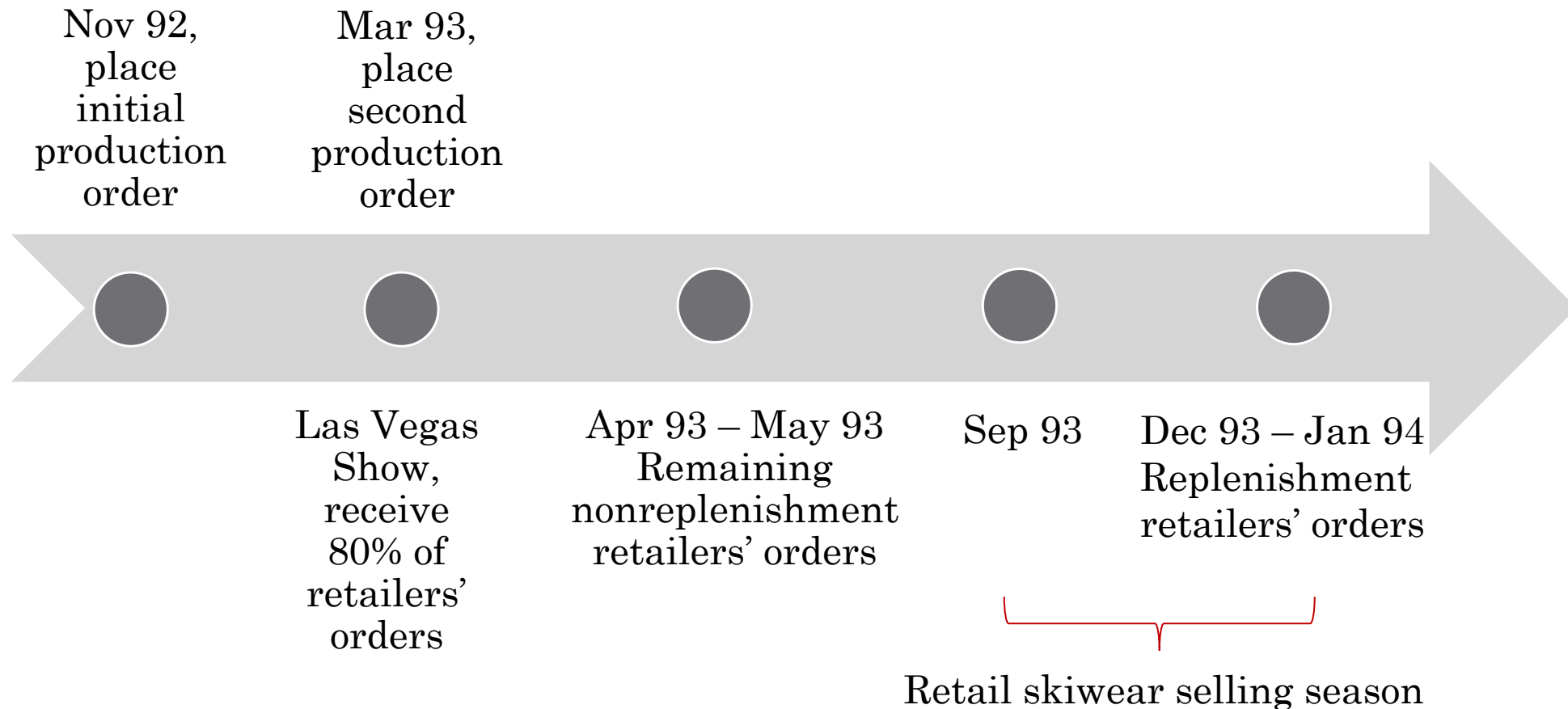
1. Production Ordering Policy

1.4 Overall Production Order for Each Style – Newsboy Model

- Short selling season
  - Mar 93 – May 93 retailers' orders
- Commits to an order quantity prior to the selling season
- Random demand
- Given overall demand forecast not half demand forecast season
  - Table 2-20 – overall demand forecast
  - Overall production order not initial production order as a newsboy model

$$The\ Initial\ Production\ Order = \frac{Overall\ Production\ Order}{2}$$

- Minimum order quantity
  - A style: ≥ 600 (Hong Kong)
    - $\geq 1{,}200$ (mainland China)
  - 10 styles: $\geq 10{,}000$ for initial production order

Newsvendor Stand

1. Production Ordering Policy

1.4 Newsboy Model for Each Style

- Wholesale price: p ($/unit)
- Unit production cost: v ($/unit)
- Salvage value per unit: g
- Penalty for not satisfying demand: B
- Assumptions
  - Demand $\sim N(\mu, \sigma)$
    μ = average of buying committee members' forecasts
    σ = twice of standard deviation of buying committee members' forecasts
- k : a value $\sim N(0, 1)$
- Overall production order quantity: Q^*
- The initial production order quantity: Q_I^*

1. Production Ordering

1.4 Newsboy Model for Each Style

Wally: "Obermeyer eared 24% of wholesale price (pre-tax) on each parka it sold, and that units left unsold at the end of the season were sold at a loss that averaged 8% of wholesale price".

$$v = (1 - 0.24)p = 0.76p$$

$$B = 0.08p$$

$$g = v - 0.08p = 0.68p$$

$$Critical\ Ratio = \frac{p-v+B}{p-g+B} = 0.80$$

$$k = 0.84$$

$$Q^* = \mu + k * \sigma.$$

Hong Kong	Mainland China
$Q_I^* = \max\left(\frac{Q^*}{2}, 600\right)$	$Q_I^* = \max\left(\frac{Q^*}{2}, 1{,}200\right)$

1. Production Ordering

1.4 Newsboy Model for Each Style – based on data of Table 2-20

Style	Hong Kong Q_I^*	Mainland China Q_I^*	Mainland China Q_I^*- Hong Kong Q_I^*
Gail	672	1,200	528
Isis	793	1,200	407
Entice	888	1,200	312
Assault	1,549	1,549	0
Teri	871	1,200	329
Electra	1,415	1,415	0
Stephanie	998	1,200	202
Seduced	2,477	2,477	0
Anita	2,529	2,529	0
Daphne	1,759	1,759	0
Sum	13,949	15,728	1,779

200 - 600 difference

Both > 10, 000, satisfy 10 styles minimum order

1. Production Ordering

1.5 Limitations and Suggestions

- Overall production capacity

  3,000/month for 7-month

  →

- Initial phase of production capacity

  $10 \text{ styles} \leq \frac{3,000*7}{2} = 10,500$

	Included Constraints	Excluded Constraints
Initial Production Order	A Style Minimum Order • ≥ 600 (Hong Kong), • ≥ 1,200 (mainland China) 10 Styles Minimum Order • ≥ 10,000	10 Styles Production Capacity • ≤ 10,500 (initial production)
Conflicts between Constraints	Sourcing in mainland China: • Based on "A Style Minimum Order", 10 styles in total should ≥ 1,200 ∗ 10 = 12,000 **>** 10,500 , "10 Styles Production Capacity" (**conflicts!**)	
To Solve Conflicts	• Increase Production Capacity • Mixed Sourcing or Sourcing Solely in Hong Kong	

2. Risk Estimation

2.1 Two Definitions

- What is risk?
  - Risk of losing overall profits by sourcing in one place rather than the other one

- What is a measure of risk?
  - Should be quantifiable
  - Expected profit relies on 3 expected quantities
  Expected inventory **shortage**
  Expected **sales**
  Expected **leftover** inventory
  - Expected overall profit difference by sourcing in mainland China rather than Hong Kong
  $E[Profit\ difference] = E[Profit]$ (Hong Kong) $- E[Profit]$ (China)

2. Risk Estimation

2.2 Formulas

- 3 Expected quantities related with expected profit
  - Take $2 * Q_I^*$ (obtained from the newsboy model) as Q into formulas:

$$E[Short] = E[\max\{0, D-Q\}] = \int_Q^{\infty} (x-Q)f(x)dx$$

$$E[Sold] = \mu - E[Short]$$

$$E[Left] = Q - \mu + E[Short]$$

- Expected profit?
  - $E[Profit] = E[\Pi(Q, D)]$:

$$E[\Pi(Q, D)] = p * E[\min\{Q, D\}] + g * E[\max\{0, Q - D\}]$$

$$-vQ - B * E[\max\{0, D - Q\}]$$

2. Risk Estimation

2.3 Results

	μ	σ	Hong Kong Overall Q	Mainland of China Overall Q	E[Short] (HK) =	E[Sold] (HK) =	E[Left] (HK)=	EProfit] (HK) =	E[Short] (CH) =	E[Sold] (CH) =	E[Left] (CH) =	E[Profit] (CH) =
Gail	1,017	388	1,344	2,034	43	974	370	201	1	1,016	1,018	163
Isis	1,042	646	1,586	2,084	72	970	616	178	15	1,027	1,057	161
Entice	1,358	496	1,775	2,716	55	1,303	473	270	0	1,358	1,358	217
Assault	2,525	680	3,097	5,050	76	2,449	648	530	0	2,525	2,525	404
Teri	1,100	762	1,741	2,200	85	1,015	726	179	25	1,075	1,125	166
Electra	2,150	807	2,829	4,300	90	2,060	769	426	1	2,149	2,151	344
Stephanie	1,113	1,048	1,995	2,226	117	996	999	150	77	1,036	1,190	147
Seduced	4,017	1,113	4,954	8,034	124	3,893	1,061	839	0	4,017	4,017	643
Anita	3,296	2,094	5,058	6,592	234	3,062	1,996	557	52	3,244	3,348	507
Daphne	2,383	1,349	3,518	4,766	151	2,232	1,286	421	21	2,362	2,404	373
SUM			27,898	40,002				$ 3,749				$ 3,123

Risk (Losing profit by sourcing in China (CH) rather than Hong Kong (HK)) = $3,749 − $3,123 = $626

2. Risk Estimation

2.4 Rationale Behind Our Definition of Risk

- Estimated profit difference between the two ordering policies – a measure of ordering policy risk
  - Profit affected by production order (constrained by minimum order)
- China's larger minimum order quantity than Hong Kong
  - When sourcing in China, we may not able to commit to the optimal order quantity – risk of losing profit
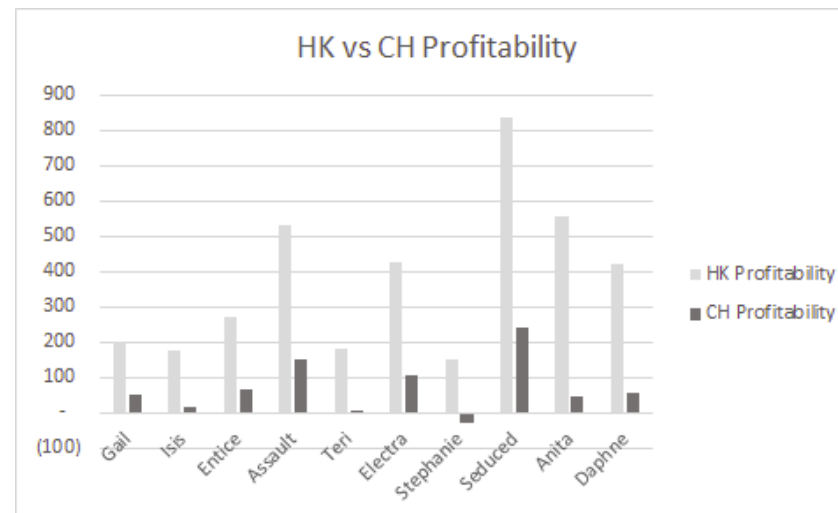
3. Operational Changes

3.1 Research and Forecasting

- Create a market research division
  - Perform market study and analysis to reduce speculation
  - Reach out to consumers directly to gather feedback early before Las Vegas Show
  - Make recommendations to the Buying Committee

- Providing earlier forecasts allow more time to translate orders into component requirements

- Utilize historical data in forecasting

- Eliminate unpopular styles to reduce complexity

- Use Las Vegas Show to confirm market analysis

3. Operational Changes

3.2 Production and Distribution

- Renegotiate lead times and analyze alternative suppliers
  - Identify high volume suppliers who can better meet demands
  - Use this leverage to reduce lead time requirements

- Establish a distribution center and warehouse in the Seattle area
  - Eliminate the 6-week transport time to Denver warehouse

Arrival of Garments	Transport to Warehouse	Deliver to Retailers
• Via ship to Seattle port	• 6-weeks from Seattle to Denver	• Various across country

4. Sourcing Policy

4.1 Comparison

Hong Kong	Mainland China
Positive: • Higher skill workers • Good quality control • Better production efficiency • Better flexibility	Positive: • Lower labor cost • Lower production cost
Negative: • Higher labor cost • Higher production cost	Negative: • Lack of training/experience • Poor quality control • Quota restrictions

4. Sourcing Policy

4.2 Short Term

- Prioritize quality over cost in the short term

- All of mainland China's positives relate to cost

- Overall, Hong Kong has more positives compared to mainland China
  - Better quality
  - Higher skilled workers
  - Higher efficiency

- Also, forecasting is currently unreliable, so it is best to focus sourcing from Hong Kong as they are more flexible.

4. Sourcing Policy

4.3 Long Term

- Mainland China has ability to improve in several areas over the long term
  - Heavily push training
  - Bring senior Hong Kong management to mainland China to train
  - Experience will come over time, thus improving quality
- Gradually shift sourcing to mainland China as these areas are improved.
- If training and quality can be improved to Hong Kong levels, then mainland China would be able to provide both good quality and low cost. That is long term goal.

Thank You!

Culverhouse
College of Business

Information Systems, Statistics and
Management Science

THE UNIVERSITY OF ALABAMA®

Information Systems, Statistics, and Management
Science
Culverhouse College of Business
The University of Alabama
Joseph Paul: jdpaul2@crimson.ua.edu
Tyler Reid: threid@crimson.ua.edu
Manfei Xie: mxie12@crimson.ua.edu