“CERVEJAS AMERICANAS”

Distributing Beer in Brazil

MIT Center for Transportation Studies
Cambridge, MA
&
Amaxon Beer Company
Miami, FL

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Overview

- Brazil is an attractive strategic market
- Major demand centers:
  - Sao Paolo
  - Rio De Janeiro
  - Belo Horizonte
  - Brasilia
- Objective: to design a flexible and cost-effective distribution network
Current Network

Demand Trend

Using DeNeufville Trading Company

Past Demand
Low Demand Forecast
High Demand Forecast
Recommendations

Build a central warehouse in Sao Paolo with expansion capability

Decision Factors

- Central warehouse vs. regional distribution centers
  - Transportation
  - Service level
- Regular warehouse vs. expandable warehouse
  - Initial investment
  - Expansion cost
Strategic Planning Methodology

- Outline choices
- Develop cost model
- Perform NPV analysis
- Decision analysis
- Sensitivity analysis
- Option valuation
- Risk analysis

Choice A: Using Trading Company

DeNeufville Trading Company

Brasilia
Belo Horizonte
Sao Paolo
Rio de Janeiro
Choice B: Central Warehouse
C: Expandable Central Warehouse

Choice D: Regional DCs
E: Expandable Regional DCs

Less Than Truckload
Full Truckload
Cost Model

- Cost Structure
  - Factory wholesale cost: US $4/case
  - Transportation costs:
    - Ocean freight
    - Land (TL/LTL) freight
    - Import tariffs
  - Warehouse costs
    - Fixed costs: real estate, equipment, tax
    - Variable costs: labor, throughput, utilities

NPV Analysis

- Timeline
  - Estimated project life - 10 years [1999-2009]
  - Initial decision for 5 years [1999-2004]
  - Decision Re-evaluated at 2004
- Price: $10 / case
- Discount rate: 10% (determined by Amaxon)
Decision Tree

Given a Demand Scenario

1 Warehouse w/exp

- High Growth
- Low Growth
- Expand Warehouse
- Shift to 4 Warehouses
- Maintain Warehouse
- Use Trading Company

Brazil

4 Warehouses w/exp

1 Warehouse w/exp

4 Warehouses

1 Warehouse

No Warehouses

In 1999

In 2004

Sensitivity Analysis - 1

Varying Price and Discount Rate

<table>
<thead>
<tr>
<th>Discount Rate</th>
<th>Unit Selling Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$9</td>
</tr>
<tr>
<td>10%</td>
<td>Central warehouse*</td>
</tr>
<tr>
<td></td>
<td>($1.7M)</td>
</tr>
<tr>
<td>15%</td>
<td>Central warehouse</td>
</tr>
<tr>
<td></td>
<td>($0.8M)</td>
</tr>
<tr>
<td>20%</td>
<td>Trading Company</td>
</tr>
<tr>
<td></td>
<td>(0.4M)</td>
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</table>

Central Warehouse*: single central warehouse with built-in expansion capabilities
Sensitivity Analysis - 2

Impact of Discount Rate

Impact of the Cost of Expansion Capability

Option Valuation

- Build in capability now with small extra investment to expand cheaply later
  - Similar to a buy option
  - Introduces flexibility
  - Accommodates growth
- Value of the option: $104,531
Risk Analysis

Probability Distribution at 1 Warehouse

Distribution Statistics
Mean: $2,917K
Std Dev: $1,264K
Min ~ Max: $751K ~ $3,912K

Probability Distribution at 1 Warehouses w/exp

Distribution Statistics
Mean: $3,022K
Std Dev: $1,615K
Min ~ Max: $163K ~ $4,255K

Conclusion

- Central warehouse with built-in expansion capacity
  - Maximum EV of $3.0 million
  - Value of the expansion option is $104K
  - Riskier approach (larger variance and lower minimum return)

- Sensitivity analysis shows that as discount rate increases (>14%), the regular central warehouse becomes the better choice.
### Appendix A: Cost Function

#### NPV CASH FLOW ANALYSIS FOR ONE WAREHOUSE (no built-in expansion capability)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Values</th>
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<tbody>
<tr>
<td>Discount rate</td>
<td>10%</td>
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<tr>
<td>Initial demand rate</td>
<td>20,000</td>
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<tr>
<td>High growth rate</td>
<td>60,000</td>
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<tr>
<td>Low growth rate</td>
<td>20,000</td>
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<tr>
<td>Maximum capacity</td>
<td>300,000</td>
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<td>Number of warehouses</td>
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<tr>
<td>Volume/plant</td>
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<tr>
<td>Price per unit</td>
<td>$10</td>
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<tr>
<td>Capital investment</td>
<td>$1,500,000</td>
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<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<tbody>
<tr>
<td>Demand (cases/yr.)</td>
<td>20,000</td>
<td>80,000</td>
<td>140,000</td>
<td>200,000</td>
<td>260,000</td>
<td>320,000</td>
<td>380,000</td>
<td>440,000</td>
<td>500,000</td>
<td>560,000</td>
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<tr>
<td>Number of warehouses</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Volume/plant (demand/ no. of plants)</td>
<td>20,000</td>
<td>80,000</td>
<td>140,000</td>
<td>200,000</td>
<td>260,000</td>
<td>160,000</td>
<td>190,000</td>
<td>220,000</td>
<td>250,000</td>
<td>280,000</td>
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<tr>
<td>Price per unit</td>
<td>$10</td>
<td>$10</td>
<td>$10</td>
<td>$10</td>
<td>$10</td>
<td>$10</td>
<td>$10</td>
<td>$10</td>
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<tr>
<td>Total revenue</td>
<td>200,000</td>
<td>800,000</td>
<td>1,400,000</td>
<td>2,000,000</td>
<td>2,600,000</td>
<td>3,200,000</td>
<td>3,800,000</td>
<td>4,400,000</td>
<td>5,000,000</td>
<td>5,600,000</td>
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<tr>
<td>Throughput cost</td>
<td>$4,000</td>
<td>$16,000</td>
<td>$28,000</td>
<td>$40,000</td>
<td>$52,000</td>
<td>$64,000</td>
<td>$76,000</td>
<td>$88,000</td>
<td>$100,000</td>
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<tr>
<td>Ocean transportation cost</td>
<td>$49,789</td>
<td>$198,858</td>
<td>$345,224</td>
<td>$494,294</td>
<td>$643,364</td>
<td>$792,433</td>
<td>$841,222</td>
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<tr>
<td>Land transportation cost</td>
<td>$6,942</td>
<td>$27,768</td>
<td>$48,594</td>
<td>$69,420</td>
<td>$90,246</td>
<td>$111,072</td>
<td>$131,898</td>
<td>$152,724</td>
<td>$173,550</td>
<td>$194,376</td>
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<tr>
<td>Total cost</td>
<td>$140,731</td>
<td>$562,626</td>
<td>$981,818</td>
<td>$1,403,714</td>
<td>$1,825,610</td>
<td>$2,247,505</td>
<td>$2,569,120</td>
<td>$2,841,946</td>
<td>$3,114,772</td>
<td>$3,387,598</td>
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<tr>
<td>Total profit</td>
<td>$59,269</td>
<td>$237,374</td>
<td>$418,182</td>
<td>$596,286</td>
<td>$774,390</td>
<td>$952,495</td>
<td>$1,230,880</td>
<td>$1,558,054</td>
<td>$1,885,228</td>
<td>$2,212,402</td>
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<tr>
<td>Capital investment</td>
<td>$1,500,000</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Net cash flow (total profit-investment)</td>
<td>$(1,500,000)</td>
<td>$59,269</td>
<td>$237,374</td>
<td>$418,182</td>
<td>$596,286</td>
<td>$(725,610)</td>
<td>$952,495</td>
<td>$1,230,880</td>
<td>$1,558,054</td>
<td>$1,885,228</td>
</tr>
<tr>
<td>Present value of cash flow (1,500,000)</td>
<td>$53,881</td>
<td>$196,177</td>
<td>$314,186</td>
<td>$407,271</td>
<td>$490,342</td>
<td>$573,406</td>
<td>$651,660</td>
<td>$726,844</td>
<td>$799,514</td>
<td>$852,057</td>
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<tr>
<td>Total NPV over 10 years</td>
<td>$2,569,605</td>
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