APEC 8002 Recitation

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Today's Agenda

1. Housekeeping
2. Duality of Cost, Revenue & Profit Functions
3. Exam I
4. Questions
5. Additional Support Resources

Housekeeping

- Problem set 2 due 11/12/20 11:59PM CST
- Problem set 3 due 11/19/20 11:59PM CST
- Exam I review on 11/19/20
- Exam I on 11/24/20
- Last day of **in-person** classes on 11/25/20

Duality of Cost, Revenue & Profit Functions

- Given **PPS**, derive $D_I(\mathbf{q}, \mathbf{z})$ or $D_O(\mathbf{q}, \mathbf{z})$*

$$D_I(\mathbf{q}, \mathbf{z}) = \max_{\delta} \left\{ \delta > 0 : \left(\mathbf{q}, -\frac{\mathbf{z}}{\delta} \right) \in \mathbf{PPS} \right\}$$
$$D_O(\mathbf{q}, \mathbf{z}) = \min_{\delta} \left\{ \delta > 0 : \left(\frac{\mathbf{q}}{\delta}, -\mathbf{z} \right) \in \mathbf{PPS} \right\}$$

- Given $\mathbf{IRS}(\mathbf{q})$, derive $D_I(\mathbf{q}, \mathbf{z})$*

$$D_I(\mathbf{q}, \mathbf{z}) = \max_{\delta} \left\{ \delta > 0 | \frac{\mathbf{z}}{\delta} \in \mathbf{ISQ}(\mathbf{q}) \right\}$$

- Given $\mathbf{FOS}(\mathbf{z})$, derive $D_O(\mathbf{q}, \mathbf{z})$*

$$D_O(\mathbf{q}, \mathbf{z}) = \min_{\delta} \left\{ \delta > 0 | \frac{\mathbf{q}}{\delta} \in \mathbf{FOS}(\mathbf{z}) \right\}$$

Duality of Cost, Revenue & Profit Functions

- Given $D_I(\mathbf{q}, \mathbf{z})$ or $D_O(\mathbf{q}, \mathbf{z})$, derive **PPS**

$$\mathbf{PPS} = \{(\mathbf{q}, -\mathbf{z}) : D_I(\mathbf{q}, \mathbf{z}) \geq 1\}$$
$$\mathbf{PPS} = \{(\mathbf{q}, -\mathbf{z}) : D_O(\mathbf{q}, \mathbf{z}) \leq 1\}$$

- Given $\mathbf{IRS}(\mathbf{q})$, derive $\mathbf{Z}(\mathbf{r}, \mathbf{q})$

$$\mathbf{Z}(\mathbf{r}, \mathbf{q}) = \{\mathbf{z} \in \mathbf{IRS}(\mathbf{q}) : \mathbf{r} \cdot \mathbf{z'} \geq \mathbf{r} \cdot \mathbf{z} \textit{ for all } \mathbf{z'} \in \mathbf{IRS}(\mathbf{q})\}$$

- Given $\mathbf{FOS}(\mathbf{z})$, derive $\mathbf{Q}(\mathbf{p}, \mathbf{z})$

$$\mathbf{Q}(\mathbf{p}, \mathbf{z}) = \{\mathbf{q} \in \mathbf{FOS}(\mathbf{z}) : \mathbf{p} \cdot \mathbf{q'} \leq \mathbf{p} \cdot \mathbf{q} \textit{ for all } \mathbf{q'} \in \mathbf{FOS}(\mathbf{z})\}$$

Duality of Cost, Revenue & Profit Functions

- Given $D_I(\mathbf{q}, \mathbf{z})$, derive $\mathbf{Z}(\mathbf{r}, \mathbf{q})$*

$$\mathbf{Z}(\mathbf{r}, \mathbf{q}) = \min_{\mathbf{z} \geq \mathbf{0}} \ \mathbf{r} \cdot \mathbf{z} \ \textit{subject to} \ D_I(\mathbf{q}, \mathbf{z}) \geq 1$$

- Given $D_O(\mathbf{q}, \mathbf{z})$, derive $\mathbf{Q}(\mathbf{p}, \mathbf{z})$*

$$\mathbf{Q}(\mathbf{p}, \mathbf{z}) = \max_{\mathbf{q} \geq \mathbf{0}} \ \mathbf{p} \cdot \mathbf{q} \ \textit{subject to} \ D_O(\mathbf{q}, \mathbf{z}) \leq 1$$

- Given $\mathbf{Z}(\mathbf{r}, \mathbf{q})$, derive $C(\mathbf{r}, \mathbf{q})$*

$$C(\mathbf{r}, \mathbf{q}) = \mathbf{r} \cdot \mathbf{z}(\mathbf{r}, \mathbf{q})$$

- Given $\mathbf{Q}(\mathbf{p}, \mathbf{z})$, derive $R(\mathbf{p}, \mathbf{z})$*

$$R(\mathbf{p}, \mathbf{z}) = \mathbf{p} \cdot \mathbf{q}(\mathbf{p}, \mathbf{z})$$

Duality of Cost, Revenue & Profit Functions

- Given $C(\mathbf{r},\mathbf{q})$, derive $\mathbf{Z}(\mathbf{r},\mathbf{q})$*

$$\mathbf{Z}(\mathbf{r},\mathbf{q}) = \nabla_r C(\mathbf{r},\mathbf{q})$$

- Given $R(\mathbf{p},\mathbf{z})$, derive $\mathbf{Q}(\mathbf{p},\mathbf{z})$*

$$\mathbf{Q}(\mathbf{p},\mathbf{z}) = \nabla_p R(\mathbf{p},\mathbf{z})$$

- Given $C(\mathbf{r},\mathbf{q})$, derive $D_I(\mathbf{q},\mathbf{z})$

$$D_I(\mathbf{q},\mathbf{z}) = \min_{\mathbf{r}>\mathbf{0}} \ \mathbf{r}\cdot\mathbf{z} \ \textit{subject to} \ C(\mathbf{r},\mathbf{q}) \geq 1$$

- Given $R(\mathbf{p},\mathbf{z})$, derive $D_O(\mathbf{q},\mathbf{z})$

$$D_O(\mathbf{q},\mathbf{z}) = \max_{\mathbf{p}>\mathbf{0}} \ \mathbf{p}\cdot\mathbf{q} \ \textit{subject to} \ R(\mathbf{p},\mathbf{z}) \leq 1$$

Duality of Cost, Revenue & Profit Functions

- Given $\pi(\mathbf{p}, \mathbf{r})$, derive $\mathbf{Z}(\mathbf{p}, \mathbf{r})$ or $\mathbf{Q}(\mathbf{p}, \mathbf{r})$*

$$\mathbf{Z}(\mathbf{p}, \mathbf{r}) = -\nabla_r \pi(\mathbf{p}, \mathbf{r})$$
$$\mathbf{Q}(\mathbf{p}, \mathbf{r}) = \nabla_p \pi(\mathbf{p}, \mathbf{r})$$

- Given $C(\mathbf{r}, \mathbf{q})$, derive $\mathbf{Q}(\mathbf{p}, \mathbf{r})$*

$$\mathbf{Q}(\mathbf{p}, \mathbf{r}) = \max_{\mathbf{q} \geq \mathbf{0}} \; \mathbf{p} \cdot \mathbf{q} - C(\mathbf{r}, \mathbf{q})$$

- Given $R(\mathbf{p}, \mathbf{z})$, derive $\mathbf{Z}(\mathbf{p}, \mathbf{r})$*

$$\mathbf{Z}(\mathbf{p}, \mathbf{r}) = \max_{\mathbf{z} \geq \mathbf{0}} \; \mathbf{r} \cdot \mathbf{z} - R(\mathbf{p}, \mathbf{z})$$

Duality of Cost, Revenue & Profit Functions

- Given $\mathbf{Z}(\mathbf{r},\mathbf{q})$, derive $\mathbf{Z}(\mathbf{p},\mathbf{r})$*

$$\mathbf{Z}(\mathbf{p},\mathbf{r}) = \mathbf{Z}(\mathbf{r},\mathbf{q}(\mathbf{p},\mathbf{r}))$$

- Given $\mathbf{Q}(\mathbf{p},\mathbf{z})$, derive $\mathbf{Q}(\mathbf{p},\mathbf{r})$*

$$\mathbf{Q}(\mathbf{p},\mathbf{r}) = \mathbf{Q}(\mathbf{p},\mathbf{z}(\mathbf{p},\mathbf{r}))$$

- Given $\mathbf{Z}(\mathbf{p},\mathbf{r})$ & $\mathbf{Q}(\mathbf{p},\mathbf{r})$, derive $\pi(\mathbf{p},\mathbf{r})$*

$$\pi(\mathbf{p},\mathbf{r}) = \mathbf{p}\cdot\mathbf{q}(\mathbf{p},\mathbf{r}) - \mathbf{r}\cdot\mathbf{z}(\mathbf{p},\mathbf{r})$$

Exam I

- First exam is on Tuesday, November 24th
- Covers topics from Modules 1 & 2
- Review past exams posted on Canvas
- Recitation review requests?

Questions?

Any remaining questions?

Additional Support Resources

- Boynton Mental Health Services
- Student Counseling Services
- Let's Talk
- Educational Workshops
- Academic Skills Coaching