Official Cheat Sheet for Midterm Exam

Econ 101 Winter 2012

Present Value

PV= $\frac{FV_1}{(1+i)^1} + \frac{FV_2}{(1+i)^2} + \ldots + \frac{FV_n}{(1+i)^n}$ **NPV**= $\frac{FV_1}{(1+i)^1} + \frac{FV_2}{(1+i)^2} + \ldots + \frac{FV_n}{(1+i)^n} - C$

$PV_{perpetuity} = \frac{CF}{i}$

Elasticity $E_{Q,y} = \frac{\partial \ln Q}{\partial \ln y} = \frac{\partial Q}{\partial y}\frac{y}{Q} \approx \frac{\%\Delta Q}{\%\Delta y}$

Own-Price elasticity of demand ➔ $E_{QxPx} = (\%\Delta Q_x) / (\%\Delta P_x)$

Cross-Price Elast. $E_{QxPy} = \frac{\%\Delta Q_x}{\%\Delta P_y}$ ➔ $\frac{\partial Q_x}{\partial P_y} \times \frac{P_y}{Q_x}$

Income-Price Elasticity: $E_{QxPy} = \frac{\%\Delta Q_x}{\%\Delta M}$ ➔ $\frac{\partial Q_x}{\partial M} \times \frac{M}{Q_x}$

Impact of price change on total revenue:

$\Delta R = [R_x(1+ E_{QxPx})+ R_y E_{QyPx}]+ \%\Delta P_x$

$MR = P\times [\frac{1+E}{E}]$ when MR > zero ➔ Elastic

MR < zero ➔ Inelastic

MR = zero ➔ Unit elastic

Log-linear Demand function: $\ln D_x = a + b \ln P_x + c \ln P_y + d \ln I$

Production Process and Costs

Production Function: Q = F(K,L)

Marginal Product of Labor: $MP = \partial Q/\partial L$

Average Product of Labor: APL = Q/L

Cost Function: C(Q) = VC + FC

Avg Cost: AC = C(Q)/Q= AVC + AFC

Marginal Cost (≈ Incremental Cost): $MC = \partial C/\partial Q \approx \Delta C/\Delta Q$

Economies of Scope: $C(Q_1,Q_2) < C(Q_1, 0) + C(0, Q_2)$

Cost Complementarity: $\partial MC_1 / \partial Q_2 < 0$.

Learning Curve: AC = $a - b \ln A$, where A=accumul.output

Economies of Scale: $\partial AC / \partial Q < 0$.

Nature of Industry

Four-Firm Conc Ratio: $FFI = C_4 = w_1 + w_2 + w_3 + w_4$

Where $w_i= S_i/ S_T$, S_T=total industry sales, S_i=firm i sales.

When C_4 close to 0 ➔ less concentrated industry

When C_4 close to 1 ➔ more concentrated industry

HHI = $10{,}000 \times \Sigma w_i^2$ US DoJ can block merger HHI>1800

Rothschild Index: $R = E_T / E_F$, where ET= Elst.of Demand in Tot.Market, E_F = Elast.of Demand for Product of a Firm

R close to 1 ➔monopoly; R close to 0 ➔ perf.compet.

Lerner Index: $L = \frac{(P - MC)}{P}$ and $\mathbf{P} = (\frac{1}{1-L}) \times MC$

Markup Factor = (1)/(1 – L) *or*

Simple Markup Rule P = [E/(1+ E)] × MC

Perfect Competition

Many buyers/sellers + Homogeneous products

Max profits when MC = MR = P

Decisions: **SR** if Loss < FC ➔ continue operate

if P < min AVC ➔ shutdown

if P ≥ min AVC ➔ continue operate

LR: P=MC or P=min AC ➔ zero econ. Profits

Monopoly

Single firm in the market ➔has Price power. Can be due to Ec. Of scale or Ec. Of scope (maybe complementarity) or Learning curve (natural) or government rules (unnatural).

Max profits MR = MC *where* $MR = P \times (\frac{1+E}{E})$

or TR= P×Q for P=a+Bq ➔ TR=aQ + bQ² ➔ MR=a + 2bQ

Multi-plant monopoly: *where* $Q = Q_1 + Q_2$

$MR(Q_1 + Q_2) = MC_1(Q_1)$

$MR(Q_1 + Q_2) = MC_2(Q_2)$

$\Pi = R(Q_1 + Q_2) - C_1(Q_1) - C_2(Q_2)$

Monopolistic Competition

Many buyers/sellers with differentiated products

Free entry/exit ➔ in LR zero econ.profit

Max Profits MR = MC

In LR: P>MC *and* P = ATC > min.average costs.

Optimal Ad budget $\frac{A}{R} = \frac{E_{Q,A}}{-E_{Q,P}}$ or $\frac{A}{R} = \frac{(P-MC)}{P} \times E_{Q,A}$

Oligopoly

Few large firms

Product can be Differentiated or Homogeneous

1) Sweezy Model for differentiated products

Firm believes: Rivals <u>will match Price Reduction</u>

Rivals will **not** match Price Increase

Max Profit MR = MC

2) Cournot Model

Firms choose output simultaneously.

Given linear (inverse) demand: $P=a-b(Q_1+Q_2)$

And constant MC w/zero FC: $C_1(Q_1)=c_1Q_1$ and $C_2(Q_2)=c_2Q_2$,

Reaction function (Cournot) is: $Q_1=r_1(Q_2)=(a-c_1)/2b - Q_2/2$

since $\Pi_1(Q_1,Q_2)$ = TR-C➔ $\Pi_1=(P- c_1)Q_1=[a-c_1-b(Q_1+Q_2)]Q_1$

➔ FOC: $0= \partial \Pi_1 /\partial Q_1=a-c_1-b(2Q_1+Q_2)]=0$ ➔

$Q_1= r(Q_2)= (a-c_1)/2b - Q_2/2$

3) Stackelberg Model Firms Set Output Sequentially

Leader set output ➔ Leader chooses: $Q_1 = (a+c_2-2c_1)/2b$

Because followers will react as in Cournot $Q_2=r_2(Q_1)$ $= (a-c_2)/2b-Q_1/2$, so Leader's profit function is

$\Pi= \{a-b[Q_1+((a-c_2)/2b-Q_1/2))]\} Q_1-c_1Q_1$

4) Bertrand Model w/Homogeneous goods

MC is constant

Each firm set its price ➔ $P_1 = P_2 = MC$ so Ec.Profit = zero

Bertrand Model w/Differentiated goods P > MC

5) Contestable markets ➔ price is driven down to the second lowest AC, due to free entry.

Game Theory

1) Look for dominant strategies
2) Put yourself in your rival's shoes
3) At Nash Eq., every player is best responding to the other players.

Nash Eq.=a strategy profile in which no player can improve her payoff by unilaterally changing her own strategy, given the other players' strategies.