ECON 701 · WEST VIRGINIA UNIVERSITY · FALL 2026

Advanced Microeconomics I

Course overview: the neoclassical core, extensions, and social context: toward a broader synthesis

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Based on The Calculus of Commerce: An Introduction to Advanced Microeconomics

Rational choice under scarcity: one method, many settings

THE TEMPLATE EVERY CHAPTER REUSES

1 · Choose x to maximize net benefit, given scarce means z

$$N = B(x, z) - C(x, z) \quad \text{or} \quad \max u(x) \ \text{ s.t. } W = \Sigma_i P_i x_i$$

2 · First-order condition: marginal benefit = marginal cost

$$N_x = B_x - C_x = 0 \equiv H(x^*, z)$$

3 · Implicit function theorem: behavior and comparative statics

$$x^* = f(z), \qquad dx^*/dz = -H_z / H_x$$

4 · Aggregation and market clearing

$$\Sigma_i d_i(P, z) = \Sigma_j s_j(P, z) \Rightarrow P^* = p(z)$$

SCARCITY AND RATIONALITY

- **Scarcity** enters as constraints: budgets, time, technology, and the opportunity cost of what is given up.
- **Rationality** is internally consistent choice: if A is preferred to B and B to C, then A is preferred to C.
- **Methodological individualism:** firms, markets and governments are analyzed as consequences of the choices of individuals.
- **Imperfect but useful:** lean models omit much, yet clarify fundamental relationships.
- The same toolkit serves consumers, firms, entrepreneurs, thieves, rulers, voters and conscientious workers.

From a lean core toward a broader synthesis

THREE PARTS AND A SYNTHESIS

Part I · Ch. 2–5
Market equilibria and comparative statics: demand, supply, production and prices

↓

Part II · Ch. 6–9, 13
Time, risk, ignorance, innovation, information and strategy

↓

Part III · Ch. 14–16, 18
Social, legal and political underpinnings of markets: law, politics, ethics and welfare

↓

Synthesis · Ch. 19
Markets embedded in law, politics and norms: the extent of commerce explained

HOW THE PARTS FIT TOGETHER

- **Part I** builds the neoclassical core: optimizing agents, known objectives and constraints, certainty and full information.
- **Part II** relaxes the informational assumptions, takes account of risk, uncertainty, innovation, the nature of products, and strategic interaction.
- **Part III** relaxes the assumption that all conduct is voluntary, honest and law-abiding, and treats law, politics and norms as both choice influencing and also objects of choice.
- Each extension adds arguments to familiar demand, supply and price functions rather than discarding them.

Neoclassical price theory and the marginal revolution

FROM MERCHANTS' RULES OF THUMB TO A CALCULUS OF PRICES

Who	Contribution
Aristotle	"Fair" prices; monopoly pricing (the olive presses)
Smith (1776)	Long-run prices from costs; competition as an invisible hand
Bentham, Mill	Utility behind demand, but the water–diamond paradox
Jevons, Menger, Walras (1871–74)	Diminishing marginal utility; Walrasian general equilibrium
Marshall (1890)	Textbook consolidation of demand and supply
Twentieth century	The neoclassical synthesis, still being refined

HOW PART I PROCEEDS

- Ch. 2 demand, Ch. 3 supply, Ch. 4 production, then Ch. 5 equilibrium prices; mostly partial equilibrium.
- The analysis of each chapter proceeds from: geometry → concrete functions → abstract families and increasingly general results.
- **Core assumptions:** agents know their objectives and constraints; choices are made under certainty with (locally) full information.
- **Payoff:** equilibrium prices exist and share marginal properties: $P^* = MB = MC$ for price takers, $MR = MC < P$ for price makers
- Market prices, in turn, coordinate individual decisions, because they are common factors in nearly all market relevant choices .

Time, risk, ignorance and strategy extend the core

WHAT EACH CHAPTER ADDS TO THE CORE MODEL

Ch. 6 · Time: benefits and costs become present values

$$PV = \Sigma_t F_t / (1 + r)^t$$

Ch. 7 · Risk: choices maximize expected utility

$$E(U) = \Sigma_i P_i U(V_i)$$

Ch. 8 · Ignorance: subjective bets on novel projects

$$\text{invest if } F\Pi / I > 1 + r$$

Ch. 9 · Information: search until marginal benefit = marginal cost

$$-p_S Q^* = c_S$$

Ch. 13 · Strategy: best replies to rivals' choices

$$Q_A^* = 475 - 0.5 Q_B$$

WHY EXTEND THE CORE?

- In the core no one errs, agency problems never arise, and nothing new is produced — In order to focus on markets for familiar products.
- Adding time and imperfect information explains how and why products are introduced, refined and abandoned.
- Stigler (1961): limited knowledge explains why prices of similar goods differ and the dispersion of those prices.
- Risk increases the demand for income smoothing and insurance but it does not cause it; rather, diminishing marginal utility does.

The “other things equal” conditions become variables

WHAT THE CORE ASSUMES, AND WHAT PART III ASKS

Chapter	The core assumes	Part III asks
14 · Law	Voluntary exchange, enforced contracts, little crime	How do theft, fraud and enforcement shape markets?
15 · Politics	Policies given from outside	Who chooses laws and services, and why?
16 · Ethics	Honest, diligent conduct	How do internalized norms expand commerce?
17 · Organization	Firms as nodes in a network of contracts	Does internal organization matter? (not covered)
18 · Welfare	Outcomes are not judged	Are markets “good” institutions?

THE SOCIAL CONTEXT OF MARKETS

- Parts I and II neglect the social context of markets through various ceteris paribus assumptions.
- Part III relaxes the assumption that market conduct is always voluntary and honest.
- Rational choice is applied to non-market settings: thieves, rulers, voters, officials and workers within firms.
- Arrow, Hayek, and Buchanan: internalized norms affect choices, conduct and prices and thereby the extent of markets.

A broader synthesis: new arguments in familiar functions

THE CORE FUNCTIONS, EXTENDED IN PART III

Consumer demand with theft risk F_C (14.16)

$$Q_1^* = b(P_1, P_2, W, F_C), \quad \partial Q_1^*/\partial F_C < 0$$

Supply with theft risk F_F (14.10–14.13)

$$Q^* = s(P, w, F_F), \quad \partial Q^*/\partial F_F < 0$$

Crime responds to enforcement G and legal wages w^0 (14.7, 15.7)

$$N^* = n(w^0, G), \quad F_C = f(G)$$

Enforcement chosen by the median voter (15.15)

$$G^* = g(W_{med}, P_1, P_2)$$

Internalized norms shift demand (16.19)

$$Q_1^* = q_1(P_1, P_2, Q_1^V)$$

Hence, schematically

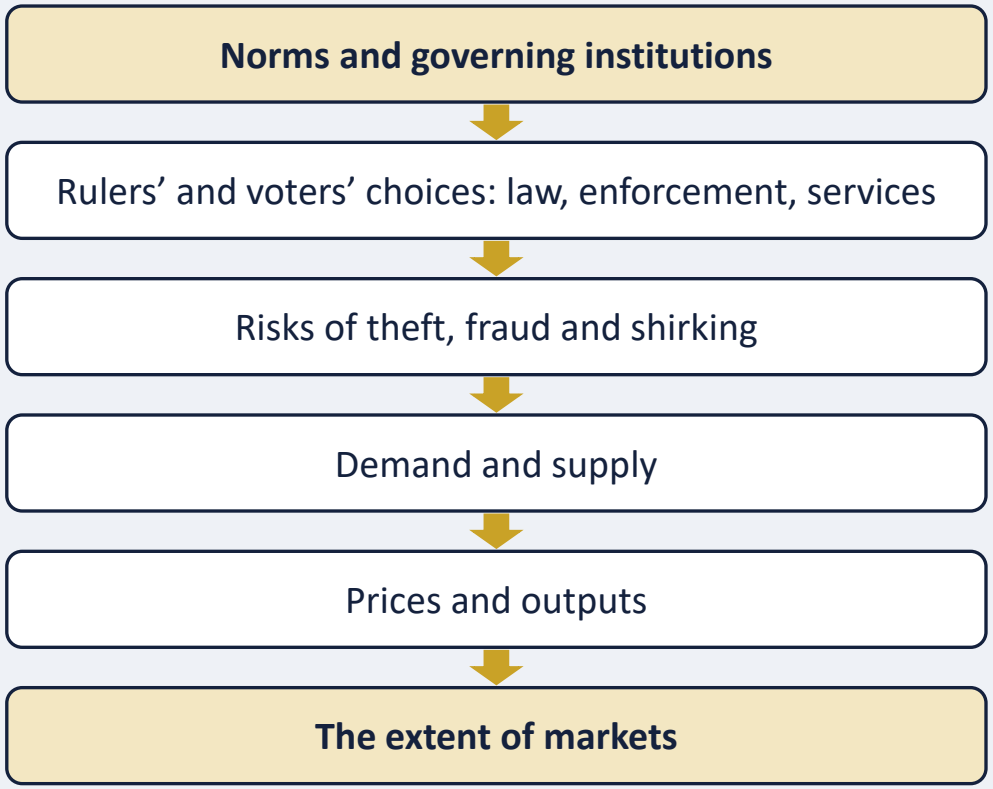
$$P^* = p(Y, w, r, T;\ F_C, F_F, G, \mathcal{G})$$

ENDOGENIZING THE SHIFT VARIABLES

- Part III does not replace the core; it adds and explains neglected shift variables.
- Law and enforcement reduce F_C and F_F, shifting demand and supply outward: output rises, prices fall.
- Politics determines G and other policies through rulers' or pivotal voters' choices, and both taxes and government services affect the choices of firms and consumers.
- Ethics (guilt $\mathcal{G}$, virtue V) changes payoffs and is a prerequisite for honest law enforcement.
- Welfare economics (Ch. 18) asks which arrangements are better.

The extent of markets is an equilibrium outcome

THE CAUSAL CHAIN IN PART III



WHY IT MATTERS

- Without law, half of potential output is reduced when a risk of theft exists (Ch. 14).
- A stationary bandit gains by limiting theft; democracies supply the services median voters want (Ch. 15).
- Work ethics, honesty and dutiful officials solve dilemmas law alone cannot (Ch. 16).
- Each link is a rational choice under scarcity: the scope of commerce is explained, not assumed.

Prosperity depends on prices and on the laws, policies and norms that make exchange safer.

On the usefulness of imperfect models

APPENDIX I: AXIOMATIC CHOICE

Transitivity

$$aRb \text{ and } bRc \Rightarrow aRc$$

Indifference and strict preference

$$aRc \text{ and } cRa \Rightarrow aIc$$

$$aRb \text{ and not } bRa \Rightarrow aPb$$

Utility representation

$$aPb \Rightarrow U(a) > U(b); \quad aIc \Rightarrow U(a) = U(c)$$

Convex sets

$$(1 - d)X_1 + dX_2 \in \text{set}, \quad 0 < d < 1$$

Consistent choices can be modeled as if they maximize utility (Samuelson's revealed preference).

MODELS, SCIENCE AND INDIVIDUALS

- Models are useful when they clarify fundamental relationships; imperfect fit alone is not grounds for rejection.
- Simple causal models work within their scope (falling objects) but not for volition (birds).
- Several models can fit the same facts; anomalies drive refinement. Scientific truths are "relatively absolute absolutes."
- **Methodological individualism:** social outcomes are consequences of individual choices.

Net-benefit maximization and the demand curve

KEY EQUATIONS (2.7–2.15B)

Exponential benefits, $B = aQ^b$, $0 < b < 1$

$$N = aQ^b - PQ$$

$$dN/dQ = abQ^{b-1} - P = 0$$

$$Q^* = (P/ab)^{1/(b-1)}$$

Any strictly concave benefit function b(Q)

$$N = b(Q) - PQ \;\Rightarrow\; B_Q - P = 0 \;\equiv\; H$$

$$Q^* = f(P), \quad dQ^*/dP = -H_P / H_Q = 1/B_{QQ} < 0$$

In logs, $\log Q^* = [1/(b-1)]\cdot\log(P/ab)$: demand can be estimated by linear regression.

WHAT THE MODEL SHOWS

- A rational consumer buys until marginal benefit equals price: MB = MC.
- The demand curve is the MB curve traced over prices.
- Strict concavity (diminishing marginal benefit) makes demand slope downward for every total benefit function that is a member of that family, not just one or two examples.
- Geometry → concrete functions → abstract families: the pattern of every Part I chapter.

Utility maximization with a budget constraint

KEY EQUATIONS (2.16–2.24)

Multiplicative-exponential utility, budget $W = P_X X + P_Y Y$

$$\mathcal{L} = aX^bY^c + \lambda[W - P_X X - P_Y Y]$$

$$bY / cX = P_X / P_Y$$

$$X^* = [b/(b + c)]\cdot W/P_X, \quad Y^* = [c/(b + c)]\cdot W/P_Y$$

Abstract two-good utility (substitution method)

$$U = u(X, (W - P_X X)/P_Y)$$

$$H \equiv U_X - U_Y(P_X/P_Y) = 0 \text{ at } X^*$$

$$X^* = f(P_X, P_Y, W), \quad dX^*/dP_X = -(\partial H/\partial P_X) / (\partial H/\partial X)$$

$dX^*/dP_X < 0$ when $U_{XX} < 0$, $U_{YY} < 0$ and $U_{XY} \geq 0$.

WHAT THE MODEL SHOWS

- Tangency: the marginal rate of substitution equals the price ratio.
- Exponential utility: constant expenditure shares, demand for X independent of P_Y, all goods normal.
- Abstract Utility Functions: The implicit function theorem allows first order contitions to be used to characterize demand without even when the FOCs cannot be solved for Q*.
- Substitutes (negative cross partials) can in principle bend demand upward, but this is very rarely observed.
- Market demand $Q^d = \Sigma_i Q_i(P, \ldots)$ inherits the downward slope of individual demand curves.

Supply by price-taking firms

KEY EQUATIONS (3.1–3.14, 3.25)

Exponential costs, $C = a + bQ^c$, $c > 1$

$$\Pi = PQ - (a + bQ^c)$$

$$P - bcQ^{c-1} = 0 \quad \Rightarrow \quad Q^* = (P/bc)^{1/(c-1)}$$

General costs $C = c(Q, w, r)$

$$\Pi = PQ - c(Q, w, r) \quad \Rightarrow \quad P - C_Q = 0$$

$$Q^* = s(P, w, r)$$

$$dQ^*/dP = 1/C_{QQ} > 0, \quad dQ^*/dw = -C_{Qw}/C_{QQ} < 0$$

Market supply

$$S^{SR} = \Sigma_j \, s_j(P, w, r)$$

WHAT THE MODEL SHOWS

- Production for sale is a utility-maximizing activity pursued through profit maximization.
- Price takers produce where P = MC; the second-order condition requires rising marginal cost, so supply slopes upward.
- **Marshallian markets:** entry until profits equal the opportunity-cost return; long-run supply is flat at minimum average cost.
- **Ricardian markets:** costs differ; only the marginal firm earns an ordinary return, the rest earn economic profits (rents).

Price-making firms: MR = MC and the Lerner index

KEY EQUATIONS (3.15–3.26, APPENDIX)

Linear demand Q = a − bP, constant marginal cost z

$$\Pi = (aQ - Q^2)/b - zQ$$

$$(a - 2Q)/b - z = 0 \quad \Rightarrow \quad Q^* = (a - bz)/2$$

$$P^* = (a + bz)/2b$$

General price maker: inverse demand $P = p(Q, Y, N, P_j)$

$$\Pi = p(Q, Y, N, P_j)Q - c(Q, w, r)$$

$$P + (dP/dQ)Q = C_Q$$

$$Q^* = s(Y, N, P_j, w, r), \quad P^* = p(Q^*, Y, N, P_j)$$

Lerner index

$$(P - MC)/P = 1/|e|$$

WHAT THE MODEL SHOWS

- A price maker also equates marginal revenue and marginal cost, but MR < P.
- There is no supply curve: output depends on demand conditions (income, buyers, rivals' prices) as well as costs.
- Price is endogenous, set jointly by demand and cost.
- The less elastic is demand, the larger the markup over marginal cost.

Production, input demand and duality

KEY EQUATIONS (4.13–4.41)

One input, Q = q(L)

$$\Pi = P \cdot q(L) - wL \;\Rightarrow\; P \cdot q_L = w, \quad L^* = g(P, w)$$

Two inputs, $Q = L^e K^f$: maximize output for a given cost

$$\mathcal{L} = L^e K^f + \lambda(C - wL - rK)$$

$$eK / fL = w / r$$

$$L^* = [e/(e+f)] \cdot C/w, \quad K^* = [f/(e+f)] \cdot C/r$$

The dual: minimize cost for a given output

$$\mathcal{L} = wL + rK + \lambda(Q - L^e K^f)$$

$$L^* = [Q / (fw/er)^f]^{1/(e+f)}$$

General production function

$$Q = q(L, K) \;\Rightarrow\; C = c(Q, w, r) \;\Rightarrow\; Q^* = s(P, w, r)$$

WHAT THE MODEL SHOWS

- Firms hire labor until its marginal revenue product equals the wage.
- With substitutable inputs, the MRTS equals the input price ratio; Leontief technologies ignore relative prices.
- Primal and dual give the same cost function, providing a production function and input price foundation for the supply curves of Ch. 3.
- Long-run costs are lower than short-run costs because more inputs can be varied.
- Monopsony purchasers of labor can lower both wages and employment (appendix).

Market-clearing prices and comparative statics

KEY EQUATIONS (5.1–5.15)

Linear demand and supply

$$D = -aP + bY - cP_0, \qquad S = eP - fw - gr + hT$$

Market clearing

$$P^* = (bY - cP_0 + fw + gr - hT) / (a + e)$$

$$dP^*/dY = b / (a + e) > 0$$

Abstract version (implicit function theorem)

$$H \equiv d(P^*, Y, P_0) - s(P^*, w, r, T) = 0$$

$$P^* = f(Y, P_0, w, r, T)$$

$$dP^*/dY = D_Y / -(D_P - S_P) > 0$$

WHAT THE MODEL SHOWS

- Prices coordinate independent decisions so that quantities supplied tend to equal quantities demanded.
- Every shift variable of Ch. 2–4 becomes an argument of the equilibrium price.
- Signs follow from the behavioral models: $D_Y > 0$ (normal good), $D_P < 0$, $S_P > 0$.
- Persistent shortages and surpluses are temporary or caused by outside factors such as regulation.

From monopoly toward competition: Cournot oligopoly

KEY EQUATIONS (5.26–5.29)

Cournot with N firms: P = a − bQ, unit cost c, rivals' output Z

$$\Pi_1 = [a - b(Q_1 + Z)]Q_1 - cQ_1 \quad \Rightarrow \quad Q_1^* = (a - bZ - c)/2b$$

$$Q_i^{**} = (a - c)/[b(N + 1)], \quad P^{**} = a - (a - c)\cdot N/(N + 1)$$

Example: P = 100 − 0.10Q, marginal cost 5

Firms N	Price	Industry profit
1 (monopoly)	52.50	22,562.50
2 (duopoly)	36.67	20,055.56
10	13.64	7,458.68
N → ∞	5.00	0

WHAT THE MODEL SHOWS

- Duopolists' best replies intersect at a Nash equilibrium between monopoly and competition.
- As N grows, N/(N + 1) → 1: price falls toward marginal cost and profits toward zero.
- Appendix: a Walrasian equilibrium exists, given our usual assumptions about preferences; demand functionss are homogeneous of degree zero and Walras' law holds.
- The lean core omits information, transaction costs, regulation and innovation: the agenda for Parts II and III.

Time, discounting and the market for loans

KEY EQUATIONS (6.1–6.16)

Present values

$$PV = \Sigma_t F_t/(1+r)^t$$

$$PV = v[(1+r)^T - 1] / [r(1+r)^T] \;\to\; v/r \text{ as } T \to \infty$$

Two-period consumption and saving

$$\mathcal{L} = C_1^a C_2^b + \lambda[Y_1 + Y_2/(1+r) - C_1 - C_2/(1+r)]$$

$$aC_2 / bC_1 = 1 + r$$

$$C_1^* = [a/(a+b)]\cdot[Y_1 + Y_2/(1+r)]$$

Capital investment financed by a loan

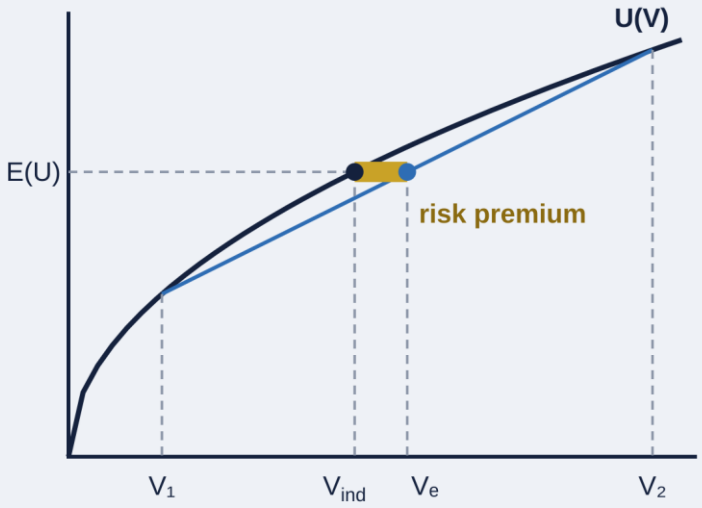
$$P\cdot f_K = b(r, T)\cdot c_K$$

WHAT THE MODEL SHOWS

- The logic of Part I survives: replace benefits and costs by their present values.
- Consumers smooth consumption: the intertemporal MRS equals 1 + r.
- Current consumption rises with income in either period; the interest-rate effect is positive for savers, ambiguous for borrowers.
- Banks set the spread $r_b - r_s$ to cover the marginal cost of intermediation.

Expected utility, risk aversion and insurance

KEY EQUATIONS AND DIAGRAM



$$E(U) = \Sigma_i P_i U(V_i)$$
$$E[U(V)] < U(E[V])$$
$$r(V) = -U''(V)/U'(V)$$
$$U = V^{0.5} \Rightarrow r = 0.5/V$$
$$\text{premium} = V_e - V_{ind}$$

Applications: Acme facing expected fines; a criminal facing detection

$$Q^* = (P + 2abQ_R)/(2cwr + 2ab), \quad Q^* = P/(2c + 2aF)$$

Risk pooling: $\text{var}(\bar{X}) = \sigma^2/N$

WHAT THE MODEL SHOWS

- With known probabilities, optimization carries over: maximize expected utility or expected profit.
- Concave utility implies risk aversion: a buyer pays up to the expected loss plus the risk premium for insurance.
- Pooling many independent risks makes insurers' average payouts predictable.
- Risky industries must offer risk-adjusted returns.
- Detection probability and fine size are substitutes in deterring violations.

Knightian uncertainty, entrepreneurs and innovation

KEY EQUATIONS (8.1–8.7)

Knight: subjective success probability F and payoff Π

$$\text{invest in I} \quad \text{if} \quad F\Pi / I > 1 + r$$

Schumpeter: innovation expands the goods space

$$k \text{ goods} \rightarrow k + n - d \text{ goods}, \quad n > d$$

Routine R&D by Acme: success probability F = f(R)

$$\Pi^e = f(R)P^{\Delta}Q + (1 - f(R))PQ - c(Q, R, w, r)$$

$$f_R(P^{\Delta} - P)Q^* = C_R \quad \text{at } R^*$$

$$Q^* = s(\Phi_0, \Delta, w, r), \quad R^* = e(\Phi_0, \Delta, w, r)$$

Two independent 50:50 research lines raise the chance of at least one success from ½ to ¾.

FOUR VIEWS OF THE ENTREPRENEUR

- **Knight:** uncertainty is distinct from risk; the most optimistic invest, so winner's curses are possible.
- **Schumpeter:** insightful disruptors whose rare breakthroughs replace old products.
- **Kirzner:** alert equilibrators who reduce ignorance; everyone is a part-time entrepreneur.
- **Formeteurs:** founders of organizations that solve team-production problems.
- With perfect information there would be no entrepreneurship.

The “simple” economics of information

KEY EQUATIONS (9.1–9.14)

Stigler search: a larger sample S lowers the expected price

$$N^e = b(Q, Y) - p(S)Q - c(S)$$

$$B_Q - P = 0, \qquad -p_S Q - c_S = 0$$

$$S_Y^* = -p_S[Q_Y^*] / (-N_{SS}) > 0$$

Latent demand: discovering a new good valued by consumers, here good C

$$U = A^a B^b \;\Rightarrow\; A^* = aW / [P_A(a + b)]$$

$$U = A^a B^b C^c \;\Rightarrow\; A^* = aW / [P_A(a + b + c)]$$

$$C^* = cW / [P_C(a + b + c)]$$

WHAT THE MODEL SHOWS

- Consumers search until the expected marginal saving equals the marginal cost of search.
- Prices of similar goods cluster around an average instead of converging to a single price; search narrows the spread.
- Higher-income buyers buy more and so (often) search more.
- New goods draw spending from old ones: innovation expands markets.
- Hayek: prices coordinate millions of relatively uninformed consumers, firms and innovators, so that surpluses and shortages rarely occur.

Strategic interaction: noncooperative 2 × 2 games

TABLES 13.1 AND 13.2

Trading game (Alice, Bob)

Alice \ Bob	Trade	Don’t trade
Trade	**(3, 2)**	(−1, 0)
Don’t trade	(0, −1)	**(0, 0)**

Prisoner’s dilemma (Al, Bob)

Al \ Bob	Testify	Don’t testify
Testify	**(−9, −9)**	(0, −10)
Don’t testify	(−10, 0)	(−1, −1)

WHAT THE GAMES SHOW

- When a few agents jointly determine outcomes, each choice depends on expectations about the others.
- **Trading game:** two Nash equilibria, so some markets may never emerge.
- **Prisoner’s dilemma:** testifying is dominant, yet both prefer mutual silence: Nash equilibria need not be Pareto optimal.
- Other games: coordination, assurance (stag hunt), chicken, zero-sum.

Races to the bottom and Stackelberg leadership

TABLE 13.6 AND EQS. 13.18–13.22

Race to the bottom (Community A, Community B)

A \ B	Weak	Medium	Strong
Weak	**(6, 6)**	(8, 4)	(9, 2)
Medium	(4, 8)	(7, 7)	(8, 5)
Strong	(2, 9)	(5, 8)	(6, 6)

Stackelberg: firm 1 anticipates firm 2's best reply

$$\Pi_2 = f(Q_1 + Q_2)Q_2 - c(Q_2) \;\Rightarrow\; Q_2^* = g(Q_1)$$

$$\Pi_1 = f(Q_1 + g(Q_1))Q_1 - c(Q_1)$$

$$f' \cdot (1 + g') \cdot Q_1 + f - c' = 0 \quad \text{at } Q_1^*$$

WHAT THE MODELS SHOW

- Competing communities deregulate below the jointly preferred (Medium, Medium); NIMBY races overregulate.
- Reciprocal externalities: a fine above 1 util moves play to the efficient middle cell.
- Stackelberg leaders earn at least their Cournot profits; total output is normally larger.
- Finitely repeated dilemmas unravel, as can be demonstrated using backward induction.
- Subgame perfection can also support credible commitments.

Hobbesian anarchy: production versus theft

TABLE 14.1 · PAYOFFS (AL, BOB); STRATEGIES ARE % PRODUCTION / % THEFT

Al \ Bob	100 / 0	75 / 25	50 / 50	25 / 75
100 / 0	(100, 100)	(50, 125)	(15, 135)	(5, 120)
75 / 25	(125, 50)	(75, 75)	(35, 90)	(25, 75)
50 / 50	(135, 15)	(90, 35)	**(50, 50)**	(30, 45)
25 / 75	(120, 5)	(75, 25)	(45, 30)	(25, 25)

Continuous version: 16 hours, S_i hours spent stealing (14.1, 14.4)

$$Q_1 = [S_1/(S_1 + S_2)]\cdot[10(16 - S_1) + 10(16 - S_2)]$$

$$S_1^* = S_2^* = 8: \quad \text{half of potential output}$$

WHAT THE MODEL SHOWS

- Stealing half the time is a dominant strategy; the Nash equilibrium realizes only half of potential output.
- A fine of 40 on theft makes full production dominant, roughly doubling output.
- A large enough expected penalty yields a corner solution with no theft.
- Law reduces the risk and uncertainty of exchange: a precondition for many of the markets of Parts I and II.

Crime, enforcement and the extent of markets

KEY EQUATIONS (14.5–14.16)

Becker-style crime: detection F = f(N, G), punishment J = j(N, w^0)

$$\Pi_i = r_i(N_i) - f_i(N_i, G)\cdot j_i(N_i, w_i^0)$$
$$N_i^* = n_i(w_i^0, G), \quad dN^*/dG < 0, \quad dN^*/dw^0 < 0$$

A firm whose output is stolen with probability F_F

$$\Pi^e = p(Q, P_0, Y)(1 - F_F)Q - w\cdot l(Q)$$
$$\partial Q^*/\partial F_F = -(P + P_Q Q)/\Pi^e{}_{QQ} < 0$$

A consumer whose good 1 is stolen with probability F_c

$$U^e = (1 - F_C)U(Q_1, Q_2) + F_C\cdot U(0, Q_2)$$
$$Q_1^* = b(P_1, P_2, W, F_C)$$

WHAT THE MODEL SHOWS

- Criminals respond to incentives: more enforcement and better legal wages (larger marginal opportunity costs) reduces crime.
- Theft lowers output and labor demand, even for risk-neutral firms, and lowers demand for vulnerable goods.
- Fraud: with fraudulent offers can have a unique equilibrium in which no trade takes place; a sufficient expected penalty for fraudulent offers can extend trade.
- Without reputations or anti-fraud law, quality can decline to a “lemons” market (Akerlof 1970).

Roving and stationary bandits

TABLE 15.1 AND EQS. 15.1–15.5

Two roving gangs: raids (Bandit 1, Bandit 2)

1 \ 2	0	5	10	15
0	(0, 0)	(0, 150)	(0, 135)	(0, 120)
5	(150, 0)	(75, 75)	(35, 90)	(25, 75)
10	(135, 0)	(90, 35)	**(50, 50)**	(30, 45)
15	(120, 0)	(75, 25)	(45, 30)	(25, 25)

A stationary bandit (Leviathan) with M markets

$$\Pi^e = F_F \cdot M \cdot s(G, P_O, Y, w, F_F) - c(G, F_F, M, D)$$

$$F_F^* = f(G, P_O, Y, w, M, D), \quad F_F^* \cdot M \cdot s_G = c_G \text{ at } G^*$$

WHAT THE MODEL SHOWS

- Two roving gangs over-raid: the Nash equilibrium is 10 raids each, with payoffs (50, 50).
- A single stationary bandit raids only 5 times and earns 150: monopoly over theft reduces theft (Olson).
- A net revenue maximizing Leviathan chooses taxes and services where there marginal revenues equal their marginal costs.
- Extractive rulers provide market-extending services only insofar as they raise revenue.

Median voters and the demand for law enforcement

KEY EQUATIONS (15.8–15.18)

Median voter's ideal level of a service G

$$U = u([Y - c(G, Y)]/P, G)$$

$$u_X(-C_G/P) + u_G = 0 \quad \Rightarrow \quad G^* = g(Y, P)$$

Demand for theft prevention, $F_c = f(G)$

$$U^e = (1 - F_C)U(Q_1, X) + F_C \cdot U(0, X)$$

$$X = [W - c(G, W) - P_1 Q_1]/P_2$$

$$G^* = g(W_{med}, P_1, P_2)$$

Redistribution by demogrant, $G = tY_A$

$$X_i = (1 - t)Y_i(t) + tY_A(t) \quad \Rightarrow \quad t_i^* = f(Y_i, Y_A)$$

WHAT THE MODEL SHOWS

- The median voter's ideal beats every alternative; pragmatic Downsian candidates converge on it.
- The median voter is the pivotal voter, a Nash equilibrium, not a representative agent.
- Voters value services that reduce risk, so democratic expenditures on law diligent enforcement tend to expand markets.
- Majority rule can cycle over distributive issues; norms and rules can stabilize outcomes.
- Excessive redistribution can produce a "democratic poverty trap."

Team production and the value of a work ethic

TABLE 16.2 · HOURS WORKED (ARMEN, HAROLD) WITH GUILT $\mathcal{G}$

Armen \ Harold	8 hours	6 hours	4 hours
8 hours	**(16, 16)**	(14, 17 − $\mathcal{G}$)	(12, 18 − 2$\mathcal{G}$)
6 hours	(17 − $\mathcal{G}$, 14)	(15 − $\mathcal{G}$, 15 − $\mathcal{G}$)	(13 − $\mathcal{G}$, 16 − 2$\mathcal{G}$)
4 hours	(18 − 2$\mathcal{G}$, 12)	(16 − 2$\mathcal{G}$, 13 − $\mathcal{G}$)	(14 − 2$\mathcal{G}$, 14 − 2$\mathcal{G}$)

Work ethic sufficient for full effort

$$\mathcal{G} > 1$$

Continuous version (16.1–16.10): T hours, shared output

$$\text{Nash: } W_m^* = T/3 \qquad \text{Joint optimum: } W_m^{**} = T/2$$

WHAT THE MODEL SHOWS

- Without norms, (4, 4) hours is the unique equilibrium, though (8, 8) is better for both (Table 16.1).
- A guilt cost $\mathcal{G} > 1$ makes full effort dominant: the shaded cell becomes the equilibrium.
- Shirking persists even when wages equal marginal revenue products.
- A work ethic is productive form of human capital—although it is not a skill in the usual sense of that term.

Honesty, corruption and demand for virtuous products

TABLE 16.4 AND EQS. 16.17–16.20

Fraud with expected fine F and virtue V (seller, buyer)

Seller \ Buyer	Accept / solicit	Ignore offers
Fraudulent offer	(3 − F, −3)	(−1 − F, 0)
Honest offer	**(2 + V, 2)**	(−1 + V, 0)
No offers	(0, −1)	(0, 0)

Guilt from deviating from an ideal level Q_1^V

$$U = u(Q_1, (W - P_1 Q_1)/P_2, |Q_1^V - Q_1|)$$

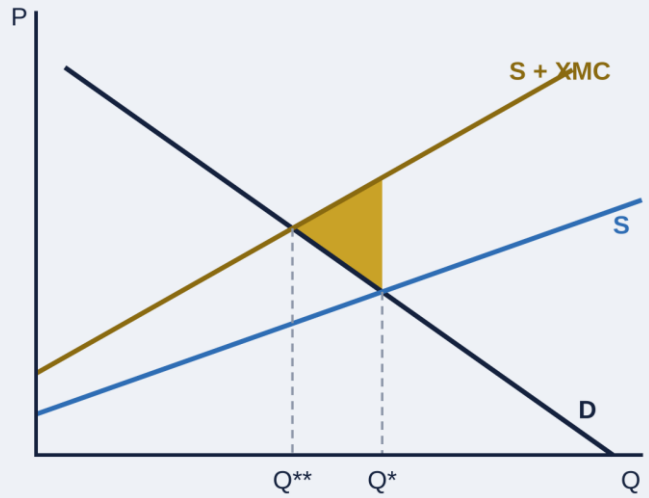
$$Q_1^* = q_1(P_1, P_2, Q_1^V), \quad \partial Q_1^*/\partial Q_1^V > 0$$

WHAT THE MODEL SHOWS

- **Fraud:** ethics and enforcement are substitutes; F > 1 or V > 1 makes honest trade the equilibrium.
- **Corruption:** they are complements; pragmatic enforcers take bribes, so dutiful officials matter most at the top.
- Ideals shift demand with no change in prices, income or tastes.
- As norms evolve, so do the extent and type of economic development.

Efficiency, externalities and cost–benefit analysis

KEY EQUATIONS (18.1–18.7) AND DIAGRAM



$$N(Q) = \int_0^Q [SMB - SMC]\, dQ$$

$$N = B(Q) - C(Q) - X(Q)$$

$$B_Q - C_Q - X_Q = 0 \quad \text{at } Q^{**}$$

Regulation R that changes output at cost g(R) (18.5b)

$$N_R = [B_Q - C_Q - X_Q]\cdot Q_R - g_R = 0 \quad \text{at } R^*$$

Cost–benefit test for a perpetual net benefit N_0 (18.7a)

$$N_0/r > F + g(R^*)/r$$

WHAT THE MODEL SHOWS

- Pareto: a move is superior if someone gains and no one loses; the contract curve is the Pareto set.
- Monopoly output below Q* creates a deadweight loss.
- External costs often induce market outputs that are normatively too large.
- A Pigovian tax or regulation can move it to Q** if it is set so that the tax equal marginal external costs and implementation costs at Q**.
- Coase: with low transaction costs, bargaining can reaches Q** whoever initially holds the right.

Social welfare functions and contractarian norms

KEY EQUATIONS (18.8–18.17)

Samuelson's pure public good

$$\mathcal{L} = w(U_1, \ldots, U_N) - \lambda T(G, X)$$

$$\Sigma_i U_{iG} / U_{iX} = T_G / T_X \quad \text{at } G^*$$

Utilitarian welfare

$$W = \Sigma_i u_i(\cdot) \quad \text{or} \quad W = w(U_1, \ldots, U_N),\ W_{Ui} > 0$$

Rawls: veil of ignorance

$$U_i^e = \Sigma_k F_k \cdot u_k(w_k(G, R, L_0))$$

Buchanan: veil of uncertainty

$$U_i^e = \Sigma_k F_k(G, R, L, W_i^0) \cdot u_i(w_{ik}(G, R, L, W_i^0))$$

WHAT THE MODELS SHOW

- Welfare economics is consequentialist and mostly utilitarian, often with income as a proxy for aggregate utility.
- The Samuelson condition (ΣMRS = MRT) does not depend on the particular social welfare function chosen.
- In contrast with utilitarian norms, Contractarian norms require that everyone expect to gain; utilitarian norms only that winners gain more than losers lose.
- Normative analysis sits at one of the boundaries of economics, near philosophy and public administration.

CHAPTER 19 · TOWARD A BROADER NEOCLASSICAL SYNTHESIS

Rational choices under scarcity → markets, law, politics and norms → the extent of commerce

- Part I’s core remains the foundation: optimizing agents, marginal conditions and equilibrium prices.
- Part II adds time, risk, ignorance, information and strategy without abandoning that logic.
- Part III explains the law, policies and norms the core takes as given, and so the scope of markets itself.
- One method, rational choice under scarcity, accounts for both market outcomes and the institutions that make markets possible.