Economics 162: Managerial Economics
By Dr. Mason Gaffney

Article citation:
Gaffney, Mason. “Economics 162: Managerial Economics.” Various Dates. Syllabi and Reading Lists.

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M. Gaffney Office Hrs. Wed. 10-12.

Ho's book

Syllabus, Administrative Studies 162, Winter Quarter, 1978, Professor Gaffney

First class January 5; Last class March 15; 20 meetings in all.

1. Purpose and survey of course

2. Why economics? Growing population and fixed resources. Malthusian gloom, Utopian prodigality, and economic sense. Substitution for and intensification of resources. (Possibilities of resource expansion through synergy and technical advance -- a foretaste.)

3. Changing factor proportions and the distribution of income and wealth. The margins of production, extensive and intensive. Growth of land rent; its functions. Factoral distribution (vs. personal and business distribution.)

4. The intensive margin, and variable proportions. Standard techniques for analyzing variable proportions--introduction of marginal analysis. Symmetry of variable proportions.

5.. Continued. Maximizing residual returns by equating marginal product and marginal cost.

6,7 Capital, a third input. Discounting, and the discounted marginal product concept. Techniques for handling two variables together. The marginal net product technique, optimizing with two or more variables.

8. Input substitution. Meaning of economic efficiency and economic intensity as opposed to physical efficiency and intensity. Economic waste vs. physical waste in management choices. Sensitivity of substitution to prices of inputs and outputs.

9. Continued

10. Synergy, increasing returns, and resource expansion.

11. Scale of firm. Increasing returns to scale of firm: causes, overstatements, and limits.

12. Scale of firm: the problem of concentrated economic power.

13. Organization through the market: supply and demand, allocative efficiency, and the equimarginal principle. Consumer sovereignty and free choice. Markets as places, the importance of location and settlement patterns.

14. Personal distribution of income and wealth: the problem of concentration. Concepts of "equity" among persons, and generations. Must consumer sovereignty be modified? Roles of tax policy and other public policy. Equity vs. efficiency.

15. Demand analysis and interpretation. Demand forecasting and its use. The marketing function--is it productive?

16. Cost analysis techniques, units and concepts, (a useful restatement of marginal productivity analysis to integrate it with demand analysis.)

17. Market structures and pricing policies.

18. Business concentration: the problems of market and political power.

Check on having 3-hr. exam
Double check Feb. Mangers

19. Government and business: the use and abuse of government power.

20. Capital budgeting, planning, and replacement policy

Final Exam Thursday, March 16 Open book. ~~Check & Report back Thurs~~

Assignments Administrative Studies 162 Winter 1978

Fri, Mar. 24, 11:30 - 2:30

Professor Gaffney Texts: Ferguson Micro-economic Theory Brigham and Pappas Managerial Economics

Class No.	Date	
1	1-5	Ferguson Chp. 1 - Brigham Chp - 2
2	1-10	Ferguson pp. 303-04 Henry George Progress and Poverty (on reserve) Book III, Chapters 1, 2, 4, 6, 7, 8 Book IV, Chapters 1, 2 Ferguson chp. 13 (optional)
3	1-12	Same
4	1-17	Ferguson Chp 6 Brigham chp 6, pp. 163-84 Brigham chp 2, pp. 17-29 (~~optional~~)
5	1-19	same
6	1-24	Brigham Chp. 1, pp.9-10 chp. 2, 17-19 chp. 13 (this will be hard) Appendix A, pp. 505 -11 (remainder optional)
7	1-26	Joan Robinson Economics of Imperfect Competition Kinko's Chp. 20, Chp. 21, pp. 243-46
8	1-31-	Ferguson, Chp. 7
9	2-2	same
10	2-7	M. Gaffney "The Synergistic City" Kinko's
11	2-9	Ferguson chp. 8 Brigham chp. 8 G. Stigler, Theory of Price, 3rd ed. Chp. 8
12	2-14	Brigham Chp. 12 McGuigan & Moyer, Managerial Economics, chp. 16
13	2-16	Ferguson, chp. 9 (optional) Brigham, chp. 10, pp. 297-308
14	2-21	———

Opt. Economics

Typo

Class No.	Date	Assignment
15	2-23	Brigham chp 4 " chp 5 (optional Ferguson chp 2 (optional) " chp 5 Philip Raup, "The Small Non-industrial Forest Owner"
16	2-28	Ferguson chp. 8 (review) Brigham chp. 8 (review)
17	3-2	Ferguson, chp. 9, 10, 12 (pp. 286-96 only), 14 Brigham chp. 10, 11
18	3-7	Review Week #12 Howard Sherman Stagflation, Chp. 7 Allvine and Patterson Competition, Ltd. chp. 9
19	3-9	Brigham chp 12 McGuigan & Moyer chps. 18, 19, 20
20	3-14	Brigham chp. 13

Econ/Admin 5t 162A
Managerial Economics

Fall Quarter 1982
Mason Gaffney

SYLLABUS

Texts:

Primary, Brigham and Pappas, Managerial Economics, 3rd ed. [B&P]
Secondary, Stokey and Zeckhauser, A Primer for Policy Analysis, 1978. [S&Z]

Also Needed:

Hand calculator for problems and exams. Powers and logs are essential.

Week	Date	Topic	Readings B&P	Readings S&Z
1	10/5	Intro, Overview	1	1
	10/7	Models	—	2
		(Transformation and Substitution)	—	(3)
2	10/12	Optimization Techniques	2	—
	10/14	(Difference Equations)	—	(4)
3	10/19	Time and Interest	App. A, pp. 581-600	10
	10/21	Review, 15 min., 11:10-11:25 Exam, 50 min., 11:25-12:15 Answers, 15 min., 12:15-12:30		
4	10/26	Time and Interest, II	13	—
	10/28	Time and Interest, III	—	—
5	11/2	Risk, Forecasting	3; App. B, pp. 601-30	—
		(Decision Trees)	—	(12)
	11/4	Demand	4, 5	—
		(The Multi-attribute Problem)	—	(8)
6	11/9	Production Economics	6	9
	11/11	Review, Second Midterm, and Answers	—	—
7	11/16	Linear Programming	7	11
	11/18	Cost Analysis	8, 9	—
8	11/23	Cost Analysis, II	—	—
	11/25	Vacation	—	—
9	11/30	Cost and Price	10, 11	—
	12/2	Cost and Price, II	—	†
10	12/7	Government; "Public Choice"	12	13, 14, 15
	12/9	Review		
	12/16	Final, 2 hours and 50 minutes		

† "When to Build What" is on Reserve. Certain pages to be announced will be expounded in class.

Weighting of Grades:

First Midterm	1/4
Second Midterm	1/4
Final Exam	1/2

Extra Credit for Constructive Participation in Class.
Loss of Credit for Bad Attendance Record.

Economics/Admin Studies 162A
Managerial Economics

Fall Quarter 1983
Mason Gaffney

Office: 4107 Sproul Hall, x4404
Office Hours: T R 1:30-3:00 pm

SYLLABUS

Text: Pappas and Brigham, Managerial Economics, 3rd edition,
OR
Pappas, Brigham and Hirschey, Managerial Economics, 4th edition.

Also Needed: Hand calculator for problems and exams. Powers and logs are essential.

Weighting of Grades:

First Midterm	1/4
Second Midterm	1/4
Final Exam	1/2

Extra Credit for Constructive Participation in Class
Loss of Credit for Bad Attendance Record.

Optional Extra Credit: Submit short report on any topic that comes up which interests or puzzles you. This will give you practice putting your questions or conclusions or coalescing thoughts in writing. Deliver to me direct, or by campus mail. I will return with comments. This is informal, do it at will, anytime before December 1.

Course Outline:

Week	Date	Topic	Readings 3rd edition	Readings 4th edition
1	9/27	Overview	Ch. 1	Ch. 1
	9/29	Math. of Finance	App. A, pp. 581-600	App. A, pp. 543-562
2	10/ 4	Math. of Finance	App. A, pp. 581-600	App. A, pp. 543-562
	10/ 6	Capital Budgeting, Investment Analysis	Ch. 13	Ch. 13
3	10/11	Capital Budgeting, Investment Analysis	Ch. 13	Ch. 13
	10/13	FIRST MIDTERM (11:40-12:30)		
4	10/18	Optimization Techniques Calculus Made Relevant	Ch. 2	Ch. 2
	10/20	Sensitivity Analysis		
5	10/25	Demand Analysis and Estimation (a midquarter breather, "an old familiar score")	Chs. 4, 5	Chs. 4, 5
	10/27	Coping with Risk Forecasting	Ch. 3 App. B, pp. 601-630	Ch. 3 App. B, pp. 563-604

Course Outline (cont):

Week	Date	Topic	Readings 3rd edition	Readings 4th edition
6	11/ 1	Production Economics I Variable Propns.	Ch. 6, pp. 201-214	Ch. 6, pp. 201-213
	11/ 3	Production Economics II Substitution, Trade-offs	Ch. 6, pp. 215-223	Ch. 6, pp. 213-229
7	11/ 8	Production Economics III Variable Scale (How small is beautiful?)	Ch. 6, pp. 231-239; pp. 317-323	Ch. 6, pp. 229-236; pp. 260-271
	11/10	Production Economics IV Linear Programming Production Economics, Risks, and Capital Budgeting SECOND MIDTERM (11:40-12:30)	Ch. 7	Ch. 9
8	11/15	Cost Analysis I	Chs. 8, 9	Chs. 7, 8
	11/17	Cost, Price and Market Structure	Chs. 10, 11	Chs. 10, 11
9	11/22	Reg. and Anti-Trust	Ch. 12	Ch. 12
	11/24	Pause and Give Thanks		
10	11/29	Grand Synthesis	Ch. 14	Ch. 14
	12/ 1	Review and Summary		

pw

M.G.

Economics - Ad. Studies 162 — Managerial Economics

Fall, 1988 — Professor M. Gaffney

Text: H.C.Petersen & W.C.Lewis, Managerial Economics, 1986

Equipment needed: hand calculator

Basis of grading:

Friday quizzes, weekly	40%
Class participation	15%
Midterm, 5th week	15%
Final	30%

Office hours: MWF 11-12; 2-2:45. 4th fl. Sproul

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Reading assignments (pages indicated from text):

	Pages
1. Intro., methods, objectives	3-17
2. "Basic Training"	
Functions	19-28
OLS (reading only)	28-39
Time value, elementary	39-49
Supplement by MG	RBR
Summary	49-50
3. First Easy Application: demand analysis	104-31
(Opt: Chap. 5, ests. & forecasts)	
4. Production theory	187-226
Calculus & production theory	226-29
Study aid	RBR
(Opt: Linear programming)	231-58
Economies of scale	498-512
	217-20
	272-75
Study aid	RBR
5. Location decisions	513-40
6. Cost theory & applications	260-290
Produce or shut down?	463-67
Public utility regulation	581-86
Price controls	586-92

7. Time value, applications	
Investment decisions	484-98
Replacement timing	473-80
Study aid and advanced applications	RBR
8. Taxes & decisions	541-65
Land gains, fast write-off, & incentives	RBR
9. Market structure	
Competition & monopoly	321-48
Oligopoly, etc.	349-78
Pricing & employment of inputs	438-61
Structure, conduct, performance	379-406
10. Regulation & anti-trust	566-92
Tax policy for workable markets	RBR
Review	

Syllabus, Ecs. 162, S90

Prof. Mason Gaffney

Text: none required; George Pinches, Essentials of Financial Management, optional.

Readings: notes by instructor and others placed on reserve. This Syllabus covers topics; reading assignments on separate list.

I. Introduction

A. Management as optimization; optimization as maximizing a bottom line which is a Performance Standard. Performance Standards are designed to maximize wealth over time, and to avoid fallacies, of which there are many.

1. 4 examples of optimizing, by subtracting, multiplying, dividing and adding.

2. Management requires imputing net returns to individual inputs, hence marginal analysis. Discounted Cash Flow (DCF) and related concepts are double net concepts, net of future expenses and of intermediate interest (and other "carrying costs" like rent).

3. Finance calls for finding tradeoff between economies of synchronism[1] and their cost in capital tied up.

The Baumol model.

B. Value of learning skills and ideas not subject to obsolescence, general ideas that endure because they transcend technologies.

C. Value of learning how to learn, and keep learning.

II. Basic Mathematics of Finance

A. Point values, aka single payments, balloon payments, lump sums, etc. The basic building block for all other formulae.

1. Compounding, discounting, rate of return (ROR), period of time.

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[1]Other names for synchronism: simultaneity, all-at-once, unitized construction, one-time buildout, scale, wholeness, single-phasing. Antonyms: piecemeal buildout, phasing, Balkanizing, dissonance, cacaphony.

2. Semilog scales.

3. Sensitivity analysis. The Arrow Model, showing sensitivity of P to i rises with n.

B. Complex point values, liquidation plus salvage value.

Value of land in perpetuity, with regular periodic payments.

Value and rent.

Once G is discovered, Gi (ground rent) becomes a prior claim on cash flow. Solving for P (the present value of capital) we see how its value is leveraged by changes in G and i. It is "subordinated" to them, economically and legally. Invasions of its value by rises of ground rent are called "locational obsolescence." Invasions by rises of <u>i</u> have no such handy common name in business, but I will call them "Fixity Obsolescence."

Prior claims are called "senior"; subordinated claims are "junior." Never underestimate the economic value of seniority. (Yes, the world is run by old beachmasters protecting their turf from the young bulls.)

C. Perpetual flows.

Idea of net flows, cash and service (imputed).

Level payments; rising payments.

D. Finite flows.

Present value (PV), Installment Plan Factor (IPF) (aka Capital Recovery Factor), Future Value Factor, Sinking Fund Factor.

E. Monthly and continuous compounding.

F. Accounting for inflation.

III. <u>Valuation</u>

A. Investment value vs. liquidation value.

Short run cash flow max vs. max valuation through time; valuation in perpetuity vs. valuation of first generation.

Two methods of raising valuation: higher productivity vs. selling to or borrowing from "strong hands". Is it helpful to

sell out to aliens?

Max personal wealth vs. max social wealth: Consistency, indifference and conflict. Legitimate self-interest vs. destructive greed and predation.

B. Measuring future values net of associated expenses. "Stumpage" in forestry; "cash flow" more generally. "Service flow" of consumer capital and land.

Why "profit" is a weasel word: 1) Arbitrary allocation of "Capital Consumption Allowances" (KCA) and of capital gains to the given year; 2) Profit is a personal return, not a functional imputation among factors of production.

Functional vs. personal analysis.

C. Discounting as subtracting interest; DCF as a double net bottom line (repeated for emphasis).

Other carrying costs over time: rent, insurance, spoilage, property tax, hazards, obsolescence, vacancies, downtime, harboring nuisances, rising environmental offensiveness, etc.

D. Simplest case: single payment present value (sppv). Aka PIPO, lump sum, balloon payment, salvage value, redemption value, liquidation value, resale value, etc.)

E. Periodic payments in perpetuity. The satori[2] of Martin Faustmann: a brush with The Infinite in daily life.

The evidence of things unseen: DCF > K , (where K is capital input at time zero, e.g. planting costs of trees). The unseen input is land, which lasts forever.

Land Value as the ultimate bottom line, triple net: net of future expenses, of interest, and of K itself.

Max PV only makes sense as a Performance Standard if there is a scale constraint, otherwise it just means keep adding more total assets. The sensible Performance Standard is max PV of each parcel of land.

Converting Faustmann Formula to simple capitalization of annual flow: let n=1.

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[2] Satori is from Zen. It is like an epiphany, except you have to work for it. Satori is a revelation received after study and meditation, as opposed to that flash of light on the road to Damascus.

Periodic payments of rising value.

F. Perpetual annual flows. (Suddenly simple again, but only on the surface.)

"Capitalization": making land exchangeable with capital (and papering over their differences).

Simplicity of capitalization: its use and abuses.

Components of value: depreciable and non-depreciable.

Rising flows: capitalization of growth.

Capitalization of property taxes on land. How to make property tax rates commensurable with interest rates, and why the former are higher than they look.

Can values be infinite? Can growth rate exceed interest rate?

Tempering role of property tax rate.

G. Finite flows

Constant (level) flows: the "one-hoss shay" model.

Declining net flows:

Decaying

Locational Obsolescence

Depletion ("use-depreciation") of expendable stocks, exhaustible resources, etc. Unit-of-production depreciation.

H. Finite flows plus a point value.

Redeemable bonds.

Real estate and common stock. Resale value as a proxy for perpetual life.

I. The time-horizon for valuation

The planning period.

Need for forecasting replacement or resale time.

Point resale value as minimum recognition of infinite

planning horizon. Fallacy of limiting horizons.

J. Sensitivity of values to parameters.

Measures of sensitivity: derivatives and differentials (changes); log derivatives (rates of change); elasticities (ratios of rates of change).

Ambiguity of "rate", which can be a weasel word. Rates are ratios. Derivatives are ratios, and "rate" sometimes refers to a derivative. However a log derivative is the derivative divided by the ordinate. That is, the derivative is dy/dx, and the log derivative is dy/dx : y.

In the basic compound interest factor, the annual change is yi, and the log derivative is yi/y, or just i, which is the fractional rate of change.

It is customary to refer loosely to this fractional rate of change as the "% change". Actually, you must multiply it times 100 to make it that.

Elasticities are ratios of log derivatives. You know about elasticity from Econ. 100A. The log derivative of the independent variable is its reciprocal. Dividing by that is the same as multiplying by the independent variable itself. Thus the elasticity of the compound interest expression when n increases by one is just ni. Thus, sensitivity of FV to i increases with n; and sensitivity to n increases with i.

Semi-log scales help us visualize sensitivity as measured by log derivatives or % changes. Review.

Log-log scales help us visualize elasticities.

Leverage and sensitivity

Supersensitivity of land price to K, i, R and n, all four.

Supersensitivity of equity values.

K. Cost of capital: effect on valuation.

Rooney's tautology: cost of capital determined by valuation. Relation of this to the "Rational Expectations" tautology.

L. Normalized models: review.

M. Valuation of wholes and increments.

(Discounted marginal product of labor, idea of.)

N. Public equity in assets.

1. Future liability for property taxes. Sometimes this outvalues private equity -- example of urban renewal in Milwaukee, 1965.

2. Deferred, accrued income taxes.

Excess, premature depreciation.

Accrued capital gains.

O. Summary: what you can adjust to max PV.

IV. Capital (K) Budgeting and Marginal Analysis

A. Elements of budgeting.

1. Allocating given K.

2. Adjusting supply of K.

3. Regulating flow of K recovery to keep liquid, meet payrolls, etc.

B. How to calculate ROR.

1. PIPO models, simple and complex. Use of semi-log scale.

2. Perpetual flows, level and rising.

3. Finite flows, and finite flows plus terminal redemption value.

4. ROR calculations automatically allow for recovery of original K input, and deduction of associated costs. ROR is net.

C. The marginal product idea.

1. Diminishing returns to variable input of K applied to fixed land. Average vs. marginal returns.

ROR applies to marginal returns or MP of capital -- average returns include return to land.

ROR applies to net gain after allowing for K Consumption Allowance (KCA).

ROR is net of all current expenses. It is a pure net gain to K.

2. ROR as a standard of measure, a basis of commensurability, a unitary Performance Standard independent of nature of product and inputs, scale, technology, durability, etc.

3. ROR is the motor of the macroeconomy, an idea acknowledged and acted on up until the 1986 tax "reform". ROR is determined only by supply and demand for <u>new</u> K. Values of old assets (land and old K) are then determined by rate on new K.

Much of "finance" is largely sterile, socially speaking, because it focuses on trading, gambling and power-playing in old assets rather than creating new ones. A reaction is inevitable; this is a good time to prepare for it.

4. Does ROR include increments to land value, (aka "capital gains")? It's time to face this long-evaded question.

5. Causes of diminishing ROR to K, private and social.

a. Variable proportions.

i. As a relationship of coexistence, e.g. crowding more building onto a small lot.

ii. As a relationship of sequence, e.g. making the building more durable.

b. Diseconomies of scale.

c. Market power.

D. Allocation of K.

The equimarginal principle. Arbitrage, internal and external.

Limits to internal equimarginal allocation of K: internal urgencies and K shortages that rule out slow paybacks.

E. Some fallacies, errors, blunders, and bad Performance Standards.

1. Underimprovement from max Ave. ROR, max Benefit/Cost ratio, min visible cost/unit of output, max "productivity" (defined in the usual partial way), max "efficiency", min payback time, max earnings/sales, max sales, max captive lands and K (the bureaucratic disease), economizing according to book value.

2. Overinvestment from equating Ave. ROR with Ave. Cost

of K (ACOK), melding disparate costs (a form of X-subsidy), pooling risks, max "mean annual increment" (MAI) of growing stock, capturing fugitive resources, "rent-seeking" outlays, comprehensive fully-integrated projects without staging, partial funding with accumulation of capitalized interest.

3. Confusing personal and functional imputation of returns (that weasel-word "profit" again).

4. Mismeasuring true cost of K.

5. Mismeasuring payback speed.

6. Confusing land gains with ROR on K.

F. Regulating the supply of K.

1. Sources of K.

a. Recoveries, and their proper assignment to KCAs.

b. New domestic saving: by firms; by households, direct and through intermediaries; by governments (don't laugh, a few of them do save); by pension funds (if they're not looted).

Parlous savings: rise of land prices, share prices, housing prices, etc.; bank expansion (forced saving); raising children; social security; other.

c. K imports: debt; equity.

2. Tapping the sources: selecting parents wisely; hocking your assets; hocking yourself; partnerships; incorporating; coops; innovative financing; joining clans. It all comes at a price.

G. Keeping liquid. Regulating turnover so cash comes in when you need it again.

V. The Cost of Capital (COK)

A. COK means carrying cost, not the price level of buying "capital goods" (all goods are capital goods, there are just differences of degree).

1. Imputed cost of owned K and land.

a. Layman's fallacy of ignoring imputed cost.

b. Economic theorists' fallacy of assuming imputed

COK is as high as borrowing rate.

2. Expected appreciation as a "cost" of corporate equity K, and a revenue from owning rising assets like stocks and land.

3. Ave. and marginal costs of borrowing.

B. COK is not the same for all. Fallacy of perfect arbitrage. Nonsense and tautologies from "rational expectations" theorists.

1. Owned vs. borrowed money, for individuals and corporations.

2. Credit ratings and structure of interest rates.

3. Differences in terms. Differential access to financial institutions for peak needs, e.g. during wars for control.

C. Sources of preferential access to credit.

1. Owned wealth, inherited from the past, regardless of source (it all gets laundered sooner or later). Liverpool slave trade in history. Conquest and "primitive accumulation". Appropriation and appreciation in recent history of offshore American holdings. Gains from illegal activities.

Family connections, next best thing to ownership. Mutual aid societies; mutual responsibility for debts.

2. Borrowing on collateral. Tendency of money to cluster around existing nuclei of wealth. Financial Law of Negative Gravity: banks etc. make liquid assets flow uphill, from scarcity to surplus, as the poor lend to the rich.

Basis of credit allocation is not marginal productivity, but collateral security. Collateral is source of financial power of Japanese investors buying in America.

Lenders' risk vs. owners' risk. Insights of Keynes vs. blindness of current crop of "explainers" to this distinction. Debt repudiation as zero-sum.

3. Mismanaged and misregulated financial institutions.

Preferential treatment of insiders by banks. Some recent war stories.

What happened to $500 billions lost by S&Ls? The perils of borrowing short and lending long. Will you spend your

lives paying for this disastrous excess of fervid ideological self-delusion exploited by cynical opportunists?

4. Reinvestment of rents; advantage of a head start; expansion around early nuclei.

5. Captive sources of capital. Corporate plowbacks to avoid tax on dividends, convert ordinary income to capital gains. Undistributed profits are not subject to test of the market.

Internalizing profits by public agencies: Forest Service, BLM, Highway Trust Fund, etc.

6. Captive lands, an annual cost (the opportunity cost) that never appears in the budget, is rarely reviewed, even when they go to "zero-based budgeting." Luxuriating in excess land while skimping on buildings and payrolls: cases of RCC, Loma Linda, Cal Baptist, Cal School for the Deaf, Sherman Indian School, UC, Stanford. Urban holdings of Ivy League schools: "Slums must create Great Universities, because it couldn't be the other way around." Tax-free California golf courses. Military bases and ranges. Licenses to appropriate (and waste) water. Broadcasting licenses. Rail and utility holdings (taxes paid, but automatically "melded" with other costs and shifted forward by rate regulation process). The National Forests. Other public lands and minerals. U.S.V.A. Hospital grounds in west L.A. and Sepulveda. This list could go on, and on, and on.

7. Irrational expectations: overvaluation of future capital gains, subtracting them from COK.

8. Tax shelters, e.g. planting fruit trees, holding and prospecting mineral leases. COK is reduced by deducting interest, capital outlays, abandonments, etc. from other income, then deferring or avoiding taxes on appreciation and sales.

9. Cross-subsidy of intensive margins of investment, e.g. if your credit is good for the first 40 stories, go for another 20. (It also helps to own a bank or an oil company.)

10. Pooling risk as a form of x-subsidy: a good principle gone wrong.

11. Borrowing by government, secured by tax revenues.

Borrowing by state and local government, interest exempt from federal income tax, most benefits to local landowners free of income tax, or tax-deferred.

Borrowing by federal government secured by FRB power to print money.

Net result: government investments can be a huge sink of real capital in low-productivity uses, some of them never being recovered. At the same time the human input in those uses may be too little.

12. Partial funding of public works. Absence of capital budgeting, reliance on annual appropriations.

D. Causes of high COK, and restricted availability.

1. Lacking collateral when others have more. Lacking collateral of the kind lenders favor at the time you need money. (Using collateral as the basis of lending is a zero-sum game. It doesn't generate more loanable funds, but reallocates them.)

2. Credit rationing. Limited amounts; limited terms.

3. General credit crunches.

a. Increased selectivity by lenders. The spurious record of cheap credit in the great depression.

b. Self-aggravation by blocking self-liquidation of frozen K. It takes working K to use fixed K.

c. Devaluation of existing fixed K. Lower share of cash flow allocated to K recovery, more to interest.

4. Dissaving and its causes. Another credit crunch coming soon?

VI. K Recovery, KCAs, and Turnover

A. Simple turnover with no interest or rent. Turnover as reciprocal of mean period of investment.

B. Real turnover vs. ownership turnover. Real recovery vs. tax write-off recovery.

C. Imputation of cash flow and priority of claims. Rent and interest come first; subordination of KCAs. K recovery as the true "residual imputee."

Problems: 1) Who gets the surplus, if any, after full recovery of K? 2) How assure the social imperative to "conserve the seed corn"?

D. Kinds of assets of intrinsic value. ("Extrinsic" value is the value of paper claims to assets of intrinsic value. This course does not deal with extrinsic values; for that try Econ. 134.)

1. Funds and flows: a basic difference, but too simple.

2. Depletable stocks

    a. Inventories.

        i. Spoiling

        ii. Growing

    b. Natural funds

3. "Flowing funds", i.e. fixed K that depreciates with time more than with use. This is the most common kind of K.

The "Milk Cow Model," a hybrid subtype. Value flows during life, and at the end the carcass is salvaged for enough to recover the initial capital input. This model has the virtues of mathematical simplicity and conceptual clarity. Refer back to it when confused!

4. Land, measured by price.

Garden-variety economists carelessly lump land prices with "fund" resources, but land value is not a fund because it can neither be stored nor unstored. It is not depleted by use nor depreciated by time. Individuals can liquidate land by selling. Even nations can, as we are selling the U.S. to aliens now. However, society as a whole can neither consume land value, nor convert it to K. Land value is not a storable fund: it is unique, a class of its own.

In a growing economy land does more than hold its value, it appreciates. Appreciation is income to individuals, but not to society, because there is no product corresponding to the income -- it is still the same land. Higher land values are increased wealth to individuals, for which there is no corresponding increased social wealth -- again, it is still the same land. These conundrums have baffled economists, who have not risen to the challenge but turned away from it muttering truisms, tautologies and trivialities.

5. Human capital. Skills, education, character, health, work habits, etc. are partly the result of self-denial, which has some similarities to saving. Nature has contrived that life itself results from parental gratification, but nowadays life is given, or not aborted, by conscious parental choice; education up to some point is the product of parental saving (some day you'll realize how <u>much</u>!) Some economists seize on this similarity to erase the distinction of labor and K.

The point is overdrawn, not to say grossly materialistic and inhumane and to me (obviously) offensive. Human "capital," (for those who must call it that) depreciates with human life, and human ability and propensity to work.

E. The K input: principal plus capitalized interest and rent.

1. PIPO case: sources of value added to growing stock.

2. Long construction period case. Using SFF to capitalize interest. Example of non-bearing orchards.

3. Example of regulated utilities. Institutionalized capitalization of interest: AFDC (Allowance for Funds During Construction). When is capitalized interest on equity treated as current income? When does it go into the rate base?

Danger of borrowing to pay interest on previous debt. When does interest capitalization become a Ponzi scheme? Problems of WPPSS.

4. Buying real estate with Negative Cash Flow (NCF). A unique form of capitalized interest that acquires rising land without creating real social capital.

F. Unfreezing fixed capital, i.e. getting it back for reuse.

1. Payback is not consumption.

"Capital is kept in existence from age to age not by preservation but by continual replacement." -- J.S. Mill.

"Fallacy of Preservationism," that identifies capital recovery with capital consumption.

"Fallacy of 'Beam me up Scotty'" that identifies replacement with identical duplication. Actually K is "Protean," and assumes different forms and sizes in each reincarnation. It is the aggregate quantity that is conserved, not particular material forms.

"Fallacy of Materials' Flow" that identifies K use with demolition, clearance and removal of old materials from carcass.

"Fallacy of Fixed Location" that treats K as lost unless replaced <u>in situ</u>. Actually K is highly migratory and routinely reinvested elsewhere.

If you understand K, each of those fallacies will be transparent for you. K will have become perspicuous to you.

You will have become perspicacious about K - got that? You will have attained a high degree of financial acumen. (A new word for you? Look it up.)

2. Real turnover vs. ownership turnover.

3. Non-self-liquidating investments: perpetuities.

Historical problems of banks lending to buy perpetuities, from the South Sea Bubble (1720) to the Great American S&L crash of like right now, man, read the papers. This is when we realize the importance of the 1st paragraph of F,4 (above).[3]

4. Full salvage

a. PIPO or tree model.

i. True recovery -- sale for immediate use.[4]

ii. Individual recovery through transfer, by: Sale before harvest; Collateralizing (aka hocking, banking, mortgaging, hypothecating, etc.); Contributing to partnership; Incorporating; etc.

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[3] However, it looks to me as though the peace dividend will save us from a crash this time. Historically, 7-10 years of peace dividends will bring on a real crash. 1720, for example, followed the Treaty of Utrecht (1713), which ended decades of wars, by 7 years. A few years after the British surrender at Yorktown and the Treaty of Paris (1783) came a crash (1798?). After Waterloo came the crash of 1819, and a bigger one in 1836, after peace dividends so generous that Uncle Sam was distributing tax surpluses to the States for public works. After the Treaty of Guadeloupe-Hidalgo (1848) came a railroad boom and the crash of 1857. 8 years after Appomattox came the crash of 1873. With continued peace dividends it only took 20 years for another crash in 1893. After Versailles everyone disarmed and signed the Kellogg-Briand peace pact, lowered taxes and paid off national debts, and ran right into the crash of 1929.

[4] Sale for use is only social recovery if the product is used up, e.g. used as kleenex. If it goes into a house to last 80 years then the social recovery is extended over 80 years. Here to keep it simple we'll assume the wood is pulped and used for wiping runny noses.

b. Tired cow model -- from milking parlor to McDonald's.[5]

c. Real estate value, where rise of land offsets ruin of building. Another case of individual salvage but social wipeout of K.[6]

5. Ordinary durable assets: the building model.

a. Amortizing loans: how bankers recover their K over time. You are dismayed at how slowly your unpaid balance falls, but they may be dismayed how slowly they are getting their money back.

b. Capital Consumption Allowances (KCAs): how owners recover K as plant (buildings) and equipment go to ruin. Similarity of building depreciation to amortization of loans.

c. Economic life and mean recovery period.

Half-life as an easier close approximation to mean recovery period.

Fallacy of assuming straight-line depreciation. Plant and equipment don't depreciate that way.

G. Measuring payback time.

1. Common meaning, n=P\a, is an economic monstrosity. It is an example of Fallacy of Arrogation (misimputation of returns), like putting your paycheck in Imelda Marcos' account. In this case, interest is credited to payback, involving the common Fallacy of Zero-interest. Try selling that idea to your banker.

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[5] It used to be old horses, from the stanchions to the glue factory. "Technology don't last; economics do."

[6] This is clear if you do not sell the land after clearing it. You are left with the same land, and no building. You can only replace the building now by using (borrowing) someone else's capital. If no one will lend, you are "land-poor," i.e. you own land but cannot afford to improve it.

It is also clear if you sell the land, and we look at the buyer. He has saved money and invested it, but created no K thereby, merely bought existing land. You now have the money, and may use it to create real new K somewhere else, which offsets the buyer's failure to create K, but does not replace the building you demolished.

2. Case of Tired Milk Cow -- payback time equals economic whole life -- or would, "in equilibrium."[7]

3. Real estate

a. Land, a perpetuity. Value never recovered "in equilibrium." Buyer must pay off loans by saving from other income, taking it out of his hide. Such loans are "non-self-liquidating." After every great banking collapse there is a reaction against them; in every long land boom they come back again.

b. Land and Building case -- false payback by substituting rising land for KCA on building.

4. Growing K like trees. Planting costs and the forest site are frozen in for the whole life; capitalized interest is tied up for less than that.

5. Paying off loans (amortization). Review from F,4.

Depreciation, and KCAs.

Mean recovery time.

Half-life, good approximation of mean.

Fallacy of straight-line depreciation.

H. Normalized models, aka staggered, aka going-concern models.

1. Why normalization doesn't change the major points, but only our perception of them: we see them as relations of co-existence rather than relations of sequence. Long periods of investment mean large inventory/sales ratios.

2. Normalized models as the link between micro and macro: Economics Reunified!

3. Abuses of normalization.

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[7] We will not waste time disputing the Equilibrium Concept, which is sometimes abused. Here it is harmless and useful. It just says capital tends to flow in and out of enterprises, through arbitrage, until costs and prices adjust so new investments make the same return in each enterprise. This happens when nothing obstructs arbitrage. It does not require us to say or believe there are no barriers to arbitrage in fact; it just says this is what happens when there are none.

a. The Fallacy of the Disappearing Inventory, as input and output become simultaneous. Some foresters argue this one in dead earnest.

b. Rejection by theorists of the "period of investment" as a concept. Mysticism of J.B. Clark and Frank Knight, and its permanent damage to economic education.

4. Normalization and factor proportions.

I. Inflation and false K recovery.

1. When KCAs are based on historical cost, you get your money back and it won't replace what you sold.

2. Phantom income, for accounting and taxation.

3. Need for indexing KCAs.

4. Fallacy of partial indexing, adjusting basis for capital gains taxes but not for ordinary depreciation.

J. Ways to unfreeze K when there is a credit crunch.

Resourceful and desperate people have figured out many ways -- how many can you think of?

K. Recovery speed and factor proportions.

1. Fast turnover maxes volume/K.

2. Fast turnover as labor-intensiveness; slow turnover as K-intensiveness. The Tao of Austrian-Wicksellian Economics.

L. Land sales and gains

Selling the flow vs. selling the fountain: the strange business of land gains.

VII. Replacement of K.

A. Economic life, mean life, and carcass life.

Recovery, reinvestment, replacement -- 3 different meanings.

KCA to recover and recycle K; replacement to recover and recycle land.

B. Economies of long life vs. costs of time.

1. Economies of long life.

Spreading overhead of K ; Reduced materials flow; Stability, tranquility; Max mean annual increment of growing stock; etc.

2. Costs of time.

Rent, interest, insurance, spoilage, depreciation, obsolescence, negative spillovers, fire hazards, vacancies, harboring nuisances, disease proneness, downtime, maladjustment of capacity to shifting demands, etc.

C. The optimal inventory model.

1. Is a normalized model, inherently.

2. Economies of long life are represented by "order costs" that are fixed, however large or small the order.

3. Shows sensitivity of turnover to i, to wage rates, and (as modified) to rent, spoilage, and other factors.

D. The redeemable bond analog model.

1. This is the "optimization by addition" model introduced at first session of class (cf. I, A, above, on p.1).

2. How long a life to plan for a plant? Max sum of PV of cash flows from 1st generation use, and resale (or other reuse) value of site.

3. Sensitivity of optimal life to major parameters: i, G, current and future construction costs, demand factors, etc.

E. The tree model

1. Cut when growth covers interest on tree plus site value.

2. Cut so as to max PV in perpetuity.

3. Consistency and identity of the two rules.

4. False solutions and confusions -- there are many, but we'll stop with two or three.

5. Sensitivity to i. How effect of higher i is tempered by countervailing changes in ground rent.

F. The culvert model

How much flood control is optimal? Sensitivity to i.

G. Models of rising demand; new issues raised.

1. The land ripening issue: when to improve land which is progressively rising in optimal intensity of use.

2. Progressive obsolescence, how to adjust to.

a. Locational

b. Functional

3. How much early excess capacity is warranted to cover rising future demands?

4. Replacement of individual by mass systems, e.g. replacing a collection of septic tanks by one sewer system.

VII. Summary, review, preview

A. What does it all mean?

B. How does it all fit together?

C. What was left out?

D. Where can I find references for review, and to learn more?

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SHORT TABLE OF CONTENTS

I. Ground Rules, Philosophy of Learning, Introduction, Overview

II. Elementary Math and Conventions

III.

I. Ground Rules, Philosophy of Learning, Introduction, Overview

A. Ground Rules

1. Text, equipment, problem sets and answers

a. Text

Text is this collection of notes and readings.

b. Equipment

Buy a basic hand calculator. Your calculator should, at a minimum, do powers, roots and logs. You must bring your calculator to use on all examinations. You will need it. Pick your own calculator, but do not skimp. Hand calculators are very cheap for what you get, one of the great bargains of all time, and still being improved every year. 25 years ago a Marchant mechanical calculator, state of the art, cost $1,000, weighed 30 pounds, and didn't do powers and roots.

You are responsible to show up fully equipped.

-- You must not share calculators during exams. Sharing calculators will be interpreted as cheating, however virtuous and innocent your intentions, and penalized accordingly. The Instructor is the sole judge of who is sharing calculators.

-- Do not ask to borrow the Instructor's calculator. He needs it too, and will just be irritated. You don't need to be remembered as the class klutz.

-- Do not plead broken calculators and dead batteries as excuses. Learn the TANE concept: "There Are No Excuses." If you blow it, you pay the price. That's life: start living it now.

Suggestion: carry a spare, for you and/or your absent-minded friend.

Some clever students will doubtless acquire programmable calculators, and program in some equations. That is legitimate, although not required. Others, less clever, perhaps, but more affluent, will acquire business/finance calculators, with standard equations hard-wired in. I cannot control that, but do not recommend it because you will have less idea what you are doing.

Learning to operate calculators is your responsibility. Learning to program calculators is at your choice, and at your own risk. You can handle all exams in this course simply by learning and using the formulas, and that is my standard expectation. I recommend you do it that way, because then you will always fully

understand what you are doing, which is the main idea. Pushing buttons can be handy, but not if it substitutes for thinking.

c. Problem sets and answers

There is a short set of problems for each week. Working problems is by far the best way to learn this material. Problems are similar to but not identical with exam questions. Exam questions may ask you to splice together two or more simpler techniques; or apply techniques in an unexpected context. Thinking on your seat teaches you to think on your feet.

2. Exams and grading

a. When given; how weighted

Number and length of exams will depend on number of students, and whether we have a grader. I prefer to give weekly, 20-minute exams, conditions permitting. I will announce exam schedule on the 2nd meeting of the class. You are responsible to be there and hear the announcement.

University regulations require us to have a final at the scheduled time.

Exams will generally bear weight in proportion to their lengths. All exams will be counted, including your worst. An unexcused absence means a grade of zero, considerably below most "F" grades.

b. Coverage

Avoid asking "Are we responsible for ... "; it makes a bad impression. If it is here, it is worth your studying. If we are on the topic, you may or may not be able to use it on an exam. You may be able to "get by" without it. You also may be able to enrich and upgrade your answers by alluding to it, but don't drag it in by the heels if not relevant to answering the question: use your judgement. If you take an interest in the subject for its own sake, and keep current with the work, being prepared for exams comes naturally as a by-product. That is the way it should be, and I am dubious of those who see it otherwise.

b. "How to write better exams": see Appendix I-1.

c. Notations used in grading: see Appendix I-2.

d. Examples of tautologies: see Appendix I-3.

e. Make-up exams

You may make up no more than two missed exams, subject to a

penalty of one full letter grade taken off the grade you make otherwise. If you make up more than two missed exams, the penalty rises to two full letter grades.

If you have a signed medical excuse to leave in my files, the penalty may be abated. Births and deaths make good excuses - documentation is appreciated. Most other excuses are not acceptable, e.g. car trouble, traffic delays, athletic team events, court appearances, personal problems, weddings (other than your own), and job interviews. Sob stories are heard skeptically.[1] You must schedule your life to accommodate the course, or pay the penalty.

f. Attendance, participation, and conduct

i. Attendance

"90% of success is just showing up." I expect you to attend class. I take attendance randomly at first, and then with special attention to problem cases. If this happens to work to your disadvantage, too bad: be there and you'll have no problem.

Three or more recorded absences are cause to lower your grade. The Instructor is the sole judge of how heavily to weight this factor. You put yourself at risk when you cut class.

Arriving late and leaving early are counted as absences, unless by prior arrangement. Leaving early after a 20-minute exam counts as an absence, even though you took the exam.

ii. Participation

I ask people questions about assigned work. Usually I ask for volunteer answers. If there are none, I start asking individuals. Your responses are weighted into your grade. The Instructor is the judge of the quality of answers, and the weighting.

You can quiz me, too. You get credit for asking good questions. This is risk-free: you do <u>not</u> risk penalties for asking dumb questions. You may not get much credit for them, of course, but again, you do <u>not</u> risk any penalty. Got that? The Instructor is the judge of how good your questions are.

Rarely, there comes a student who asks too many digressive, disruptive questions. I may point that out and decline to answer, to keep the class on track. Don't let this inhibit you, in general: if it's a problem, I'll let you know.

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[1] Sandy Schauer, on the other hand, is a sympathetic ear when you need a friend, a chaplain or a shrink.

You also get credit for challenging the Instructor successfully. You get lots of credit for catching the Instructor off base. I make mistakes, sometimes on purpose, sometimes not. Do not be afraid to embarrass the Instructor, I have a thick skin.

Be prepared, in return, for some friendly needling and genteel jousting. That's all part of the game and it is supposed to make learning more fun. If you think I'm picking on you, you're missing the point: don't fear to talk back. Sharpen your wit with those rapier-like ripostes.

You also get credit for catching other students off base, that's part of the game, too. Don't get mad at another student who disputes you: he/she may get credit, but if you're off base the Instructor knows it anyway. Remember, too, when dealing in matters of judgement, it is legitimate to suggest moving the bases.

iii. Conduct

You must not hold private conferences in class. Class is a community activity. Private discussion here disrupts the class. It is disorderly conduct, and hurts your grade more than an absence. It is better for you to be away than to disrupt the class. Tell your friend, "We've got to stop meeting like this." If someone insists on talking to you, don't answer. If you must confer, there is a wide world outside the door: use it.

My first response to disruptors is to ask them questions. Some people are surprisingly dense about this. If they still don't catch on, they'll have to leave.

In some classes I set up competing teams who confer to determine group strategy. This is not one of those classes, however.

There are a few bizarre cases, like the girl who brought her baby to class. That was a tough one, especially coming at the height of ERA. It was still unfair to other students as well as the young mother herself. Only the baby really enjoyed it, and it didn't show for exams.

g. Cheating

The <u>minimum</u> penalty for any form of cheating is forfeiture of the exam paper, resulting in a grade of zero (lower than an "F," which could be as high as 65 points). Aggravated cheating will result in expulsion and/or course failure. The Instructor is the judge of whether cheating has occurred. It is in your interest to avoid both sin, and the appearance of sin: use your head, and don't act suspiciously.

Leaving class during an exam for a drink or a pit-stop is one way of acting suspiciously: try to take care of these basic matters in advance.[2]

B. Philosophy of Learning

Turning from the ridiculous to the sublime, let's take a look at how you may learn best.

1. There is lasting value in learning skills and ideas of great generality. These are not limited by time or place: they endure and apply widely because they transcend technologies and institutions and circumstances. They may appear "abstract," because of their generalized form, but we deal here with general ideas like compound interest, that are relevant to dealing with practical, applied problems of business and life. You may learn about interest the easy way from me, or the hard way from your banker.

2. There is continual value in testing general ideas by particular experience. A great modern philosopher defined thinking as "solving problems that arise in a social context." That was John Dewey, the pragmaticist. These abstract ideas, that you may ingest all clean, washed and cooked, a priori, were originally discovered the other way, from hard experience. They may and should always be retested by experience. In between abstraction and experience there are numerical examples and problems, of which you will be seeing many.

Many economists today, and business theorists too, abuse abstraction by straying off into truly useless, rarefied, arid, mystical, sterile, pedantic, esoteric, recondite, Laputan realms that simply waste their time, and yours. Such work is "abstruse," which is the seamy side of "abstract."

Putting the best light on it, they are following an ancient compulsion to produce sacred priestly incomprehensible writings to mystify the heathen and uphold the faith. They are the descendants of those who similarly abused religion during the age of theology, and turned "Jesuitical" and "Scholastic" into terms of reproach. Their writings fill the learned journals today, leading a Business Week reporter at a recent convention of the AEA to headline, "7,000 Economists and No Answers." You may

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[2] I understand that the "fight-or-flight" reaction of adrenalin pumping during the thinking process can be cathartic. This is a delicate matter to mention, of course, but you can handle this by pumping yourself up by working some problems before the exam.

rightly suspect, therefore, when I uphold the value of abstract reasoning, that I, too, am going to fill your head with useless mysteries and conundrums. Rather, this is a course in applying theory to solve real problems that arise in a social context.

3. There is value in learning how to learn, and keep learning. See Appendix I-4, for excerpts from Eric Berne and Abraham Maslow.

4. There is value in doing problems. You learn by doing. Working problems suddenly converts you from a passive recipient of formulas to an active agent, a problem solver. To repeat Dewey, thinking is solving problems. It activates your adrenalin. At first it is a shock to the system, with a "fight-or-flight" reaction, but you'll get to like it. It brings out and develops the real you, the potential thinker.

Do not complain that exams are "unfair" if they do not exactly track the problem questions. They are designed to make you think what you are doing, and to give the best students a chance to show their stuff.

5. There are at least four common ways to pose and express functional relationships:

a. Graphically;

b. Algebraically;

c. With specific numerical examples;

d. With tables of all, or most, likely numerical outcomes.

Algebra has always stood highest among the learned, but the other methods are useful, too: for learning; for applications in the field; for getting a feel for the ballpark of likely outcomes, and the relative weights of different elements in a problem; and for giving visual insights that help in both the understanding and creative processes.

Algebra is programmable, hence increasingly useful and popular. Resign yourself, therefore, to learning a good deal of algebra. We will, however, use the other three methods, too: all are useful, and will remain so.

6. There are limits to Rationalistic Management based on careful measurement, optimizing, and monetary self-interest. Be aware that other values move people, too.

This course does not deal with these other topics because that is not its mission. That does not mean, however, that the Instructor

recommends a "hard-line" quantitative approach to management. Mathematical tools and understanding and measurements are useful; they are not everything, not self-sufficient. For the wisdom and judgement you need in order to manage successfully, you must integrate and harmonize your mastery of abstract thought with some knowledge of law, history, tradition, religion, social psychology, administration, communication, engineering, professionalism, aesthetics, drama, rhetoric, and much else. A lot of common sense will always be needed, too.

Some studies of motivation are in Appendix I-5.

Some studies of successful companies, and other organizations (military, religious, educational, colonizing groups, etc.) are cited there.

C. Introduction to substantive material ~~of this course~~

1. Management as optimization

Optimizing is maximizing a bottom line. A bottom line is the net result of the interaction of two or more variables, like revenues and costs. You already know a lot about optimizing. Marginal analysis is a tool for optimizing. Maximizing profit (properly defined) is a form of optimizing.

A bottom line is a Performance Standard. Performance Standards are designed first to assure survival and solvency; then to maximize wealth over time. Many texts omit the first, but anyone who omits giving priority to survival and solvency has led a sheltered life and ~~may not keep you alive through the first year of your business~~. should be replaced w/ a realist.

Choosing the right performance standard also helps to avoid fallacies, of which there are many. See Appendix I-6 for a list of common fallacies.

a. Trade-offs

Optimizing involves trade-offs. Rarely is it economical to maximize any simple measure, like output per worker, or sales per square foot. Rather, you trade off some output per worker to get more sales per square foot. You trade off some miles per gallon to spend less on capital cost and maintenance. Sometimes it is economical to maximize "profit," but only when you define profit carefully and correctly.

b. Measurement

Trade-offs presume commensurability. You cannot know if trade-

offs are desirable until you measure everything by the same yardstick. Applied economics is necessarily quantitative: it gives numerical answers, and criteria for numerical answers, to questions of how much, when, and where. (~~It only helps answer~~ other questions like what, why and how, are not qualitative.)

c. Yardsticks[3]

Commensurability presumes a common standard of value. Our basic measures are dollars, which give rates of exchange between apples and oranges, and interest rates, which give rates of exchange between dates.[4] That implies rejecting other measures like energy, requirements, fixed standards, tax minimization, foreign exchange earnings, materials flow, food production, and other alternative values that are constantly thrown up as better yardsticks. Managers are constantly arbitrating among competing fundamentalists, each of whom overvalues his special bag and derogates others. You cannot ~~manage~~ arbitrate without an objective yardstick.

Money and interest rates are better-balanced standards than the others suggested. They have their weaknesses, however, and are often abused, which is why rival measures are always being advanced. We should listen respectfully to the heretics, and ask ourselves what abuse of our system is leading them to waste their time advancing indefensible ideas. It happens with every crisis or readjustment.

d. Examples of optimizing

-- by subtracting, e.g. subtracting expenses from revenues to find cash flow; subtracting depreciation from cash flow to find income; subtracting interest from income to find ground rent.

-- by multiplying, e.g. multiplying price times quantity to find gross revenue. Applying differential calculus to maximize the product of two variables. Maximizing a product by equating (with reverse signs) the percentage changes of its two factors. Example of maximizing area enclosed by a fence of given length. Example of finding marginal revenue. Relationship to elasticity of demand. Log derivatives as fractional changes. Finding log derivatives with your calculator. Elasticities as

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[3]Theorists like to say "numeraires," which is as classy as supercalifragilisticexpialidocious, indubitably, but only means what yardstick means.

[4]Given time we would also look at transportation costs, which give rates of exchange between places; and transactions costs, giving rates of exchange between owners.

ratios of log derivatives.

-- by dividing, e.g. dividing rising stumpage value by the compound interest factor to maximize present value (PV). Applying differential calculus to maximize the quotient or ratio of two variables, a dividend and a divisor. Maximizing a quotient by equating the percentage changes of its two factors. Example of maximizing average revenue of a variable input. Relationship to elasticity of production. Example of finding discounted marginal product of time. Log derivatives of exponential functions like the compound interest function.

-- by adding, e.g. adding PV of salvage to PV of ordinary cash flow to maximize PV of series of structures, determine optimal life.

-- by compounding, e.g. adding capital cost up front to increase durability of capital equipment. Here we learn something about exponential functions like the compound interest factor. Its log-derivative is simpler than its derivative: it is the interest rate.

-- Another approach to interest costs is Baumol's inventory model. See Appendix I-7.

Finance calls for finding the tradeoff between economies of one-time, plan-ahead[5] construction, and its cost in capital tied up. Baumol's model is an excellent way to summarize major points of financial management, and will be referred back to a lot.

2. Imputation

Management requires imputing net returns to individual inputs. Hence marginal analysis is valuable for managers. Marginal analysis and imputation go together - they are two different (but interrelated) ways of doing the same thing. Each has the purpose of telling you what specific individual inputs do for you, i.e. what they add to your output. That is how you know what they are worth, and what you can bid for them.

It is good to know that if you pay each input what it is worth you will not run short of funds. There is a theorem for that. A basic theorem of Intermediate Micro is "Euler's Theorem," which shows that the laws of distribution are integrated: if every input is paid its marginal product, the total product is

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[5]Other names for synchronism: simultaneity, all-at-once, unitized construction, one-time buildout, scale, wholeness, single-phasing. Antonyms: piecemeal buildout, phasing, Balkanizing, dissonance, cacaphony.

"exhausted," i.e. all paid out. The corollary of that is that if the return to any input is imputed "residually," i.e. by subtracting the returns to other inputs from the total product, then the residual share equals the marginal product of the input.

We will not make much use of Euler in this course. You will benefit, nonethess, by reviewing Euler's theorem, using the Cobb-Douglas Function. See Appendix I-8. The usefulness of this review in this course is 1) To link this course to Intermediate Micro; and 2) To see how exponents in production functions are elasticities of production.

A main weakness of Euler's theorem is that it seems to be timeless, i.e. it deals solely with relations of coexistence, not of sequence. It does not deal explicitly with the time value of money. This limits its generality and persuasiveness. In this course, therefore, we will not use Euler's Theorem.

Instead, we will use the concept of The Discounted Net Product. Cash Flow (CF) is the standard business term for Net Product; Discounted Cash Flow (DCF) is the standard term for The Discounted Net Product. ("Discounted Marginal Product" is also used.) These are <u>double</u> net concepts: CF, first of all, is net of future expenses; then <u>discounting</u> subtracts out intermediate "carrying costs" or time costs.

η. The time cost most discussed by economists is interest. There are, however, two others that we will be careful to include: ground rent, and property taxes. Sometimes they are smaller; sometimes larger. Ground rent usually varies inversely with interest rates, offsetting in part the effect of changes in interest rates. This gives ground rent a special twist that most economists overlook.

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A. Ground Rules, Philosophy of Learning, Introduction, Overview

Intro and general, pp. 1-12
"Learning to learn": several short readings, by Berne, Goble, Brandis, Adler, Hartig, Mill, Hubbert, Bernstein, Mencken,

B. Basic Math and Conventions

1. The PIPO building block.

Notes, pp. 1-8.
Problem set #1, with answer set, and text therein.
Notes on continuous interest, derivation of e.
"Reswitching," pp. 1-12 (deals with payback times)

2. Converting point to flow values, and v.v.

a. Valuation: solving for Present Value

Notes, pp. 9-14
Problem set #2, with answer set
Present value of periodic replacement costs (of undergrounding a water tank) pp. 1-5
Price risk, assets of various terms
Rent, interest, property taxes, and land prices
Rising rents

b. Amassing assets or debts: solving for Future Value
(Capitalized interest; AFDC; etc.)

Notes, pp. 16-18

c. Annualizing: solving for annuity value (a)
(Paying past debts; preparing for future debts; making irregular payments commensurable; making payments over various terms commensurable)

Notes, pp. 14-16; 18-20
Reswitching, pp. 13-end.

d. Finding rates of return: solving for i
Notes, pp. 20-21; 39-43
Finding rates of return, pp. 1-2
Carter's Cut
TISTOC (Tax-induced slow turnover of capital). Pages to be announced.

TIME FOR 1ST MIDTERM; END OF BOOK I OF READINGS

e. Payback time (mean period of investment)

Notes, pp. 22-29
Period of investment: calculating the mean with normalized models, pp. 1-21

Economics - Bus. Ad. 162, S95
Syllabus (Rev. 10 April)

I. *Introduction to Course*

A. Ground Rules.

READING: Ground Rules

B. Review of conventional short-run cost curves

C. Need for co-measuring, common yardsticks for trade-offs

1. Money as a measure;

2. Need for capital theory: translating between point values and flow values; rates of exchange between times; user-cost of capital vs. user-cost of land (depreciation vs. appreciation)

3. Need for imputation of price-determined values (Triffin's Rule)

4. Cash flow: an improvement on simple money measures

5. Need for homogeneity and fungibility.
Special problems of measuring land, which lacks both qualities, and whose value is often found by imputing away excess profits.

READING: Imputing.

II. *Introduction to Optimizing*

A. Limitations of economic reasoning

B. Examples of optimizing, using multiplication, division, exponentiation with division, subtraction, and addition.

READING: Optimizing;
READING: Rectangle dimensions
READING: Fallacy of petty incrementalism

C. Need for finer co-measuring tools revealed by above examples

D. Optimal combination of inputs

1. Inadequacy of conventional cost curves

2. Diminishing returns: example of crowding citrus trees (or cattle, fishing boats, autos, etc.).

READING: Diminishing Returns;
READING: MP as a System Concept.
READING: Optimal Combination of Inputs

Concept of crowding as a cost, and space-preemption as a form of consumption

Why the analogy of diminishing returns does not apply perfectly to crowding people, houses, etc. Fallacy of composition in applying it to whole world. Synergies among people: why organic human society differs from mobs and herds of cattle, schools of fish, flocks of ducks, etc.

3. Office-building model

READING: Office-building model

a. This is a practical, comprehensive way of including most relevant variables of cost and net revenue.

b. Relation of this model to conventional cost-curve analysis: the trade-off between FC and VC.

False efficiency of minimizing AVC while ignoring or undervaluing AFC. Other fallacies of partial economizing.

c. Need for finer tools to measure user-costs of capital and land: why we will study capital theory.

4. Fallacies of partial maximization

5. Fallacy of free rent

READING: Fallacy of Free Rent

E. Optimal allocation of mobile resources; the equimarginal principle

READING: Equimarginal Principle

1. Be sure the products in question are net, not gross; false efficiency from ignoring marginal complementary costs. Be sure they are marginal, not average: false efficiency by focusing on average products (or average costs)

2. Example of allocating water among rivals

3. Example of allocating capital among divisions: central management as a form of banking

F. Economies of scale

READING: Pros and Cons of Scale

Summary ***READING***: Glossary

G. Optimal inventory and turnover

1. The Baumol Model

READING: Baumol's Inventory Model

2. The partial insight into why capital (K) is productive: economies of bulk buying, shipping, handling, and selling

3. The pro and con of bulk: saves labor, but uses more K

4. Finding optimal combination of labor and K.

Effects of changing i.r. and wage rate on what is optimal.

Working land cost into the model.

5. Effect of taxes on optimal combinations. The heavy weight of institutional bias. As a private optimizer, shut up and live with it; as a citizen, expose it, fight it, and reform it lest we, too, go down the tubes with Rome, Babylon, Nineveh and Tyre.

6. Bulk purchase as a metaphor or paradigm (exemplar) of economies of scale, durability, advance provision, mass production, synchrony of producing organic units, long production runs, etc.

7. The insight of this model into normalized (staggered, going-concern) models of investing-liquidating.

8. Lead-in to capital theory

III. ***Practical Capital Theory***

A. Basic Math of Finance, and Conventions used in This Course

1. The PIPO building block.

Readings: BMF ("Basic Math of Finance"), pp. 1-8.
Problem set #1, with answer set, and text therein.
Notes on continuous interest, derivation of e.
"Reswitching," pp. 1-12 (deals with payback times)

2. Converting point to flow values, and v.v.

a. Valuation: solving for Present Value

BMF, pp. 9-14
Problem set #2, with answer set
Present value of periodic replacement costs (of undergrounding a water tank) pp. 1-5
Price risk, assets of various terms
Rent, interest, property taxes, and land prices
Rising rents

b. Amassing assets or debts: solving for Future Value

(Capitalized interest; AFDC; etc.)
BMF, pp. 16-18

c. Annualizing: solving for annuity value (a)

(Paying past debts; preparing for future debts; making irregular payments commensurable; making payments over various terms commensurable)
BMF, pp. 14-16; 18-20
Reswitching, pp. 13-end.

d. Finding rates of return: solving for i

BMF, pp. 20-21; 39-43
Finding rates of return, pp. 1-2
Carter's Cut
TISTOC (Tax-induced slow turnover of capital). Pages to be announced.

e. Payback time (mean period of investment)
BMF, pp. 22-29
Period of investment: calculating the mean with normalized models, pp. 1-21

4. There will be more.

Contents, Readings, Managerial Economics, S95

THIS CONTENTS IS PLACED IN VOLUME B, BUT ALSO COVERS VOLUME A

A FEW ITEMS ARE ONLY ON RESERVE. THESE ITEMS ARE MARKED "RBR." ALL OF THEM ARE OPTIONAL READINGS

Volume A

A, 1. Ground Rules
A, 2. Introduction to Optimizing
A, 3. Imputing
A, 4. Rectangle Dimensions
A, 5-1. Fallacy of Petty Incrementalism
A, 5-2. Diminishing Returns
A, 5-3. Marginal Product as a Systems Concept
A, 6. Optimal Combination of Inputs
A, 7. The Office Building Model
A, 8-1. The Fallacy of Free Rent
A, 8-2. The Equimarginal Principle
A, 9. Pros and Cons of Scale
A, 10. Glossary, First Two Weeks
A, 11. Baumol's Inventory Model
A, 12. Basic Mathematics of Finance

Volume B

Part I, *Production Economics*

B, 1. Labor-spurning Tendency of Big Firms
B, 2. Saving Labor by Wasting Land
B, 3. The Fallacy of Fixed Proportions
B, 4. Effect on Wage Rates of AP and MP of Labor
B, 5. Euler's Theorem
B, 6. What is Economic "Intensity"?
B, 7. Elasticity of Production (ϵ), and Playing the Percentages
B, 8. Substitution: Two's Company, Three's a Crowd
B, 9. The Fallacy of Automatic Pass-through
B, 10. Quantum Leaps and Ecotones
B, 11. Complementation, Scale, and the Marginal Net Product
B, 12. Effects of Lender Risk and Bias
B, 13. False Performance Standards
B, 14. Generic Fallacies that are Common in Economic Discourse

RBR Falling Property Tax Rates and Rising Concentration

Part II, *Financial Economics*

Technical

BF, 1. Napier and Continuous Interest

Valuation, and Maximizing DCF over Time

Maximizing Net Present Value. See the papers and pages indicated below:

"Land Prices, Forecasts, and Appreciation," Sections 3,4.
"Redeemable Bonds and Orange Groves," Section IV, pp. 11-13
"Rent, Interest, Taxes, and Land Prices," pp. 1-3
"Maximizing Value in Perpetuity," pp. 1-4

RBR "Objectives of Government Policy in Leasing Mineral Lands."
RBR "Property Taxes and the Frequency of Urban Renewal."

Valuation, DCF, Sensitivity to Discount Rates

BF, 2. Possessory Value and Resale Value of Land
BF, 3. Using Semi-log Scales
BF, 4. The n% Rule of Thumb
BF, 5. Price Risk, Assets of Various Terms
BF, 6. Sensitivity of Financial Factors to n and i
BF, 7. Rent, Interest, Taxes, and Land Prices

RBR Sensitivity of Present Values to Different Kinds of Taxes (Paper, "Taxes on Yield, Property, Income, and Site")

Valuation with Repeating Generations

BF, 8. Present Value of Periodic Future Capital Costs: water-tank example
BF, 9. Maximizing Value in Perpetuity (T-max)
BF, 10. Land Prices, Forecasts, and Appreciation

Replacement Policy

BF, 11. When to Cut a Tree
BF, 12. "Influence of Anticipated Obsolescence" (from Lutz and Lutz, Pp. 109-12)
BF, 13. Finding Optimal Life of Capital
BF, 14. Some Life Cycles of Capital

RBR "When to Build What?"

Capital Recovery, Turnover, Capital Consumption Allowances, Cashflow Management, Payback Time, and "User-cost" of Capital

BF, 15. Depreciation, Repaying Debt, and Recovering Capital
BF, 16. A 5-year Repayment Schedule
BF, 17. Calculating Mean Periods of Investment, using Normalized Models
BF, 18. "Reswitching: How to Resolve the Cambridge Controversy"

RBR "Tax-induced Slow Turnover of Capital (TISTOC)

Rates of Return

BF, 19. Redeemable Bonds and Orange Groves
BF, 20. Rate of Return after Tax

RBR "Land Gains, Fast Write-off, and Incentives to Build"

Capital Budgeting: Rival Performance Standards

Review "Calculating Mean Periods of Investment," pp. 1-7
Outline of Lecture Notes, to be distributed

Extractive Resources

BF, 21. "The Analysis of Time-indivisibility." From *Extractive Resources and Taxation*, pp. 342-67.

RBR Oil and Gas: Leasing Policies for Alaska

General Theory

BF, 22. Fallacies about Capital Theory, Finance, etc.

Readings on Reserve

NOTE: THESE ARE ALSO LISTED ABOVE, BY TOPIC

RBR, 1. Objectives of Government Policy in Leasing Mineral Lands
RBR, 2. Tax-induced Slow Turnover of Capital
RBR, 3. When to Build What?
RBR, 4. Falling Property Tax Rates and Rising Concentration
RBR, 5. Land Gains, Fast Write-off, and Incentives to Build
RBR, 6. Taxes on Yield, Property, Income, and Site
RBR, 7. Property Taxes and the Frequency of Urban Renewal
RBR, 8. Oil and Gas: Leasing Policy for Alaska

Reading List, Managerial Econ., S96

VOLUME ONE OF READINGS

Outline Code	Rdg. No.	Reading Title
	1	This Reading List
	2	Syllabus
Intro		
A	3	Ground Rules
B	4	How to Learn
C		Eric Berne, Abraham Maslow (on reserve)
D	5	How to Write Better Exams
E		Marginal Acronyms Used in Grading Exams
I, A	6a,b	Measurement; Imputing
I, D	7	Discounting the Net Product
I, H	8	Standard Algebraic Notation for this Course
I, J	9	Glossary: Learning by Expanding Your Vocabulary
II, a	10	Max Current Cash Flow vs. Max DCF
II, C	11	Introduction to Optimizing
II, C		Optimizing Dimensions of a Rectangle
II, C	12	Fragment on Equimarginal Allocation
II, E	13	False Performance Standards
II, F		"Logos Abused," on Limits of Ec. Reasoning. This Is on Reserve, Not Bound in this Volume.
III, a	14	Productivity of Capital
III, B		Volume and Turnover: Fragment
III, C	15	The PIPO Compounding Factor
III, C	16	Use of Logs and Semi-log Scales
III, D	17	Solving the Compounding Factor for its Elements
III, E,3,a	18	Faustmann's Formula
III, E,3	19	Present Value in Perpetuity
III, E,3,b	20	Rolls Royce vs. The 7 Buicks
III, F	21	DCF of Infinite and Finite Flows

End of Volume One of Readings

VOLUME TWO OF READINGS

III, E,2	23	Valuation: Redeemable Bonds and Orange Groves (Brief Introduction)
III, F,8	24	Price Risk, Assets of Various Terms
III, F,11	25	Extractive Resources and Taxation, Excerpt

For Vol. II

Reading List and Schedule, Managerial Econ., S97

COURSE ORDER, 3/31

1,2 This Reading List and Schedule
3 Ground Rules
4 How to Learn
5 Study questions and answers (bound separately)

BUILDING BLOCKS, 4/2 - 4/4

6 Standard Algebraic Notation for this Course
7 Valuation and Holding Costs for Perpetuities
Solving capitalization formula for its elements
8 Compounding and the compounding factor (CF): the PIPO model
Solving CF for its elements (preliminary)
9 Use of logs for compounding; semi-log scales
10 Optional: John Napier and Continuous Compounding
11 Why pay interest? The productivity of capital

DISCOUNTING THE FUTURE, 4/7

12 Discounting the future (solving CF for Present Value),pp.1-2
13 Measurement, Yardsticks, Commensurability and Discounting. (See also #41 and #42 for more on this topic.)
14 Discounting the net product (DNP) of labor
15 Discounted value of cash flows (DCF), infinite and finite
16 Discounting as commensuration: the imperative to co-measure

VALUATION, 4/9 - 4/11

17 Net Present Value (NPV) of One Generation (NPV = DCF - K)
18 Optional, on reserve. Valuation of mines, excerpt from *Extractive Resources and Taxation*
19 "Redeemable Bonds and Orange Groves": Valuation of flow values plus point salvage values
20 Why Valuation? "Maximizing Current Cash Flow vs. Maximizing Wealth." Net DCF is a **Comprehensive** Performance Standard. Contrast with maximizing current "profits." Reconcile by adjusting balance sheet, "marking to market." Contrast with the error of maximizing DCF while ignoring K.
21 (See #41 for text) Net Present Value of Generations in Series: Faustmann and the Land Value Multiplier (LVM)
22 (See #42 for text) Present Value in Perpetuity
23 Valuation of rising cash flows (reading #7, expanded)

24 DCF from a Series of Discrete, Progressively Higher Future Uses (we may cover this after #42, rather than here)
25 Deleted

SENSITIVITY ANALYSIS, 4/14 - 4/16

26 Sensitivity of Values to n and i
27 How to adapt to higher or lower i.r.: the "n% Rule of Thumb"
28 (Reading TBS) How to adapt to higher or lower wage rates: the method of maximizing NPV. Cross refs: #42, Aunt Tillie; #77, Baumol's Model
29 Optional; on reserve. "A Simple Test for Tax Bias."
30 Optional. "Price risk; assets of various terms." (The hazard of "i.r. obsolescence".)
31 Some Economic Life Cycles (how long do various real things last?)
32 How to adapt to limited capital: Volume and Turnover
33 Optional; on reserve. "Rent, Interest, and Taxes: Effects on Land Prices."

LINKING CAUSE AND EFFECT: FUNCTIONAL RELATIONSHIPS, 4/18

34 To be supplied: Cash flow (c.f.) as the product of capital
35 Marginal c.f. (m.c.f.) as the product of incremental capital: the office building model
36 Discounted Net Product (DNP) as the marginal net product of labor. See #14, "Discounting the Net Product ... "
37 Four ways of showing functional relationships: arithmetic examples, tables, graphs, algebra. See #4, "How to Learn," pp.2-3; and #50, "Annualizing with the IPF," pp.1-2.

VALUATION OF INTERMITTENT FLOWS, 4/21 - 4/23

38 A Rolls-Royce vs. a series of seven Buicks
39 Undergrounding a water tank
40 Early excess capacity vs. later twinning
41 Faustmann's Formula: the infinite time horizon
42 DCF in Perpetuity (Case of Aunt Tillie). Recaps #41

CAPITALIZED INTEREST, 4/25

43 Finding the Future Value of a Given Flow: the Compounded Cash Flow Factor (CCFF)

44 The CCFF in Action: Forest Taxation in California
45 The joys of capitalized interest: building your nest egg
46 The perils of capitalized interest: digging your grave

PREPARING FOR MIDTERM, 4/28

47 How to Write Better Exams
48 Acronyms Used in Grading Exams
49 Glossary: Expand your vocabulary to express yourself better

MIDTERM, 5/2

PAYING DEBTS AND RECOVERING CAPITAL, 5/5 - 5/9

50 Annualizing with the Installment Plan Factor (IPF)
51 Depreciation and capital recovery allowances
52 Capital sinks, white elephants, and "Hayeks." Cf. #46.
53 Payback times with level installments
54 Planning paybacks ahead: the Sinking Fund Factor (SFF)
55 How a Rise of Discount Rates Downvalues and Destroys Capital: the risk of "i.r. obsolescence"
56 How a rise of land values downvalues and destroys capital: the risk of "locational obsolescence"
57 Rent or buy?

END VOLUME I

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BEGIN VOLUME II

Note. The contents below are slightly revised from the list given in Volume I. Use this one.

34 (Omitted from its proper place in VOLUME I; is now placed here, instead.)
Cash flow (c.f.) as the product of capital

A SELF-AWARE LOOK AT METHODOLOGY, 5/12

58 Why all the math? Note: there is no reading here. I will cover these points orally in class.

The imperative of commensuration (common yardstick - see #68, which stresses this)
Background for intelligent discussion of choices (if you stumble on the basic math, you'll never know what you are doing)
Prelude to optimizing (see #73)

59 Imputing
60 Trade-offs and optimizing (prelude to #73)

RATE OF RETURN (ROR), 5/14 - 5/16

61 Simple cases: perpetuities and PIPOs. (See #7; and #8, pp. 2-3)
62 Cash flow equations: finding "i" When You Know "a", P, and "n". "Current yield" vs. "Yield to Maturity" (YTM)
a) Finite Flows
b) Orange Groves and Redeemable Bonds
63 Optional: Carter's Cut (How to Lose Money on Junk Bonds and Never Know It!)
64 ROR as Affected by Land Value Increments
65 Distinguishing phantom income from real income: Excerpt from "The Partiality of Indexing Capital Gains"
66A Rate of Return after Tax (RORAT)[1]
66B Optional. Effect of Taxes on ROR[2] On Reserve

PERFORMANCE STANDARDS FOR CAPITAL BUDGETING, 5/19 - 5/21

67 Review #20, "Net gain vs. DCF."
68 Max DCF of one generation vs. Max DCF in perpetuity (stress commensurability). Cf. #81, pp.1-3.
69 Max ROR; use of floor or "hurdle" ROR
69B Are "capital gains" part of the ROR? Cf. #64.
70 Max annualized value, the best standard overall. Review #68.
71 Minimize payback time, maximize turnover
72 False standards, common errors of "partial optimization" (selected from #83-85)

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[1]Summarizes "Land Gains, Fast Write-off, and Incentives to Build") (optional, on reserve). These show how to find ROR when land prices change over time. Is this change part of the return on capital, or something independent that would happen anyway?

[2]"Tax-induced Slow Turnover of Capital," Excerpt

OPTIMIZING, 5/23

73 Introduction to Optimizing
74 Optimizing Dimensions of a Rectangle, simple object lesson
75 Fragment on Equimarginal Allocation
~~76~~ On Reserve; optional. "Logos Abused"[3]

NORMALIZING: "GOING-CONCERN" MODELS, 5/26

77 Baumol's model for managing inventories
78 Volume and turnover
79 Mean Payback Times in Going Concerns (Normalized Rotations)

REPLACEMENT POLICY, 5/28

80 Dwindling c.f.: "Challenger/Defender" Models. Excerpt from "Property Taxes and the Frequecy of Urban Renewal"
81 Replacing growing capital (when to cut a tree)
82 On Reserve; optional. Replacement of Individual by Mass Systems

RETROSPECT: HOW DID WE GET HERE FROM THERE? 5/30

COMMON FALLACIES YOU NOW KNOW BETTER THAN TO FALL FOR, 6/2

83 False performance standards (review)
84 Fallacies about capital theory and finance
85 Fallacies in microeconomics and production economics

REVIEW, 6/4 - 6/6

FINAL, 6/11, 3 PM

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Listed below are some other relevant papers that are available on request, but not assigned nor distributed this year.

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[3]Limits of math and abstract logic; superior role of judgment and wisdom.

86 Land and Capital Analyzed Separately in the DCFF
87 DCFF with Rise of Site Value
88 Figuring Cost per Ton of Abating Air Pollutants
89 "Ripening." Lutz and Lutz, Excerpt
90 Inflation: The Partiality of Indexing Capital Gains
91 Payback: Repayment Schedule (5 years)
92 White elephants: overconversion of Working into Fixed Capital[4]
93 Capital Sinks[5]
94 Capital Leakage by Rise of Land Price[6]
95 Timing Replacements to Max S.V. in Perpetuity[7]
96 Life Cycle Costing (Supplements "Annualizing")

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[4]Path: excerpt from ms on downturn.

[5]Paths: \Kshort\Mtrls; mac\Hayeks

[6]Excerpt from Appendix, D93, to mss\downturn

[7]Maximize w.r.t. n, mostly.

Syllabus for Manageral Economics, Econ and Bus. Ad. 162, S96

INTRODUCTION

A. Ground Rules
B. Is this course for you? It's exacting, demanding, and optional. If you are interested in learning, will put in time, and work hard, you will gain a lot; if not, drop out now.
C. How to Learn
D. How to Write Better Exams
E. Marginal Acronyms used in Grading

I. Measures, Definitions, and Methods: Essential Tools

A. Exchange value as a yardstick
Money as the measure of exchange value, and as arbitrator among rival individual preferences; need for a common yardstick to compare values (make apples and oranges commensurable)
Some single-valued yardsticks proposed by others; perils of economic fundamentalism (imposing one's values on others)
Cash flows, service flows, and imputed values
Danger of money itself being a fundamentalist value: the Scrooge syndrome
Adjusting for inflation: "deflating" current $s, to $s of constant buying power, by dividing current $ value by a price index
B. Consumer sovereignty: its virtues, limitations, and perversions
C. Entitlements of purchasing power and wealth created before you were born: how sacred and binding?
D. Rates of exchange (terms of trade)
1. Preview of need for capital theory
Current and future goods
Point values and flow values
2. Natural resources and labor
Malthus' forecast: its errors and its truth
How many calculators must you produce to pay the rent?
3. Cash costs and Opportunity costs and other Imputed costs
E. 3-factor economics: fallacy of 2-factor analysis (fusing land and capital). Why land values are neither fund values nor flow values.
F. Fungibility; homogeneity; interchangeability
G. Four basic methods of showing functional relationships
Graphs; arithmetic examples; tables; algebra and programming
H. Standard algebraic notation used in this course
I. Survey of kinds of algebra used in this course; warning against common errors; useful shortcuts and their hazards

J. Glossary. Importance of vocabulary expansion: learn the subject by learning the lingo

II. Performance Standards: a Foretaste

A "performance standard" is something it makes sense for you to maximize, minimize, optimize, or otherwise set up as a goal when you make decisions. "The bottom line" is a performance standard - but how do you define the bottom line? Read on.

A. Max current "profits," or max present value of an enterprise? Reconcile by including current appreciation as part of income. Distinguish earned and unearned appreciation.
B. Choosing among discrete alternatives: either/or choices
C. Optimizing with continuous variation: tradeoffs at the margin
Examples using division, multiplication, addition, and subtraction. Idea of equimarginal allocation (budgeting)
D. Reconciling, a superior alternative to trading-off: sometimes you can "have it all." TITSATAAFL instead of TANSTAAFL. Playing the percentages. Raising sights from molehills to mountains; from gnats to camels; from bean-counting to new concepts
E. Some false performance standards: a preview
F. Limits of economic reasoning; danger of Philistinism; tempering abstract reason with common sense, humanity, humility, and compassion; fallacies of Platonism and Cartesianism; moving beyond *Logos* through *Sophia* towards *Kosmos*. Examples: dealing with nonpoint pollution; dealing with in-stream values of water; understanding ecology; dealing with *Chaos*, uncertainty, and indeterminance.

III. Basic Capital Theory and Valuation

A. Productivity of capital (K)
What is capital? How is it formed?
Biological growth; contrast of biological growth paths and those of capital
Excess of cash flow of plant and equipment over initial K
Capital can do things labor cannot
Productivity from adaptability and versatility of capital; Productivity from availability of capital
Measuring capital's contribution to value-added, and the capitalist's share of the total product

B. 3 basic building blocks of financial mathematics
Intro: the harmony or consistency of math. It all fits

together, buttresses and supports itself in every aspect; otherwise it is wrong. Therefore when you learn a part, you are learning it all. Think of it this way, and a jumble of separate formulae resolve into one or two basic ideas.

Equations do not imply causality. Rather, they show how values must fit together, so you can find the unknown from the known. The cause is what is independent; the effect is what is dependent. It varies from case to case.

Building Block #1. The PIPO Compounding Factor (CF). Rate of exchange between current and future goods or values

Building Block #2. Valuation in perpetuity (capitalization). The simple obverse of drawing interest on a savings account

Building Block #3. Volume and Turnover. Volume equals KxT. Your need for K equals V/T. T is the reciprocal of the average period of investment (P), so needed K=VxP.

C. Growth at compound interest: the PIPO Compounding Factor (CF)

Notation

Compounding as a form of addition

Exponential growth paths: what they look like

(Preview: backwards growth, or discounting)

Exponential growth vs. biological (logistic) growth: contrasting paths

Doubling time: rule of 72

Use of logs, and semi-log scales

The exponential growth path becomes linear

Monthly compounding: standard business practice

Continuous compounding: its mathematical convenience, and practical inconsequence

Sensitivity of future values to interest rates (i.r.s)

Visual on semi-log scale

Algebraic ratio of compounding factors

Real and nominal i.r.s; adjusting for inflation

(When you can safely use (1+i+g) in lieu of (1+i)(1+g); and (1+i-g) in lieu of (1+i)/(1+g))

The impossibility of uninterrupted exponential growth

Some causes of interruption

Effect of changing growth rates on growth paths

D. Finding the unknown from the known: a preview, using the PIPO CF (i.e., the Point-Input Point-Output Compounding Factor)

Review: math shows how the parts fit together, not the direction of causation

1. Discounting: finding P from known F

Discounting as a form of subtraction: the cost of traveling through time

Rationale for discounting

Fallacy of using unrealistically high rates

Future values and discount rates are both forecasts, often wrong

Adjusting for changes in discount rate through period of discounting

First arrow diagram on semi-log scale: sensitivity of P to changes in i

Investment value vs. liquidation value: two different growth paths; two different discount paths

Price risk as an increasing function of n

How Δi destroys real capital just as though it were destroyed physically

Marking to market (MTM) (letting the sunshine in): fallacy of failing to do so; sources of resistance; rejection of reserve recognition accounting (RRA) by oil firms; hidden insolvency of some banks; hidden or sleeping assets of some corporations, and resulting corporate raiding

Deducting lump value of capital cost (K) to find Net Present Value (NPV)

Imputing NPV to its source (normally land), and using it to put a value on the source.

2. Rate of return (ROR, or just r): finding r from known P, F, and n

a. Basic method: find the nth root of F/P, subtract 1

b. Log method:

Simplified log method using continuous interest

c. False (overstated) ROR found by omitting costs of fixed (catalytic) assets preempted by the subject investment

d. Effect of higher and lower P on ROR: 2nd arrow diagram on semi-log scale

e. Effect of various taxes on ROR. Importance of timing of recognition of costs and revenues. Intertemporal bias of deferred taxes. Tax exemption via early deductions. Why the "flat tax" is tilted.

f. Sifting out phantom returns due to inflation. Intertemporal bias of taxes on phantom returns

3. Finding n from known P, F, and i.

E. Some standard combinations of basic building blocks: a preview and survey

1. PV of finite level cashflows: the DCF Factor

2. PV of finite level cashflows followed by resale or reuse: model applied to redeeemable bonds; orange groves; and possessory values plus fee values

3. PV of periodic future lump values (revenues or costs)

a. Periodic revenues in perpetuity: Faustmann's Formula

b. Finite periodic costs: case of one Rolls-Royce vs. a series of Buicks; case of undergrounding a water tank

c. Infinite periodic lump costs: land valuation

4. Rising and falling cash flows

5. Baumol's inventory model: effects of wage rates and interest rates on capital needs and turnover rates

F. DCF of finite flows: wading into the technicalities

Review: rate of exchange between point values and flow values

Preview: possibility of solving DCFF for all its elements (to be completed in §IV)

1. DCFF as the sum of a geometric progression: a summation of point values

Graphic picture: curve of exponential decay; DCFF as area under the curve; interest as area over the curve, under the cash flow

2. DCFF as a fraction of the DCF of an infinite cash flow.

3. Demonstrating the identity of the results of the two methods in #1 and #2 above, using your calculator

4. Graphic picture: DCFF as an increasing function of $\underline{n}$

DCFF/n as a decreasing function of $\underline{n}$

$\underline{n}$ - DCFF as measure of fraction of cash flow paid to capitalist for use of capital

5. Change of DCFF over life

Depreciation of DCF as time passes: tracing the growth path backwards

Non-linear shape of depreciation curve - fallacy of straight-line depreciation. (More general fallacy of forcing data into linear models, subordinating reality to careerist needs of model-builders)

Depreciation and capital recovery

6. Preview: Dividing cash flow between interest and repayment of principal in year one

7. Sensitivity of DCF to $\underline{n}$: diminishing returns to durability

The low PV of adding to life

Graphic picture: the flattening of the DCF curve; its asymptote

The concept of elasticity (ϵ)

ϵ of PV w.r.t. $\underline{n}$

Dividing DCF into elements derived from 4 successive decades

8. Sensitivity of DCF to $\Delta\underline{i}$

Review: the PIPO case (¶ D,1, above)

Price risk as increasing function of $\underline{n}$

Marking to market: and fallacy of failing to do so

How Δi destroys real capital as though it were destroyed physically - a preview

9. Using DCF to annualize point values: a preview
10. DCF of lumpy values. Review case of a Rolls vs. a series of Buicks
11. DCF of exhaustible funds (like oil reserves):
    The Hoover hypothesis of optimal timing to max DCF
    (Same model is used to find DCF of depreciation allowed for income-tax calculation.)
    The Value of depletion
    Reserve/Output ratios dependent on speed of extraction
12. DCF as a tool for capital budgeting: the fallacy of unfair comparisons; use of annualization to correct for differences of lives (a preview)
13. Finding end of life
    Max sum of DCF and discounted R
    Easier approach: when cash flow of existing capital (the defender) falls below annual value of R (the challenger)

G. DCF of Infinite Flows: review and advance to new material

1. Simple capitalization,
2. Cap rate reciprocal as a P/e ratio (and a rate of exchange between current goods and future flows)
3. Effect of expected growth of cash flows on DCF and cap rates

   Dangerous simplicity of assuming perpetual growth; impossibility of endless growth of real cash flows; history of cycles (e.g. the Japanese bubble economy)
4. Absence of turnover of land
5. DCF of infinite periodic lump values: Faustmann's equation

   Fraction of DCF contributed by postprimary values
6. Valuation by deducting periodic chunks of K
7. Valuation of land with periodic higher uses

   Possessory vs. Reuse elements of land value: the orange grove model reviewed

   Finessing the valuation problem by compressing future uses into lump-sum resale or reuse value (R) of the fee

   Valuing a series of investment-liquidation cycles

   Effect of replacement frequency on value
8. Sensitivity of DCF to i
   a. First effect: cost of capital
   b. 2nd effect: cap rate
   c. 3rd effect: cap rate leveraged by growth prospect
   d. 4th (possible) effect: positive feedback between collateral value of land, and availability of credit
9. Special sensitivity of Reuse value (R) to i

10. Replacement policy
    a. Appreciating biological capital
    b. Depreciating capital
    c. Capital experiencing locational obsolescence
11. Effects of various kinds of taxes on DCF
    Why taxes deferred are taxes denied
    How taxes are deferred
12. Maximizing DCF
    a. Optimal intensity: the office building model
    b. Maximize DCF of [revs - costs]; not of revs/costs
    c. Max DCF in perpetuity; not over one cycle
    d. Find optimal life (repeat #10)
    e. Find optimal date to begin: when is land "ripe"

IV. Finding the Unknown from the Known in the DCFF
Annual Flow Value, Future Value, ROR, and Payback Time

Review: math shows necessary relationships, but not direction of causation; DCFF shows rate of exchange between flow values and point values

A. Annualizing: solve for a

1. Application: finding annual "debt service" to pay off debt, with interest at all times on the unpaid balance, in level annual amounts. The "Installment Plan Factor" (IPF)

IPF as a combination of paying off principal, and paying interest. Graph showing it is always greater than each of them

Dividing IPF between interest and principal: preview (see "Payback time" for more)

2. Making lumpy payments smooth and unitary, and therefore commensurable
3. Making payments of different lives commensurable, to make fair comparisons to use in capital budgeting
4. Annualizing as a prelude to capitalizing in perpetuity (just divide by i)
5. The Cambridge Curve Ball, or "Reswitching Paradox." Annualization resolves the paradox
6. Preview: annual value of future point values: the Sinking Fund Factor (SFF) to prepare for future lump sum needs

Application. What is best use of land: sheep or timber?

B. Amassing annual flow values into future point values: the Compounded Cash Flow Factor (CCFF)

1. Deriving CCFF from DCFF: multiply through by the point CF. Simple algebra

Graphic picture: curve of exponential decay raised from below the cash flow line to above it

2. Applications

a. The bright side: amassing future wealth

b. The dark side: accumulating debts

Long construction periods: capitalized interest as part of capital costs. Some frightful examples

Utility rate regulation: AFDC as part of capital cost on which return is guaranteed. Resulting "Averch-Johnson Effect"

Public projects: fallacy of partial funding

c. The wild side: ex parte exaggerations of FV of annual property taxes on forest land

d. Compound example: find fraction of cash flow that goes as interest when construction takes 14 years, and the facility stays on stream for 30 years before capital cost is fully recovered.

3. Converse of CCFF: finding a when you know F: the Sinking Fund Factor (SFF)

Applications: saving in advance to buy a house (the old-fashioned way); building up fund to decommission a Nuclear Generating Station, or to redeem a bond issue, or to retire; how figures are fudged by cute "engineering" firms to underfund regulatory goals; review of comparing sheep with timber; etc.

D. Finding the ROR

1. Review the PIPO case

2. Avoiding fallacy of inflating ROR by omitting fixed costs, which are invisible and catalytic; finding true ROR

3. Perpetuities

a. ROR when g=0 and t=0

b. Effects of g and t on ROR

c. Perpetuities with periodic chunks of K input

4. Finite flows: solving the DCF for ROR

Some tricky math: need for Newton's "method" of trial and error; calculators, computers, and tables make it simple

5. Redeemable bond case

Fallacy of Carter's Cut

6. Adding fixed costs to ROR calculation; splitting P and F into two parts, the expendable and the catalytic

7. Bias added by various taxes

E. Performance Standards for Capital Budgeting, or where shall my firm invest its money?

Max DCF vs. max Annual Value vs. Max ROR. Review, comparison, and recommendation

F. Payback time: a Performance Standard for people in a hurry
1. Simplest case: the cow-sow-hen model, where n=K/O ratio
2. Case of land: zero payback, n=∞
3. Case of appreciating land: negative payback (in special sense of interest > cash flow)
4. Case of growing crops, industrial and retail inventories, feeder cattle: fast payback
5. Durable capital: slow payback, with risk of negative payback
6. Fallacies
   a. Fallacy that Appreciation is not income
   b. Fallacy of using zero-interest
   c. Fallacy of treating profit as just a residual after payback
   d. Fallacy of Straight line payback
   e. Fallacy of Identifying payback with end of life, or with salvaging old materials
7. Using normalized models to find overall payback time

V. Production Economics and Cost Analysis

TO BE ADDED IF CLASS MOVES FAST THROUGH MATERIAL ABOVE

Reading List, Managerial Econ., S96

VOLUME ONE OF READINGS

Outline Code	Rdg. No.	Reading Title
	1	This Reading List
	2	Syllabus
Intro		
A	3	Ground Rules
B	4	How to Learn
C		Eric Berne, Abraham Maslow (on reserve)
D	5	How to Write Better Exams
E		Marginal Acronyms Used in Grading Exams
I, A	6,a	Measurement
	6,b	Imputing
I, D	7	Discounting the Net Product
I, H	8	Standard Algebraic Notation for this Course
I, J	9	Glossary: Learning by Expanding Your Vocabulary
II, a	10	Max Current Cash Flow vs. Max DCF
II, C	11	Introduction to Optimizing
II, C		Optimizing Dimensions of a Rectangle
II, C	12	Fragment on Equimarginal Allocation
II, E	13	False Performance Standards
II, F		"Logos Abused," on Limits of Ec. Reasoning. This Is on Reserve, Not Bound in this Volume.
III, a	14	Productivity of Capital
III, B		Volume and Turnover: Fragment
III, C	15	The PIPO Compounding Factor
III, C	16	Use of Logs and Semi-log Scales
III, D	17	Solving the Compounding Factor for its Elements
III, E,3,a	18	Faustmann's Formula
III, E,3	19	Present Value in Perpetuity (Case of Aunt Tillie)
III, E,3,b	20	Rolls Royce vs. The 7 Buicks
III, F	21	DCF of Infinite and Finite Flows

End of Volume One of Readings

VOLUME TWO OF READINGS

III, E,2	23	Valuation: Redeemable Bonds and Orange Groves (Brief Introduction - more is in #37,b)
III, F,8	24	Price Risk, Assets of Various Terms

III, F,11	25	Extractive Resources and Taxation, Excerpt
III, F,13	26	Property Taxes and the Freq. Of Renewal, Excerpt
III, G,1-4	27	Valuation and Holding Costs When Rents Are Rising
III, G,7	28	Land Prices with a Series of Discrete, Progressively Higher Future Uses
III, G,10	29	Replacing Growing Capital
III, G,11	30	Tax-induced Slow Turnover, Excerpt
III, G,12	31	Lutz and Lutz, Excerpt
III, G,12	22	The Office Building Model (Note That this Is Bound at the End of Volume I, out of Sequence, and Numbered #22)
IV, a	32	Annualizing with the Installment Plan Factor (IPF)
IV, a	33	John Napier and Continuous Compounding
IV, B	34	Finding the Future Value of a Given Flow: the CCFF (Compounded Cash Flow Factor)
IV, B,2,c	35	The CCFF in Action: Forest Taxation in California
IV, C,3	36	Finding "a" When You Know F: the Sinking Fund Factor (SFF)
IV, D	37	Rate of Return (ROR): Finding "i" When You Know "a", P, and "n" a) Finite Flows b) Orange Groves and Redeemable Bonds
IV, D,5	38	Carter's Cut (How to Lose Money on Junk Bonds)
IV, D,7	39	Finding ROR When Land Prices Change over Time (LGFW&IB) (Link to RORAT 2-pager, Vol.3)
IV, F	40	Payback Time: Knowing it and Controlling it
IV, F	41	Some Economic Life Cycles
IV, F	42	How a Rise of Discount Rates Downvalues and Destroys Capital
IV, F,7	43	Mean Payback Times in Going Concerns (Normalized Rotations)
IV, F,7	44	Baumol's Model for Managing Inventories
		PROBLEMS
	45	PIPO Problems, #1-26
	46	Problems on Valuation, #1-50
	47	Problems on Performance Standards, #1-19

End of Volume Two of Readings

VOLUME THREE OF READINGS

Land and Capital

Land and Capital Analyzed Separately in the DCFF
DCFF with Rise of Site Value
RORAT (2 pages). Supplement to LGFW&IB, #39

Sensitivity

Sensitivity
Rent, Interest, and Taxes: Effects on Land Prices
n% Rule of Thumb
Loan Bias, 1
Effects of Lender Risk and Bias

Inflation

Inflation (Supplement to 6,a, Measurement)
The Partiality of Indexing Capital Gains

Payback

Depreciation (Supplements #40, Payback Time)
Repayment Schedule (5 years)
Overconversion of Working into Fixed Capital[1]
Capital Sinks (\Kshort\Mtrls; add mac\Hayeks
Yield Curve (Kshort Mtrls)
Capital Leakage by Rise of Land Price[2]

Replacement

Undergrounding a Water Tank (Supplements #20)
When to Replace Old Capital like Buildings
Timing Replacements to Max S.V. in Perpetuity[3]
When to Cut a Tree

Misc.

Life Cycle Costing (Supplements Annualizing)
Figuring Cost per Ton of Abating Air Pollutants
Fallacies
a) About Capital Theory, Finance, etc.
b) About Performance Standards
c) About Micro and Production Economics

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[1]Excerpt from ms on downturn.

[2]Excerpt from Appendix, D93, to mss\downturn

[3]Maximize w.r.t. n, mostly.

Managerial Economics, Supplemental Notes, 23 Apr 96

Topics: 1) Faustmann as a Performance Standard
2) Faustmann as a springboard to all the math of finance

1. Short derivation of Faustmann

Divide Present Value (P) in 2 parts, S and K. K is embodied in the product, F. S is like land or a catalyst, needed to make processes work, but not embodied in the products.

$$(K+S)\cdot I^n = F+S$$

Solving for S:

$$S(I^n-1) = F-KI^n$$

$$S = \frac{-KI^n + F}{I^n - 1} \qquad (1)$$

2. All the math of finance follows from (1). Examples follow - and more come during the rest of the course.

3. Let n=1. This means F comes annually. Following our conventions, that makes it a flow, instead of a point (or series of lumpy points). Our convention is to denote that flow as "a" (for annual).

$$S = \frac{-K(1+i) + a}{i} \qquad (2)$$

Note how closely this resembles one of our 3 basic building blocks of finance, namely: S=a/i. In (2) the numerator is still basically cash flow, which we have called a. Here, however, we have treated some of the expenses explicitly as capital, K. This capital is exhausted within a year, so we call it "working capital." The formula deducts not just the outlay on capital, but interest on it, too.[1]

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[1]Since the capital outlay here is exhausted within the year, it is an annual flow, and we should change K to k. However, since we are doing nothing further with it here, we omit this

Where deducting of K(1+i) is not done explicitly, as in (2), you should consider it done silently behind the scenes in calculating a. This deduction is, as the usage goes, "subsumed" in a. "Subsumed" means hidden, but silently understood. Such hiding is done not to conceal, but to simplify the numerator while we manipulate and analyze the rest of Equation (1). However, be warned, it may also lead to forgetting what is hidden, hence to error. Therefore, **REMEMBER!!!**: a, by itself, is net of expenses, and expenses include interest on working capital.

That is why we can, and routinely do, simplify (2) into $S = a/i$.

Before we do, however, let's see why we must never forget this concealed cost of interest on K. §s 4-9 deal with it. Whenever n>1, this factor begins chipping away at a with strength that grows with n and i. With n>1, also, we stop calling it working capital; it becomes hardware capital (and has other descriptors like heavy capital, fixed capital, hard capital, capital goods, clay capital, buildings, machinery, equipment, etc.)

4. When n=2, we observe two changes in (2):

$$S = \frac{-KI^2 + F}{2i + i^2} \qquad (3)$$

The major change is in the base, which has doubled (i^2 is negligible at this point - it represents the effect of compounding, which later looms much larger). However, compound interest on K has also begun to erode the numerator.

To visualize what happens as n grows, draw a figure with n as the abscissa, with two curves: a logistic growth curve of F, and a curve of exponential growth, beginning from K on the ordinate. There should be a lenticular area between the two curves, beginning where they cross, and F becomes higher than KI^n.

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step.

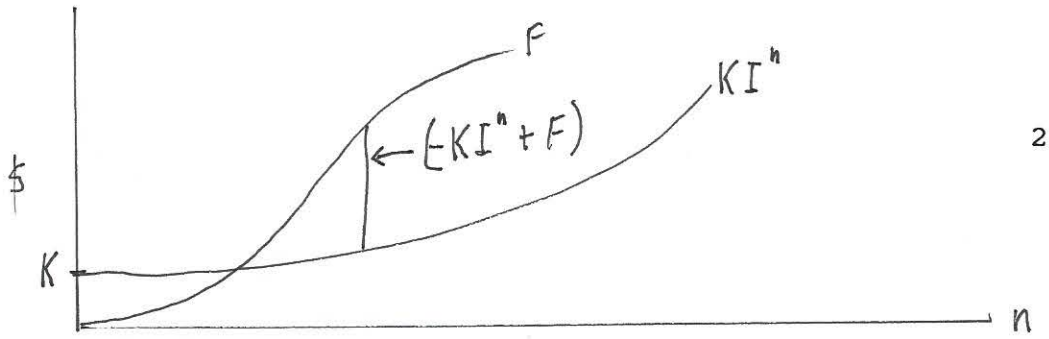

Figure 1: Elements of Numerator of Equation (1), visualized

As n rises, two things change:

1) KI^n rises. This part is obvious.
2) F and K occur less often. Visualize the vertical line between them moving to the right. This vertical is the numerator of (1). Algebraically, the effect of this on S is shown in the growth of the base of (1).

5. Note the dual sensitivity of S to i. i appears twice in (1), and both times with leverage. This means S is highly sensitive to $\pm\Delta i$. This is why land prices, historically, have been so unstable. For example, in Japan it is why they were able to rise fantastically, 1979-89, and then fall by 80%, 1989-96.

To offset this risk, plan land uses with lower n values. You have some control over n; but very little control over i, which is ruled by world markets.

6. (1) is an excellent Performance Standard. It is much more comprehensive than most. It lets you juggle many balls in the air at once.

a. F is gross revenue less current running costs. These costs are traditonally called "expenses," as opposed to hardware purchases, called "capital outlays." The deduction of expenses is "subsumed" in F.

b. K is hardware cost. We treat it separately from working capital, following universal tradition and custom. Thus, both K (capitalized outlays) and e (expenses) are deducted, although in different ways and places.

c. Interest on capital is deducted: interest on K, explicitly; interest on working capital, silently or implicitly.

d. The value of time appears twice; both times negatively. It is subtracted from the numerator; and added to the base.

e. Competing S-values derived from competing uses of capital and land are made **commensurable**, regardless of different

n-values, because they are all assumed to repeat forever. We will learn the importance of this point via examples, problems, and illustrations, as we proceed. See §11.

7. The above sets up a good quiz question or problem. Given the following facts, which is a better use of land, A or B?

	F	n	i	K
A	100	5	.06	50
B	200	7	.08	115

Comparing F and K, choice B looks much better. However, choice A "lays its egg" in 5 years instead of 7. Use B is also handicapped by the premise of a higher discount rate.[2]

Plugging values into (1), we find use A yields a higher S-value.

$$\text{A.}\quad S = \frac{-50 \cdot 1.06^5 + 100}{1.06^5 - 1} = \frac{-67 + 100}{.338} = \frac{33}{.338} = 98$$

$$\text{B.}\quad S = \frac{-115 \cdot 1.08^7 + 200}{1.08^7 - 1} = \frac{-197 + 200}{.714} = \frac{3}{.714} = 4.2$$

Note how (1) steers you away from heavy use of hardware, and deferred yields, and high i.r.s.

Notice how (1) guides you where to focus your attention, to maximize your wealth. E.g., at 8%, it tells you to raise F by spending more on o&m[3] in later years, rather than K up front.

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[2]The premise fits the facts of many cases, where the lender has a steep "yield curve preference," meaning she charges a higher rate on longer-term loans.

[3]o&m = operation and maintenance. It is traditionally given in upper case, but I use lower case to stick with my convention of using lower case letters to denote flow values. o&m costs are part of expenses, not capitalized.

Notice how (1) screams at you to lower n, if you can. Cf. §5, and 6,d.

8. The problem given in §7 stacked the cards against B by giving it a longer period, n, and a higher i.r., .08. Let's do it again using the same values for both A and B: n=5, and i=.06.

A. S = 98 (same as before)

$$\text{B. } S = \frac{-115 \cdot 1.338 + 200}{.338} = \frac{-154 + 200}{.338} = \frac{46}{.338} = 136$$

Now, B is the better use (136>98).

9. Considering the great benefit of lowering n, one might invest K specifically to speed the arrival of F, rather than to raise its value. An example is investing in marketing; another is planting nursery stock, instead of seeds, to get a new forest off to a fast start.

Let's invest another 15, to lower n from 5 to 4, and evaluate B now.

$$\text{B. } S = \frac{-130 \cdot 1.262 + 200}{.262} = \frac{36}{.262} = 137$$

137>136, so in this case, the gain is only trivial. You can play "what if," and identify other cases where the gain would be great. What if the quicker payback let you finance at 5% instead of 6%? Over to you.

For a stronger example, let's invest an added $50 of K to lower n from 10 (choice C) to 8 (choice D).

	F	n	i	K	I^n	$F-KI^n$	I^n-1	S
C	800	10	.06	400	1.791	80	.791	101
D	800	8	.06	450	1.594	83	.594	139

A good way to summarize these results is in terms of fractional changes. We raised K by 12.5%. This lowered n by

20%. S rose by 38%. Almost all the rise of S is due to the fall of the base (I^n-1).

If we could lower n from 10 to 8 without any rise of K, e.g. simply by changing some part of our philosophy of management, we would raise S all the way up to $273.

The moral is: to maximize your wealth, **SPEED!**

PART II: Faustmann as a springboard to all math of finance

10. Now, let's conflate[4] the numerator of (1) into one figure or symbol, F. That is, let it be silently understood here that F is net of KI^n. We can do this because F and KI^n are **commensurable.** They are point values at the same point in time, viz. n. To be sure, K occurs at time 0, but we converted it to the equivalent value at time n by compounding it.

We are doing this to cut down the clutter, while we manipulate the rest of the equation. However, it has another, greater value. Note that when there are intermediate costs and revenues, at times other than n or 0, we can also compound them forward to time n, and conflate them with F. By this technique, we make (1) much more general and adaptable in application.

(1) now becomes:

$$S = F/(I^n-1) \qquad (4)$$

11. That pesky little "-1" in the base of (4) makes all S-values **commensurable**, because they all have the same time frame: infinity. That little "-1" distinguishes (4) from simple discounting of F. When n is quite long, and/or if i is high, the "-1" is swamped by the high value of I^n, and hardly affects S. However, when n and i are low, the "-1" exerts great leverage, and raises S a lot. Here is a numerical comparison of 2 rival uses, E and F, for a parcel of land.

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[4]"Conflate" means to treat a collection of things as a unit. Sometimes it means to commingle thngs irreversibly - to fuse, meld, or scramble. My intent here is to hold the parts separate for future analysis. The melding is only temporary.

Let $P = F/I^n$.

	F	i	n	I^n	I^n-1	P	S	S/P
E	600	.11	10	2.84	1.84	211	326	1.54
F	300	.11	5	1.68	.68	179	441	2.46

Thus, $300 coming every 5 years (that's F) is worth more than $600 coming every 10 years (that's E). 441>326.

More is involved here than simple discounting. Using simple discounting, E is worth a lot more than F (211>179). The other, greater factor is making the two choices **commensurable**, by using the same time-span for each.

Like many important truths, once you get it, it seems so obvious you wonder if you have learned anything difficult. If you find it obvious, congratulations! The reason it is worth stressing, though, is that many writers on management, unthinking, give you P as a performance standard. They would make E the better choice. Now you know better than to fall for that.

12. Now, let's do some tricks to spring from (4) to all the mathematics of finance. We already know that a=Si. This is one of the 3 basic building-blocks of finance. It follows that S=a/i. Substitute this in (4), and solve for a:

$$a/i = F/(I^n-1)$$

$$a = F\frac{i}{I^n - 1} \qquad (5)$$

(5) converts F into its level annual equivalent (a). This is called **annualizing**. It gives us the rate of exchange between point values (like F) and flow values (like a).

a is also a comprehensive Performance Standard, just like S. S has disappeared. We are now dealing with a finite flow, n years long. However, all a values are commensurable, whatever the length of the n from which they are derived. They could be repeated to from here to eternity.

Think of a as you would a simple mean. It is a kind of mean, but one that is adjusted for the time-value of money. Call it a "time-average." To see this plainly, let i--->0. What happens to a?

Whoops!, you say, the ratio on the right side approaches 0/0. We learned somewhere that is "indeterminate." However, that is just a cop-out used in pre-calculus. It actually approaches 1/n, meaning a--->F/n. Check this out on your calculator, using a very low i-value like i = .000001, and any value of n. You'll see. You may also look up "l'Hôpital's Rule" in your calculus text.

When i>0, (5) automatically adjusts for the fact that future sums are worth less than present sums, and a<F/n. How much less depends on the value of n. Here is an example to illustrate.

	F	i	n	I^n-1	a
G	300	.08	10	1.16	11.17
H	100	.08	5	.469	17.05

Thus, $100 coming along every 5 years is worth more than $300 every 10 years, even though 300/10 > 100/5, and also, $300/1.08^{10} > 100/1.08^5$.

The a-values of G and H are **commensurable** - that magic word again - because each value is an annual flow, and could be repeated forever.

12. We can solve (5) for any of its elements. Starting with Reading #32, we will do so systematically, and show how this one equation contains and yields the entire mathematics of finance, which otherwise appears to be so diverse and complex. Our learning sequence, however, is to begin with finding present values, and work with that until we feel entirely at home with valuation.

Let us, therefore, solve (5) for P, where P is the Present Value of one cycle of use (investment followed by recovery).

P does not seem to appear in (5). However, recall that $P=FI^{-n}$. Then, first, solve (5) for F:

$$F = a \frac{I^n - 1}{i} \qquad (6)^5$$

Now substitute $P=FI^{-n}$:

$$P = FI^{-n} = a \frac{1 - I^{-n}}{i} \qquad (7)$$

(7) gives the Discounted Cash Flow (DCF) of a for n years. The ratio on the right side, which is P/a, is the Discounted Cash Flow Factor (DCFF). It gives the Present Value of a finite flow of cash of $1 per year.

In Reading #21, at the end of Volume I of Readings, this is called the DCF of a Finite Flow, and is derived in another way.[6] The point here is that Faustmann's Formula is as good an entrée as any into the harmonious, mutually consistent world of finance, all of which fits together with all parts supporting and confirming all other parts. With Reading #32 and ff., we will see how all of finance is contained in (7).

To close, here are some lines from UCR's Poet Laureate, The Great Highlander, Bobbie Burns.

To catch Dame Fortune's golden smile
  Assiduous wait upon her;
And gather gear by every wile
  That's justified by honour:
Not for to hide it in a hedge
  Nor for a train-attendant
But for the glorious privilege
  Of being independent.

In ploughman phrase, "God send you speed,"
  Still daily to grow wiser;
And may ye better reck the rede,[7]
  Than ever did th'adviser!

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[5]For future reference, this is the Compounded Cash Flow Factor, or CCFF.

[6]If a principle is true, you can derive it in many ways, because the laws of the universe are harmonious. If you can't derive it more ways than one, you probably made an error the first time.

[7]"Reck the rede" means heed the advice.