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Semester: Autumn 2026

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Course: Advanced Microeconomics (805) • Level: MSc Economics

Semester: Autumn 2026

Assignment No. 1 (Units 1–5)

SOLVED ASSIGNMENT GUIDE

(For Study & Reference)

Note: This guide is prepared for study and reference purposes. Students are advised to read the relevant units of the course book, understand the concepts, and then write the assignment in their own words. Total marks of the assignment are 100; each question carries the marks shown with it.

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Question 1: Why Firms Use Average-Cost Pricing Rather Than Marginal-Cost Pricing (20 Marks)

Why do most of the firms apply average cost-pricing rather than marginal cost-pricing criterion in practices?

Introduction

The traditional marginalist theory of the firm, as presented in textbooks, states a simple and elegant pricing rule: a profit-maximising firm produces the output at which marginal revenue equals marginal cost (MR = MC) and charges the price that demand allows at that output. Yet when economists went out and asked businessmen how they actually fix prices, they found something quite different. The famous enquiry of Hall and Hitch (1939) at Oxford, and many surveys after it, showed that most firms do not calculate marginal revenue and marginal cost at all. Instead, they calculate the average (full) cost of production at a normal or budgeted level of output, add a conventional percentage mark-up for profit, and quote the resulting figure as the price. This is called average-cost pricing, full-cost pricing, or cost-plus pricing. This answer first

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defines the two rules clearly, and then explains, point by point, why in real-world practice the average-cost rule is preferred to the marginal-cost rule.

The Two Pricing Rules Defined

Marginal-cost pricing requires the firm to equate marginal revenue with marginal cost. It therefore requires knowledge of the whole demand curve facing the firm (in order to derive marginal revenue) and of the marginal cost curve at every level of output. Price is then read off the demand curve at the MR = MC output. The rule is forward-looking and output is decided first; price follows from demand.

Average-cost pricing works in the opposite direction. The firm first estimates average cost at a standard or normal level of output — average variable cost plus average fixed (overhead) cost, including a normal return on capital — and then adds a mark-up, say 10, 20 or 33 per cent, to cover profit and contingencies. In symbols, Price = Average Cost × (1 + mark-up percentage). Price is decided first, directly from cost data which the firm's own accounts supply; the quantity sold then adjusts to whatever buyers take at that price. Figure 1 illustrates the rule.

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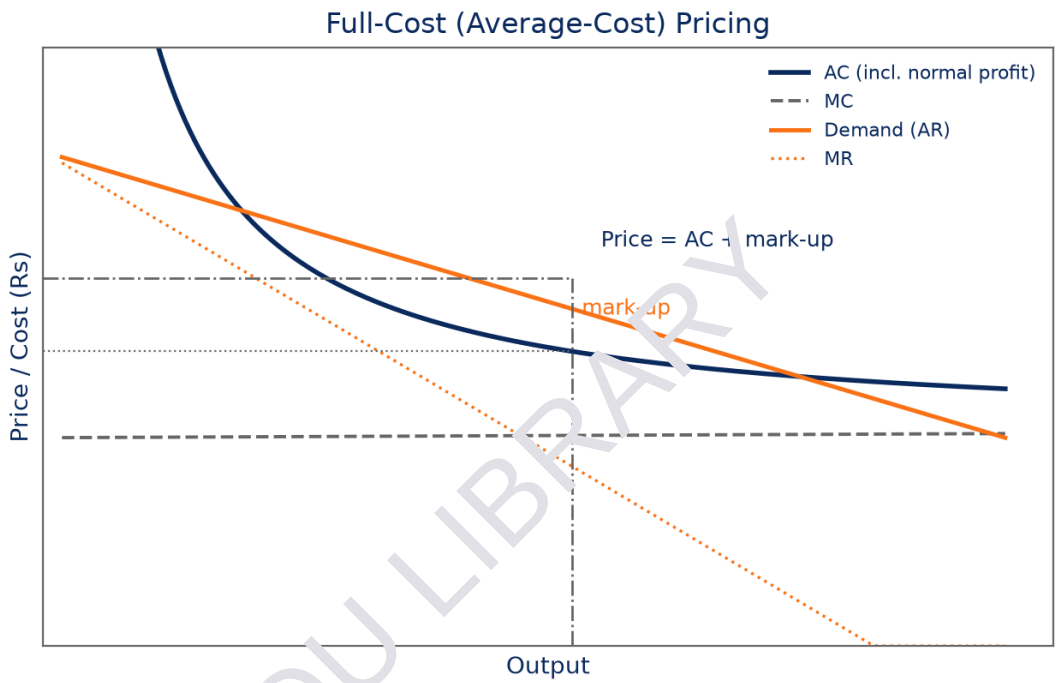

Figure 1: Under full-cost pricing the firm calculates average cost (including normal profit) at the normal output and adds a conventional mark-up to obtain the selling price.

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Why Firms Prefer Average-Cost Pricing: The Main Reasons

1. Marginal magnitudes are practically impossible to measure

The deepest reason is informational. A firm rarely knows its demand curve. Demand depends on rivals' prices, consumers' incomes, tastes, expectations and the state of the trade cycle, and it shifts constantly. Without a known demand curve there is no marginal revenue curve, and the MR = MC calculation simply cannot be performed. Marginal cost is equally elusive: in a multi-process factory, the cost of one extra unit is an accountant's reconstruction, not a directly observed figure, and it changes with capacity utilisation, overtime, and input prices. Average cost, by contrast, is computed routinely from the firm's books. A rule that uses data the firm actually possesses will naturally displace a rule that requires data nobody has.

2. Oligopolistic interdependence makes marginal calculation meaningless

Most modern industries are oligopolies, where each firm's sales depend on how rivals react. If a firm cannot predict whether rivals will match a price cut or a price rise, its demand curve — and hence its marginal revenue — is indeterminate, as Sweezy's kinked-demand analysis showed. Businessmen interviewed by Hall and Hitch said precisely this: they feared that cutting price below the full-cost level would provoke retaliation and a ruinous price war, while raising it would lose customers to rivals who stayed put. The full-cost price, widely understood and conventionally accepted in the trade, acts as a focal point around which oligopolists can coordinate without any illegal agreement.

3. Price stability and the avoidance of frequent revision

Marginal cost fluctuates with every change in orders and capacity use, so strict marginalist pricing would require prices to change continuously. Firms dislike this: reprinting price lists, renegotiating contracts and informing customers are costly (what are now called menu costs), and customers regard constantly changing prices as unfair and confusing. Average cost calculated at normal output is comparatively stable, so cost-plus pricing yields steady prices over long periods. The observed rigidity of industrial prices, especially in recessions when firms refuse to cut prices below full cost even with idle capacity, is direct evidence of this practice.

4. Fairness, goodwill and long-run customer relations

Businessmen in the Oxford survey repeatedly justified full-cost pricing on ethical grounds: it was the 'fair' price that covered costs and a reasonable profit, no more. Exploiting a temporary shortage by raising price to what demand would bear might maximise this month's profit but

destroys goodwill, invites new entrants, and can provoke government intervention. A firm that aims to survive for decades rationally protects its reputation and market position. Average-cost pricing, which visibly links price to cost, is defensible before customers, dealers and regulators in a way that scarcity pricing is not.

5. It guarantees survival: full cost recovery in the long run

Marginal-cost pricing contains a danger: whenever demand is weak, marginal cost may lie below average cost, and a firm pricing at marginal cost would fail to recover its overheads and would make losses that eventually drive it out of business. This is exactly why economists themselves recommend average-cost pricing for decreasing-cost public utilities, where marginal-cost pricing would produce a permanent deficit. The private firm applies the same logic: a price that covers total average cost at normal output, including a normal return on capital, guarantees solvency, replacement of worn-out capital, and funds for growth. Managers answerable to shareholders for the firm's survival prefer a rule that never systematically prices below total cost.

6. Multi-product production and joint costs

Real firms produce dozens or hundreds of products sharing common overheads — the same factory, management, and sales force. There is no non-arbitrary way to assign the marginal cost of the shared facilities to one product. What accounts can do is allocate total overhead across products by some accepted convention and compute a full cost per product, to which the mark-up is added. Pricing committees in large firms therefore work with full-cost sheets product by

product; a marginal calculation for each of thousands of items would be administratively impossible.

7. Firms pursue goals besides short-run profit maximisation

The marginalist rule presupposes that the only goal is maximum short-run profit. Modern theories of the firm — Baumol's sales maximisation, Marris's growth model, and the behavioural theory of Cyert and March — show that managers also value sales, growth, market share, security and a quiet life, and typically satisfice rather than maximise. A mark-up that yields a satisfactory or target rate of return on capital fits these goals perfectly: it is a target-return rule. Once the target return is achieved, the firm has no instruction from the marginalist calculus telling it what to do next, whereas cost-plus pricing gives a complete, workable routine for every pricing decision.

8. Administrative simplicity, delegation and contracts

Cost-plus pricing is a simple formula that can be delegated: a sales manager or a branch can be told 'price = full cost plus 25 per cent' and can apply it instantly to new products, special orders and tenders without head-office calculation. It is also the basis of cost-plus contracts in defence and construction, and of rate-of-return regulation, because an outside party can audit costs but cannot audit a firm's estimate of its own marginal revenue. Wherever a price must be justified to someone else — a customer, a ministry, a court — the average-cost justification is the only verifiable one.

Is Average-Cost Pricing Necessarily Irrational?

It would be wrong to conclude that businessmen are simply ignorant of profit opportunities. Two reconciliations matter. First, the size of the mark-up is not arbitrary: in competitive trades it is small and in sheltered trades large, which suggests firms do respond to demand conditions — indeed, under constant marginal cost the profit-maximising mark-up over marginal cost is exactly the inverse of the elasticity of demand, so a demand-sensitive mark-up over average cost can reproduce the marginalist result. Second, in the long run, at the normal output for which the plant was designed, average and marginal reasoning converge: a firm that habitually failed to equate the two would either leave profitable sales unmade or accumulate losses, and competition would eliminate it. Machlup therefore argued that businessmen may achieve marginalist outcomes through rules of thumb. Critics such as Lester replied that the survey evidence still shows the marginal magnitudes themselves are never computed. The fair verdict is that average-cost pricing is a practical decision routine adopted under uncertainty, whose results often approximate, but are not calculated by, the marginal rule.

Conclusion

To conclude, most firms apply average-cost pricing because it uses the cost information they actually have, it is stable and administrable, it coordinates oligopolists and avoids price wars, it is regarded as fair, it guarantees recovery of full cost and hence long-run survival, and it serves the multiple goals that real managers pursue. Marginal-cost pricing remains an invaluable analytical benchmark — it identifies the direction in which profit can be increased and it guides

public policy in special cases — but as a description of day-to-day business practice, the full-cost principle of Hall and Hitch is decisively the more accurate account.

Question 2: Profit Maximisation versus Sales Maximisation Without Advertising (20 Marks)

Show the difference between profit-maximization and sales-maximization behavior of a firm when there is no advertising.

Introduction

The neoclassical theory assumes that the firm has one goal: maximum profit. W. J. Baumol, in Business Behaviour, Value and Growth (1959), challenged this assumption for the modern large corporation, in which ownership is separated from management. Managers' salaries, prestige, power and job security, Baumol argued, are more closely related to the size and sales revenue of the firm than to its profit; shareholders, meanwhile, are satisfied with a reasonable, acceptable profit. The result is a firm that maximises sales revenue subject to earning at least a minimum acceptable profit. This answer compares the two behaviours in the simplest version of Baumol's static model — the single-product firm that does not advertise, so that sales can be increased only by cutting price and expanding output along a given demand curve.

The Profit-Maximising Firm

The profit-maximising firm expands output while marginal revenue exceeds marginal cost and stops where MR = MC (with MC rising). This output is relatively small and its price relatively high, because the firm deliberately restricts sales of units that would add more to cost than to

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revenue, even though those units could be sold at a price above average cost and would raise total revenue. Maximum profit is the largest possible vertical distance between the total revenue (TR) and total cost (TC) curves.

The Sales-Maximising Firm (Baumol)

Baumol's firm maximises total sales revenue, but not unconditionally. It must earn a minimum profit — the amount needed to pay acceptable dividends, satisfy shareholders and the capital market, and finance future growth. If the profit constraint did not bind, the firm would expand output to the point where total revenue is at its maximum, that is where marginal revenue is zero (MR = 0), because beyond that point extra sales actually reduce revenue. When the unconstrained revenue maximum yields less than the minimum required profit, the constraint binds: the firm expands output beyond the profit-maximising level only until profit falls to the minimum acceptable level, and stops there. Its output is therefore larger and its price lower than the profit maximiser's, but its output is smaller than the unconstrained revenue maximum.

A Worked Numerical Example

Let the firm face the demand curve $P = 200 - 2Q$, with total cost $TC = 400 + 20Q + Q^2$, where P is price and Q is output. Total revenue is $TR = 200Q - 2Q^2$, so marginal revenue is $MR = 200 - 4Q$, and marginal cost is $MC = 20 + 2Q$. The profit maximiser sets MR = MC: $200 - 4Q = 20 + 2Q$, giving $Q = 30$ and $P = 200 - 60 = Rs\ 140$. Total revenue is $140 \times 30 = Rs\ 4,200$; total cost is $400 + 600 + 900 = Rs\ 1,900$; maximum profit is Rs 2,300.

The unconstrained sales maximiser sets MR = 0: $200 - 4Q = 0$, giving $Q = 50$, $P = Rs\ 100$ and $TR = Rs\ 5,000$, the highest revenue obtainable. But profit there is only $5,000 - (400 + 1,000 + 2,500) =$

Rs 1,100. Suppose shareholders demand a minimum profit of Rs 1,500. Profit as a function of output is TR − TC = $-3Q^2 + 180Q - 400$. Setting this equal to 1,500 gives $3Q^2 - 180Q + 1{,}900 = 0$, whose larger root is Q ≈ 46.3. The constrained sales maximiser therefore produces about 46.3 units at a price of about Rs 107.3, earns revenue of roughly Rs 4,973, and accepts profit of exactly Rs 1,500 — the minimum. The comparison is complete: output rises from 30 to 46.3, price falls from Rs 140 to about Rs 107, revenue rises from Rs 4,200 to about Rs 4,973, and profit falls from the maximum Rs 2,300 to the acceptable Rs 1,500. Figure 1 shows the same relationships.

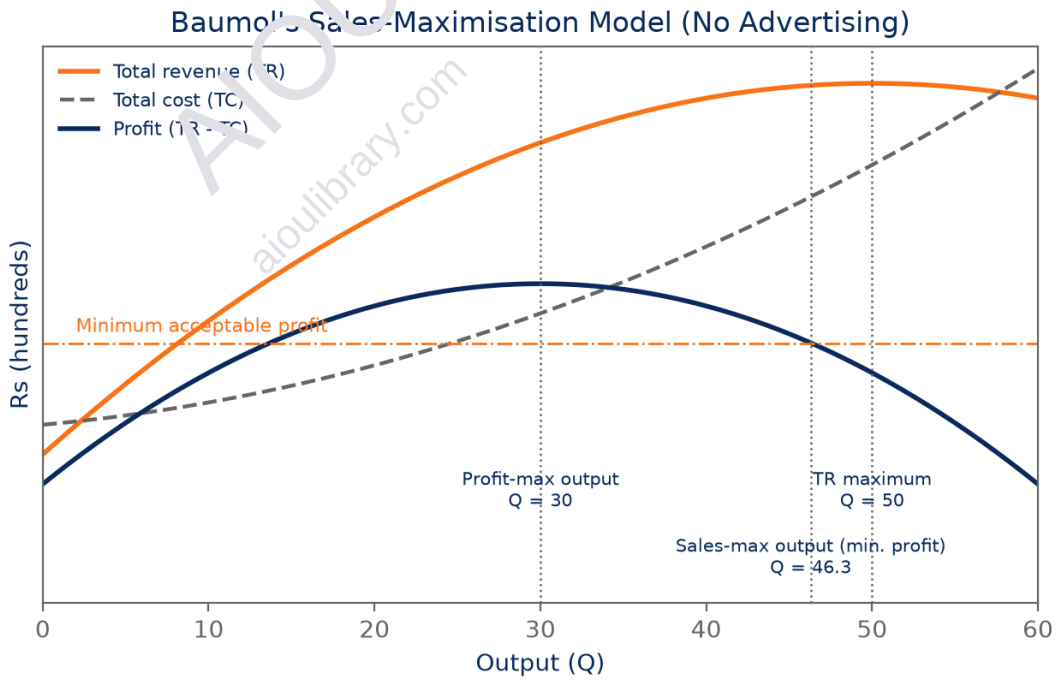

Figure 1: Total revenue, total cost and profit. Profit is maximum at Q = 30; revenue is maximum at Q = 50; with a minimum-profit constraint of Rs 1,500 the sales maximiser stops at Q ≈ 46.3.

Point-by-Point Differences

Table 1: Profit maximisation versus sales maximisation (no advertising)

Feature	Profit-maximising firm	Sales-maximising firm (Baumol)

Objective	Maximum total profit	Maximum sales revenue, subject to a minimum profit constraint
Decision rule	MR = MC	Expand output until profit falls to the minimum acceptable level (or MR = 0 if the constraint does not bind)
Output	Smaller (Q = 30 in the example)	Larger (Q ≈ 46.3 in the example)
Price	Higher (Rs 140)	Lower (about Rs 107)
Profit earned	The maximum possible (Rs 2,3[illegible])	Only the minimum acceptable (Rs 1,500), unless the constraint does not bind
Marginal condition at chosen output	MR equals MC	MR is less than MC: extra units add more to cost than to revenue, but they still raise revenue
Attitude to extra sales	Rejects sales that reduce profit, even if revenue rises	Actively seeks sales, market share and size
Use of earnings	Profit itself is the goal; distribution policy follows from maximisation	Profit above the minimum is deliberately sacrificed for growth of sales; retained minimum finances expansion
Social result	Output more restricted; price further above marginal cost	Output closer to the competitive level; lower price benefits consumers and raises employment

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Why the Difference Matters

The contrast is not a minor technicality. A sales-maximising industry produces more output and charges lower prices than the textbook profit-maximising industry, so the familiar deadweight loss of monopoly is smaller than the simple model predicts. The model also explains observed behaviour that profit maximisation cannot: why large firms fight aggressively for market share, why managers resist takeovers that would 'rationalise' the firm into a smaller but more profitable unit, and why firms retain capacity and staff beyond the profit peak. Baumol further noted that the minimum-profit constraint links the model to the capital market: if profits fall

below the acceptable level, the share price drops and the firm becomes a takeover target, so the constraint is a genuine survival condition, not a whim.

Critical Appraisal

The model has been criticised on several grounds. The minimum acceptable profit is not precisely defined, and in practice it is difficult to observe whether a firm is at the constraint. The static model without advertising is only a first step; Baumol himself extended it to advertising, where the sales maximiser spends more on advertisement than the profit maximiser, and to a dynamic growth version. It is also said that in the long run competition for capital forces firms back towards profit maximisation. Nevertheless, the model survives because its central insight — that with the separation of ownership from control, revenue and growth enter the firm's objective function in their own right — is supported by a great deal of managerial evidence.

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Conclusion

To conclude, when there is no advertising, the difference between the two behaviours reduces to how far output is pushed along the same demand curve. The profit maximiser stops where MR = MC, producing less and charging more; the sales maximiser, in Baumol's theory, pushes output beyond that point — up to where the minimum acceptable profit is just earned (or, if the constraint permits, where MR = 0) — producing more, charging less, earning more revenue and accepting less profit. Both firms face identical demand and cost conditions; it is the objective function, and the objective function alone, that generates the different price-output behaviour.

Question 3: The Behavioural Theory of the Firm (20 Marks)

Explain in detail the behavioral theory of a firm.

Introduction

The behavioural theory of the firm, developed by Richard Cyert and James March in A Behavioral Theory of the Firm (1963) and built on Herbert Simon's ideas of bounded rationality and satisficing, is the most influential alternative to the neoclassical theory. The neoclassical firm is a fiction: a single decision-maker with complete information who maximises profit. Cyert and March studied how real firms — large, complex organisations staffed by people with limited information and conflicting interests — actually make decisions about price, output and resource allocation. Their answer is that the firm must be understood not as a maximising individual but as a coalition of groups whose conflicting goals are only partly reconciled, which proceeds by rules of thumb, feedback and search. This answer explains the theory in detail: its view of the firm, its treatment of goals, conflict, slack, uncertainty and learning, and then evaluates it.

The Firm as a Coalition

The starting point is organisational. The 'firm' consists of participants — managers of different departments, workers, shareholders, and in a wider sense suppliers, customers, bankers and government agencies — who form a coalition to pursue their own demands. Each group makes demands on the organisation: production wants smooth, uninterrupted runs; sales wants variety, stocks and low prices; shareholders want dividends; workers want wages and security;

top management wants growth and prestige. There is no single goal given from outside. The goals of the firm are the outcome of a continuing bargaining process inside the coalition, in which side payments — money, promotion, perquisites, policy commitments — are used to keep every group willing to participate. When the environment changes, the bargain is renegotiated; goals are therefore endogenous and shifting, unlike the fixed profit maximum of the textbook.

Multiple Goals and Aspiration Levels

In place of one goal, Cyert and March identify a small set of operative goals, typically five: the production goal (a target level and stability of output), the inventory goal (a satisfactory stock level), the sales goal (a target revenue or market share), the market-share goal, and the profit goal. Crucially, each goal is expressed not as a maximum but as an aspiration level — a satisfactory target, such as 'a 10 per cent return' or 'last year's sales plus 5 per cent'. Aspiration levels are formed from past achievement and from comparison with similar firms, and they adapt: success raises aspirations, failure lowers them. This is Simon's satisficing behaviour applied to the organisation: the firm searches until it finds an alternative that meets its aspiration levels on the goals it is currently attending to, and then stops. It does not compare all possible alternatives, because it cannot.

The Quasi-Resolution of Conflict

Since the goals conflict — low prices please sales but offend profit; large stocks please sales but offend inventory and finance — the theory must explain how decisions are reached at all. Cyert and March argue that conflict is never fully resolved; it is only quasi-resolved by three devices.

First, local rationality: the organisation is divided into sub-units, each dealing with a narrow set of problems and goals, so that most conflicts never meet head-on. Second, acceptable-level decision rules: policies are adopted if they are good enough on the goals they affect, rather than optimal on all goals jointly. Third, and most importantly, sequential attention to goals: the firm attends to goals one at a time, in order of urgency. The goal whose aspiration level is currently being missed — the one in crisis — commands attention and resources this period; the others wait. Just as a household deals first with the leaking roof and then with the garden, the firm deals first with whichever target is failing. Sequential attention converts an impossible simultaneous optimisation into a feasible series of single-problem responses.

Organisational Slack

A central concept is organisational slack: the difference between the total resources of the coalition and the payments strictly necessary to keep it together. In good times the firm accumulates slack — staff are a little more numerous than necessary, wages and perquisites a little generous, prices a little higher, effort a little relaxed. Slack is not mere waste in this theory; it is the lubricant of the coalition. It absorbs shocks: when times worsen, the firm cuts slack rather than renegotiating the whole bargain, so it survives downturns without internal conflict, and in good times slack quietly raises aspiration-satisfying payments to all groups, keeping the coalition stable. The existence of slack explains a fact the neoclassical theory cannot: why firms under pressure can suddenly cut costs substantially without reducing output — the costs were slack all along.

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Uncertainty Avoidance

Boundedly rational firms cannot optimise against an unknown future, so they avoid uncertainty rather than gamble on forecasts. They do this in two ways. First, they rely on short-run reaction to feedback: decisions are revised frequently in response to immediate results — stocks rose, so cut production; sales fell short, so review price — instead of following a long-run plan derived from estimated demand curves. Second, they negotiate their environment: long-term contracts with suppliers and customers, trade-association understandings, conventional mark-up pricing and similar arrangements convert an uncertain environment into a partly guaranteed one. The full-cost pricing described by Hall and Hitch is, in this light, an uncertainty-avoiding routine: it replaces an unknowable demand calculation with a stable, defensible rule.

Problemistic Search and Organisational Learning

Search — looking for new alternatives — is not continuous or random; it is problemistic. It is stimulated by failure to meet an aspiration level, it is motivated (biased by the nature of the problem: a sales shortfall triggers search in the marketing area first), and it proceeds from simple to complex solutions, starting in the neighbourhood of the current policy and of the symptom. A firm whose profit falls does not re-optimise the whole business; it first tries a small price change or a cost trim near where the trouble appeared. Finally, the firm learns: aspiration levels, attention rules (which goals and which parts of the environment are watched) and search rules are all revised in the light of experience. The organisation is thus an adaptive system — a 'coalition that learns' — which is why the theory is as much a theory of organisational behaviour as of economics.

What the Theory Predicts

Applied to pricing, the theory predicts — consistently with survey evidence — sticky prices reviewed when goals are missed, mark-ups adjusted slowly towards a target return, and output changed in response to inventory feedback rather than to marginal calculations. It predicts that firms in the same industry with identical technology can behave differently because their coalition bargains, aspiration levels and slack differ. It also predicts counter-cyclical behaviour of costs through slack absorption, and explains why mergers, diversification and managerial resistance to takeovers occur even when they do not maximise shareholder profit.

Critical Evaluation

The theory's strengths are its realism and explanatory breadth: it accounts for satisficing, routines, stickiness and internal politics that the maximising model must ignore, and it founded the modern study of organisations and, later, evolutionary economics. Its weaknesses are equally clear. It is descriptive rather than predictive in the sharp sense: it rarely yields a unique price or output for given demand and cost data, which makes it hard to test and easy to fit after the event. Its concepts — slack, aspiration levels — are difficult to measure independently. And critics note that competitive selection may discipline even satisficing firms in the long run, pushing survivors towards profit-seeking behaviour, so the two theories may describe different time horizons rather than contradict each other outright.

Conclusion

To conclude, the behavioural theory of Cyert and March replaces the single maximising entrepreneur with a coalition of groups bargaining over multiple goals expressed as adaptive

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aspiration levels. Conflict is quasi-resolved through local rationality, acceptable-level rules and sequential attention; organisational slack stabilises the coalition and absorbs shocks; uncertainty is avoided through feedback reaction and a negotiated environment; and search is problemistic, with the whole system learning from experience. It sacrifices the neat predictions of profit maximisation in order to describe, far more faithfully, how firms actually decide.

Question 4: Factors Influencing the Shape of the Supply Curve of a Factor of Production (20 Marks)

Describe the factors that influence the shape of the supply curve of a factor of production.

Introduction

The supply curve of a factor of production — labour, land, capital or enterprise — shows how much of the factor will be offered at each possible factor price (wage, rent, interest or normal profit), other things equal. Unlike the supply of a produced commodity, factor supply curves show no single standard shape: the supply of labour to the whole economy may bend backwards, the supply of land is vertical, the supply of capital is vertical in the short run and upward sloping in the long run, and the supply of any factor to one small firm or industry is typically upward sloping or even perfectly elastic. This answer explains the factors that determine which shape emerges: the nature and mobility of the factor, the time period, opportunity cost, the income and substitution effects for labour, the distinction between the total stock and the supply to a particular use, institutional arrangements, and related influences.

1. The Nature of the Factor: Stock, Flow and Reproducibility

The most fundamental influence is what kind of thing the factor is. Land exists as a fixed stock given by nature; no rise in rent can create more of it, so the total supply curve of land to the whole economy is a vertical line — perfectly inelastic at every price. Produced factors, by contrast, are flows that respond to price: a higher return to capital calls forth more saving and investment, and higher wages call forth more hours, more participation and more training, giving an upward-sloping curve. Labour has a further peculiarity: it is perishable and inseparable from the worker. A day's labour not sold today is lost forever, and supplying labour means giving up leisure, which no produced commodity requires. These characteristics are what make the peculiar shapes — above all the backward-bending labour supply curve — possible.

2. The Time Period Allowed for Adjustment

Supply is almost always more elastic, and the curve flatter, the longer the period allowed. In the very short run the supply of nearly every factor is fixed: the number of trained surgeons, of machines installed, of developed plots is given, and the curve is vertical. Given months and years, higher prices induce entry: students choose the well-paid profession, firms order machines, land is drained and developed. Marshall's distinction between the short-period supply of capital (inelastic, earning a quasi-rent) and its long-period supply (elastic, governed by the cost of producing and maintaining capital goods) is the classic statement. Time therefore rotates the supply curve anticlockwise — from vertical towards flat — for every reproducible factor.

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3. Mobility and Specificity of the Factor

A factor that can move easily between occupations, industries and places responds strongly to a price rise in any one of them: a small wage premium draws in many workers, so the supply curve to that industry is flat and highly elastic. A highly specific factor — a blast-furnace crew, land suited to one crop, a machine built for one process — has few alternative uses; its supply to any use is governed by its total stock and is correspondingly steep. Mobility itself depends on training periods, information, housing, family ties, licensing and union rules. Geographical and occupational mobility therefore determine the slope of supply to particular employments, while the supply to the economy as a whole is set by deeper factors such as population and the capital stock.

4. Opportunity Cost and Transfer Earnings

For any particular use, a factor must be paid at least its transfer earnings — what it can earn in its best alternative use — or it will leave. The supply price rises with quantity because the units drawn in successively have higher and higher opportunity costs: the first workers attracted to a new factory are the unemployed or the low-paid nearby; later recruits must be bid away from good jobs or distant places. This rising opportunity cost is the basic reason why supply curves to an industry slope upward, and anything that raises alternative earnings (a boom elsewhere, better social security, a higher minimum wage in other employments) shifts the curve leftward and makes it steeper. The excess of actual earnings over transfer earnings is economic rent, and the proportion of rent in a factor's income is greater the more inelastic — the steeper — its supply.

5. Income and Substitution Effects: The Backward-Bending Supply of Labour

For labour, the supply curve is the outcome of each worker's choice between income and leisure, and a wage change pulls in opposite directions. The substitution effect of a higher wage makes leisure more expensive, encouraging more work: it pushes the curve upward to the right. The income effect of a higher wage makes the worker richer, and since leisure is a normal good, encourages him to 'buy' more leisure and work less: it pushes the curve backwards. At low wages the substitution effect normally dominates and the curve slopes upward; but at high wages the income effect may dominate, and the supply curve bends backwards — hours offered actually fall as the wage rises further, as with professionals who take longer holidays or a four-day week once a target income is comfortably exceeded. For the whole economy, participation decisions of married women, students and older workers add a further margin: higher wages draw non-participants into the labour force, which can keep the aggregate curve sloping upward even when individual hours bend back. The population size, age structure and social attitudes to work shift the whole curve.

6. Total Supply versus Supply to a Particular Use

The same factor can have a vertical supply curve in one market and an elastic one in another, because the relevant constraint differs. The total supply of land is fixed, but the supply of land to housing, to wheat, or to one town is elastic: a higher price in one use bids land away from others. Similarly, the total supply of labour in a country this year is nearly fixed, but the supply to one small firm is perfectly elastic at the going wage — the firm can hire all it wants without affecting the wage — which is why the firm under competition faces a horizontal supply

(average cost of the factor) curve, while the industry, which must bid workers away from other industries, faces an upward-sloping one. Any statement about shape must therefore specify: supply to whom, over what period.

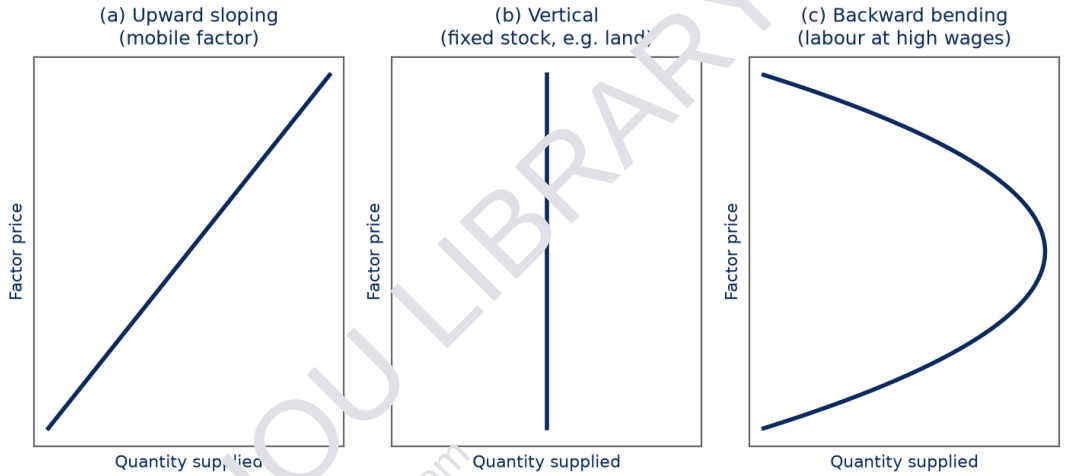

Figure 1: Three characteristic shapes — (a) upward sloping for a mobile, reproducible factor; (b) vertical for a fixed stock such as land in total; (c) backward bending for labour when the income effect overtakes the substitution effect at high wages.

7. Institutional and Non-Economic Influences

Institutions can impose kinks and flat segments that pure economics would not predict. A statutory minimum wage makes the effective supply curve horizontal at the minimum up to the quantity of labour available, and trade-union wage agreements do the same in covered sectors. Licensing and professional entry restrictions make supply steeper by blocking the response of numbers to price. Non-monetary attractions also matter: jobs that are pleasant, safe, prestigious or conveniently located attract supply at lower wages (compensating wage differentials work in reverse), which shifts the curve rightward, while dangerous or degrading work shifts it leftward. For capital, the supply of saving responds to the rate of interest but also

to precautionary and life-cycle motives, expectations and the tax system — one reason the aggregate saving curve is often drawn as steep or even, for target savers, backward sloping.

Conclusion

To conclude, the shape of a factor's supply curve is not arbitrary: it is determined by the factor's physical nature and reproducibility, the time allowed for adjustment, its mobility and specificity, the opportunity costs of successive units, the balance of income and substitution effects in the special case of labour, the market for which supply is measured (firm, industry or whole economy), and the institutional and non-monetary environment. Vertical, horizontal, upward-sloping and backward-bending curves are all special cases generated by these influences, and identifying which influences dominate in a given market is the first step in analysing how factor prices — wages, rent and interest — are determined.

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Question 5: Marginal Conditions of Optimality in General Equilibrium (20 Marks)

Explain the marginal condition of optimality that is observed in a general equilibrium state.

Introduction

Partial equilibrium analysis studies one market at a time. General equilibrium analysis, founded by Walras and perfected by Pareto, Hicks and Arrow and Debreu, studies the economy as a complete interdependent system in which all prices and quantities are determined simultaneously. A general equilibrium is Pareto optimal — no one can be made better off without making someone else worse off — when a specific set of marginal conditions is

simultaneously satisfied. These conditions state, in essence, that certain marginal rates of substitution and transformation must be equal everywhere they can be compared, because if any two differed, a mutually beneficial reallocation would still be possible and the economy would not be at an optimum. This answer explains the conditions in exchange, in production, and in the composition of output, and shows how a competitive price system brings them all about.

The Logic of Marginal Equality

Every marginal optimality condition has the same structure. A marginal rate of substitution (MRS) measures how much of one thing an agent will give up for a marginal unit of another while remaining equally well off; a marginal rate of transformation (MRT) or of technical substitution (MRTS) measures how much of one thing must in fact be given up, technically, to obtain a marginal unit of another. If the subjective rate at which people are willing to substitute differs from the technical rate at which substitution is possible, resources can be reshuffled to make someone better off at no cost to others. Optimality therefore requires willingness and possibility to coincide at the margin — in every use, for every agent, simultaneously.

Condition 1: Efficiency in Exchange — Equal Marginal Rates of Substitution

For any two goods X and Y, the marginal rate of substitution between them must be the same for all consumers: MRS of X for Y of person A = MRS of X for Y of person B, for every pair of consumers. Suppose instead that A values the last unit of X at 3 units of Y while B values it at only 1 unit of Y. Then B can give A one unit of X in exchange for, say, 2 units of Y, and both gain: A receives something he values at 3 for only 2, and B receives 2 for something he valued at 1.

Trade continues until the rates are equalised, which is the tangency of the two consumers' indifference curves along the contract curve of the Edgeworth box. In competitive equilibrium the condition is secured automatically, because every consumer equates his MRS to the common price ratio: MRS = Px/Py for all, so all MRSs are equal to each other.

Condition 2: Efficiency in Production — Equal Marginal Rates of Technical Substitution

For any two inputs, say labour and capital, used to produce different goods, the marginal rate of technical substitution between the inputs must be the same in every firm and industry: MRTS of labour for capital in industry X = MRTS in industry Y. The MRTS equals the ratio of the marginal physical products of the inputs, MP_L/MP_K. If the MRTS were 2 in industry X and only 1 in industry Y, then moving one unit of capital from Y to X and one unit of labour from X to Y would raise output of X (capital there replaces 2 units of labour's worth) without reducing output of Y (where one unit of labour replaces one of capital) — total production from the same total inputs would increase, proving the original allocation inefficient. Reallocation continues until the MRTSs equalise. Competition secures this too: every cost-minimising firm equates its MRTS to the common factor-price ratio, MP_L/MP_K = w/r, and since all firms face the same w and r, all MRTSs are equal.

Condition 3: Efficiency in the Product Mix — MRS Equals MRT

The highest, or top-level, condition links consumption and production together: the marginal rate of substitution between any two goods, common to all consumers, must equal the marginal rate of transformation between them along the production possibility frontier: MRS =

MRT. The MRT — the slope of the PPF — measures how much of Y the economy must sacrifice to produce one more unit of X; it equals the ratio of the marginal costs of the two goods, MC_X/MC_Y. Suppose MRS = 3 but MRT = 1: consumers will give up 3 units of Y for one more X, while the economy need give up only 1 unit of Y to produce it. Producing more X and less Y then creates a clear surplus of welfare; resources should shift towards X until diminishing MRS and rising MRT bring the two rates together. In competitive equilibrium the condition holds because consumers set MRS = Px/Py and profit-maximising firms, pricing at marginal cost, set Px/Py = MC_X/MC_Y = MRT, so MRS = MRT. A related condition governs the allocation of each factor between production and leisure: the MRS between leisure and income for each worker must equal the wage rate, which equals the value of the marginal product of labour, ensuring labour is supplied up to the point where its marginal contribution to output matches its marginal cost to the worker.

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Table 1: The marginal conditions of a Pareto-optimal general equilibrium

Sphere	Condition	Competitive mechanism that secures it
Exchange	MRS(X,Y) equal for all consumers	Each consumer sets MRS = Px/Py; prices are common to all
Production (input allocation)	MRTS(L,K) equal in all firms and industries	Each firm sets MRTS = w/r; factor prices are common to all
Product mix (exchange + production)	MRS(X,Y) = MRT(X,Y) for every pair of goods	MRS = Px/Py and Px/Py = MC_X/MC_Y = MRT under price = marginal cost
Factor supply	MRS between leisure and income = wage = value of marginal product of labour	Workers equate the two at the ruling wage; firms hire until VMP = wage

Second-Order and Total Conditions

The marginal equalities are necessary (first-order) conditions; for a true maximum, curvature (second-order) conditions must also hold: indifference curves must be convex to the origin (diminishing MRS), isoquants convex (diminishing MRTS), and the production possibility frontier concave to the origin (increasing MRT as more of X is produced). Without these, tangencies could mark minima rather than optima. In addition, total conditions must be satisfied: total output of each good must equal total consumption of it (markets clear), total employment of each factor cannot exceed its endowment, and no available Pareto improvement through a discrete, non-marginal reallocation may remain. A state satisfying all the marginal and total conditions under the convexity assumptions is a full Pareto optimum.

Significance for General Equilibrium Theory

These conditions are the analytical heart of welfare economics. The first fundamental theorem of welfare economics states that every competitive general equilibrium satisfies them and is therefore Pareto optimal; the conditions are what the invisible hand is proved to achieve. Conversely, the second theorem states that any allocation satisfying the conditions can be sustained as a competitive equilibrium after suitable lump-sum redistribution of endowments. The conditions also provide the diagnostic list used to identify market failure: wherever an economy violates one — monopoly pricing (price above marginal cost, so MRS ≠ MRT), externalities (private and social margins diverging), public goods (MRSs must be summed, not equalised individually) or missing markets — a potential Pareto improvement is being forgone.

Conclusion

To conclude, Pareto optimality in a general equilibrium state is characterised by a connected system of marginal equalities: the MRS between any two goods equal across all consumers; the MRTS between any two inputs equal across all producers; the common MRS equal to the MRT between every pair of goods; and each factor supplied until its marginal value product matches the supplier's marginal rate of substitution between income and leisure. Together with diminishing MRS and MRTS and rising MRT (the second-order conditions) and the market-clearing total conditions, these equalities define the point at which the economy's resources are so completely and consistently allocated that no further reallocation can benefit anyone without harming another — and a complete competitive price system is precisely the mechanism that establishes all of them at once.

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