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Lecture 1.4: Incentives & Behavioral Responses

Classical Incentives: Prices, Taxes, Subsidies, Regulation

In classical microeconomic analysis, **incentives** enter primarily through prices and policy levers. A change in a relative price (via taxation, subsidy, or regulation) provides an incentive that alters the individual's budget constraint and thus their optimal choice. For example, an excise tax on a good raises its consumer price and shifts the consumer's budget line inward and "rotates" it, leading to a new tangency of the highest attainable indifference curve at a lower quantity. In contrast, a lump-sum tax (or uniform subsidy) simply shifts the budget line parallelly without distorting relative prices. In fact, the "lump-sum principle" shows that uniform taxes or income grants leave consumers free to re-optimize their consumption bundle, whereas commodity taxes create **distortions**. As Nicholson and Snyder show, a general income tax or subsidy leaves the individual "free to decide how to allocate whatever final income he or she has. On the other hand, taxes or subsidies on specific goods both change a person's purchasing power and distort his or her choices… Hence general income taxes and subsidies are to be preferred if efficiency is important" [1]. In practice, however, lump-sum taxes are often infeasible, so policy uses commodity taxes (e.g. "Pigouvian" taxes to correct externalities) or subsidies (to encourage desired behavior).

When prices change, **marginal analysis** determines responses. A consumer maximizing utility $U(x, y)$ subject to prices (p_x, p_y) and income I must satisfy

$$p_x x + p_y y = I, \quad \frac{MU_x}{p_x} = \frac{MU_y}{p_y},$$

so that the marginal rate of substitution (MRS) equals the price ratio [2]. In supply-and-demand diagrams, an increase in a good's price (due to a tax) reduces quantity demanded, while the subsidy case is analogous in reverse. By contrast, controls or regulations may impose quantity quotas or binding price ceilings/floors. For instance, a binding price ceiling creates excess demand (a shortage), whereas a binding floor creates excess supply. Both outcomes are inefficient compared to the equilibrium price which equates supply and demand. Regulations such as pollution limits (quotas) can also be interpreted as implicit taxes: e.g. an emissions cap effectively sets a "shadow price" on each unit of pollution.

Economic agents thus respond predictably to price-based incentives. On the production side, a competitive firm maximizes profit $\pi(q) = p\,q - C(q)$. The first-order condition is $p = C'(q)$, meaning price equals marginal cost (i.e.\ $P = MC$), or more generally marginal revenue equals marginal cost [3]. Equivalently, each input is hired up to the point its marginal revenue product equals its cost: "the firm will hire any input up to the point at which its marginal revenue product is just equal to its per-unit market price" [4]. These conditions reflect classical **marginalism**: decisions are guided by marginal gains. Regulatory price caps or floors disrupt this margin-setting. For example, a binding price ceiling $P_c < P^*$ reduces output (since $P_c < MC$ at the old output), creates a shortage, and generates deadweight loss. A tax on production raises MC by the tax amount, reducing output and raising the consumer price; a subsidy has the opposite effect. Graphical supply–demand analysis succinctly shows these shifts and the new equilibrium point under each policy.

In all these classical cases, the underlying microfoundation is standard utility- or profit- maximization: agents are assumed to take prices as given and adjust quantities until marginal benefit equals marginal cost (for themselves) [2] [3]. In this fully rational framework, incentives simply change the parameters of the optimization problem, and equilibrium outcomes shift accordingly.

Microeconomic Foundations of Incentives

At its core, incentive analysis relies on the **constrained optimization** model. A representative household solves

$$\max_{x,y,\ell} U(x,y,\ell) \quad \text{s.t. } p_x x + p_y y + w(1-\ell) \le I,$$

where x, y are consumption goods and ℓ is leisure (so $1-\ell$ labor supplied). The budget constraint reflects prices (p_x, p_y), wage w, and nonlabor income I. The first-order conditions equate the marginal rate of substitution (MRS) between goods and leisure to the wage and price ratios. For example, the condition

$$\frac{MU_x}{p_x} = \frac{MU_\ell}{w}$$

balances the marginal utility per dollar of consuming x versus working (earning wage w). Equivalently, $MU_\ell/MU_x = w/p_x$. These conditions determine labor–leisure choices and labor supply: a higher wage (all else equal) raises the marginal benefit of work and tends to increase labor supply (the **substitution effect**), though possibly with an offsetting income effect.

A tax on wages or labor income effectively lowers the net wage $w(1-\tau)$, tilting the budget line inward more steeply and changing the equilibrium labor supply. If $MU_\ell/MU_x = (1-\tau)w/p_x$, one can solve for the change in ℓ in response to τ. Classical (Walrasian) analysis predicts some reduction in labor if the substitution effect dominates, but a sufficiently large income effect could offset it. In contrast, **behavioral** models (see below) might predict even more reduced effort if, say, people anchor on gross wages or face present-bias in work effort.

On the production side, a firm's objective is $\max_q\{pq - C(q)\}$. The FOC $p = C'(q)$ shows profit-maximizing output satisfies $P = MC$ (in perfect competition) or $MR = MC$ more generally [3]. This yields supply curves in markets. A **price subsidy** effectively lowers marginal cost to the firm, increasing output, whereas a tax raises marginal cost and reduces output. The extent of output change depends on the elasticities (the curvature of $C(q)$) and market structure. In monopolistic or oligopolistic settings, firms may have additional strategic responses to incentives (e.g.\ price discrimination for different consumer types), but the marginal principle still underlies any output choice.

When analyzing social welfare, we compare these private incentives to true social costs/benefits. A **Pigouvian tax** of size t can be derived by setting $t = MEC(q^*)$, the marginal external cost at the competitive output q^*, so as to realign private MC with social MC. Graphically, this shows up as shifting supply upward by t, reducing output to the social optimum. The classical result is that taxing negative externalities or subsidizing positive externalities can "internalize" them, given rational response.

Monetary and Fiscal Policy Incentives

At the macroeconomic level, incentives are embedded in policy instruments like interest rates, money growth, and fiscal taxes/transfers. The central bank's **monetary policy** sets a nominal interest rate i, which (under rational expectations) influences the real rate r via the Fisher relation $(1+r) = (1+i)/(1+\pi_e)$. Lowering i provides an intertemporal incentive for households and firms to borrow and spend more today (and save/invest), while raising i encourages saving and dampens spending. In New Keynesian models, a lower nominal rate (especially when near zero) is the only way to respond to a negative demand shock, illustrating the **liquidity constraint**. Moreover, credible inflation targets shape expectations π_e: if people expect higher inflation, the real return on savings falls, spurring consumption/investment. Thus monetary policy operates via **price-based incentives** in the intertemporal budget (e.g.\ through the Euler equation $U'(C_t) = \beta(1+r)E[U'(C_{t+1})]$). Time-inconsistent policies (à la Kydland–Prescott) highlight that a commitment to future low inflation provides an incentive for rational agents to price current investment differently [5] [6].

On the fiscal side, **tax cuts or transfers** also act as incentives. A temporary tax rebate increases disposable income, raising current consumption (Keynesian multiplier), whereas a tax increase lowers it. Beyond aggregate demand, fiscal rules can incentivize behavior: e.g. tax credits for hiring (subsidizing labor demand), investment tax credits, or sin taxes on harmful goods (incentivizing reduced consumption). Automatic stabilizers like unemployment insurance provide transfers that mechanically offset income changes, smoothing incentives cyclically. More novel "nudges" (Thaler–Sunstein style) use defaults or framing (not changing prices directly) to steer behavior – for instance, automatically enrolling workers in retirement savings with opt-out privileges greatly increases participation.

Fiscal policy must also consider incentive distortions. For example, high marginal tax rates can discourage work effort: the effective marginal tax on income beyond a threshold reduces the reward for additional labor. The celebrated **labor-leisure choice under income tax** shows that a worker maximizes $U(c,\ell)$ with $c = w(1-\tau)(1-\ell)$. The after-tax wage $w(1-\tau)$ determines the substitution effect on leisure versus income. If τ increases, the individual moves along their indifference curves to a new optimum with more leisure (if substitution dominates) or less (if income effect dominates). In practice, top earned-income-tax-rate changes have measurable effects on labor supply, consistent with these marginal incentives.

Although policy incentives are often analyzed in partial equilibrium, a general equilibrium view recognizes feedbacks: e.g. a tax cut may raise interest rates if the economy heats up, partially crowding out. Nevertheless, the central lesson is that macro policies influence agent choices via marginal conditions just like micro prices.

Game-Theoretic Incentives: Information and Contracts

When decisions are strategic or involve hidden information/actions, game theory refines the analysis of incentives. The **principal–agent model** epitomizes incentive problems under hidden action (moral hazard) or hidden type (adverse selection). Consider an employer (principal) who cannot perfectly observe a worker's effort e. A simple hidden-action model specifies that worker utility $U(w,e)$ and principal profit $\pi(e) = p \cdot f(e) - w$ depend on effort. The contract $w(e)$ must be designed so that the agent's *incentive compatibility constraint* (choosing the desired e) is met, along with a *participation constraint* (the worker's expected utility meets a reservation level). Formally, the incentive constraint can be written

$$U(w(e^*), e^*) \ \geq \ U(w(\tilde{e}), \tilde{e}) \quad \forall \tilde{e},$$

ensuring the chosen effort e^* is optimal for the agent. As Nicholson & Snyder illustrate, we require each agent type to prefer its own contract to that of other types (an IC constraint) [7] . The participation constraint ensures the agent will take the contract at all. For example, "Equation 18.5 is called a participation constraint, ensuring the agent's participation in the contract" [8] . Only contracts satisfying both constraints are **incentive-compatible**.

Moral hazard arises when an agent's actions are unobservable. For instance, in insurance, if an insured person can shirk safety precautions, insurance coverage creates a behavioral distortion. Formally, moral hazard is defined as "the effect of insurance coverage on an individual's precautions, which may change the likelihood or size of losses" [9] . To mitigate this, contracts tie payouts to outcomes – e.g.\ deductibles and co-pays ensure the insured internalizes part of the cost. In principal–agent terms, the principal induces the desired action by making the agent's payoff depend on observable output: "the principal tries to induce the agent to take appropriate actions by tying the agent's payments to observable outcomes" [5] . For example, a bonus or piece-rate pay scheme motivates workers to exert effort despite risk aversion.

Adverse selection occurs when one party (say an insured client) has private information about their risk type before contracting. High-risk individuals are more likely to seek insurance, threatening to unravel the market. The classic definition is: *"the problem facing insurers that risky types are both more likely to accept an insurance policy and more expensive to serve."* [6] . This drives selection: insurers must design separate contracts (menus) so that each type self-selects its intended contract, again using IC constraints. In either case, formal mechanism-design analysis ensures incentive compatibility: contracts must be structured so that truthful revelation (or best-response effort) is optimal. In general, "the first best is not incentive compatible if the barista cannot observe the customer's type" – meaning the simple optimal allocation must be adjusted to satisfy IC constraints [10] .

In broad terms, mechanism design imposes a hierarchy of constraints. Each participating agent i faces a *participation (individual rationality) constraint* $U_i(\theta_i) \geq \bar{U}_i$ and an *incentive compatibility constraint* ensuring truthful reporting or effort. Nicholson & Snyder summarize this succinctly: in a two-type contract, "the first two [constraints] are participation constraints for the low and high type… ensuring that they accept the contract… The last two [constraints] are incentive compatibility constraints, ensuring that each type chooses the bundle targeted to him rather than the other type's bundle." [11] . Solving such constrained optimization problems (often with Lagrangians) yields the optimal distortion of contracts under asymmetric information.

Game-theoretic incentives also appear in simpler non-cooperative settings. For example, in a Cournot duopoly, each firm's output decision takes into account competitors' responses – a change in marginal cost (e.g. via a production tax) alters each firm's best-response function, shifting the Nash equilibrium. In a public-goods game, the incentive to free-ride means that individual contributions under-provide the good; governments may then use subsidies or matching grants as incentives to approach the social optimum. Similarly, labor-wage contracts often incorporate incentive terms (commissions, profit-sharing) to align agent actions with firm objectives. In all these cases, game theory formalizes how payoffs and information shape strategic responses to incentives.

Incentive Compatibility and Participation in Formal Models

In formal mechanism-design models, the role of **incentive compatibility (IC)** and **participation (individual rationality, IR)** constraints is paramount. A direct mechanism must satisfy for every agent i:

$$U_i(\theta_i, \text{report } \theta_i) \geq U_i(\theta_i, \text{report } \theta_i') \quad (\text{IC}),$$

$$U_i(\theta_i, \text{report } \theta_i) \geq \bar{U}_i \quad (\text{IR}),$$

where θ_i is the agent's type and $\bar{U}_i$ is the reservation utility. As noted by Nicholson & Snyder, these constraints must hold with equality at the optimum (the IR binds for the marginal participant) [12] [11]. In multi-type models (e.g.\ screening), one finds the envelope conditions $U_i'(\theta_i) = \dots$ that characterize the optimal distortion of transfers. For example, with adverse selection in insurance, the low-risk type's IC constraint and the high-risk type's IR constraint usually bind. In mechanism design (e.g.\ auctions, auctions with private values), similar IC/IR constraints determine how to allocate goods to maximize revenue or efficiency. Overall, solving these contracts involves the math of Lagrangians and the envelope theorem, but conceptually it means designing incentives so that all agents truthfully reveal or optimally choose their assigned action.

Behavioral Economic Insights: Bounded Rationality and Biases

Classical models assume fully rational agents, but behavioral economics documents systematic deviations. **Bounded rationality** (Herbert Simon) recognizes that cognitive limitations and incomplete information make true optimization impossible. Agents instead use heuristics or rules of thumb. For instance, consumers may satisfy rather than optimize when faced with a complex choice. Bounded agents are influenced by reference points: wealth changes are evaluated relative to a current reference, not as absolute utility. Prospect Theory (Kahneman–Tversky) formalizes this, showing a value function that is concave for gains but convex for losses around a reference, and steeper for losses (loss aversion). This implies, for example, that a \$100 tax might "feel" worse than a \$100 subsidy feels good, so people may strongly avoid new taxes even when utility losses are objectively symmetric.

Other behavioral phenomena include **present bias** and **time inconsistency**: people often have quasi-hyperbolic preferences, valuing immediate rewards disproportionately. Formally, instead of discounting future utility by a constant factor β^t, they use $\beta\delta^t$ with $\beta < 1$, making short-run incentives much more potent. For example, a future tax rebate may be discounted so heavily that it fails to change current spending, whereas a wallet cash of the same amount would. Time-inconsistent agents might plan to invest tomorrow but procrastinate, undermining rational predictions.

Behavioral biases can alter the response to classical incentives. For instance, **overconfidence** or optimism bias may lead entrepreneurs to under-insure or take on excessive leverage. **Reference dependence** means that people may be loss-averse: sales taxes can feel like losses, so consumers might reduce consumption more than standard models predict (Thaler calls this "the pain of paying"). In labor supply, inertia or negotiation norms (e.g.\ fixed wages rather than flexible hours) can blunt the effect of a tax on the margin. In public goods, many experiments find that some people do contribute voluntarily (warm-glow giving) or cooperate more than Nash predicts, but also that they punish non-contributors (strong reciprocity), which is not in classical theory.

Policy incentives sometimes explicitly leverage behavioral insights. “Nudges” such as default rules or framing harness predictable biases. For example, default enrollment in pensions takes advantage of inertia to raise savings rates without changing economic tradeoffs. Recognizing that agents may not always act on small incentives, policymakers sometimes combine prices with behavioral tools: e.g. in health, taxes on cigarettes are paired with graphic warnings. Conversely, behavioral deviations can undermine traditional incentives: if people are very present-biased, a future environmental tax may not deter present consumption of gasoline.

Rational vs. Behavioral Responses to Incentives

Classical rational models predict that a small change in incentives produces a proportional marginal response (modulated by elasticities). In contrast, behavioral models often predict **nonlinear** or **threshold** effects. For example, a tiny carbon tax may be ignored by boundedly rational consumers, whereas a large visible tax spike might have a strong effect (due to salience). Prospect Theory suggests that people overweight small probabilities and underweight moderate probabilities: thus, incentives that operate via chance (like lotteries or probability-weighted benefits) can have outsized or muted impact.

Another comparison is in time choice: a rational agent discounts at rate δ and any credible future incentive will be factored in. A hyperbolic discounter, however, might heavily favor immediate gratification and only respond to immediate incentives. For example, offering a tax credit to be received next year might do little to boost investment today, whereas an immediate subsidy works better. Thus, a policy that seems equivalent under rational preferences can differ under behavioral ones. Empirical evidence on this is mixed: some studies find smaller labor supply responses to taxes than predicted (possibly due to framing or perceived fairness), while others confirm elasticity ranges.

Understanding these differences is important for design. For instance, in retirement savings, a small increase in the contribution-matching rate (a rational incentive) might not raise participation much if cognitive load is high; a default-enrollment (a behavioral nudge) can do more. Similarly, welfare “cliffs” from means-tested benefits create perverse incentives: rationally, individuals might not work slightly more if they lose substantial benefits, but behavioral framing can exacerbate this by triggering reference-dependent losses. Behavioral deviations often reduce the effectiveness of incentive policy, which in turn can justify stronger or differently structured incentives (e.g.\ upfront grants instead of deferred tax breaks).

Examples: Pigouvian Taxes, Sin Taxes, Labor Supply, Public Goods, Welfare Cliffs

- **Pigouvian Taxes.** Consider a negative externality like pollution with marginal external cost $MEC(q)$. Classical analysis sets a tax $t = MEC(q^*)$ to equate private marginal cost to social marginal cost at the desired output q^*. Diagrams show supply shifting from MC to $MC + t$, reducing equilibrium output from q_{priv} to q^*. Empirically, carbon taxes and congestion pricing use this logic. Behavioral issues (like discounting of future health effects) suggest the optimal tax might be higher than rational models indicate. If consumers are present-biased, their current consumption may not drop as much, implying a need for larger taxes or complementary regulations.

- **Sin Taxes.** Governments tax “sinful” goods (tobacco, alcohol, sugary drinks) both to raise revenue and to discourage use. A standard demand analysis shows that higher excise taxes shift up the price, reducing quantity and improving welfare if the good has negative externalities or internalities. However, empirical price elasticity is key: cigarettes, for example, are relatively inelastic, so taxes mainly raise revenue with moderate consumption drops. Behavioral models add nuance: loss aversion and addiction may make consumers less sensitive to price (if they "snack" unexpectedly), but salient tax hikes (e.g.\ phasing in a steep increase) can cause sharper declines than small, gradual increases.

- **Labor–Leisure Choice under Tax.** As above, a labor tax reduces the net wage and tilts the budget constraint. Utility maximization yields the condition $MRS_{c,\ell} = (1-\tau)w/p$. In a pure income tax, substitution encourages more leisure, but income effects (from higher after-tax income) encourage more work; the net effect depends on preferences. Empirically, labor supply elasticities are modest, but concentrated at intensive margins or among secondary earners. A nuanced example is the EITC (Earned Income Tax Credit) in the U.S.: while it raises incomes for low earners (increasing labor supply on the subsidy phase-in), it creates a "welfare cliff" where benefits rapidly phase out as income rises, effectively imposing high marginal tax rates and discouraging additional work at that point. This cliff can be modeled as a non-monotonic budget set, and behavioral evidence suggests many workers reduce hours sharply near the cliff [1].

- **Public Goods and Collective Action.** Public goods (like national defense or public broadcast) are non-excludable, leading to free-rider incentives. In the simple model of n identical consumers with utility $U(g,\ell)$ and private leisure ℓ (labor finances the public good g), the Nash equilibrium provision is below the social optimum. Each individual's incentive is to under-contribute, as the marginal private benefit of funding equals $\frac{\partial U}{\partial g}$ but the cost is their full marginal cost of taxes. A price-based incentive (a voluntary contribution or tax) fails to achieve full provision. Solutions include mandatory taxation or matching grants (government matches contributions), effectively subsidizing contributions so that the private cost equals the true marginal benefit. Behavioral experiments often show some people contribute more than zero even without enforcement (warm glow), yet the systematic under-provision confirms the classic prediction.

- **Welfare Cliffs (Benefit Phase-Outs).** Means-tested benefits (e.g.\ housing subsidies, food stamps) create sharp "cliffs" where a small increase in earnings triggers a large drop in benefits. Graphically, the after-tax budget line has a jump discontinuity. Classical analysis shows this creates extremely high marginal tax rates (the loss of benefits), discouraging work. Behavioral responses can amplify this: individuals may irrationally anticipate losing all future benefits after a threshold, causing them to remain at the cliff. Thus policymakers often smooth these cliffs (e.g.\ gradual phase-outs) or use incentives (work requirements) to offset the disincentive.

In each of the above examples, equilibrium responses can be predicted by shifting supply/demand or reaction functions. For instance, a subsidy on investment shifts the firm's marginal cost curve down, raising equilibrium quantity (and possibly lowering price, if competition is imperfect). In a general-equilibrium context, one also checks effects on related markets (e.g.\ higher labor supply due to a childcare subsidy could raise wages). The common thread is that incentives change first-order conditions (e.g.\ $p = MC$ becomes $p + t = MC$ or $p = MC - t$), and markets clear at a new equilibrium consistent with those conditions. Rational expectations (in macro) mean agents anticipate policy shifts: if the central bank signals future inflation, long-run interest rates rise immediately. By contrast, if agents are bounded-rational or adaptive, policy surprises can have larger short-run effects because expectations adjust slowly.

Economic models therefore combine equilibrium analysis with incentive effects. For example, in a simple supply-demand diagram, an excise tax t raises consumer price by less than t (shared tax incidence) and reduces quantity; welfare analysis then computes the triangles of deadweight loss. In more complex models, one derives comparative statics: e.g.\ $\frac{\partial x^*}{\partial p_x} = (elasticity)$. Formal derivations, either via differentiation of FOCs or envelope theorems, underpin these comparative statics.

Figure: An illustrative data chart on a workspace (showing price or quantity trends). In classroom models, such graphs depict how incentives (like an interest-rate cut or tax change) cause market trends. The objective and constraints of agents determine their response. [2] [3]

Figure: A financial chart and cryptocurrency token. Macro incentives (e.g.\ monetary expansion or digital currency policies) influence price trajectories. Game-theoretic incentives (such as contract rewards) similarly shape strategic financial behavior. [9] [6]

Equilibrium Responses to Incentive Shifts

When incentives change, **equilibrium** outcomes adjust in predictable ways. In a competitive market, shifting supply or demand curves yields new intersection points. For instance, a tax on sellers shifts the supply curve vertically by the tax amount, raising the equilibrium price paid by buyers and lowering quantity. Algebraically, if demand $D(p)$ and supply $S(p)$ determine $D(P^*) = S(P^*)$, then a per-unit tax t on producers leads to $D(P_1^*) = S(P_1^* - t)$. Solving yields $P_1^* > P^*, Q_1^* < Q^*$. The exact changes depend on elasticities (i.e.\ partial derivatives of D and S). Often one computes the tax incidence formulas.

In general equilibrium, other prices adjust too. For example, a tax on labor income might reduce labor supply and thus raise wages in equilibrium (if output falls, reducing labor demand). Macroeconomists use IS–LM or AD–AS frameworks: a fiscal expansion (tax cut or spending increase) shifts the IS curve or AD curve, leading to higher output and possibly inflation depending on slopes. If expectations are rational, an anticipated inflationary policy will shift the SRAS curve via expected inflation, mitigating real effects.

Game-theoretic incentives also have equilibria. In auctions, for example, changing the "rules of the game" (a reserve price, entry fee, or information structure) changes the bidding equilibrium. In bargaining, altering the outside option (welfare benefit or unemployment insurance) is an incentive that affects the Nash bargaining outcome. In many cases, one sets up the agents' best-response functions and finds the new Nash equilibrium after the incentive.

Finally, consider a signalling game (like Spence's education model). If education subsidies are introduced, the equilibrium separating signal might become cheaper, causing both types to get more education. If subsidies are conditional on schooling, they create an incentive that directly shifts the signal threshold. Likewise, introducing a screening test (mechanism) changes the equilibrium allocation of goods to types. Each such adjustment can be derived by solving for the new equilibrium strategy profiles.

Summary: Incentives operate through the marginal calculus of consumers, firms, and strategic players. Classical theory provides clear prescriptions (e.g.\ "equate MRS to price" [2], "set $P = MC$" [3], use Pigouvian tax size MEC), but real agents may deviate due to bounded rationality or biases. Equilibrium analysis then examines how the entire system adjusts to these incentive-induced behavioral changes. By combining micro foundations, macro contexts, game-theoretic models, and behavioral insights, we develop a comprehensive view of how incentives shape economic outcomes.

Citations: Classical microfoundations and contract theory follow standard texts [2] [3] [7] [8]. Behavioral aspects draw on Kahneman–Tversky and recent literature. The examples (Pigouvian tax, labor supply, adverse selection) are canonical and appear in Mas-Colell et al., Varian, and related sources. (See references cited above.)

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