Activity 7B: Mechanism Redesign

Digital Finance Intensive Course — Prof. Dr. Joerg Osterrieder

Day 7B companion (Platform Wars) | 45 min | Pairs

What is a mechanism? A set of rules that maps participants' actions to outcomes. A *well-designed* mechanism aligns individual incentives with the desired collective outcome. A *broken* mechanism produces a predictable gap between what the rules say and what participants actually do.

Your task. Each pair is assigned one problem below. Identify the mechanism failure, explain why it is incentive-incompatible, and propose a redesign that restores alignment. Time: 35 min design + 10 min class debrief.

Problem 1 – Constant Product AMM and Impermanent Loss

Current mechanism: Uniswap v2 uses the constant product rule $x \cdot y = k$. Liquidity providers (LPs) deposit both assets in a 50/50 ratio and receive trading fees (0.3% per swap).

Failure symptom: When asset prices move significantly, LPs systematically end up with *less* value than if they had simply held the same assets outside the pool (impermanent loss). Formula: $\text{IL} = 2\sqrt{r}/(1+r) - 1$ where $r = p'/p$. At $r = 4$ (price quadruples), $\text{IL} \approx -20\%$ before fees.

Redesign prompt. Your pair must answer:

(a) *Why does the constant product rule create impermanent loss?* Trace the mechanism: when ETH price doubles externally, what do arbitrageurs do to the pool, and why does this hurt LPs?

(b) *Propose a redesign.* Choose from: dynamic fee adjustment (higher fees when price volatility is high), concentrated liquidity (Uniswap v3 style: LPs choose a price range), or active rebalancing with oracle price feed. For your chosen redesign, explain: what does the mechanism change? Who gains, who loses? What new failure mode does it introduce?

(c) *Is there any mechanism that eliminates IL entirely?* Why or why not?

Problem 2 – Credit Score Misalignment (PFOF for Data)

Current mechanism: Traditional credit bureaux (Equifax, Experian, TransUnion) collect data from lenders and sell it back to lenders as credit scores. Consumers generate the data but do not own it. Bureaux are paid per query by lenders, not by consumers.

Failure symptom: The mechanism incentivises bureaux to maximise data volume and lender queries, not data accuracy. Consumers bear the cost of errors (loan rejections, higher rates) but have limited recourse. Errors affect 20%+ of US credit reports (FTC 2013). Alternative-data providers (Sesame Credit style) face the same misalignment: the party with the most to gain from accuracy (the consumer) does not pay for the service.

Redesign prompt. Your pair must answer:

(a) *Map the principal-agent problem.* Who is the principal? Who is the agent? What does the agent optimise when paid by lenders?

(b) *Propose a redesign.* Options: consumer-pays model (consumer pays for their own score, owns the data), portable credit history (the EU's Open Finance model: score travels with the consumer), or accuracy-based bureau compensation (bureaux earn a fee only when their score correctly predicts repayment). For your chosen redesign: who benefits, who loses, what prevents adoption?

(c) *Sesame Credit (Ant Group) owns the scoring model AND the payment data.* Is this a better or worse mechanism from a consumer welfare perspective? Apply the Akerlof framework.

Problem 3 – MYbank Loan-to-Deposit Ratio

Current mechanism: Ant Group's MYbank used a "310" model: 3-minute application, 1-second approval, 0-human-touch. Loan-to-deposit ratio: approximately 10% (most deposits are in Yu'e Bao money market, not MYbank's balance sheet). Traditional banks require 100% reserve / capital ratio alignment with loans.

Failure symptom: If Ant's transaction data model misprices risk (black swan scenario), MYbank could face a bank run with a 10% LTV ratio (10 cents in reserves for every dollar of exposure). Regulators (PBOC) identified this as systemic risk: MYbank's exposure is 1.7 trillion RMB with near-zero capital buffer by traditional standards. The mechanism (algorithmic approval + low reserves) works until it doesn't.

Redesign prompt. Your pair must answer:

(a) *Why does the 310 model create systemic risk even if the ML model is excellent?* Think about: tail risks (rare events not in training data), model correlation (if many borrowers have correlated defaults, the model fails simultaneously), and liquidity vs. solvency risk.

(b) *The PBOC required Ant to become a financial holding company subject to bank capital rules.* Is this the right mechanism redesign? What does it fix? What does it break (i.e., what was the social value of the original 310 model that might be lost)?

(c) *Propose an alternative redesign* that preserves the access benefits of the 310 model while addressing the systemic risk concern. Consider: tiered capital requirements by loan size, ML model auditability requirements, or dynamic reserve ratios tied to portfolio concentration.

Problem 4 – Gas Auction Front-Running and MEV

Current mechanism (pre-EIP-1559): Ethereum used a first-price gas auction. Users bid gas prices; the highest bidder gets their transaction included first. Miners (now validators) include highest-paying transactions.

Failure symptom: Sophisticated bots observed pending transactions in the public mempool and submitted the same transaction with a higher gas price, guaranteed to execute first (front-running). This enabled "sandwiching": buy before a pending large swap, sell after. Value extracted: estimated $1bn+ per year in MEV. Users consistently paid more than the stated mechanism price. EIP-1559 introduced a base fee (burned) + optional tip. Result: more predictable fees, but MEV extraction (now called "maximal extractable value") continues because transaction ordering is still visible.

Redesign prompt. Your pair must answer:

(a) *EIP-1559 fixed overbidding but not MEV. Why?* Identify the structural feature that enables MEV even after EIP-1559: is it the auction mechanism, the mempool visibility, or the validator's ordering power?

(b) *Propose a redesign that specifically targets MEV.* Options: commit-reveal schemes (users commit to transactions without revealing content, then reveal later), encrypted mempools (transaction content hidden until block finalization), or fair-sequencing services (FCFS ordering guaranteed by decentralised validators). For your chosen redesign: what does it sacrifice (transaction speed? composability? decentralisation)?

(c) *Is some MEV socially beneficial?* Arbitrage MEV (bots correcting price discrepancies between pools) versus sandwich MEV (pure extraction). Should a redesign eliminate all MEV or only predatory MEV? How would the mechanism distinguish between them?

Cross-problem discussion (5 min). After presentations: what do all four failure modes have in common? (Hint: all involve an agent who can observe a signal and act on it before the mechanism's intended beneficiary can respond.)