

Pay, Incentives, Multitasking, and Relational Contracts

Organizations, Personnel, and Internal Labor Markets
Week 4

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Higher output after a bonus leaves the mechanism open

Central question

How do formal pay rules and informal commitments change effort, risk, selection, and cooperation?

- A bonus may change effort per hour, hours, the workforce, task priorities, or beliefs about payment.
- Measured output, realized pay, economic value, and worker welfare can move differently.
- Start with the promise workers knew before acting, then follow behavior and fulfillment.

Field orientation: Gibbons (1998); Prendergast (1999); Hoffman–Stanton (2025).

Learning goals: distinguish the contract from its consequences

- Reconstruct compensation's level, slope, timing, risk, and credibility.
- Use incentive, insurance, multitasking, and enforcement models with explicit assumptions.
- Separate incumbent response, entry/exit, production, and realized payment.
- Design a reform that distinguishes two mechanisms and measures independent quality and worker welfare.

Core points

The offered rule defines exposure. Realized receipt follows performance. A useful evaluation identifies the policy effect and states which mechanisms remain unresolved.

The empirical contract requires five linked records

Record	Preserve	Question it answers
Promised terms	Version, rates, thresholds, caps, dates	What rule was available before work?
Awareness/eligibility	Announcement, eligible roster, worker knowledge	Who could respond to which promise?
Production	Tasks, hours, units, independent quality	What changed in work?
Realized payments	Calculation, paid date, exceptions	Was the promise fulfilled?
Participation	Applications, entry, exit, missing outcomes	Whose outcomes are observed?

Keep announcement, work, measurement, and payment dates distinct. A zero bonus may reflect ineligibility, a missed target, exit, or nonpayment.

One pay formula can contain several different incentives

$$w_{it} = a_{it} + b_{it}m_{it} + B_{it}\mathbf{1}\{M_{gt} \geq T_{gt}\} + r_{it}(\mathcal{H}_t).$$

- i, g, t : worker, group, period; a : guaranteed pay; b : individual rate; m : measured performance.
- B : bonus; M : group measure; T : target; r : discretionary payment based on history $\mathcal{H}_t$.
- A signing bonus affects entry or vesting; a piece rate rewards another unit; a discretionary promise requires credibility.
- Reconstruct caps, floors, clawbacks, target revisions, and eligibility before fitting a regression.

Organizing teaching template. Employers need not use every component; average realized pay does not recover the marginal reward.

The marginal reward is concentrated near a threshold

$$w(m) = 20 + 0.10m + 51\{m \geq 100\}.$$

Move	Initial pay	New pay	Pay gain
98 $\rightarrow$ 99	29.80	29.90	0.10
99 $\rightarrow$ 100	29.90	35.00	5.10
100 $\rightarrow$ 101	35.00	35.10	0.10

- The discontinuity creates a large local gain, not a high marginal reward everywhere.
- Before uncertainty resolves, effort depends on the probability of reaching the target and time left.
- Actual receipt sorts observations by eventual success.

All amounts and units in this example are hypothetical.

Performance pay rewards effort and exposes income to risk

$$q = e + \epsilon, \quad c(e) = \frac{e^2}{2k}, \quad w = a + bq, \quad \epsilon \sim N(0, \sigma^2).$$

- q : output; $e \geq 0$: effort; $k > 0$: inverse effort-cost curvature.
- The worker has CARA utility with absolute risk aversion $\rho > 0$; $b \geq 0$ is the marginal reward.
- The risk-neutral firm values output at $p > 0$ per unit.
- Known parameters, one task, no selection, freely adjustable fixed pay, and no limited-liability or minimum-pay constraint.

Original teaching benchmark motivated by Gibbons (1998) and Prendergast (1999). The interior solution is conditional on employing the worker.

A steeper rate raises effort and the worker's risk premium

$$CE(e; a, b) = a + be - \frac{e^2}{2k} - \frac{\rho b^2 \sigma^2}{2}.$$

$$\frac{\partial CE}{\partial e} = b - \frac{e}{k} = 0 \quad \implies \quad e^* = kb.$$

- CE : certainty equivalent under the CARA-normal assumptions; the last term is the risk premium.
- Increasing b raises effort here; it also makes income more sensitive to noise.
- Pay dispersion, downside exposure, guarantees, and hours help reveal what risk the contract transfers.

The effort response is a model implication. An observed pay-output correlation does not identify it.

Optimal insurance uses the fixed payment as well as the rate

$$a(b) = \bar{U} - \frac{kb^2}{2} + \frac{\rho b^2 \sigma^2}{2}, \quad CE(e^*; a, b) = \bar{U}.$$

$$\Pi(b) = pkb - \frac{k + \rho\sigma^2}{2}b^2 - \bar{U}, \quad b^* = \frac{pk}{k + \rho\sigma^2}.$$

- $\bar{U}$: reservation certainty equivalent; Π : expected firm profit conditional on employment.
- Binding participation and unrestricted fixed transfers let the firm adjust a to the chosen b .
- The formula requires the interior, one-task, known-parameter environment. A reform raising b at fixed a is a different experiment.
- If the conditional maximum profit is below the firm's outside option, this calculation does not establish an operating employment relationship.

Greater noise lowers the slope in this particular model

$$p = k = \rho = 1, \quad b^* = \frac{1}{1 + \sigma^2}, \quad e^* = b^*.$$

Hypothetical noise variance	Optimal slope	Effort
$\sigma^2 = 1$	0.50	0.50
$\sigma^2 = 4$	0.20	0.20

- Low-powered incentives can be a deliberate insurance choice.
- In data, measurement, assignment, workforce, and guarantees may also change.
- Choosing variable pay can reflect ability, risk tolerance, liquidity, beliefs, or outside options.

Constructed arithmetic under binding participation, freely adjustable fixed pay, and the one-task interior model; not a calibrated compensation recommendation.

Lazear and Shearer identify different incentive comparisons

	Lazear	Shearer
Setting	Safelite; personnel records	Tree planting; individual workers
Variation	Firm compensation reform	Field-experimental piece-rate versus fixed-wage work
Outcomes	Productivity and workforce composition	Worker output under the experimental conditions
Limitation	Not an RCT or pure effort effect; retention and other changes matter	Within-experiment contrast differs from structural extrapolation to other conditions

Worker fixed effects do not eliminate time-varying assignment or selective observation. Experimental transport requires an additional argument.

Lazear (2000); Shearer (2004).

Leaver separates recruitment terms from post-entry terms

Stage	Variation	Margin and population
Recruitment	Advertised contracts assigned across district $\times$ subject-family markets	Application, entry, and composition of recruited teachers
After recruitment	Realized contracts rerandomized at the school level	Post-entry behavior and retention under the offered regime

- **Setting:** Rwandan primary schools.
- **Outcomes:** recruitment, teacher behavior/retention, and pupil learning.
- **Limitation:** the two stages have different assignment units and populations. Pupil learning is not direct latent teacher effort.
- Draw announcement, hiring, school assignment, work, and outcome dates before defining each contrast.

Leaver, Ozier, Serneels, and Zeitlin (2021), required reading.

A composition identity is an accounting convention

$$\bar{q}^1 - \bar{q}^0 = \underbrace{\sum_h s_h^0 (q_h^1 - q_h^0)}_{\text{within type, old shares}} + \underbrace{\sum_h (s_h^1 - s_h^0) q_h^1}_{\text{composition, new outputs}} .$$

- h : worker type; $r \in \{0, 1\}$: regime; s_h^r : type share; q_h^r : mean output for that type.
- This identity is exact for the displayed weighting convention.
- Alternative weights allocate the interaction differently.
- In personnel data, types and counterfactual type means may be unobserved. Labels do not make either component causal.

Original teaching decomposition. Leaver et al.'s separate assignment stages provide identifying variation that an accounting identity alone cannot supply.

The invented output increase is 2.8, with two components

	Old share	Old output	New share	New output
High-output type	0.30	12	0.60	14
Other type	0.70	8	0.40	9

$$\bar{q}^0 = 0.3(12) + 0.7(8) = 9.2, \quad \bar{q}^1 = 0.6(14) + 0.4(9) = 12.$$

$$\text{Within} = 0.3(2) + 0.7(1) = 1.3, \quad \text{Composition} = 0.3(14) - 0.3(9) = 1.5.$$

Interpretation

2.8 = 1.3 + 1.5 describes known synthetic types and outcomes. It does not establish a real reform's incentive and selection effects.

Define the population before calling the outcome productivity

Target	Useful outcome	Main issue
Baseline incumbents	Output, hours, pay, retention	Exit can remove performance records
Entrants	Applications, hires, initial quality	Applicant and hiring selection
Current workforce	Mean output per active worker	Population changes with treatment
Baseline positions/firm	Total output or contribution	Vacancies and replacement enter the effect
Workers after exit	Earnings and well-being	Often missing; not observed zero

Retain the baseline roster. A stayer-only sample conditions on a possible response to the reform.

Selection discipline: Lazear (2000); Leaver et al. (2021); Lee (2009).

Multitasking makes the relative reward across tasks matter

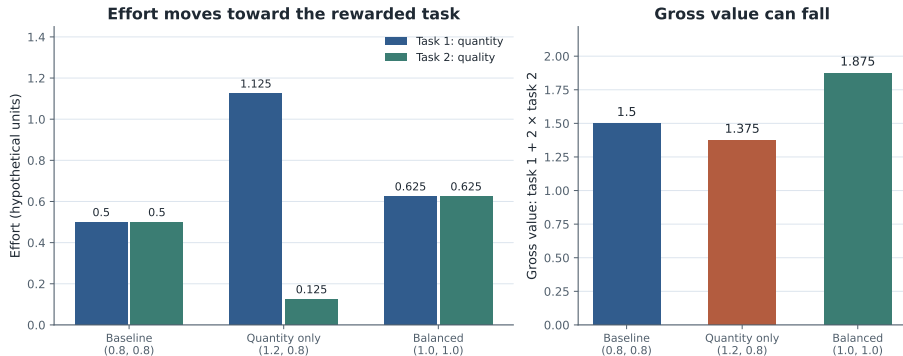
$$c(e_1, e_2) = \frac{1}{2}(e_1^2 + e_2^2 + 2\kappa e_1 e_2), \quad |\kappa| < 1.$$

$$\begin{pmatrix} e_1^* \\ e_2^* \end{pmatrix} = \begin{pmatrix} 1 & \kappa \\ \kappa & 1 \end{pmatrix}^{-1} \begin{pmatrix} b_1 \\ b_2 \end{pmatrix}, \quad \frac{\partial e_2^*}{\partial b_1} = -\frac{\kappa}{1 - \kappa^2}.$$

- Risk-neutral worker; both tasks measured perfectly; b_1, b_2 : marginal rewards.
- $|\kappa| < 1$ makes the cost matrix positive definite. The formula requires an interior, nonnegative effort solution.
- Positive κ makes effort on the tasks compete through costs; negative κ reverses the cross-response.

Original teaching construction motivated by Holmström–Milgrom (1991); it isolates allocation from measurement noise.

Rewarding quantity alone can lower gross value



Two-task quadratic costs; $\kappa = 0.6$; interior nonnegative effort; labels show reward slopes.

Gross value excludes compensation, effort costs and measurement costs; it is not profit or worker welfare.

SYNTHETIC_TEACHING_NOT_PUBLISHED_ESTIMATES

Synthetic two-task model: $\kappa = 0.6$, interior efforts; gross value $v = e_1 + 2e_2$. Rates (0.8, 0.8), (1.2, 0.8), and (1, 1).

Generated from the lab's analytical CSV; no empirical effects.

The multitask arithmetic depends on substitution and the target

Contract slopes	e_1	e_2	$e_1 + 2e_2$	Interpretation
(0.8, 0.8)	0.500	0.500	1.500	Baseline
(1.2, 0.8)	1.125	0.125	1.375	Quantity-only increase
(1.0, 1.0)	0.625	0.625	1.875	Balanced increase

- All three interior solutions satisfy $e_1, e_2 \geq 0$ for $\kappa = 0.6$.
- Gross value excludes payroll, effort disutility, and the cost of measuring quality.
- With cost complementarity, $\kappa = -0.2$, raising b_1 raises e_2 instead.
- **Exercise:** compute that complement case and check feasibility before interpreting the derivative.

Hypothetical model arithmetic; neither a profit ranking nor a welfare ranking.

An independent outcome can overturn a favorable target effect

Rewarded margin	Independent outcome	Required follow-up
Sales volume	Returns, discounts, contribution	Work dates, return windows, prices
Completed units	Defects, rework, safety	Stable blinded audits and task mix
Individual output	Coworker support and delays	Transfers, workflow and hours
Recorded revenue	Customer retention	Longer outcome horizon
Pay earned	Risk, effort burden, well-being	Baseline cohort and exits

If the reform changes task assignment, that reallocation belongs in its total effect. Controlling for the new task mix changes the estimand.

Multitask logic: Holmström–Milgrom (1991). Timing and economic consequences: Larkin (2014).

Timing and discounts can change without more annual value

	Oyer	Larkin
Setting	Fiscal-year business patterns	Enterprise software sales
Variation	Calendar patterns associated with nonlinear incentives	Compensation schedule, deal timing, prices
Outcomes	Business seasonality	Sales timing and discounts
Limitation	Demand and production seasonality share the calendar	Sales and threshold crossing are chosen; returns and concessions matter

Identification

A kink or threshold in pay is not an RD assignment rule. Reconstruct reset dates and opportunities, then justify the comparison.

Oyer (1998); Larkin (2014).

A tournament rewards the chance of outranking an opponent

$$\Delta W \frac{\partial P(\text{win} \mid e_i, e_j)}{\partial e_i} = c'_i(e_i).$$

- Interior best response for a risk-neutral worker in a two-person contest; ΔW : prize spread; P : winning probability; c_i : effort cost.
- Incentives depend on the opponent, noise, and how effort changes rank.
- Common shocks may cancel, but unequal territories, tasks, or ability can create unequal opportunities.
- Withholding help or obstructing another worker can improve relative standing. Record coworkers' outcomes and the comparison pool.

Teaching first-order condition motivated by Lazear–Rosen (1981). Rank is a contract component, not a welfare criterion.

Relative incentives can make workers care about coworkers' pay

- **Setting:** Bandiera–Barankay–Rasul (2005), personnel data in agricultural production.
- **Variation:** relative versus individual incentive regimes, with social relationships and observability.
- **Outcomes:** productivity and responses linked to the consequences for colleagues.
- **Limitation:** social ties are not independently randomized; state what changes across regimes and who can observe actions.

Empirical object

Recover the relative-pay denominator and relevant coworker group. One worker's extra output can change others' compensation.

Bandiera, Barankay, and Rasul (2005). Detailed endogenous team formation returns in Week 7.

Rank information and tournament money are distinct additions

Earlier regime	Next regime	Later regime
Team piece rates	Team piece rates + ranks	Team piece rates + ranks + prizes

- **Setting:** Bandiera–Barankay–Rasul (2013), teams in a firm.
- **Variation:** sequential within-subject regimes; team composition can change.
- **Outcomes:** team performance and composition.
- **Limitation:** not simultaneous team randomization, not fixed versus piece-rate pay. Seasonal changes require an argument.

Bandiera, Barankay, and Rasul (2013). A proposed rankings-only versus rankings-plus-prize design would separate components under its own assignment and spillover assumptions.

Friebel studies an offered team contract in retail

- **Setting:** shops and employees in a retail chain.
- **Variation:** randomized team-bonus eligibility.
- **Outcomes:** sales, customers, compensation, and shop/firm outcomes.
- **Mechanism:** results motivate effort complementarities; a team effect does not establish peer pressure.
- **Limitation:** payment depends on reaching the target, and gains can differ across team members.

Friebel, Heinz, Krueger, and Zubanov (2017), required reading and lab anchor. Our 24-shop, 12-pair exercise is an invented design, not the study's original allocation.

Comparing bonus recipients conditions on successful performance

$$P_{gt} = Z_g \mathbf{1}\{M_{gt} \geq T_{gt}\}, \quad \tau_{ITT} = \mathbb{E}[Y_g(1) - Y_g(0)].$$

- Z_g : offered regime; P_{gt} : receipt; M_{gt} : measured performance; T_{gt} : target.
- $Y_g(z)$: shop outcome under offer z . Define its period and eligible population.
- Receipt compares successful treated shops with a selected mixture of other shops.
- Eligibility as an instrument for payment can fail exclusion: the offer can change behavior even when payment is missed.

Friebel et al. supplies the policy-assignment anchor. The threshold equation is a simplified teaching rule; receipt is not randomized eligibility.

A team effect leaves cooperation, pressure, and opportunity open

Mechanism	Additional measure	Discriminating evidence
Complementary effort	Bottlenecks, task support, joint workload	Gains where tasks depend on one another
Peer pressure	Confidential pressure reports, hours	Output gains alongside burden or coercion
Customer opportunity	Traffic, cases, equipment uptime	Predetermined opportunity predicts response
Assignment/reallocation	Task and roster histories	Different work allocation after the offer

These are candidate predictions, not identified mediators. Cross-shop transfers or spillovers can contaminate a simple control group.

Team-bonus anchor: Friebel et al. (2017). Separate mechanism variation is stronger than a positive shop-level effect alone.

Gifts can change extra work differently from productivity

- **Setting:** DellaVigna–List–Malmendier–Rao field experiments.
- **Variation:** private pay incentives, employer returns, and unexpected gifts.
- **Outcomes:** productivity and extra work, measured separately.
- **Limitation:** generosity is not the same treatment as a known marginal reward; different margins need not share a response.

Timing distinguishes the mechanism

An unexpected payment after an earlier decision can change reciprocity without having changed the incentive anticipated for that decision.

DellaVigna et al. (2022). A reciprocal response need not require a repeated, self-enforcing relationship.

Choosing commitment is different from being offered the option

- **Setting:** Kaur–Kremer–Mullainathan, data-entry workers.
- **Variation:** experimental commitment opportunities and payday variation; workers also make voluntary contract choices.
- **Outcomes:** contract demand, output, and work timing.
- **Limitation:** take-up is selected. Use the actual experimental comparison rather than a chooser/nonchooser coefficient.

Interpretation

A contract dominated at fixed output need not be utility-dominated if it changes future behavior. Payday patterns also raise liquidity and timing explanations.

Kaur, Kremer, and Mullainathan (2015). The 2022 erratum corrects an anecdotal quotation, not empirical estimates; that anecdote is omitted here.

Reciprocity, self-commitment, and enforcement have different tests

Mechanism	What motivates the action?	What to distinguish empirically
Reciprocity	Response to generosity or treatment	Surprise versus anticipated pay; own versus employer return
Self-commitment	Value of restricting one's future choices	Randomly offered option versus chosen restriction
Relational enforcement	Future surplus sustains a promise	Announced amount versus credible fulfillment and continuation

Record what the worker knew at each decision. An option that helps voluntary choosers does not establish the value of imposing it on everyone.

DellaVigna et al. (2022); Kaur et al. (2015); Levin (2003); Brown–Falk–Fehr (2004).

Subjective rewards need both clarity and credibility

- Some valuable actions—judgment, help, learning—are difficult to verify for an external enforcer.
- **Clarity:** the parties understand what counts as fulfilling the promise.
- **Credibility:** the party owing a payment has an incentive to honor it.
- Better formal measures can change subjective incentives and fallback options; formal and informal contracts can be substitutes or complements.

Data implication

Store the promise, evidence available to the evaluator, discretion, appeals, and payment history. A subjective-award column alone cannot identify either problem.

Baker–Gibbons–Murphy (1994); Levin (2003); Gibbons–Henderson (2012).

A relational payment promise faces an enforcement constraint

$$B \leq \frac{d}{1-d} \Delta \Pi, \quad d = \delta s < 1, \quad d \geq \frac{B}{B + \Delta \Pi}.$$

- At the payment node, reneging saves the employer $B > 0$ now.
- $\Delta \Pi > 0$: stationary per-period profit from cooperation above the punishment outcome.
- δ : time discount factor; s : assumed exogenous continuation probability; d : effective continuation factor.
- The displayed future value assumes the specified punishment and stationary surplus. Endogenous separation needs a richer model.

Original teaching calculation motivated by Levin (2003). This is an employer-side necessary payment condition, not a full relational-contract equilibrium.

A bonus of three needs an effective continuation factor of .75

$$B = 3, \quad \Delta\Pi = 1, \quad d_{\min} = \frac{3}{3 + 1} = 0.75.$$

Effective continuation	Future surplus	Employer payment condition
$d = 0.80$	$0.8/(1 - 0.8) = 4$	Holds
$d = 0.60$	$0.6/(1 - 0.6) = 1.5$	Fails

- Worker participation, effort incentives, off-path behavior, and credible punishment remain to be checked.
- Long tenure and high effort can also reflect matches, learning, or selection.

Hypothetical employer-side calculation. The numbers do not estimate trust, patience, or a workplace's enforceability.

Brown–Falk–Fehr changes the enforcement environment

- **Setting:** a laboratory market with buyers/employers and sellers/workers.
- **Variation:** enforcement environments under controlled market rules.
- **Outcomes:** market interactions, effort, and the relationships that emerge.
- **Limitation:** this is laboratory evidence, not a firm field RCT or a field effect of tenure.
- Repeated cooperation can involve several motives. The toy payment condition does not uniquely explain every action in the experiment.

Brown, Falk, and Fehr (2004), required reading. Compare rules across environments before interpreting endogenous long relationships.

A credibility design keeps the announced reward separate

- ① Hold nominal terms fixed and vary a credible guarantee or adjudication mechanism where feasible.
- ② Measure beliefs before work and fulfillment after it.
- ③ Follow independent output, payment disputes, and the relevant outside options.
- ④ Separate fulfillment beliefs from competing channels such as liquidity relief or perceived fairness.

Manager-transition application

A new award approver may also change coaching, tasks, or customers. A new-manager indicator needs an assignment argument; Week 5 develops it.

Proposed design motivated by relational-contract theory. A demand shock that changes both reneging and output does not isolate credibility.

Signing bonuses and monitoring change different contract margins

- **Setting:** Cai–Luo–Wang, new hires at a Chinese automobile manufacturer.
- **Variation:** experimental signing-bonus and monitoring interventions.
- **Outcomes:** hours, manager-evaluated performance, and quits.
- **Limitation:** a signing bonus changes entry/vesting value, not a piece-rate slope. A manager rating is not direct latent effort.
- Compare the two interventions using separate work, evaluation, and retention outcomes.

Cai, Luo, and Wang (2025), *Money or Monitoring*, NBER working paper. The source summary does not license additional numerical or protocol claims.

An online cross-country experiment does not randomize culture

- **Setting:** Davies–Fafchamps, employment-framed online experiments across participating samples.
- **Variation:** randomized feasible contract menus; employers choose offers from those menus.
- **Outcomes:** effort choices in the experimental environment.
- **Limitation:** nationality is not randomly assigned, and platform samples need not represent national populations.
- A transport claim needs a mechanism and information about the people, tasks, stakes, and institutions being compared.

Davies and Fafchamps (2025), *Games and Economic Behavior*. Menu assignment and national representativeness are separate questions.

Ownership-change papers study different populations and outcomes

	Cai–Prat–Yu	Herkenhoff et al.
Setting/shock	Mergers; employee reviews	US private-equity buyouts; linked workers
Outcomes	Satisfaction and text about noncontractible benefits	Worker outcomes compared with model predictions
Interpretation	Authors emphasize patterns consistent with implicit-promise breaches	Authors emphasize patterns consistent with reallocation
Limitation	Review selection, exits, disruption, correlated changes	Different events and outcome domain; not a universal verdict on ownership

Cai, Prat, and Yu (2026) and Herkenhoff et al. (2025), NBER working papers. These studies are not direct refutations of one another; full reorganization analysis belongs in Week 9.

A contract dictionary needs versions, opportunities, and calendars

Object	Required fields	Critical check
Rule	Rates, thresholds, caps, eligibility, version	Available before the work decision
Opportunity	Tasks, traffic, uptime, assigned cases	Predetermined versus realized success
Production	Quantity, hours, returns, quality	Comparable windows and definitions
Payment	Work period, earned amount, paid date	Replay rule; retain discrepancy reasons
Peers	Team/contest roster and transfers	Group relevant at decision time
Welfare	Risk, burden, liquidity, ability to decline	Independent collection and exit coverage

The chapter's five maps provide longer paper, data, contract, methods, and reading handouts. Preserve raw and amended schedules rather than overwriting them.

Methods Box: the comparison must match the changed term

Target / anchor	Data and variation	Assumption and limit
Within-worker pay response / Shearer	Worker–task panel, assigned pay and order	Covered work conditions; anticipation/carryover
Recruitment versus response / Leaver	Market and school assignments, rosters	Separate units and target populations
Team-offer ITT / Friebe	Shop offers, outcomes, and peer links	Assignment and spillover environment
Timing / Larkin	Full schedule, deals, prices, resets	Chosen thresholds do not create RD
Credibility / Brown et al.	Enforcement rules, promises, fulfillment	Lab mechanism does not identify field tenure effect

Start with assignment or institutional variation. Worker fixed effects cannot by themselves repair endogenous reform timing or composition.

A repository listing and a runnable replication are different

Resource	Useful route	Current boundary
Friebel archive	Team-incentive reproduction	Listing documented; original files not executed here
Leaver archive	Recruitment/post-entry design	Inspect actual inputs, rules, and dependencies
DellaVigna archive	Productivity versus extra work	Keep tasks and experimental arms distinct
IAB Linked Personnel Panel	Employer–employee practices	Research access and Campus File are different products
This week's lab	Contract replay and diagnostics	Entirely synthetic records and analytical models

See the chapter's resource ledger and lab source notes. An original-data claim requires inspected permitted inputs, a specified target, and a completed run.

Selection, spillovers, and many outcomes need explicit decisions

- Preserve baseline workers, entrants, exits, and reasons for missing outcomes.
- Lee-style bounds need relevant assignment and monotone selection; equal retention rates do not establish that assumption.
- For team incentives, within-team interactions are part of the policy. State whether controls are exposed through cross-team contact.
- Name a primary endpoint, secondary families, aggregation weights, horizons, and a multiplicity strategy.
- A nonsignificant effect does not establish equivalence; a difference in significance is not a test of the difference between effects.

Lee (2009); Cameron–Miller (2015). Pay, sales, accounting contribution, full profit, and worker welfare remain distinct targets.

The synthetic paired estimator uses twelve independent contrasts

$$\Delta Y_{pj} = \bar{Y}_{pj,\text{post}} - \bar{Y}_{pj,\text{pre}}, \quad \hat{\tau} = \frac{1}{P} \sum_{p=1}^P (\Delta Y_{p,T} - \Delta Y_{p,C}), \quad P = 12.$$

- p : pair; j : shop; T, C : assigned treated and control shops within that pair.
- Each shop has six pre and six post weeks; each pair contributes equally.
- Exactly one shop per pair receives the offer. Assume no cross-shop interference for this teaching comparison.
- The standard deviation of pair contrasts divided by $\sqrt{12}$ is a pair-level SE summary, not a claim of 288 independent assignments.

Synthetic 24-shop design motivated by Friebe et al.; the original study's allocation is not replaced by this teaching scheme.

The exact sharp-null test respects the paired assignment

$$\#\{\text{allowed assignments}\} = 2^{12} = 4096.$$

- 1 State the sharp null: the offer has no effect on any shop.
- 2 Hold observed outcomes fixed under that null and swap treatment labels within pairs.
- 3 Compute the absolute mean pair contrast for each of the 4096 assignments.
- 4 Compare with the observed absolute statistic using the prespecified two-sided rule.

Boundary

This is not a generic test of a heterogeneous zero-average-effect null. Permuting shop-week rows would violate the randomized design.

All 4096 assignments belong to the stated synthetic pair design. In an empirical replication, replay the actual permitted assignment support.

Research Lab: replay the rule before estimating the offer effect

- **Mode:** guaranteed offline synthetic design reconstruction plus analytical teaching calculations.
- Twenty-four shops, twelve pairs, twelve weeks: 288 records; every unit, schedule, and outcome is invented.
- Frozen targets; one offered shop per pair; an eligible shop receives 120 currency units when its target is reached.
- Primary endpoint: gross sales. Secondary endpoints: paid hours, return costs, payroll, and accounting contribution.

$$\text{Contribution} = 0.45 \text{ gross sales} - \text{return costs} - \text{payroll}.$$

Contribution is not full profit or worker welfare. Secondary exact p-values are unadjusted and exploratory. No original microdata were downloaded or executed for this lab.

Diagnose four mistakes using known synthetic mechanisms

Diagnostic	What the lab knows	What the result cannot establish
Receipt selection	Zero offer effect for every unit; positive receipt association	A causal effect of actually being paid
Two tasks	Quantity can rise while gross value falls	Net profit or welfare ranking
Two types	$2.8 = 1.3 + 1.5$ under specified weights	Identified real-world effort/sorting effects
Relational grid	Employer payment condition holds or fails	Worker IC, trust, or full equilibrium

The separate receipt-null example has 160 units in 80 matched pairs. Instructor potential outcomes are not learner predictors.

Lab checks contract replay, accounting, model feasibility, pair assignment, exact enumeration, and deterministic reruns.

Research questions should predict a result that would disagree

Proposed intervention	Preferred mechanism	Counterprediction / independent test
Quantity-only versus balanced rewards	Task reallocation	Stable quality despite shifted incentives
Guarantee with nominal terms fixed	Promise credibility	Beliefs unchanged; liquidity explains response
Same offer, different prior opportunity	Discretion over outcomes	Traffic alone explains the gain
Unexpected target-update rule	Anticipated quota ratchet	No response across reset cycles
Pay reform with baseline follow-up	Improved worker welfare	Higher pay but greater risk or burden

Proposed directions, not completed findings. Use predetermined opportunities, stable audits, and follow-up long enough to observe delayed costs.

Three required readings prepare three different design skills

Required reading	Preparation
Leaver et al. (2021)	Draw recruitment-market and school-level assignments; name both target populations
Friebel et al. (2017)	Reconstruct offered terms, assignment, receipt, shop outcomes, and unresolved mechanisms
Brown–Falk–Fehr (2004)	Compare enforcement rules and distinguish laboratory findings from model interpretation

Use Gibbons/Prendergast and selected contract theory as foundations. Rotate presentations on timing, team rewards, gifts, commitment, or current working papers.

The broader reference list is a project resource, not 26 compulsory readings. The chapter and maps contain the full reading ladder and source links.

Transfer: write an incentive-reform proposal with two mechanisms

Two-page memo plus contract dictionary

State the term changed, information available before action, eligible population, assignment/comparison unit, timeline, and primary outcome.

- Give two competing mechanisms, a prediction for each, and a result that would reject your preferred explanation.
- Include independent quality, participation/exit, and a worker-welfare measure.
- Address delayed outcomes, selection, spillovers, and inference.
- State what the design can identify about behavior or composition and what remains unknown about optimality or welfare.

Reproduce → Diagnose → Transfer. Leaver supplies the selection/incentive design comparison; Friebe supplies the offered-contract anchor.

Week 5 asks how managers implement and modify the contract

- Pay schedules direct choices, while managers still assign tasks, set targets, coach, delegate, and grant exceptions.
- A changed outcome can reflect a changed formal rate, a credible promise, different opportunities, or different people.
- Carry the contract ledger into the manager panel: decisions, information, authority, implementation, and outcomes.

Bridge forward

Managers, hierarchies, authority, and delegation: distinguish managerial contributions from the workers and tasks assigned to them.

Keep full manager assignment for Week 5, team formation for Week 7, incidence for Week 8, and organizational change for Week 9.