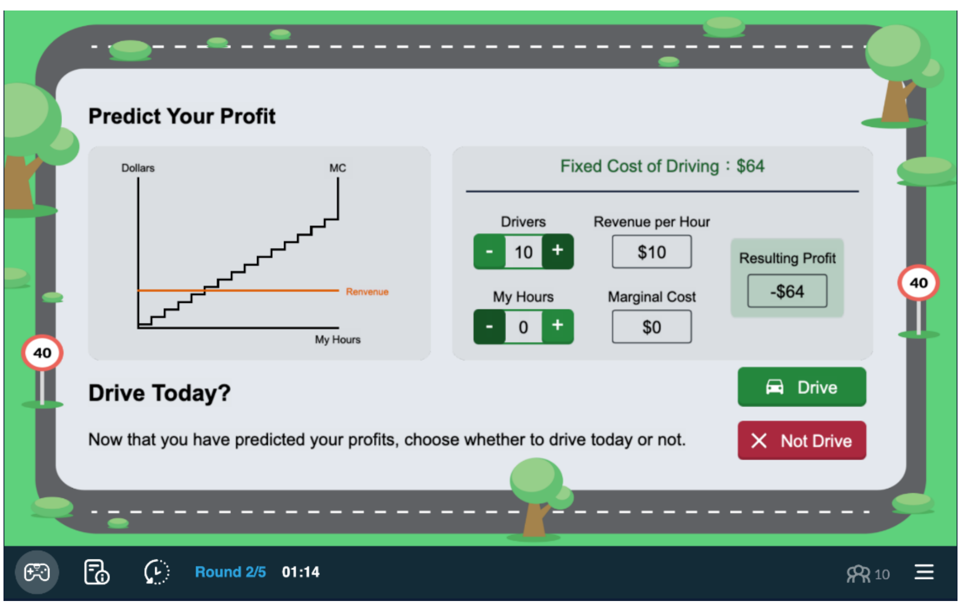
Production with Entry and Exit (Rideshare)

Teaching Note | MobLab x Harvard Business Impact

Primary Topic:	Microeconomics, Industrial Organization, Competitive Markets
Typical Duration:	Set-up: 5 min | Game play: 10 min | Debrief: 10-15 min
Group Size:	10 players per market (default); up to 20 per market for larger classes
Difficulty Level:	Introductory / Intermediate
Prerequisites:	Basic understanding of marginal cost, fixed vs. variable costs, and profit maximization. Works best after covering the firm's short-run decision and before or alongside long-run competitive equilibrium.

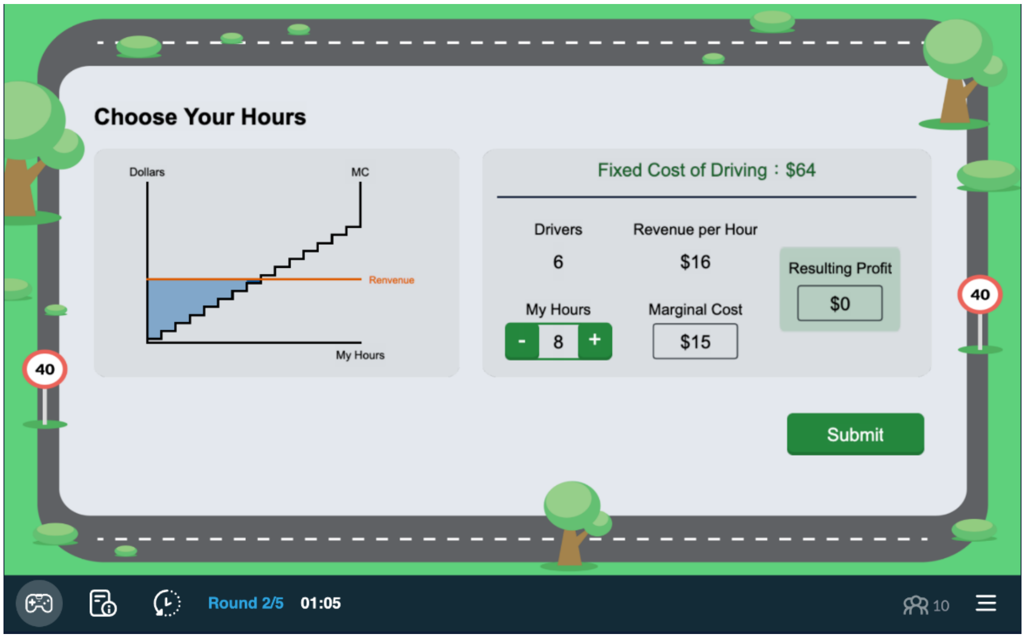
1. Simulation Overview

Inspired by Cheung (2005), this simulation places each student in the role of a potential rideshare driver in a ten-person market. Each round (representing one day) unfolds in two sequential stages. First, every driver simultaneously decides whether to drive or stay home. Then, revenue per hour (determined by how many drivers entered) is announced to everyone. Drivers who enter then choose how many hours to drive using an on-screen profit calculator; non-entrants can use the same calculator to explore what their profit would have been had they entered.



The market price each day is a function of the number of entrants N: $P(N) = 2(8N^* + 16) / (2 + N)$, where N^* is the equilibrium number of entrants. With default parameters ($N^* = 6$), the market price is \$16 when exactly 6 drivers enter, and each entrant earns a producer surplus of exactly

$64 — which equals the fixed cost of driving. As a result, the long-run equilibrium profit is zero: drivers earn just enough to cover their costs. If fewer than 6 enter, incumbents earn positive profits and attract additional entry; if more than 6 enter, incumbents earn losses and some exit next round.



Across five rounds, students typically converge toward the equilibrium entry level. The experiment makes two classic microeconomic ideas tangible: the marginal output decision in the short run (how many hours to drive, given the market price), and the entry/exit dynamic in the long run (whether to drive at all, given expected profits).

Citation: This game is inspired by: Cheung, Steven L. (2005). 'A Classroom Entry and Exit Game of Supply with Price-Taking Firms.' Journal of Economic Education, 36(4): 358-368.

Learning Objectives

By the end of this simulation, students will be able to:

- Long-Run vs. Short-Run: Explain the distinction between fixed and variable costs in the short run and the long run — specifically, that fixed costs are only fixed in the short run. In the long run, a firm's decision to enter or exit is effectively a choice over its fixed costs.
- Short-Run Profit Maximization: Apply the marginal cost rule to choose the profit-maximizing output level: drive all hours where revenue per hour exceeds (or equals) the marginal cost of that hour, and stop when marginal cost exceeds revenue.
- Long-Run Competitive Equilibrium: Identify the long-run equilibrium as the number of entrants at which every firm in the market earns zero profit and no outside firm could profitably enter. Explain the entry and exit dynamics that drive markets toward this equilibrium.

- Market Correction Dynamics: Describe how profit signals guide entry and exit decisions across rounds — positive profits attract entry, negative profits drive exit — and connect this mechanism to the invisible hand of competitive markets.

2. Key Mechanics

The Payoff Structure

Each round, a student's payoff depends on their entry decision:

- No Drive: Payoff = $0 for the round. No costs, no revenue.
- Drive: Payoff = Revenue minus Fixed Cost minus Variable Costs.

Where:

- Revenue = Revenue per hour x hours driven
- Fixed Cost = Paid only if the student chooses to drive (default: $64)
- Variable Cost = Sum of marginal costs for each hour driven. Each additional hour costs more than the last (increasing marginal cost): C(q) = q squared, so the marginal cost of the q-th hour is 2q - 1.

Worked Example

The following example uses simplified parameter values to illustrate the payoff calculation:

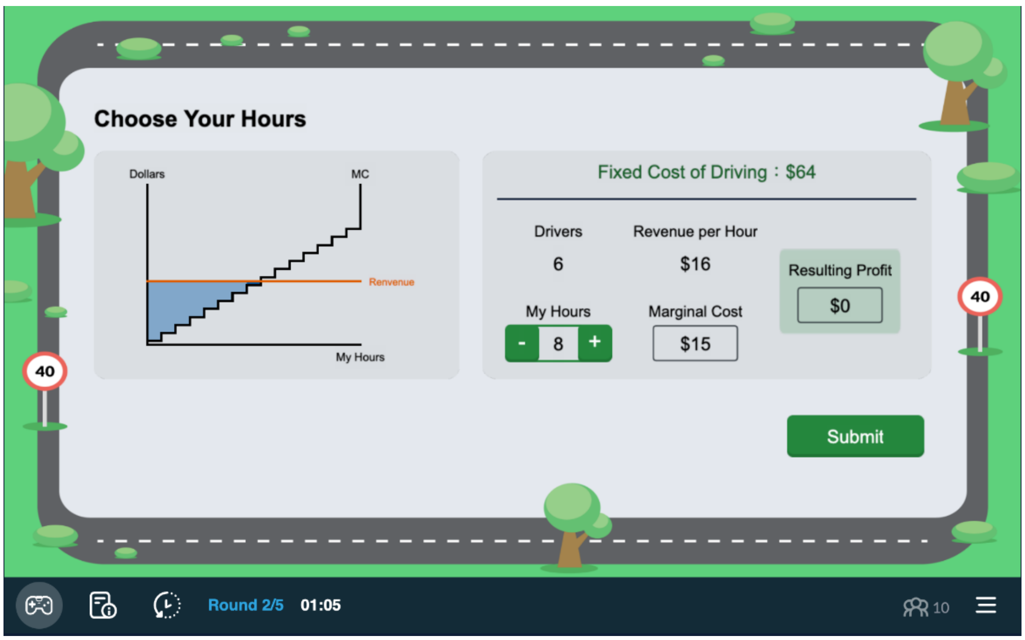
Item	Value
Fixed Cost	$20
Marginal Cost: Hour 1	$1
Marginal Cost: Hour 2	$3
Marginal Cost: Hour 3	$5
Marginal Cost: Hour 4	$7
Hours driven (chosen)	3
Revenue per hour	$9
Revenue (3 x $9)	$27
Variable Cost ($1 + $3 + $5)	$9
Profit ($27 - $20 - $9)	-$2

Instructor Note: In the default game, fixed costs are $64 and the per-period cost function is C(qi) = Fi + qi squared. The marginal cost of the q-th hour is 2q - 1 (i.e., $1 for hour 1, $3 for hour 2, $5 for hour 3, and so on). Students use the on-screen profit calculator to find their profit-maximizing hours — but it is worth walking through the logic once before play so students understand that they are applying the MC = MR rule.

The Profit Calculator

Before committing to a decision, every student can use the profit calculator to explore different scenarios:

- Pre-entry: Students can vary the number of predicted drivers and see how that changes the market price, then adjust their hours to see how profit changes. This is an explicit application of best-response reasoning — choosing optimally given a belief about what others will do.
- Post-entry (after all have decided): The calculator is locked to the actual number of entrants and the actual market price. Entrants use it to choose how many hours to drive. Non-entrants use it to calculate what their profit would have been had they entered.



3. Classroom Setup

Configuration	Recommended Setting
Group Size	Default: 10 players per market. For classes larger than 100 students, increase to 20 players per market and set Equilibrium Entrants to 12.
Equilibrium Entrants (N*)	Default: 6. This is the number of drivers at which market price equals the long-run zero-profit level. Entry will typically converge to this number by round 5.
Number of Rounds	Default: 5 rounds. Sufficient to observe the full entry-exit dynamic and convergence. More rounds are possible but add little new learning after convergence.
Fixed Costs	Homogeneous (default): all drivers pay $64. Convergence to equilibrium is slower as any player can be a marginal entrant.

Configuration	Recommended Setting
	Heterogeneous: N* players draw fixed costs between \$54-\$64 (low-cost), remainder draw \$65-\$74 (high-cost). Only low-cost drivers should enter in equilibrium — produces faster and cleaner convergence.
Robot Players	Robots enter randomly (50%) in round 1, then adjust based on realized profit: they enter if profitable, exit if not, with some random noise. Useful for filling thin markets.
Technology Required	Laptop or tablet with an up-to-date web browser. Direct students to video instructions before class.

4. Pedagogical Instructions

Pre-Game Briefing

The profit calculator is central to the game — spend 5 minutes walking through it before play:

- Explain the two-stage decision: first decide whether to drive (entry decision), then decide how many hours to drive (output decision). These correspond to the long-run and short-run decisions in the textbook model.
- Show students the increasing marginal cost schedule. Ask: if revenue per hour is \$9, how many hours should you drive? Work through the answer: drive until marginal cost exceeds revenue per hour. With MC schedule \$1, \$3, \$5, \$7... and price \$9, drive 4 hours (MC of 4th hour = \$7 < \$9; MC of 5th hour = \$9 = revenue, so stop at 4).
- Point out that the entry decision is forward-looking: before the round, students must predict how many others will drive and whether that market price will be high enough to cover their fixed cost. The profit calculator lets them do this explicitly.
- Announce that the equilibrium number of entrants is 6 (with default settings). Tell students the equilibrium, but let them discover for themselves whether they can coordinate on it.

> **Instructor Tip:** Ask students to take 60 seconds before round 1 to use the profit calculator and predict: if 6 people drive, is it profitable to drive? If 7 people drive? This primes them to engage with the entry decision analytically rather than intuitively, and makes the debrief discussion of convergence much richer.

The Gameplay Experience

Across five rounds, watch for the following dynamics:

- Round 1 — Dispersed Entry: With no prior information, entry is heterogeneous. Some students enter, some stay home. Market price is determined by actual entry, which may be above or below N*. Profits vary widely across students.
- Rounds 2-3 — Profit-Driven Adjustment: Students who made positive profits are likely to re-enter; those who made losses may exit. This is the entry-exit mechanism in action. If many entered in round 1 and all made losses, expect a wave of exits in round 2 — and

watch for over-correction (too few enter, prices spike, profits are high, then too many re-enter).

- Rounds 4-5 — Convergence: Most groups converge toward the equilibrium entry number by round 4 or 5, though rarely exactly at N* in every round. Profits approach zero. Use the Aggregate Outcomes graph to show the path of convergence across all groups — some will converge cleanly, others will oscillate.

> **Instructor Tip:** If using Heterogeneous fixed costs, convergence is typically faster and cleaner because the entry decision has a natural selection mechanism built in — low-cost drivers always want to enter, high-cost drivers always want to stay out at equilibrium. This is a useful treatment comparison for illustrating how market structure affects speed of adjustment.

Facilitator Checklist

1. Configure Group Size, Equilibrium Entrants, and Fixed Costs (Homogeneous or Heterogeneous) before class.
2. Direct students to watch the video instructions before class via the Instructions link in the game interface.
3. Open the activity and wait for all students to join before clicking Begin.
4. Monitor the Monitor tab during play to track which round each group is on and to add robot players if needed.
5. Before the debrief, navigate to Results and prepare both the Aggregate Outcomes view and the Individual Markets view.

5. Debriefing & Discussion

Plan for 10-15 minutes. Open with the results graphs and ask students to describe what they see before introducing theory. Prompt written reflection first — it dramatically improves discussion quality.

Suggested Reflection Questions (before viewing results)

6. What was your Round 1 decision — drive or stay home? What factors did you consider?
7. If you chose to drive, how did you decide on how many hours to drive? Did you use the profit calculator, or did you use a rule of thumb?
8. Did you notice a pattern in how many students chose to drive across rounds? What would you have expected?

Discussion Questions (after viewing results)

- Look at the aggregate results. How many rounds did it take for most groups to converge to the equilibrium number of entrants? What drove that convergence?
- In round 1, some groups had too many entrants and some had too few. What happened to profits in each case, and how did that affect entry decisions in round 2?
- By the final round, most drivers earned close to zero profit. In what sense is this a good outcome for the market as a whole — and in what sense is it frustrating for individual drivers?

- The fixed cost is only paid if you drive. In the short run, once you have decided to drive and paid the fixed cost, how should you decide how many hours to drive? What cost is relevant for that decision?
- How does this game connect to real rideshare markets like Uber and Lyft? What features of the real market does the game capture, and what important features does it leave out?

Theoretical Connections

- Fixed vs. Variable Costs: The entry decision is a long-run choice — students decide whether to incur the fixed cost of driving. Once that decision is made, the output decision (hours driven) is a short-run choice using only variable cost information. This two-stage structure cleanly embodies the textbook distinction between the long-run and short-run firm decision.
- Marginal Cost Pricing: The profit-maximizing output rule — drive until marginal cost equals price — is directly implemented in the profit calculator. Students experience this rule as a concrete decision rather than an abstract condition. The calculator's visual display of the MC schedule makes the step-by-step logic visible.
- Long-Run Zero-Profit Condition: In a perfectly competitive market, the long-run equilibrium requires that every active firm earns zero economic profit. The game reaches this condition when exactly N* firms enter — enough to drive the market price down to the level at which revenue just covers total cost (fixed plus variable). Students see this as the endpoint of a dynamic process, not just a static condition.
- Entry and Exit Dynamics: The feedback mechanism — positive profits attract entry, negative profits induce exit — is the invisible hand of competitive markets operating in real time. By round 5, most markets have self-organized to the equilibrium without any central coordinator, demonstrating Hayek's price mechanism in a simplified but vivid form.
- Heterogeneous Costs and Efficient Selection: With heterogeneous fixed costs, the equilibrium requires that low-cost drivers enter and high-cost drivers stay out. This is the market's efficiency property — resources flow to their most productive uses. Students with high fixed costs who enter in early rounds typically make losses and exit, illustrating competitive selection.

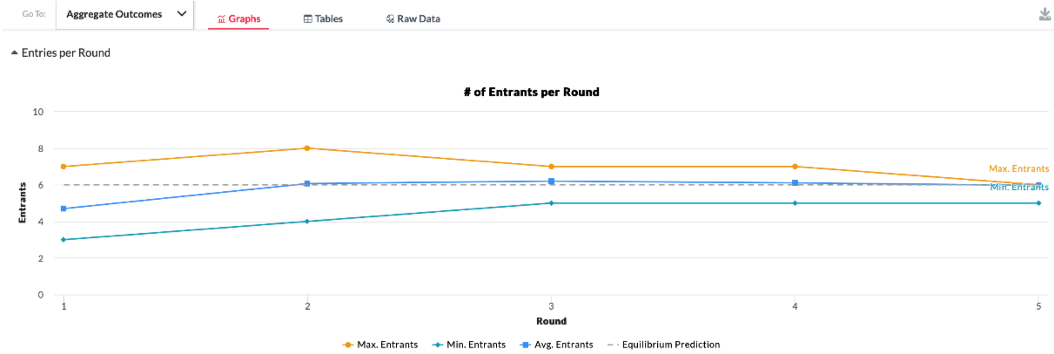
6. Results & Data Interpretation

Reading the Results Dashboard

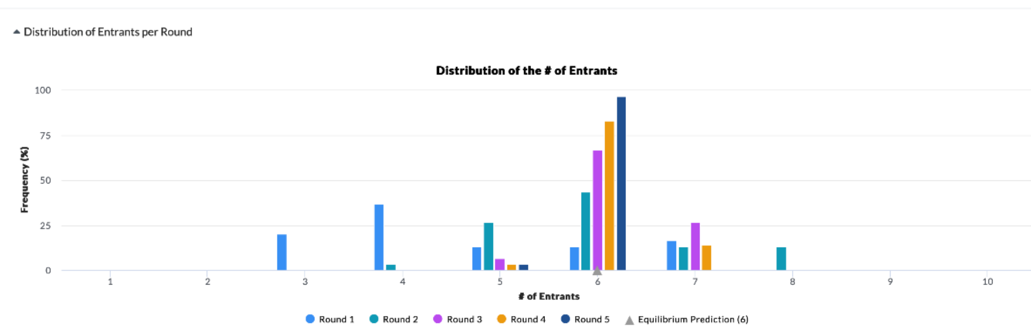
Select from the dropdown at the top to switch between Aggregate Outcomes and Individual Markets views:

Aggregate Outcomes

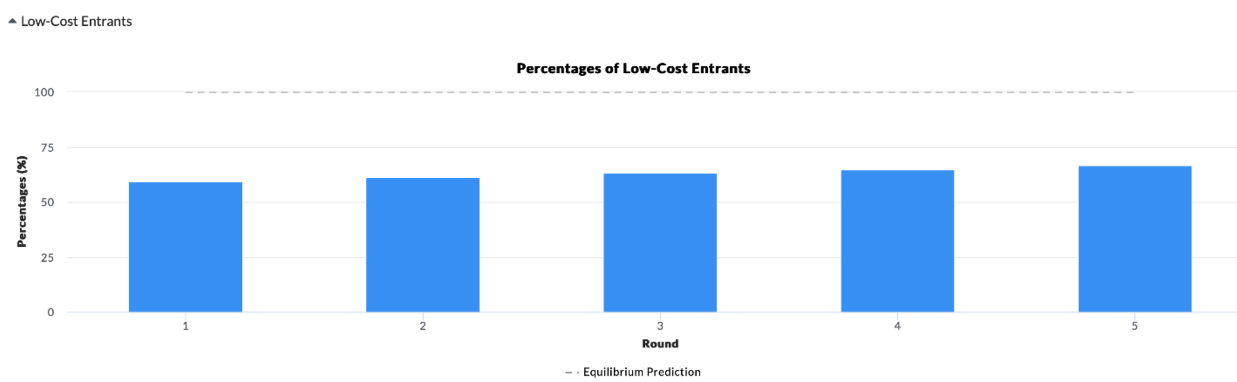
- Figure 1 — Aggregate Number of Entrants per Round: Shows the minimum, average, and maximum number of entrants per group in each round. A clean convergence pattern shows the average narrowing toward N* across rounds, with the min and max also tightening. Use this to discuss speed of convergence and market coordination.



- Figure 2 — Distribution of Entrants Across All Markets: A histogram of entry counts by round. In early rounds, entry is dispersed across many possible values. By later rounds, the distribution should cluster sharply around N*. Selecting specific rounds from the legend allows direct round-by-round comparison.



- Figure 3 — Percentage of Low-Cost Entrants (Heterogeneous only): Shows what fraction of entrants in each round had low fixed costs. In equilibrium, all entrants should be low-cost. This graph tracks how quickly the market selects for the most efficient producers.



- Figure 4 — Summary Table: Shows, per round, the fraction of entrants making the profit-maximizing output choice (Correct Quant. Choice), average number of entrants, and average profits. The Correct Quant. Choice column is useful for connecting the short-run output decision to the MC = P rule — watch whether students improve in their output choices across rounds.

Go To: Aggregate Outcomes | Graphs | Tables | Raw Data

Game Configuration

# of Rounds	Total # of Markets	Group Size	Equilibrium Entrants	Fixed Cost
5	30	10	6	Homogeneous

Action Frequencies

Round	Total # of Markets	Mean Market Entrants	Mean Market Profits	# of Markets Reaching Equilibrium	% of Entrants	% of Entrants Choosing Optimal Hours
1	30	4.7	116.2	9	47%	99.29%
2	30	6.07	-15.1	21	60.67%	99.45%
3	30	6.2	-22.37	28	62%	99.46%
4	29	6.1	-11.55	28	61.03%	100%
5	29	5.97	2.93	28	59.66%	100%

Individual Markets

- Figure 5: Plots per-round entry for each individual market, with lines for actual entry and the equilibrium prediction. This is the most powerful single visual for the debrief: a market that starts far from equilibrium and converges by round 4 or 5 illustrates the dynamic adjustment process far more concretely than the aggregate. Use the checkbox to toggle the equilibrium prediction line on and off.

Common Outcome Patterns

- Convergence by Round 4-5 (expected): Most markets reach or hover around N* by the final rounds, with average profits near zero. The path there often involves overshoot and correction, this oscillation around the equilibrium is itself a teaching point about market dynamics.
- Over-Entry in Round 1 (common): With no prior information, students tend to over-enter. Market price falls below the zero-profit level, most drivers make losses, and a wave of exits occurs in round 2. This produces the sharpest and most dramatic convergence pattern.
- Under-Entry in Round 1 (less common): Sometimes students are too cautious, and too few enter. Prices are high, entrants earn large profits, and entry surges in round 2, overshooting in the other direction. This is equally useful for discussion.
- Heterogeneous Costs — Clean Selection: With heterogeneous fixed costs, the equilibrium is unique: exactly the low-cost players should enter. By round 3-4, Figure 3 typically shows near-100% low-cost entrants, with high-cost players having been selected out by losses.

7. Extensions & Variations

Homogeneous vs. Heterogeneous Fixed Costs

Running both treatments in sequence — or comparing results across sections — cleanly demonstrates the role of cost heterogeneity in market efficiency. Under homogeneous costs, any player could be a marginal entrant, so the equilibrium does not specify who enters. Under heterogeneous costs, the equilibrium selects the low-cost producers and excludes the high-cost ones, connecting the simulation to the textbook proposition that competitive markets achieve efficient allocation.

Larger Class Sizes

For classes of more than 100 students, increase Group Size to 20 and set Equilibrium Entrants to 12. The market dynamics are identical; only the scale changes. This is also a useful treatment for exploring whether larger markets converge faster (more information, more participants to coordinate) or slower (more noise).

Cross-Disciplinary Connections

- Real Rideshare Markets (Uber, Lyft): The game's entry-exit dynamic mirrors the surge pricing mechanism in real rideshare markets. When few drivers are active, prices rise (revenue per hour increases), attracting more drivers — exactly the convergence mechanism in the game. Ask students: what does the game get right about Uber/Lyft, and what important features (dynamic pricing, geographic dispersion, driver heterogeneity) does it abstract away?
- Labor Markets and Entry: The entry decision in this game is analogous to the decision to enter a labor market or profession. When wages (revenue per hour) are high relative to the cost of entry (fixed costs of training, certification), more workers enter and wages are bid down. The long-run zero-profit condition maps to the concept of compensating differentials.
- Entrepreneurship and New Markets: In new or growing markets, early entrants earn positive profits (like drivers in round 1 when few enter). This attracts additional entry, profits fall, and eventually the market reaches a competitive equilibrium. The simulation compresses this process into five rounds, making visible what normally takes years or decades.

8. References & Further Reading

The following resources pair well with this experiment:

- Cheung, Steven L. (2005). A Classroom Entry and Exit Game of Supply with Price-Taking Firms. Journal of Economic Education, 36(4): 358-368. The foundational classroom experiment on which MobLab's Rideshare game is directly based.
- Mankiw, N.G. (current edition). Principles of Economics. Cengage. Chapters on the Costs of Production, Firms in Competitive Markets, and Supply, Demand, and Government Policies map directly onto the game's three learning objectives.
- Varian, H.R. (current edition). Intermediate Microeconomics. Norton. Chapters on Profit Maximization and the Competitive Market provide the formal treatment of short-run and long-run equilibrium that underpins the game's structure.
- Pindyck, R.S. and Rubinfeld, D.L. (current edition). Microeconomics. Pearson. Chapter on Competitive Markets and the Long-Run Supply Curve connects the entry-exit dynamics to the broader concept of industry supply.