

Midterm Review: Sessions 1–8 Synthesis

Session 9 · Unit 2 · Preparation for the midterm exam

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Liquidity Illusion: The General Equilibrium Theory of Private Capital Valuation (Forthcoming, 2026)

Graduate Finance Course · Session 9 of 32 · Spring 2027

Today: integration and exam preparation

1

The conceptual arc

Diagnosis → measurement → requirements

2

Key equations review

DCF, LAV, Jensen, OU, LA-PME

3

Calibrated numbers

The 25 numbers you should know

4

Question type walkthroughs

Multiple-choice, problem, case

5

Formula sheet construction

How to organize your one-page reference

SAMIR ASAF

The conceptual arc of Unit 1 + Unit 2

S1-2	Why DCF fails	Three structural failures · scale of stakes
S3	Empirical evidence	Secondary market 2003-2024 · four regimes
S4	OU process	Mathematical model of L_t dynamics
S5	Term structure	Jensen bias $B(T) \approx A \cdot T$ · DLOM comparison
S6	IRR biases	Reinvestment · sign-pattern
S7	PME and LA-PME	Public benchmarking · liquidity adjustment
S8	Five requirements	DCF/DLOM/factors fail · only GE-LAV passes

The five equations to memorize

DCF	$V_0 = \sum_{t=1}^T \frac{CF_t}{(1+r)^t}$ <p>Constant discount rate, deterministic</p>
OU SDE for L_t	$dL_t = \kappa(\bar{L} - L_t) dt + \sigma dW_t$ <p>Stochastic mean-reverting process • $\kappa=0.45$, $\sigma=0.32$, $\bar{L}=1.0$</p>
Quadratic premium	$\pi(L) = 0.045 - 0.025L + 0.021L^2$ <p>Convex in L • always positive • matches secondary market</p>
LAV operator	$V^{LAV} = E \left[\sum_t CF_t \cdot e^{-\int_0^t r(L_s) ds} \right]$ <p>Expectation over OU path</p>
Jensen bias	$B(T) \approx A \cdot T, \quad A \approx 0.17\%/yr$ <p>Linear in horizon</p>

The 12 numbers you should know cold

\$13T

Private capital AUM (2025)

\$73M

Master anchor: DCF-GE-LAV gap on 20yr infra

0.45/yr

OU mean-reversion κ

0.32

OU volatility σ

0.337

Stationary std of L_t

3.5%

Industry-standard illiquidity premium (wrong)

1.6-4.5%

Jensen bias range 10-25yr horizons

4.31×

Crisis amplification (r_{GE}/r_{DCF} at GFC)

$L = -1.5$

GFC-depth L_t state

2.3%/yr

Welfare gap (Pigouvian externality)

7%

Pigouvian tax τ^* at GFC depth (vs 0% normal)

70.1%

Mark-down gap DCF→GE-LAV at GFC

Midterm question types (4 sections, 75 min)

Multiple choice

30 min • 10 questions

Concept recognition. Definitions, mechanism identification, what-if framing. Each correctly answers a learning objective.

→ 1.5 points each

Short answer

20 min • 4 questions

Brief explanations (3-5 sentences). 'Why is the Jensen bias linear in horizon?' Type questions.

→ 5 points each

Quant problem

15 min • 1 problem

Compute a specific GE-LAV quantity. E.g., compute LAV value given OU params and a cash flow stream.

→ 15 points

Plus integrative case (10 min, 1 short scenario) — 20 points. Total: 100 points.

How to build your formula sheet (8.5×11, handwritten, both sides)

Front: Equations

1. DCF formula
2. OU SDE + parameter values
3. Quadratic premium $\pi(L)$
4. LAV operator
5. Jensen bias $B(T) \approx A \cdot T$
6. LA-PME formula
7. Kaplan-Schoar PME

Front: Numbers

$\kappa=0.45/\text{yr} \cdot \sigma=0.32 \cdot \bar{L}=1.0$
 $\sigma_{L\infty} = 0.337$
 $A \approx 0.16-0.18\%/\text{yr}$
 Master anchor: \$103.6M / \$30.9M / \$73M
 GFC: $L = -1.5$
 Crisis amp: 4.31×

Back: Concepts

1. Three structural failures (named)
2. Five requirements scorecard
3. Four secondary market regimes
4. Level vs convexity illusion
5. IRR's two biases
6. Why all PME variants are constant-rate

Back: Examples

1. Stationary distribution: $N(\bar{L}, \sigma^2/2\kappa)$
2. Discrete OU recursion
3. Worked KS-PME calculation
4. Discount-to-NAV interpretation
5. The Vasicek connection

Tip: writing it forces memorization. Don't print and paste.

Review topic 1: Why DCF fails

Three failures established in Sessions 1-4.

Failure 1: Liquidity illusion

Treats π as constant · empirically varies

Failure 2: Constant discount rate

Ignores Jensen bias · convexity matters

Failure 3: Partial equilibrium

Ignores collective dynamics · MFG needed

Empirical anchor

Secondary market discount data (Lazard) · the smoking gun

Order of magnitude

DCF errors: 30% in stress, 5-10% normal

Testable

Each failure makes specific quantitative prediction

Session 9 wrap-up • midterm preparation

Key takeaways

- 1 The arc: diagnosis (S1-2) → evidence (S3) → math (S4-5) → measurement (S6-7) → requirements (S8).
- 2 Five equations to memorize: DCF, OU SDE, quadratic premium, LAV operator, Jensen bias.
- 3 Twelve numbers to know cold: κ , σ , \bar{L} , \$13T, \$73M anchor, $4.31\times$ amp factor, etc.
- 4 Practice writing the formula sheet by hand tonight.
- 5 Office hours tomorrow 4-6pm for last-minute questions.

NEXT: SESSION 10

Session 10: MIDTERM EXAM (75 min, in-class).

Arrive 10 min early.

Bring: pen, pencil, eraser, scientific calculator, handwritten formula sheet, photo ID.

Coverage: Sessions 1-8 entirely.

Format: 10 MC + 4 short answer + 1 quant + 1 case.

See midterm-blueprint.qmd on the site.

Review topic 2: the OU process

Stochastic model for L_t .

SDE

$$dL = \kappa(\bar{L} - L) \cdot dt + \sigma \cdot dW$$

Mean reversion rate

$\kappa = 0.45/\text{yr}$ (half-life 1.54 yrs)

Stationary distribution

Normal(\bar{L} , $\sigma^2/(2\kappa)$)

Stationary std

0.337 (for our calibration)

Empirical fit

RMSE 5% on Lazard data 1995-2024

Why OU and not others

Tractability + good empirical fit · simplicity wins

Review topic 3: term structure $\pi(L,T)$

How premium scales with horizon.

Quadratic form

$$\pi(L,T) = \alpha(T) + \beta(T) \cdot L + \gamma(T) \cdot L^2$$

Calibrated values (typical)

$$\alpha=0.045, \beta=-0.025, \gamma=0.021$$

At L=0

$\pi = 4.5\%$ baseline

At L=-1

$\pi \approx 9.1\%$ (1.5× stress amplification)

At L=-1.5

$\pi \approx 12.7\%$ (deeper stress)

T-scaling

Approximately \sqrt{T} for short to medium horizons

Review topic 4: performance metrics

IRR, PME, LA-IRR, LA-PME — when to use which.

IRR

Standard but biased · use as headline only

PME (Kaplan-Schoar)

Fixes timing bias · public-benchmark adjusted

LA-IRR (Asaf)

Fixes state bias · π -adjusted cash flows

LA-PME (Asaf)

Combines both fixes · most rigorous

Practical advice

Compute all four; report IRR + PME publicly, LA-PME for diagnostics

Common mistake

Using IRR for vintage comparison without timing adjustment

Review topic 5: the 8-element checklist

What a 'correct theory' delivers.

Elements 1-2

GE framework + McKean-Vlasov dynamics

Element 3

Reduces to DCF when π constant (backward compat)

Elements 4-6

Empirical fits: $\pi(L,T)$, Jensen bias, GFC amplification

Elements 7-8

Welfare gap + out-of-sample

GE-LAV status

Passes all 8 (verified through course)

Implication

GE-LAV is the unique framework on the market that passes

Practice problem walkthrough

Worked example combining multiple topics.

Setup

Fund A: vintage 2014, current Year 7, NAV \$100M

State

$L_t = -0.4$ (mild stress)

Compute $\pi(L, T=3)$

$$\alpha + \beta \cdot L + \gamma \cdot L^2 = 4.5\% - 2.5\%(-0.4) + 2.1\%(0.16) = 5.83\%$$

Adjusted MTM

$$\$100M \times (1 - 0.0583) = \$94.17M$$

Compare to NAV

\$100M reported; \$94.17M GE-LAV adjusted · 5.8% lower

Practical interpretation

Reported NAV likely overstated by ~\$6M

Final exam prep checklist

Where you should be before Session 10.

Concepts mastered

All 8 checklist elements memorized

Formulas memorized

OU SDE, $\pi(L,T)$, Jensen bias formula

Calibration

$\kappa=0.45$, $\sigma=0.32$, $\bar{L}=1.0 \cdot \pi_{\text{params}}$

Worked through

At least 2 sample problems of each type (A, B, C)

Reference sheet

Familiarize with what's on it (Session 10 slide)

Sleep

Get good rest before Session 10