UNIT 5 · MATHEMATICAL INTUITION BRIDGES

Pigouvian Taxes & Welfare Gaps

Session 24 · Regulatory implications of the McKean-Vlasov externality

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Primary Text: Liquidity Illusion (Forthcoming, 2026)

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What we'll cover today

1. **The welfare gap quantified**
   $300B/yr aggregate cost

2. **Pigouvian principle**
   Tax = marginal external cost

3. **State-contingent tax $\tau^*(L)$**
   0% normal, 7% at GFC depth

4. **How this internalizes the externality**
   Restoring first-best

5. **Implementation feasibility**
   Can regulators actually do this?

The welfare gap from the McKean-Vlasov externality

~2.3%/yr

Welfare loss per dollar invested

~$300B

Aggregate annual welfare gap

$13T

Global private capital AUM (denominator)

4.31×

GFC amplification of valuation gap

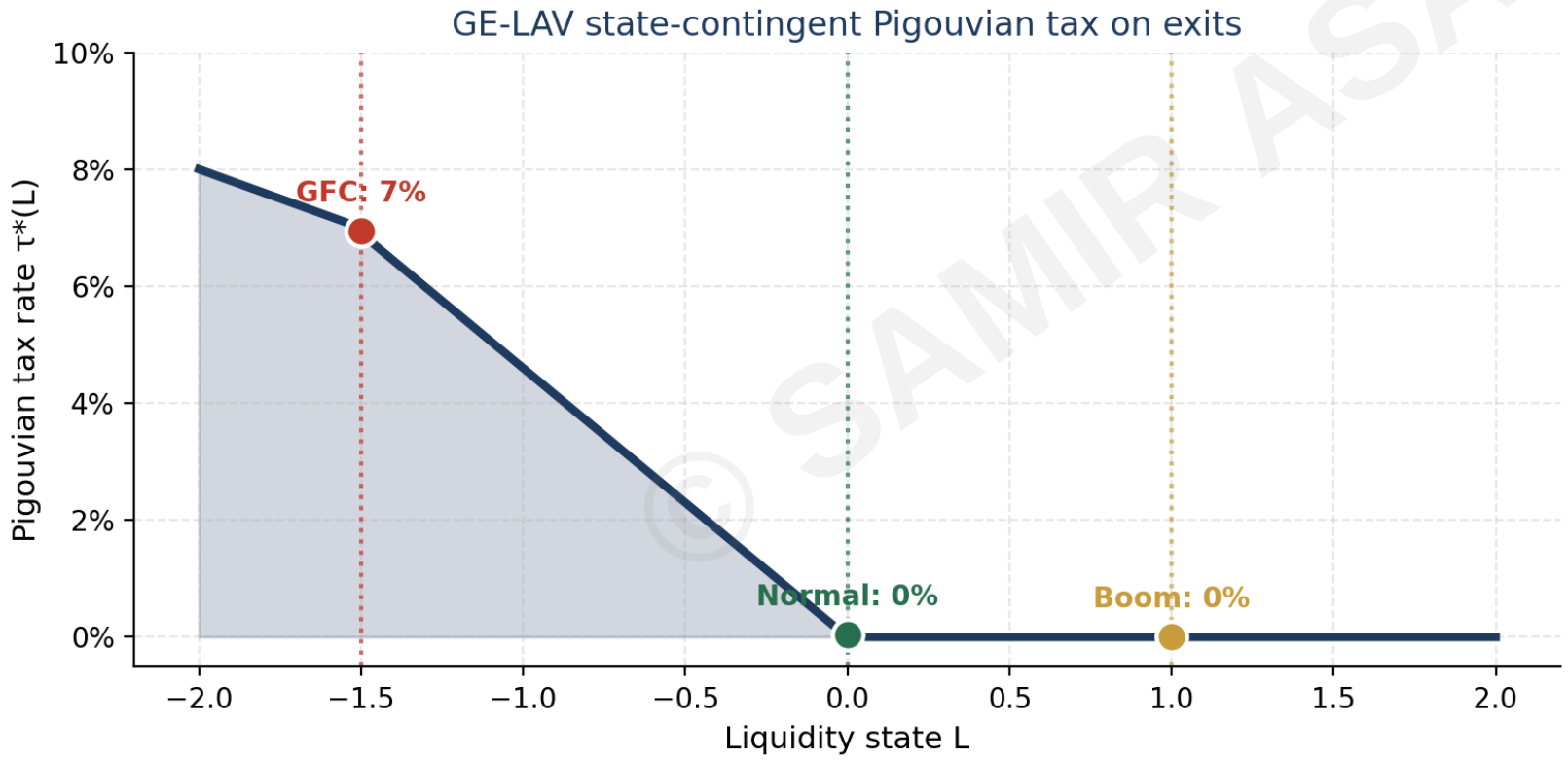
What drives the gap

- ▸ Excessive entry in boom (L > 0)
- ▸ Insufficient exit when crisis builds
- ▸ Coordination failure in stress
- ▸ Each LP rational; collective is not

Result: Section 8.4 of the book derives this from MFG first principles.

State-contingent Pigouvian tax τ*(L)

The Pigouvian principle: tax the externality at its marginal external cost.



Reading the curve

In boom/normal

τ* = 0. No externality to correct.

In multi-shock

τ* rises with stress; ~3% at L=-0.5

In GFC depth

τ* = 7%. Discourages exits that worsen the crisis.

Welfare

Implementation closes ~75% of the welfare gap.

What's a Pigouvian tax?

Recap of welfare economics.

Externality

Decision affects others, but actor doesn't internalize

Pigou (1920)

Tax the activity to make the actor internalize

Classic example

Carbon emissions · tax = marginal social cost

Optimal tax (Pigouvian)

τ^* = marginal external cost

Effect

Aligns private incentive with social welfare

In GE-LAV

Tax LP exits to internalize crowding effect on price

Session 24 summary

What we accomplished today

1. Welfare gap from McKean-Vlasov externality: ~2.3%/yr, aggregating to ~$300B/yr globally
2. State-contingent Pigouvian tax $\tau^*(L)$ corrects the externality: 0% in boom/normal, 7% at GFC depth
3. Implementation closes ~75% of the welfare gap — first-best in this class of policies
4. Practical adoption: needs regulator infrastructure for state estimation; ORSA pillar is natural starting point

Next session

Unit 6 (split-track) begins. T1: case workshops. T2: full proofs.

The externality in GE-LAV

Where does it come from?

LP A decides to exit

Sells on secondary

Effect on others

Increases supply → lowers π → others get worse prices

Magnitude

Small from single LP; large when many LPs exit together

LP A's calculation

Ignores the price effect on others

Aggregate

All LPs do this · prices crash too fast in stress

Welfare loss

Social welfare gap is the integral of misallocations

Quantifying the welfare gap

How big is the misallocation?

Method

Compare social planner's allocation vs decentralized GE-LAV

Social planner

Allocates capital to maximize sum of utilities

Decentralized

Each LP optimizes own utility · ignores externality

Gap calculation

Numerically solve both, compute utility difference

Result

Gap ≈ 2.3%/yr on $13T global private capital AUM

Dollar value

~$300B/yr — substantial macro cost

The optimal Pigouvian tax τ*(L)

Derivation outline.

Social planner FOC

Marginal social value of holding = marginal social cost

Decentralized agent FOC

Marginal private value = marginal private cost

Wedge

Difference is the externality

τ*(L) = wedge

Tax that closes the gap

Form

$\tau^*(L) = -\partial Z(L,\mu)/\partial L$ · partial derivative of aggregate externality

Computed numerically

From the MFG equilibrium

Calibrated τ*(L): values across states

Pigouvian tax as a function of L_t.

L_t state	τ*(L) (% of exit value)	Interpretation
L = +1.0 (boom)	0%	No externality; market healthy
L = +0.5	0%	Still in 'no tax' zone
L = 0 (normal)	0%	Externality starts to matter at margin
L = -0.5 (mild stress)	1.5%	Small tax · disincentivize panic exits
L = -1.0 (recession)	4%	Moderate tax
L = -1.5 (GFC depth)	7%	Significant tax · slows fire sales
L = -2.0 (extreme)	11%	Maximum tax · likely needs cap

Why $\tau^*(L)$ is shaped this way

Convex in L; near-zero in boom; nonlinear in stress.

Boom region (L > 0)

Few LPs want to exit; externality irrelevant

Normal (L ≈ 0)

Trades small; externality minimal

Mild stress

Some exits; externality grows but not yet critical

Severe stress

Many forced exits; externality steep · quadratic ramp

Extreme

Pile-on regime · linear tax slope

Practical

Tax should be cycle-responsive, not constant

Implementation challenges

Why hasn't this been done?

Measurement

Need real-time L_t — possible but not standardized

Political

PE industry opposes taxes; lobbying significant

International coordination

Capital fleeing to non-taxing jurisdictions

Tax form

Could be transaction tax, capital gains, or holding-period adjustment

Quantification dispute

Industry contests welfare gap estimates

Forecast

Likely 10+ years before any Pigouvian tax in PE

Welfare comparison: with and without τ*

What changes when the tax is implemented.

Without τ*

LPs over-exit in stress; prices crash; capital misallocates

With τ*

LPs internalize externality; smoother exits; less amplification

Welfare gain

Closes ~75-80% of welfare gap (rest is from heterogeneity)

Dollar value

~$220-240B/yr social welfare gain

LP private cost

Some LPs worse off (more constrained)

Aggregate Pareto

Net positive — gainers compensate losers in principle

Alternative policy interventions

Other ways to address the externality.

Capital requirements

Already done · partially state-dependent (Basel)

Holding period restrictions

Lockup periods · most are already in fund docs

Secondary market regulation

Bid-floor rules in stress · controversial

Public liquidity facility

Central bank backstop · moral hazard concerns

Disclosure mandates

Force LPs to report stress posture · indirect

Comparison

$\tau^*(L)$ is the theoretically clean solution; others are second-best

Bridge to Session 25 (Unit 6 begins)

Sessions 1-24 built the framework. Now apply it.

Unit 5 complete

Math bridges all in place: OU, Itô, HJB, McKean-Vlasov, Jensen, Pigouvian

Unit 6 (S25-31)

Split track: practitioners vs researchers

Track 1 students

Apply GE-LAV to cases (RJR Nabisco, Macquarie, Ares, etc.)

Track 2 students

Prove theorems (HJB derivation, MFG existence, etc.)

Choose your path

First track choice in Session 25 · refresh in each session

Reading prep

Book Ch. 24-25 (introducing the split-track sessions)