🧪 MU Test Log — Test 8 (γ-Sweep, β=8→10 step=0.25)

Parameters

- $\hbar$ = 0.1 (fixed)
- γ = 0.5, 1.0, 2.0
- β = 8.0 → 10.0 in steps of 0.25
- Velocities: v = 0.050 (slow), v = 0.500 (fast)
- Selector: $T(r) = \frac{1}{1 + |r - r_c|}$, $r_c = 0.25$

Results (Console Highlights)

```
--- gamma=0.5, beta=8.00 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=8.7770e+30, w_fast=1.8627e+25
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=8.25 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=8.1742e+31, w_fast=1.1533e+26
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=8.50 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=7.6128e+32, w_fast=7.1411e+26
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=8.75 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=7.0900e+33, w_fast=4.4216e+27
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=9.00 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=6.6031e+34, w_fast=2.7377e+28
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=9.25 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=6.1496e+35, w_fast=1.6951e+29
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=9.50 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=5.7273e+36, w_fast=1.0496e+30
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=9.75 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
w_slow=5.3339e+37, w_fast=6.4987e+30
**SURVIVAL VISIBLE**
--- gamma=0.5, beta=10.00 ---
Q_slow=0.015625, Q_fast=0.015625
QT_slow=0.892574, QT_fast=0.729286
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w_slow=4.9676e+38, w_fast=4.0238e+31
SURVIVAL VISIBLE
--- gamma=1.0, beta=8.00 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=7.5074e+30, w_fast=1.5932e+25
SURVIVAL VISIBLE
--- gamma=1.0, beta=8.25 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=6.9918e+31, w_fast=9.8649e+25
SURVIVAL VISIBLE
--- gamma=1.0, beta=8.50 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=6.5116e+32, w_fast=6.1081e+26
SURVIVAL VISIBLE
--- gamma=1.0, beta=8.75 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=6.0644e+33, w_fast=3.7820e+27
SURVIVAL VISIBLE
--- gamma=1.0, beta=9.00 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=5.6479e+34, w_fast=2.3417e+28
SURVIVAL VISIBLE
--- gamma=1.0, beta=9.25 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=5.2600e+35, w_fast=1.4499e+29
SURVIVAL VISIBLE
--- gamma=1.0, beta=9.50 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=4.8988e+36, w_fast=8.9775e+29
SURVIVAL VISIBLE
--- gamma=1.0, beta=9.75 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=4.5624e+37, w_fast=5.5587e+30
SURVIVAL VISIBLE
--- gamma=1.0, beta=10.00 ---
Q_slow=0.031250, Q_fast=0.031250
QT_slow=0.892574, QT_fast=0.729286
w_slow=4.2490e+38, w_fast=3.4418e+31
SURVIVAL VISIBLE
--- gamma=2.0, beta=8.00 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=5.4925e+30, w_fast=1.1656e+25
SURVIVAL VISIBLE
--- gamma=2.0, beta=8.25 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=5.1153e+31, w_fast=7.2173e+25
SURVIVAL VISIBLE
--- gamma=2.0, beta=8.50 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=4.7640e+32, w_fast=4.4688e+26
SURVIVAL VISIBLE
--- gamma=2.0, beta=8.75 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286

```
w_slow=4.4368e+33, w_fast=2.7670e+27
**SURVIVAL VISIBLE**
--- gamma=2.0, beta=9.00 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=4.1321e+34, w_fast=1.7132e+28
**SURVIVAL VISIBLE**
--- gamma=2.0, beta=9.25 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=3.8483e+35, w_fast=1.0608e+29
**SURVIVAL VISIBLE**
--- gamma=2.0, beta=9.50 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=3.5840e+36, w_fast=6.5681e+29
**SURVIVAL VISIBLE**
--- gamma=2.0, beta=9.75 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=3.3379e+37, w_fast=4.0668e+30
**SURVIVAL VISIBLE**
--- gamma=2.0, beta=10.00 ---
Q_slow=0.062500, Q_fast=0.062500
QT_slow=0.892574, QT_fast=0.729286
w_slow=3.1087e+38, w_fast=2.5181e+31
**SURVIVAL VISIBLE**
```

- For **all γ values** (0.5, 1.0, 2.0):
  - Both **slow and fast paths** are exponentially amplified.
  - Slow weight is consistently ~10^5–10^7 times larger than fast weight.
  - Survival is **visible at β=8.0 already**, and grows explosively with β.
  - Example at β=10.0:
    - γ=0.5 → w_slow ≈ 10^{38}, w_fast ≈ 10^{31}
    - γ=1.0 → w_slow ≈ 4×10^{38}, w_fast ≈ 3×10^{31}
    - γ=2.0 → w_slow ≈ 3×10^{38}, w_fast ≈ 2.5×10^{31}

Interpretation

- **Threshold β≈9 is gone**: unlike earlier tests where slow needed β≥9 to become macroscopic, here both slow and fast are already enormous at β=8.
- Why? Because Q_slow = Q_fast (same action cost), so the only distinguishing factor is **QT**, and both paths now get amplified by Truth.
- The exponential blowup means:
  - Truth is not just selecting, but **amplifying both paths**.
  - However, slow always wins, because QT_slow > QT_fast.

Why It Matters

- This is the first time we've seen **fast path survival return** (non-zero but smaller).
- It suggests that when the action cost (Q) is **degenerate** between paths, Truth amplifies **all accessible options**, but still favors the one with the larger QT.
- In other words: **degeneracy opens the door to multi-path survival.**

Highlights

- **Universal scaling**: changing γ just rescales Q, but doesn't change relative survival order.
- **No sharp β threshold**: with Q_slow = Q_fast, both paths amplify smoothly from β=8 onward.
- **Implication for MU**:
  - When environments are degenerate, multiple futures may survive simultaneously.
  - Truth doesn't collapse to a single path immediately — it allows "branch coexistence" weighted by QT.

Next Steps

1. **Non-degenerate action test**: Modify paths so that Q_slow ≠ Q_fast, and re-run.
   - This should restore the β-threshold behavior.
2. **Phase diagram idea**: Plot survival behavior across (γ, β) space, marking where one vs two paths survive.
3. **Interpret physically**: Degeneracy could correspond to **symmetry conditions** (two paths costing the same "energy"). MU then predicts *both persist, but weighted*.

✅ **Conclusion:**
Test 8 shows that when Q_slow = Q_fast, the MU doesn't force a single survivor. Both paths amplify, but slow wins quantitatively. This introduces a new MU prediction: **degenerate systems do not collapse uniquely — they sustain multi-path survival with relative weighting by T.**