

Financing toll roads: public, private or public-private partnerships?

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Why PPPs (in highways)?

- PPPs relieve strained public budgets
- Private cost-of-funds is lower (no need to raise distortionary taxes)
- Private firms are more efficient (productive efficiency)

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- Hence it has to raise \$1 in additional taxes ...
- ... which costs $\$ \lambda_{\tau} > \1 to society

This talk

- The cost-of-funds argument and an irrelevance result (public, private or public-private)
- If private sector is more efficient, and road is self-financing then concessions should be fully private, but for a limited term
- If private sector is more efficient but road cannot pay its way, an *indefinite* PPP is optimal

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- Discount rate r , cost of public funds $\lambda_\tau > 1$, toll P , term of concession (in state i) T_i

The present value of revenue

$$\text{PVR}_i(T_i) \equiv \int_0^{T_i} P Q_i e^{-rt} dt$$

The planner's problem

$$\min \sum \pi_i \left[\text{PVR}_i + \lambda_\tau S_i - (\lambda_\tau - 1) \left(\frac{PQ_i}{r} - \text{PVR}_i \right) \right]$$

$$\text{s.t. } \sum \pi_i u(\text{PVR}_i + S_i - I) = u(0)$$

At the margin, perfect substitutes

$$\sum \pi_i \lambda_\tau (\text{PVR}_i + S_i)$$

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- Any combination in between is admissible!

Productive efficiency

Assumption: public sector must “spend” $\$ \zeta$ to achieve $\$1$ of private spending

- If $\zeta < 1$, then public sector is more efficient
- If $\zeta > 1$, then private sector is more efficient

The planner's problem

$$\min \sum \pi_i \left[\text{PVR}_i + \zeta \lambda_\tau S_i - (\lambda_\tau - 1) \left(\frac{PQ_i}{r} - \text{PVR}_i \right) \right]$$

$$\text{s.t. } \sum \pi_i u(\text{PVR}_i + S_i - I) = u(0)$$

At the margin, one or the other

$$\sum \pi_i \lambda_\tau (\text{PVR}_i + \zeta S_i)$$

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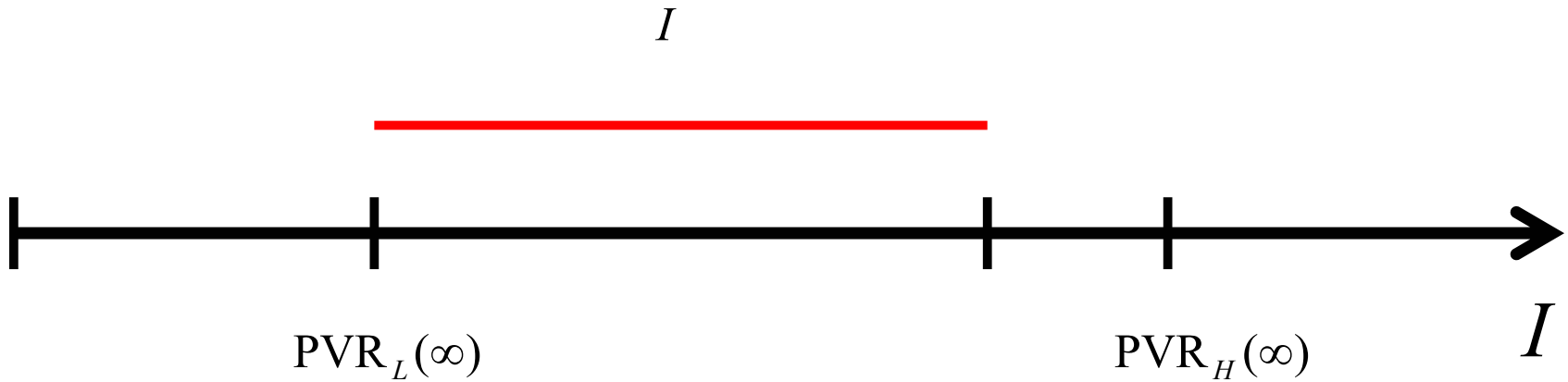
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- If $\zeta < 1$, $PVR_i(T_i) = 0$, $S_i = I$ → traditional model is better

Is ever a PPP warranted?

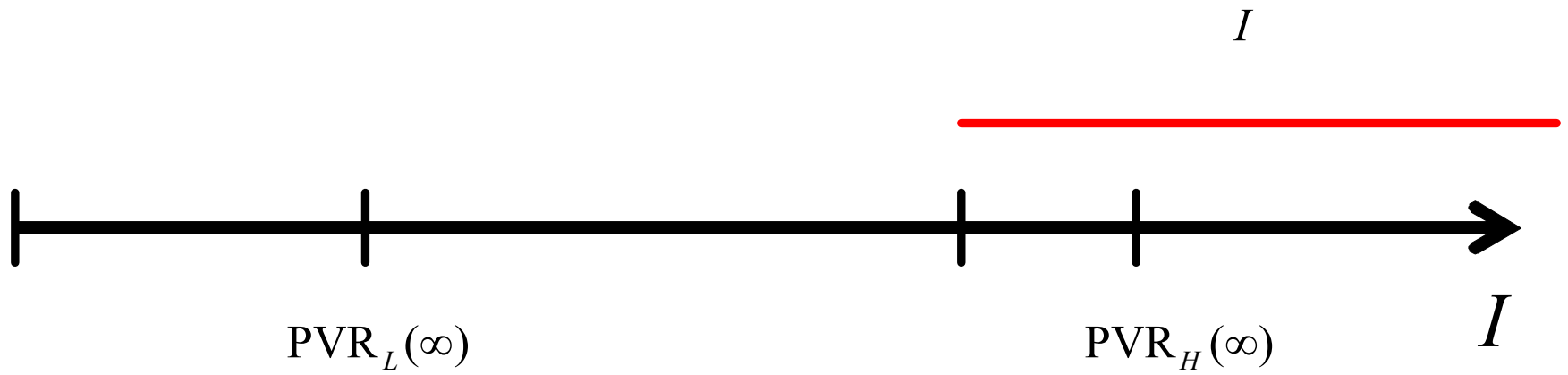
A self-financing road: no subsidy, no PPP



But here low-demand state requires subsidy



Both states require subsidy



If subsidies are warranted,
then a PPP is

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- In states where subsidies are not paid, $T_i < \infty$
- Full insurance if subsidies are paid in all states
- Some risk is introduced if $S_L > 0$ and $S_H = 0$

$$\text{PVR}_L(\infty) + S_L < I < \text{PVR}_H(T_H)$$

Conclusion

- Toll-road concessions should have limited but flexible terms (LPVR auction)
- Self-financing roads should be either private (if private firms are more efficient) or public, but not public-private
- Roads that require subsidies should have indefinite (very long) concession terms