Corporate Finance: The soft budget constraint

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Dewatripont and Maskin, RES 1995

Credit and efficiency in centralized and decentralized economies

The model

- The timing:

Period 0	Period 1	Period 2
An entrepreneur has a project which is either good or bad and requires \$1 of investment from a creditor	A good project yields $R>1$ A bad project needs additional 1\$ of investment	If the bad project is refinanced, it yields aR, where a is the creditor's effort that costs $\Psi(a)$

- $\Psi'(a)$, $\Psi''(a)>0$, $\Psi'(0)=0$
- a is the "prob. of success"
- The entrepreneur gets positive benefits from completed projects and negative benefits from aborted projects
- The creditor has all the bargaining power vis-à-vis the entrepreneur

The period 1 problem when the project is bad

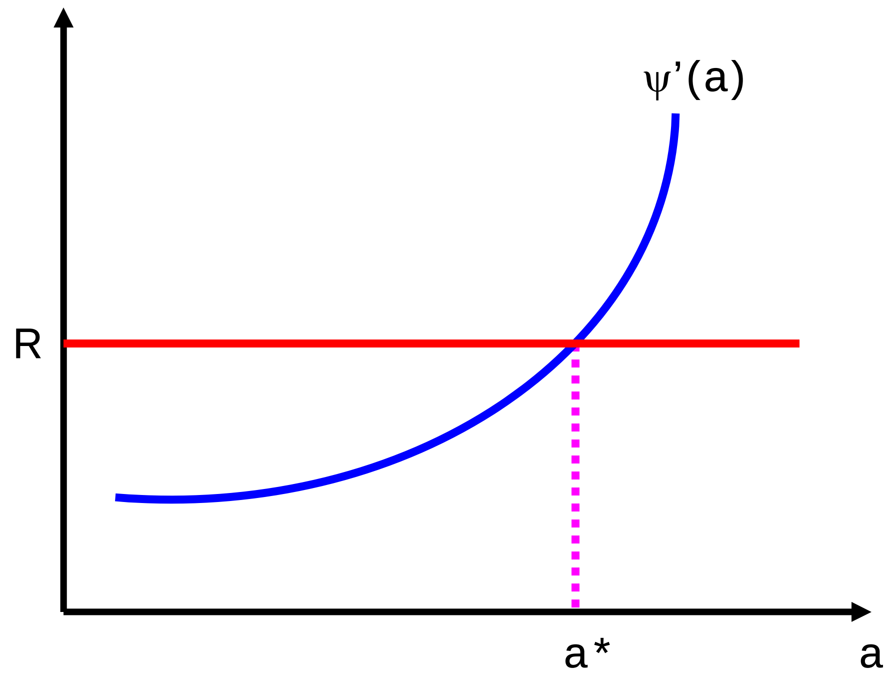
- When the creditor agrees to refinance he will demand the entire cash flow
- The entrepreneur will accept since he gets private benefits from completed projects (if he rejects the project is aborted)
- The creditor's problem:

$$\max_{a} aR - \psi(a)$$

The creditor's problem in period 1 when the project is bad

- F.O.C for the creditor's problem:

$$R - \psi'(a) = 0 \quad \Rightarrow \quad \psi'(a^*) = R.$$



The SBC problem

- The creditor's payoff at the optimum:

$$\pi(a^*) \equiv a^* R - \psi(a^*)$$

- Two possibilities:
  - $\pi(a^*)>1$: the creditor will refinance a bad project
  - $\Rightarrow$ An entrepreneur with a bad project will take it anyway (he knows it will be refinanced in period 1)
  - $\pi(a^*)<1$: the creditor loses money and will not refinance a bad project
  - $\Rightarrow$ An entrepreneur with a bad project will not take the project (he knows it will be aborted in period 1)

Deterring bad projects

- To deter bad projects, the creditor must commit not to refinance
- When $\pi(a^*) > 1$, this commitment is not credible
- Sol'n: suppose the initial creditor is "small" and has only $1. Refinancing can be done only by another creditor:
  - The new creditor is passive and does not exert effort (the initial creditor must still exert effort during refinancing)
  - The initial creditor has all the bargaining power vis-à-vis the new creditor and the entrepreneur

Contracting with a new creditor

- The new creditor must break even (otherwise he will not agree to refinance):

$$\underbrace{\hat{a}}_{\substack{\text{Expected}\\\text{effort by}\\\text{initial creditor}}} \times \underbrace{C}_{\text{Compensation}} = 1 \Rightarrow C = \frac{1}{\hat{a}}$$

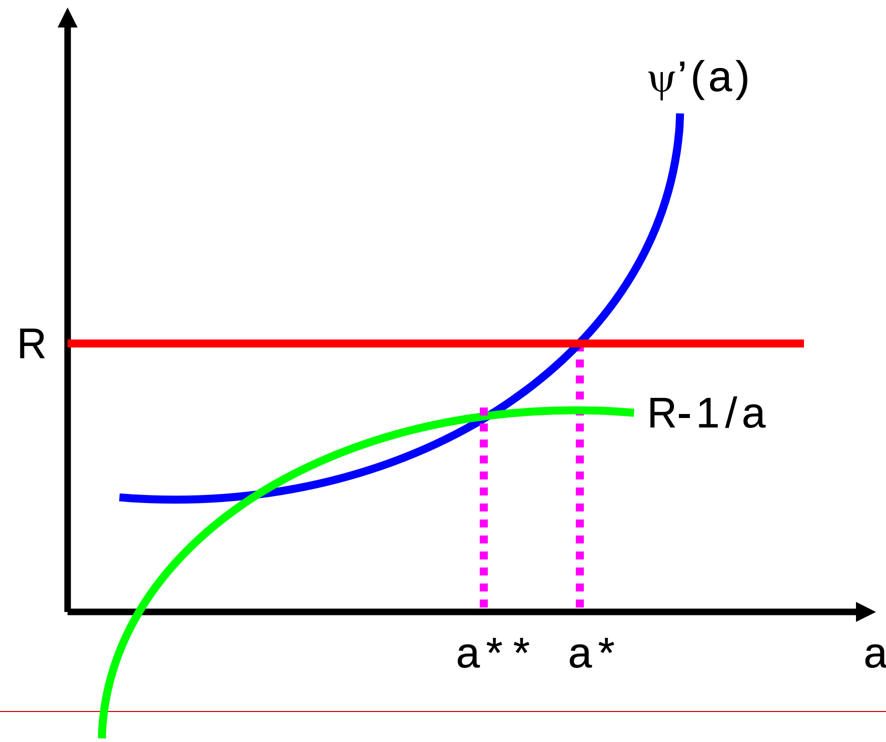
- The initial creditor's problem:

$$\underset{a}{Max}\, a\left(R - \frac{1}{\hat{a}}\right) - \psi(a)$$

The initial creditor's problem in period 1 when the project is bad

- F.O.C for the creditor's problem:

$$R-\frac{1}{\hat{a}}-\psi'(a)=0 \quad \Rightarrow \quad \psi'(a^{**})=R-\frac{1}{\hat{a}}=R-\frac{1}{a^{**}}.$$



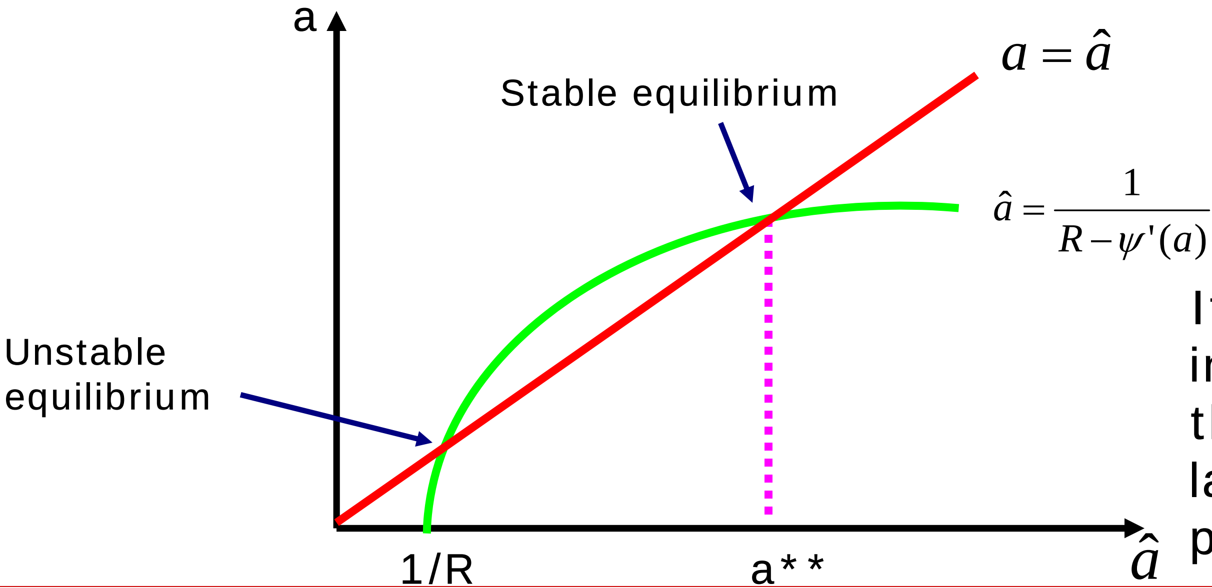
a**<a* due to a "free-rider" problem or "cost of outside equity"

Illustrating the equilibrium

- The best response of the first creditor against the second creditor's beliefs are defined by:

$$R - \frac{1}{\hat{a}} - \psi'(a) = 0 \quad \Rightarrow \quad \hat{a} = \frac{1}{R - \psi'(a)}$$

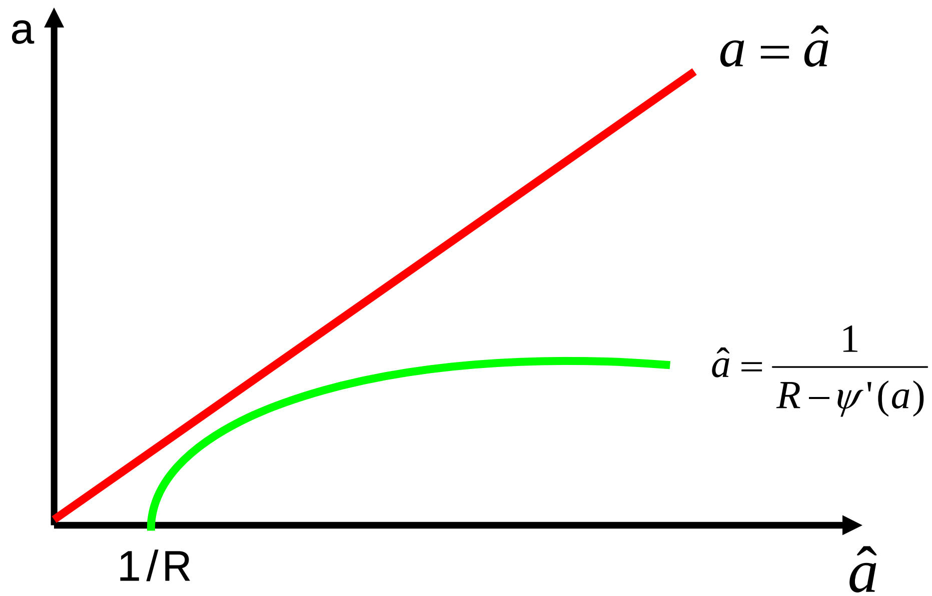
- The second creditor's beliefs are correct: $a = \hat{a}$



If we are interested in stable equilibria then a** is the large intersection point

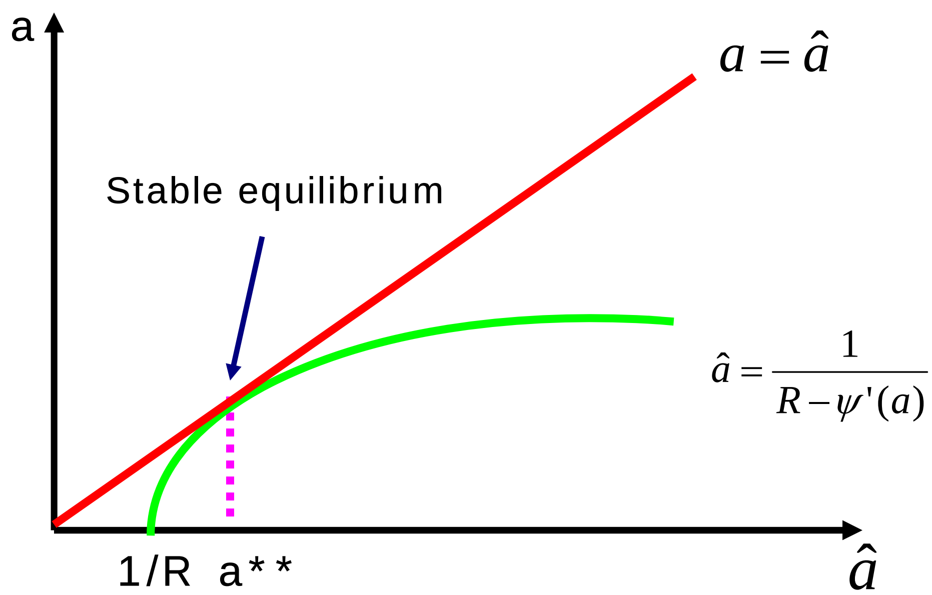
No effort equilibrium

- If the best response of the first creditor is always below the 45 line, then the first creditor will exert no effort and the second creditor will anticipate that
- But with no effort, a bad project fails for sure and will not be refinanced $\Rightarrow$ no SBC problem



Unique interior equilibrium

- We can also have a unique equilibrium if the best response of the first creditor is just tangent to the 45 line. This obviously happens for a measure 0 of parameters



The SBC problem with a new creditor

- The initial creditor's payoff at the optimum:

$$a^{**}\left(R-\frac{1}{a^{**}}\right)-\psi(a^{**})=\underbrace{a^{**}R-\psi(a^{**})}_{\pi(a^{**})}-1$$

- By revealed preferences:

$$\pi\left(a^{**}\right)=a^{**}R-\psi(a^{**})<a^{*}R-\psi(a^{*})=\pi\left(a^{*}\right)$$

- Two possibilities:
  - $\pi(a^{**}) < 1 < \pi(a^{*})$: the SBC problem is solved when a bad project has to be refinanced in period 1 by a new creditor (the entrepreneur will not take a bad project)
  - $1 < \pi(a^{**}) < \pi(a^{*})$: the SBC problem remains

Short-termism

- There are many entrepreneurs and many creditors
- Initially, all creditors have only \$1, but any two creditors can merge and become "large" with \$2 to invest
- 2 types of entrepreneurs, all require \$1 in period 0:
  - Bad (prob. $1-\alpha$)– have access to bad projects which require additional \$1 in period 1 and yield aR in period 2
  - Good (prob. α) – can choose between:
    - Good projects which yield $R>1$ in period 1
    - Very good projects which require additional \$1 in period 1 and yields $R_v > R$ in period 2

Pessimistic beliefs – small creditors and short-termism

- Suppose that creditors believe that α is small

$\Rightarrow$ If a project requires refinancing in $t = 1$ then it's likely to be bad

$\Rightarrow$ If $\pi(a^{**}) < 1$, a small creditor will never refinance projects in period 1, so good entrepreneurs will take good projects, but not very good projects

$\Rightarrow$ The assumption that $\alpha = 0$ in $t = 1$ is not contradicted

Optimistic beliefs – large creditors Very good and bad projects

- Suppose that creditors believe that α is close to 1
- Conditions for equil. with large creditors and very good projects:
  - Creditors will refinancing in period 1 if:

$$\underbrace{\alpha R_v}_{\text{Good entrep.}} + \underbrace{(1-\alpha)\pi(a^*)}_{\text{Bad entrep.}} - 1 > 0$$

  - Large creditors make more money than small creditors:

$$\underbrace{\alpha R_v + (1-\alpha)\pi(a^*) - 2}_{\text{Payoff of large creditors}} > \underbrace{\alpha(R-1)}_{\text{Payoff of small creditors}}$$

- The first condition implies the second since the LHS of the first exceeds the LHS in the second and the RHS is smaller

Bergemann and Hege, RJE 2005

The financing of innovation: learning and stopping

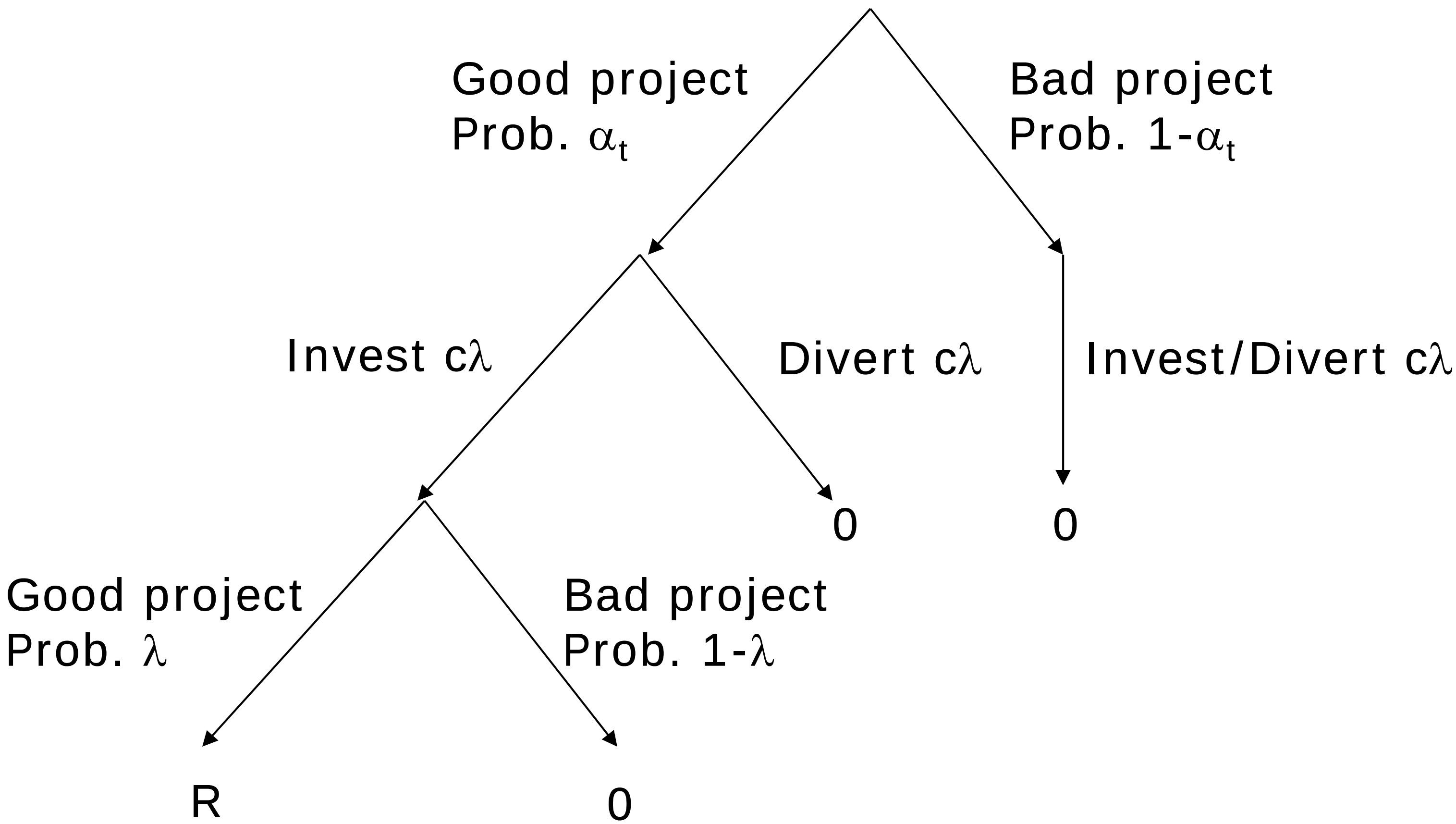
The model

- The timing:

Period 0	Period 0	Period 1
An entrepreneur, E, has a project, which is good with prob. α_0 and bad with prob. $1-\alpha_0$. E raises $c\lambda$ from an investor, I	E either invests $c\lambda$ or diverts it. If E invests, a good project yields R with prob. λ, and a bad project yields 0 for sure	If the project did not yield R, I may give E another $c\lambda$ to invest. If E invests, the project yields R with prob. λ if it's good and yields 0 if it's bad

- If E invests $c\lambda$ in period t, the prob. of success is λ
- E can divert $c\lambda$ to his private consumption

Illustration of period t



- If E invests, the project succeeds with prob. $\alpha_0\lambda$

Belief updating in period 1

- Suppose that I does not observe whether E invested the funds or diverted them in t = 0, but believes that I invests in equilibrium (yellow means the project failed):

	Good project that succeed	Good project that failed	Bad project
Prob.	$\alpha_0\lambda$	$\alpha_0(1-\lambda)$	$1-\alpha_0$

- I's revised belief that the project is good if it failed at t = 0, assuming that E invested:

$$\alpha_1 = \frac{\alpha_0(1-\lambda)}{1-\alpha_0\lambda}$$

The main idea

- Note that:

$$\alpha_1 = \frac{\alpha_0(1-\lambda)}{1-\alpha_0\lambda} = \alpha_0 \underbrace{\left(\frac{1-\lambda}{1-\alpha_0\lambda}\right)}_{<1} < \alpha_0$$

- I becomes more pessimistic if he sees a failure at t = 0 (recall that I believes that E invested)

- If I sees that E diverted funds at t = 0, I believes that the prob. that the project is good is still α_0 (no updating, as failure was due to diversion)

Solving the model – period 1

- Given α_1, the minimal stake, s, that E can keep to ensure funding (I gets 1-s) is:

$$\underbrace{\alpha_1\lambda(1-s)R}_{\text{Ex. payoff}} = \underbrace{c\lambda}_{\text{Cost}} \quad \Rightarrow \quad s = \frac{\alpha_1 R - c}{\alpha_1 R}$$

- E will invest in period 1 iff

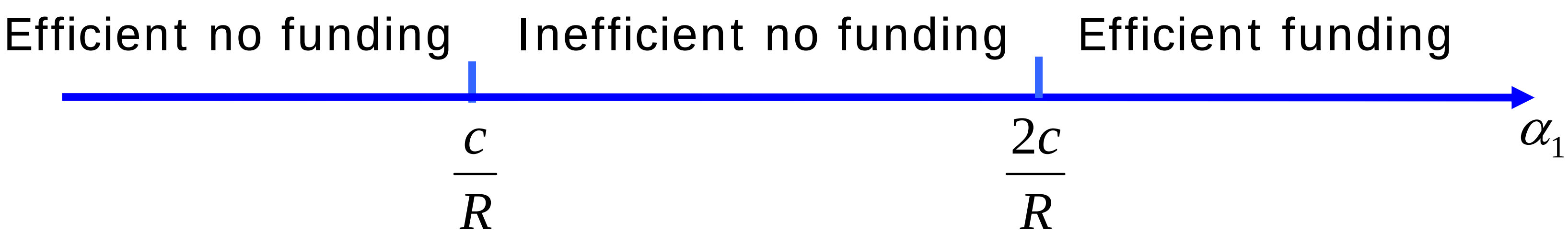
$$\underbrace{\alpha_1\lambda\overbrace{\left(\frac{\alpha_1 R - c}{\alpha_1 R}\right)}^{s}R}_{\text{Success}} \geq \underbrace{c\lambda}_{\text{Diversion}} \quad \Rightarrow \quad \alpha_1 \geq \frac{2c}{R}$$

Solving the model – period 1

- The project is funded in t = 1 only if α_1 is sufficiently high
- It's efficient to fund the project in t = 1 if

$$\lambda \alpha_1 R \geq c\lambda \quad \Rightarrow \quad \alpha_1 \geq \frac{c}{R}$$

- The equil. is inefficient:



- The inefficiency is due to E's MH problem

The main idea

- The project is refinanced in t = 1 if

$$\alpha_1 \geq \frac{2c}{R}$$

- If $\alpha_0 > 2c/R > \alpha_1$, we have an SBC problem under full info. (the project will be refinanced in t = 1 if I observes what happened in t = 0) but no SBC problem under asym. info. (I will not refinance in t = 1 under asym. info.). E will not divert in t = 0 under asym. info

- Asym. info. can solve the SBC problem as it makes I more pessimistic when the project fails $\Rightarrow$ E will be more reluctant to divert funds

Symmetric info. – period 0

- Suppose that I observes whether E diverted funds at t = 0
- E's continuation payoff if E invests at t = 0, but the project fails:

$$V_E(\alpha_1) = \begin{cases} \lambda\alpha_1 \overbrace{\left(\dfrac{\alpha_1 R - c}{\alpha_1 R}\right)}^{s} R = \lambda\alpha_1 R - c\lambda & \alpha_1 \geq \dfrac{2c}{R} \\ 0 & \alpha_1 < \dfrac{2c}{R} \end{cases}$$

- If E diverted funds at t = 0, E does not learn anything new about the project, so the continuation payoff is $V_E(\alpha_0)$ (α_0 replaces α_1)

Symmetric info. – period 0

- Given α_0, the minimal stake, s, that E offers I to ensure funding:

$$\underbrace{\lambda\alpha_0(1-s)R}_{\text{Ex. payoff}} = \underbrace{c\lambda}_{\text{Cost}} \quad \Rightarrow \quad s = \frac{\alpha_0 R - c}{\alpha_0 R}$$

- E will invest at t = 0 if

$$\underbrace{\lambda\alpha_0 \overbrace{\left(\frac{\alpha_0 R - c}{\alpha_0 R}\right)}^{s} R}_{\text{The project succeeds}} + \underbrace{(1-\alpha_0\lambda)\delta V_E(\alpha_1)}_{\text{The project fails}} \geq \underbrace{c\lambda + \delta V_E(\alpha_0)}_{\text{E diverts funds}}$$

Symmetric info. – period 0

- Substituting for the continuation payoffs and for α_1:

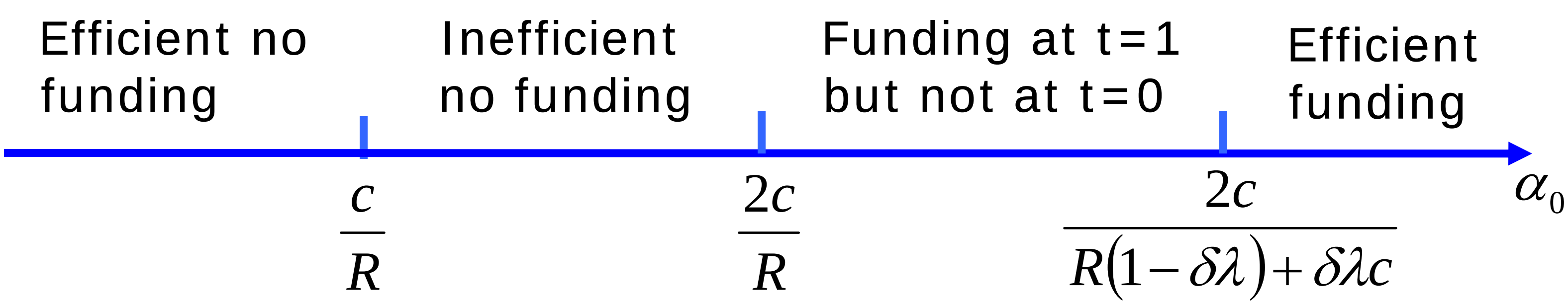
$$\underbrace{\lambda(\alpha_0 R - c)}_{\text{The project succeeds}} + \underbrace{(1-\alpha_0\lambda)\delta(\alpha_1\lambda R - c\lambda)}_{\text{The project fails}} \geq \underbrace{c\lambda + \delta(\alpha_0\lambda R - c\lambda)}_{\text{E diverts funds}}$$

$$\Rightarrow \quad (\alpha_0 R - c) + (1-\alpha_0\lambda)\delta\left(\overbrace{\frac{\alpha_0(1-\lambda)}{1-\alpha_0\lambda}}^{\alpha_1} R - c\right) \geq c + \delta(\alpha_0 R - c)$$

$$\Rightarrow \quad \alpha_0 \geq \frac{2c}{R(1-\delta\lambda)+\delta\lambda c}$$

Symmetric info. – period 0

- The project is funded at t = 0 if $\alpha_0 \geq \frac{2c}{R(1-\delta\lambda)+\delta\lambda c}$
- If $\delta = 0$, we get the same rule as in t = 1
- As $\delta \uparrow$ the RHS $\uparrow$



Asymmetric info. – period 0

- Suppose that I does not observe whether E diverted funds at t = 0
- On the equil. path, E's continuation payoff if E invested at t = 0, but the project failed, is still $V_E(\alpha_1)$ as before
- If E deviated at t = 0 and diverted funds, E knows that the prob. that the project is good is α_0, but I thinks it is α_1 (as he believes that E invested) so E's continuation payoff:

$$V_E^{\,d}(\alpha_1) = \begin{cases} \lambda\alpha_0 \overbrace{\left(\frac{\alpha_1 R - c}{\alpha_1 R}\right)}^{s} R = \lambda\alpha_0 R - \lambda\frac{\alpha_0}{\alpha_1} c & \alpha_1 \geq \frac{2c}{R} \\ 0 & \alpha_1 < \frac{2c}{R} \end{cases}$$

Asymmetric info. – period 0

- E will invest at t = 0 if

$$\underbrace{\lambda\alpha_0\overbrace{\left(\frac{\alpha_0 R-c}{\alpha_0 R}\right)}^{s}R}_{\text{The project succeeds}}+\underbrace{(1-\alpha_0\lambda)\delta V_E(\alpha_1)}_{\text{The project fails}}\geq\underbrace{c\lambda+\delta V_E{}^d(\alpha_1)}_{\text{E diverts funds}}$$

- Since $\alpha_1 < \alpha_0$: $\underbrace{\lambda\alpha_0 R-\lambda\frac{\alpha_0}{\alpha_1}c}_{V_E{}^d(\alpha_1)}<\underbrace{\lambda\alpha_0 R-\lambda c}_{V_E(\alpha_1)}$

- Diversion is less profitable under asym. info

- The condition for funding at t = 0 is easier to satisfy under asym. info. $\Rightarrow$ funding at t = 0 is more likely

Asymmetric info. – period 0

- Substituting for the continuation payoffs and for α_1:

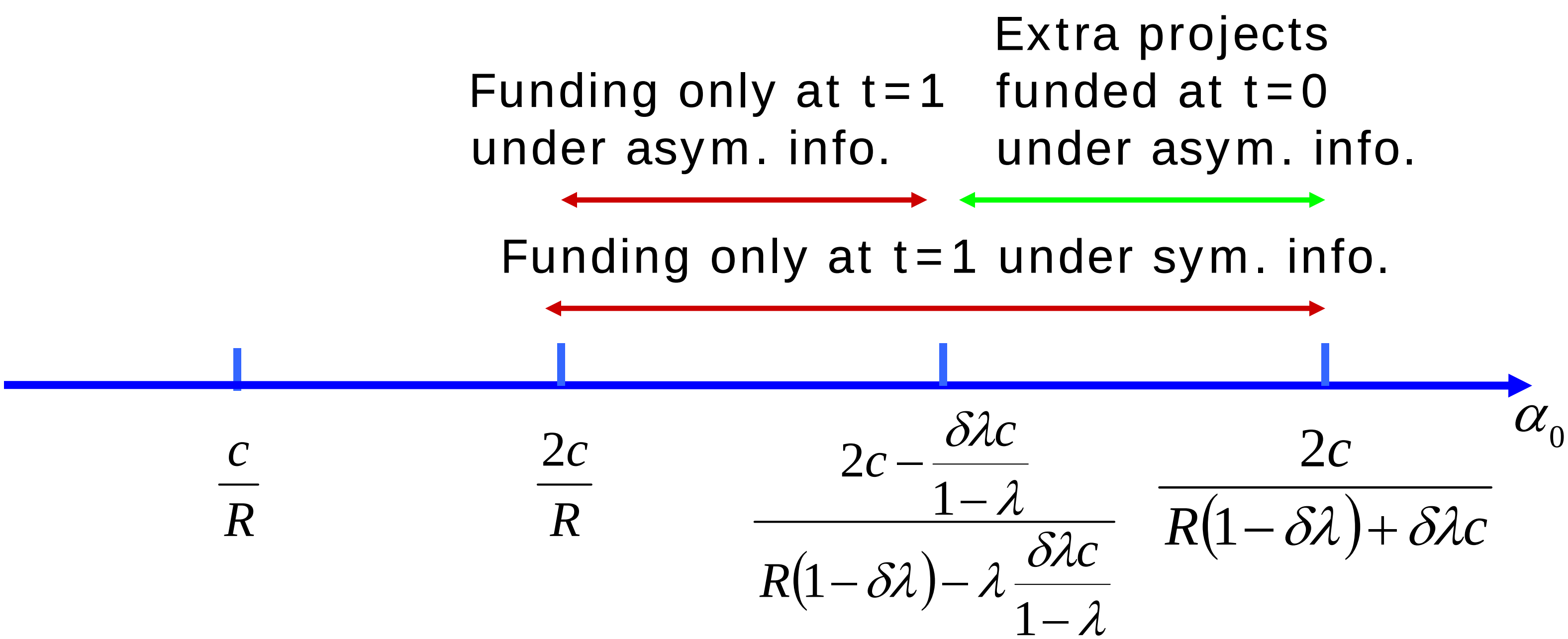
$$\underbrace{\lambda(\alpha_0 R - c)}_{\text{The project succeeds}} + \underbrace{(1-\alpha_0\lambda)\delta(\alpha_1\lambda R - c\lambda)}_{\text{The project fails}} \geq \underbrace{c\lambda + \delta\left(\alpha_0\lambda R - \frac{\alpha_0}{\alpha_1}c\lambda\right)}_{\text{E diverts funds}}$$

$$\Rightarrow \quad (\alpha_0 R - c) + (1-\alpha_0\lambda)\delta\left(\frac{\alpha_0(1-\lambda)}{1-\alpha_0\lambda}R - c\right) \geq c + \delta\left(\alpha_0 R - \frac{\alpha_0}{\frac{\alpha_0(1-\lambda)}{1-\alpha_0\lambda}}c\right)$$

$$\Rightarrow \quad \alpha_0 \geq \frac{2c - \frac{\delta\lambda c}{1-\lambda}}{R(1-\delta\lambda) - \lambda\frac{\delta\lambda c}{1-\lambda}}$$

Asymmetric info. – period 0

- The project is funded at t = 0 if: $$\alpha_0 \geq \frac{2c - \frac{\delta\lambda c}{1-\lambda}}{R(1-\delta\lambda) - \lambda\frac{\delta\lambda c}{1-\lambda}}$$
- For $\delta > 0$:



Asymmetric info. – period 0

- The project is funded at t = 0 if:

$$\alpha_0 \geq \frac{2c - \frac{\delta\lambda c}{1-\lambda}}{R(1-\delta\lambda) - \lambda\frac{\delta\lambda c}{1-\lambda}} = \frac{2c - \frac{\delta\lambda c}{1-\lambda}}{R(1-\delta\lambda) + \delta\lambda c - \frac{\delta\lambda c}{1-\lambda}}$$

- The RHS can be written as

$$\frac{2c - \frac{\delta\lambda c}{1-\lambda}}{R(1-\delta\lambda) + \delta\lambda c - \frac{\delta\lambda c}{1-\lambda}} = \frac{2c - x}{R(1-\delta\lambda) + \delta\lambda c - x}$$

- Under symmetric info., x = 0. An increase in x lowers the expression if $2c < R(1-\delta\lambda)+\delta\lambda c \Leftrightarrow (2-\delta\lambda)c < R(1-\delta\lambda)$

Summary

- Under asym. info. there's less delay in funding the project (funding is delayed to $t = 1$ for a smaller set of parameters)

- Asym. info. deters diversion of funds and hence alleviates the SBC problem