Corporate Finance Theory

Lecture 10

Flip Side of Financial Synergies (1)
Banal-Estanol et al. (2013)

Nick Vikander
Department of Economics

Intended outcomes for the day:

1. **To describe** the relationship between bankruptcy costs, bankruptcy probability, and creditor expectations, in the setting of Banal-Estanol et al. (2013)

2. **To mathematically derive** when joint financing provides coinsurance gains, and when it generates risk-contamination losses, compared to separate financing

3. **To intuitively explain** why an entrepreneur may choose separate financing in some situations where raising funds would be cheaper under joint financing (i.e. joint financing would provide a higher price of debt)

This Paper

Consider **purely financial reasons** for mergers/conglomeration

A firm needs debt financing, bankruptcies are costly

Combination of two projects in one firm with joint debt obligations may have two key effects

Coinsurance: when one project fails, a success of the other project can help to avoid bankruptcy

Contamination: one project's failure may bankrupt the entire firm

We will talk about an "entrepreneur" with two projects. But you can also think of two firms, each with one project, deciding whether or not to merge.

Baseline model

Projects:

An entrepreneur has two identical projects, where each project:
-Requires initial investment 1, and either succeeds or fails
-Success yields r_H, failure yields r_L with $r_H > 1 > r_L$.
-Probability of success p, independent across projects.
-Positive NPV: $p\, r_H + (1-p)\, r_L - 1 > 0$

Project Funding:

Question: what interest rate r lets creditors, on average, recoup their investment.

To fund each project, the entrepreneur issues debt
-Perfectly competitive credit market, risk-free rate is zero
-Creditors will break even, pay "price equal to market value of debt"
-Hence, entrepreneur issues debt such that market value = 1
-But what about the face value: r* (gross interest rate, 1/price of debt)?
-This will depend on when creditors expect to be paid back!

Baseline model

First scenario: **separate financing**

"lend to one project"

Creditors who purchase debt for one project, i, only have a claim on the returns r_i of that project

If $r_i \geq r^*$, then the entrepreneur remains **solvent** (with respect to that project)
-Creditors for that project are paid back in full
-Receive face value of debt, r^*

(default).

If $r_i < r^*$, then the entrepreneur goes **bankrupt** (with respect to that project)
-Creditors for that project are not paid back in full
-They receive γ r_i, and the entrepreneur gets nothing from that project
-Value $(1-\gamma)$ r_i is lost to bankruptcy costs

$\gamma r_i \rightarrow$ fraction γ of the realized cash-flow.

γ is a parameter; $1-\gamma \approx$ default costs.

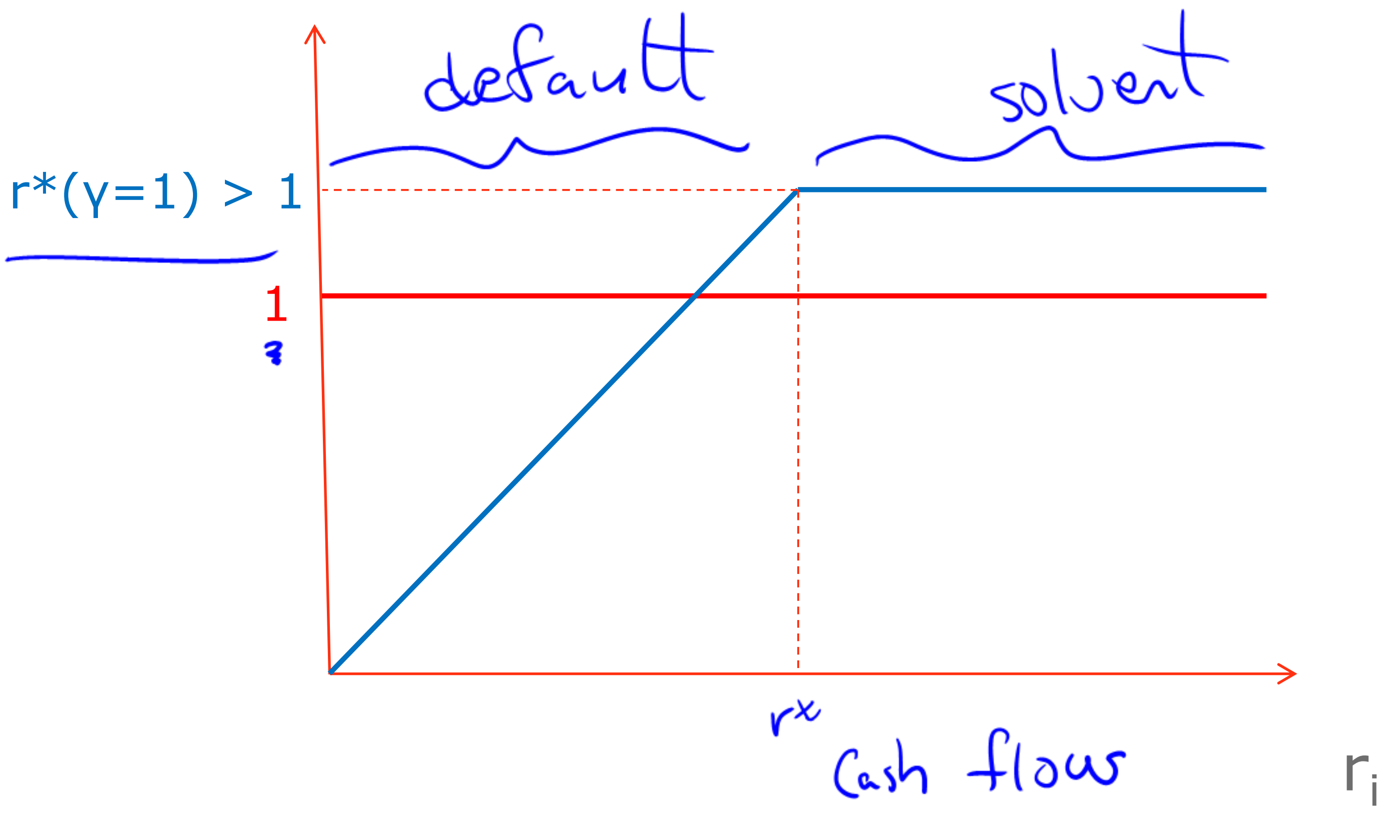
Illustration: assume for the moment that r_i is uniformly distributed between 0 and some upper bound.

$\rightarrow$ just for the figure !!

Illustration with costless bankruptcy

(that is, assume $\gamma = 1$)

Creditor payoff



Question: Illustration with costly bankruptcy

Redraw the previous figure in the case where bankruptcy costs are strictly positive ($\gamma < 1$).

Working in groups, discuss and come up with an answer to the following question:

How does the new curve (with positive bankruptcy costs) look compared to the old curve (drawn in blue, with zero bankruptcy costs). Does it lie above the old curve? Below? Partly above, partly below?

Then go to socrative.com, room 897458, and vote:

The introduction of bankruptcy costs, $\gamma < 1$, makes bankruptcy:

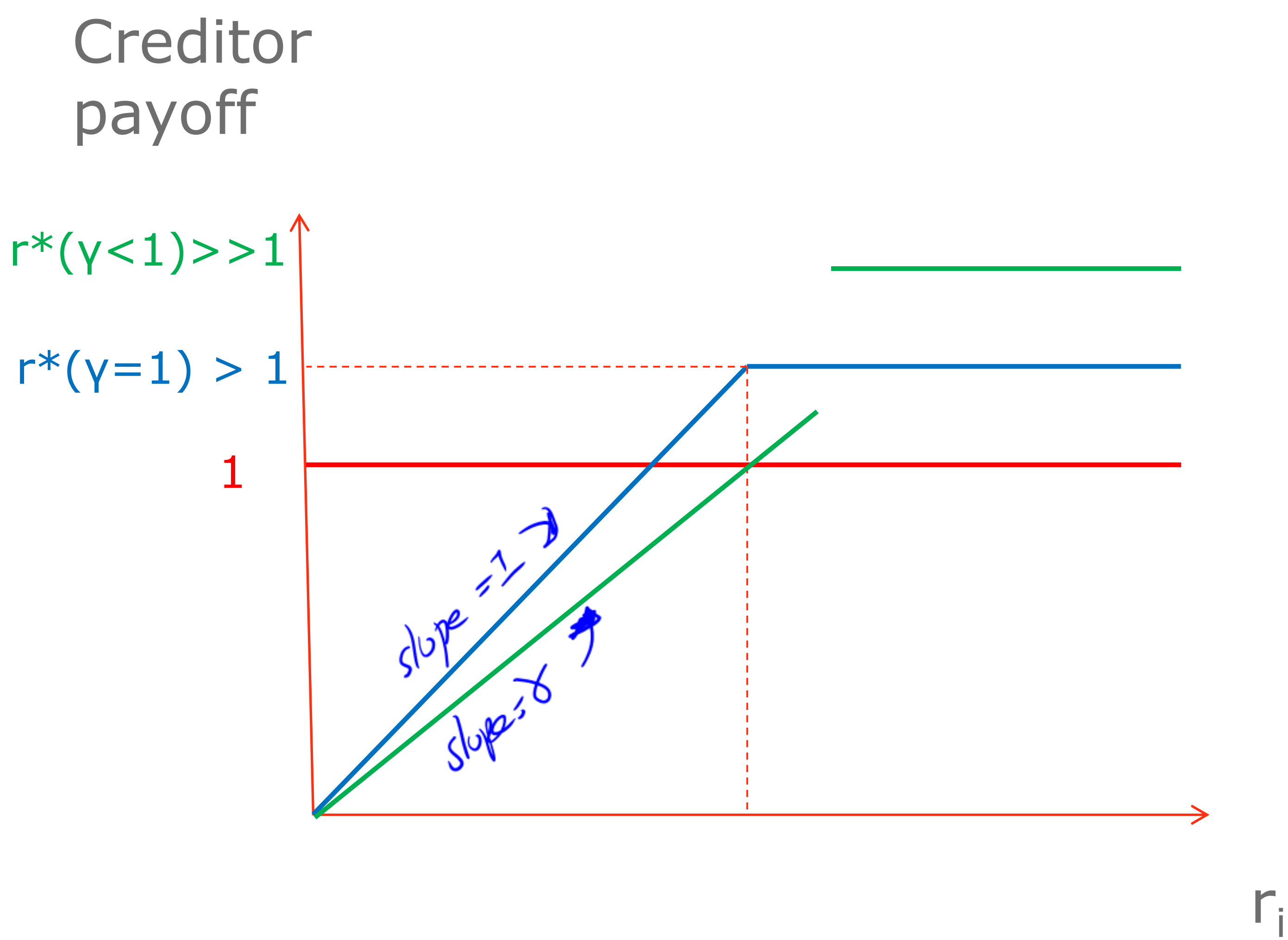
(a)More likely, because creditors will demand a higher return

(b)Less likely, because the entrepreneur will remain solvent to avoid these costs

(c) Equally likely, because project return r_i is drawn from an exogenous probability distribution, which is not affected by γ

.

Illustration with costly bankruptcy



Discussion

The new curve will lie partly above, partly below the old curve

Bankruptcy will now be more likely, because creditors will demand a higher return r*.

They require a higher payoff during solvency, to compensate them for the value lost during bankruptcy, $(1-\gamma)r_i$

Subtle: creditors also take into account that higher r* will make bankruptcy more likely, which will reduce the value they receive

Conclusion: a rise in bankruptcy costs can reduce project value both **directly** and **indirectly**

Directly: more value is lost when bankruptcy occurs
Indirectly: bankruptcy becomes more likely

Question: Illustration with costly bankruptcy

Question:

The introduction of bankruptcy costs, $\gamma < 1$, makes bankruptcy:

(a) More likely, because creditors will demand a higher return

(b) Less likely, because the entrepreneur will remain solvent to avoid these costs

(c) Equally likely, because project return r_i is drawn from an exogenous probability distribution, which is not affected by γ

Baseline model

Bankruptcy costs are the problem

Relate this idea back to our baseline model

Recall that creditors break even in expectation. Hence, under separate financing, the entrepreneur's payoff per project is

$$\mathbf{p\, r_H + (1 - p)\, r_L - 1} - \textbf{(Expected Bankruptcy Costs)}$$

where these expected costs depend on γ both **directly** and **indirectly** (through creditor expectations)

The entrepreneur wants to minimize expected bankruptcy costs. Is this possible through joint financing?

Baseline model

Second scenario: **joint financing**

(lend to finance one project).

Creditors who purchase debt for one project, i, have a claim on total returns of both projects, $r_i + r_j$; equivalently, on the average project return, $(r_i + r_j)/2$

← Promised repayment to creditors.

If $\mathbf{(r_i + r_j)/2 \geq r_m^*}$, then the entrepreneur remains **solvent**

-All creditors are paid back in full

-Receive face value of debt, r_m^*

If $\mathbf{(r_i + r_j)/2 < r_m^*}$, then the entrepreneur goes **bankrupt**

-No creditors are paid back in full

-They receive $\gamma(r_i + r_j)/2$ per project, and the entrepreneur gets nothing

-Value $(1-\gamma)\ (r_i + r_j)/2$ per project is lost to bankruptcy costs

Expected bankruptcy costs

Three relevant situations

Separate (1)

-For each project, bankruptcy if and only if return is r_L

-Expected bankruptcy costs: $(1-p)(1-\gamma)r_L$

Joint, coinsurance (2)

-Bankruptcy if and only if both returns are r_L

-Expected bankruptcy costs: $(1-p)^2(1-\gamma)r_L$

(assuming success/failure of project i is independent of that of project j)

Joint, contamination (3)

-Bankruptcy if and only if at least one return is r_L

-Expected bankrup. costs: $2p(1-p)(1-\gamma)\frac{(r_H+r_L)}{2}+(1-p)^2(1-\gamma)r_L$

Bankruptcy costs: (2) < (1) < (3)

Question: Expected bankruptcy costs

(3) - (1) can be described as the "coinsurance gains".

Separate (1) $(1-p)(1-\gamma)r_L$

Joint, coinsurance (2) $(1-p)^2(1-\gamma)r_L$

Joint contamination (3) $p(1-p)(1-\gamma)(r_H + r_L) + (1-p)^2(1-\gamma)r_L$

Bankruptcy costs: (2) < (1) < (3)

Question: (3) – (1) is

(a) Increasing in p, increasing in γ
(b) Increasing in p, decreasing in γ
(c) Decreasing in p, increasing in γ
(d) Decreasing in p, decreasing in γ
(e) None of the above

No need to vote; just give it some thought for 2 minutes

Work out which you think is the best answer, then go to socrative.com, room 897458, and vote.

Discussion

Separate (1): $(1\text{-}p)(1\text{-}\gamma)r_L$

Joint, coinsurance (2): $(1\text{-}p)^2(1\text{-}\gamma)r_L$

Joint, contamination (3): $p(1\text{-}p)(1\text{-}\gamma)(r_H + r_L) + (1\text{-}p)^2(1\text{-}\gamma)r_L$

$(3) - (1) = p(1\text{-}p)(1\text{-}\gamma)r_H$ -> correct answer was *(e) None of the above*

Risk-contamination losses

$(1) - (2) = p(1\text{-}p)(1\text{-}\gamma)r_L$

Coinsurance gains

For more on intuition, see p.12 of the paper

Discussion

Separate:

$$(1\text{-}p)(1\text{-}\ \gamma)r_L$$

Joint, coinsurance:

$$(1\text{-}p)^2(1\text{-}\ \gamma)r_L$$

Joint, contamination:

$$p(1\text{-}p)\ (1\text{-}\ \gamma)(r_H + r_L) + (1\text{-}p)^2\ (1\text{-}\ \gamma)\ r_L$$

The entrepreneur will choose joint financing if it provides coinsurance gains, but not if it generates risk-contamination losses

Look at this in more detail.

Please complete the evaluation: evaluering.ku.dk. Take 5 minutes.

→ look at the interest rate under joint vs. separate financing

Gross interest rate - Separate Financing

Suppose that creditors **always expect to be paid back in full**; solvency both when $r_i = r_H$ and when $r_i = r_L$.

Then to break even, creditors require

$$\underbrace{p\, r^*}_{\text{success}} + \underbrace{(1-p)\, r^*}_{\text{failure}} = 1$$

; creditors expect full repayment r^* in both outcomes.

This implies a gross interest rate of $r^* = 1$

Face value and market value of debt coincide

But by assumption, $r_L < 1$, which implies $r_L < r^*$

Creditor **expectations** will **not be confirmed**, since the entrepreneur will go bankrupt when $r_i = r_L$

Gross interest rate - Separate Financing

Suppose that creditors **only expect to be paid back in full when the project succeeds**; solvency when $r_i = r_H$

Then to break even, creditors require

repayment in case of failure.

$$p\, r^* + (1-p)\, \gamma\, r_L = 1$$

This implies a gross interest rate: $r^* = \frac{1-(1-p)\gamma r_L}{p} > 1$

Face value of debt exceeds market value of debt

For creditor **expectations** to be **confirmed**, need to check

$r^* \le r_H$, or

$$\boxed{p\, r_H + (1-p)\, \gamma\, r_L \geq 1}$$

; substitute the expression for r^* and simplify

promised repayment

cash flow in case of success.

Gross interest rate - Joint Financing, Coinsurance

Suppose that creditors **expect to be paid back in full unless both projects fail**; solvency unless $r_i = r_j = r_L$

intermediate outcome → solvency;

Then to break even, creditors require

$$\underbrace{(1-(1-p)^2)}_{\text{Prob. of at least one success}}\, r_m^* + \overbrace{(1-p)^2}^{\text{prob. of two failures.}} \gamma\, r_L = 1$$

This implies a gross interest rate of

$$\boxed{r_m^* = \frac{1-(1-p)^2 \gamma r_L}{1-(1-p)^2}}$$

For creditor **expectations** to be **confirmed**, we need $r_m^* \leq (r_H + r_L)/2$, or

total cash flows intermediate case.

$$\underbrace{2r_m^*}_{\text{debt obligations}} \leq \underbrace{r_H + r_L}_{\text{intermediate cash}}$$

$$(1-(1-p)^2)\,(r_H + r_L)/2 + (1-p)^2 \gamma\, r_L \geq 1$$

Otherwise, the entrepreneur would go bankrupt when one return is high and the other return is low

Gross interest rate - Joint Financing, Contamination

Assume $r_m^* > (r_H + r_L)/2$, so there can be no coinsurance. Suppose instead **creditors expect to only be paid back in full if both projects succeed**; solvency only if $r_i = r_j = r_H$

Then to break even, creditors require

$$p^2\, r_m^{**} + 2p(1-p)\,\gamma\,(r_H + r_L)/2 + (1-p)^2\,\gamma\, r_L = 1$$

intermediate outcome.

This implies a gross interest rate of

$$r_m^{**} = \frac{1 - p(1-p)\gamma(r_H + r_L) - (1-p)^2\gamma r_L}{p^2}$$

For **expectations** to be **confirmed**, we need $r_m^{**} \leq r_H$, or

$$p^2 r_H + p(1-p)\,\gamma\,(r_H + r_L) + (1-p)^2\,\gamma\, r_L \geq 1$$

Otherwise, the entrepreneur would go bankrupt even with two high returns

Comparing interest rates

Separate (1):

$$r^* = \frac{1-(1-p)\gamma\ r_L}{p}$$

Joint, coinsurance (2)

$$r_m{}^* = \frac{1-(1-p)^2\gamma\ r_L}{1-(1-p)^2}$$

Joint, contamin (3):

$$r_m{}^{**} = \frac{1-p(1-p)\gamma(r_H+r_L)-(1-p)^2\gamma r_L}{p^2}$$

We know that joint financing outperforms separate financing if there is coinsurance but not if there is risk contamination.

Comparing interest rates

Separate (1): $$r^* = \frac{1-(1-p)\gamma\ r_L}{p}$$

Joint, coinsurance (2) $$r_m^{\ *} = \frac{1-(1-p)^2\gamma\ r_L}{1-(1-p)^2}$$

Joint, contamination (3): $$r_m^{\ **} = \frac{1-p(1-p)\gamma(r_H+r_L)-(1-p)^2\gamma r_L}{p^2}$$

But:
(1) will be the highest, not (3), when $\gamma > 1/\ [pr_H + (1-p)r_L]$

-> when coinsurance is not possible, best to choose separate financing, even when joint financing would allow the firm to borrow more cheaply/ issue less debt

Intuition about the interest rate

Clear that separate financing is better than joint financing with contamination

But the gross interest rate may be higher with separate financing.

How can this be?

Creditors

-With contamination, expect bankruptcy relatively often

-Expect a relatively high payoff, on average, during bankruptcy

-Require a lower return during solvency (gross interest rate) to break even

Entrepreneur: by choosing separate financing with a higher interest rate.

-Loses, relative to contamination, when both projects succeed. Must pay back all creditors at the higher rate

-Gains, relative to contamination, when exactly one project succeeds. Remains solvent with respect to that project, obtains positive payoff

-Gains outweigh losses

Intended outcomes revisited:

1. To describe the relationship between bankruptcy costs, bankruptcy probability, and creditor expectations, in the setting of Banal-Estanol et al. (2013)

Bankruptcy costs matter, not bankruptcy itself. Costs affect value directly, but also indirectly through probability of bankruptcy (via creditor expectations)

2. To mathematically derive when joint financing provides coinsurance gains, and when it generates risk-contamination losses, compared to separate financing

Derived conditions under which coinsurance occurs. The benefits of coinsurance (and costs of risk-contamination) are increasing in bankruptcy costs, but non-monotonic in probability of project success.

3. To intuitively explain why an entrepreneur may choose separate financing in some situations where raising funds would be cheaper under joint financing (i.e. joint financing would provide a higher price of debt)

Creditors under contamination get relatively high payoff in bankruptcy; demand lower interest rate

For next time

1. (Re)read all of Section 2, now focusing on the predictions, and looking at the proofs. Also read the Conclusion.

2. Banal Estanol et al. emphasize how joint financing can generate risk-contamination losses ("contrary to popular wisdom"). Yet they only mention one motivating example for possible risk-contamination, that of UBS, on p.2. Is this a weakness of the paper? Why or why not? Be ready to share your ideas next time.

3. Read the two Bloomberg articles posted in the folder for Lecture 11, regarding the merger between American Airlines and US Airways. In your view, what are the likely reasons for this merger? Are any of them related to the ideas in Banal-Estanol et al.? Be ready to share your ideas next time.