

Project Finance

Corporate Finance - MSc in Finance (BGSE)

Albert Banal-Estañol

Universitat Pompeu Fabra and Barcelona GSE

Plan

- Project finance:
 - Definition and examples
 - Comparison with other financing mechanisms
 - PPPs and PFIs
- Descriptive statistics:
 - History of project finance
 - Project finance numbers in the last 5 years
- Reasons to finance infrastructure using “project finance”
 - Reduce agency costs
 - Avoid risk-contamination
 - ...
- Conclusions and current trends
- Appendix: a model of risk contamination

What is project finance?

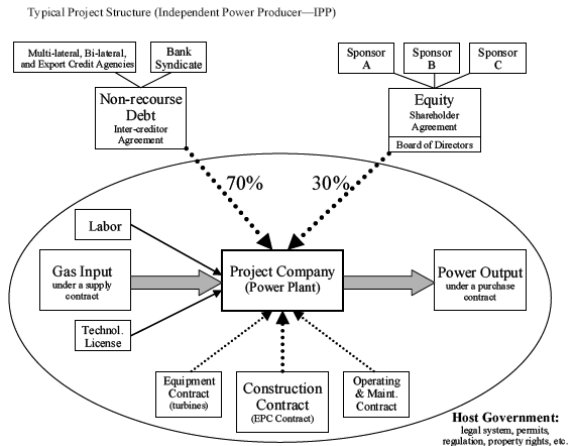
- Project finance involves...
 - creation of a legally independent project company
 - financed with nonrecourse debt (and equity from sponsoring firms)
 - to finance investment in single-purpose capital asset
 - e.g. power plant, oil or gas pipeline system, school...
- Some project finance deals:
 - \$4bn Chad-Cameroon pipeline project
 - \$6bn Iridium global satellite project (Motorola)
 - €900m A2 Road project in Poland
- Distinctions:
 - Stock-type: extract resources, sell output until depletion
 - Flow-type: asset use generate proceeds

Infrastructure projects often have...

- Characteristics:
 - high operating margins; low to medium return on capital; limited life;
 - high free cash flows; few diversification opportunities; asset specificity
- Symmetric risks:
 - demand, price; input/supply; reserve (stock) or throughput (flow)
 - currency, interest rate, inflation
- Asymmetric downside risks:
 - environmental; expropriation
- Binary risks
 - technology failure; direct expropriation
 - counterparty failure; force majeure; regulatory risk
- Design **capital structure/asset specific governance systems** to
- ... minimize cash flow volatility and maximize firm value!!!

An example: an independent power plant

- Typical structure:
 - 15 or more parties from input supplier to output buyer
 - 1000 or more contractual agreements
- Step 1: sign contracts, especially...
 - Construction and equipment contract with contractor
 - Long-term fuel supply contract
 - Long-term power purchase agreement with public utility
 - Operating and maintenance contract
- Step 2: finance contractual bundle on project basis
 - Typically, high leverage with limited recourse
 - But with steady streams of cash flow (key: off-take contracts)



Source: Esty (2004)

Context: an example of structured finance

- Securitisation:
 - originator generating receivables raises capital by selling them to SPV
 - e.g. credit card lender or financial company with loans or mortgages
 - SPV issues securities backed by receivable collections
- Project finance:
 - sponsor sets up SPV to build and/or operate revenue generating project
 - e.g. power plant, oil or gas pipeline system, school, hospital
 - lenders provide capital based on project revenues
- Both of them examples of structured finance:
 - “Arranging for a lender to make a loan under conditions that are structured so as to free the lender from concern over the credit-worthiness of the borrower”
 - Lender relies on assets **legally separated** from the borrower

Similarities and differences

- Both bankruptcy remote,
 - remote from the prospect of a bankruptcy proceeding of its own
 - removed from risk of its being consolidated in the bankruptcy of originator
- Differences between securitisation (sec) and project finance (pf):
 - Securitisation enhances originator's financial profile
 - Project finance creates new business (riskier)
 - In sec portfolio more stable and therefore support more debt
 - Receivable payable by one or few obligors in pf but multiple in sec
 - Receivables sold to SPV in sec, in pf SPV generates receivables

Differences with other financing mechanisms

- Secured debt
 - also has recourse to corporate assets and cash flows
- Asset-backed securities or real estate investment trusts
 - Hold financial assets rather than a single purpose, capital asset
- Joint ventures
 - Different unless joint venture funded with nonrecourse debt
- Leases
 - Obligation has recourse to the lessor
 - do not involve asset ownership by the lessor.
- Leveraged and management buyouts (LBOs and MBOs)
 - they lack a corporate sponsor

Public-Private Partnerships (PPP)

- Project-financed public sector activities:
 - Roads, prisons, schools, hospitals,...
 - Construction and operation risks borne by private sector
 - Government assumes market risk (e.g. traffic volumes in toll roads)
- Wide spectrum of responsibilities and risks:
 - Private sector designs and builds an asset for a fee
 - Private sector builds, owns and operates an asset (BOO)
 - In between, build-operate-transfer (BTO) arrangements
- Objectives:
 - Encourage better management
 - Promote more efficient risk-sharing
 - Expand pool of available funds

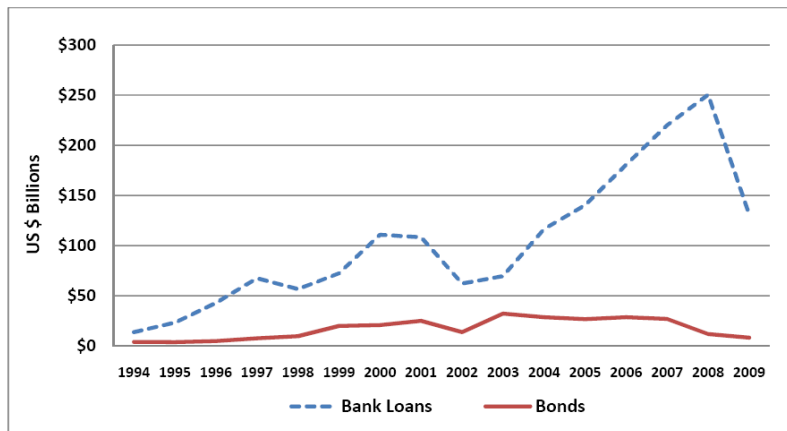
PPP vs. Public Funding Initiatives (PFI)

- Public funding initiatives:
 - PPP in which private sector also finances the project
- In a DBFO
 - private firm designs, builds, finances and operates
 - public sector maintains ownership of the asset
- PFI around the world:
 - Originated in the UK in the 1990s
 - Between 1992 and 2010: 667 PFI projects worth £56b
 - Now programs in Australia, Brazil, Ireland, Italy and South Africa

History of project finance (Esty, 2009)

- Development of Devon silver mines (1299):
 - Florentine bank received a one-year lease from English Crown..
 - for total output in exchange of paying all operating costs
 - without recourse to the Crown if the value of the ore less than expected
- Dutch/British East India Company (17th/18th century)
- Suez canal (1858), Eiffel Tower (1880s)
- Railroads in the US (1840-1870), spur lines and bridges
- Oilfield exploration projects in the early part of the 20th century
- More recently,...
 - BP raised \$945m to develop the Forties Field in North Sea or Erstberg and Bougainville copper mines in Indonesia and Papua (large project magnitude with respect to the size of sponsoring firms)
 - Independent power producers in the US from 1980s

Project finance bonds and loans in the last 5 years



Source: Adapted from *Project Finance International*, various issues January 1995 to January 2010, (London: IFR Publishing).

Total Project-Financed Investment (US\$ billions)

Year	Bank Loans	Bonds	Total	Year-to-Year Percent Change	BLA & MLA Finance ^a	Equity Finance (Estimate) ^b	Grand Total
2009	\$139.19	\$8.27	\$147.46	-44%	\$20.49	\$71.99	\$239.94
2008	250.56	11.89	262.45	6	23.76	122.66	408.87
2007	219.99	26.82	246.81	18	22.34	115.35	384.51
2006	180.61	28.67	209.28	25	20.00	98.26	327.55
2005	140.31	26.70	167.01	15	20.00	80.15	267.16
2004	116.44	28.65	145.09	43	18.75	70.22	234.06
2003	69.56	32.16	101.72	34	18.75	51.63	172.10
2002	62.20	13.80	76.00	-43	18.75	40.61	135.36
2001	108.48	25.00	133.48	1	18.75	65.24	217.47
2000	110.89	20.81	131.70	43	17.69	64.02	213.40
1999	72.39	19.97	92.36	39	16.62	46.70	155.68
1998	56.65	9.79	66.44	-11	20.97	37.46	124.87
1997	67.43	7.50	74.93	57	22.05	41.56	138.54
1996	42.83	4.79	47.62	76	18.96	28.54	95.12
1995	23.33	3.79	27.12	53	17.59	19.16	63.88
1994	13.68	3.99	17.67	—	11.25	12.39	41.31

Percent of Lending by Type of Debt			Number of Projects With		Average Size (US\$ millions)	
Bank Loans	Bonds	Total	Bank Loans	Bonds	Bank Loans	Bonds
94%	6%	100%	461	31	\$302	\$267
95	5	100	689	26	364	457
89	11	100	616	57	357	471
86	14	100	541	68	334	422
84	16	100	513	63	274	424
80	20	100	472	86	247	247
68	32	100	302	89	230	361
82	18	100	284	53	219	260
81	19	100	314	79	345	316
84	16	100	594	86	187	242
78	22	100	559	78	130	256
85	15	100	419	43	135	228
90	10	100	407	25	166	300
90	10	100	341	19	126	252
86	14	100	—	22	—	172
77	23	100	—	—	—	—

Project finance bank loans by sector and region

Sector	Europe, Middle East, and Africa	Asia Pacific	Americas	Total 2005 to 2009	Percent of Total
Power	\$154.3	\$89.5	\$80.4	\$324.2	35%
Transportation	119.5	45.0	33.0	197.5	21
Oil & Gas	78.8	31.3	36.5	146.6	16
Leisure & Property	50.8	19.6	2.5	72.9	8
Petrochemicals	37.5	12.1	4.4	54.0	6
Industrial	29.2	8.0	4.1	41.3	4
Telecom	17.6	14.5	1.2	33.3	4
Mining	10.6	8.4	7.0	26.0	3
Water & Sewage	12.8	5.0	1.5	19.3	2
Other ^a	6.9	1.2	0.0	8.1	1
PPP ^b	<u>5.0</u>	<u>1.5</u>	<u>1.0</u>	<u>7.5</u>	<u>0</u>
Total	\$523.0	\$236.1	\$171.6	\$930.7	100%
Percent	56.2%	25.4%	18.4%	100.0%	

Source: Adapted from *Project Finance International*, various issues January 2005 to January 2010 (London: IFR Publishing).

Project finance bonds by country

Country	2005	2006	2007	2008	2009	Total 2005 to 2009	Percent of Total
United States	\$12,582	\$4,482	\$7,055	\$5,266	\$3,385	\$32,770	32.0%
United Kingdom	4,669	8,938	4,355	2,968	0	20,930	20.4
Australia	841	4,243	4,359	300	188	9,931	9.7
Canada	956	2,536	3,002	1,738	877	9,109	8.9
Qatar	2,250	2,700	0	0	1,248	6,198	6.1
France	0	0	5,500	0	0	5,500	5.4
Mexico	3,000	1,080	259	700	0	5,039	4.9
Malaysia	2,278	356	0	473	0	3,107	3.0
UAE	0	100	0	0	2,229	2,329	2.3
Peru	50	303	575	198	200	1,326	1.3
Austria	0	1,284	0	0	0	1,284	1.3
Germany	0	884	373	0	0	1,257	1.2
Other countries	<u>75</u>	<u>1,767</u>	<u>1,345</u>	<u>242</u>	<u>139</u>	<u>3,568</u>	<u>3.5</u>
Total	\$26,701	\$28,673	\$26,823	\$11,885	\$8,266	\$102,348	100.0%
Total number of countries where bonds were used	10	17	12	10	7		

Source: Adapted from *Project Finance International*, various issues January 2005 to January 2010 (London: IFR Publishing).

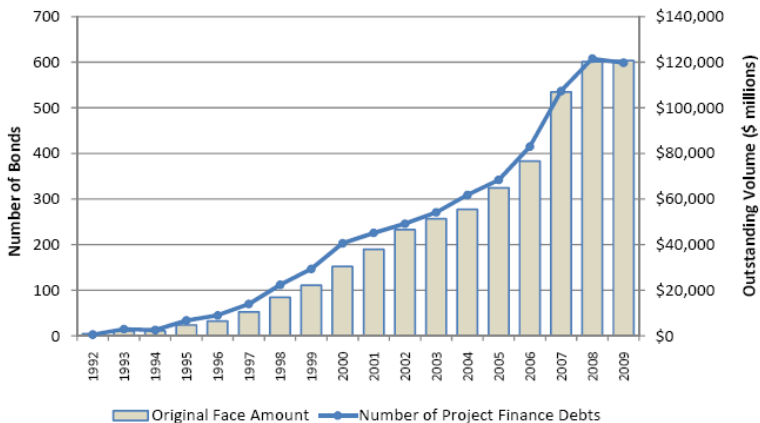
Project finance bonds by sector

Sector	2005	2006	2007	2008	2009	Total 2005 to 2009	Percent of Total	4-Year CAGR
Infrastructure	\$8,645	\$15,354	\$16,423	\$6,940	\$1,416	\$48,778	47.7%	-36%
Oil & Gas	9,677	9,074	2,100	4,537	5,497	30,885	30.2	-13
Power	7,261	2,453	7,000	378	1,353	18,445	18.0	-34
Leisure & Property	0	512	1,300	0	0	1,812	1.8	NA
Mining	718	680	0	30	0	1,428	1.4	-100
Petrochemical	<u>400</u>	<u>600</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>1,000</u>	<u>1.0</u>	<u>-100</u>
Total	\$26,701	\$28,673	\$26,823	\$11,885	\$8,266	\$102,348	100.0%	-25%

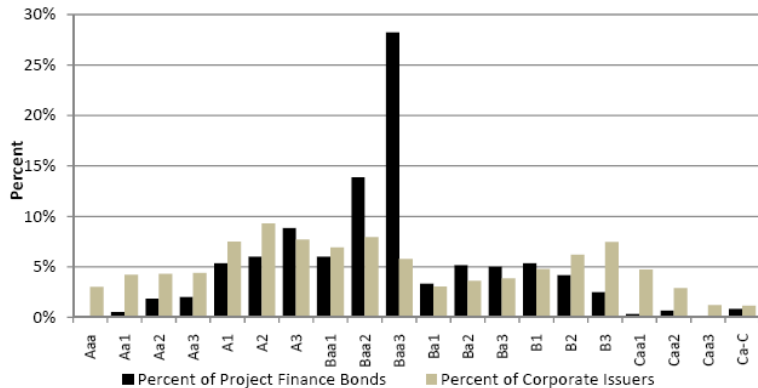
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Note: For 2008 & 2009, Infrastructure sector largely includes transportation and social infrastructure projects (e.g., school, hospitals).

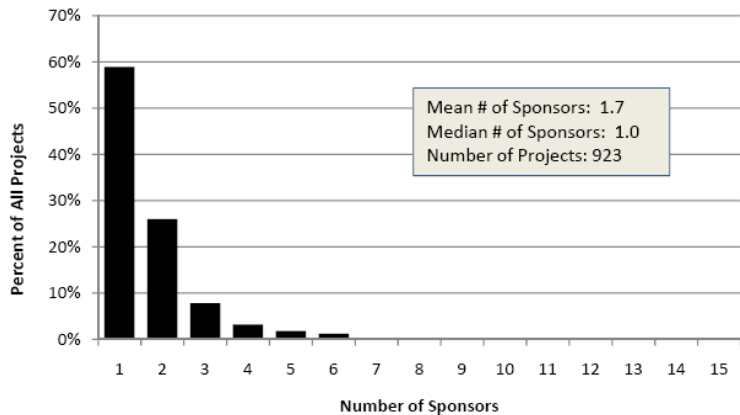
Number of project bonds outstanding and total volume



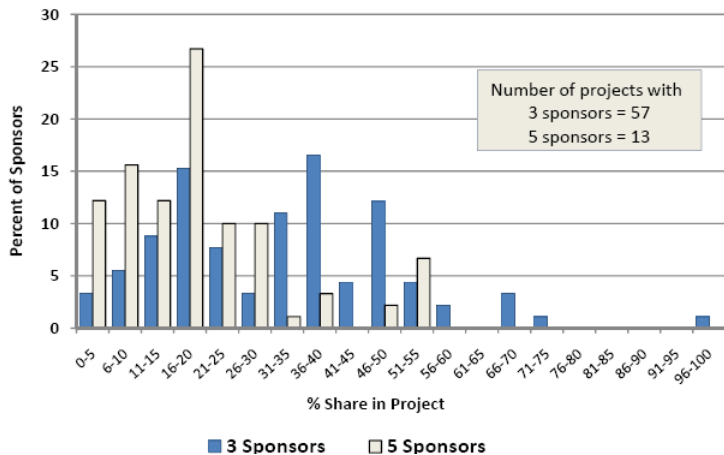
Ratings of project bonds versus corporate bonds



Distribution of projects by number of sponsors



Distribution of ownership shares



Size distribution by year (by number of projects)

Size	2005	2006	2007	2008	2009	Total
< \$50 million	23%	22%	14%	19%	17%	19%
\$50-\$100	17	18	21	15	17	17
\$101-\$500	40	40	41	43	44	42
\$501-\$1 billion	12	10	14	11	10	11
> \$1 billion	<u>7</u>	<u>10</u>	<u>10</u>	<u>12</u>	<u>12</u>	<u>11</u>
Total	100%	100%	100%	100%	100%	100%

Note: Total number of projects = 2,465 (projects reaching financial close).

Size distribution by year (by value of projects)

Size	2005	2006	2007	2008	2009	Total
< \$50 million	2%	1%	1%	1%	1%	1%
\$50-\$100	3	3	3	2	3	3
\$101-\$500	27	19	19	23	22	21
\$501-\$1 billion	25	16	18	16	15	18
> \$1 billion	<u>43</u>	<u>61</u>	<u>59</u>	<u>58</u>	<u>59</u>	<u>57</u>
Total	100%	100%	100%	100%	100%	100%

Note: Total value of projects = \$1,148.6 billion.

Leverage ratios by sector

Sector	Total Percent	Number of Projects	Percent by Number	Debt-to-Total Capital	
				Mean	Median
Power	100%	454	39%	77%	79%
Leisure & Property	100	209	18	79	85
Transportation	100	190	17	75	76
Oil & Gas	100	84	7	74	73
Industrial	100	52	5	68	66
Petrochemical	100	45	4	70	70
Mining	100	43	4	64	64
Water & Sewage	100	29	3	77	81
Telecom	100	20	2	60	63
Waste & Recycling	100	18	1	81	85
Agriculture & Forestry	100	5	0	70	70
Total	100%	1,149	100%	76%	77%

Leverage ratios by sector

Sector	Debt-to-Total Capitalization Ratio					
	< 50%	50%-59%	60%-69%	70%-79%	80%-89%	≥90%
Power	3%	6%	13%	29%	30%	20%
Leisure & Property	5	5	12	15	23	40
Transportation	4	9	16	29	23	19
Oil & Gas	1	10	24	26	21	18
Industrial	4	17	44	17	6	12
Petrochemical	4	11	27	42	13	2
Mining	16	26	21	16	12	9
Water & Sewage	7	1	7	21	31	31
Telecom	15	30	20	10	25	0
Waste & Recycling	0	6	6	17	56	17
Agriculture & Forestry	<u>0</u>	<u>0</u>	<u>40</u>	<u>60</u>	<u>0</u>	<u>0</u>
Total	4%	8%	16%	25%	25%	22%

Length of construction, off-take and concession contracts

	Number of Years						Mean	Median
	≤ 1.0	1.1 to 2.0	2.1 to 3.0	3.1 to 4.0	4.1 to 5.0	> 5.0		
Number	90	101	67	18	8	15	2.2	2.0
Percent	30%	34%	22%	6%	3%	5%		

	Number of Years						Mean	Median
	≤ 5	6 to 10	11 to 15	16 to 20	21 to 25	> 25		
Number	26	41	89	112	71	16	17.6	20.0
Percent	7%	12%	25%	32%	20%	4%		

	Number of Years						Mean	Median
	≤ 10	11 to 20	21 to 30	31 to 40	41 to 50	> 50		
Number	22	132	443	101	25	21	28.7	30.0
Percent	3%	18%	59%	14%	3%	3%		

Lead arrangers (bank financing)

2009 Rank	Name	2008 Rank	2009		
			Number of Facilities	Amount Underwritten	Percent of Total
1	State Bank of India	3	37	\$19,945	14.3%
2	Calyon	5	80	7,360	5.3
3	BNP Paribas	2	63	5,836	4.2
4	Société Générale	12	51	4,284	3.1
5	Sumitomo Mitsui Banking Corp	4	40	4,025	2.9
6	Industrial Development Bank of India	45	11	3,989	2.9
7	Mitsubishi UFJ	7	52	3,876	2.8
8	Banco Bilbao Vizcaya Argentaria	13	54	3,641	2.6
9	Santander	11	55	3,344	2.4
10	Mizuho Financial Group	15	26	2,819	2.0
	Other		<u>N/A</u>	<u>80,067</u>	<u>57.5</u>
	Total Market		461	\$139,186	100.0%

Lead managers (bond issues)

2009 Rank	Name	2008 Rank	2009		
			Number of Issues	Amount Underwritten	Percent of Total
1	Deutsche Bank	1	3	\$1,560	18.9%
2	Royal Bank of Scotland	4	3	1,246	15.1
3	Credit Suisse	6	3	941	11.4
4	Citigroup	9	1	743	9.0
4	Hong Kong and Shanghai Banking Corp.	18	1	743	9.0
6	Royal Bank of Canada	12	3	713	8.6
7	BNP Paribas	7	1	312	3.8
7	Abu Dhabi Commercial Bank	–	1	312	3.8
7	National Bank of Abu Dhabi	–	1	312	3.8
10	Bank of America	–	1	250	3.0
	Other		<u>N/A</u>	<u>1,134</u>	<u>13.7</u>
	Total Market		31	\$8,266	100.0%

Lead arrangers infrastructure

2009 Rank	Name	2008 Rank	2009		
			Number of Facilities	Amount Underwritten	Percent of Total
1	Calyon	4	61	\$4,469	4.3%
2	Grupo Santander	N/A	61	3,433	3.3
3	Banco Bilbao Vizcaya Argentaria	6	49	3,382	3.2
4	BNP Paribas	2	49	3,215	3.1
5	Sumitomo Mitsui Banking Corp.	8	37	3,189	3.0
6	Société Générale	N/A	43	3,001	2.9
7	West LB	10	37	2,450	2.3
8	Caixa Geral de Depositos	N/A	19	2,229	2.1
9	State Bank of India	N/A	13	2,176	2.1
10	Bank of Tokyo – Mitsubishi UFJ	7	<u>32</u>	<u>2,146</u>	<u>2.0</u>
	Subtotal		401	29,690	28.2
	Other			75,462	71.8
	Total Market		N/A	\$105,152	100.0%

Lead managers infrastructure

2009 Rank	Name	2008 Rank	2009		
			Number of Issues	Amount Underwritten	Percent of Total
1	Credit Suisse	2	4	\$1,651.6	19.9%
2	Citigroup	N/A	1	743.3	8.9
2	HSBC	5	1	743.3	8.9
4	Royal Bank of Scotland	N/A	3	704.2	8.5
5	FI-FGTS*	N/A	1	518.0	6.2
6	Bank of America	N/A	2	408.3	4.9
7	Deutsche Bank	7	2	391.7	4.7
8	National Bank of Abu Dhabi	N/A	1	312.5	3.8
9	Abu Dhabi Commercial Bank	N/A	1	312.5	3.8
10	BNP Paribas	3	1	312.5	3.8
	Subtotal		17	6,097.9	73.3
	Other		N/A	2,221.2	26.7
	Total Market		N/A	\$8,319.1	100.0%

Financial highlights

- Highly concentrated equity and debt ownership
 - One to three equity sponsors
 - Syndicate of banks and/or financial institutions provide credit
 - Governing board mainly affiliated directors from sponsors
- Extremely high debt levels
 - Mean debt of 70% and as high as nearly 100%
(as compared to 30% of similar-sized investments)
 - Rest sponsors' equity or subordinated debt (quasi equity)
 - Debt is non-recourse to the sponsors
 - Debt service depends exclusively on project revenues
 - Has higher spreads than corporate debt

Project finance versus corporate finance

- Capital Structure irrelevant in absence of frictions (M&M)
- But, project financing...:
 - Longer to structure than equivalent size corporate finance
 - Higher transaction costs due to creation of an SPV
 - Debt substantially more expensive due to non-recourse nature
 - Extensive contracting restricts managerial decision making
 - Greater disclosure of proprietary information and strategic deals
- ... then why do corporations...
 - Set up independent companies to undertake mega projects?
 - Financed with 70% debt (substantial risks and minimal tax shields)?

A summary for why do we..

- ... use project finance?
 - Reduce agency costs
 - Minimise partner's/host country opportunistic behaviour
 - Avoid risk-contamination
 - Other
- ... use high debt levels?
 - Agency costs of equity versus agency costs of debt

Motivation (1): agency costs

- Potential managerial mismanagement:
 - High levels of free cash flow (e.g. power plant, mine)
 - Wasteful expenditures and sub-optimal investments
 - Monitoring devices such as takeovers, product competition absent
- Project financing reduces discretion:
 - Create a mechanism for allocation of cash flows (“cash flow waterfall”)
 - Reduce free cash flow through high debt service
 - Senior (hard) bank debt forces pay outs in early years
 - Separate ownership: single cash flow stream, easier monitoring
 - Incentive to generate free cash is higher (no safety net)
- ...and concentrated equity and bank loans provide monitoring

Motivation (2): opportunistic behaviour by trading partners

- The hold-up problem:
 - Large capital investment with little value outside relationship (e.g. build power plant close to coal mine)
 - Vulnerable to expropriation and ex-post renegotiation
 - Standard vertical integration solution may be absent
- Project financing:
 - Long term contracts (supply and purchase) before investment
 - Joint ownership of asset control and cash flow rights aligns incentives
- ... and high debt levels avoids opportunism because of costly default

Motivation (3): opportunistic behaviour by governments

- Total or partial expropriation by host government:
 - Asset seizure or increased tax/royalties (difficult to highlight)
 - Ex-ante increase in risk and required return
- Project financing...:
 - Makes expropriation more visible (company is stand alone)
 - High payments leaves less cash on the table (high leverage)
 - Reduces accounting profits and local opposition (high leverage)
 - Allows multilateral lenders (World Bank) (only lend to standalone)
 - Non-recourse debt have tougher covenants

Motivation (4): risk contamination

- Sponsor and project can risk-contaminate each other:
 - A high risk project can drag a healthy corporation into distress
 - Or, cash flow volatility increases and firm value decreases
 - Conversely, failing corporation can drag down healthy project
- Non-recourse project finance:
 - Sponsor exposed to loss of equity commitment only
 - Sponsors can share project risk with other sponsors
 - Capital pooling reduces individual distress cost (smaller investment)

Motivation (5): Other

- Taxes
- Location:
 - Equity not easily available in emerging markets
 - Investment-specific equity from abroad hard to get
 - Debt seems the best option
- Heterogeneous partners:
 - Financially weak sponsor needs project finance to participate
 - Provides project with the benefits of project finance
 - The bigger partner if using corporate finance can be seen as free-riding
 - The bigger partner is better equipped to negotiate terms with banks than the smaller partner and hence has to participate in project finance

Why do we use high debt levels?

- High agency costs of equity
 - managerial discretion
 - expropriation
 - ...
- Low agency costs of debt (low investment opportunities)
 - debt overhang
 - risk shifting
- Debt provides a governance mechanism

Which type of debt?

- Bank Loans:
 - Cheaper to issue
 - Tighter covenants and better monitoring
 - Easier to restructure during distress
 - Lower duration forces managers to disgorge cash early
- Project Bonds:
 - Lower interest rates (given good credit rating)
 - Less covenants and more flexibility for future growth
- Agency Loans:
 - Reduce expropriation risk.
 - Validate social aspects of the project
- Insider debt:
 - Reduce information asymmetry for future capital providers

Example 1: BP-Amoco

- Develop Caspian oilfields in Azerbaijan (1999)
- Issues:
 - Size of the project: \$10bn.
 - Political risk of investing in Azerbaijan, a new country
 - Risk of transporting oil through unstable and hostile countries
 - Industry risks: price of oil and estimation of reserves
 - Financial risk: Asian crisis and Russian default

Project finance highlights

- Risk sharing:
 - Increase number of participants to 11 (decrease exposure)
 - Partners, though, heterogeneous in financial size/capacity
- Expropriation risk:
 - Get sponsors from major superpowers to avoid opportunism
 - Get IFC and EBRD (multilateral agencies) into loan syndicate
- Project risk:
 - Staged investment: 1st phase (\$1.9bn) and 2nd phase (\$8bn)
 - Decreases cost of debt in the 2nd phase

Example 2: Australia Japan Cable

- Project characteristics:
 - 12,500km cable from Sydney to Japan via Guam (\$520m)
 - Key sponsors: Japan Telecom, Telstra and Teleglobe
 - Asset life of 15 years
- Key Issues:
 - limited growth potential
 - market risk from fast changing telecom market
 - risk from project delay
 - specialized use asset
 - significant Free Cash Flow

Project finance highlights

- Avoid hold up problem through governance structure:
 - Long term contracts with landing stations.
- Capital structure:
 - Joint equity ownership with Telstra and landing station owners
 - High project leverage of 85%
 - Shares project risk with debt holders
 - enforces contractual agreement by pre-allocating revenue waterfall
 - short term debt allow for early disgorging of cash

In sum

- Project finance involves...
 - creation of a legally independent project company
 - financed with nonrecourse debt (and equity from sponsoring firms)
 - to finance investment in single-purpose capital asset
- ... and can solve agency and risk contamination problems
- As a result, becoming ever more important:
 - To finance large infrastructure projects (e.g. power plants)
- Cash-strapped governments worldwide also likely to use
 - public-private partnerships or public funding initiatives
 - to finance roads, prisons, schools, hospitals,...

Current trends

- Privatisation:
 - Spread worldwide including developing countries
 - Newly privatised companies step in, using project finance (YPF)
- Deregulation in key industrial sectors such as power and telecoms:
 - Project finance often used to finance large capital investments
- Globalisation:
 - Increased minimum efficiency scales in many industries
 - Resource depletion forces search in more remote and risky locations
- Financial crisis:
 - Stimulus packages emphasising infrastructure investment

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- Guasch, J. Luis, 2004, Granting and Renegotiating Infrastructure Contracts: Doing It Right, WBI Development Series, The World Bank, (Washington, DC).
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Appendix

Co-insurance versus risk contamination

Banal-Estanol and Ottaviani, 2010

- “Merging [financing jointly] decreases the probability of financial distress, other things equal. If it allows increased borrowing, and increased value from the interest tax shields, there can be a net gain to the merger” [Brealey, Myers, and Allen, 2006, page 880]
- Joint financing reduces expected bankruptcy costs & eases financing (Lewellen, 1971) (**co-insurance effect**)
- Separate financing “reduces the possibility of **risk contamination**” (Esty, 2003)
- **Objective: when co-insurance dominates risk contamination?**

Model

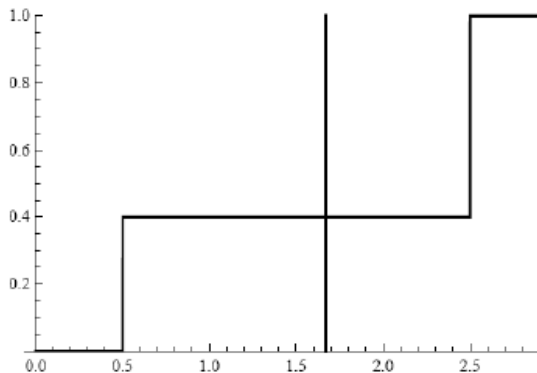
- *Risk neutral* firm has 2 ex-ante identical and independent projects.
 - Each requires fixed investment outlay of $I = 1$ at $t = 0$
 - return at $t = 1$: $r_H > 1$ with prob p and $r_L < 1$ with prob $1 - p$
 - has positive NPV: $pr_H + (1 - p)r_L > 1$
- Firm (without internal funds) must raise external financing at $t = 0$
 - Competitive *risk neutral* credit market— loans at zero expected return
 - Repayment r_j^* at $t = 1$, comprising interest and principal, on loan j
- Default if r_j^* not repaid, in which case proceeds accrue to creditor
 - Costly bankruptcy—fraction β of return recovered by lender, $1 - \beta$ lost
- Can projects be financed? Should be financed jointly or separately?

Separate finance

- Promised repayment r_i^* must satisfy $r_L < 1 \leq r_i^* < r_H$, and hence

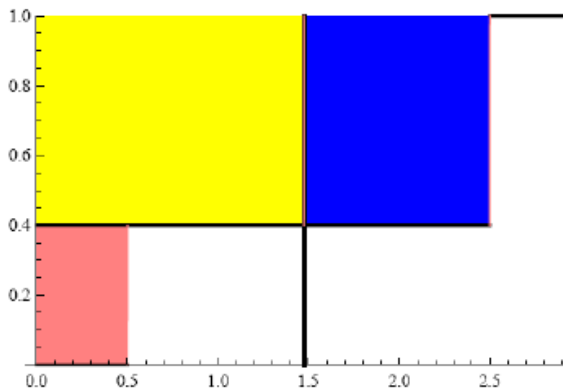
$$r_i^* = \frac{1 - (1 - p)\beta r_L}{p} < r_H$$

Separate finance



$$r_L = 0.5, r_H = 2.5, p = 0.6$$

Separate finance



NPV: colored area; $E(\text{creditor returns}) = \text{yellow} + \beta (\text{pink})$

$E(\text{net firm returns}) = \text{blue}$

r_i^* s.t. $\text{yellow} + \beta (\text{pink}) = 1$, $E(\text{bankruptcy costs}) = (1 - \beta)(\text{pink})$

Joint finance

Bankruptcy if a high return (r_H) on one & low (r_L) on the other?

- No, if $1 < r_m^* < (r_H + r_L)/2$ (r_m^* repayment *per project*). Possible iff

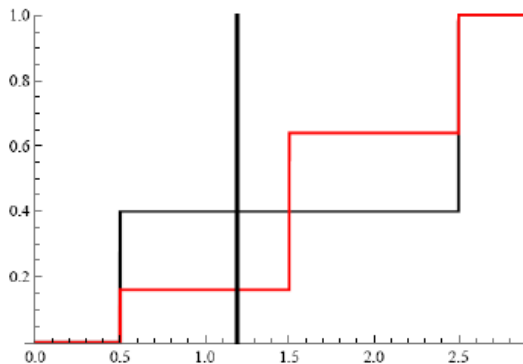
$$r_m^* := \frac{1 - (1 - p)^2 \beta r_L}{1 - (1 - p)^2} < \frac{r_H + r_L}{2}.$$

- Less bankruptcy than with separate finance
- Yes, if $(r_H + r_L)/2 < r_m^* < r_H$. Joint financing is possible iff

$$r_m^{**} := \frac{1 - (1 - p) \beta (pr_H + r_L)}{p^2} < r_H.$$

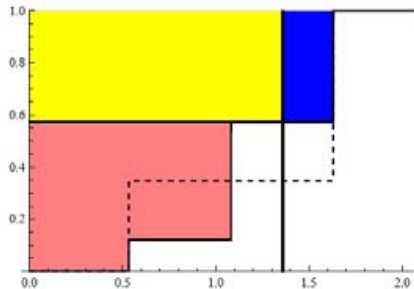
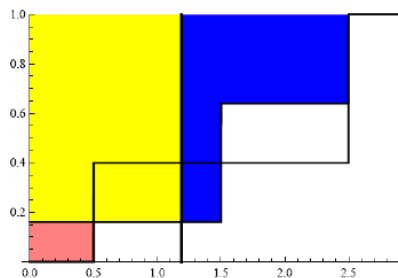
- More bankruptcy than with separate finance

Joint finance



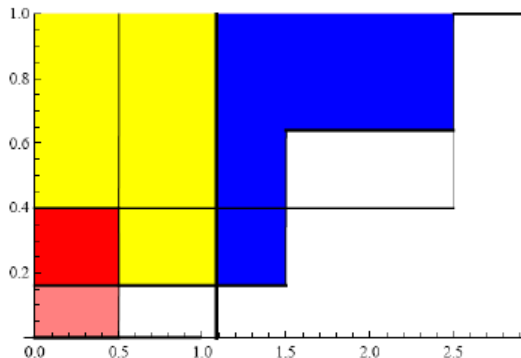
Anti-clockwise rotation of return distribution around crossing point

Joint finance



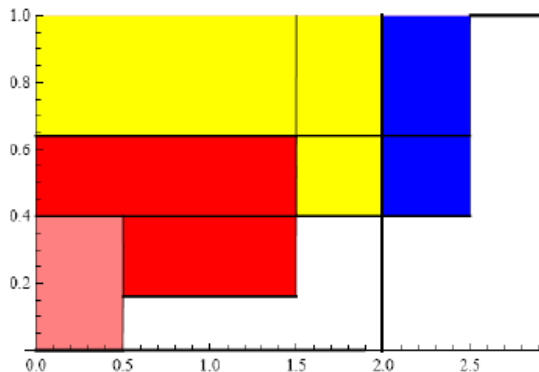
Key: can the joint rate be obtained below the crossing point?

Coinsurance effect



Yes, finance jointly! Surplus = $(1 - \beta) \cdot \text{red area} = (1 - \beta)p(1 - p)r_L$

Risk contamination effect



No, finance separately! Surplus = $(1 - \beta) \cdot \text{red area} = (1 - \beta)p(1 - p)r_H$

Separate or joint financing

Key condition for borrower to prefer joint to separate financing:

$$\text{("joint" repayment rate) } r_m^* := \frac{1 - (1 - p)^2 \beta r_L}{1 - (1 - p)^2} < \frac{r_H + r_L}{2} \text{ (crossing point)}$$

NO DEFAULT FOR INTERMEDIATE RETURNS!

Comparative Statics Predictions

- Higher **bankruptcy costs** (lower β):
 - more difficult to finance, both jointly and separately
 - separate financing preferred to joint for a larger parameter region

- Intuition:
 - r_m^* decreasing in β ; crossing point unaffected by β
(pink area discounted more)

- Evidence (Subramanian et al., 2009):
 - Project finance more likely than corporate finance in countries with (i) less efficient bankruptcy procedures and (ii) weaker creditor rights in bankruptcy

Comparative Statics Predictions

- Higher **probability of high return** (higher p):
 - easier to finance, both jointly and separately
 - joint financing preferred to separate for a larger parameter region
- Intuition:
 - r_m^* decreasing in p ; crossing point unaffected by p (horizontal lines down)
- Conflicting evidence but Schoar (2002) finds:
 - productivity of plants in conglomerate firms are higher than in stand-alone firms

Comparative Statics Predictions

- **Higher variability** (MPS with increase in r_H & reduction in r_L):
 - separate more preferred iff not too positively skewed ($p > \bar{p}$, $\bar{p} < 1/2$)
- Intuition:
 - (i) r_m^* decreases in r_L —favoring separate financing
 - (ii) crossing point (a) unchanged when $p = 1/2$, (b) decreased for $p > 1/2$ —favoring separate financing, (c) increased for $p < 1/2$ —favoring joint financing
- Evidence (Kleimeier and Megginson, 2000)
 - project finance more likely in riskier countries

Comparative Statics Predictions

- Mean-preserving **increase in negative skewness** ($\downarrow r_L, \uparrow p$)
 - separate financing preferred for a larger parameter region iff r_H sufficiently high
- Intuition:
 - (i) r_m^* decreases—favoring joint financing
 - (ii) crossing point reduced—favoring separate financing
 - for high r_H , effect (ii) dominates (as r_L must be reduced by more) (yellow area's width \uparrow and height \downarrow while pink area \downarrow)
- Evidence (Esty, 2002, 2003)
 - project finance is used when returns have large negative skewness (due e.g. to environmental and expropriation risks)

Extensions

- Higher **correlation**...
 - financing separately not affected
 - financing jointly before crossing point more difficult (line up)
 - financing jointly before crossing point easier (line down)
 - separate financing preferred for a larger parameter region
- For a sufficiently **large number of projects**:
 - A bundle incorporating all projects can be financed
 - Returns from this bundle are close to first best (“approx.” optimal)