

Risk, Return and Cash Flow Characteristics of Infrastructure Fund Investments

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CEFS-Infrastructure Finance Initiative –
sponsored by the European Investment Bank

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Hypotheses

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Summary

Motivation

- **Infrastructure financing gap between demand and supply**
 - Maintenance and replacement of existing infrastructure assets
 - New infrastructure needs due to population growth, technological development, consumers` preferences
 - Tightening governmental budget restrictions
- ➔ OECD Study: USD 53-70tr needed between 2005 and 2030
- **Private capital available**
 - Pension funds and insurances are largest investors (AUM USD 25.3tr for OECD pension funds) and have started shifting assets towards infrastructure
 - **Infrastructure funds**
 - 'New' way to provide private financing for illiquid and capital-intensive assets
 - Most common way for private infrastructure investing (currently over 71 funds, first vintage year in 1993, average size of about USD3.3bn)

- ➔ Infrastructure Funds might be able to narrow the financing gap to a large extent due to available capital
- ➔ But are they good investments for institutional investors at all???

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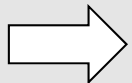
Characteristics of Infrastructure Investments

Infrastructure investments are said to offer

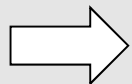
- Long-term assets
- Inflation-linked cash flows
- Cash flows uncorrelated to other asset classes and macroeconomic cycles
- Stable cash flows
- Low risk investments

Why??

- Regulated markets
- Monopolistic markets
- Long-lived assets
- Real assets with stable demand



Many studies from practitioners cite these intuitive arguments



However, empirical and academically sound analyses are still missing
(except for listed infra stocks)

Infrastructure-specific Hypotheses for Our Empirical Work:

Infrastructure Fund Investments offer

1. Long-term assets
2. Inflation-linked cash flows
3. Cash flows uncorrelated to public equity markets and macroeconomic cycles
4. Stable cash flows
5. Low risk investments
6. Different risk and return profiles for Greenfield and Brownfield investments
7. Exposure to capital inflows into the market just like other assets (‘bubble’ argument)

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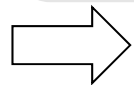
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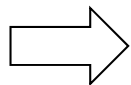
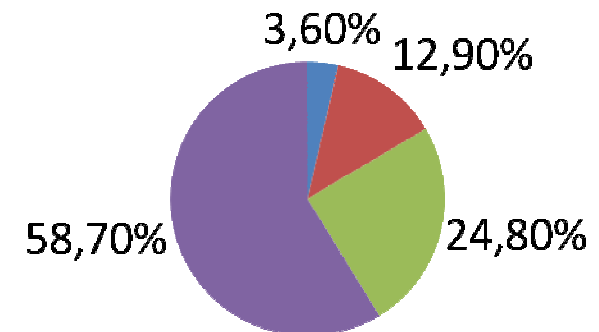
Database

- Contains over 25'000 deals (direct investments) done by unlisted PE-type funds between Jan 1971 and Sep 2009 worldwide (provided by project partner CEPRES)
- Information on cash flows of equity deals made by unlisted funds – anonymized!
- Eliminate partially realized investments (only full history of cash flows considered)
- Split into infrastructure and non-infrastructure deals according to the network-based CEFS definition of infrastructure:



363 infrastructure deals of which are:

Alternative Energy	(3.6%)
Renewables	
Transport	(12.9%)
Aviation, Railways, Roadsystems	
Natural Resources & Energy	(24.8%)
Oil	
Gas	
Teleheating	
Electricity	
Telecommunication	(58.7%)
Datatransmission	
Navigation Systems	



11'223 non-infrastructure deals

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Empirical Evidence – Descriptive Statistics

- Infra deals do not show a longer **duration of investment** than non-infra deals:

H1

	Infra Deals	Non-Infra Deals
Duration of Investment (in Months)	48.9	50.83

- Infra deals show a much lower default frequency than non-infra deals:

H5

Historical Defaults in %	Infra Deals	Non-Infra Deals
multiple=0	14.60%	18.84%
multiple<1	33.06%	46.74%

- Brownfield investments consistently show a lower default frequency than Greenfield investments:

H6

Historical Defaults in %	Greenfield		Brownfield	
	Infra	Non-Infra	Infra	Non-Infra
multiple=0	22.92%	25.93%	5.26%	9.00%
multiple<1	45.31%	58.95%	19.30%	30.20%

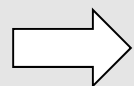
Empirical Evidence – Performance

- Descriptive statistics show that infra and non-infra deals exhibit a clearly different performance. This also holds for the Greenfield and Brownfield subsamples

	Infra Deals	Non-Infra Deals
average IRR	66.88%	20.15%
average multiple	2.29	2.08

	Greenfield		Brownfield	
	Infra	Non-Infra	Infra	Non-Infra
average IRR	45.73%	6.27%	90.68%	39.54%
average multiple	2.17	2.13	3.27	2.92

- Also **OLS regressions** for the whole sample show that infra deals have a (highly) significantly larger IRR than non-infra deals



What are the drivers of performance and how do they differ between infra and non-infra deals?

Note: IRR-outliers are eliminated at the 95%-quantile

Model	IRR (full sample)
	coefficients (t-statistic)
LN_GENERATION	0.142 (0.21)
LN_DURATION	27.11 *** (41.64)
INFLATION	-1.627 (-1.33)
GDP	2.429 *** (3.65)
PUBL_MKT_PERF	-0.005 (-0.76)
LN_SIZE	1.892 *** (4.33)
ASIA	4.953 * (1.96)
EUROPE	21.353 *** (10.48)
INFRA	12.769 *** (3.77)
BROWN	22.415 *** (15.54)
LN_NUMBER	-30.602 *** (-34.92)
RISKFREEERATE	-3.942 *** (-11.71)
LN_COMMITTED_CAP	-13.484 *** (-16.22)
# observations	9295
max VIF	2.41
Adj.R2	34.24

Empirical Evidence –Hypotheses

- A split into an infra- and non-infra subsample shows:

- H2** No inflation-linked cash flows
- H3** Infra deals are uncorrelated to macro development but positively to public equity markets
- H6** Brownfield offer a higher IRR than Greenfield deals(!)
- H7** Infra is not influenced by capital inflow into PE market

Also:

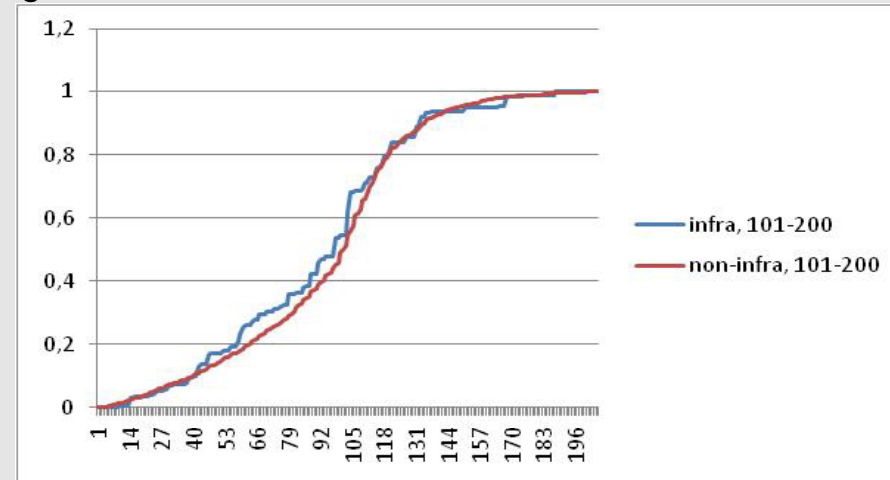
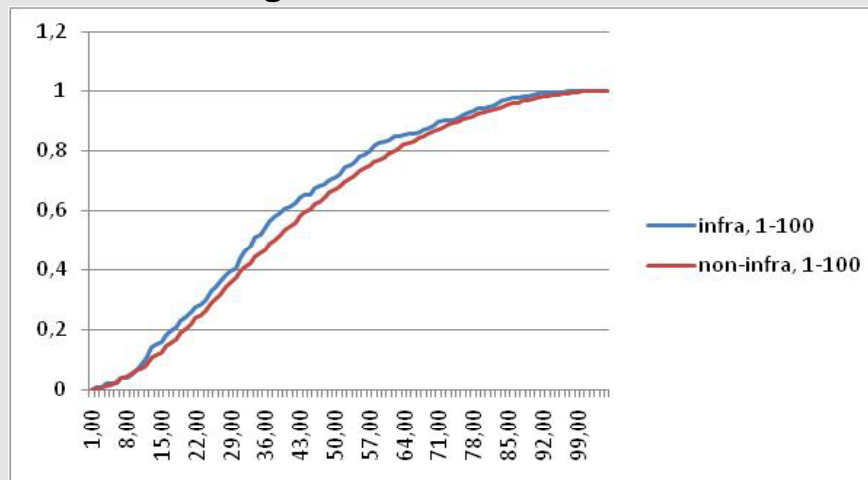
- Size matters for non-infra but not for for infra deals
- Europe offers highest IRRs
- Transportation-IRR is highest in infra
- Higher Leverage for infra deals?

Note: IRR-outliers are eliminated at the 95%-quantile

Modell	IRR (infra deals) coefficients (t-statistic)	Modell	IRR (non-infra deals) coefficients (t-statistic)
LN_GENERATION	1.827 (0.50)	LN_GENERATION	0.374 (0.55)
LN_DURATION	26.613 *** (7.67)	LN_DURATION	27.027 *** (40.77)
INFLATION	-4.792 (-0.74)	INFLATION	-1.176 (-0.94)
GDP	2.205 (0.69)	GDP	2.534 *** (3.62)
PUBL_MKT_PERF	0.124 *** (2.82)	PUBL_MKT_PERF	-0.009 (-1.21)
LN_SIZE	1.165 (0.62)	LN_SIZE	1.845 *** (4.08)
ASIA	-3.256 (-0.27)	ASIA	5.225 ** (2.02)
EUROPE	33.493 *** (3.14)	EUROPE	20.496 *** (9.80)
NAT_RES_ENERGY	-1.570 (-0.21)	NAT_RES_ENERGY*	8.73 (1.07)
TRANSPORT	30.872 *** (2.74)	INDUSTRIAL*	4.77 *** (3.30)
BROWN	23.312 *** (3.38)	BROWN	21.207 *** (13.96)
LN_NUMBER	-27.491 *** (-6.77)	LN_NUMBER	-30.690 *** (-34.12)
RISKFREEERATE	-4.216 ** (-2.30)	RISKFREEERATE	-3.976 *** (-11.6)
LN_COMMITTED_CAP	-4.503 (-1.02)	LN_COMMITTED_CAP	-13.445 *** (-15.73)
<i>*further industry dummies included</i>			
# observations	297	# observations	8998
max VIF	3.44	max VIF	2.44
Adj.R2	40.45	Adj.R2	34.16

Empirical Evidence – How to measure stability of cash (out)flows?

- Assumption: cash flows of infra- and non-infra investments follow a certain distribution
- Average** cumulative outflows relative to average total outflow over time:



- Infra investments seem to payout their cash distributions quicker than non-infra investments (not statistically significant)

- Taking the **variance** for each deal around the mean (from above) expresses the stability / variability of cash (out)flows:

INFRA_VAR	1-100	101-200	NON_INFRA_VAR	1-100	101-200
mean	0.1344	0.1128	mean	0.1325	0.1035

- From these descriptive statistics, there is no real indication that infra investments do offer more stable cash (out)flows than non-infra investments.

H4 Also in a OLS regression no statistically significant difference between infra and non-infra deals can be found

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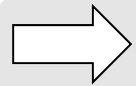
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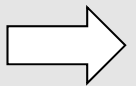
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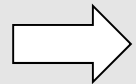


What we could show:

- Infra deals show **only a few infra characteristics** frequently stated (such as no correlation to macroeconomic development, low default probability)
- ‚Infra-myths‘ that could NOT be found: long-term (PE –type funds!), inflation-linked and stable cash flows that are uncorrelated to public equity markets
- However, we found **non-standard properties** that could point to special economic characteristics of infra deals:
 - Higher IRR despite lower risk
 - Not dependent on size (monitoring implications by manager)
 - No exposure to capital inflows in PE market (for time considered!)



Implication: infrastructure fund investments do have special characteristics that are of interest for institutional investor and thus could help narrowing the infrastructure financing gap



Remaining work:

- How about debt or direct infrastructure investments, PPPs?
- Can similar results be obtained from listed infrastructure funds as well?

Thank you for your attention!

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