

Webinar Series 2021:

Are Institutional Investors Using the Right Structure to Invest in Infrastructure

Tuesday, January 19, 2021; 10:00am – 11:00am ET | 3:00pm – 4:00pm GMT



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Are Institutional Investors Using the Right Structure to Invest in Infrastructure?

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Motivation

Organizations highlighting gap between demand for infrastructure and provision of capital:

- Infrastructure needs far exceed the resources that countries can hope to raise in a fiscally responsible and macroeconomically sustainable way (IMF 2020).
- Basic infrastructure in the U.S. owned by governments has aged dramatically (Bennett et al., 2020).
- World Bank: \$15 trillion gap between global need and projected infrastructure investment to 2040.
- Calls for recourse to private capital in infrastructure (G20 Global Infrastructure Initiative, 2017).

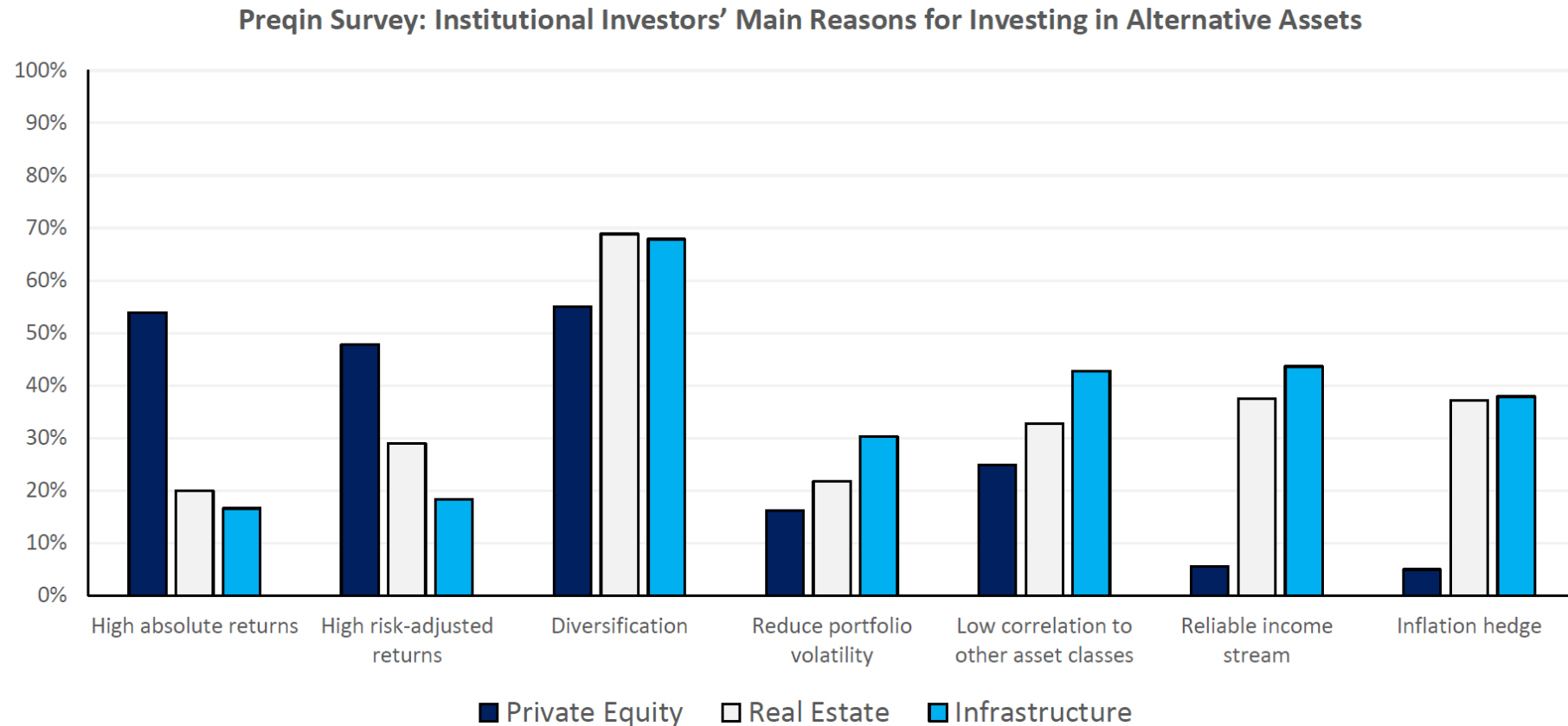
Institutional investors have become more active in supplying capital to infrastructure:

- LP: CalSTRS is doubling its allocation to infrastructure from 2% to 4% of its \$250 billion in assets; Norwegian SWF will start investing 2% (\$20 billion) in unlisted renewable energy infrastructure.
- GP: Global Infrastructure Partners IV final size \$22 billion and life span of 10 years (plus CalPERS separate account); Brookfield Infrastructure Fund IV final size \$20 billion and life span of 12 years.
- We estimate \$486 billion in AUM by closed infrastructure funds in 2019, up almost 8.5x since 2008.

Risk and return characteristics of infrastructure investments are not known.

What Do Institutional Investors Expect from Infrastructure?

- **Prequin Investor Outlook surveys** during 2017–2019 period; multiple answers are possible.
- **Expectations from infrastructure:** diversification, reliable income stream and inflation hedge. The expectations from infrastructure are different from the expectations from private equity.



What Do Institutional Investors Expect from Infrastructure?

Answer: Steady cash flows in the long run and diversification benefits.

- CalPERS website as of January 2020: “Infrastructure targets stable, defensive investments within the water, energy, waste, transportation, technology, and communications sectors.”
- Infrastructure investments are supposed to offer investors long-term, low-risk, inflation-protected and a-cyclical returns. As such, they would be a natural fit with long-lasting, often inflation-linked pension liabilities (see Della Croce, 2012).

Regulators are increasingly treating infrastructure more favorably than other private assets:

- Newly-added article 55f to the Swiss pension regulation BVV2: allows an allocation of up to 10% only to infrastructure and imposes a joint maximum cap of 15% to all other alternative assets.

Financial industry endorses these investor expectations and favorable regulations:

- Deutsche Bank Asset Management (2017): “Infrastructure offers relatively low long-term cash flow volatility compared with other asset classes and can also provide attractive, inflation-hedged returns.”
- J.P. Morgan Asset Management (2017) bases its case for infrastructure on “benefits of diversification, inflation protection, and yield, along with a strong focus on ESG principles.”

This Research

1. We study the payout profile and riskiness of infrastructure fund investments:

- Institutional investors gain exposure to infra predominantly through closed finite-horizon private funds.
- We reject the hypothesis that infrastructure investing as currently done by institutional investors on average delivers more stable, long-term and diversifying cash flows than other alternative asset classes.
 - Compared to buyout and RE funds, similar dispersion (and left tail) of performance.
 - Similar risk as the cash flows and returns also primarily reflect quick asset sales (not stable yields).
 - Infrastructure funds deliver procyclical cash flows sensitive to the business cycle.

2. We find heterogeneity in performance by investor type: Public investors underperform.

- Despite weak risk-adjusted returns and failure to match the supposed characteristics of infrastructure assets, closed funds have received more commitments over time, particularly from public investors.
- Public investors receive a 0.026 lower PME, a 1.810 percentage points lower IRR, and a 0.038 lower multiple of invested capital than private investors (robust to deal level controls for risk exposure).
- The underperformance is partially driven by the stronger social externalities of infrastructure assets:
 - ESG preferences and regulations explain 25-40% of the increased allocation to infrastructure and 30% of the underperformance of public investors.

Outline

- **The Characteristics of Infrastructure Funds and Deals.**
- Assessing the Risk and Return Properties of Infrastructure.
- Performance Differences Between Public and Private Investors.
- Implications for Institutional Investors.

Prequin Data and Investment Approaches in Infrastructure

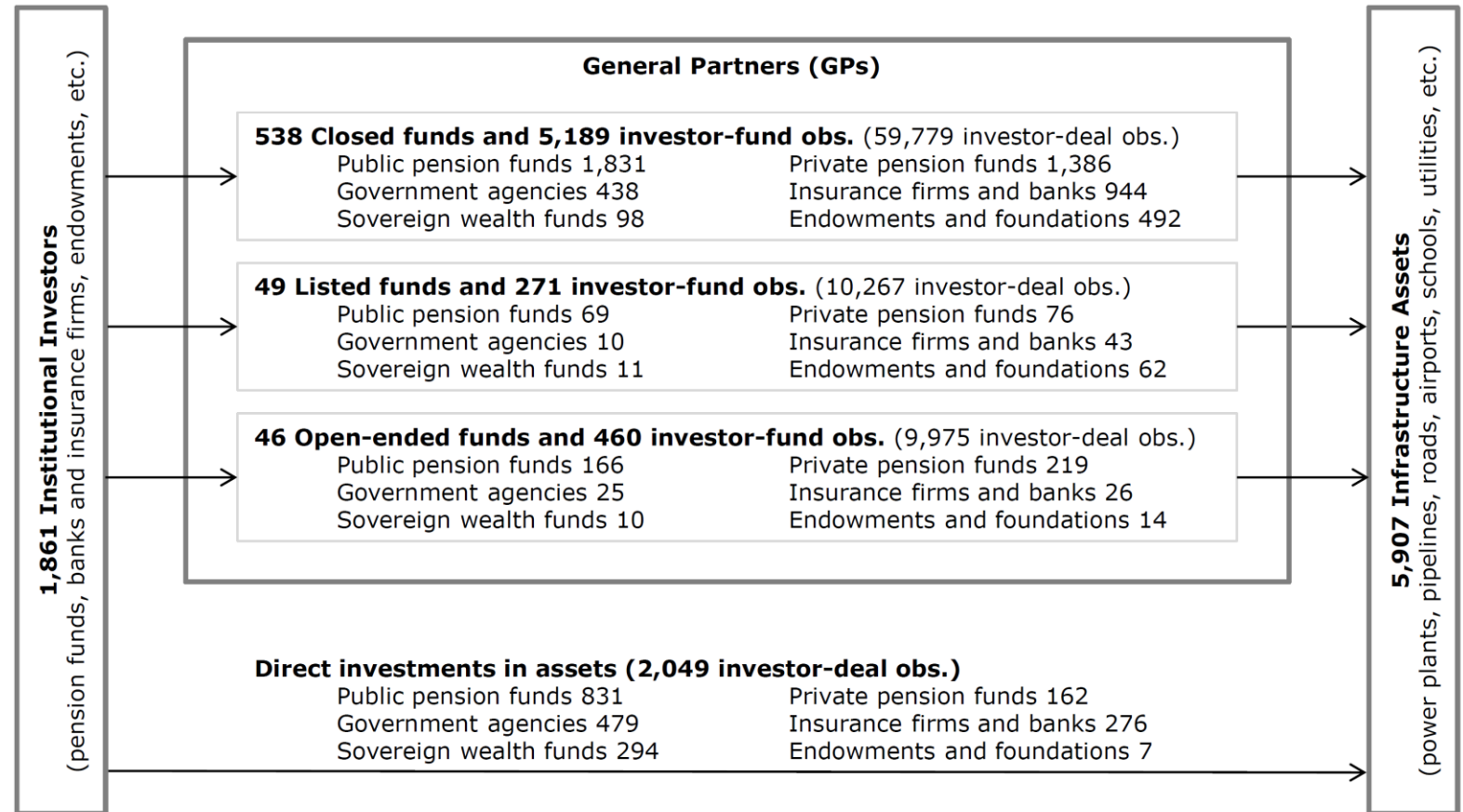
Institutional investors:

- Public: 409 public pension funds, 183 government agencies, and 37 sovereign wealth funds.
- Private: 569 private pension funds, 338 insurance firms and banks, 325 endowments and foundations.
- From 69 countries plus several international investors.

Time period 1991–2020 (but most of investments after 2008).

5,907 unique assets in 135 countries:

- Data on transaction dates, industry, project stage, concession backing, and ownership.



Main Industries and Assets within Infrastructure

Traditional energy (1,047 assets):
Coal and nuclear power plants, natural resources pipelines, refineries and storage facilities.



Social (821 assets):
Hospitals, senior homes, student accommodation, prisons, defense accommodation, and police stations.



Renewable energy (2,538 assets):
Wind, solar, hydro, biomass and geothermal power facilities.



Utilities (325 assets):
Water and sewage treatment plants, water and power distribution, sewage networks and waste management.



Transportation (894 assets):
Toll roads, parking lots, tunnels, bridges, railroads and rolling stocks, airports, and sea ports.



Telecom (261 assets):
Mobile phone, landline phone, wireless, internet, cable television and satellite networks.



Example: London City Airport (2006–2020)

Description: London City Airport is an international airport serving destinations across the UK and Europe. It is located close to Canary Wharf and the City of London, the centres of London's financial industry. In November 2006, Global Infrastructure Partners and AIG Financial Products acquired 100% of London City Airport via a 50:50 joint venture from Irish businessman Dermot Desmond.

Investor	Investment stake in % by date			
	Nov-06	Sep-08	Oct-08	Feb-16
Global Infrastructure Partners	50%	100%	75%	Exit
AIG Financial Products	50%	Exit		
Highstar Capital Fund III			25%	Exit
Alberta Investment Management Corporation (AIMCo)				25%
OMERS Infrastructure Management				25%
Ontario Teachers' Pension Plan				25%
Kuwait Investment Authority (Wren House Infrastructure Management)				25%

Global Infrastructure Partners is a closed fund with 80 investors.

Highstar Capital Fund III is a closed fund with 44 investors.

Deal Type and Investment Structure

We focus primarily on closed funds as this approach is the most relevant for investors:

- Compared to listed and open-ended funds, closed funds attract 10x more commitments.
- Closed funds raise capital from a broad investor base. Direct investing is not applicable to the majority of institutional investors and highly concentrated (top 20 investors account for 55% of observations).
- Closed funds create infrastructure as higher probability to invest in greenfield/brownfield projects.
- Closed funds have fewer co-investors and acquire higher inv. stake; direct deals provide deep pockets.

Panel A: Deal Project Stage and Industry								
	Greenfield	Brownfield	Secondary	Concession	Renewable Energy	Traditional Energy	Transport	Utilities
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Unconditional Prob.	0.252	0.084	0.664	0.160	0.358	0.173	0.196	0.065
Direct Deal	-0.050** [0.025]	-0.034*** [0.010]	0.083*** [0.029]	0.025 [0.025]	-0.115*** [0.037]	-0.031* [0.018]	0.118*** [0.025]	0.051*** [0.014]
Listed	-0.111*** [0.036]	-0.052*** [0.019]	0.165*** [0.042]	-0.021 [0.035]	0.107 [0.078]	-0.125*** [0.022]	-0.019 [0.035]	-0.030** [0.014]
Open Ended	-0.109*** [0.038]	-0.045*** [0.014]	0.157*** [0.042]	-0.049 [0.035]	0.106 [0.105]	-0.005 [0.035]	-0.006 [0.042]	0.034 [0.024]
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,665	8,649	8,665	8,651	8,591	8,652	8,651	8,595

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Performance Distribution: Infrastructure vs. Other Funds

Institutional investors expect long-term stable and predictable cash flows from infrastructure, so we look at:

- Standard deviation and performance distribution.
- Annual amounts of capital calls and distributions.

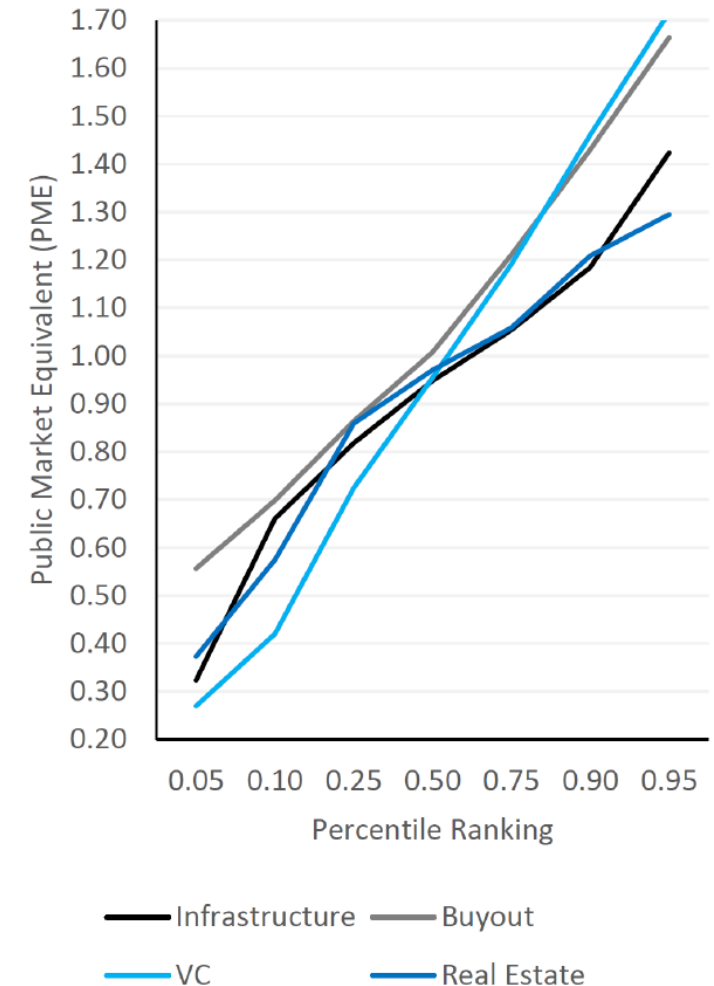
There are fewer infrastructure funds, but they are large:

- Mean size \$1.35 and median \$0.72 billion.
- Marginally above buyout; 2x larger than RE funds and 4x larger than VC funds.

In addition to low PME, infrastructure has also a negative GPME which implies an abnormal loss of \$0.257 per dollar invested.

	Mean			Standard Deviation		
	PME	IRR	Multiple	PME	IRR	Multiple
Infrastructure	0.93	9.92	1.34	0.31	13.53	0.49
Buyout	1.05	14.52	1.56	0.36	16.46	0.65
VC	0.99	13.33	1.74	0.56	22.52	2.66
RE	0.94	10.58	1.36	0.28	14.71	0.51

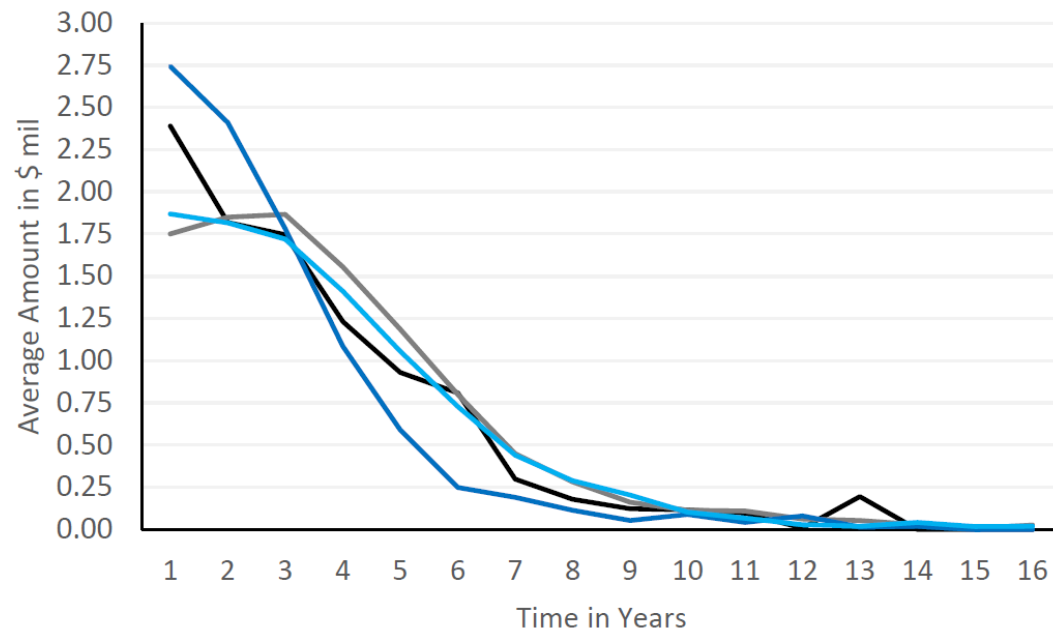
Panel A: Fund Type and PME Distribution



Calls and Distributions: Infrastructure vs. Other Funds

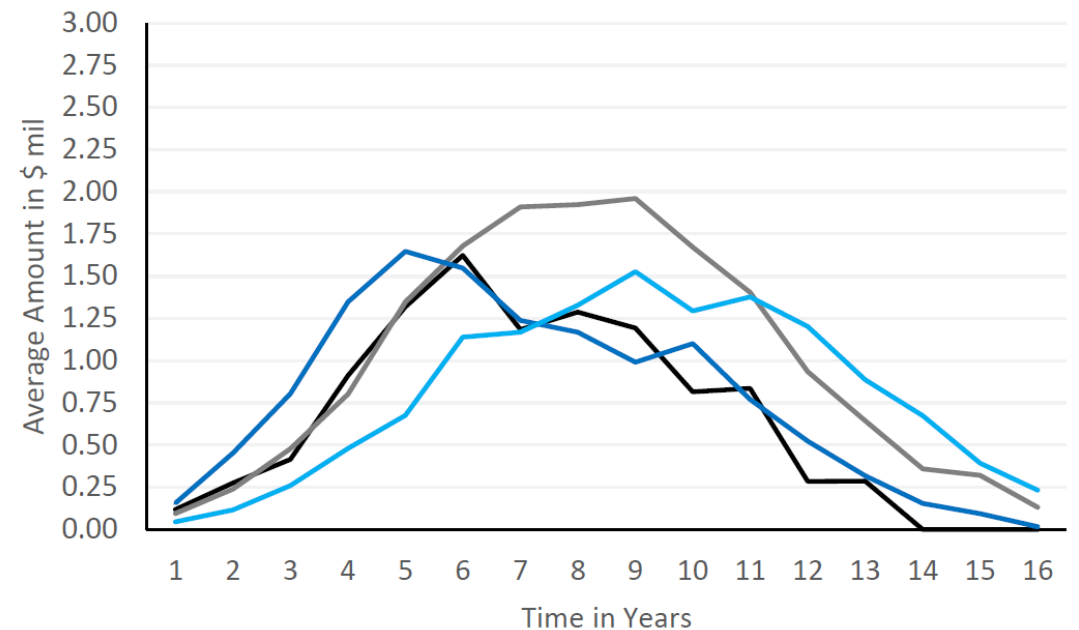
- **Standardize the cash flows** over the life of a fund (t=1 corresponds to the vintage year).
- **Expectations from infrastructure:** larger calls at the beginning and flatter distributions over time.
- **The payout profile provided by infrastructure funds** over time is statistically and economically similar to payout profile provided by buyout and real estate funds (but on average smaller amounts).

Panel A: Capital Calls over Time (All Funds)



— Infrastructure — Buyout — Real Estate — VC

Panel C: Distributions over Time (All funds)



— Infrastructure — Buyout — Real Estate — VC

Performance of Closed Funds and Exited Deals

- **Infrastructure funds have a similar payout profile to other private funds because their distributions are primarily driven by deal exits** (similar to prior literature and results for buyout and VC funds).
- **Reporting performance – logit regressions:** a 10 percentage point increase in the percentage of exited deals is associated with a 2.69 percentage point higher probability of reporting PME, IRR and/or Multiple.
- **Performance measures:** a 10 percentage point increase in exited deals in the first five years is associated with a 0.085 higher PME, 2.576 percentage point higher IRR, and 0.079 higher multiple of invested capital.

Table 4	Reporting		PME		Net IRR		Multiple	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
%Exited deals	0.269** [0.113]		0.636*** [0.206]		19.944*** [3.779]		0.561*** [0.191]	
%Exited deals in years 0-5		0.290* [0.151]		0.851*** [0.209]		25.762*** [3.868]		0.787*** [0.204]
%Exited deals in years 5-10		0.246* [0.145]		0.140 [0.263]		9.088* [5.152]		0.201 [0.155]
%Exited deals in years >10		0.201 [0.372]		-0.822 [1.315]		-8.028 [8.749]		-0.041 [0.342]
Fund Size	0.167*** [0.026]	0.168*** [0.026]	-0.014 [0.022]	-0.027 [0.025]	-2.128* [1.076]	-1.785 [1.039]	-0.056* [0.032]	-0.050 [0.031]
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
%Project Stage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
%Concession	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
%Deal Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
%Deal Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	526	526	125	125	183	183	260	260
R-squared			0.445	0.487	0.168	0.198	0.359	0.378

Infrastructure Cash Flows and Business Cycle

Are the cash flows of infrastructure funds sensitive to the business cycle?

- Two proxies of business cycle (Robinson and Sensoy, 2016): price-dividend ratio and yield spread.
- We add inflation (U.S. CPI).

Infrastructure funds are procyclical like other private funds:

- Net cash flows of infrastructure funds are high when the P/D ratio is high.
- Distributions are more sensitive to the business cycle than capital calls.

Difficult for infrastructure to provide diversification benefits:

- Investors receive cash flows from infrastructure funds at very similar times to when other private funds distribute cash flows, and when public equity markets perform well.

Table 5	Net Cash Flows		Distributions		Capital Calls	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(P/D)	4.981*** [1.855]	4.098** [1.979]	1.177*** [0.365]	1.140*** [0.354]	0.224 [0.376]	0.584 [0.402]
ln(Yield Spread)	0.342 [0.213]	0.320 [0.219]	-0.076* [0.043]	-0.076* [0.043]	-0.074* [0.039]	-0.066* [0.038]
Inflation		0.161 [0.139]		0.007 [0.025]		-0.065** [0.028]
Fund Age FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund Focus FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,066	3,066	3,066	3,066	3,066	3,066
Adjusted R-squared	0.128	0.128				
Pseudo R-squared			0.057	0.057	0.090	0.090

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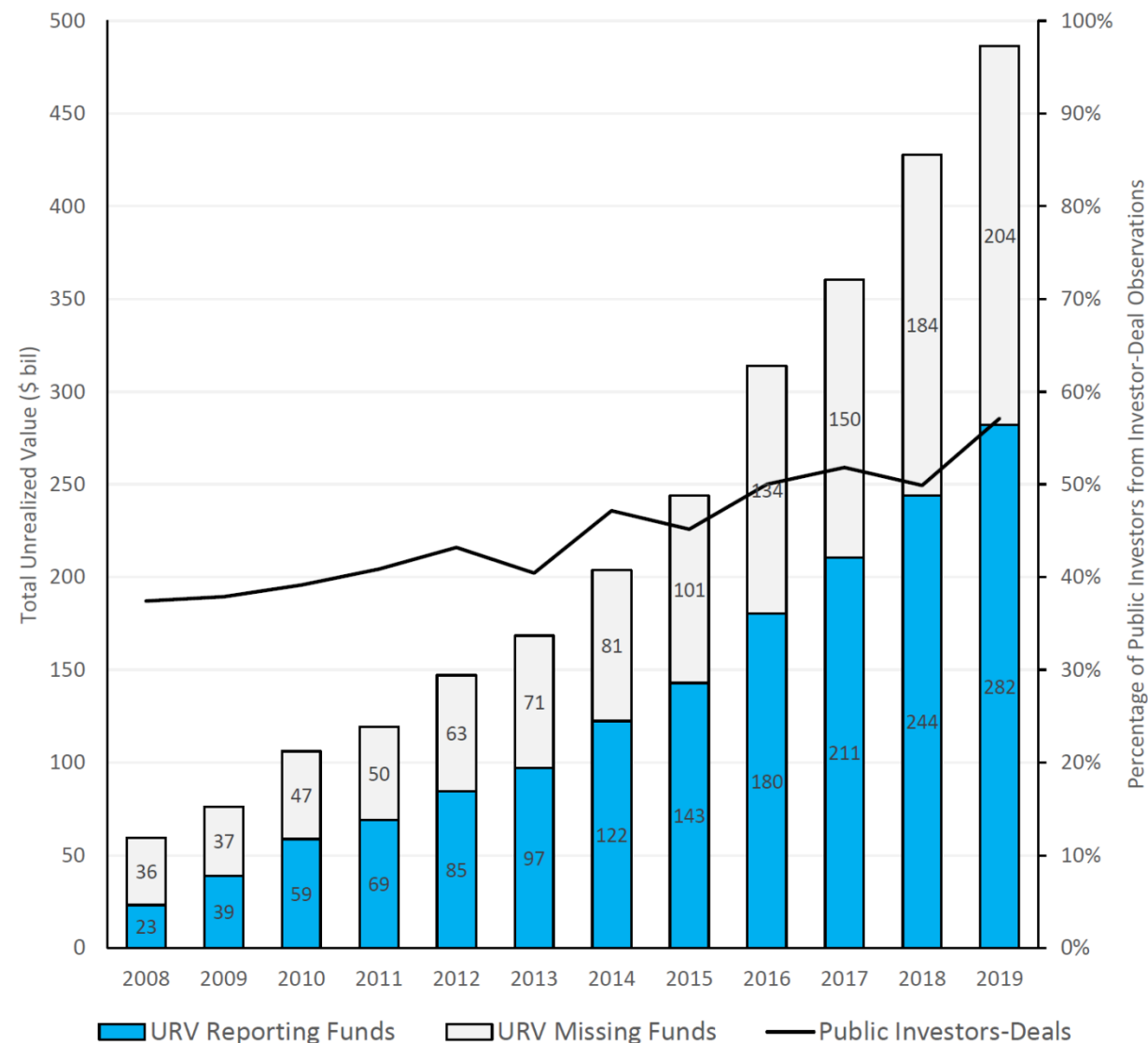
Infrastructure Assets under Management (by Closed Funds)

Despite failing to meet investor expectations, closed funds have experienced rapid growth:

- Analyze annual snapshots and transform the ratio of residual value to paid-in capital into dollar amounts using the percentage of capital called and fund size.
- Assume that every fund that does not report performance holds 25% of the average assets of reporting funds from the same vintage.
- Private equity and hedge funds managed to grow after very successful years (e.g., Dichev and Yu, 2011; Sensoy, Wang and Weisbach, 2014).

The growth in AUM of closed infrastructure funds is driven primarily by relatively more commitments from public investors over time:

- Public investors account for 57% of investor-deal observations in 2019 vs 37% in 2008.
- Their relative importance will increase further as their share in recent commitments is >60%.



Who Invests More in Infrastructure over Time?

Analysis of the number of investments on an investor-vintage year level:

- **Public investors** increase allocation over time.
- **Preferences:** UN PRI signatories invest more in infrastructure.
- **Regulatory pressure:** Investors targeted by mandatory or voluntary ESG regulation invest more in infrastructure.
- **Interactions:** ESG preferences and regulation explain 25-40% of the higher number of investments by public institutional investors.

	Number of Investments				ln(Number of Investments + 1)			
	1990-2020		2011-2020		1990-2020		2011-2020	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Public Investor	0.124*** [0.016]	0.072*** [0.011]	0.311*** [0.038]	0.203*** [0.032]	0.055*** [0.006]	0.038*** [0.005]	0.133*** [0.013]	0.109*** [0.013]
UN PRI Signatory	0.385*** [0.086]	0.038 [0.037]	0.343*** [0.083]	0.045 [0.045]	0.138*** [0.025]	0.031* [0.018]	0.121*** [0.024]	0.038** [0.019]
Mandatory Regulation	0.151* [0.083]	0.057 [0.037]	0.308* [0.158]	0.204** [0.093]	0.035* [0.019]	0.026 [0.016]	0.077** [0.033]	0.085*** [0.029]
Voluntary Regulation	0.014 [0.026]	-0.007 [0.019]	0.093 [0.063]	0.074 [0.067]	0.011 [0.011]	-0.002 [0.009]	0.046** [0.019]	0.039** [0.020]
Public Investor × UN PRI Signatory		0.759*** [0.178]		0.692*** [0.191]		0.240*** [0.051]		0.198*** [0.052]
Public Investor × Mandatory Regulation		0.162 [0.183]		0.127 [0.240]		-0.004 [0.043]		-0.052 [0.053]
Public Investor × Voluntary Regulation		0.092* [0.054]		0.065 [0.086]		0.047** [0.021]		0.019 [0.030]
Log Investor Size	0.037*** [0.004]	0.036*** [0.004]	0.074*** [0.009]	0.073*** [0.009]	0.017*** [0.001]	0.017*** [0.001]	0.032*** [0.003]	0.032*** [0.003]
Year First Invest	-0.010*** [0.001]	-0.009*** [0.001]	-0.009*** [0.002]	-0.008*** [0.002]	-0.005*** [0.000]	-0.005*** [0.000]	-0.002*** [0.001]	-0.002*** [0.001]
LP Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	57,691	57,691	18,610	18,610	57,691	57,691	18,610	18,610
Adjusted R-squared	0.091	0.103	0.087	0.097	0.136	0.144	0.128	0.135

Investor-Fund Level: Investor Type and Performance

Public investors underperform: Funds selected by public investors deliver 0.026 lower PME, 1.810 percentage points lower IRR, and 0.038 lower multiple of invested capital.

Controls:

- LP size, year of first investment, and #funds as proxies for negotiating power, experience, or access.
- Indicators for few funds-of-funds and debt funds hold direct equity stakes.
- Deal level controls for concession, project stage, region and industry of assets.
- Double cluster the standard errors by institutional investor and infrastructure fund.

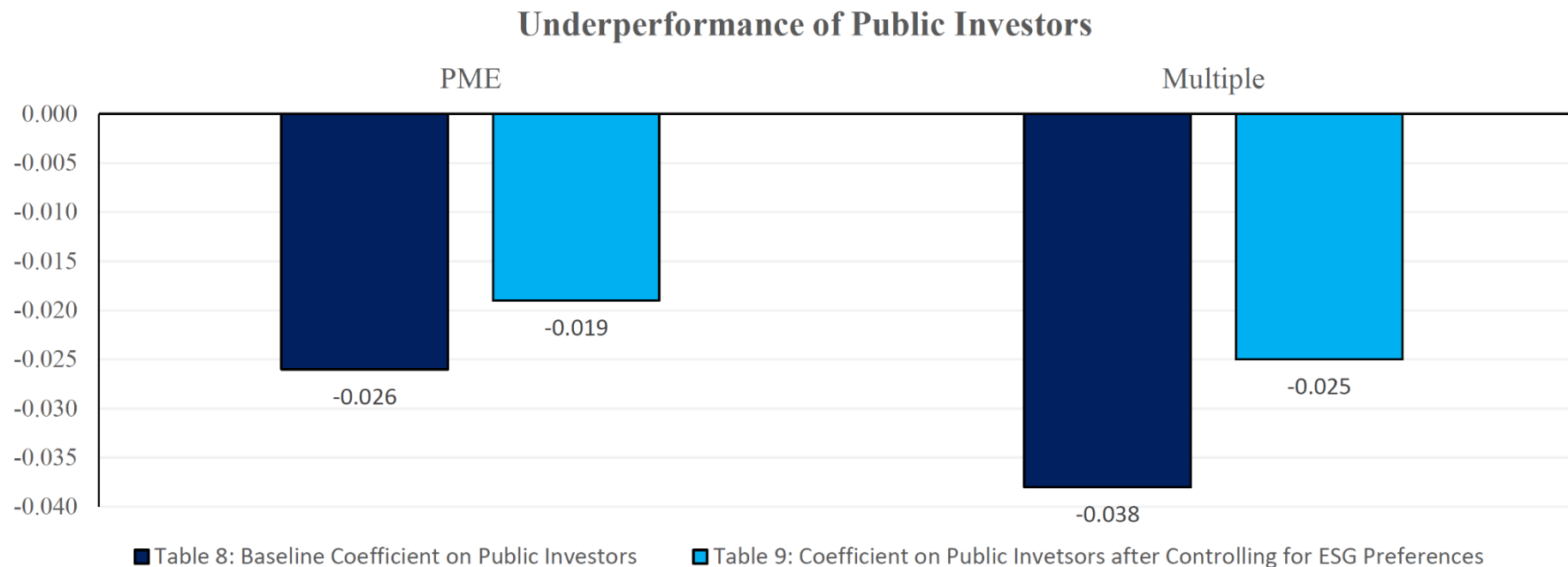
Table 8	PME		Net IRR		Multiple	
	(1)	(2)	(3)	(4)	(5)	(6)
Public Investor	-0.026** [0.012]		-1.810*** [0.588]		-0.038*** [0.014]	
U.S. Public PF		-0.026* [0.016]		-1.978** [0.962]		-0.024 [0.021]
Non U.S. Public PF		-0.024 [0.019]		-1.489* [0.764]		-0.050** [0.020]
Government Agencies		-0.001 [0.035]		-1.057 [1.491]		-0.082 [0.052]
Sovereign Wealth Funds		-0.069** [0.028]		-4.196** [2.022]		-0.052 [0.039]
Controls	Yes	Yes	Yes	Yes	Yes	Yes
LP Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Vintage FE	Yes	Yes	Yes	Yes	Yes	Yes
%Deal Region	Yes	Yes	Yes	Yes	Yes	Yes
%Deal Industry	Yes	Yes	Yes	Yes	Yes	Yes
%Project Stage	Yes	Yes	Yes	Yes	Yes	Yes
%Concession	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,342	2,342	3,021	3,021	3,853	3,853
Adjusted R-squared	0.450	0.450	0.150	0.150	0.326	0.326

Explanations of the Underperformance of Public Investors

1. **Evidence so far not really consistent with lower risk:**
 - Deal characteristics as proxies for factors that capture the riskiness of the underlying assets.
2. **Evidence also not consistent with differences in preferences for gaining long-term exposure:**
 - Public investors expect long-term cash flows, but their managers look for appreciation and sales.
 - Closed funds (strongest incentive to exit deals faster) are their primary investment approach.
3. **Could be lower skill in the fund selection or only having access to worse-performing funds:**
 - Politicized governance and unskilled board members (Andonov, Hochberg and Rauh, 2018).
 - Constraints on the compensation needed to attract talented staff (Dyck, Manoel and Morse, 2019).
 - Inability to select or access better-performing asset managers (Sensoy, Wang and Weisbach, 2014).
4. **Underperformance may also be driven by stronger social externalities of infrastructure assets:**
 - Infrastructure investments may offer a wide range of environmental, social and political benefits.
 - Public investors with ESG preferences or regulatory pressure invest more in infrastructure.
 - If public investors have higher target asset allocation to infrastructure due to regulation or impact investing they may take on more marginal funds (deals) in order to meet the target.

Social Externalities and Public Investor Underperformance

- **ESG preferences explain 30% of the underperformance of public investors:**
 - UN PRI signatories have a significantly lower performance.
 - Impact funds, defined based on objective and name, underperform (Barber, Morse and Yasuda, 2021).
- **ESG regulation** also seems to matter, but most measures have been only recently enacted.
- **UNPRI signatories and impact funds underperform after controlling for allocation to different industries and regions, so due to investing in marginal deals within these industries or regions.**
 - Not because they invest in renewable energy or emerging economies per se.



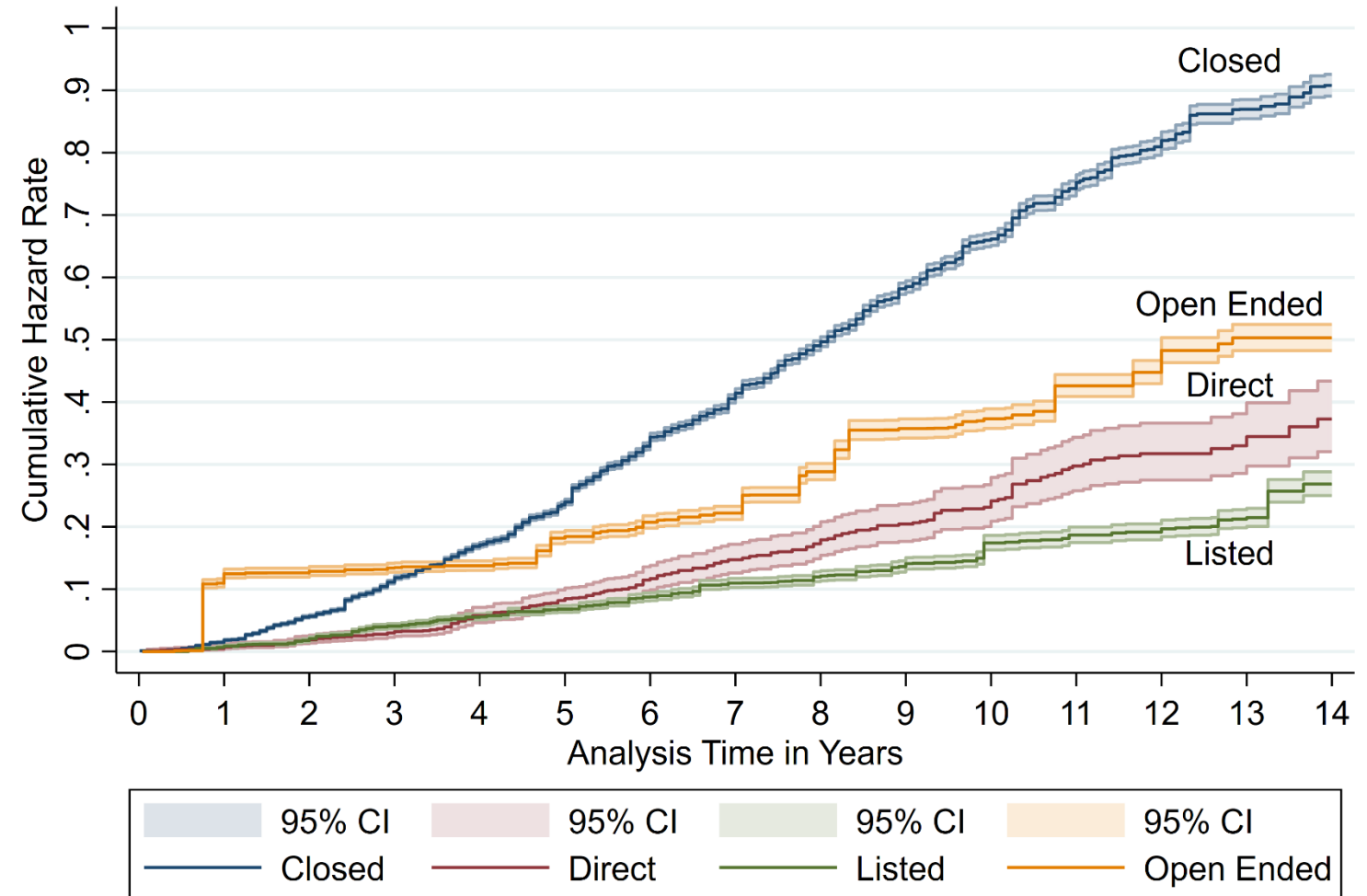
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Implication: Deal Exits and Different Investment Structures

Cumulative hazard rates:

- **Analysis on an investor-deal level.**
- **Hazard model of fully exiting an asset:** probability that an exit will come to fruition in year t conditional on it not happening prior to year t .
- **Closed funds** have exited more than 90% of the deals in 14 years.
- **Listed, open-ended and direct** investments have lower exit rates and may be better designed to deliver reliable income stream on a long run.
- **Public investors** have a 7.7% lower probability of exiting a deal as compared to private investors.
- **Deal level controls** are important.



Conclusion and Implications

1. The main investment structure in infrastructure, closed funds, does not meet investor expectations:

- Their cash flows display similar volatility and cyclicity as other private equity investments.
- The performance of closed funds depends on quick deal exits.

2. Public investors perform worse than private investors:

- ESG preferences and regulations explain one-third of their increased allocation and underperformance.

3. The development of infrastructure as an asset class depends on establishing an investment structure that takes into account the specific nature of the underlying assets and investor objectives:

- Other investment structures may be better designed to provide long-term exposure and stable cash flows.
 - The closed fund structure is also not ideal for addressing long-term ESG risks such as climate.
- Public investors may accept lower returns when investing in assets characterized by positive externalities:
 - The underperformance reflects a price that is paid to create societal benefits from infrastructure.
 - The transfers are going either to the infrastructure assets or to the GPs through fees.
 - We estimate the annual dollar value of these transfers to be about \$5 billion.
- Risk that in the long run infrastructure may not attract sufficient capital in private markets:
 - Implication for competitiveness and long run potential economic growth.
 - Implications for wasteful spending and corruption that are associated with government programs.

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