Imperial means
Intelligent Business

Centre for Climate Finance and Investment

Infrastructure returns across markets and vehicles

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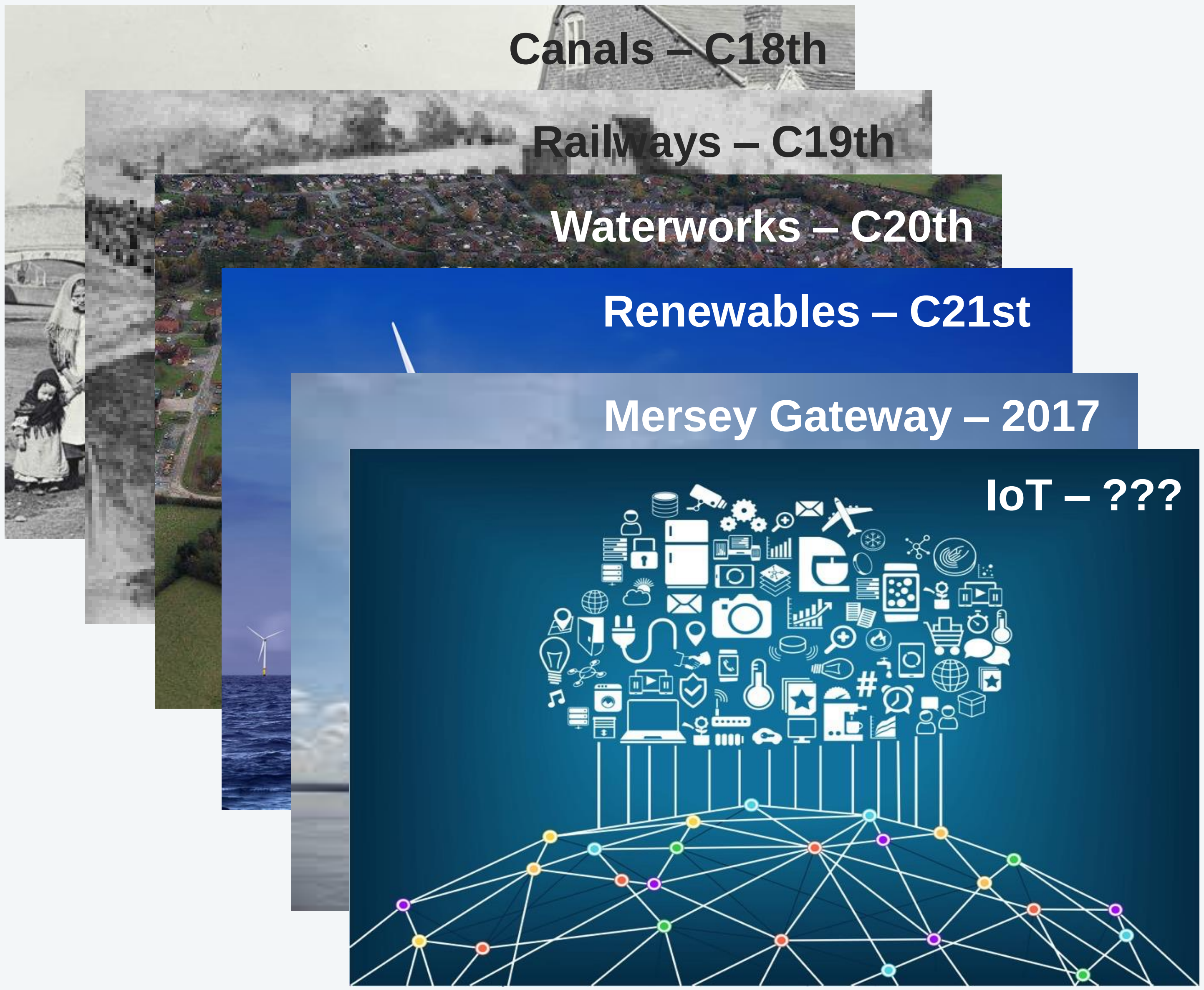
Infrastructure as an investment
Macro-economic perspectives

Examples of infrastructure



Potential benefits

- Long-term development
- Shorter-term GDP boosts
- Increased productivity
- Fund green growth

Potential providers

- Governments
- Corporations
- Financial investors

Significant interest

- UK government, G20
- OECD, IMF, World Bank
- World Economic Forum

Infrastructure as an investment
The investor perspective

- The "investment narrative"
  - Low demand risk with stable returns
  - Uncorrelated to equities / low market risk
  - Inflation hedge
  - Downside protection

- How can institutions invest?
  - Listed infrastructure equities - $2+ trillion market cap
  - Infra funds (typically unlisted/PE-style) - $400bn raised in 10yrs
  - Direct investment (e.g. Ontario Teachers PF / Bristol Airport)

- Example of "alternative asset class"
  - $7tr total value (Preqin 2016)
    - $4tr Private Equity / Real Estate / Infrastructure Funds
    - $3bn Hedge Funds

How has infrastructure performed?
Approach varies by method of investment

- Listed infrastructure stocks
  - Straightforward approach / good data / many indices
  - Issues with previous studies undertaken
- Infrastructure funds
  - Private data access issues
  - Shorter investment history
- Direct investing
  - Even less public data and shorter history

Our approach looks at unlisted fund data to understand better investors' preferred investment route and compare with better understood listed benchmarks

Infrastructure return benchmarks

Too many benchmarks?

Wide variety of benchmark providers:

Listed

- Dow Jones Brookfield, FTSE, S&P, MSCI, UBS
- GLIO (143 "core" companies)

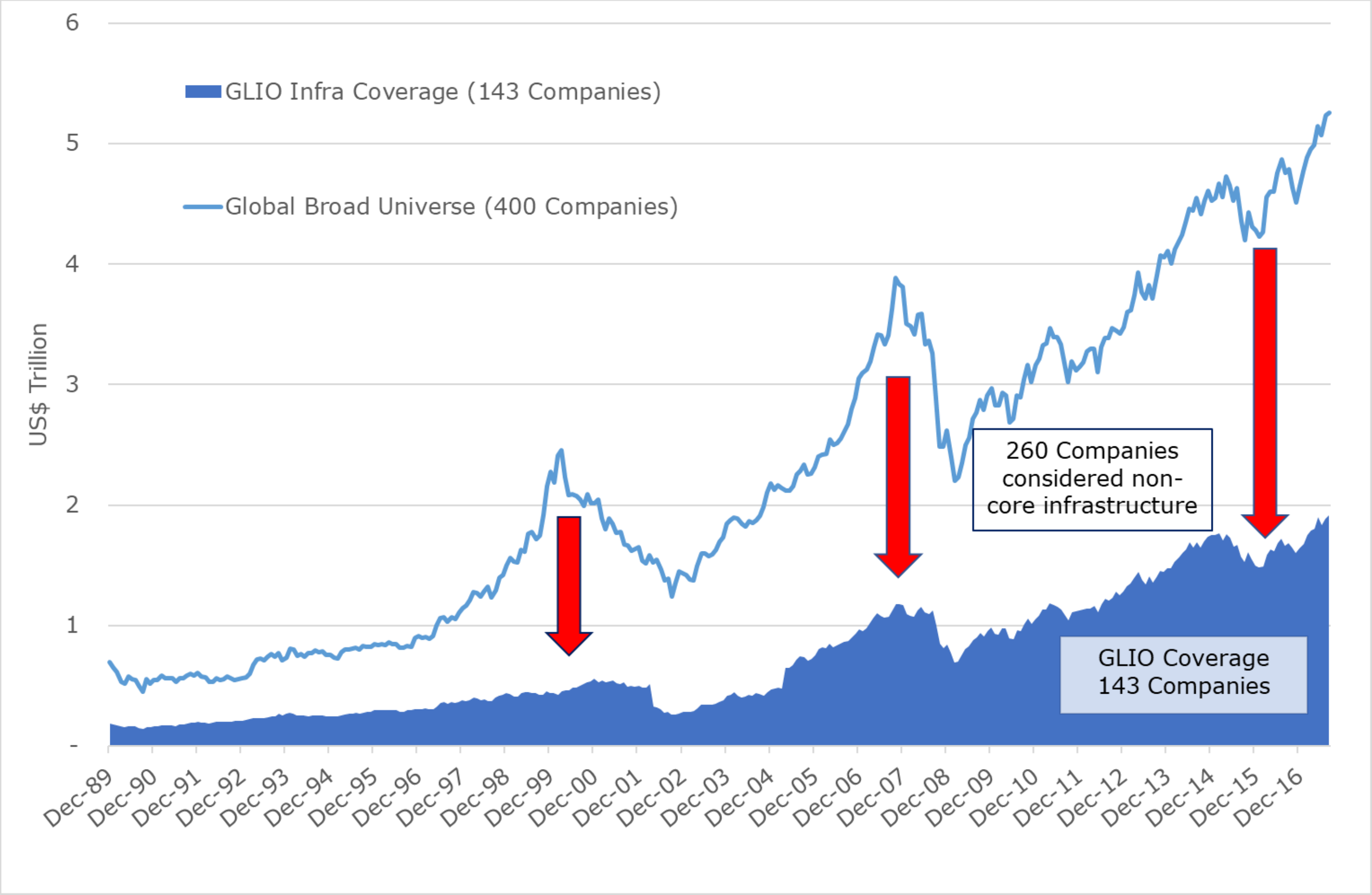
Unlisted

- Preqin (242 funds), Cambridge Associates (93 funds)
- MSCI/IPD (9 fund managers)
- EDHEC (303 assets)

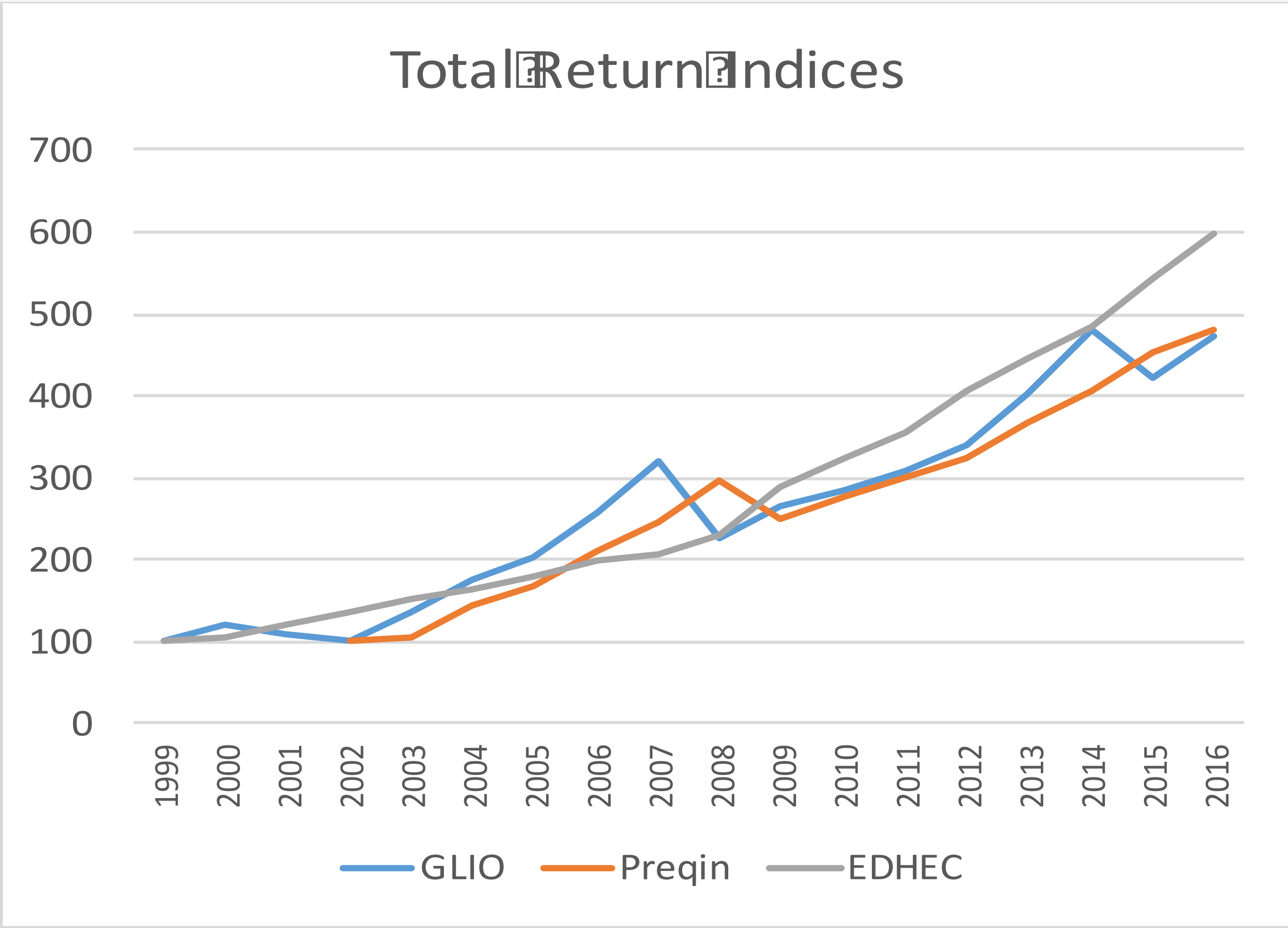
Are these companies "infrastructure" ?

- Vodafone, Royal Mail, Ferrovial

GLIO exclude "non-core" stocks



Infrastructure returns
By type of investment vehicle



	Sharpe Ratio (unadjusted)	CAPM beta (unadjusted)
Listed stocks	0.54	0.76
Unlisted funds	0.92	0.18
Unlisted assets	1.98	c. Zero

Returns

- Annualised: 1999-2016
- Similar by vehicle:
  - Listed (GLIO) 11.0%
  - Unlisted funds (Preqin) 12.5%
  - Unlisted assets (EDHEC) 11.2%

Volatility (Std. Deviations)

- Very different by vehicle
  - Listed (GLIO) 17.1%
  - Unlisted funds (Preqin) 11.8%
  - Unlisted assets (EDHEC) 4.8%

Should we use IRRs for fund investments?
Modified IRR estimates realised returns

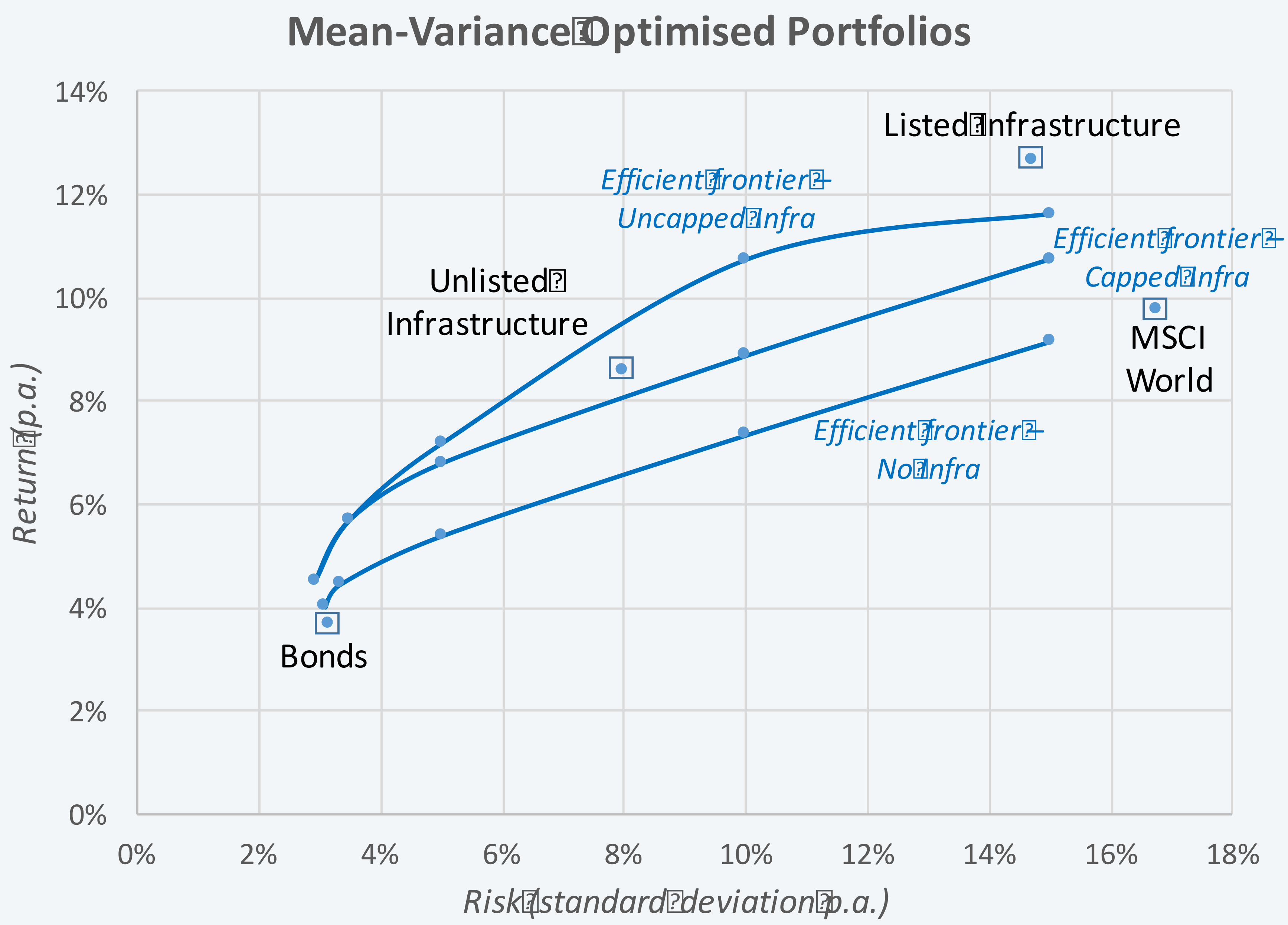
	Fund sample			Preqin database		
Vintage	Number	IRR	MIRR*	Average IRR	1st quartile	3rd quartile
2002-5	7	15.8%	10.4%	16%	25%	9%
2006	5	2.7%	6.7%	8%	11%	5%
2007	5	9.5%	7.7%	5%	12%	2%
2008	2	0.4%	5.6%	9%	11%	4%
2009	5	14.3%	8.9%	13%	18%	9%
2010	7	10.8%	9.1%	9%	23%	8%
2011	10	11.1%	8.3%	15%	20%	9%
2012	6	20.4%	9.2%	14%	20%	10%
Average		*11.7%*	*8.5%*	*11.1%*		

** Assuming 8% re-investment rate for MIRR calculation*

Source: Preqin Infrastructure Online

- Based on PhD research on c.70 fund sample
- Support for sample being representative
- Unlisted funds refer to high IRRs: 11-12% but have long-term yields
- Hence re-investment assumption is crucial and can reduce realised returns
  - MIRR is 8.5% at 8% reinvestment rate
  - MIRR is 10.1% at 10% reinvestment rate

Portfolio allocation implications
Infrastructure does look like a diversifier



- Many possible portfolio optimisation approaches
- Based here on M-V
- Adding infrastructure moves the EF
- In most cases, optimum allocation includes both listed and unlisted infra
- Diversification within infrastructure:
  - Correlation: c.0.5

Source: Wilde (2017) 'Defining the blend', *GLIO Journal*

Unresolved issues
Governance, measurement and liquidity

Governance

- Company or Fund – competing mis-alignments of interest
- Fund manager or Direct Investing – scale, skill, incentives
- Role of leverage

Measurement

- Market prices or NAVs or Academic models
- Time period of returns
- What risks to include – and how to measure them:
    - Cash flow, Market, Regulatory/political, Climate/ESG, Technology
- Appropriate sector and country benchmarks

Liquidity

- What premium should we expect from illiquid funds and assets
- How can long-term investors appropriately arbitrage such premia

THANK YOU

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