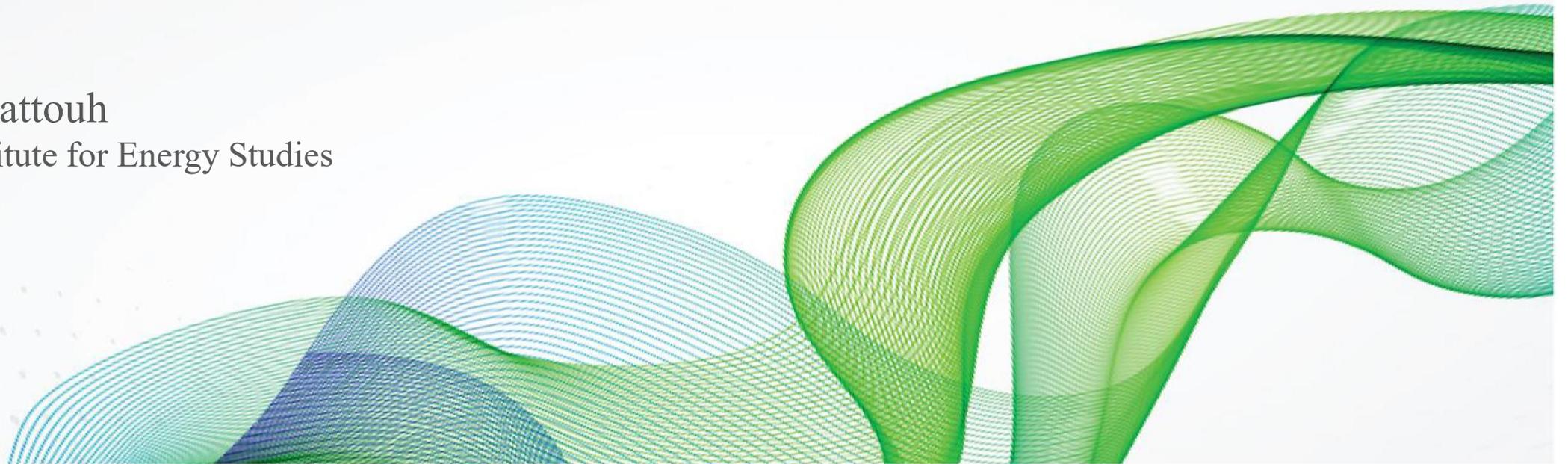




THE OXFORD
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The Energy Transition & Adaptation Strategies for Oil Exporters

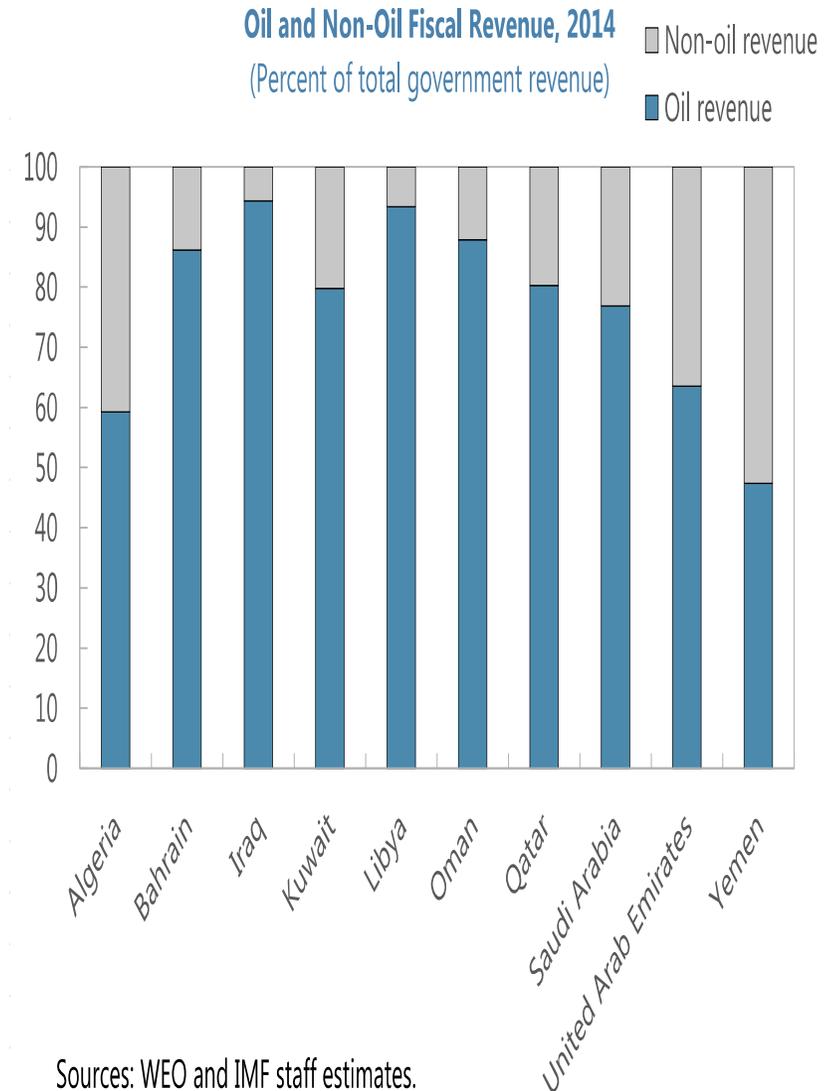
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Oil exporters face a major challenge amidst energy transition

- As energy transition expected to lead to structural changes in energy markets and the energy mix, oil-exporting countries face serious challenges
- With proved reserves-to-production ratios of multiple decades they face challenge of monetizing large reserve base
- Risk of losses in export revenues which could disrupt their socio-economic wellbeing given high reliance of their budget on oil revenues.
- Adapt to energy transition the speed of which is highly uncertain and unlikely to have uniform impact globally



Diversifying bet hedging strategy

- In an uncertain environment, the long-term fitness and adaptability can be improved through two pure risk reduction strategies and their combination:
- **Diversifying bet hedging** and **conservative bet hedging**
- The essence of diversified bet hedging is reflected in the old saying: “don’t put all your eggs in one basket”
- A diversified strategy reduces the variance of return in presence of an unpredictable environment
- The mechanism through which it achieves this result is risk spreading by pooling unrelated incomes, for instance by creating news sector other than oil (if oil revenues decline, other sectors could compensate for the decline)

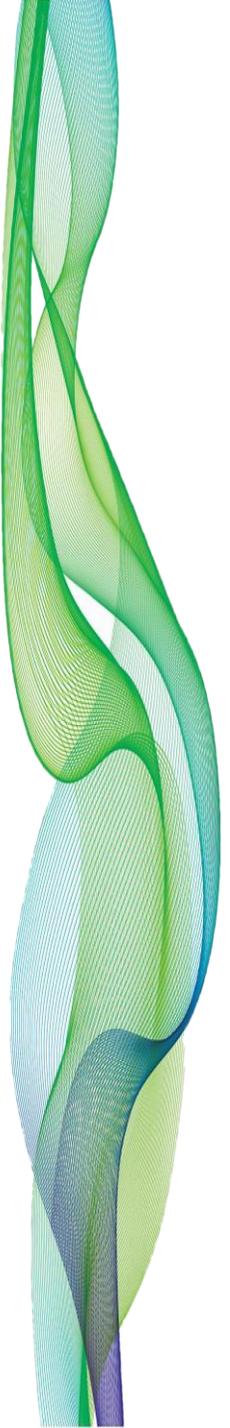
I Diversifying Bet Hedging Strategy

	Strategy		
Year type	A	B	D
Good year	11	1.1	6.05
Bad year	1	10	5.5
Arithmetic mean	6	5.55	5.775
Geometric mean	3.31	3.31	5.76

Source: Poudineh and Fattouh (2020)

Diversification efforts but low success

- Many attempts in OPEC oil exporters to expand to new sectors such as banking and financial services, tourism, entertainment, as well as agriculture but with mixed success. Some countries have a more diversified economic base, but their government income still highly reliant on oil revenues
- Countries face real challenges to realise a meaningful diversification strategy:
 - Only successful if it offers risk reduction by pooling uncorrelated income streams
 - Diversification into substantively different areas away from their core competitive advantage run the risk of failure of establishing viable non-resource export sectors
 - Achieving diversification requires building human capital and improving the education system as well as extensive reforms to improve the business environment, transparency, and economic governance; reducing excess monopoly rents in non-tradable sectors and removing barriers to private sector participation
- Wide uncertainty (or even scepticism) about whether, and how quickly, such extensive economic and institutional reforms can be implemented



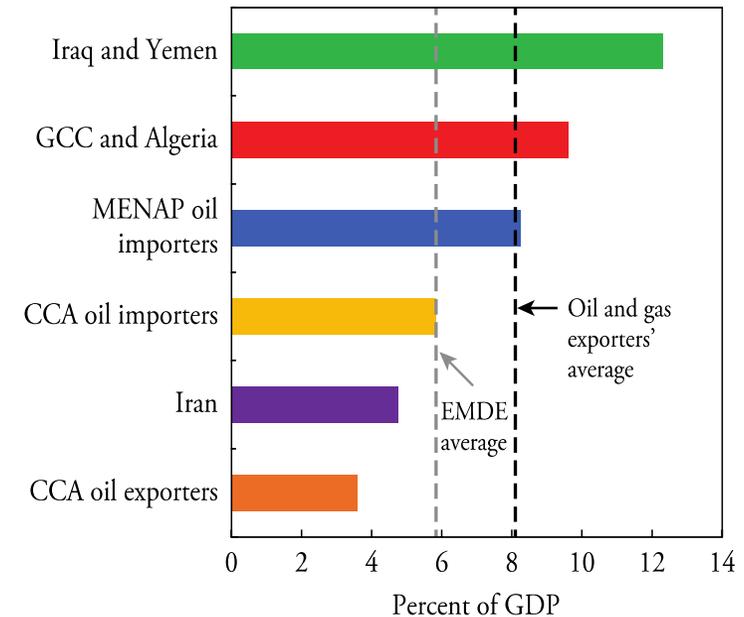
The challenge of diversification

Diversification is long and complex process

- Multiple features of resource-rich economies make diversification a difficult and lengthy process
- A non-energy sector largely geared towards non-tradable so it contributes little to exports' earnings
- Fiscal structure designed to heavily rely on oil revenue with few other additional sources (private sector & individuals not taxed; instead receive subsidies)
- Fiscal rigidities limit scope and flexibility of public expenditures (subsidies and large public sector wage bill)
- Large public sectors, highly segmented labour markets and education systems that fail to produce the skills that are required by the private sector
- Real and meaningful diversification can only be achieved by deep and painful structural reforms; some are better equipped than others

Figure 2.1. General Government Wage Bills, 2005–16

(Percent of GDP, period average)



Sources: IMF, World Economic Outlook; and IMF staff estimates.

Note: CCA = Caucasus and Central Asia; EMDE = emerging market and developing economies; GCC = Gulf Cooperation Council; MENAP = Middle East and North Africa, Afghanistan, and Pakistan.

Conservative bet hedging strategy

- To expect OPEC member countries to diversify away from the oil sector which constitutes their core competitive advantage and for this strategic sector to play a lesser role in the transition process is **not realistic nor optimal** as they will be limiting their risk reduction strategies and strategic choices
- The oil sector remains very profitable and enjoys higher margins than any new industries/sectors that the government aims to establish
- Economies need to put in place mitigating mechanisms financed by oil revenues to enable reforms (transfer schemes to households, firms, etc...)
- In addition, to diversifying bet hedging, MENA oil exporters can pursue a conservative bet hedging
- Essence of strategy is reflected in the old saying that ‘a bird in the hand is worth two in the bush’

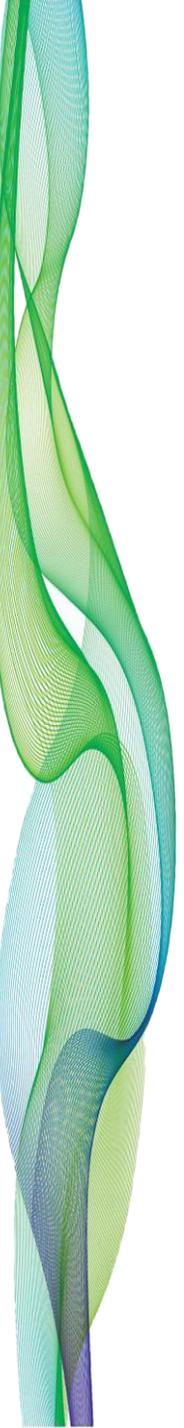
Conservative Bet Hedging Strategy?

	Strategy	
Year type	A	B
Good year	11	6
Bad year	1	3
Arithmetic mean	6	4.5
Geometric mean	3.31	4.24

Source: Poudineh and Fattouh (2020)

Core competitiveness and improve resilience

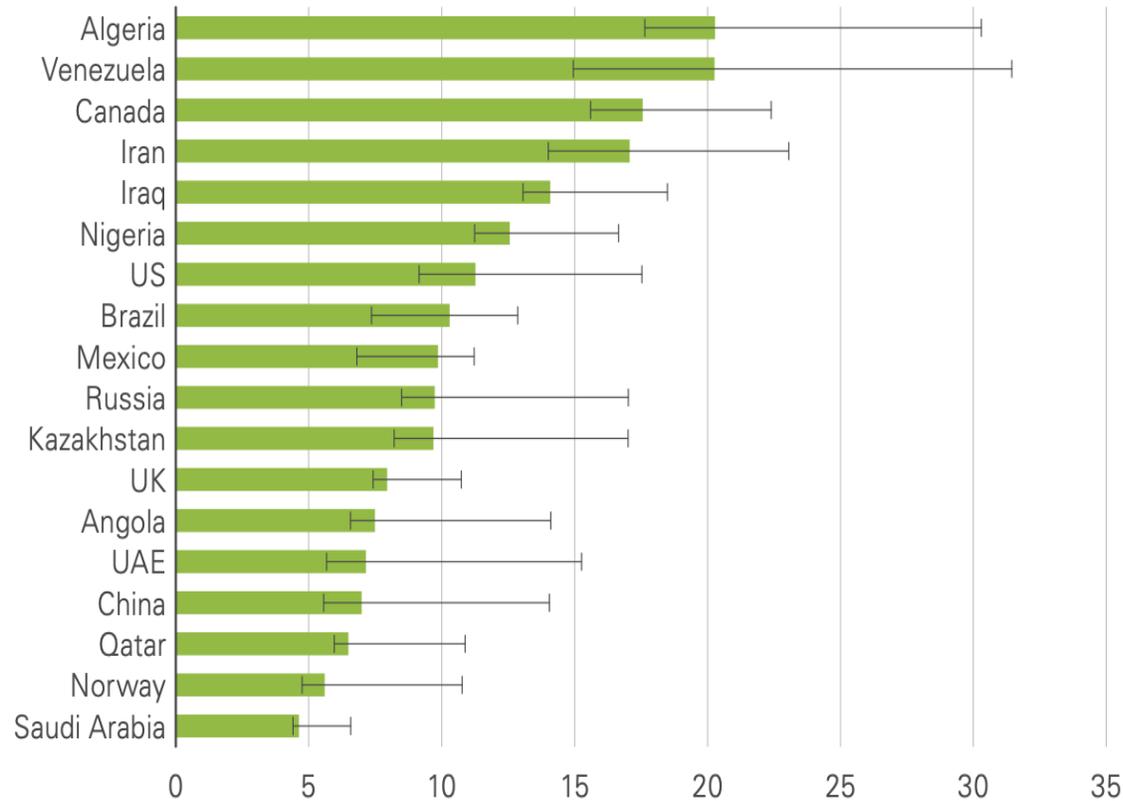
- The core of a conservative bet hedging strategy is to retain the competitiveness of the energy sector and increase its resilience against potential risks of disruption.
- This involves taking a set of key measures
 - Lowering production costs and improving oil and gas production efficiency so to compete in any price environment;
 - Decarbonising oil and gas production to enhance competitiveness in world of rising carbon prices;
 - Improving the efficiency of domestic energy use and optimising the energy mix to maximise the oil export potential;
 - Shifting the portfolio towards petrochemicals and non-combustible uses of oil;
 - Decarbonising the final petroleum products to sustain demand for these countries' core products as transition towards decarbonised sources of energy advance.



Compete on areas other than cost

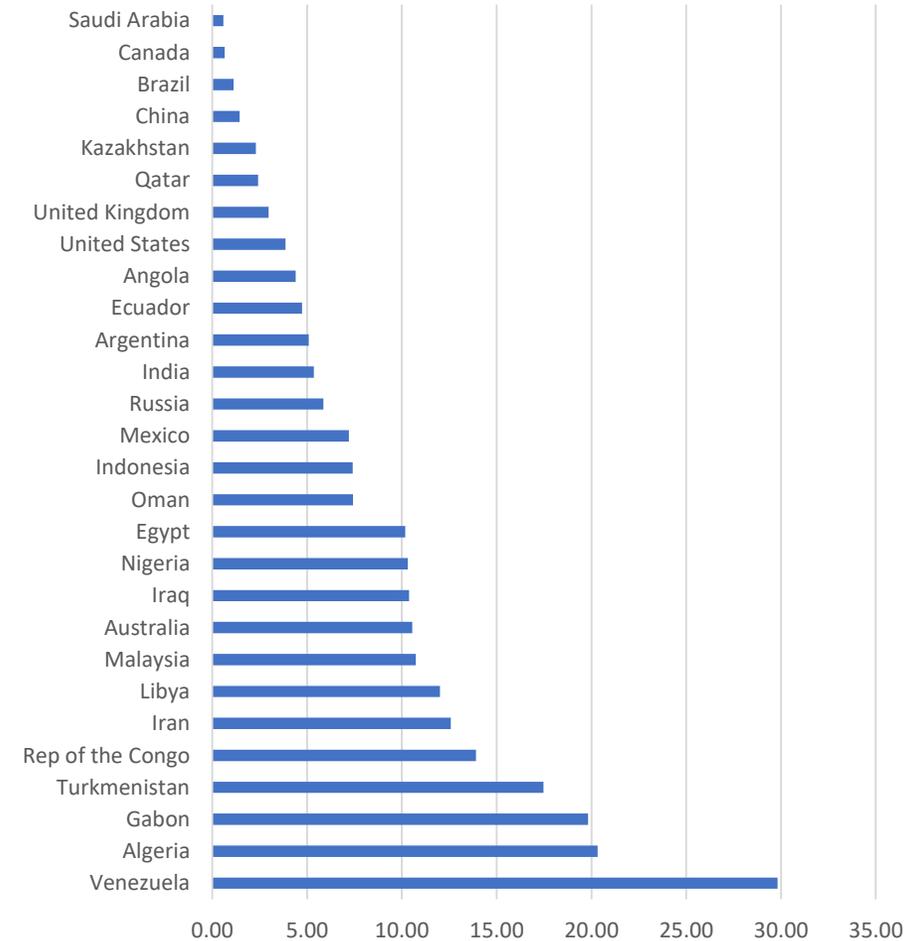
Average carbon intensity of crude production by country, 2015

g of CO₂e/MJ



Source: Masnadi et al. (2018), Global carbon intensity of crude oil production graph includes countries with crude and condensates above 1 Mb/d in 2018. Error bars include 5-95th percentile of fields

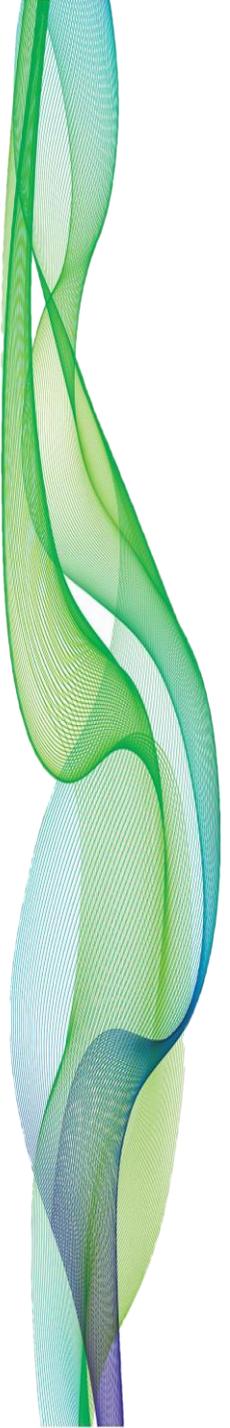
Flaring Intensity, Cubic Meter Gas Flared per barrel of oil produced



Source: BP, World Bank

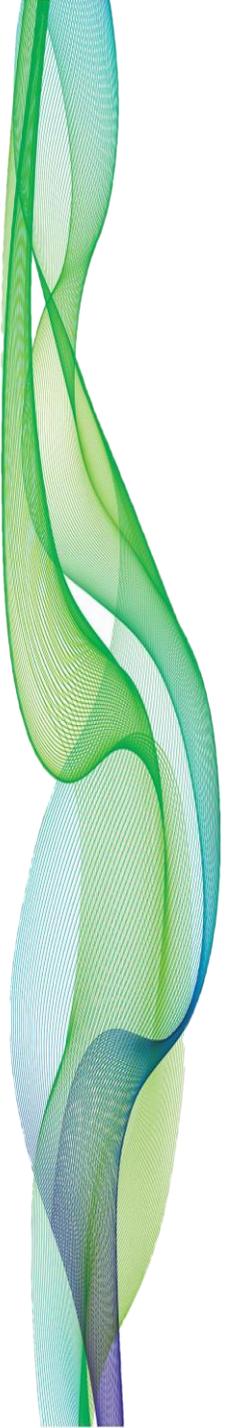
Lower returns but higher resilience

- Return on a conservative bet hedging strategy is lower than the current default strategy of oil and gas exports given costs involved and the lower margins involved in decarbonization
- But risk profile also lower
 - Improving cost efficiency of oil and gas industry increases resilience
 - Decarbonization technologies are well established (significant room for cost efficiency gain and R&D in this area that these countries can exploit)
 - During the transition era these countries can still export oil/gas and benefit from the generated rents, while at the same time, improve the return on decarbonised products
- Strategy less complex to implement given its close relationship with existing hydrocarbon business
- But suffers from drawbacks
 - Some degree of correlation between prices of all energy products
 - Growth of decentralised technologies (increasingly difficult to extract rent beyond marginal costs)
 - Not deliver other government objectives such as job creation



Decision-making under uncertainty

- Oil exporting countries are exposed to many uncertainties as far as long-term strategy is concerned
- Consider four sources of uncertainties and each have two possibilities:
 1. The speed of the energy transition can be fast or slow;
 2. Covid-19 can accelerate or decelerate the energy transition;
 3. Economic/institutional reform can be successful or unsuccessful;
 4. Decarbonised technology mix can be favourable with CCUS in the mix or unfavourable without CCUS.
- 16 possibilities of future outcomes (policymaker long-term strategy needs to be made under uncertainty)
- Calculate the payoffs for each strategy, under each possible outcome of uncertainty under various assumptions
- We assume
 - The maximum gain of diversified strategy is 30 and its cost is 5
 - The maximum gain of conservative bet hedging is 22 and its costs is 2
 - Combined strategy yields a payoff which is average of diversified and conservative bet hedging



Payoffs under different possibilities amidst uncertainties

Energy transition																
	Fast								Slow							
<i>External factors (covid-19)</i>	Accelerate				Decelerate				Accelerate				Decelerate			
<i>Economic reforms successful?</i>	Yes		No		Yes		No		Yes		No		Yes		No	
<i>CCs in the mix?</i>	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Conservative bet hedging	7.9	-0.9	6.8	-2	11.2	2.4	10.1	1.3	16.7	7.9	18.9	6.8	20	11.2	18.9	10.1
Diversified bet hedging	14.5	17	-3.5	-5	19	17.5	1	-0.5	20.5	19	2.5	1	25	23.5	7	5.5
Combined Strategy	11.2	8.05	1.65	-3.5	15.1	9.95	5.55	0.4	18.6	13.45	10.7	3.9	22.5	17.35	12.95	7.8

Source: Poudineh and Fattouh (2020)

Conclusions

- Over last two decades many oil exporters have been trying to hedge their bets through diversification efforts
- Reveals that these countries have had some hope and perhaps confidence that uncertainties affecting the outcome of this strategy will likely be in their favour (for example current efforts to remove barriers to diversification will likely succeed)
- Long-term strategy for oil exporting countries is about risk reduction and not just about revenue generation
- A risk reduction strategy builds on enhancing the competitiveness of the energy sector and increasing its resilience against potential risks of disruption
- A risk reduction strategy always involves a cost or trade-off between expected return and its variance
- Means the long-term adaptability of oil exporting countries entail accepting lower return on their existing assets: for instance by incurring a cost in making their products and processes in line with the requirements of a low carbon future

