Climate policies and oil exporters: a general equilibrium assessment of monetary compensations

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Introduction

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- We investigate 3 possible responses of oil producers to global climate policies
  - Participating without compensations
  - Participating in exchange for monetary compensations
  - Remaining outside of the agreement

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- We investigate 3 possible responses of oil producers to global climate policies
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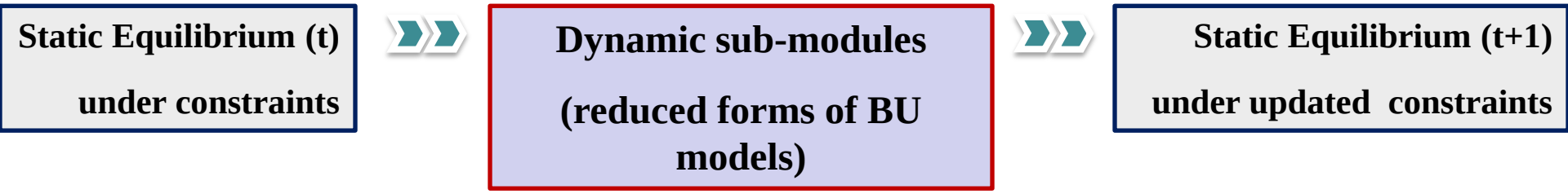
  - Remaining outside of the agreement

- Modelling needs:
  - General equibrium to consider the feedback effects of climate policies (e.g. on oil demand through reduced economic activity)
  - Limited flexibility of economic adjustments to represent co-benefits of climate policies

THE IMACLIM-R MODEL

IMACLIM-R: a recursive dynamic approach

Simulation (not optimal control)



Myopic economic agents

Putty-clay description of capital *(with fixed energy intensity for old vintages)*

Mark-up pricing

3 crucial specificities of oil supply

- Heterogeneous reserves: in each region, 7 categories of conventional + 5 categories of non-conventional reserves

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- Maximum rate of increase of production capacity for each category, given geological constraints

$$\frac{\Delta Cap_{\max}(t,i)}{Cap(t,i)} = \frac{b_i.\left(e^{-b_i(t-t_{0,i})}-1\right)}{\left(1+e^{-b_i(t-t_{0,i})}\right)}$$

b_i: steepness of the bell-shape profile
$t_{0,i}$: expected date of the maximum for oil category i, given past production

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- Market power: Middle-East countries can influence the world oil price through their production decision.

Two options for short-term oil pricing strategies

Different Middle-East production capacity expansion in the short term

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  - ME restricts capacity expansion to let short-term prices rise
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Different Middle-East production capacity expansion in the short term

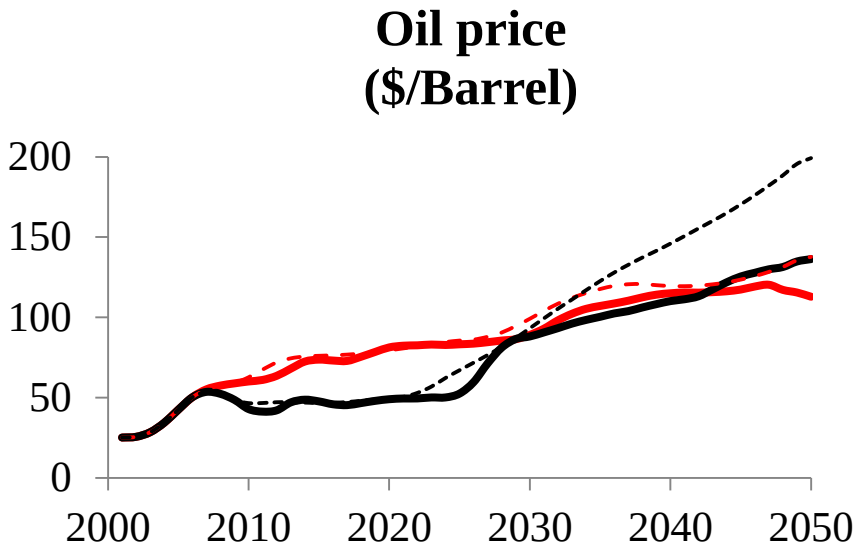
- **Limited Deployment strategy (LD)**
  - ME restricts capacity expansion to let short-term prices rise
  - Extract oil rent as soon as possible
- **Market Flooding strategy (MF)**
  - ME expands production capacities to maintain oil price at 2009 level
  - Sacrifice in view of two benefits:
    - low oil price implies higher carbon price
    - Technical change towards oil-free patterns is discouraged

BENCHMARK: COSTS OF CLIMATE POLICIES FOR OIL EXPORTERS

Effect of a global climate policy (450ppm-CO2)

Global carbon price + quotas exchange following a « contraction-convergence principle »

Effect of a global climate policy (450ppm-CO2)



Market Flooding strategy (BAU)

Market Flooding strategy (climate policy)

Low deployment strategy (BAU)

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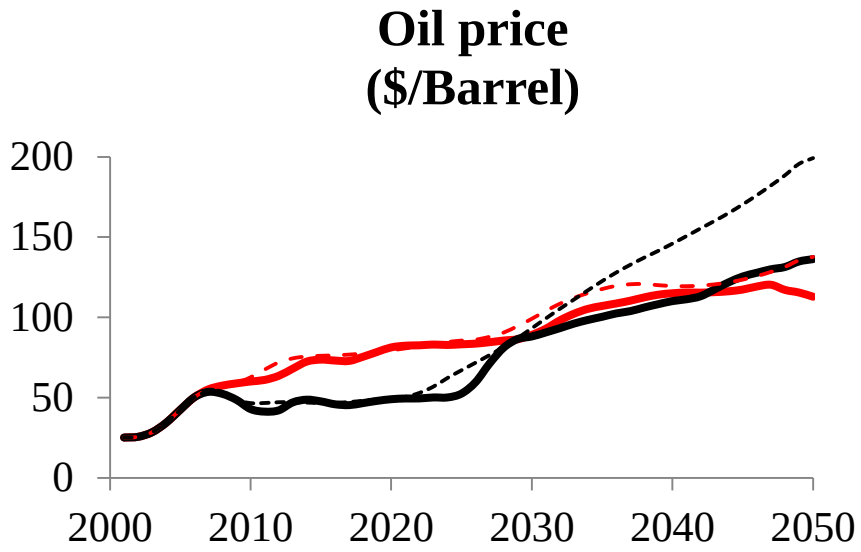

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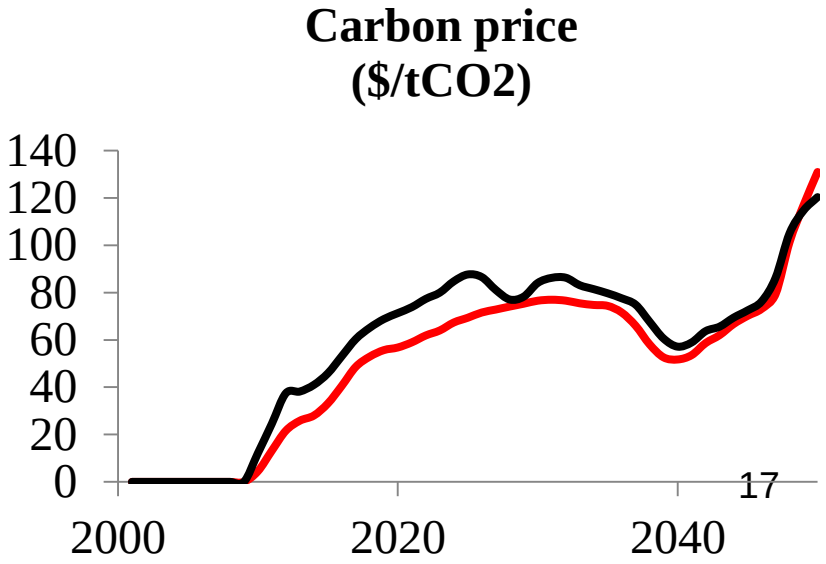
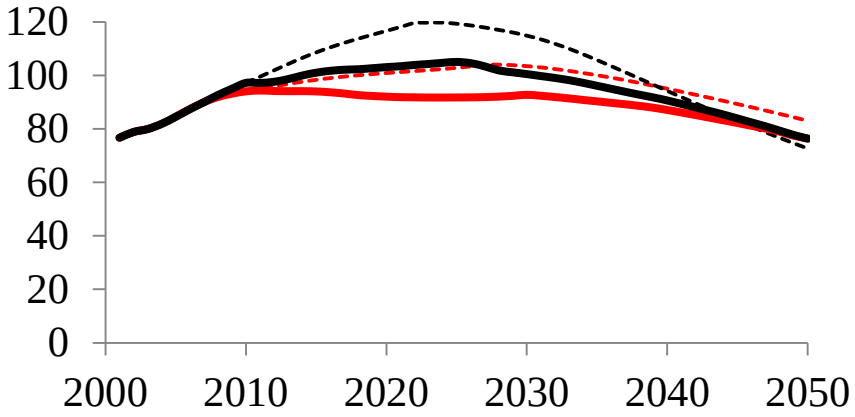
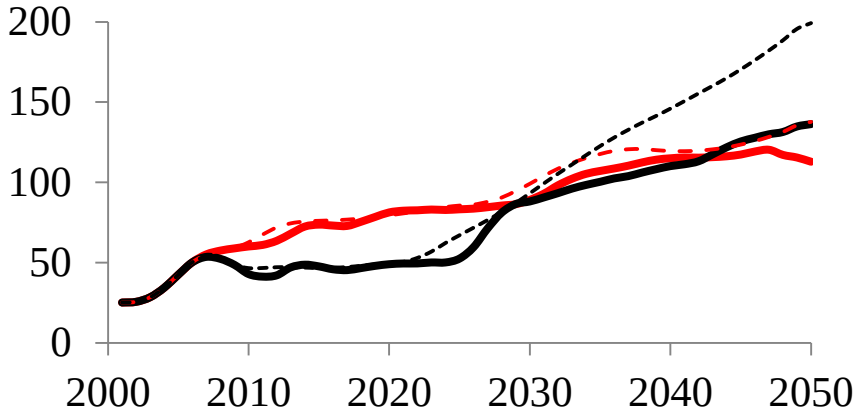


Effect of a global climate policy (450ppm-CO2)

World oil demand (MBarrel/day)



Oil price ($/Barrel)



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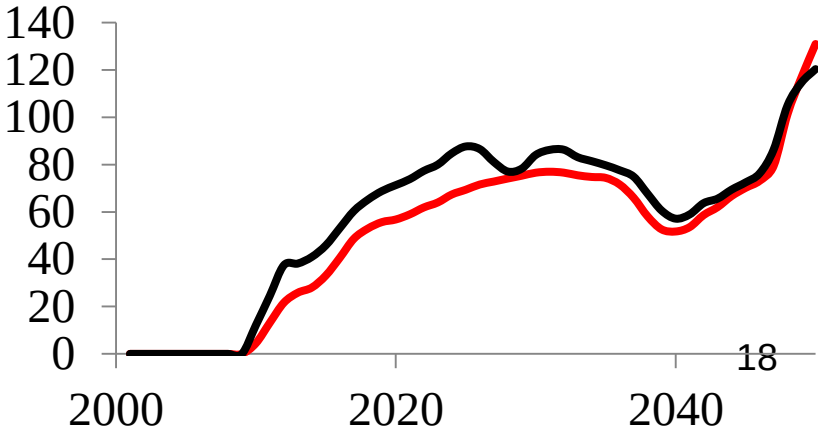
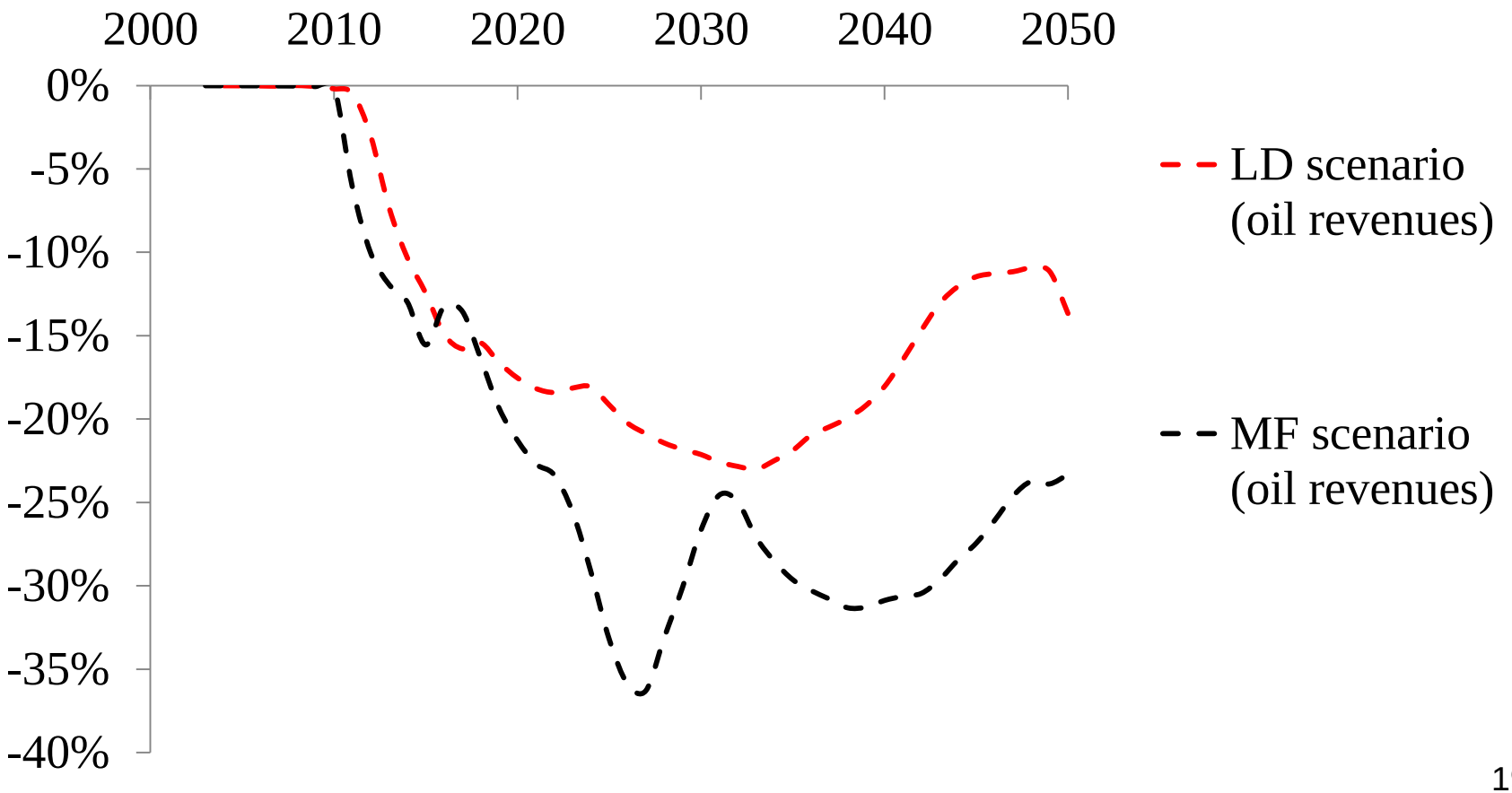


For Middle-East countries, macroeconomic losses are lower than sectoral losses

Variations of oil revenues under climate policy



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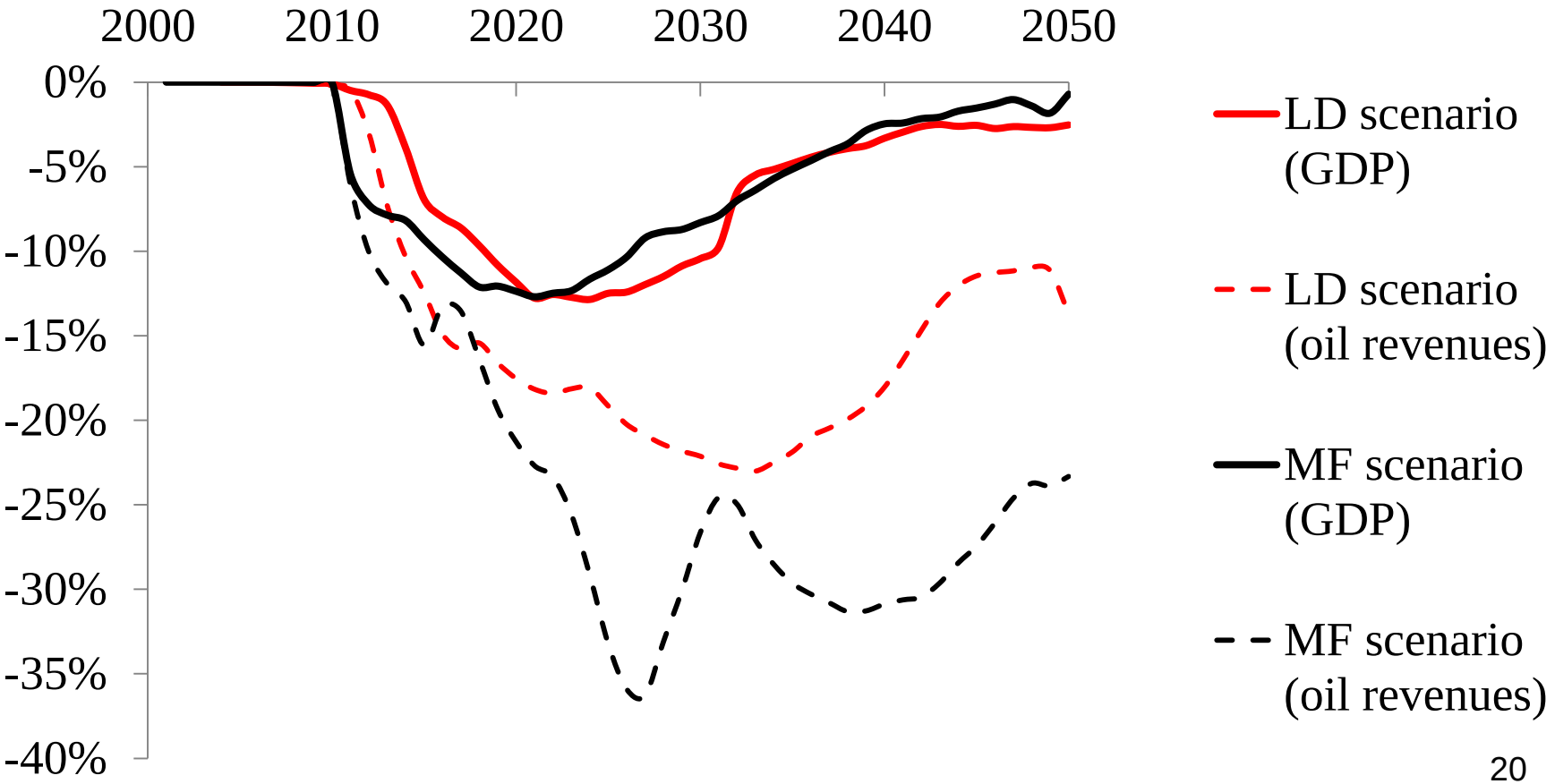
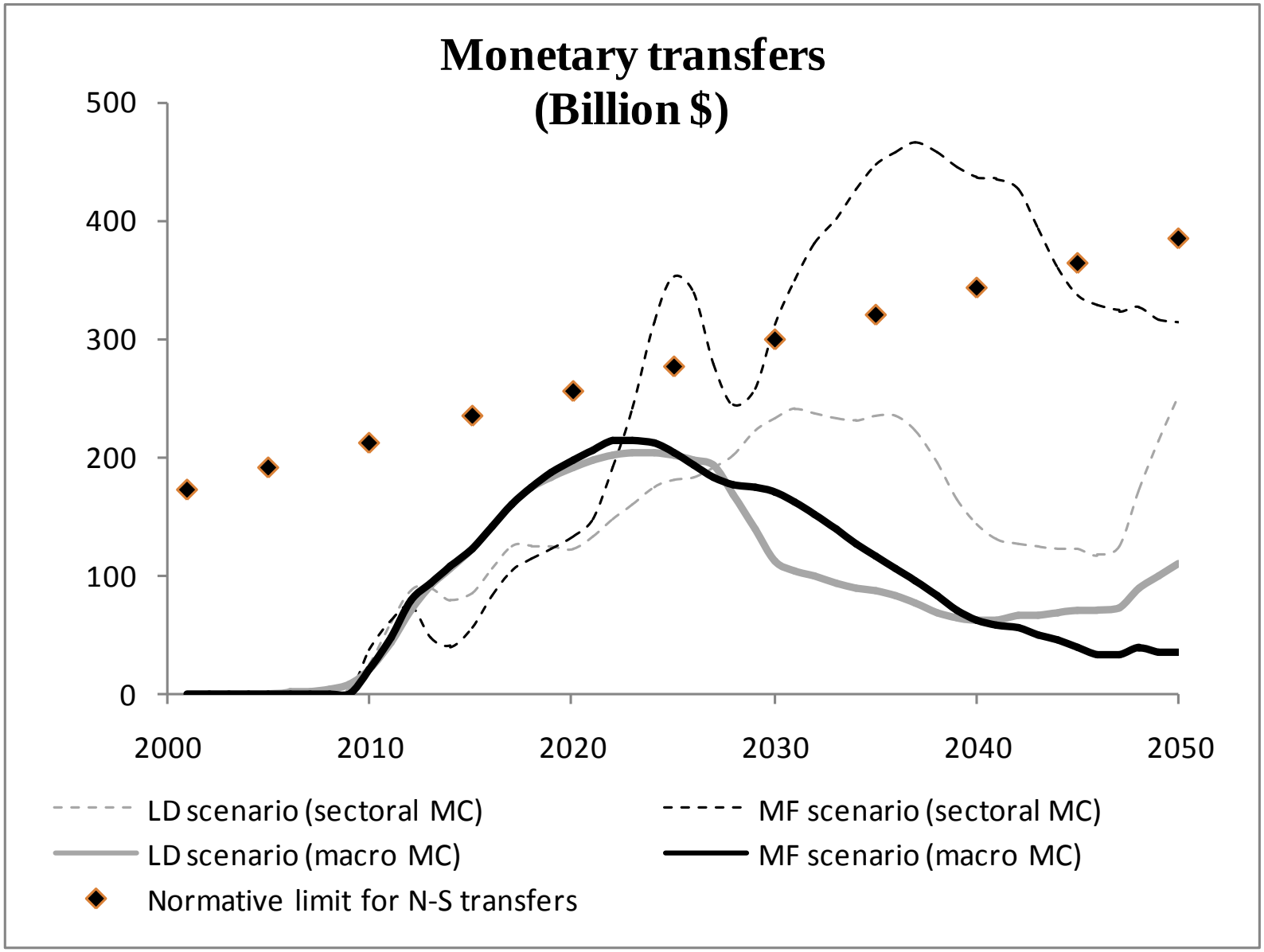
Variations of oil revenues and GDP under climate policy



CLIMATE POLICIES AND MONETARY COMPENSATIONS

What monetary compensations?



General equilibrium effects of monetary transfers

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- The additional cost for OECD countries is less than 1% of their GDP

NO PARTICIPATION OF MIDDLE-EAST COUNTRIES

Trade-off between compensations and no participation

Households' surplus variation

Preference for transfers		2010-2030	2030-2040	2040-2050
Middle-East			+	
OECD	Low Deployment strategy	-		--
	Market Flooding strategy		+	+

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- The cost of Middle-East exiting the climate coalition depends on oil pricing trajectories
  - High short-term oil prices put M-E in an unfavorable position to obtain monetary compensations
  - Low short-term oil prices trigger such important long-term losses in OECD that these countries would be more encline to accept monetary compensations so that M-E countries join the coalition.

Thank you for your attention!

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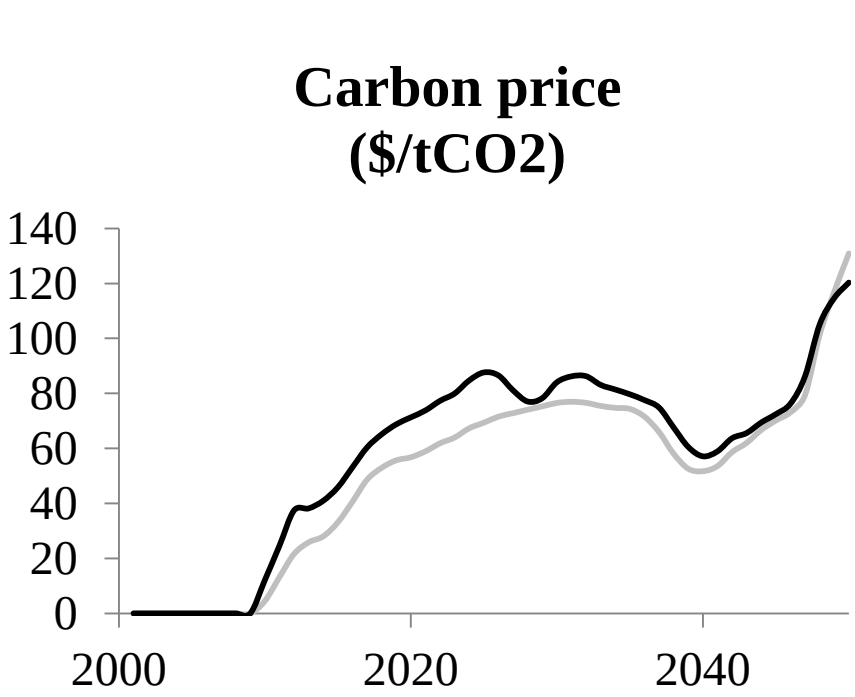
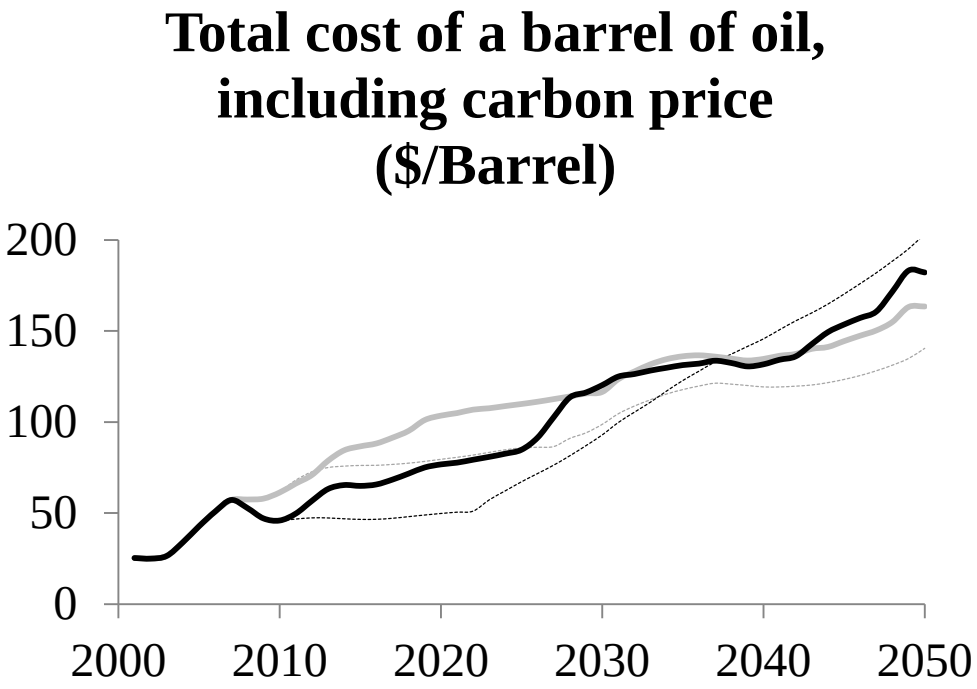
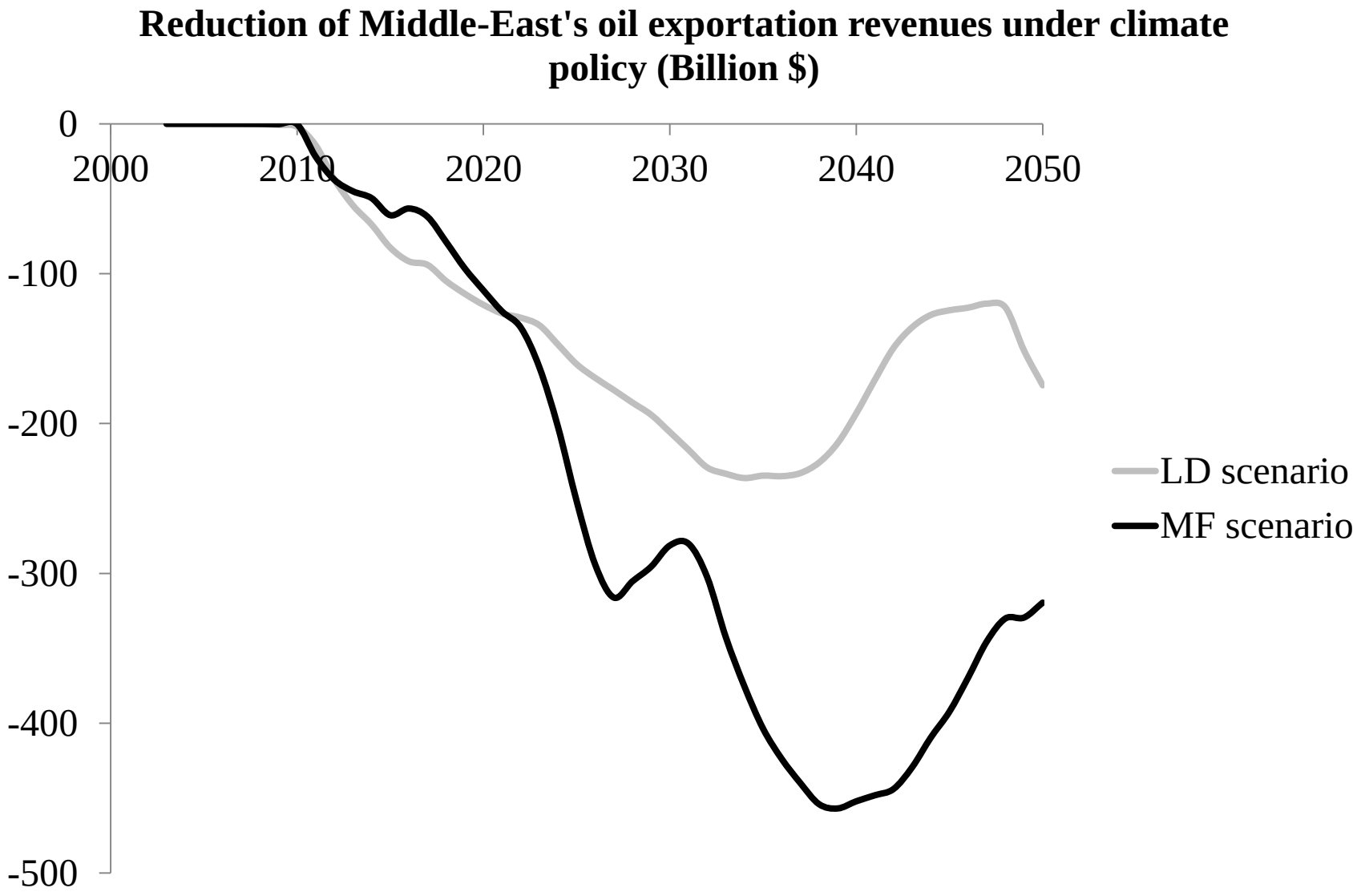
BACK UP

Table 1. Cumulated production of fossil fuels under climate policy over the period 2010-2050 (GToe)

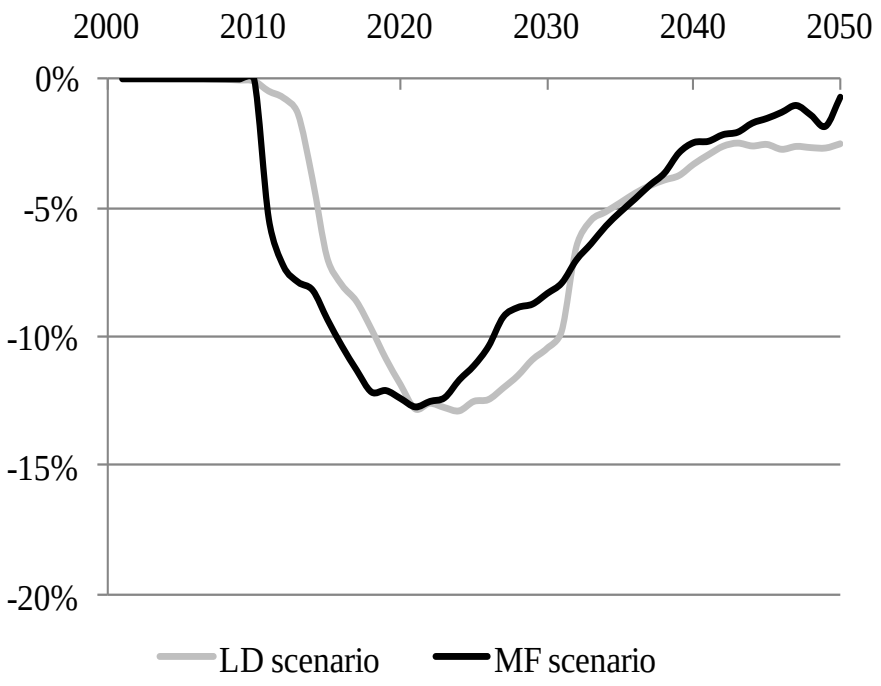
	Oil	Gas	Coal
LD scenario	182.3	97	162.6
MF scenario	195.2	115.1	142.9



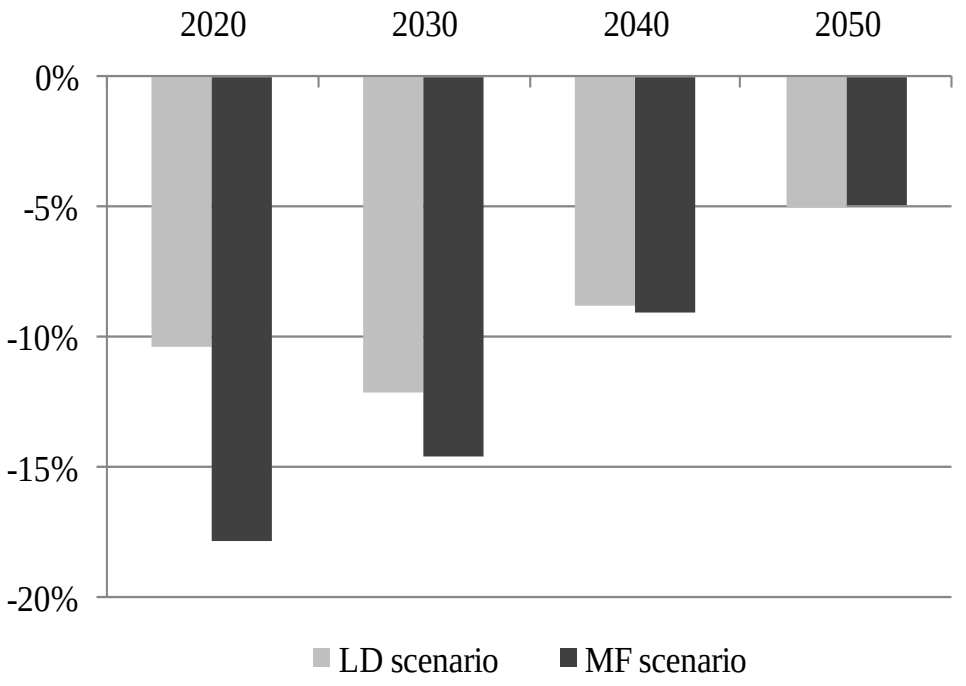



Reduction of Middle-East's oil exportation revenues under climate policy (Billion $)
0
-100
-200
-300
-400
-500
2000
2010
2020
2030
2040
2050
LD scenario
MF scenario

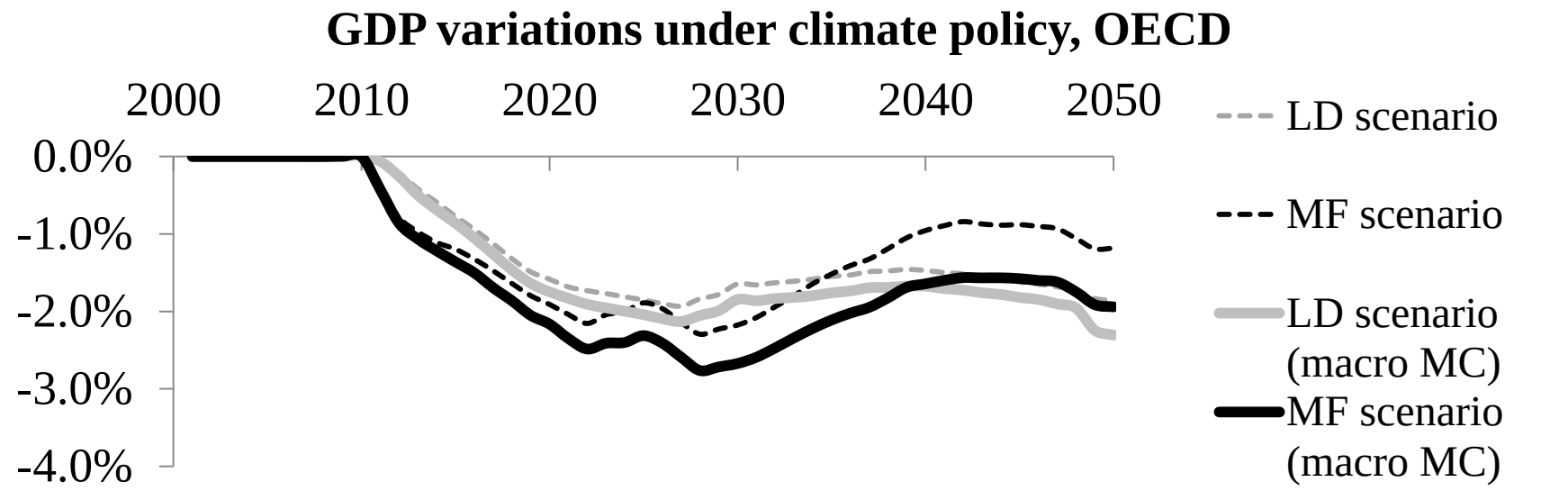
Middle-East GDP variation under climate policy

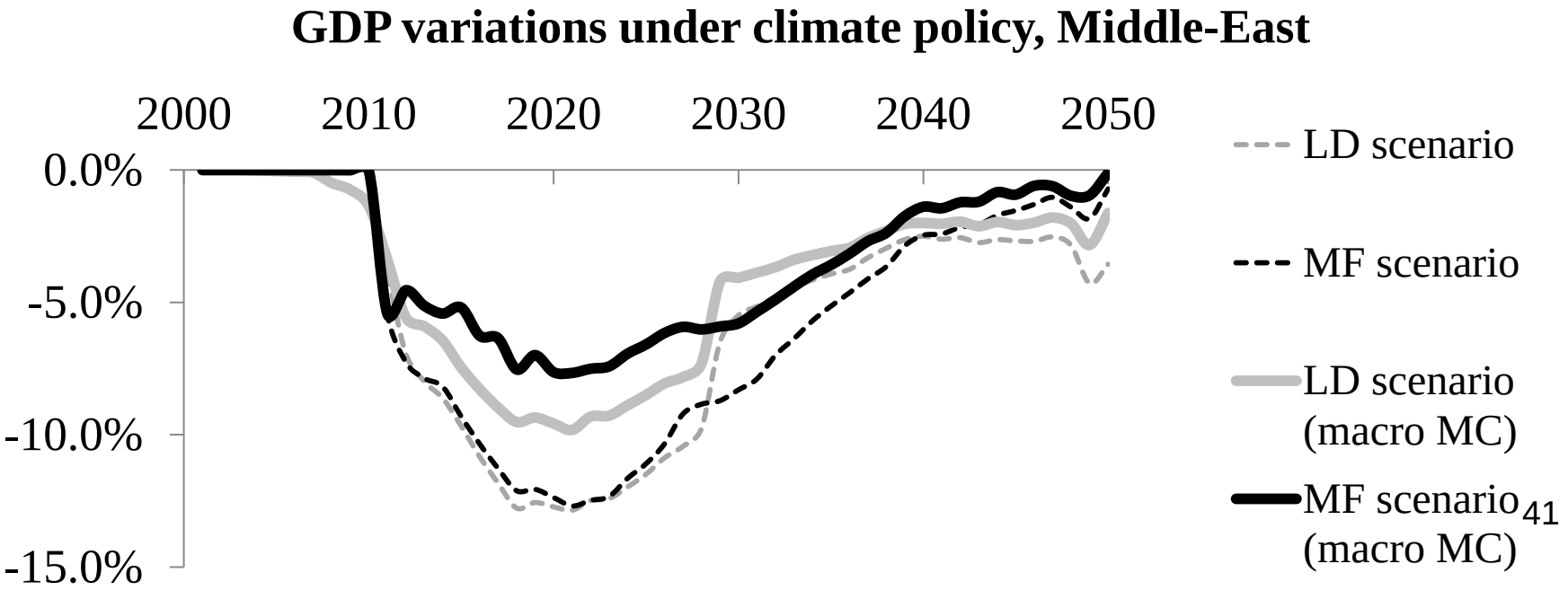


Middle-East countries surplus variation under climate policy



Relative GDP variations for macroeconomic compensations





Net effect of monetary compensations

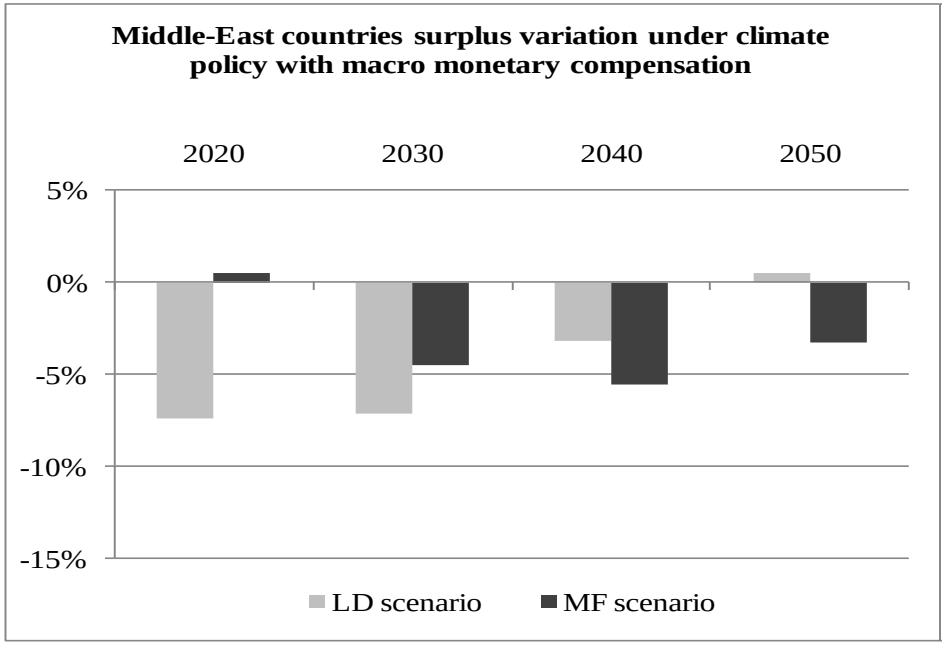
« Efficiency index » of monetary transfers in Middle-East countries

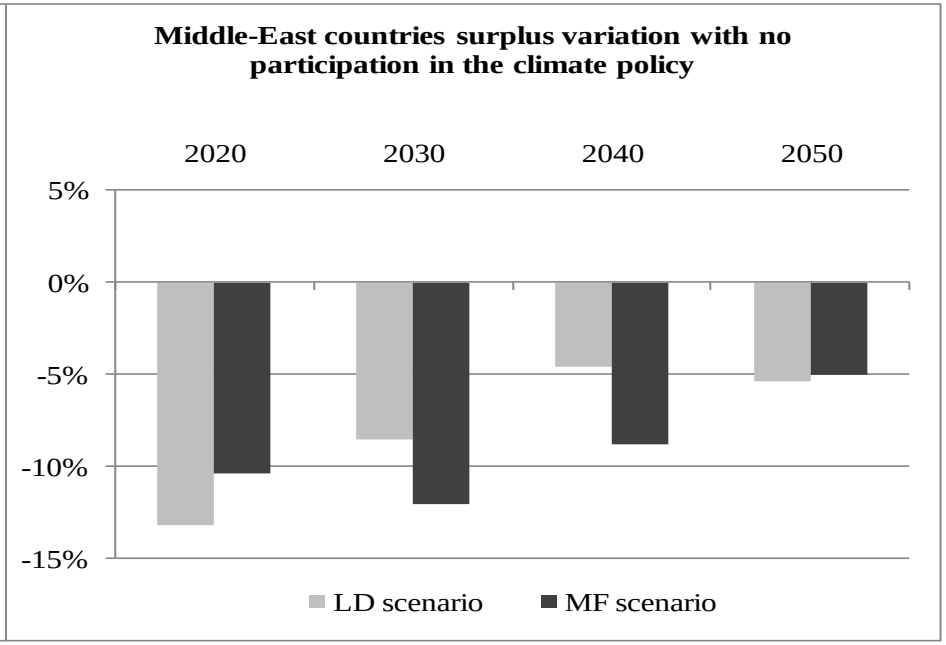
	Total	Consumption	Investments	Trade	*of which:*	
					Oil	*Industry*
LD scenario	0.21	0.76	0.15	-0.70	-0.02	-0.56
MF scenario	0.63	0.62	0.06	-0.05	0.11	-0.17

Positive total effect

Negative effect on trade

Trade-off between compensations and no participation





For OECD: « acceptability index »

		2010-2020	2020-2030	2030-2040	2040-2050
Monetary compensations	LD scenario	-1.3%	-1.4%	-0.5%	-1.6%
	MF scenario	-1.1%	-1.4%	-0.9%	-1.8%
No participation of ME countries	LD scenario	-0.9%	-1.0%	-0.6%	+0.3%
	MF scenario	-1.0%	-1.5%	-1.5%	-2.2%
Comparison Mon. comp. *vs* no particip	**LD scenario**	**-**	**-**	**0**	**--**
	MF scenario	**0**	**0**	**+**	**+**