

Economic implications of the Nationally Determined Contributions and goals of the Paris Agreement

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October 17, 2022

What is the Paris Agreement?

United Nations Framework Convention on Climate Change agreement to:

- (a) Limit temperature increases to “well below” 2°C or, if possible, 1.5°C;
- (b) Improve adaptation to climate change; and,
- (c) Ensure “finance flows” are “consistent” with (a) and (b).

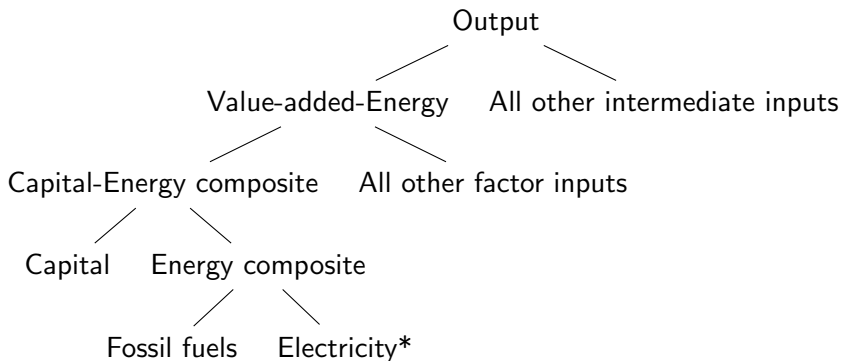
Nationally Determined Contributions (NDCs) are commitments to reduce greenhouse gas emissions that countries make in order to achieve (a).

CGE modelling can help assess economic impacts

Non-exhaustive list of contributions:

- OECD (2012) - ENV-Linkages
- Golub (2013) - GDyn-E
- Fujimori et al. (2016) - AIM/CGE
- Kompas et al. (2018) - GTAP-INT
- Brinsmead et al. (2019) - GTAP-ANO
- Fernando et al. (2021) - G-Cubed
- Whitten et al. (2021) - GTEM / KPMG-EE
- Deloitte Economics Institute (2021a,b, 2022) - D.Climate
- Chen et al. (2022) - EPPA

GDyn-E



Includes accounting of carbon dioxide (CO₂) emissions from consumption of fossil fuels.

*The electricity sector is disaggregated in this study.

Ways GDyn-E is expanded in this study

1. Increased number of greenhouse gases covered
 - Data from Chepeliev (2020)
 - Method based on Brinsmead et al. (2019)
2. Disaggregated electricity sector
 - Data from various sources, discussed next
 - Method based on Peters (2016)

Global average levelised cost of electricity (\$/MWh)

Technology	Capital	O&M	Fuel	Total
Hydro	\$23.01	\$10.54	\$-	\$33.55
Wind	\$31.39	\$17.59	\$-	\$48.98
Nuclear	\$25.98	\$15.87	\$10.68	\$52.53
Coal	\$12.73	\$8.54	\$36.44	\$57.71
Gas	\$11.95	\$8.79	\$62.86	\$83.61
Solar	\$87.10	\$27.60	\$-	\$114.70
Other	\$13.13	\$17.38	\$96.13	\$126.64
Oil Products	\$12.42	\$26.24	\$229.71	\$268.37
Oil	\$51.54	\$25.17	\$212.79	\$289.50

Sources: IEA/NEA (2015), Power Generation Cost Analysis Working Group (2015), Lazard (2015), Lazard (2017), GTAP (2020) and author's calculations.

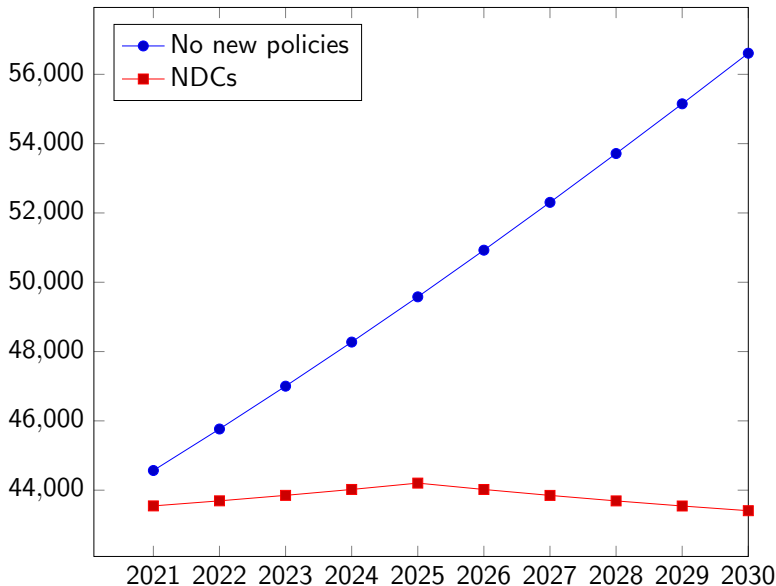
Nationally Determined Contributions

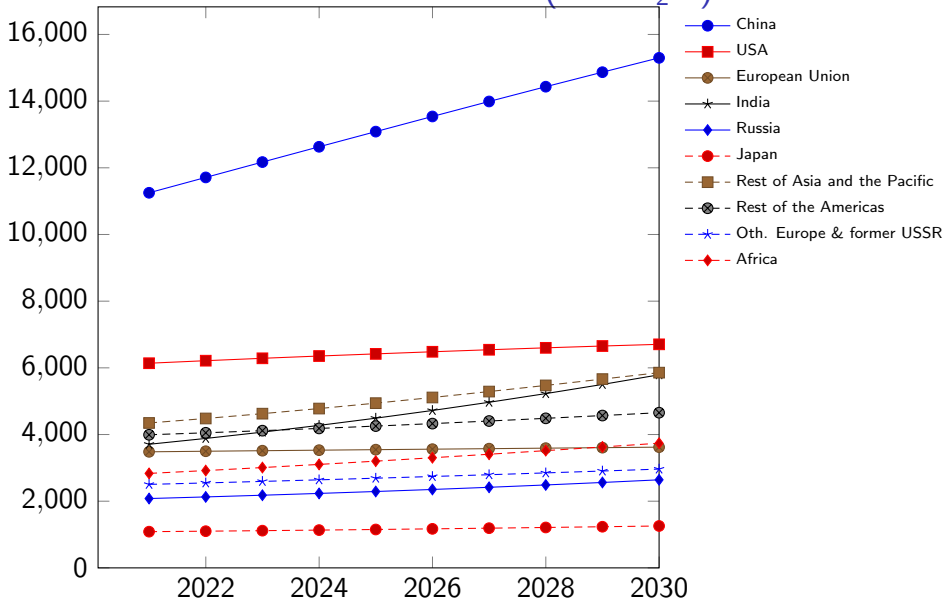
Annual percentage changes in emissions quotas

Region	2021-2025	2026-2030
China and Hong Kong	0.5	-0.6
United States	-2.3	-7.5
European Union	-4.3	-5.5
India	4.1	3.4
Russia	3.3	2.8
Japan	-4.6	-5.9
Australia	-3.6	-4.4
Rest of Asia and the Pacific	3.2	4.3
Rest of the Americas	0.2	-0.5
Rest of Europe and former Soviet Union	1.2	1.0
Middle East	1.2	1.1
Africa	-0.1	-0.5

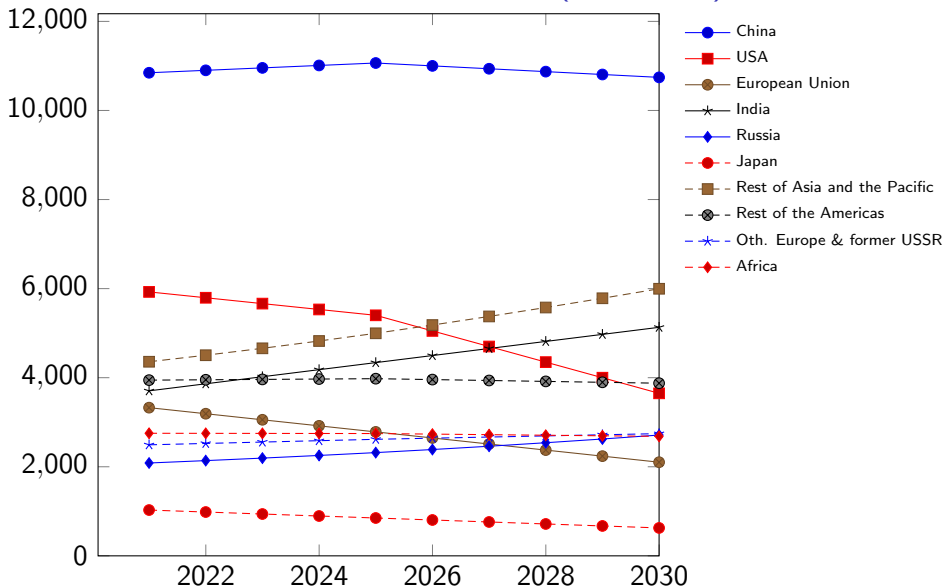
Source: Fenhann (2022) and author's calculations

Global greenhouse gas emissions (megatonnes CO₂ equiv.)

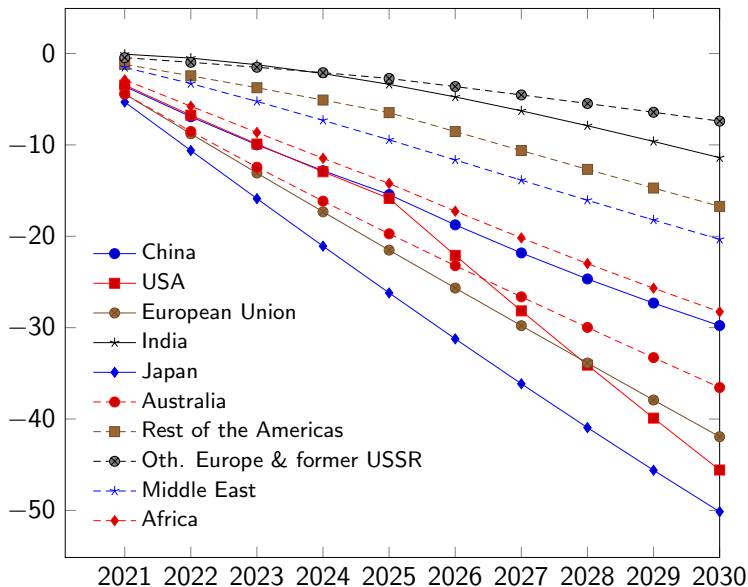


Base case emissions (MtCO₂-e)

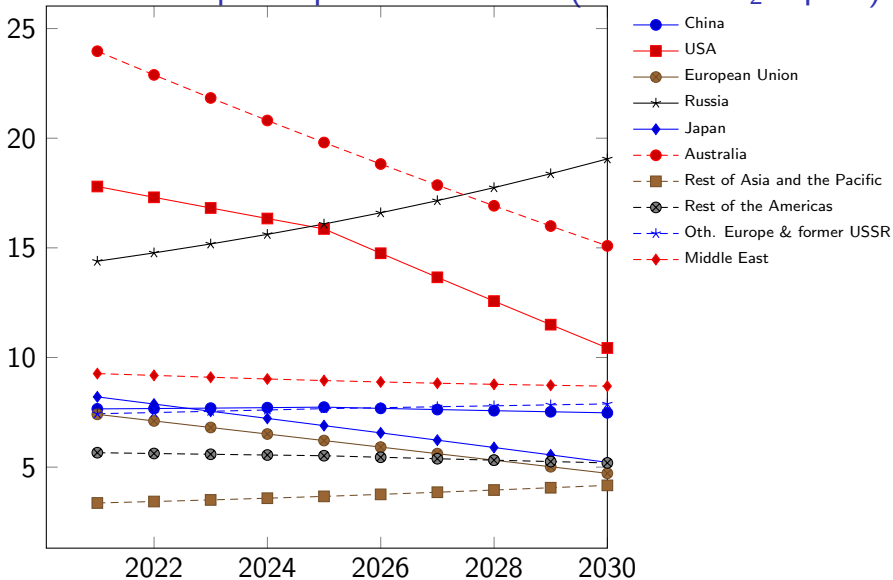
Emissions with NDCs (MtCO₂-e)



Deviation in emissions (%)



Emissions per capita with NDCs (tonnes CO₂ equiv.)

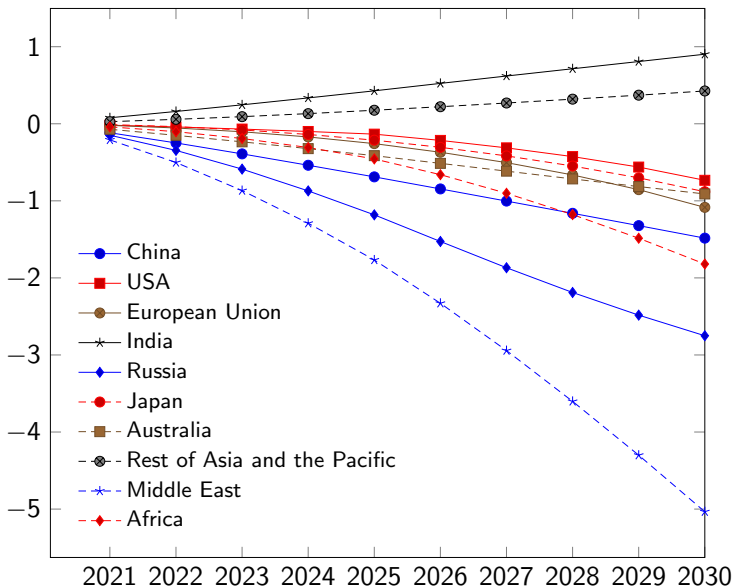


Electricity sector share of emissions (%)

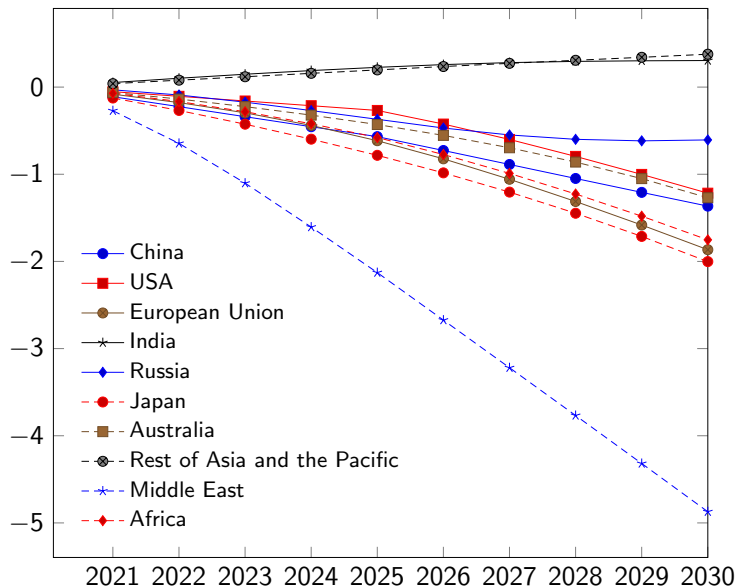
Region	2017	2030 (base)	2030 (policy)
China and Hong Kong	39	38	20
United States	33	26	3
European Union	24	18	2
India	30	31	30
Russia	41	41	41
Japan	44	41	14
Australia	27	20	5
Rest of Asia and the Pacific	24	26	25
Rest of the Americas	13	11	7
Rest of Europe and former USSR	25	24	18
Middle East	27	29	29
Africa	17	17	9
World	30	28	19

Sources: GTAP (2020) and author's calculations.

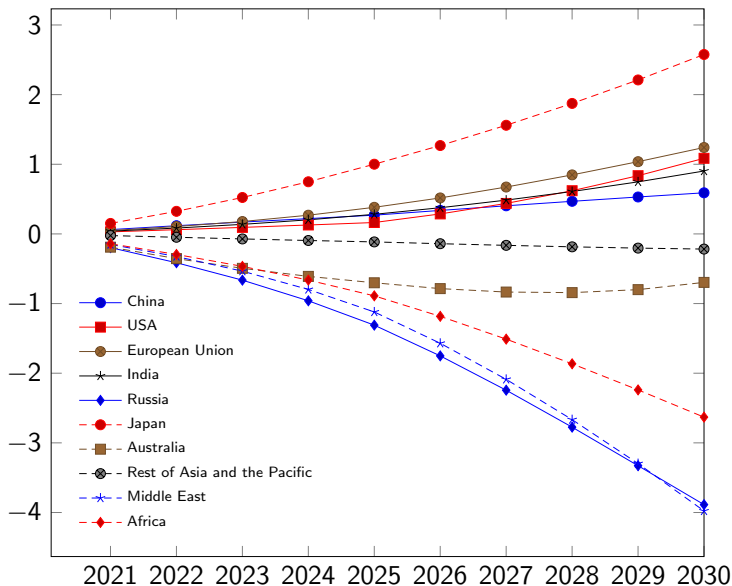
Deviation in real GNP (%)



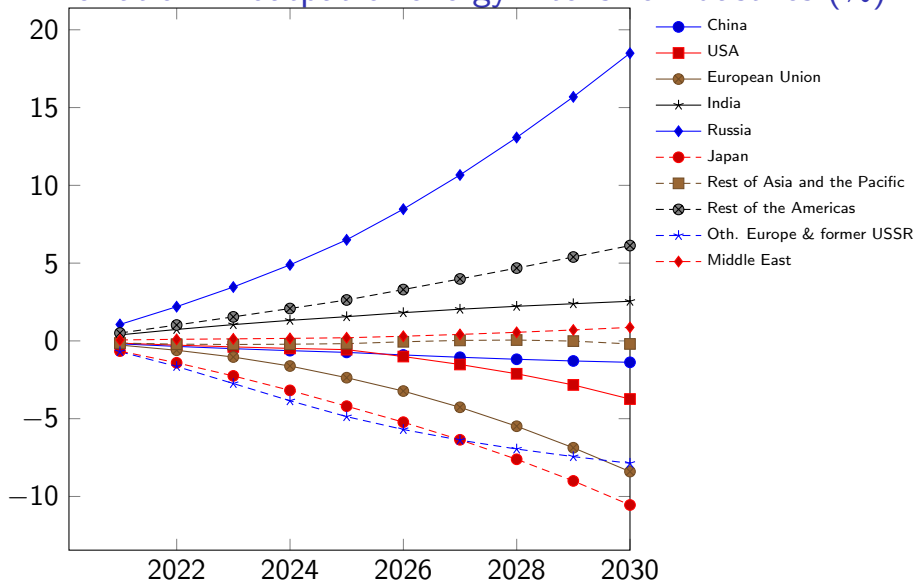
Deviation in real GDP (%)



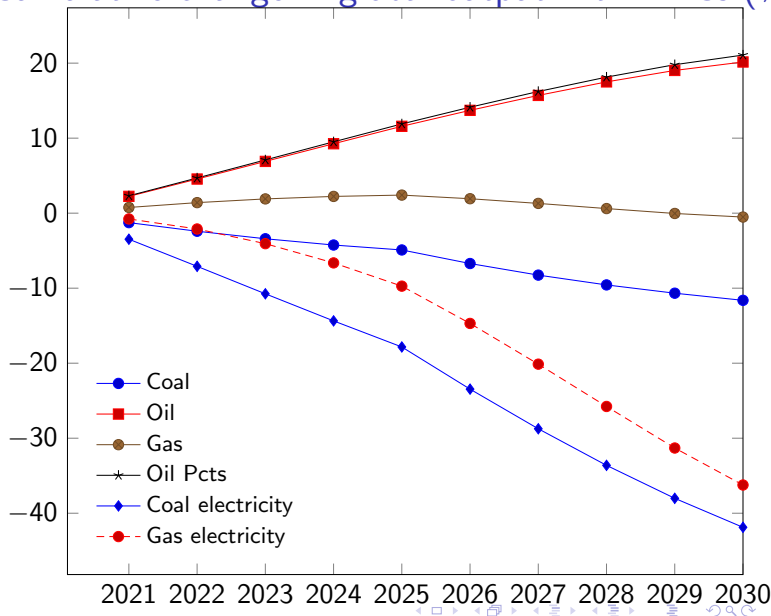
Deviation in terms of trade (%)



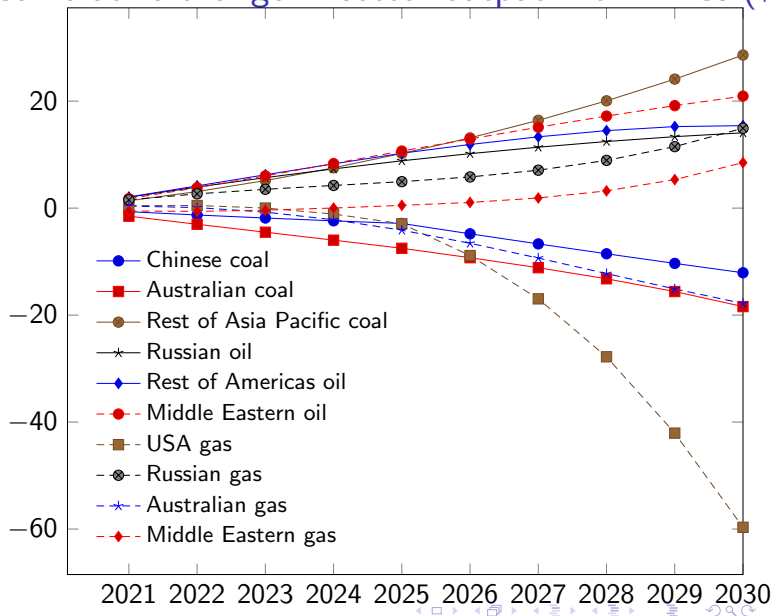
Deviation in output of energy intensive industries (%)



Cumulative change in global output with NDCs (%)



Cumulative change in sector output with NDCs (%)



Discussion / limitations

- Marginal Abatement Cost curves
- Carbon Border Adjustment Mechanisms
- Alternative energy commodities
- Negative emissions sources

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