Transparency, Policy Surveillance, and Levels of Effort: Assessing and Comparing INDCs

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Analysis to Support Pledge & Review

- Normative analysis suggests what countries *should* do
- Our objective analysis tries to deduce what countries *are* doing to support cooperation and future action on climate change
- Objective analysis allows countries to make their own judgement about the relevant actions of peers
- Objective analysis is necessary in the emerging pledge and review architecture to encourage both delivery on current pledges and stronger actions in the future.

The Role of Economic Modeling

- Pledges exist in a wide range of formats, ranging from targets relative to various base years, targets relative to baseline forecasts, targets relative to GDP, and other policy objectives.
- Many of these formats require economic modeling to translate into comparable formats – for example, baseline forecasts of emissions or GDP.
- Countries own assessments may be selective, may reflect national interests, and may not permit apples-to-apples comparisons.
- Cross-border effects imply that countries' own analysis of their efforts in isolation will not capture the net effect of all countries acting simultaneously.
- Economic modeling can encourage policy learning about the relative costs of different policies, particularly the cost-savings associated with carbon pricing.

Principles for Metrics of Comparability

- **Comprehensive**
  - Captures the notion of “effort” in the widest possible sense.
  - Similar countries might be expected to exhibit similar effort values in a “fair” agreement
- **Measurable and Replicable**
  - Directly observable or based on transparent analysis
  - Replicable by independent third parties
- **Universal**
  - Can be applied to pledges by a broad set of countries

Metrics for Comparing Effort

- **Simple Metrics** - easily measurable and replicable
  - Pledged emission reductions against a base year
- **More Advanced Metrics** - more comprehensive, but require forecasts
  - Emission pledges pertaining to future years
  - Emission pledges per unit of GDP
- **Most Advanced Metrics** - most comprehensive, but require modeling
  - Impact of pledged actions on energy price impacts
  - Marginal cost of pledged emission reductions (per ton of CO_2)
  - Economic cost of pledged action as a share of GDP

WITCH and DNE21+ Models

- Level of aggregation:
  - 13 regions (WITCH) and 54 regions (DNE21+). For comparison, DNE21+ regions have been aggregated to match. Main results focus on seven countries (three only from DNE21+).
- Model design:
  - DNE21+ minimizes the cost of meeting global energy needs in a technology rich (200+ technologies) bottom-up model. WITCH maximizes the discounted utility of consumption with a single final good, produced using capital, labor, six fuels and seven electricity technologies in a top-down model.
- Trade:
  - Both models include trade in fuels.
- Forestry emissions:
  - WITCH includes forestry emissions; DNE21+ does not.

INDC Assessment: Select Countries & Regions

Results averaged over 2025-2030

Country or Region	US		EU*		China		India	
	WITCH	DNE21+	WITCH	DNE21+	WITCH	DNE21+	WITCH	DNE21+
GHG emissions [$MtCO_2eq/yr$]	5470	5091	3844	3733	14680	17353	4304	6366
vs. 1990 [%]	1	-18	-30	-35	356	338	255	389
vs. 2005 [%]	-27	-30	-30	-30	96	109	105	206
vs. 2025-2030 BAU [%]	-39	-35	-32	-32	-22	-4	-14	0
GHG/GDP								
Δ (GHG/GDP) 2015–25 (%/yr)	-5.8	-4.4	-5.4	-2.7	-4.6	-4.6	-3.5	-1.8
Δ (GHG/GDP) 2015–30 (%/yr)	-4.5	-4.0	-5.2	-3.3	-4.3	-4.3	-3.1	-1.8
Prices								
Marginal abatement costs [$US\$/tCO_2e$]	96	92	118	149	20	1	0	0
Electricity price [% increase]	89	38	143	30	18	-5	-1	-4
Gasoline price [% increase]	27	35	21	28	31	-2	0	-3
Natural gas price [% increase]	67	70	68	44	8	0	-5	0
Costs								
Mitigation costs per GDP [%]	0.86	0.42	0.90	0.59	0.89	-0.20	0.35	0.00

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Country or Region	Canada, Japan, NZ		Japan	Korea, S. Afr., Aus.		S. Afr.	Trans. Economies		Russia
	WITCH	DNE21+	DNE21+	WITCH	DNE21+	DNE21+	WITCH	DNE21+	DNE21+
GHG emissions [$MtCO_2eq/yr$]	1933	1694	1107	1523	1478	525	5127	4575	2383
vs. 1990 [%]	13	-12	-13	35	39	50	-8	-18	-29
vs. 2005 [%]	-21	-23	-21	28	-4	18	71	25	12
vs. 2025-2030 BAU [%]	-18	-27	-20	-38	-34	-26	-20	-4	-9
GHG/GDP									
Δ (GHG/GDP) 2015–25 (%/yr)	-2.9	-3.7	-3.3	-6.2	-2.5	-2.4	-3.3	-4.1	-5.1
Δ (GHG/GDP) 2015–30 (%/yr)	-3.3	-3.7	-3.5	-5.7	-2.8	-3.2	-3.4	-3.5	-5.0
Prices									
Marginal abatement costs [$US\$/tCO_2e$]	42	191	237	99	81	16	20	7	3
Electricity price [% increase]	39	42	48	92	56	33	39	4	9
Gasoline price [% increase]	7	45	49	64	13	4	20	1	2
Natural gas price [% increase]	23	51	36	60	19	0	16	5	11
Costs									
Mitigation costs per GDP [%]	0.91	0.47	0.47	2.98	1.30	2.11	2.55	0.19	0.23

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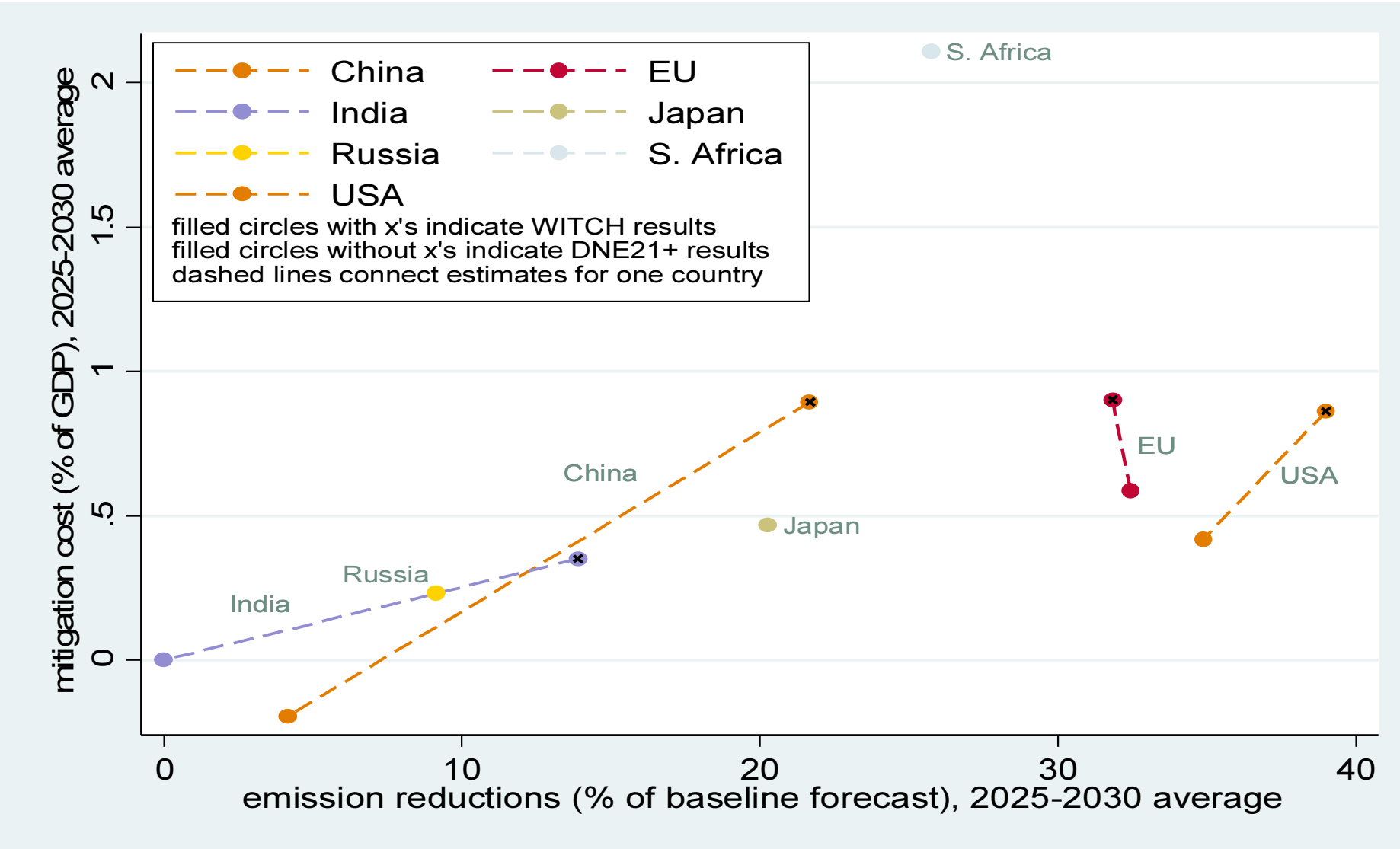
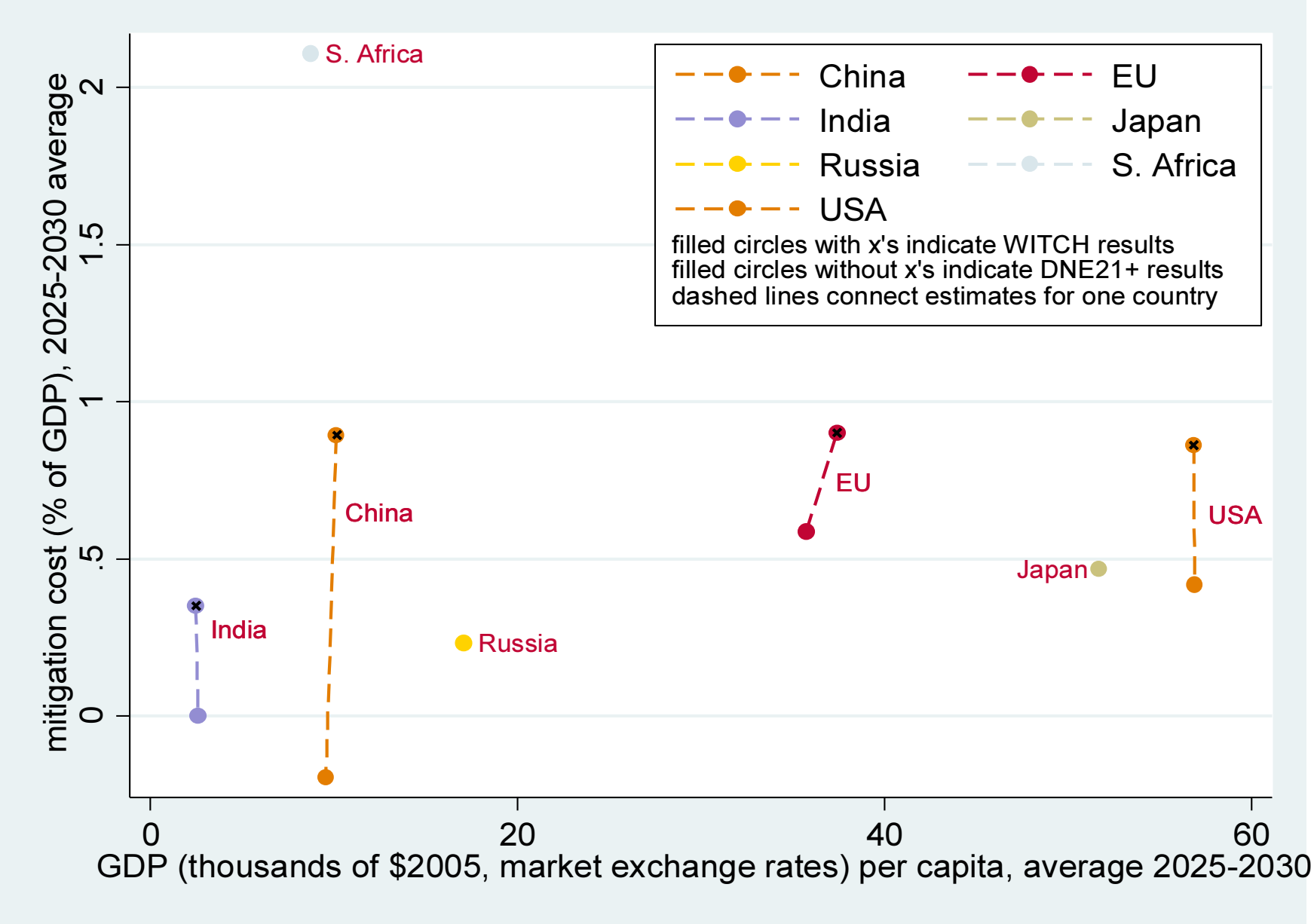
Mitigation costs (% GDP)

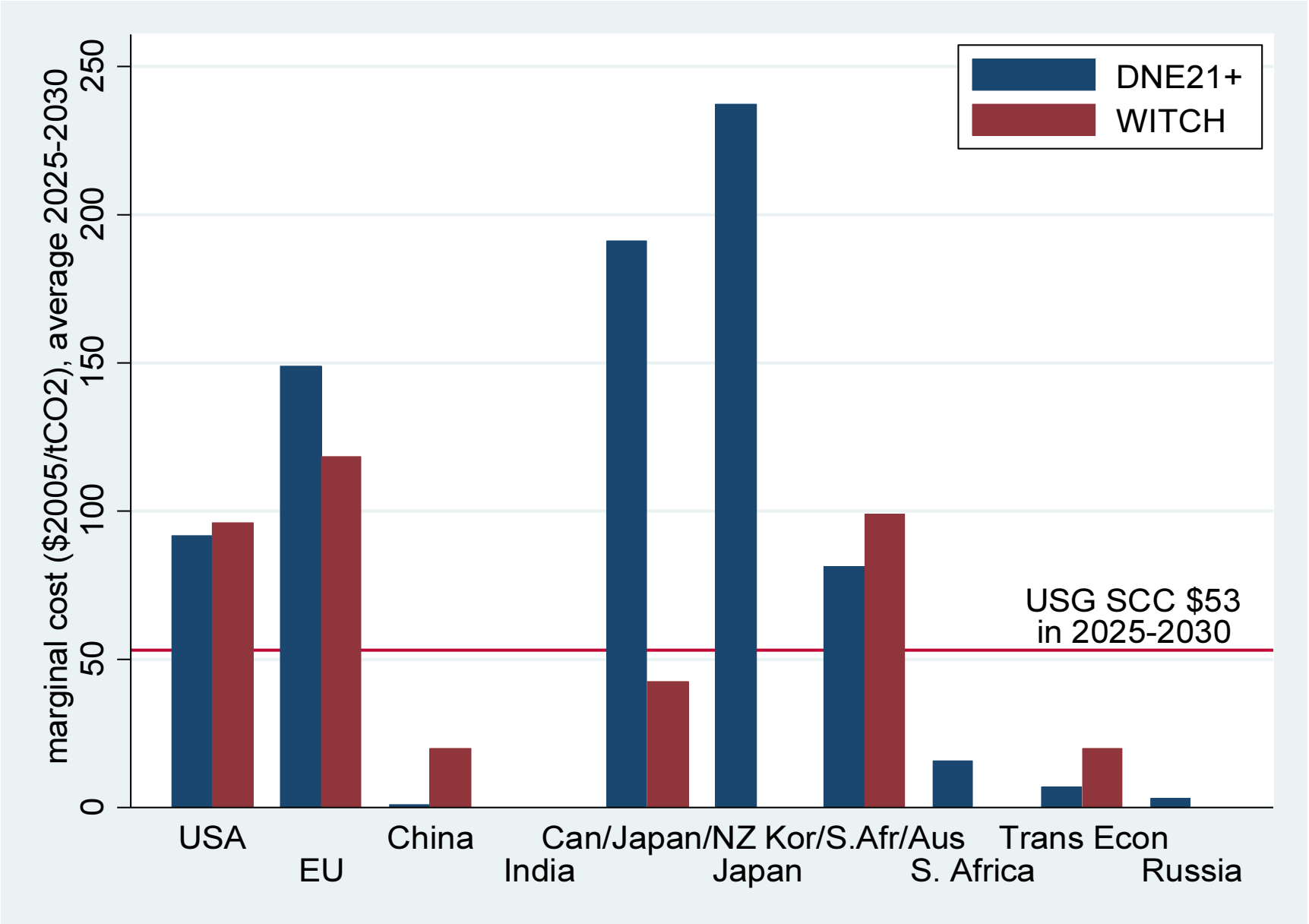
Costs rise proportional to mitigation effort (% BAU)



Mitigation Cost and Country Per capita Income



Marginal Controls Costs Vary Widely



Summary Results

- Mitigation ranges from zero to almost 40 percent of baseline forecasts in 2025-2030. Costs range from 0-1 percent of GDP.
- The models are fairly consistent in the relationship between mitigation and cost, but their interpretation of INDCs and/or baselines lead to wide variations for China and India.
- Countries under $20,000/capita (China, India, Russia) have costs in the 0-0.5% of GDP range; countries over $20,000/capita (US, EU, Japan) have costs in the 0.5-1% of GDP range.
- Estimated marginal costs range from zero to $250/tCO2, suggesting large potential gains from trade
- South Africa is an outlier in costs perhaps because it is suffering a decline in coal exports

Appendix

Modeling issues

- Some models include forestry, some do not. This is important to consider for countries with large forestry emissions (Brazil, Indonesia)
- Treatment of international trade can vary. Trade effects can shift mitigation burden across countries (e.g., to oil exporters); energy consumers with weak mitigation commitments may benefit.
- Models assume cost-effective mitigation through carbon pricing; national policies generally are not.
- Prices may be before or after implied carbon pricing.
- Costs can be calculated different ways – based on GDP changes, household consumption changes, or energy system costs for fixed GDP.
- Models may have different baseline assumptions, and/or interpretations of the INDCs.