In praise of different prices

Francis Dennig Navigate Virtual Workshop

September 21, 2021

with thanks to my co-authors D. Anthoff, M. Budolfson, J. Emmerling, F. Errickson, K. Kuruc, D. Spears, N. Dubash

Francis Dennig Navigate Virtual Workshop

In praise of different prices

A single carbon price versus different prices

- We usually compute outcomes with a single global carbon price because it is supposedly efficient
- Chichilnisky and Heal (1995) already made the point that without transfers the contrained Pareto frontier consists mostly of outcomes with different prices in countries with different capacities

イロト イポト イヨト イヨト 二日

A single carbon price versus different prices

- We usually compute outcomes with a single global carbon price because it is supposedly efficient
- Chichilnisky and Heal (1995) already made the point that without transfers the contrained Pareto frontier consists mostly of outcomes with different prices in countries with different capacities
- If we hope to stay at less than 1 trillion tons, applying a carbon price of \$100/tCO2 to the remaining carbon stock values the "market" at \$108 trillion
- The \$100 billion pledged (and not delivered) in developing country financing is only 0.05% of the value of this market
- If we expect to decarbonize in 40 years, \$100 billion is 2% of the annual market

イロト イポト イヨト イヨト 二日

A single carbon price versus different prices

- We usually compute outcomes with a single global carbon price because it is supposedly efficient
- Chichilnisky and Heal (1995) already made the point that without transfers the contrained Pareto frontier consists mostly of outcomes with different prices in countries with different capacities
- If we hope to stay at less than 1 trillion tons, applying a carbon price of \$100/tCO2 to the remaining carbon stock values the "market" at \$108 trillion
- The \$100 billion pledged (and not delivered) in developing country financing is only 0.05% of the value of this market
- If we expect to decarbonize in 40 years, \$100 billion is 2% of the annual market
- The global policy framework is effectively one without transfers
- We should propose policies that acknowledge this constraint

Francis Dennig Navigate Virtual Workshop

In praise of different prices

Utilitarian optimum

- Different points on the (constrained) Pareto frontier are the optima according to differently weighted objective functions
- In a recent paper we compute the optima in the RICE model with a utilitarian (equally weighted) objective function, without transfers

イロト 不得 トイヨト イヨト 二日

Utilitarian optimum

- Different points on the (constrained) Pareto frontier are the optima according to differently weighted objective functions
- In a recent paper we compute the optima in the RICE model with a utilitarian (equally weighted) objective function, without transfers

- The result has regional carbon prices
- We compare the result to the standard outcome with a single MAC, without transfers



Emission shares and population



- Total emissions with single price: 27 Gtons CO2 ($\approx 3tCO2/cap$)
- Total emissions with different prices: 18 Gtons CO2 ($\approx 2tCO2/cap$)

< □ > < @ >

Compared against current trajectory



Different prices in orange and single price in blue

Э

590

イロト イポト イヨト イヨト

Impacts on consumption



Difference between optimum with different prices and single price

э

< □ > < @ >

Capital costs: another reason to ditch the global price

- Capital costs vary widely
 - In evaluating energy projects in Vietnam, the electricity model the World Bank Uses for Vietnam has a 10% interest rate
 - $\bullet\,$ Lazard, in their levelized cost analyses use 10-12% for Brazil, and 4-4.5% for US cost of debt
 - The current ultra low interest environment is only low in OECD countries

Capital costs: another reason to ditch the global price

- Capital costs vary widely
 - In evaluating energy projects in Vietnam, the electricity model the World Bank Uses for Vietnam has a 10% interest rate
 - $\bullet\,$ Lazard, in their levelized cost analyses use 10-12% for Brazil, and 4-4.5% for US cost of debt
 - The current ultra low interest environment is only low in OECD countries
- Recall that the MAC is the marginal cost of reducing a ton of emissions
- So if instead of reducing a ton today, Brazilians reduce it instead next year
 - To a first approximation, the switch is climate neutral
 - It buys them MAC_t dollars today and costs them MAC_{t+1} dollars next year
 - But today's dollars are worth more by the cost of capital

▲□▶ ▲□▶ ▲三▶ ▲三▶ 三三 つのべ

Different interest rates mean different carbon prices

- Intertemporal efficiency in decarbonization requires the MAC to grow at the **local** rate of interest
- So if the interest rates in different countries vary by a factor of two, then very soon it won't be efficient to have the carbon prices be the same

Different interest rates mean different carbon prices

- Intertemporal efficiency in decarbonization requires the MAC to grow at the **local** rate of interest
- So if the interest rates in different countries vary by a factor of two, then very soon it won't be efficient to have the carbon prices be the same
- Most of our models already acknowledge the different costs of capital in different regions
- We should start requiring the carbon prices to grow according to the local rate

3

프 () () 프 ()

Different interest rates mean different carbon prices

- Intertemporal efficiency in decarbonization requires the MAC to grow at the **local** rate of interest
- So if the interest rates in different countries vary by a factor of two, then very soon it won't be efficient to have the carbon prices be the same
- Most of our models already acknowledge the different costs of capital in different regions
- We should start requiring the carbon prices to grow according to the local rate
- This does not mean that Brazil and the US should have the same price to start off with and Brazil's becoming greater than the US'
- We can also think of countries fully decarbonizing at roughly the same time, so that the price in Brazil starts at a lower level than the US, but grows more quickly to catch up in 2060, for example.