

Estimating the Costs of REDD: an overview of approaches

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Outline of the talk

- Kinds of models:
 - Local/regional, empirical, emissions-based
 - Global, empirical, area-based (Stern Review)
 - Global simulation models
- Kinds of costs
 - Opportunity costs
 - Additional costs – implementation, transaction, stabilization, etc.
- The political/institutional aspect – who'll be participating, and when?
- Making apples more like oranges

Three kinds of approaches

- 1) Empirical studies of particular regions, dividing local cost (\$/ha) by local carbon density of the forest (tCO₂eq/ha) to get price (\$/tCO₂eq) (“local”)
- 2) Empirical studies → overall per-area cost (\$/ha), divided by a global figure for carbon density (tCO₂eq/ha) will give price in \$/tCO₂eq (“area”)
- 3) Global partial equilibrium models of the forest, agriculture and sometimes energy sectors to simulate the world economy and derive supply curves (“global”)

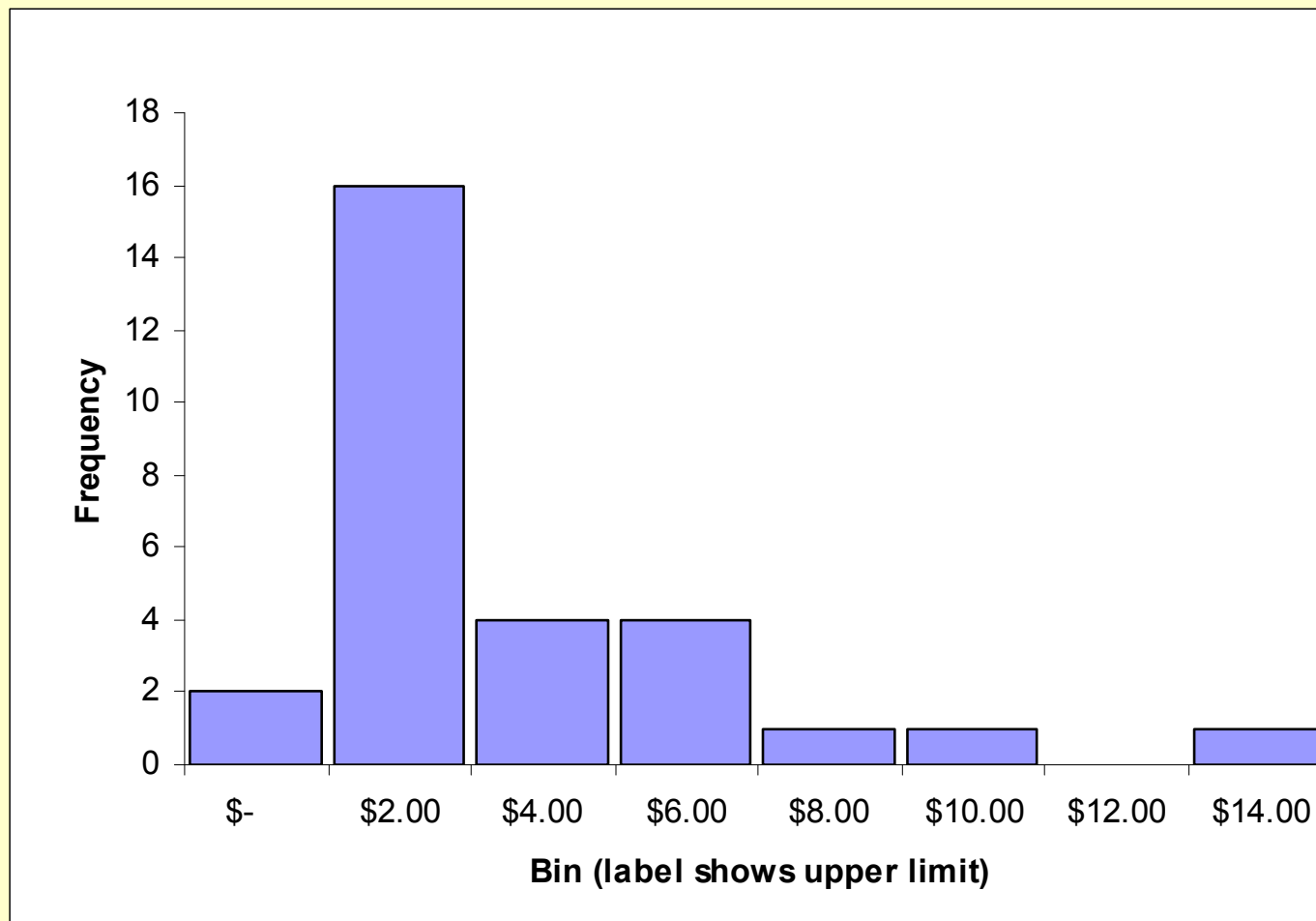
Several kinds of costs

- **Opportunity** costs – highest alternative land use of forest, including net revenue from conversion (e.g. timber value)
- **Implementation** costs – measurement, monitoring, capacity building, planning, enforcement, governance, social programs
- **Transaction** costs – brokerage, verification, certification, insurance, reserves
- **Stabilization** of low-deforestation countries/regions (= leakage prevention = HFLD = “the Congo Basin issue”) – how to include it?

First approach: Local opportunity costs

- Review of the literature
- REDD in tropical countries only
- 23 studies, providing 29 data points
- Data converted to comparable units:
 - Prices in \$ US, 2005
 - Emissions in tCO₂ eq
- Gives point estimates only, not whole curves
- Usually don't know where on the supply curve the point is located (though probably low)

Frequency distribution of opportunity costs from local studies



n = 29; mean = \$ 2.51, S.D. = \$ 3.00

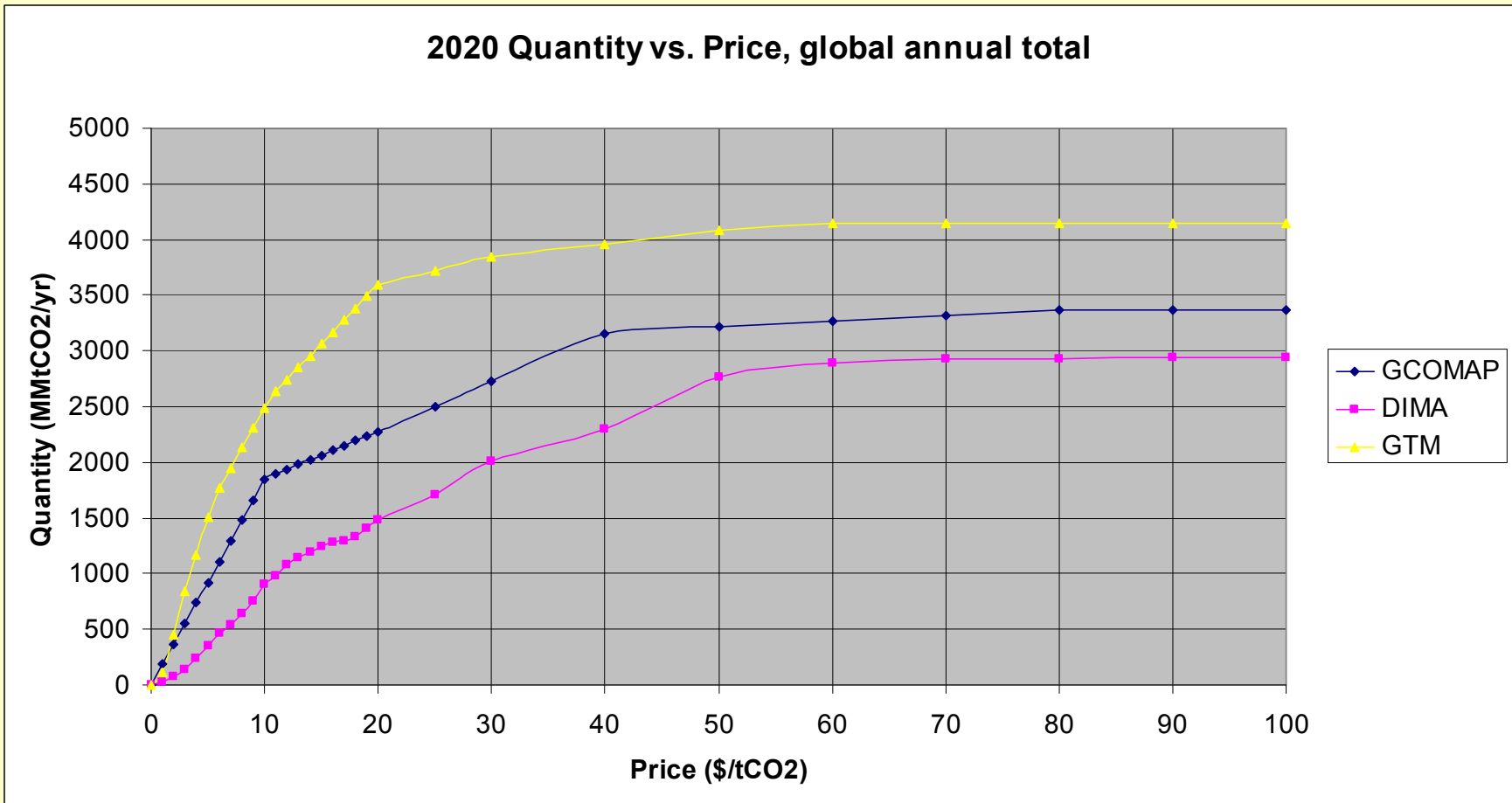
Second approach: Area-based opportunity costs (Stern Review), converted to tCO₂eq

- Grieg-Gran 2006 estimate for the Stern Review:
 - Can reduce deforestation by 46% (in **area** terms) for \$ 5-15 million/year
 - Based on 8 major tropical forest nations
- Converted from area to emissions, using global values from Houghton 2007 (→ 538 tCO₂eq/ha)
- Result: cost estimates correspond to a range of \$ 1.74 to \$ 5.22/tCO₂eq
- Midpoint (\$ **3.48**/tCO₂eq) is 36% higher than the mean of the local estimates of the first approach

Third approach: Global models based on opportunity costs

- Global partial equilibrium models
- Three major groups : GCOMAP, DIMA, GTM
- Supply curves, varying by region and year
- Differences in inputs, e.g.:
 - Data sets
 - Interest rates
 - Model components and linkages
- Differences in outputs, e.g.:
 - Maximum reduction in emissions (= plateau height)
 - Shape of supply curves
 - Differences among regions

Supply curves in absolute terms (quantity vs. price)



Supply curves in relative terms (% maximum quantity vs. price)

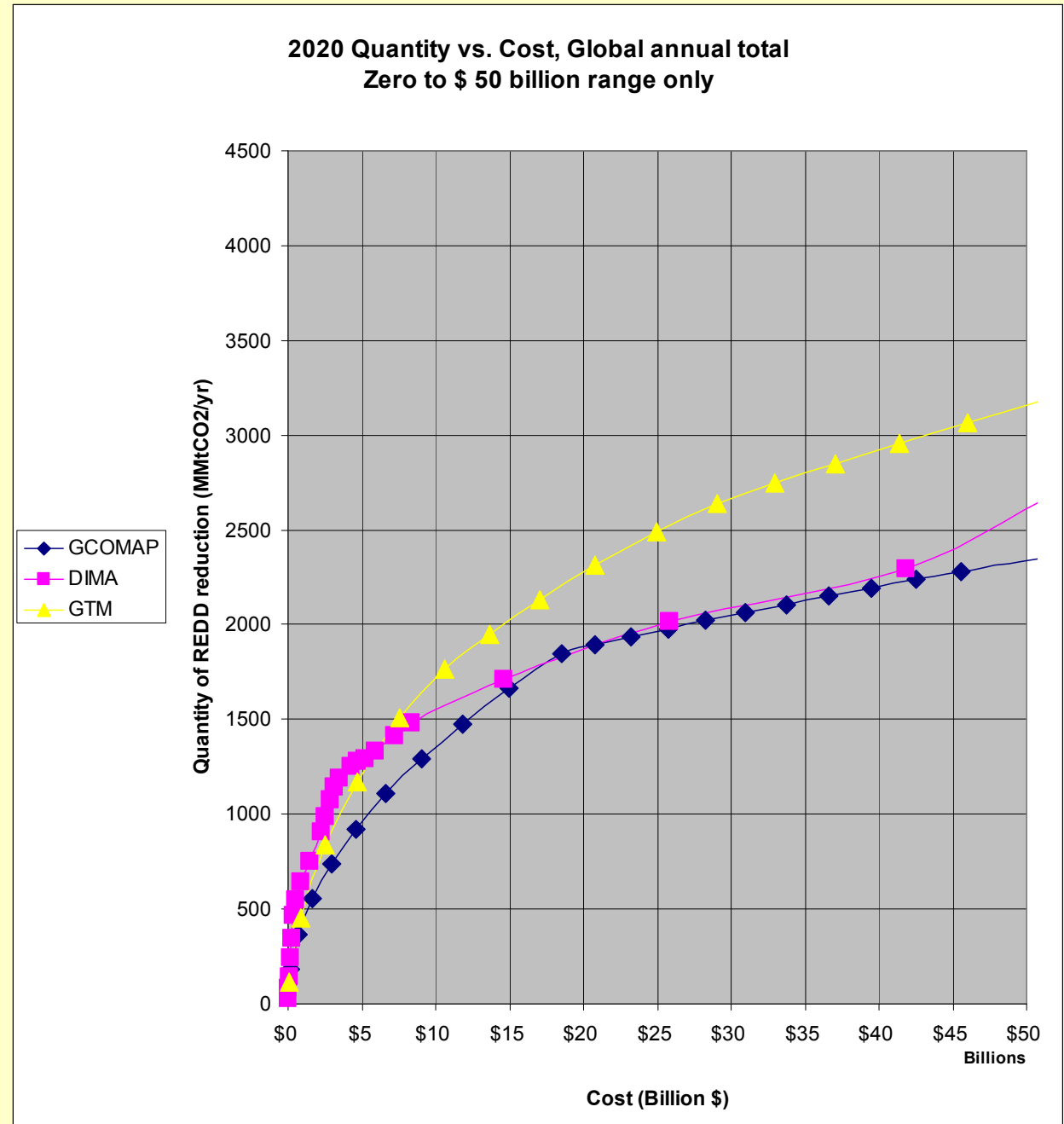


Relative supply curves vs. Stern Review estimates



Low-cost parts of curves

- Converted to (Quantity vs. Cost) curves, over likely range of ODA and market-linked funding
- Differences are less marked than for supply curves over whole range





Other kinds of costs, besides opportunity costs

- Few sources of data to estimate these
- The few quantitative estimates indicate that they are smaller than opportunity costs, but not negligible:
 - Implementation – from Nepstad et al. 2007 (Brazilian Amazon, year 10) → **\$ 0.51/tCO₂eq**
 - Transaction – from Antonori and Sathaye 2007 (mean of 11 forestry projects) → **\$ 0.38/tCO₂eq**
 - Administration – from Grieg-Gran 2006, \$ 4 to \$15/ha → **\$ 0.01 to \$ 0.03/tCO₂eq**

Stabilization (prevention of international leakage)

- Estimates of costs from da Fonseca et al. 2007

Reference deforestation rate (% of global rate)	Countries compensated	Cost (\$ million/yr)
33.3%	7	\$ 365 million
50%	10	\$ 630 million
100%	11	\$ 1,800 million

- Three possibilities for including these costs:
 - Convert to \$/tCO₂ by distributing among all reductions, worldwide
 - Allocate funding for them separately (“fixed cost”)
 - Varying estimates based on countries participating



Political/institutional limits to a global REDD system

- Models assume widespread participation, among both tropical and industrial nations
- How many countries will participate, how soon?
 - Capacity – countries able to participate
 - Willingness – countries willing to participate in the system as created (e.g. carbon market vs. fund)
- Difficult to estimate quantitatively, though can use somewhat subjective indirect indicators
- Only a small number of countries have sizeable emissions, so their participation is key to how global the system is

Indirect indicators for political/institutional constraints, timing of entry

- Capacity
 - Technological measures – universities, research budgets, etc.
 - Governance measures – e.g. World Bank
- Willingness
 - Participation in negotiations – UNFCCC submissions, CfRN members, Forestry Eleven members, etc.
 - Positions on carbon market, fund, etc.

Possible timing of entry vs. percent of emissions

Country	% LUCF Emissions	Capacity	Willingness	Timing of entry
Indonesia	33.7%	Moderate	Moderate	Middle
Brazil	18.0%	High	Moderate	Early
Malaysia	9.2%	Moderate	Moderate	Middle
Myanmar	5.6%	Low	Low	Late
DR Congo	4.2%	Low	Moderate	Late
Zambia	3.1%	Low	Moderate	Late
Nigeria	2.6%	Moderate	Moderate	Middle
Peru	2.5%	Moderate	Moderate	Middle
PNG	1.9%	Low	High	Middle



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Making apples more like oranges

- Would be helpful to standardize methods more
- Need to clarify what is being modeled:
 - Behavior of the global carbon market, if REDD is included in it
 - Costs of REDD, whether implemented through the carbon market, by a market-linked system (e.g. auction revenue, allocation of allowances), or by ODA
- Some other questions to resolve

Differences in methods

- Baselines: recent global average, or take into account future “forest transitions”?
 - “Running out of forest” will necessarily reduce deforestation emissions
 - Internal political dynamics will also lead to reductions, even without REDD payment
- Why the differences in plateau levels?
- Could interest rates and other model details be standardized?

What is being modeled?

- World carbon market dynamics if REDD is included
 - Assumes wide carbon market participation, by both buyers and sellers (cf. Brazil, E.U.)
 - REDD prices pulled up toward world carbon price
- Cost of REDD, irrespective of the financing mechanism
 - Do buying countries only pay each tropical country its (opportunity + additional) costs? (act as a monopsony)
 - Or, same REDD price for all countries?

Some other important questions

Why the large differences between global model and local prices?

Possible explanations:

- Local points are at the lower-left hand corner of the supply curve
- Global models include the timber sector, which is typically high-value relative to ranching and crop production
- Global models include adjustment of global land use as REDD is implemented
- Some other fundamental difference in assumptions?

Opportunity costs – are they a lower or upper bound?

- o "We estimate opportunity costs of forgone profits from non-forest land uses as an upper limit benchmark to the cost of REDD programs. The actual costs of REDD programs should be considerably lower than full compensation of these opportunity costs since Brazilian society has already taken steps to remove much of these forests from the agricultural/livestock land market through the creation of formal forest reserves. The cost of REDD should also be lower than full compensation of opportunity costs because of the benefits of forest protection that accrue to Brazilian society."

Nepstad et al. 2007

Could/should we reduce the cost by not trying to pay for the “last tons”?

- Brazilian Amazon (Nepstad et al. 2007): \$ 1.49 for 100% of emissions vs. \$ 0.76 for 94% of emissions
- Brazil (Vera Diaz and Schwartzman 2005): \$ 5.44 including soy, \$ 2.34 not including soy
- Sumatra (Tomich et al. 2005): \$ 13.34 for commercial logging, range of \$ -0.26 to \$ 5.22 for crops
- Indonesia (van Noordwijk et al. 2007): considerably higher prices in high-access areas

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Questions and comments?

