REDD-based Offsets: Benefit Sharing and Risks

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Research Highlights

In this study we identified promising approaches to effective financial support of **R**educed **E**missions from **D**eforestation and **D**egradation (REDD) [1].

1. Parties' *risk aversion* increases the volume of contracted REDD-based offsets at fair prices.
2. *Benefit sharing mechanism* increases contracted amount and at the same time decreases the price.
3. Public funds might help closing the price gap and ultimately enable REDD.

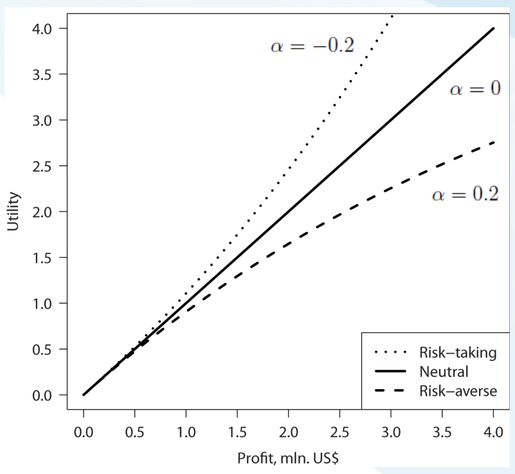
Methodology and Results

We construct a microeconomic model of interaction between the forest owner (REDD-supplier), electricity producer, and electricity consumer [2].

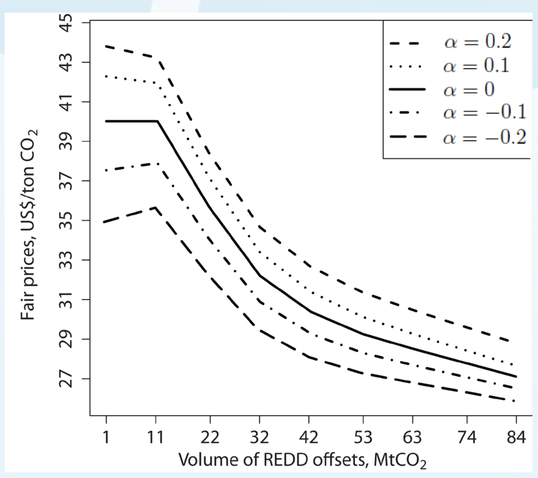
The decision-making process of the electricity producer (under uncertain CO_2 tax/price) consists of:

1. Choosing power plant load factors to minimize the cost given the hourly electricity demand profile and installed capacities of particular power generation technologies;
2. Setting electricity price to maximize the profit based on the demand function indicating consumer's sensitivity to electricity price;
3. Hedging by REDD-based offsets.

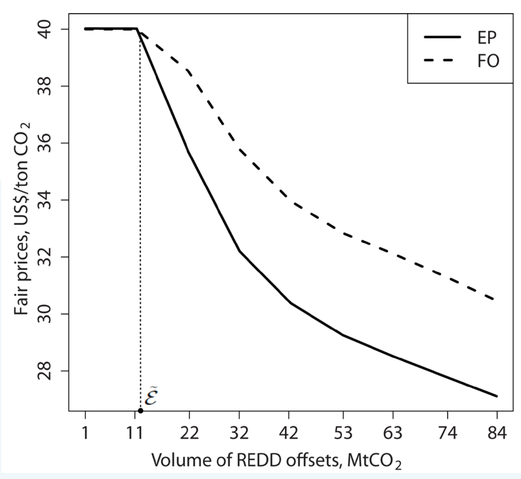
*The **fair REDD offset price** in the study is understood in the sense of parties' **indifference** to whether contract a given amount of offsets, or not.*
***Fair prices** represent **risk-adjusted supply and demand curves** for REDD-based offsets.*



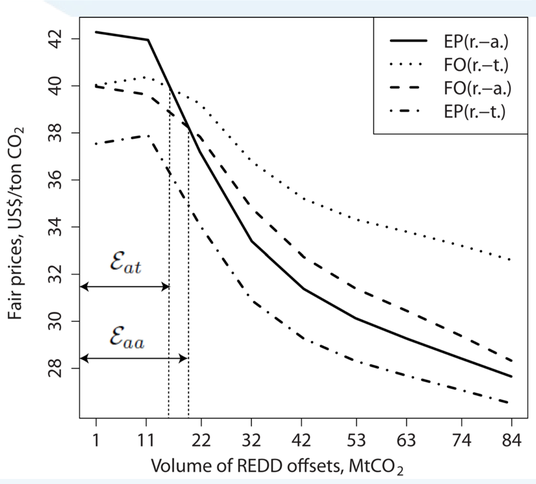
Risk preferences are modeled by *exponential utility functions* [3].



Fair prices with respect to risk preferences: $\alpha<0$ – *risk-taking*, $\alpha\simeq0$ – *risk-neutral*, $\alpha>0$ – *risk-averse*.



Fair prices of the *risk-neutral* electricity producer (EP) and forest owner (FO) depending on the volume of REDD offsets. The future CO_2 price distribution is uniform within the range 0-80 US$/ton CO_2.

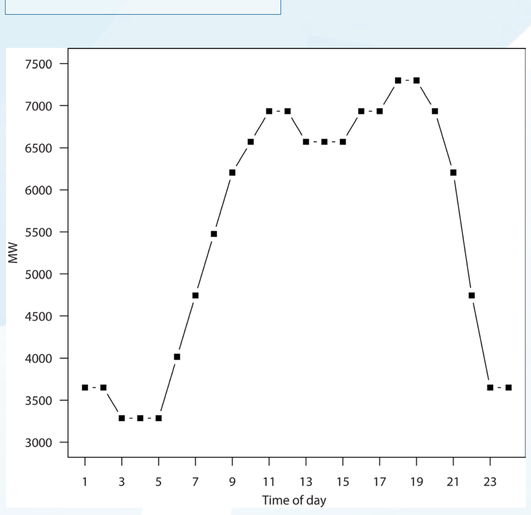


Risk-averse (r.-a.) behavior considerably increases the contracted amounts of REDD offsets and creates a higher potential for REDD implementation.

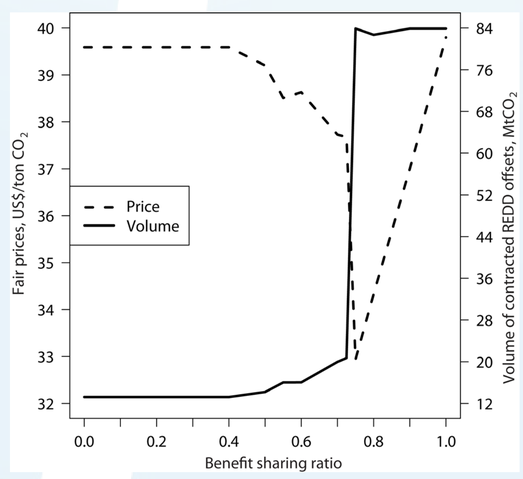
Technological data for the case-study*

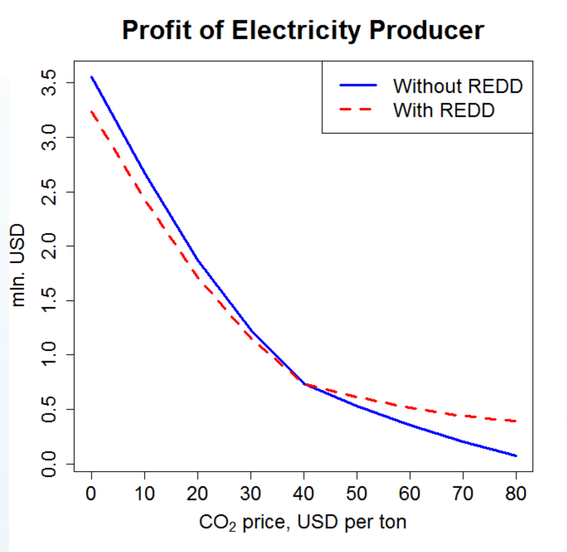
Technology	Annual fixed cost, thousand US$/MWy	Variable cost, US$/MWh	Installed capacity, MW (≈ size of Belarus)	Emission factors, ton CO_2/MWh
Coal-fired	224	18.9	3800	1.02
Natural gas-fired combustion turbine	64	55.6	1900	0.55
Natural gas-fired combined cycle	96	39	2200	0.33

* Sources: [4]-[6].



Average hourly electricity demand (based on [7]).





Financial instrument supporting REDD might help avoid bankruptcy of CO_2-intensive producers at high levels of CO_2 price.

Benefit sharing mechanism increases contracted amount and at the same time decreases the price.

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References

1. Lubowski, R.N., Rose, S.K., 2013. The potential for REDD+: Key economic modeling insights and issues. Review of Environmental Economics and Policy, Vol. 7, No. 1, P. 67-90.
2. Krasovskii, A.A., Khabarov, N.V., Obersteiner, M., 2014. Impacts of the fairly priced REDD-based CO_2 offset options on the electricity producers and consumers. Economy of Region, No. 3, P. 273-288.
3. Raiffa, H., 1968. Decision analysis: Introductory lectures on choices under uncertainty. Addison-Wesley.
4. Masters, G., 2004. Renewable and efficient electric power systems. Wiley.
5. Schröder, A., Kunz, F., Meiss, J., Mendelevitch, R., Von Hirschhausen, C., 2013. Current and prospective costs of electricity generation until 2050. DIW Data Documentation, Vol. 68.
6. Weisser, D., 2007. A guide to life-cycle greenhouse gas (GHG) emissions from electric supply technologies. Energy, Vol. 32, No. 9, P. 1543-1559.
7. Bigerna, S., Bollino, C.A., 2013. Hourly electricity demand in Italian market. Tech. rep., Universita di Perugia, Dipartimento Economia, Finanza e Statistica.