Conservation by Lending

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"Commitment by Lending"?

- Ideal policies often fail to be time consistent.
- Thus, a policymaker P_t would value a possibility to "tie the hands" of P_{t+1}.
- "Commitment by lending" allows P_t to borrow at an interest rate that depends on P_{t+t}'s policy.
- **"Conservation by lending"** combines a loan with a repayment that will be requested (or an interest rate that will be high) if and only if the forest cover falls relative to a benchmark.

Alternatives

- United Nation: REDD+ ("reducing emissions from deforestation and forest degradation").
- **Traditional REDD+ contracts** take the following form:
  - If the deforestation level is below a benchmark, the forest-owning government will be paid.
  - The amount is linear in the distance between a threshold and the actual deforestation level.
  - There is no repayment/history dependence.
- The two instruments are *not necessarily* performing different.

A benchmark model

- A policymaker P governs a resource stock S_t and can extract fraction x_t to obtain (agric) benefit Ax_tS_t, at cost $\frac{c}{2}x_t^2S_t$, but the per-period benefit of the forest is $b\left(1-x_t\right)S_t$.
- With discount factor $\delta \in (0,1)$, P maximizes

$$\left(Ax_t + (1-b)\,x_t - \frac{c}{2}x_t^2 + \delta v\left(x_s\right)\right)S_t,$$

$$\text{where } v\left(x_s\right) = \frac{x_sA + (1-x_s)\,b - x_s^2c/2}{1-\delta\left(1-x_s\right)}.$$

- To reduce x to x_* from next period, P requests a loan (/payment) of

$$L \geq \delta\left(v\left(x_s\right) - v\left(x_*\right)\right)S_t.$$

- Alternatively, a compensation k s.t.:

$$\frac{x_*A + (1-x_*)\,(b+k) - x_*^2c/2}{1-\delta\left(1-x_*\right)}S_t \geq v\left(x_s\right)S_t.$$

A benchmark model

- When both inequalities bind, they are equally costly:

$$\frac{(1-x_*)\,k_*}{1-\delta\,(1-x_*)} = L_*.$$

- Both schemes implements the "first best" of **conserving at least cost s.t. PC**. (I.e., *min* costs s.t. IC & PC.)
- So, they are equally costly for K (compensator, creditor, or donor).

Lessons

- The present-discounted costs of k and L were exactly the same in the benchmark model.

- But that model assumed:

1. K faces no time inconsistency.problem.
2. P faces no time inconsistency problem.
3. P's preferences are constant over time.
4. P is not subject to elections.
5. There is no uncertainty.
6. P is as patient as is K.
7. P cannot borrow in the credit market.

- **If we relax any of these assumptions, conservation by lending is less expensive!**

1: K's time inconsistency

- The "conservation contradiction":
- If P **expects** K to compensate, P will be more inclined to **conserve** (even without compensation today).
- But when P conserves anyway, **K will not need to pay**.
- K will be tempted to not pay, if K cannot commit.
- ("The Market for Conservation and Other Hostages," *JET* 2016)

2: P's time inconsistency

- P_t in office today might be different from P_{t+1}.
- P_t fears that P_{t+1} will extract too much.
- Anticipating this, P_t extracts more if s/he is likely to be replaced
  - Collier (2010, 1124): "ministers in the transitional government in the Democratic Republic of Congo (DRC) knew that they had only around three years in office. During this period many contracts were signed with resource extraction companies conceding very generous terms in return for signature bonuses that cashed in the value of the natural assets to the society".
- ... as in "The Conservation Multiplier" (*JPE* 2023).

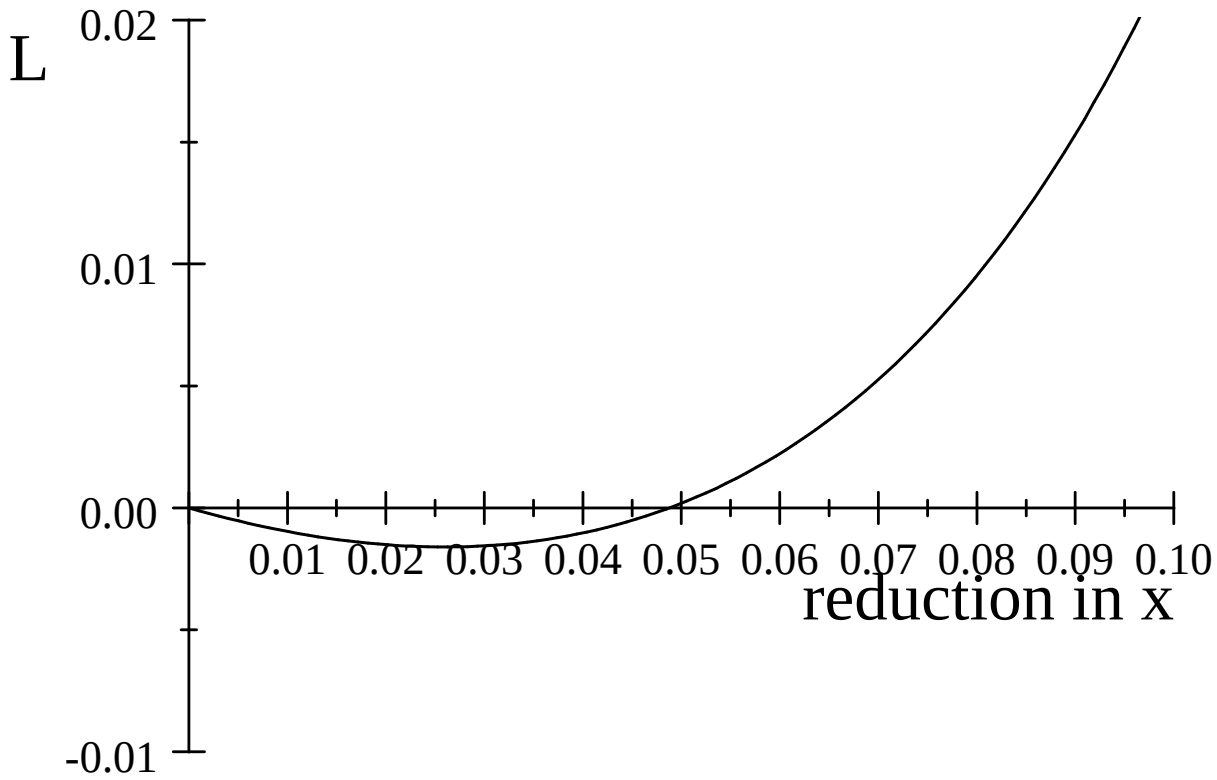
2: P's time inconsistency: A model

- The party in power benefits Δ more from exploitation (because revenues can be diverted, spend on party perks, or because of corruption).
- The party in power now is in power later with probability $p < 1$.
- This leads to $\beta\delta$-discounting (as with quasi-hyperbolic discounting) and time inconsistency problems: P_t wants P_{t+1} to conserve more.

2: P's time inconsistency: Results

- A loan ties the hands of P_{t+1}, making it less attractive to exploit.
- The larger is $(1-p)\,\Delta$, the larger is P's desire to commit
- and the smaller is the necessary loan from K
- but the larger is the compensation, k, that induces P to conserve now.
  - With rotation of political power, K must compensate every P_t for its chance to extract.
- **The loan conserves at least cost; REDD+ does not.**

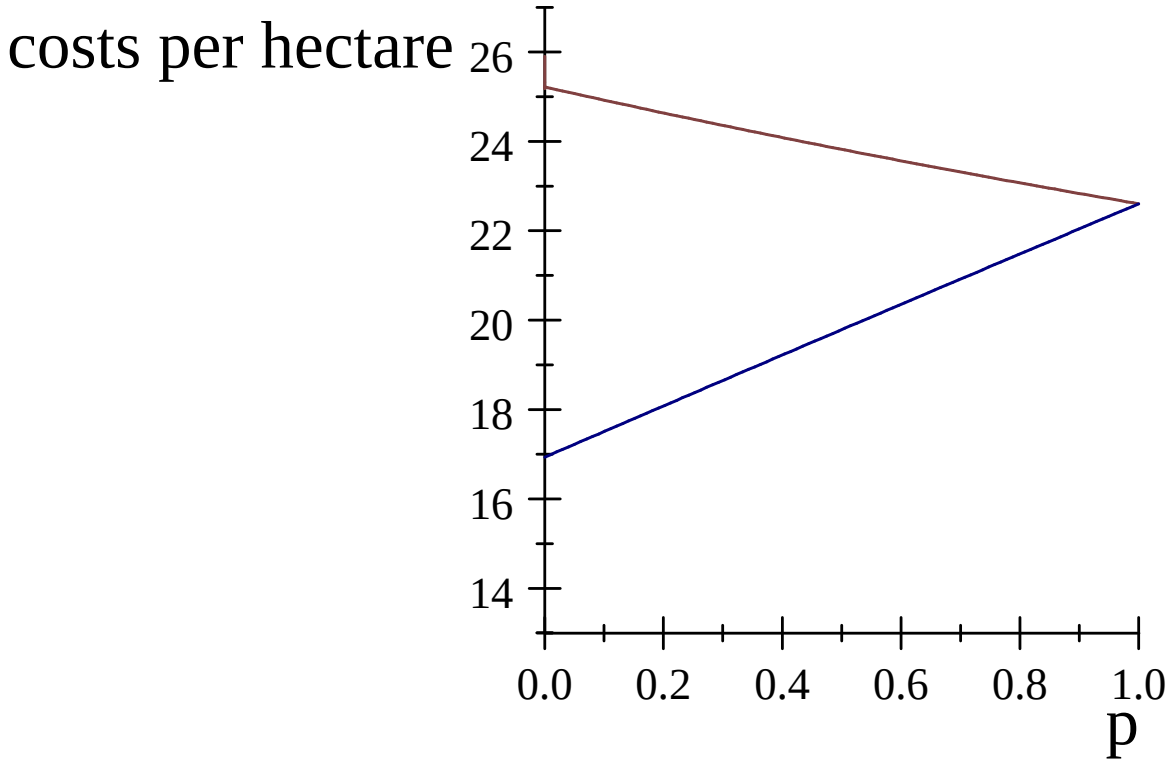
2: P's time inconsistency: Cost of the Loan



- *Because of P_t's time-inconsistency problem, the cost of the loan is small (and can be negative) if the requested reduction in x is small.*'
- Because of lower costs, K will conserve more when using a loan, than when using REDD

2: P's time inconsistency: Calibration

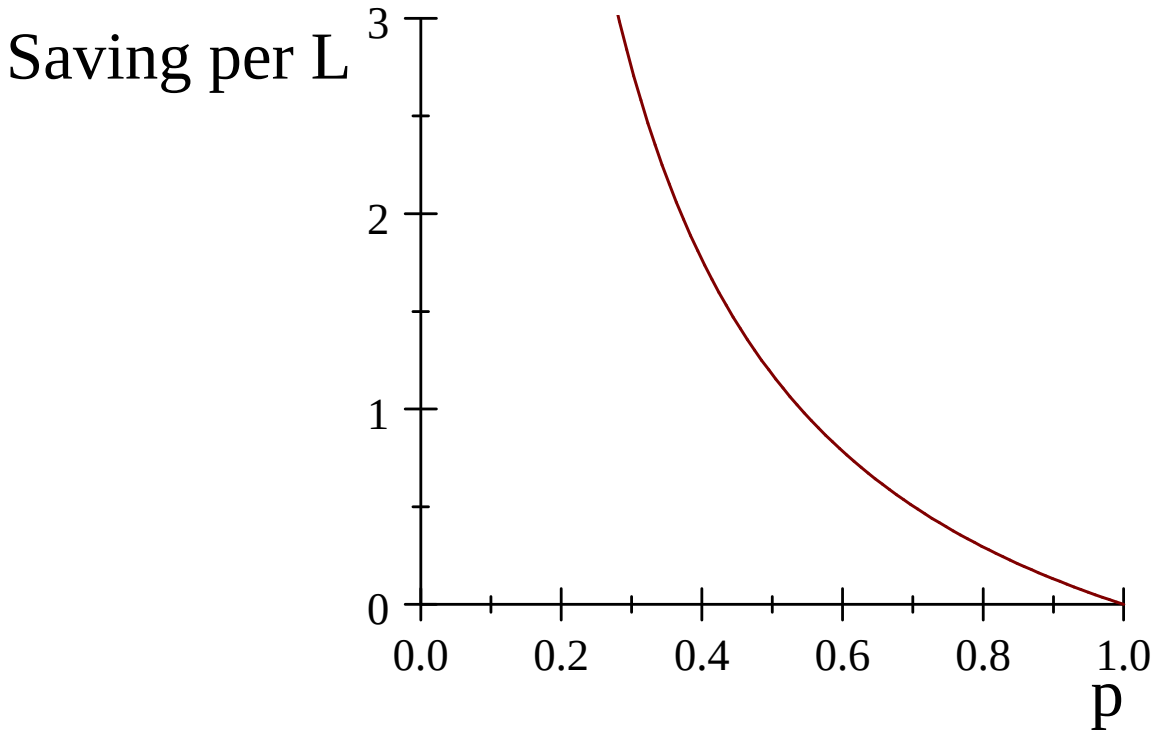
- The literature suggests $\Delta/A \approx .15$, $\delta \approx .85$, $A = \$369$ per hectare.
- With this, we can calibrate the model and estimate the values of the parameters.
- F.ex., suppose $b = 0$ and $x \approx .02$ with $p \approx .5$. (With 500m hectares, \$10b).



2: P's time inconsistency: Combination

- With limits on L, K needs to combine L with k.
- K's present-discounted cost from conservation depends on p:

$$\frac{\partial \text{saving}}{\partial L} = -\frac{1-p}{p}\frac{1}{\delta}, \text{ e.g.: } \frac{1-p}{p}\frac{1}{0.85}.$$



3. Heterogeneity

- Even if $\Delta = 0$, rotation/instability raises x_m if parties prefer different x_s's.
- Each party thinks the other "mismanages" the resource.
- If the conservation-friendly party is expected to conserve even more, because of compensations from K, the exploitation-friendly party may want to exploit more.
- REDD+ can be counter-productive.
- Conservation by lending is more robust to heterogeneous parties

4. Endogenous p and elections

- If voters are identical, and voters forward-looking, then x_t cannot influence p.
- With heterogeneous parties, a "minority" party prefers a larger x_t.
- Voters (may) dislike that $x_m > x_*$, and thus prefer to elect a major party (self-enforcing eq.)
- The minority party may prefer to raise x_t to end its handicape.
- REDD+ might motivate voters to elect candidates with low b to get larger k.
- Conservation by lending might motivate voters to elect candidates that will not default.

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Implementation in practice

- **Sustainability-linked bonds**: “Unlike green or sustainable bonds, the funds raised with this instrument are not tagged to a specific use of proceeds but for general corporate purposes [but] the interest rate is dynamic and linked to some selected sustainability performance indicators"
- 2023: “Sovereign SLBs have been among the slowest of the existing labelled bond instruments to take off"... “just two countries, Chile and Uruguay, have issued SLBs so far. Both issued in 2022, the two SLBs raised $2bn and $1.5bn, respectively”
- “Brazil’s recently elected leftwing president Luiz Inácio Lula da Silva, who has pledged to reduce logging to zero in the Amazon, could be next in line to try to issue an SLB”.
- The points of this project is to shed light on the benefits of this instrument.

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	Chile	Uruguay
Key Performance Indicators (KPI)	**KPI 1. Absolute GHG Emissions (in $MtCO_2e$)** • Baseline: *109,460 $MtCO_2e$* (2018) **KPI 2. Share of non-conventional renewable energy generation in the National Electric System (in %)** • Baseline: *27%* (2021) **KPI 3. Percentage of women in board of directors at companies reporting to Chile's Financial Market Commission (CMF) (in %)** • Baseline: *14%* (2022)	**KPI 1. Education of aggregate gross GHG emissions (in $GtCO_2e$) per real GDP unit with respect to reference year (in %)** • Baseline: *19.45 GtCO2e* (1990) **KPI 2. Maintenance of native forest area (in hectares) with respect to reference year (in %)** • Baseline: *892,458* (2012)
Sustainability Performance Targets (SPT)	**SPT 1a.** Achieve **annual GHG emissions of 95 $MtCO_2$ by 2030** **SPT 1b. Maximum of 1,100 $MtCO_2$ between 2020 and 2030** **SPT 2a.** Achieve **50% of electricity generated from non-conventional renewable energy sources by 2028** **SPT 2b.** Achieve **60% electricity generation derived from non-conventional renewable sources by 2032** **SPT 3.** Achieve **at least 40% of women representation in board of directors at companies to CMF by 2031**	**SPT 1a. Uruguay's Nationally Determined Contribution (NDC) commitment:** Achieve **at least 50% reduction in GHG emissions by 2025** from the 1990 reference year **SPT 1b. Outperformance compared to Uruguay's NDC commitment:** Achieve **more than 52% reduction in GHG emissions intensity by 2025** from the 1990 reference year **SPT 2a. Uruguay's NDC commitment: Maintain at least 100% of the native forest area** compared to reference year 2012 **SPT 2b. Outperformance compared to Uruguay's NDC commitment:** Achieve **an increase higher than 3% of the native forest area** compared to reference year 2012
Bond Characteristics	• Max. coupon **step-up of 25 bps if 2 SPTs or more are not met** (see Sustainalytics (2023, p. 13-14) & Browne-Amorim (2023)) • Coupon **step-up of 12.5 bps if 1 SPT is not met** • **Multiple observation dates** (see Chile's Ministry of Finance (2023a)) that could lead to step-up • **Cumulative coupon payments**	• Max. **one-time** coupon **step-up of 15 bps if SPT 1 & SPT 2 or more are not met** (see Uruguay's Sovereign Debt Management Unit (2022, p. 57-58) & Browne-Amorim (2023)) • Max. **one-time** coupon **step-down of 15bps if SPT1 & SPT 2 are met** (see Uruguay's Sovereign Debt Management Unit (2022, p. 57-58) & Browne-Amorim (2023))
Reporting	• Chile publishes **annual SLB reports** with information on KPI evolution, SPT progress, and additional materials relevant for investors (see Chile's Ministry of Finance (2023b)) • **Biennially information on KPI 1** (consistent with Chile's current NDC and the UNFCCC's requirements) • **Annual information on the KPI 2 and 3**	• Uruguay has an internal governance system in-place (recognized by UN-Global Support program as international best practice) to ensure the timeliness and quality of data reported to the UNFCCC. • **Frequency: every two years reports to UNFCCC** • **Publication timing: two years post-data collection** • Uruguay **attempts to follow private-sector standards** (as UNFCCC reporting timeframes are longer than **International Captial Market Association's (IAMC)**). • Move from biennially progress **report on KPI 1** to **annual frequency.**
Verification	• Commitment to **external verification** (by Moody's ESG, Sustainalytics) **in line with the Sustainability-Linked Bond Principles 2023** (verification conducted on bonds progress towards each SPT for each KPI **at least once a year**) (see Sustainalytics (2023))	• Commitment to **external verification using the principals of the ICMA guidelines** (see Uruguay's Sovereign Debt Management Unit (2022))
Investment (Source: Browne-Amorim (2023))	• Initial investment of $2 billion USD • Demand: $8 billion USD • The bond carries a 4.346% coupon rate above 20-year maturity • Credit rating: A- (Fitch)	• Initial investment of $1.5 billion USD • Demand: $3.96 billion USD • The bond carries a 5.75% coupon rate above 12-year maturity • Credit rating: BBB+ (R&I) • Highest credit rating Uruguay has ever received
Forestry	• Emissions from land use, land use change and forestry are explicitly excluded from KPI 1.	• Forests are a key part of Uruguay's SLB (see KPI 2).

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