



ZEF Bonn

Designing Payments for Environmental Services in the Context of Weak Property Rights and Commercial Interests

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Outline

1. Introduction
2. Game-theoretic model of community-firm interactions
3. Implications for PES design
4. Empirical application
5. Conclusions

Indonesian Setting

- 10 % of world tropical forests
- Tremendous biodiversity
- 40% of forests lost in 1950-2000
- Rate accelerating (2 mio ha/year)
- Lowland tropical forests predicted to disappear in Sumatra and Kalimantan by 2010
- Commercial exploitation as a main cause



Indonesian Setting (cont.)



- Post-Suharto Decentralization Reforms
- Acknowledgement of communities' forest 'rights'
- Exercise rights by negotiating logging agreements
- 'Selling off forests for a satellite dish'
- Payments for Environmental Services (PES) could provide alternative income source

Issues in designing PES

1. Effectiveness

- How much to pay?
 - **Conventional answer:** Opportunity costs = expected payoffs from logging deals
- Additionality
- Enforcement

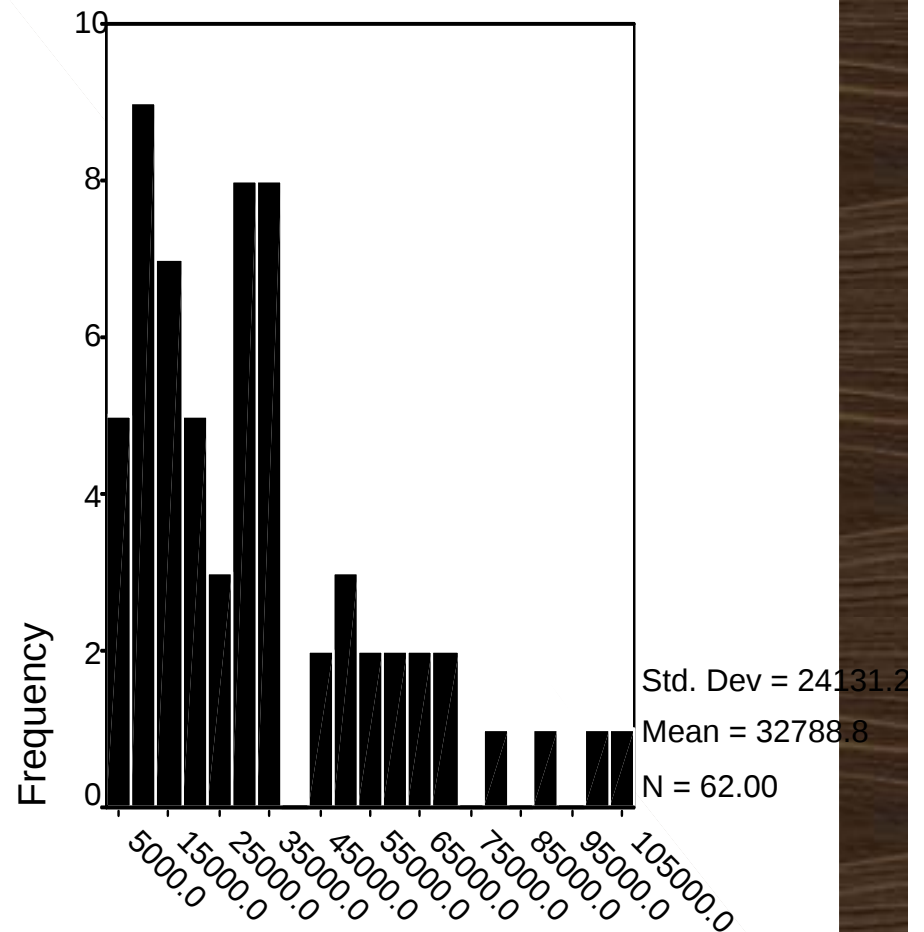
Community payoffs from negotiated agreements in Indonesia

Survey results from East Kalimantan, Indonesia

62 community-firm
logging agreements

**Actual fees paid
(US\$ per m³):**

Min=0.28, Max=11.81
 $\bar{x}$ =3.54



Issues in designing PES

1. Effectiveness

- How much to pay?
 - **Conventional answer:** Opportunity costs = expected payoffs from logging deals
- Additionality
- Enforcement

Issues in designing PES (cont.)

2. Efficiency

- How to maximize environmental services with given budget?
 - **Conventional answer:** Target communities with lowest expected payoffs from logging agreements

Complexities in our setting

- Opportunity costs are result of community interactions with commercial interests (logging companies)
- Strong variation in observed logging fees received
- Weak property rights -> Can communities really protect forest?

=> Conventional answers are misleading!

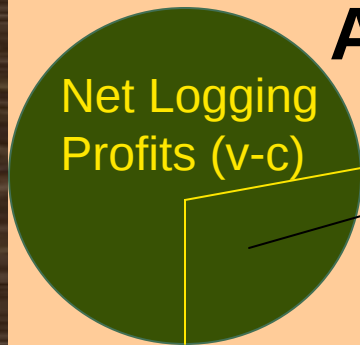
Game-theoretic model

- Simplified version of Engel, López & Palmer (forthcoming) and Engel & López (2004)
- Integrating conflict and bargaining theory
- Assumptions
 - 2 actors: Community, Firm
 - Only firm has access to capital
 - Weak community rights over forest
 - Perfect information
 - Risk neutrality

A simplified game-theoretic model

- Component 1: Negotiation

Alternating-Offers Bargaining Game



Community payoffs depend on:

- Bargaining powers
- Size of the cake (logging profits)
- Reservation utilities

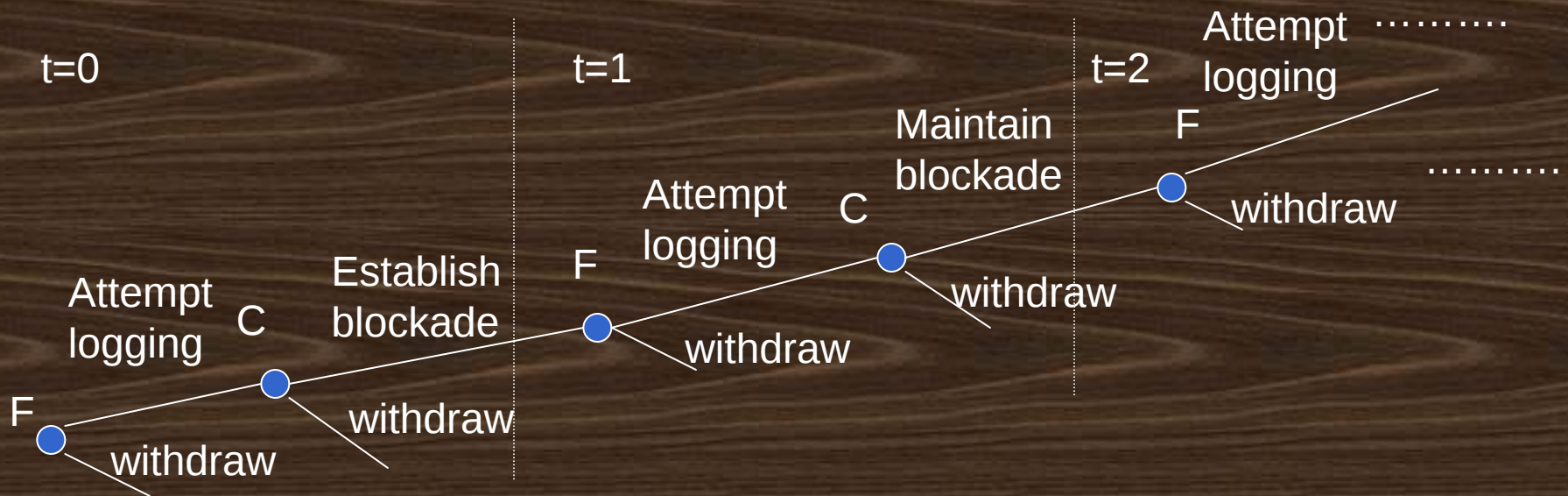
Reservation utilities = payoffs if negotiations do not succeed
Here:

- Would the firm leave and forests be conserved? or
- Would the firm log anyhow without community consent?

A simplified game-theoretic model

- Component 2: Conflict over de facto rights

WAR OF ATTRITION (based on Burton, ERE 2003)



- **Community's ability to self-enforce its forest rights depends on:**
- Profitability of logging, fixed logging costs
 - Blockading costs (social capital, opportunity cost of time)
 - Discount rates
 - Community's valuation of the standing forest

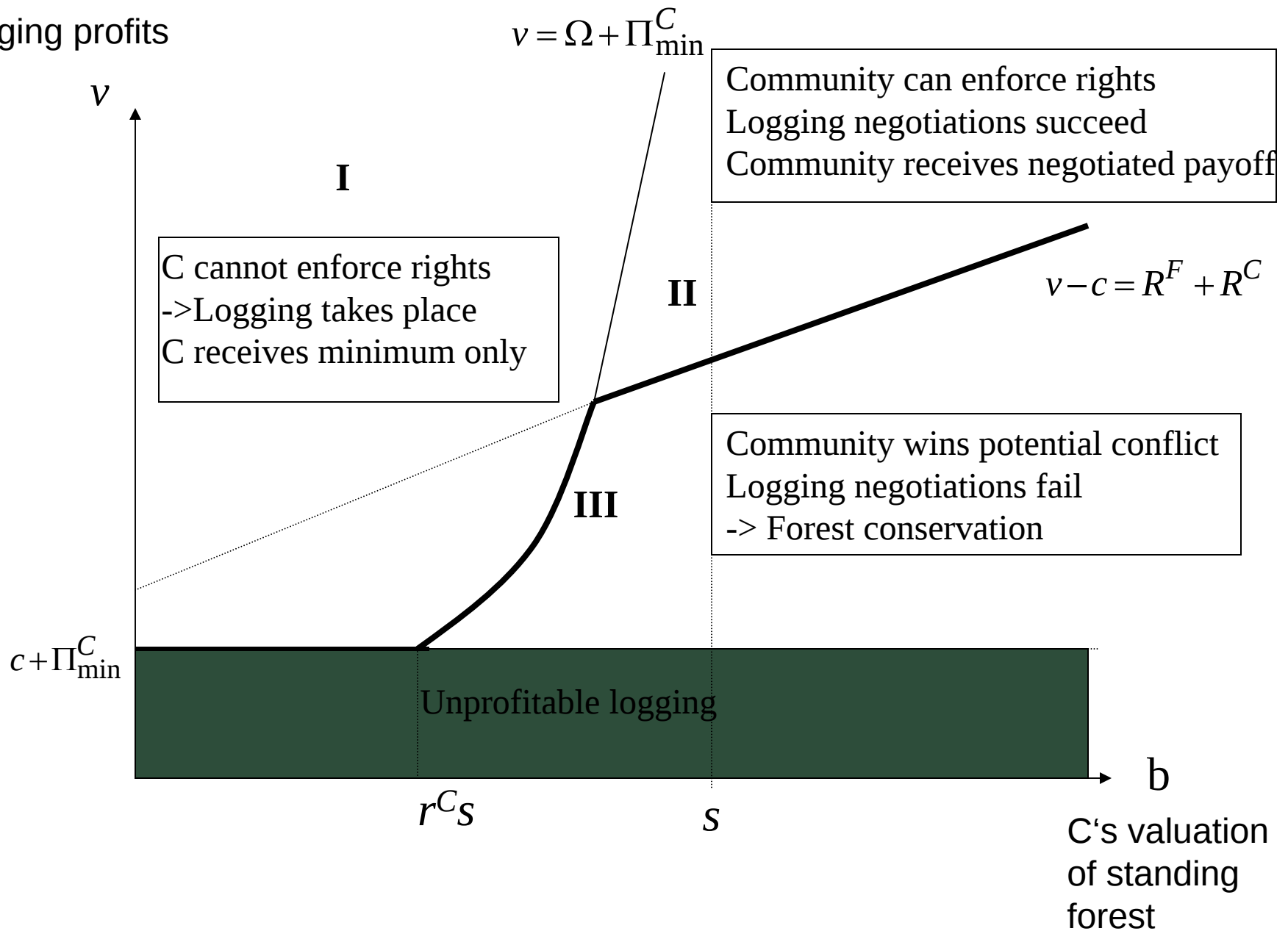
Determinants of Community Payoffs - Hypotheses

Determining factors	(1) Effect in bargaining	(2) Effect on property rights	Total Effect
Logging profit (v)	+	-	?
Fixed logging costs (c)	-	+	?
Community's valuation of standing forest (b)	+	+	+
Community blockade costs (s)	No effect	-	-
Firm profits in next-best activity (d^F)	-	No effect	-
Community discount rate (r^C)	-	-	-
Firm discount rate (r^F)	+	+	+
Other factors increasing community bargaining power (z)	+	No effect	+

Empirical Analysis – Proxies from Survey & Results (Engel & Palmer, f'coming)

FACTOR	PROXIES
Logging profits and costs (v, c)	Size of concession area ^{**} ; Dummy, whether area was logged before
Community's valuation of standing forest (b)	Average % of household income from forest products [*]
Community blockade costs (s)	% of households (HH) with at least one government employee [*] ; Distance to market ^{**} ; % of HH with members in community organizations [*] ; % of HH belonging to ethnic majority [*] ;
Firm profits in next-best activity (d^F)	NA
Community discount rate (r^C)	% of HH with savings (bank account) before negotiations ^{**}
Firm discount rate (r^F)	NA
Other factors increasing community bargaining power	% of HH with previous experience working for a logging company

Logging profits



Implications for PES Design

- Objective of PES: forest conservation
- PES introduces new value of standing forest to community:

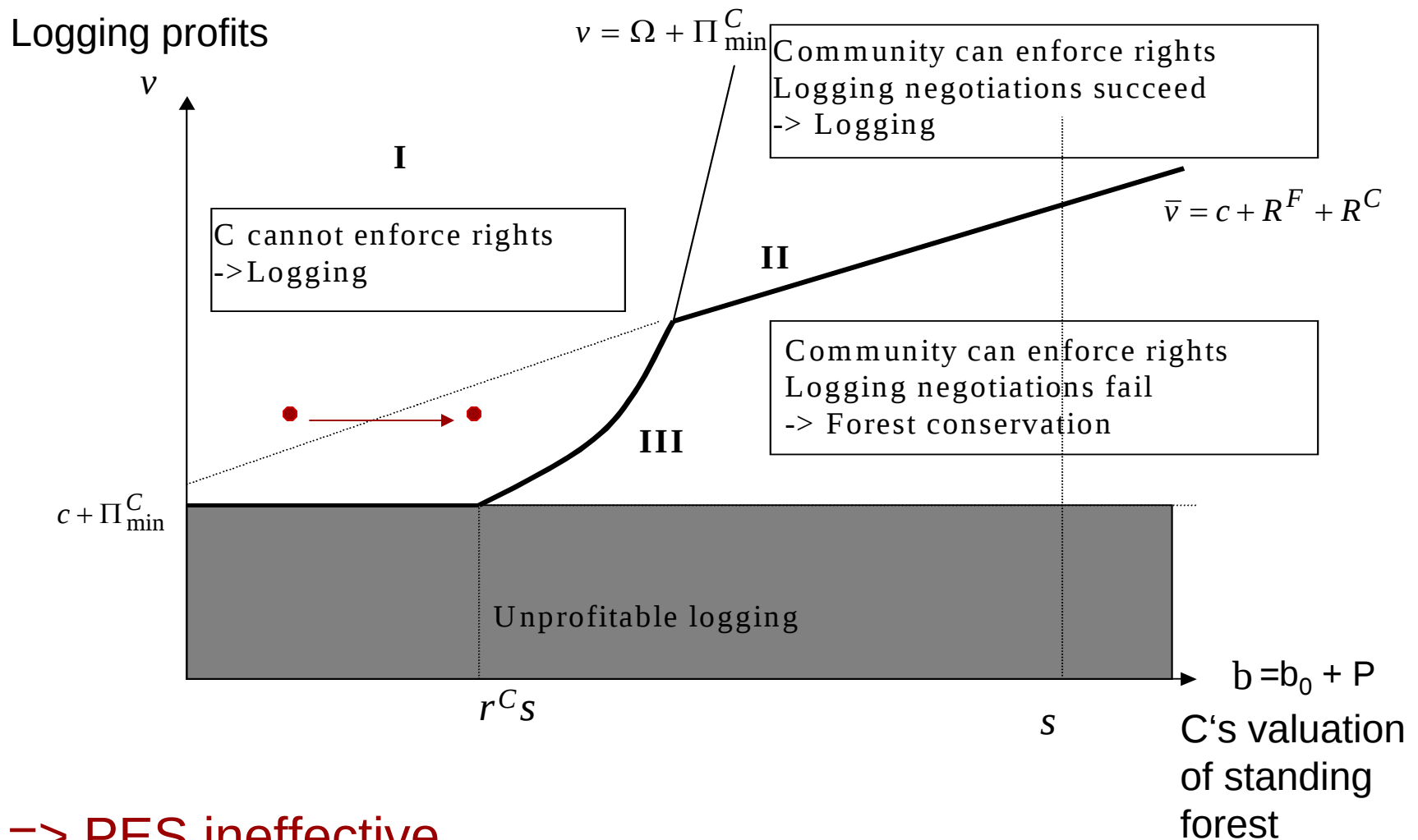
$$b = b_0^{\uparrow} + P$$


**C's valuation
of standing forest per
period without PES**

PES amount per period

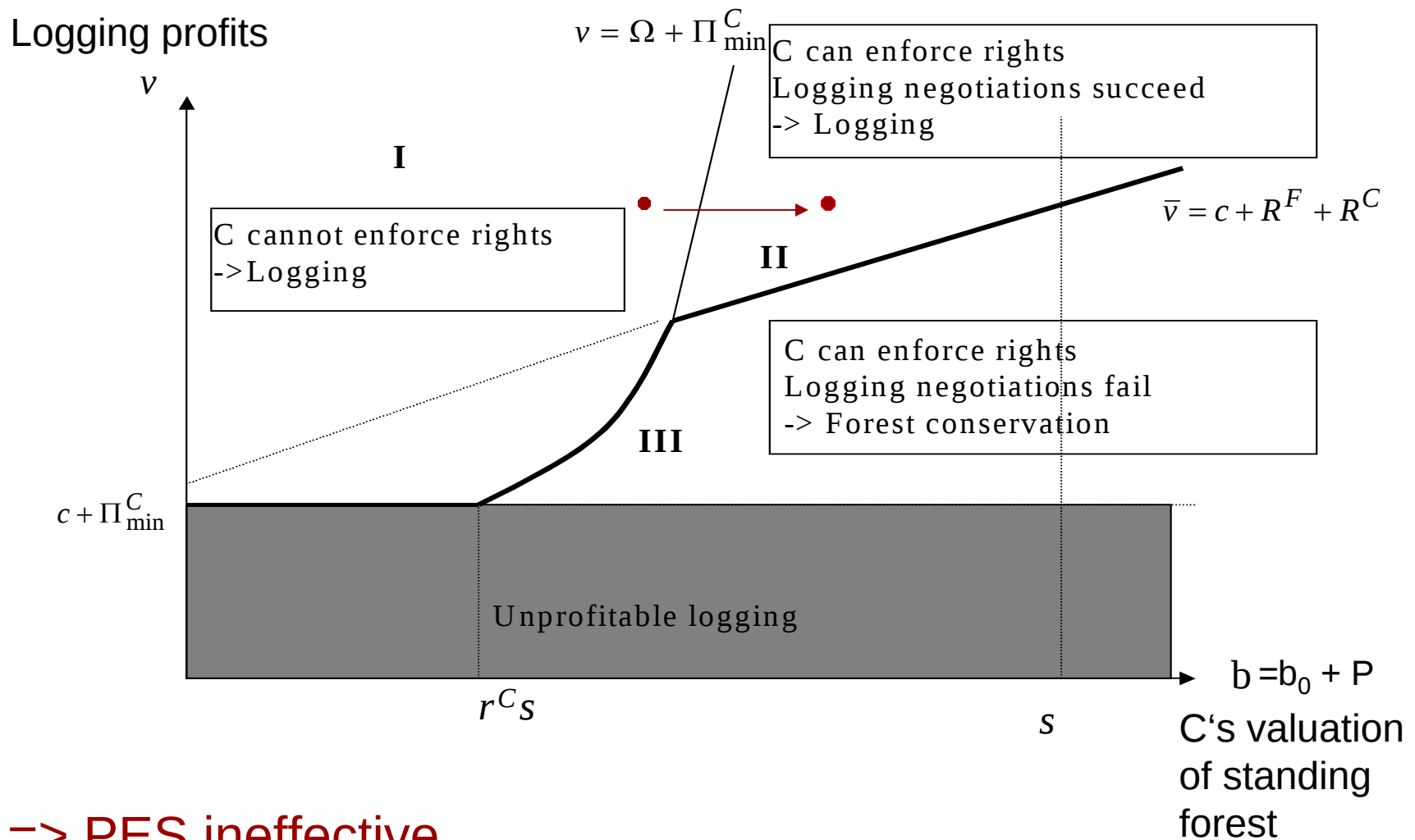
(fuelwood, non-timber forest products, hunting, local ecological services)

Implication 1: PES may not be enforceable

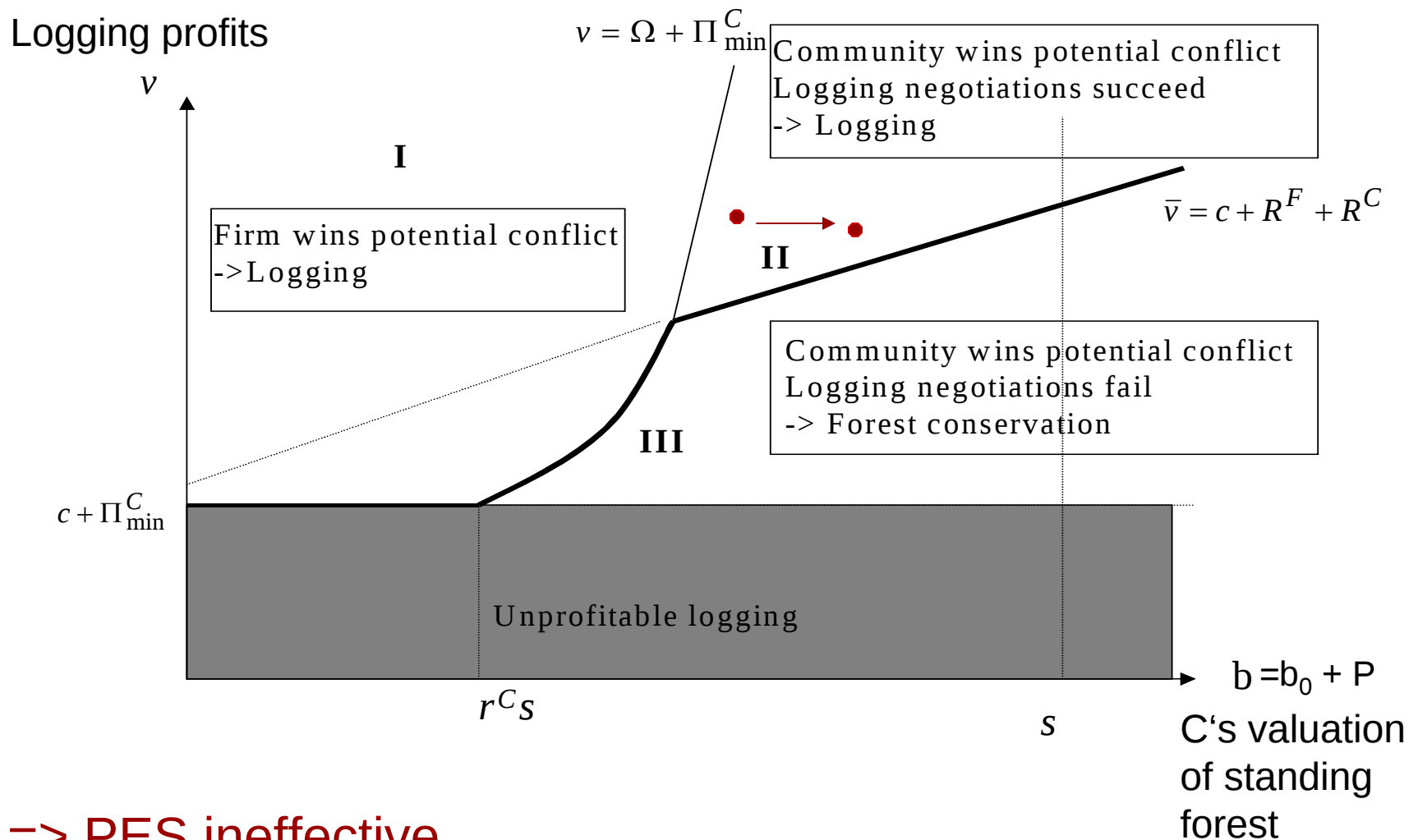


=> PES ineffective

Implication 2: PES raises C's ability of enforcement, improving logging deal

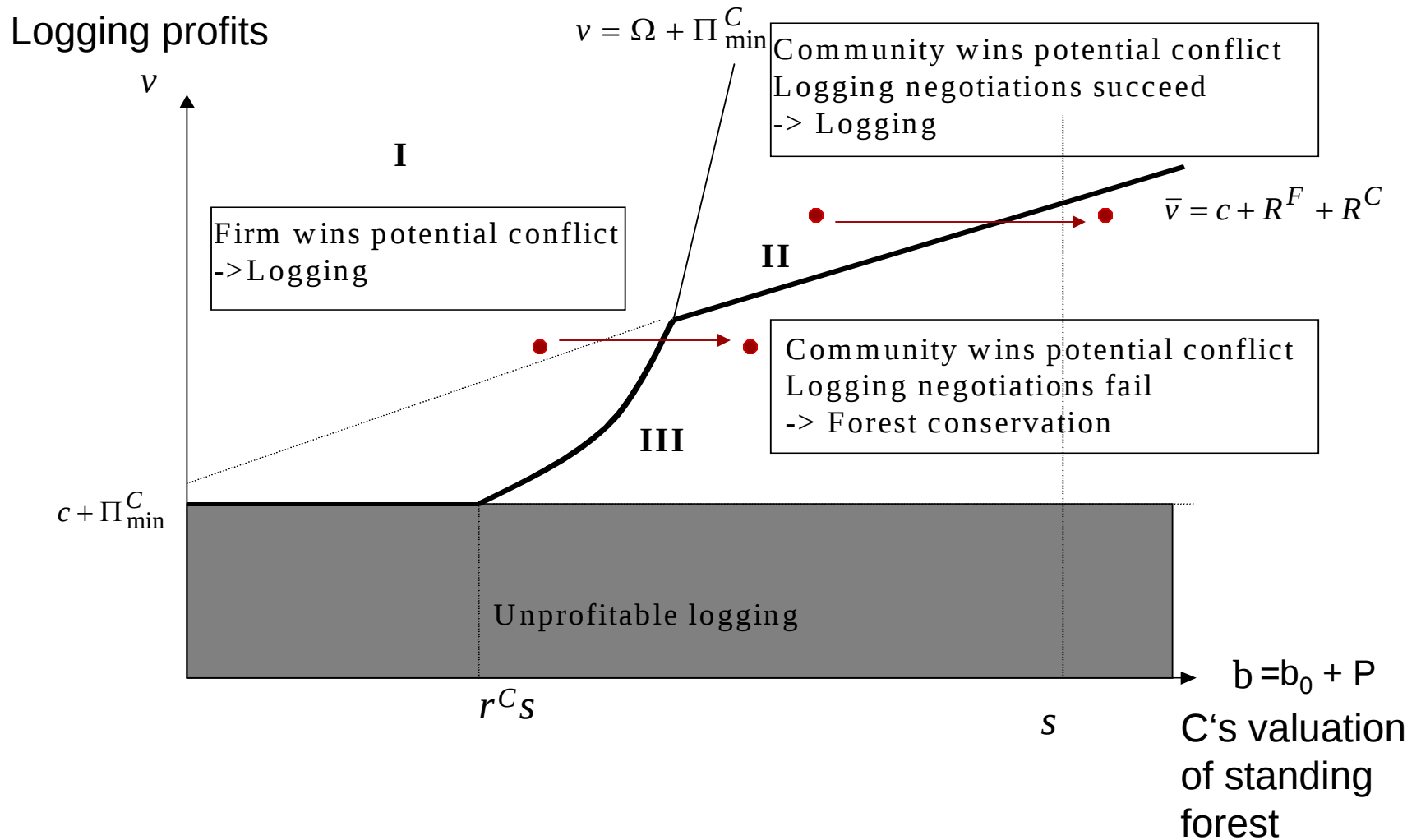


Implication 3: PES raises C's outside option, leading to better logging deal



=> PES ineffective

Effective PES



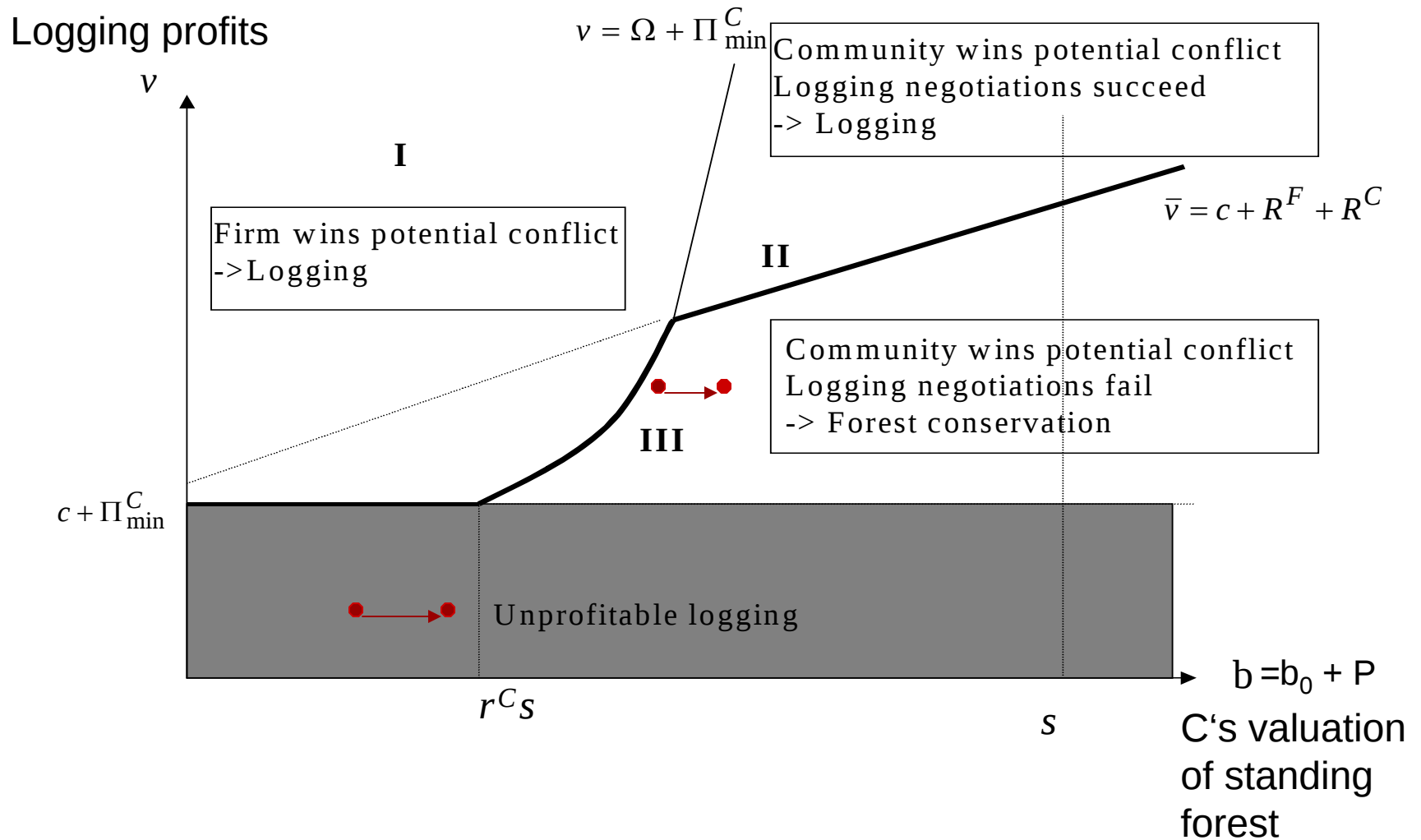
Conditions for effective PES (1)

1. Community needs to be able to win potential conflict with the firm (otherwise firm can log despite PES agreement)
2. PES needs to induce negotiation failure

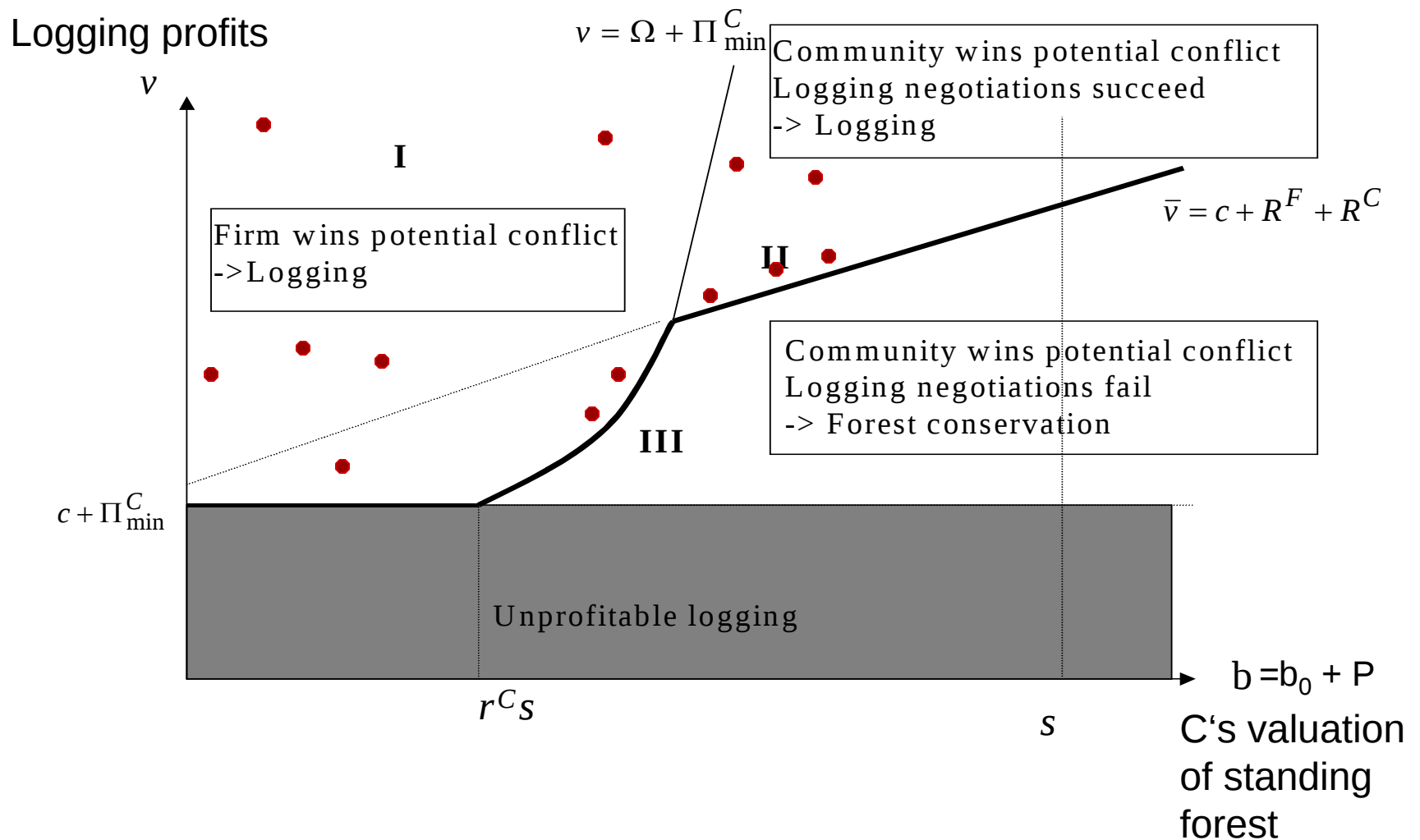
$$PES \text{ (per period) } \geq \underbrace{r^C [v - c - R^F]}_{\substack{\text{C's discount} \\ \text{rate}}} - \underbrace{b_0}_{\substack{\text{Maximum that F} \\ \text{would ever offer} \\ \text{(F's surplus)}}}$$

C's own valuation of forest

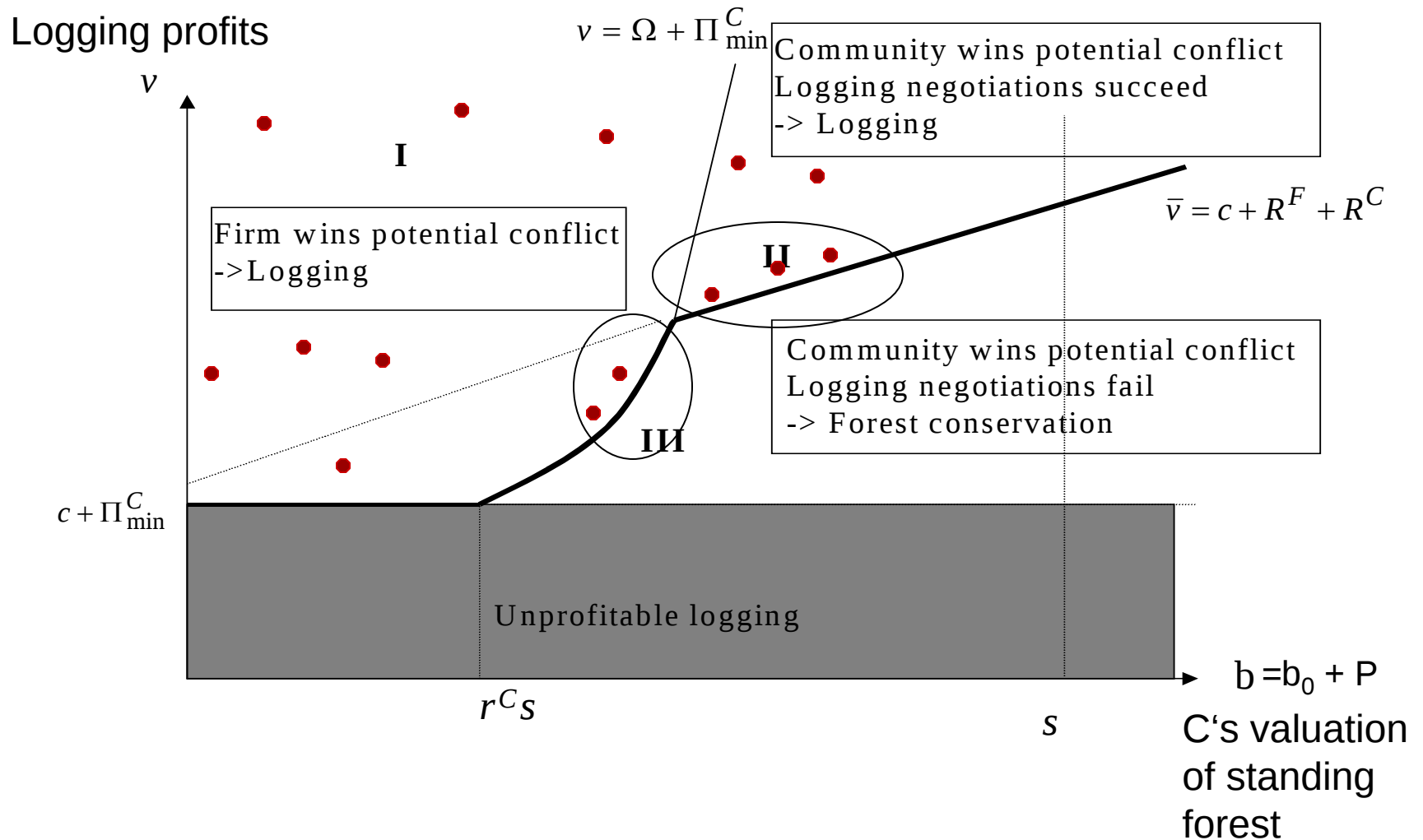
No additionality



Efficiency of PES



Efficiency of PES



Conditions for effective PES

1. Community needs to be able to win potential conflict with the firm (otherwise firm can log despite PES agreement)
2. PES needs to induce negotiation failure

$$PES \text{ (per period)} \geq r^C \left[\underbrace{v - c - R^F}_{\text{Maximum that F would ever offer (F's surplus)}} \right] - b_0$$

Poverty-Environment Tradeoff!

C's discount rate

C's own valuation of forest

Empirical application

- Use fieldwork data to estimate boundary conditions:
 - a. Probability of winning conflict
 - b. Probability of negotiation failure
- Collect data on potential PES communities
- Compute predicted probabilities a. and b.
- Choose communities with one of these probabilities above 0.5 and the other below, but close to 0.5

Empirical estimation: Probability of winning conflict

Probability of receiving payoff above minimum negotiated level (15.000 IDR)

Variable (Parameter proxied)	Coeff	Std. Error
Constant	-3.2680	2.6455
Average proportion of household incomes derived from sale of forest products, AVINCFP (<i>b</i>)	0.1587	0.2272
Forest quality: area logged before by commercial operation (Yes=1, No=0), LOGGEDB4 (<i>v</i>)	2.1276	1.1978*
Actual area logged (ha), ACTHA (<i>v</i>)	-0.009559	0.004437**
Proportion of households containing at least one government employee, PGOVJOB (<i>s</i>)	-0.7598	0.5081
Proportion of households that participate in community organizations, HPARTORG (<i>s</i>)	0.7434	0.3270**
Proportion of households containing members of dominant ethnic grouping, PHHDOMGP (<i>s</i>)	0.3034	0.2534
Distance to nearest market (km), DISTMARK (<i>s</i>)	-0.2566	0.1570
Proportion of hhs holding savings before agreement, HBANKACC (<i>r^C</i>)	0.1267	0.5515**
No. of observations	62	
% of outcomes predicted correctly	71%	

Empirical application

- Use fieldwork data to estimate boundary conditions:
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Empirical application (cont.)

- Computation of minimum payments requires information that is not observed
- Alternative:
 - Use previous analysis to assure additionality (starting point in area I or II)
 - Use auction to let communities self-reveal opportunity costs (size of payment required)

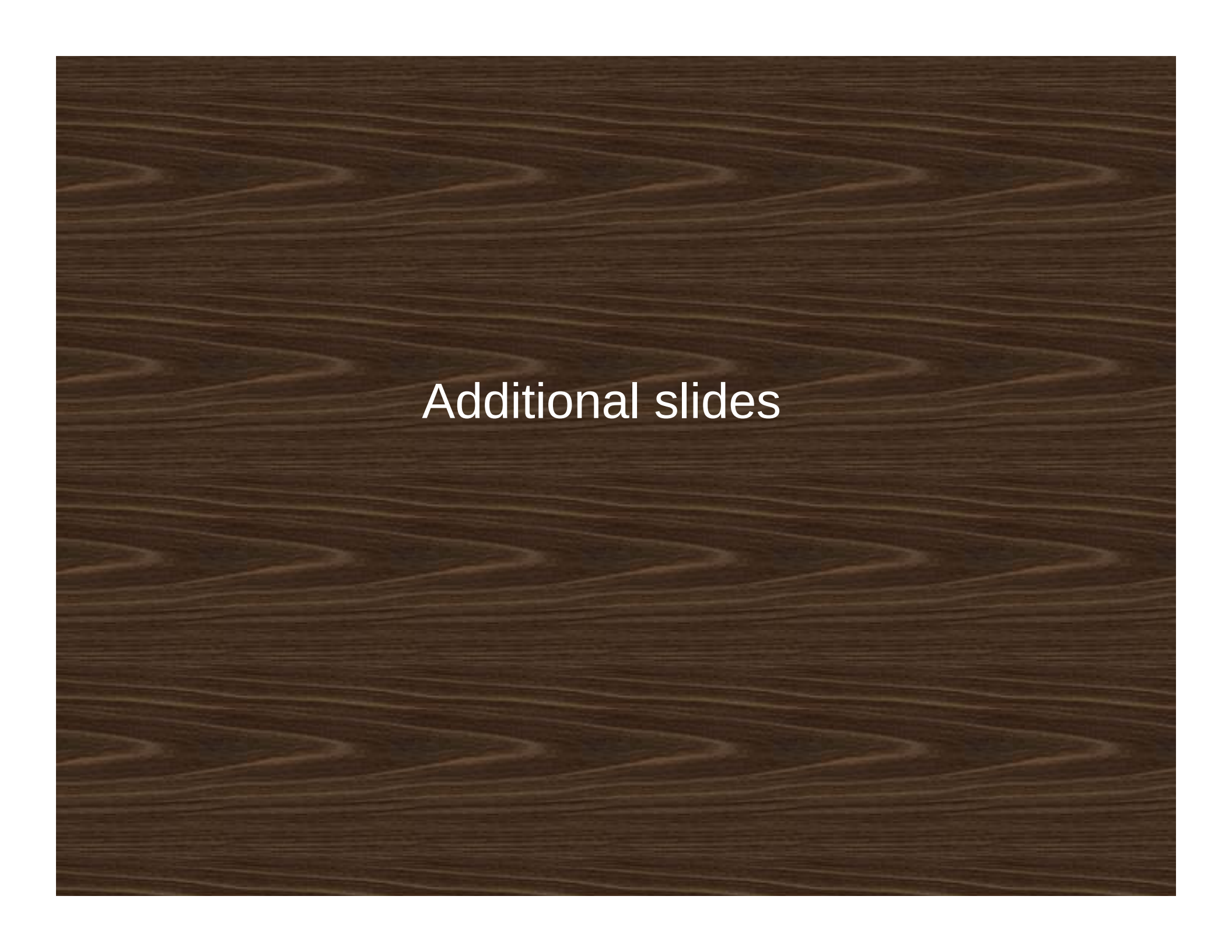
Conclusions

- Conventional wisdom:
 - Estimate expected logging payoffs based on observed variation
 - Pay at least these expected payoffs
 - Focus on communities with low expected payoffs
- Incorrect here
 - Communities with lowest expected payoffs cannot enforce forest conservation
 - **Failure to consider weak property rights leads to lack of enforceability**
 - Introduction of PES raises expected logging payoffs
 - **Failure to consider this endogeneity of payoffs leads to better logging deals rather than conservation**

Conclusions (cont.)

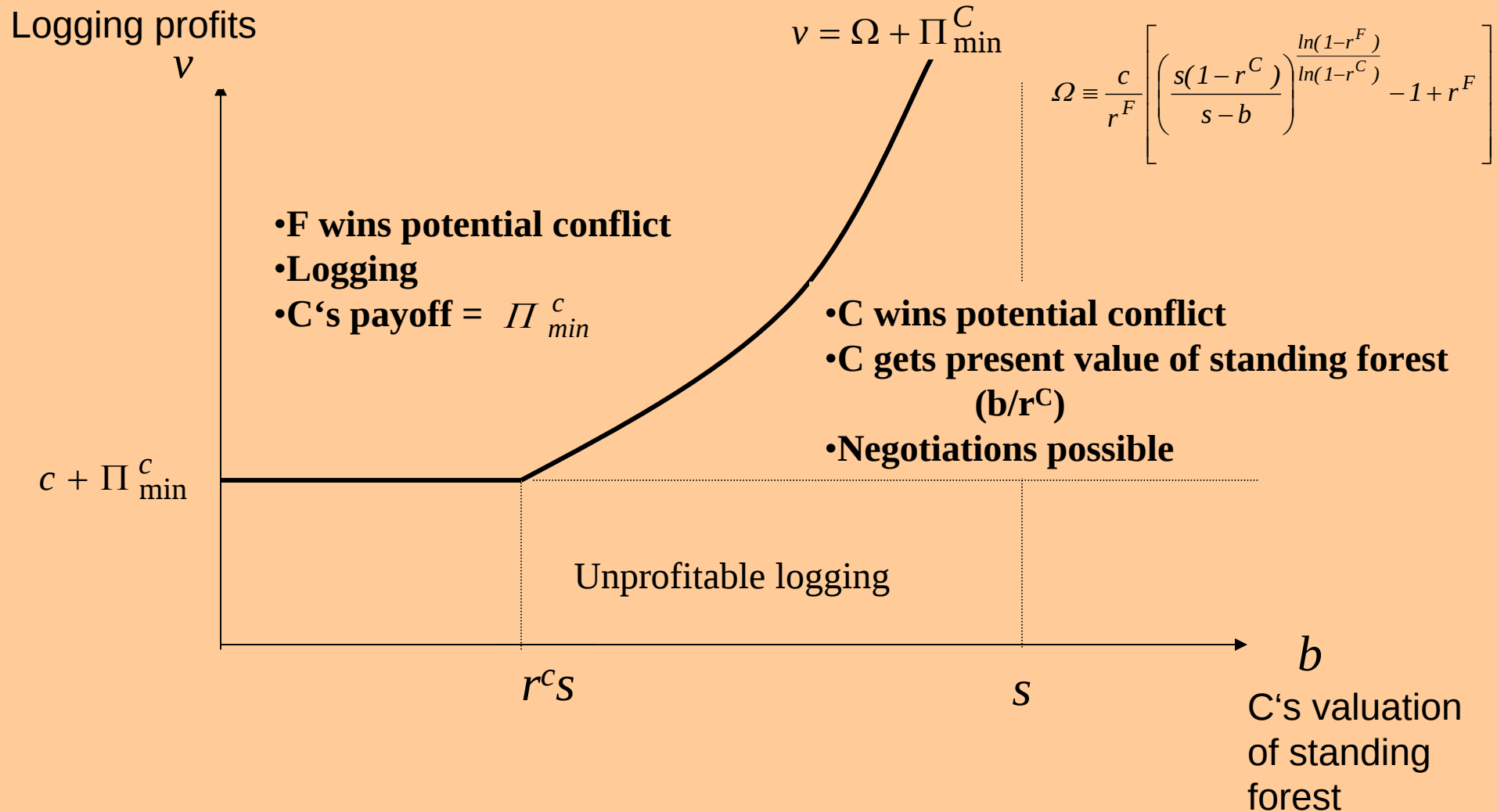
- PES design as complex task
- Need to compensate for best possible offer by company (unobserved) minus C's own valuation of standing forest
- Poverty vs. Conservation Tradeoff
- Applicability to other situations with weak property rights and commercial interests



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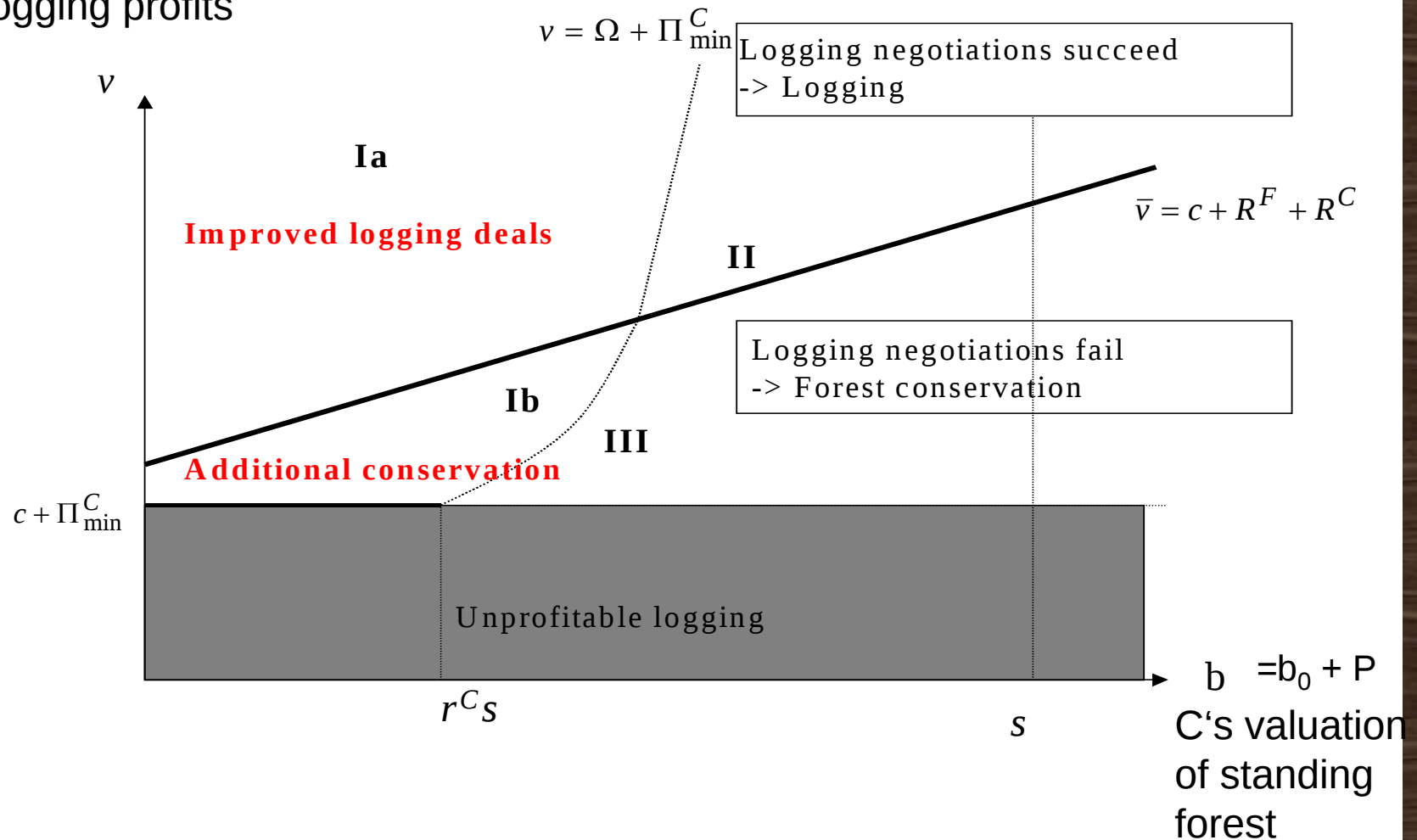
Additional slides

Conflict outcomes



What if property rights are secured?

Logging profits



So, what determines community payoffs?

Combining conflict and bargaining results...

$$\Pi^C = \begin{cases} \Pi_{min}^C & \text{if } v < \Omega(b, \dots) + \Pi_{min}^C \\ \frac{b}{r_C} + (1 - \tau) \left(v - \frac{b}{r_C} - \bar{d}^F \right) & \text{if } v > \Omega(b, \dots) + \Pi_{min}^C \end{cases}$$

➤ Depends on:

- Value of standing forest (b), bargaining power, profitability, etc.
- Ability to self-enforce property rights (win conflict)
 - Depends on value of standing forest (b), other parameters

Moreover: Negotiations fail only if $v - c < R^C + R^F$

Size of cake < sum of outside options

Empirical Analysis - Results

- Confirms hypotheses derived from theoretical model
- Empirically significant factors:
 - Importance of forest for household incomes (+)
 - Size of concession area (-)
 - Household income (Bank account) (+)
 - Determinants of collective action (Blockade costs):
 - Opportunity costs (government jobs, distance from mkt.) (-)
 - Social capital (Participation in organisations) (+)
 - Social homogeneity (% in ethnic majority) (+)
- **Community payoffs depend crucially on (potential) ability of the community to self-enforce its property rights over the forest (win a conflict).**

Implications for PES Design (cont.)

- Introduction of PES raises community's valuation of standing forest
- Raises community's ability to win potential conflict and its inside/outside option in bargaining
- Raises community's expected payoff from negotiations because firm would offer more
- If this endogeneity is ignored, community may simply negotiate better logging deal