

Lectures on Economic Inequality

Warwick, Summer 2018, Supplement to Slides 4

Debraj Ray

- Inequality and Divergence I. Personal Inequalities, Slides 1 and 2
- Inequality and Divergence II. Functional Inequalities, Slides 3
- Inequality and Conflict I. Polarization and Fractionalization, Slides 4
- Group Size and Conflict, Supplement to Slides 4

Private Prize (total value v , $\pi = v/m$, and $\bar{\pi} = v/\bar{m}$)

- Nash equilibrium of this game has three components:

1. *Relative resource* contribution:

$$\gamma \equiv \frac{r}{\bar{r}} = \left(\frac{\pi}{\bar{\pi}} \right)^{1/\alpha} = \left(\frac{v/m}{v/\bar{m}} \right)^{1/\alpha} = \left(\frac{\bar{m}}{m} \right)^{1/\alpha}.$$

2. *Win probability* for the group:

$$p = \frac{m\gamma}{m\gamma + (1-m)} = \frac{m^k}{m^k + (1-m)^k}$$

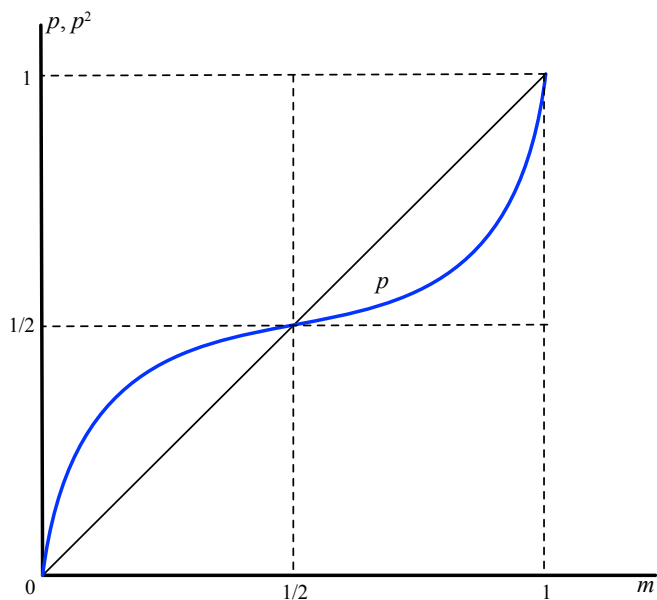
3. *Expected per-capita payoff* to group:

$$\frac{v}{m} [kp + (1-k)p^2], \text{ where } k \equiv \frac{\alpha - 1}{\alpha}.$$

non-discriminatory peacetime per-capita payoff: v

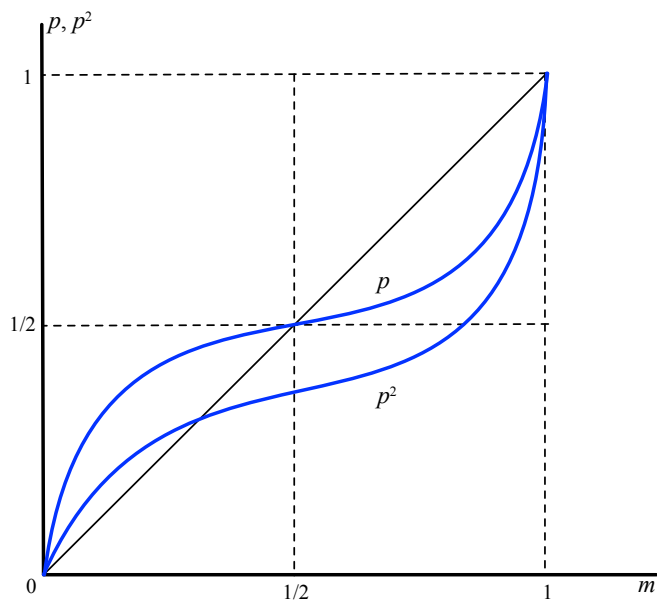
■ **Proposition 1 [Private prize.]** Then is $m^* \in (0, 1/2)$ such that a Rebel with $m < m^*$ will block the non-discriminatory allocation. Society is conflict-prone in the presence of smaller Rebels.

■ **Proof.** Need $kp + (1 - k)p^2 > m$, where $p = \frac{m^k}{m^k + (1 - m)^k}$.



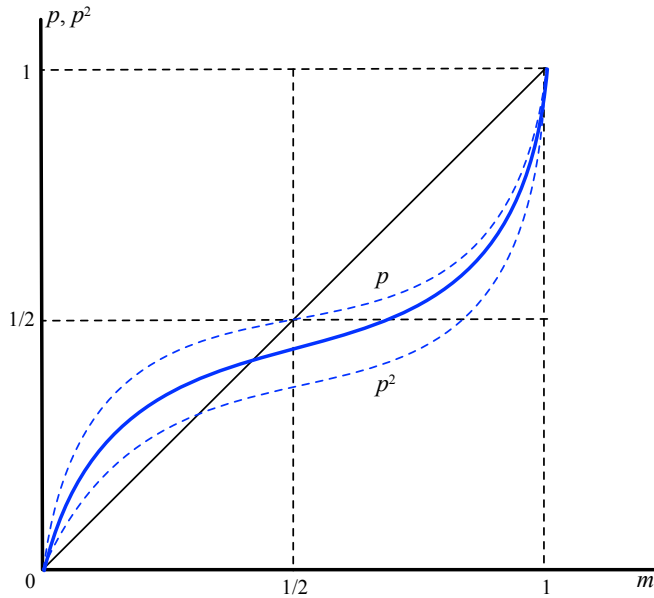
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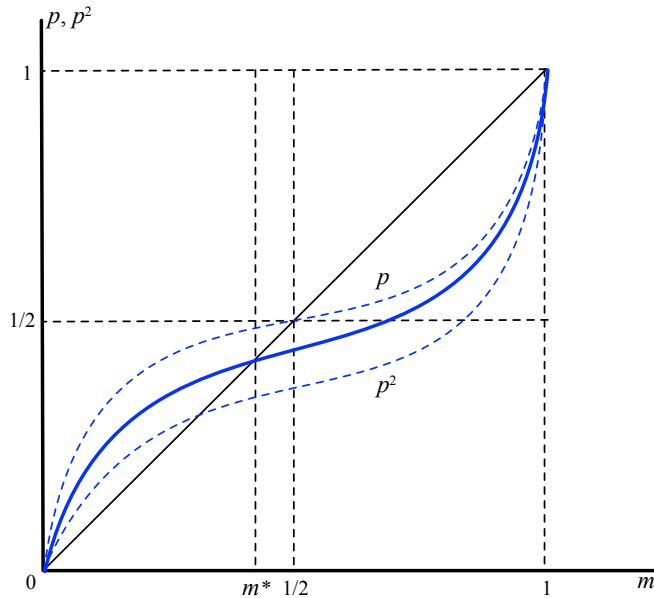
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Public Goods

- n groups, each with favored mix of public goods:
 - e.g., religion, health, education, trade protection
 - Budget v used to produce public goods 1-1.
- For ease of exposition here:
 - Groups disjoint, one good for each group, so
 - $X(v) = \{ \mathbf{x} | x(j) = v_i \text{ for } j \text{ in group } i \text{ and } \sum_j v_j = v \}$.
 - **Note!** Payoffs independent of group sizes.

Public Prize ($\pi = v$, and $\bar{\pi} = v/[n-1]$)

- Nash equilibrium of this game has three components:

1. *Relative resource contribution:*

$$\gamma \equiv \frac{r}{\bar{r}} = \left(\frac{\pi}{\bar{\pi}} \right)^{1/\alpha}.$$

2. *Win probability* for the group:

$$p = \frac{m\gamma}{m\gamma + (1-m)}$$

3. *Expected per-capita payoff* to group:

$$\pi [kp + (1-k)p^2], \text{ where } k \equiv \frac{\alpha-1}{\alpha}.$$

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2. *Win probability* for the group:

$$p = \frac{m\gamma}{m\gamma + (1-m)} = \frac{m(n-1)^{1/\alpha}}{m(n-1)^{1/\alpha} + (1-m)}$$

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$$v [kp + (1-k)p^2], \text{ where } k \equiv \frac{\alpha - 1}{\alpha}.$$

non-discriminatory peacetime per-capita payoff: v/n

■ **Proposition 2 [Public Prize]**. There is $\hat{m} \in (0, 1)$ such that a Rebel with $m > \hat{m}$ will block the non-discriminatory allocation. Society is conflict-prone in the presence of larger Rebels.

■ **Proof**. Blocking condition: $kp(m) + (1-k)p(m)^2 > 1/n$, where

$$p(m) = \frac{m(n-1)^{1/\alpha}}{m(n-1)^{1/\alpha} + (1-m)}.$$

■ $p(m)$ increasing + end-point conditions.

■ **Examples**,

■ Two groups, quadratic cost: $\hat{m} = 61.8\%$.

■ Three groups, $\alpha = 1.2$, $\hat{m} = 39.7\%$.

Discriminatory Allocations and the Coase Theorem

- Discriminatory allocations do not need to:
 - treat group members in an identical way
 - hold per-capita payoffs constant over groups
- **Coase Theorem:**
 - Conflict inefficient, so *some* allocation appeases any potential Rebel.
 - *But that allocation will need to vary with the potential threat.*
 - If there are several potential initiators, this could be hard.
 - Can formalize this idea.

Balancedness

- **Balanced collection** is finite set \mathcal{C} of potential initiators:
 - There are weights $\lambda(G) \in [0, 1]$, one for each $G \in \mathcal{C}$, such that
$$\sum_{G \in \mathcal{C}, i \in G} \lambda(G) = 1 \text{ for every } i \text{ in society}$$
- **Essential meaning:** there are no central subgroups of individuals.
 - *Example.* \mathcal{C} only contains subgroups of society that contain $[0, 1/2]$.
 - *Example.* $\{12\}, \{23\}, \{31\}$.

- Proposition 3 [Private Goods Revisited].
 - Suppose there is a balanced collection \mathcal{C} of Rebels, each with $m < m^*$.
 - Then society is actively conflictual.
- Remark 1.
 - Suppose society can be partitioned into markers of size $m < m^*$.
 - Then society is actively conflictual.
- Remark 2.
 - Can prove a similar result for public goods.

Empirics

- Ethnic Groups and Conflict
 - 50–70% of all conflicts since WWII (Doyle-Sambanis 2006, Fearon-Laitin 2003).
- Geo-referenced ethnic groups (GREG); Weidman, Rod and Cederman 2010.
digitized version of Atlas Narodov Mira 1964.
 - 145 countries, homelands of 929 ethnic groups as in ANM 1964
Split by country: 1475 group-country units.
- Our study runs from 1960-2006, but homelands are fixed as in ANM 1964.
- Obvious disadvantages and advantages.

- **Group-level conflict data** from Cederman, Buhaug and Rod 2009.
- Subset of UCDP/PRIO Armed Conflict Dataset.
- **Incidence**: armed conflict against State with 25+ battle deaths.
- **Onset**: if armed conflict against State with 25+ deaths starts that year

- **Prizes**:
- **Private prize**. Based on oil availability in ethnic homeland:
 - $\ln(\text{ethnic homeland area covered by oil '000km}^2) \times \text{international oil price}$.
 - Merges GREG with geo-ref'd PETRODATA; Lujala, Rod and Thieme 2007.
 - *Robustness*: land, *national* oil rents, minerals.

■ Prizes:

■ Public prize. Baseline attempt.

■ *Autocracy Index from Polity IV*: “codings of the competitiveness of political participation, the regulation of participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive.”

■ Pre-sample information exclusively: sample average 1945–1960.

■ Alternative attempts:

■ *Exclusion*: whether group was excluded from power in previous year.

■ *EMR 2012*: averages autocracy with *Freedom House* indicators.

■ *Religious freedom* indicators from the *Religion and State Project*.

■ *Residual View*: everything not private is public.

■ Controls

■ Country and time fixed effects throughout

■ Population and population density

■ Mountainous terrain

■ Group’s distance to country capital

■ Number of years since last group-level onset

■ Lagged conflict incidence

■ GDP per capita

■ Whether the ethnic group is represented in power

■ Whether the ethnic group is partitioned across countries

Baseline Specification

$$\text{INCIDENCE}_{c,g,t} = \beta_1 \text{SIZE}_{c,g} + \beta_2 \text{SIZE}_{c,g} \times \text{PRIV}_{c,g,t} + \beta_3 \text{PRIV}_{c,g,t} \\ + \beta_4 \text{SIZE}_{c,g} \times \text{PUB}_c + X'_{c,g,t} \alpha + Y'_{c,t} \delta + Z'_c \gamma + W'_t \eta + \varepsilon_{c,g,t},$$

- for countries $c = 1, \dots, C$, groups $g = 1, \dots, G_c$, and dates $t = 1, \dots, T$.
- Prediction: $\beta_2 < 0$, $\beta_4 > 0$.
- (“residual view”): $\beta_2 < 0$, and $\beta_1 > 0$ when we impose $\beta_4 = 0$.
- Linear probability model:
 - Interpreting interactions in other models nontrivial; Ai and Norton 2003.
 - statistical conclusions still valid for nonlinear models.
 - robust standard errors clustered at country-group level (see variations).

Group Size and Conflict Incidence

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
SIZE	-0.002 (0.307)	0.003 (0.101)	0.007*** (0.001)	0.007*** (0.001)	-0.003 (0.116)	-0.005** (0.014)	-0.002 (0.328)	0.003 (0.156)
OIL	0.448** (0.040)	0.684*** (0.009)	0.830*** (0.002)	0.795*** (0.008)		0.446** (0.040)	0.606** (0.012)	0.762** (0.010)
SIZE×OIL		-1.363*** (0.000)	-1.528*** (0.000)	-1.521*** (0.000)				-1.390*** (0.000)
SIZE×AUTOC					0.008** (0.012)	0.008** (0.011)	0.009*** (0.006)	0.009** (0.015)
CONTROLS	n	n	y	y	n	n	y	y
POP, GDP	n	n	n	y	n	n	n	y
LAGGED CONFL.	0.895*** (0.000)	0.895*** (0.000)	0.894*** (0.000)	0.893*** (0.000)	0.899*** (0.000)	0.899*** (0.000)	0.898*** (0.000)	0.898*** (0.000)
R ²	0.844	0.844	0.844	0.846	0.849	0.849	0.849	0.851
Obs	64839	64839	64839	57559	62650	62650	62650	55383

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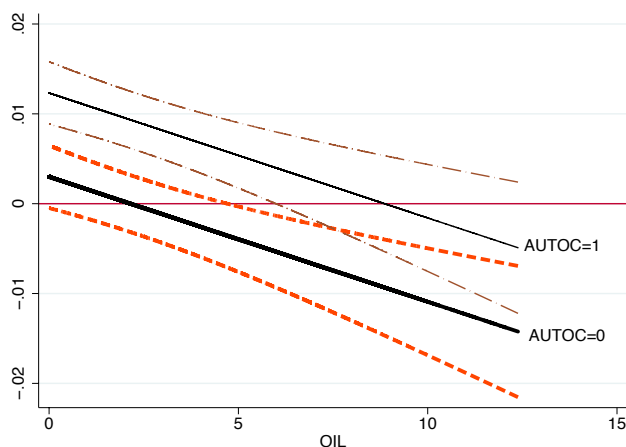
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Magnitudes

- Set AUTOC high, and OIL low:
 - Group size ↑ 1SD ⇒ incidence ↑ by 9.5% (onset ↑ 69.8%)
- Set AUTOC low, and OIL high:
 - Group size ↑ 1SD ⇒ incidence ↓ by 4.2% (onset ↓ 23.2%)



Conflict Incidence		
	[1]	[2]
SIZE	0.008*** (0.000)	0.004** (0.045)
SIZE × AUTO		0.009** (0.024)
OIL _{0+–25TH}	-0.004** (0.013)	-0.004** (0.012)
OIL _{25–50TH}	-0.000 (0.815)	-0.001 (0.774)
OIL _{50–75TH}	0.004** (0.036)	0.004** (0.041)
OIL _{>75TH}	0.007** (0.014)	0.006** (0.019)
SIZE × OIL _{0+–25TH}	0.005 (0.550)	0.005 (0.512)
SIZE × OIL _{25–50TH}	-0.008 (0.209)	-0.007 (0.277)
SIZE × OIL _{50–75TH}	-0.013*** (0.003)	-0.013*** (0.003)
SIZE × OIL _{>75TH}	-0.014*** (0.000)	-0.013*** (0.000)
ALL CONTROLS	y	y
LAG	0.893*** (0.000)	0.898*** (0.000)
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Compute $SIZE + SIZE \times OIL_{\text{quartile}}$ and test if negative for high X .

We can reject the hypothesis that this sum is larger or equal than zero for $X \in 50-75$ (5%) and $X \geq 75$ (1%).

Variations

- Alternative measures of conflict
- Other proxies for the private prize
- Other proxies for the public prize
- Group- (rather than country-) fixed effects
- Alternative estimation strategies (logit)
- Coalitions across ethnic groups
- Error clustering variations: country level, two-way clustering.
- Robustness to dropping different regions of the world
- Potential confounding role of ethnic fractionalization and polarization.

Group Size and Conflict Onset

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	
SIZE	-0.001 (0.333)	0.003** (0.025)	0.005*** (0.001)	0.005*** (0.001)	-0.000 (0.853)	-0.001 (0.668)	-0.001 (0.668)	0.0 (0.0)
OIL	0.652*** (0.002)	0.870*** (0.001)	0.966*** (0.000)	0.937*** (0.001)		0.791*** (0.002)	0.791*** (0.002)	0.957 (0.0)
SIZE×OIL		-1.221*** (0.000)	-1.171*** (0.000)	-1.149*** (0.000)				-1.079 (0.0)
SIZE×AUTOC					0.005* (0.052)	0.006** (0.043)	0.006** (0.043)	0.0 (0.0)
CONTROLS	n	n	y	y	n	n	y	
POP, GDP	n	n	n	y	n	n	n	
PEACEYRS	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001 (0.0)
R ²	0.030	0.031	0.031	0.033	0.032	0.034	0.034	0.0
Obs	63187	63187	62762	55611	60971	53466	53466	53

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Variations in the Private Prize

Oil Alternatives and Land Abundance

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SIZE	***0.006 (0.004)	0.002 (0.338)	***0.005 (0.009)	0.001 (0.647)	***0.018 (0.003)	***0.015 (0.005)
OIL(AREA)	**0.002 (0.012)	**0.002 (0.019)				
SIZE × OIL(AREA)	***-0.003 (0.001)	***-0.003 (0.003)				
OIL(SHARE)			*0.010 (0.078)	*0.010 (0.087)		
SIZE × OIL(SHARE)			**0.021 (0.019)	*-0.016 (0.057)		
AREA(SHARE)					**0.021 (0.032)	**0.021 (0.043)
SIZE × AREA(SHARE)					***-0.042 (0.000)	***-0.040 (0.000)
SIZE × AUTOC		**0.009 (0.018)		**0.010 (0.011)		*0.007 (0.063)
CONTROLS, LAG	Y	Y	Y	Y	Y	Y
R ²	0.846	0.851	0.846	0.851	0.846	0.851
Obs	57559	55383	57559	55383	56756	54580

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OIL(SHARE)			*0.010 (0.078)	*0.010 (0.087)		
SIZE × OIL(SHARE)			** -0.021 (0.019)	* -0.016 (0.057)		
AREA(SHARE)					**0.021 (0.032)	**0.021 (0.043)
SIZE × AREA(SHARE)					***-0.042 (0.000)	***-0.040 (0.000)
SIZE × AUTOC		**0.009 (0.018)		**0.010 (0.011)		*0.007 (0.063)
CONTROLS, LAG	Y	Y	Y	Y	Y	Y
R ²	0.846	0.851	0.846	0.851	0.846	0.851
Obs	57559	55383	57559	55383	56756	54580

More Variations in the Private Prize

Minerals								
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
SIZE	**0.007 (0.020)	0.003 (0.349)	**0.008 (0.015)	0.004 (0.269)	**0.007 (0.022)	0.003 (0.378)	**0.008 (0.016)	0.004 (0.290)
MINES	0.000 (0.830)	0.000 (0.881)						
SIZE × MINES	-0.002** (0.021)	-0.001** (0.049)						
MINES+OIL			0.000 (0.592)	0.000 (0.635)				
SIZE × MINES+OIL			-0.002** (0.012)	-0.002** (0.029)				
MINES(UNWEIGH.)					0.000 (0.862)	0.000 (0.909)		
SIZE × MINES(UNWEIGH.)					-0.001** (0.023)	-0.001* (0.056)		
MINES+OIL(UNWEIGH.)							0.000 (0.625)	0.000 (0.666)
SIZE × MINES+OIL(UNWEIGH.)							-0.002** (0.013)	-0.001** (0.033)
SIZE × AUTOC		0.009** (0.029)		0.008** (0.037)		0.009** (0.030)		0.008** (0.038)
R ²	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.836
Obs	35265	34887	35265	34887	35265	34887	35265	34887

More Variations in the Private Prize

Minerals								
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
SIZE	**0.007	0.003	**0.008	0.004	**0.007	0.003	**0.008	0.004
	(0.020)	(0.349)	(0.015)	(0.269)	(0.022)	(0.378)	(0.016)	(0.290)
MINES	0.000	0.000						
	(0.830)	(0.881)						
SIZE × MINES	-0.002**	-0.001**						
	(0.021)	(0.049)						
MINES+OIL			0.000	0.000				
			(0.592)	(0.635)				
SIZE × MINES+OIL			-0.002**	-0.002**				
			(0.012)	(0.029)				
MINES(UNWEIGH.)					0.000	0.000		
					(0.862)	(0.909)		
SIZE × MINES(UNWEIGH.)					-0.001**	-0.001*		
					(0.023)	(0.056)		
MINES+OIL(UNWEIGH.)							0.000	0.000
							(0.625)	(0.666)
SIZE × MINES+OIL(UNWEIGH.)							-0.002**	-0.001**
							(0.013)	(0.033)
SIZE × AUTOC		0.009**		0.008**		0.009**		0.008**
		(0.029)		(0.037)		(0.030)		(0.038)
R ²	0.836	0.836	0.836	0.836	0.836	0.836	0.836	0.836
Obs	35265	34887	35265	34887	35265	34887	35265	34887

Variations in the Public Prize

Exclusion, EMR Measure, Religious Freedoms							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
SIZE	-0.000	0.007***	0.003	0.004	0.001	**0.005	-0.001
	(0.985)	(0.001)	(0.337)	(0.166)	(0.815)	(0.010)	(0.882)
OIL	**0.695	0.795***	**0.760	***0.777	**0.719	***0.790	**1.162
	(0.039)	(0.008)	(0.011)	(0.010)	(0.032)	(0.008)	(0.025)
SIZE × OIL	-1.217**	-1.521***	-1.371***	-1.555***	-1.143**	-1.369***	-2.138***
	(0.012)	(0.000)	(0.001)	(0.000)	(0.016)	(0.000)	(0.002)
SIZE × AUTOC(1960-80)	0.008**						
	(0.039)						
EXCLUDED		0.003*	0.002				
		(0.057)	(0.354)				
SIZE × EXCLUDED			0.008*				
			(0.067)				
EXCLUDED(1945-60)				0.002			
				(0.363)			
SIZE × EXCLUDED(1945-60)				0.005			
				(0.148)			
EXCLUDED(1960-80)					0.002		
					(0.465)		
SIZE × EXCLUDED(1960-80)					0.012**		
					(0.015)		
SIZE × PUB(EMR)						0.009***	
						(0.002)	
RELIGFREEDOM						***0.043	
						(0.007)	
SIZE × RELIGFREEDOM							0.021*
							(0.086)
R ²	0.836	0.846	0.846	0.846	0.836	0.846	0.763
Obs	34887	57559	57559	57559	34965	57559	22166

Variations in the Public Prize

Exclusion, EMR Measure, Religious Freedoms							
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
SIZE	-0.000 (0.985)	0.007*** (0.001)	0.003 (0.337)	0.004 (0.166)	0.001 (0.815)	**0.005 (0.010)	-0.001 (0.882)
OIL	**0.695 (0.039)	0.795*** (0.008)	**0.760 (0.011)	***0.777 (0.010)	**0.719 (0.032)	***0.790 (0.008)	**1.162 (0.025)
SIZE × OIL	-1.217** (0.012)	-1.521*** (0.000)	-1.371*** (0.001)	-1.555*** (0.000)	-1.143** (0.016)	-1.369*** (0.000)	-2.138*** (0.002)
SIZE × AUTOC(1960-80)	0.008** (0.039)						
EXCLUDED		0.003* (0.057)	0.002 (0.354)				
SIZE × EXCLUDED			0.008* (0.067)				
EXCLUDED(1945-60)				0.002 (0.363)			
SIZE × EXCLUDED(1945-60)				0.005 (0.148)			
EXCLUDED(1960-80)					0.002 (0.465)		
SIZE × EXCLUDED(1960-80)					0.012** (0.015)		
SIZE × PUB(EMR)						0.009*** (0.002)	
RELIGFREEDOM						***0.043 (0.007)	
SIZE × RELIGFREEDOM							0.021* (0.086)
R ²	0.836	0.846	0.846	0.846	0.836	0.846	0.763
Obs	34887	57559	57559	57559	34965	57559	22166

Other Material in the Paper

■ More variations:

- National level oil wealth
- Group fixed effects
- Nonlinear specifications
- Alliances in conflict
- Dropping countries with small ruling elites
- Other (pure cross-section, assessing importance of OVB, more)

■ **Summary: A Theory of Multiple Threats to Peace**

- Small groups initiate when the prize is private.
- Large groups initiate when the prize is public.
- Society may be actively conflictual, depending on the variety of threats.
- The data significantly support the predictions of the theory.

■ **Two Remarks on Salience**

■ **Dynamics.**

- Institutional sluggishness versus speed of marker formation.

■ **Multiple Identities.**

- Sen's argument.
- Ideologies and cultures versus resource-grabbing.