



INFRASTRUCTURE PROCUREMENT AND EX POST COST ADJUSTMENTS

**~EVIDENCE FROM ODA-FINANCED ROAD
PROCUREMENT IN AFRICA ~**

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MOTIVATION (1/4):

INFRASTRUCTURE PROCUREMENT MARKETS

- Sizeable infrastructure procurement markets in developing countries
 - 0.84% of GDP for on-budget road investment in Africa; 0.4% of GDP for off-budget (Briceno-G. *et al.*, 2008)
- Limited financial resources
 - Chronic problem
 - Also, more O&M costs expected in the future, given massive stimulus packages focusing on public infrastructure
- Alleged concern about collusion and corruption (Olken, 2005; Gulati & Rao, 2007)



MOTIVATION (2/4): IMPORTANCE OF EFFICIENT PROCUREMENT

What can we do to meet significant demand with limited resources?

- One of the general solutions:
 - Improved efficiency in public procurement can generate additional fiscal space
- Still, how to design efficient public procurement remains a challenge for many developing countries
 - Of particular note, rebidding is very costly in infrastructure development projects



MOTIVATION (3/4): MASSIVE COST OVERRUNS AND DELAYS

- Particular problems in infrastructure procurement
 - Cost overruns
 - 9 out of 10 transport projects underwent cost overruns (Flyvbjerg *et al.*, 2002)
 - Average cost escalation during projects is 27.6% (Flyvbjerg, 2005)
 - In some cases in Africa, road contract costs exceeded engineering estimates by 20% (Alexeeva *et al.*, 2008)
 - Another 20% would be added during implementation (*ditto*)
 - Project delays
 - Average delay reaches 10 months in road contracts in Africa (Alexeeva *et al.*, 2008)
 - Delays are costly; construction costs would increase by 4.6% per year of delay (Flyvbjerg, 2005)



MOTIVATION (4/4): CONSEQUENCES OF COST OVERRUNS

Why do we have to avoid cost overruns?

1. Cost overruns and delays make budget execution unreliable and unpredictable
 2. Chronic cost underestimation biases public project prioritization
 3. “Low balling” distorts auction outcomes
- Main question of the paper:
Do ex post cost adjustments affect the equilibrium bid function?



SOME RELEVANT LITERATURE

- Theory:
 - Tradeoff between providing tight incentives and reducing ex post renegotiation costs (Bajari & Tadelis, 2001)
- Evidence:
 - \$2.7 per \$1 of ex post cost adjustment in California highway contracts (Bajari, Houghton & Tadelis, 2006)
 - PPP road construction is 24% more costly than traditional procurement in Europe (Blanc-Brude, Goldsmith & Valila, 2006)
 - Cost-saving investment for future O&M, or
 - Premium for transferring construction risks (inc. cost overruns)
 - More evidence on PPP renegotiation (Guashe, 2004; Guasch, Laffont & Straub, 2007, 2008)
- *How about the implicit cost of cost overruns in road procurement in Africa?*



DATA

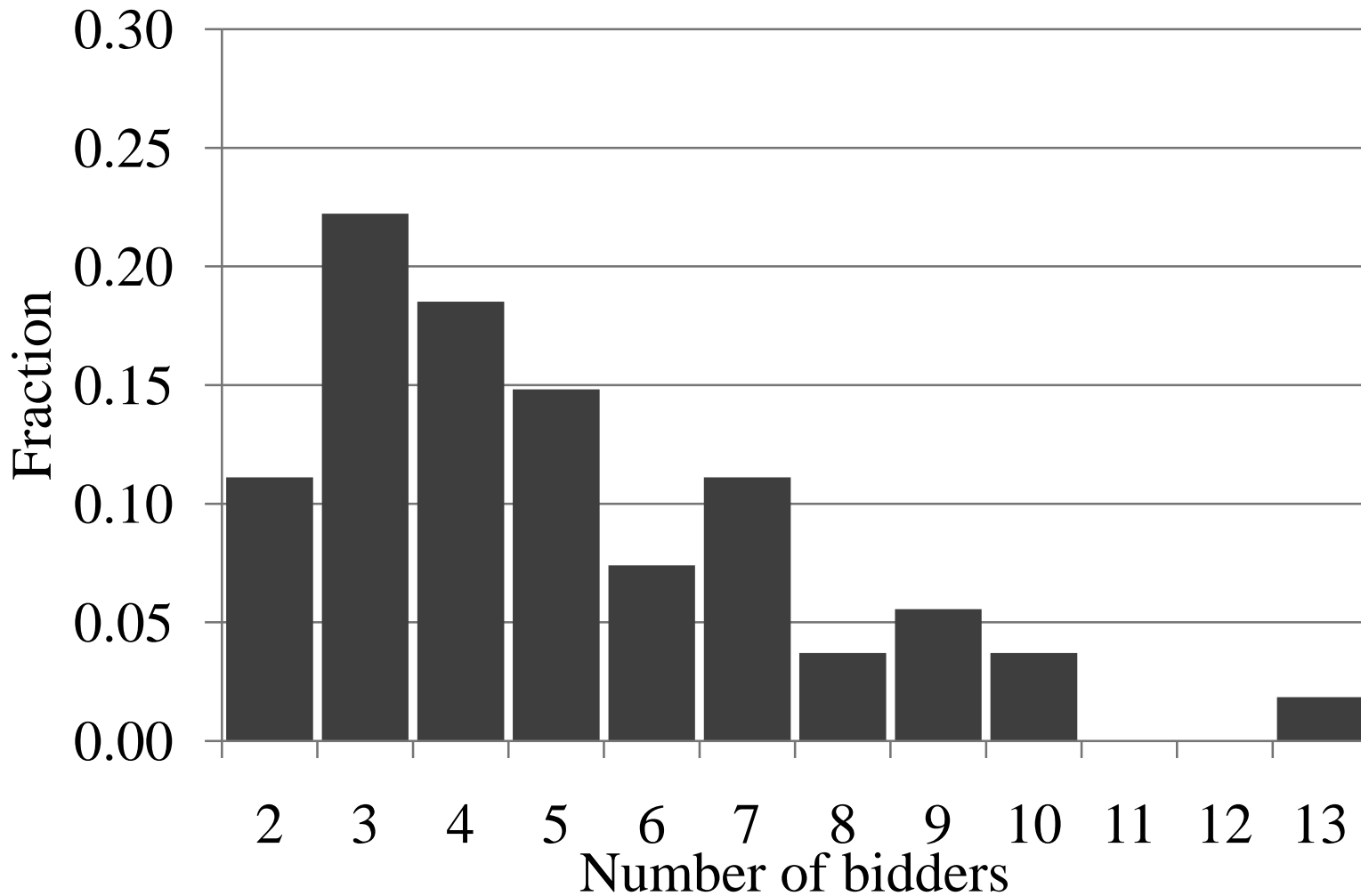
- Original data: Alexeeva *et al.* (2008)
 - Over 400 winning and losing bids on World Bank-financed road projects in Africa
- Our sample:
 - 270 winning and losing bids
 - On 54 road contract auctions
 - In 12 Sub-Saharan African countries



AVERAGE COST OVERRUNS IN WORLD BANK ROAD PROJECTS IN AFRICA

	(Bid / Cost estimate -1)		(Original contract / Cost estimate -1)		(Actual payment / Original contract -1)	
	Obs.	Mean	Obs.	Mean	Obs.	Mean
All	344	46.1	73	16.6	100	7.4
Congo, Dem. Rep.	7	62.2	1	15.0	8	3.0
Congo, Rep.	22	26.9	7	21.4	6	12.9
Ethiopia	36	46.8	9	21.8	11	0.1
Ghana	37	0.9	7	-9.2	9	20.4
Kenya	15	19.7	4	2.2	4	3.1
Madagascar	21	28.7	5	7.8	6	-3.5
Malawi	11	26.3	4	11.6	7	0.5
Mauritania	7	-1.6	2	3.1	3	-5.3
Mozambique	56	108.2	9	46.5	10	16.5
Nigeria	58	60.1	9	21.7	13	22.5
Tanzania	43	27.8	7	9.7	9	-0.4
Uganda	19	53.6	6	24.8	7	1.0
Zambia	12	14.0	3	-5.1	7	1.9

PROBABILITY DISTRIBUTION OF NUMBER OF BIDDERS



EX POST COST ADJUSTMENTS IN SAMPLE DATA

% of original contract	Number of contracts
Adjustment < -5%	2
-5% < Adjustment < -2%	3
-2% < Adjustment < 0%	9
No adjustment	3
0% < Adjustment < 2%	19
2% < Adjustment < 5%	7
5% < Adjustment < 15%	5
Adjustment > 15%	6
Total	54

THEORETICAL BACKGROUND

- First-price sealed-bid auction with private and common values

$$\pi_i = \begin{cases} b_i - c_i + (adj + \frac{1}{n} \sum_{i=1}^n v_i) & \text{if } b_i = \min_{j \in n} \{b_j\} \\ 0 & \text{otherwise} \end{cases}$$

b : bid

c : private cost parameter

$adj+V$: common ex post adjustment (constant plus mean)

- Equilibrium bid function (Goeree & Offerman, 2003; Bajari *et al.*, 2006; De Silva *et al.*, 2008)

$$B_{n-1}(s_i) = E_{n-1}[c - adj - V | s_i = x, Y_1 = x] + E_{n-1}[y_1 - Y_1 | s_i = x, Y_1 = x]$$

where $s_i = c_i - adj - v_i/n$, $Y_1 = \min_i \{c_i - adj - v_i/n\}$ and

$$y_1 = \min_{j \neq i} \{c_j - adj - v_j/n\}$$

EMPIRICAL MODEL

- Standard reduced form bid function (e.g., Porter & Zona, 1993; De Silva *et al.*, 2008):

$$\ln BID = \theta_1 D_{>15\%} \ln ADJ + \theta_2 (1 - D_{>15\%}) \ln ADJ + \alpha \ln NUM + X' \beta + \varepsilon_1$$

ADJ: (Final payment – Original contract amount)

- Differentiating contracts by size of adjustments: More than 15% and less than 15%
- Endogeneity of bidder participation (*NUM*)
 - Two instruments:
 1. Number of prequalified bidders
 2. 6 governance indices from the Worldwide Governance Research Indicators database (Kaufmann *et al.*, 2008)
 - E.g., government effectiveness; rule of law; anticorruption
 - 60% of potential contractors do not participate in public tenders in Nigeria, because they do not trust the selection mechanism (World Bank, 2008)

MAIN ESTIMATION RESULTS

Estimation method	OLS	OLS	IV	IV
$\ln ADJ(\theta)$	-0.0012 (0.0019)		-0.0011 (0.0019)	
$\ln ADJ_{>15\%}(\theta_1)$		-0.0065 (0.0050)		-0.0080* (0.0049)
$\ln ADJ_{<15\%}(\theta_2)$		-0.0007 (0.0020)		-0.0005 (0.0020)
$\ln NUM$	0.001 (0.054)	0.015 (0.057)	0.184** (0.094)	0.184** (0.094)
$\ln LENG$	0.079* (0.049)	0.091* (0.050)	0.057 (0.048)	0.074 (0.049)
$\ln WIDT$	0.034 (0.183)	0.030 (0.189)	0.220 (0.215)	0.197 (0.222)
$\ln COST$	0.895*** (0.042)	0.891*** (0.042)	0.889*** (0.043)	0.884*** (0.043)
Obs.	270	270	270	270
Adj. <i>R</i> -squared	0.956	0.957	0.955	0.955
<i>F</i> -statistics	357.54	345.46	325.19	300.84

Dependent variable: $\ln BID$

Other independent variables: Utilization rate; success rate; minimum rival's utilization rate; rival's success rate; country dummy variables; bidder nationality dummies.

Instruments for *NUM*: Number of qualified bidders; governance indicators.

POLICY IMPLICATIONS

- Anticipated large (>15%) cost overruns would matter to bidders at the time of bidding.
 - Marginal effect of large (15% more) adjustment = -0.07 (std. err. 0.03)
- Two direct implications with the model evaluated at sample means:
 1. Implicit cost of ex post adjustments:
 - 93 cents per \$1 of adjustment, under the perfect foresight assumption
 2. Low balling:
 - Less than \$158,000 per km (the lower bound of the 95% confidence interval of the predicted road contract price, even if the above effect is accounted for)

OTHER ESTIMATION RESULTS

- Two-stage quantile regressions (Arias *et al.*, 2001):
 - Robustness
 - Larger implicit adjustment costs for smaller contracts
- First-stage zero-truncated negative binomial regressions:
 - Positive coefficients on *NUMQ*
 - Governance matters to bidder entry
 - Rule of law and anticorruption policies are of particular importance to foster competition

SOME DISCUSSION

- *What can we do to avoid costly ex post adjustments ?*

- Three possibilities:
 1. Strengthening contract enforceability
 - More responsibility transferred to contractors in French defense procurement (Kapstein & Oudot, 2009)
 - Explicit time incentives in Minnesota road procurement (Bajari & Lewis, 2009)
 2. Output-based aid (OBA)
 - Linking payments to output delivery
 3. More flexible contracts
 - Periodical benchmarking of prices in PFI (NAO, 2001)
 - IDIQ (indefinite delivery/indefinite quantity) contracts by US General Services Administration



THANK YOU!

COMMENTS ARE WELCOME!

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