

# Green Criteria vs Green Clauses

## Assessing the Impact on Competition in Public Procurement

Adrien Deschamps<sup>1</sup>, François Maréchal<sup>2</sup>, Pierre-Henri Morand<sup>1</sup>

<sup>1</sup> JPEG, Avignon University    <sup>2</sup> CRESE, University of Franche-Comté

June 10, 2024

- 1 Introduction
- 2 Theoretical model
- 3 Empirical evidence

- 1 Introduction
- 2 Theoretical model
- 3 Empirical evidence

- The issue of the level of effective competition in public procurement procedures in Europe came to the fore in **2024**
- The special report 28/2023 of the European Court of Auditors points out that over the last decade, competition for public contracts has **decreased**.
- It concludes “that key goals of the EU’s 2014 reform to ensure competition [...] have not been met and that some of the **objectives may even reduce competition**”
- In France, over the period 2015-2023, the number of contracts awarded when only **one** company had bid is increasing!

⇒ What are the underlying **causes** of the change in the way public procurement operates?

## Research question (2)

- Many public authorities in the world are implementing **Green Public Procurement (GPP)** as part of a broader approach to sustainability in their purchasing
- By 2026, in France, all public procurement contracts must consider environmental impact

Legally, this can be done in two ways:

- By including a **green criterion** (e.g. with weightings) in the selection rule
  - ⇒ Each competing firm will have to bid on this criterion
- By including **environmental clauses**, which define a minimum level of environmental performance required to compete for the contract

Aim of this article: compare the impact of the choice "**clause vs criteria**" on the level of participation of firms in procurement contracts

- Optimal procedures for awarding procurement contracts when price and quality matter when the number of participating firms is **exogenous** (e.g. Che (1993) and Asker and Cantillon (2010))
- Need to consider that each firm incurs a **cost of participation** (e.g. to prepare a bid)  $\Rightarrow$  **Endogenous participation** of firms
- When price is the sole award criterion Samuelson (1985) and Menezes and Monteiro (2000)

Key result: expected cost **does not necessarily decline when the number of bidders increases** (contrary to the models with an exogenous number of bidders)

- **Intuition:** when  $n \rightarrow n + 1$ , the expected (second lowest) cost is decreasing but fewer firms are participating
- $\Rightarrow$  Policies to **stimulate competition are not necessarily** welfare improving!

### **Endogenous entry** of firms when a procurement contract is awarded on **price and quality criteria**

- Estache and limi (2009): highlight the interactive effects among quality, entry, and competition
  - Theoretical analysis
    - ⇒ In the context of a **clause**, quality threshold can be used, by the public buyer, as an **instrument to modulate** the level of competition
  - Empirical analysis: data on procurement auctions for large electricity projects in developing countries.
    - ⇒ Public buyers **cannot easily substitute prices for quality**
- Pohja (2021) : empirical analysis of the impact of the choice of the awarding rule (**criteria vs clause**) on the level of competition
  - Data from construction works in Finland
  - Result : **more competition with criteria than with clauses**

- 1 Introduction
- 2 Theoretical model
- 3 Empirical evidence



# Theoretical model: assumptions

We extend the model of auction with endogenous participation and price only of Menezes and Monteiro (2000) to an auction on **price and quality**

## Assumptions:

- Each firm has a private information on an i.i.d parameter entering its cost of providing quality
  - **endogeneous quality**: Each firm is able to provide (at different costs) any level of quality
  - **exogeneous quality**: Each firm has a technology able to provide a determined level of quality
- To submit a bid, each firm incurs a participation cost
- Each firm knows its cost of providing quality before deciding to pay the participation cost
- Each firm only knows the number of potential bidders

# Theoretical predictions

## Endogenous quality

### Prediction 1

**Greater level of competition** observed in contracts **with** environmental clauses than without

### Prediction 2

The **higher the quality weighting**, the **greater** the effective participation

⇒ **Intuition** for these results: the quality component allows firms to increase their expected profits

- Increasing the level of potential bidders (e.g. via a longer advertising period) does not necessarily increase the level of effective competition

⇒ **Intuition**: same result as in the case of a price-only auction (with endogenous participation)

# Theoretical predictions

## Exogeneous quality

- **Uncertain impact on the level of competition** of environmental clauses/criteria

⇒ **Intuition:** two opposite effects of environmental quality target.

- ① exclude all the firms with inappropriate technology
- ② increase markup effect on participation (similar to endogeneous quality)

- 1 Introduction
- 2 Theoretical model
- 3 Empirical evidence**

# Data overview

Source : Deschamps and Potin (2024)

(preprint : <https://ssrn.com/abstract=4841560>)

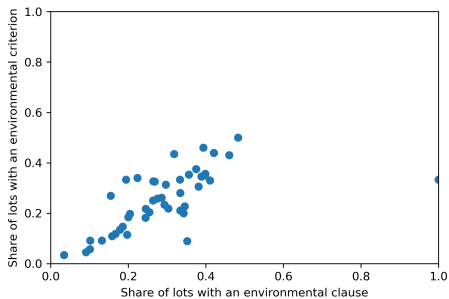
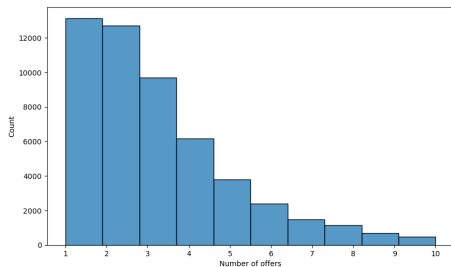
	environmental_weight	advertising	p_criterion_weight	cae_size	number_offers	award_price
count	51644	51644	51644	51644	51644	51644
mean	2.90	37.50	45.92	93.34	3.02	12.27
std	6.08	11.26	13.54	150.05	2.01	1.98
min	0	1	0	1	1	0.18
25%	0	31	40	14	1	11.14
50%	0	33	40	39	2.50	12.34
75%	5	40	60	99	4	13.48
max	60	396	95	862	10	27.63

Table 1: Description of continuous variables

	renewable	environmental_criterion	environmental_clause	social_clause	framework_agreement	allotment
True	0.62	0.26	0.28	0.11	0.53	0.78
False	0.38	0.74	0.72	0.89	0.47	0.22

Table 2: Description of dummy variables

# Important variables



- Negative binomial regression
- Zero-truncation
- Clusterized standard errors

# Results : all contracts

	<b>number_offers</b>	allotment	-0.018 (0.013)
advertising	0.001* (0.0009)	social_clause	0.017 (0.025)
p_criterion_weight	-0.003*** (0.001)	renewable	0.086*** (0.020)
award_price	0.022*** (0.005)	cpv (2 digits)	Yes
cae_size	-0.0003*** (0.0001)	month	Yes
environmental_weight	-0.0002 (0.002)	zip_code	Yes
environmental_criterion	-0.013 (0.034)	_cons	0.455*** (0.116)
environmental_clause	0.027 (0.021)	lnalpha _cons	-1.580*** (0.046)
framework_agreement	0.047** (0.020)	<i>N</i>	51,644
		Clusters	20,013
		Pseudo $R^2$	0.03
		Standard errors in parentheses	
		* $p < 0.10$ , ** $p < 0.05$ , *** $p < 0.01$	

**Table 3:** Truncated negative binomial regression for all sectors



## Results : all contracts (2)

Among the results, we find

- No significant impact of green clauses and award criteria
- A negative impact of the value of the weighting of the price in the selection rule
- A positive impact of the value of the award price

# Results : construction contracts

	number_offers	allotment	-0.013 (0.028)
advertising	0.001 (0.001)	social_clause	0.105*** (0.032)
p_criterion_weight	0.0008 (0.001)	renewable	0.033 (0.043)
award_price	0.04*** (0.009)	cpv (3 digits)	Yes
cae_size	-0.0002 (0.0001)	month	Yes
environmental_weight	0.008 ** (0.003)	zip_code	Yes
environmental_criterion	-0.147 *** (0.054)	_cons	0.306 (0.232)
environmental_clause	-0.046 (0.033)	lnalpha _cons	-2.855*** (0.15)
framework_agreement	0.12*** (0.043)	N	7,561
		Clusters	2,179
		Pseudo R <sup>2</sup>	0.04
		Standard errors in parentheses	
		* $p < 0.10$ , ** $p < 0.05$ , *** $p < 0.01$	

Table 4: Truncated negative binomial regression for construction works

## Results : construction contracts (2)

Among the results, we find

- No effects for green clauses
- Opposite effects concerning the presence and the weight of the environmental criteria
  - ⇒ Introducing a green criterion deters firms from submitting offers, but once there is a green criterion, the higher the weight, the manier the offers (**Pred. 1**)

# Results : environmental services

	number_offers	allotment	0.035 (0.038)
advertising	0.003 (0.002)	social_clause	-0.088* (0.051)
p_criterion_weight	-0.002 (0.002)	renewable	0.053 (0.046)
award_price	0.070*** (0.010)	cpv (3 digits)	Yes
cae_size	-0.0003 (0.0003)	month	Yes
environmental_weight	-0.006 (0.004)	zip_code	Yes
environmental_criterion	0.036 (0.065)	_cons	0.061 (0.309)
environmental_clause	0.11** (0.05)	lnalpha _cons	-2.55*** (0.283)
framework_agreement	-0.087** (0.038)	<i>N</i>	4,298
		Clusters	1,835
		Pseudo $R^2$	0.12
		Standard errors in parentheses	
		* $p < 0.10$ , ** $p < 0.05$ , *** $p < 0.01$	

**Table 5:** Truncated negative binomial regression for environmental services

## Results : environmental services (2)

Among the results, we find

- A positive impact of environmental clauses (**Pred. 2**)
- No significant effect of green award criteria

# Appendix: theoretical analysis of an environmental clause

Expected profit of firm  $i$

$$E\pi(\theta_i) = (b_i(\theta_i) - c(\theta_i, q)) (1 - F(b^{-1}(b_i(\theta_i))))^{n-1} - \kappa.$$

Optimal bidding strategy of firm  $i$

$$b_i(\theta_i) = c(\theta_i, q) + \frac{\kappa}{(1 - F(\theta_i))^{n-1}} + \frac{\int_{\tilde{\theta}}^{\theta_i} \left( \frac{\partial c(\theta, q)}{\partial \theta} \right) (1 - F(\theta))^{n-1} d\theta}{(1 - F(\theta_i))^{n-1}}$$

The threshold value  $\tilde{\theta}$  is implicitly defined as the solution of  $E\pi(\tilde{\theta}) = 0$

$$(b_i(\tilde{\theta}) - c(\tilde{\theta}, q)) (1 - F(\tilde{\theta}))^{n-1} - \kappa = 0. \quad (1)$$

Firm with parameter  $\tilde{\theta}$  can only win the contract if it is the sole supplier. Then, it is optimal for this firm to submit a bid equal to the maximal acceptable one, which is equal to  $c(\bar{\theta}, q)$ . Substituting this value in (1) yields

$$(c(\bar{\theta}, q) - c(\tilde{\theta}, q)) (1 - F(\tilde{\theta}))^{n-1} - \kappa = 0.$$

## Appendix: theoretical analysys of an environmental clause (2)

- The public buyer imposes the level of quality that the winning firm has to use
- More specifically, the public buyer will impose a level of quality  $q = \arg \max V(q) - b_i(\theta_{i(1)})$ , where subscript (1) refers to the lowest expected efficiency parameter
- In order to derive explicit formula, let us consider that  $c(\theta_i, q) = \theta_i q^2$  and  $F$  is uniform on  $[1, 2]$
- Then

$$\tilde{\theta} = 2 - \left( \frac{\kappa}{q^2} \right)^{\frac{1}{n}}.$$

- Asker, J. and Cantillon, E. (2010). Procurement when price and quality matter. *The Rand journal of economics*, 41(1):1–34.
- Che, Y.-K. (1993). Design competition through multidimensional auctions. *The RAND Journal of Economics*, pages 668–680.
- Deschamps, A. and Potin, L. (2024). Processing and consolidation of open data on public procurement in france (2015-2023).
- Estache, A. and limi, A. (2009). Auctions with endogenous participation and quality thresholds: evidence from oda infrastructure procurement. *World Bank Policy Research Working Paper*, (4853).
- Menezes, F. M. and Monteiro, P. K. (2000). Auctions with endogenous participation. *Review of Economic Design*, 5:71–89.
- Pohja, J. (2021). The effect of bid evaluation rule on participation in public procurement competitions with endogenous entry. Master's thesis.



Samuelson, W. F. (1985). Competitive bidding with entry costs.  
*Economics letters*, 17(1-2):53–57.