The Impact of Flexibility on Pricing in Framework Agreements: Exploring a Simple Model

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1 Introduction

Economic theory predicts the challenges – sometimes the impossibility – of aggregating preferences into one singular solution.

On the topic of framework agreements, this is common knowledge. Many such agreements are centralized, meaning that a Centralized Purchasing Body (CPB) enters the agreement on behalf of maybe thousands of individual Contracting Authorities.

Here, different Authorities generally want different solution. A common solution is to increase the flexibility of choice after the general procurement procedure.

Yet, increased flexibility will diffuse competition from a single point to multiple points. This should increase the prices per product. And this leads to a trade-off between receiving preferred products and paying higher prices. From a policy perspective it is worth considering whether increased flexibility is the right way to optimize end-user value.

This insight also has legal implications, since allowing different purchasing decisions after a finalized procurement may run foul of what the procurement rules are meant to ensure: transparency and predictability at all stages of the procurement procedure.

If increased flexibility does indeed decrease transparency, it may do so only if the impingement is proportionate. This at least requires that a legitimate aim is pursued. One such legitimate aim is value for money.

In this paper, I introduce a simple linear city model to provide some initial insights as to the trade-off between lower prices and receiving preferred products.

While the model is very simple and has not yet been the subject of more generalized proofs, it does indicate a potential path of future inquiry into the policy and legal implications of increased flexibility.

I show that whether flexibility is preferred to increased competition depends on the intensity with which competition will occur. If the potential competition at point a is weak, it may be beneficial to instead diffuse competition, such that two options exist. Likewise, if competition in a is strong, it may again be beneficial to diffuse competition. This indicates that increased flexibility is not beneficial only in the Goldilocks zone of mediocre competitive pressure.

2 Why do we like flexibility?

Let us start by exploring why flexibility may be preferable to competition at a single point. Let us take the example of a CPB buyng services for local libraries in Denmark.[1] For simplicity, assume that the contract should only cover two libraries: one

[1] This example is borrowed from Bogetoft and Socha (2023).

in the western part of Denmark (Jutland) and one in the eastern part (Zealand). Both need the same quantity of deliveries, and the only relevant parameter is the price of delivery.

Let us assume that three tenderers make a bid according to the following prices:

Contract	Prices Jutland	Prices Zealand	Average Prices
A	45	5	25
B	20	20	20
C	5	45	25

The prices can be illustrated as such:

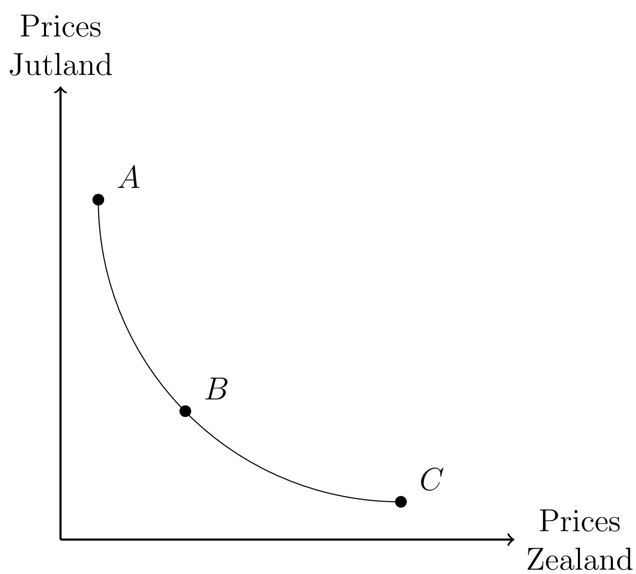


Figure 1: Three potential contracts

If the Jutlandian Contracting Authority were to make its own procurement procedure the prices for delivery in Zealand are of no interest, and vice versa. If the CPB, however, attempts to find the tender that best combines the needs of the individual Contracting Authorities, an obvious strategy for doing so is to choose the Economic Operator that offers the lowest average prices.

Contract B has the lowest average prices, and the CPB trying to minimize average costs, should pick it. But if the Contracting Authorities could pick for themselves, Jutland would choose contract C and Zealand would choose contract A.

By picking the product that is best on average, the CPB effectively makes Jutland and Zealand worse off than they would have been, had they chosen for themselves. Conversely, could Jutland and Zealand pick for themselves, total costs would also be lower.

This leads to an unsatisfying conclusion: The individual Contracting Authorities must accept products at a higher price than what is offered, and society at large forgoes savings.

Taken so far, it seems clear that flexibility can indeed increase value of money. Just letting Justland and Zealand pick their preferred tenderer, leaves everyone better off.

That conclusion, however, is dependent on how the competitive pressure is allocated ex ante. Prices may be so low, because tenderers expect to be able to sell to the entire market, if they win. If that expectation changes, prices may change with it. This is exactly the trade-off, I will exlore in sections 4 and onwards.

3 The legal backdrop

While it is quite clear from the policy perspective, why increased flexibility may be (non-)beneficial, it may be less clear how the legal landscape limits flexibility. Below, I will give a cursory overview of flexibility en EU Public Procurement Law.[2]

3.1 Defining Flexibility

Flexibility can take on many meanings in public procurement law. In this paper, flexibility refers to Contracting Authorities' ability to choose between different products or services after the procurement proceedings have ended, *e.g.*, at the call-off

[2]For a fuller exposition, see Bogetoft and Socha (2023).

stage of a multi-supplier agreement.

This is a somewhat narrower definition of flexibility than what has been offered in other contexts. Flexibility has for instance been used in relation to the freedom of choice as to when to make the purchase. This is of course one of the benefits of Framework Agreements, but is not the focus of our paper. Flexibility has also been used in the discussion of allowing for changes to the procurement documents after negotiations, and more generally in relation to "flexible" procedures. In that case, flexibility can be understood more so as allowing Contracting Authorities to update or clarify their needs under specific circumstances.

3.2 Flexibility in Public Procurement Law

Flexibility can occur in the guise of agreements where one vendor must provide a range a products, in multi-tender agreements, with liberal standards for direct awards or mini-competition, in framework agreements with several sub-contracts, or the the case where multiple framework agreements cover similar subject matters.

Framework agreements generally take on the same overall structure: An initial stage where at least one supplier is awarded the framework agreement, and a subsequent, less formalistic, stage where individual Contracting Authorities make purchases as needed, i.e., call-off awards. The idea of creating a menu of contracts pertains to allowing some flexibility in the choice of products at the call-off stage.

Framework agreements with sub-contracts

Product Range Procurement.

Framework agreements with direct award for specific needs. The use of direct award for Contract Authorities' specific needs is found in at least Denmark, Finland, Italy, and Sweden (Hamer, 2021).

3.3 The Challenge of Transparency

It has been argued that allowing flexibility of choice at the call-off stage also risks impinging on transparency.[3]

In the case of direct award, a fairly obvious problem with allowing Contracting Authorities to purchase based on individual needs is if these needs become so vague that they work as a smoke screen for unrestricted discretion. The Danish Complaints Board's decision in Assemble v. Sorø Municipality (pronounced "Zoro") illustrates these considerations. Here the Board found that a "needs assessment" using formulations such as "It must be possible to" or "There must be an opportunity for," were so broadly formulated that the needs assessment risked making illusory competition within the framework, giving contracting authorities absolute freedom of choice between the different suppliers.

Now, whether there is an issue of transparency or equal treatment will depend greatly on the procurement design. The need for a menu of contracts may occur inside a framework agreement even if differences in preferences between Contracting Authorities are known at the outset of the procedure for the framework agreement.

As such, it may be possible to require Contracting Authorities to state at the outset exactly what objective criteria may lead them to use direct award based on individual needs.

Such a design likely limit transparency issues while still giving Contracting Authorities the chance to procure the products most relevant to them and would – in our view – carry with it no concerns of transparency or equal treatment.

It will, however, likely not be possible to design away all transparency or equal treatment issues in situations where flexibility may be beneficial. For one, as there are transaction costs associated with identifying all needs up front, it may simply be too costly for the CPB to obtain and identify all relevant needs, in which case

[3] See, *e.g.*, Andrecka (2015).

a more practical design may be to have the Contracting Authorities create "needs assessments" before making individual purchases, such as design may not be possible.

3.4 Flexibility as a proportionate limitation on transparency

If transparency is hindered by increased flexibility, the relevant legal test is whether the hindrance is proportionate.

It has repeatedly been emphasized that one of the aims of public procurement is to secure the best value for public money.[4] Although the procurement Directives are not directed at achieving value for money per se, better value for money is certainly one of the benefits intended to follow from the internal market and, in particular, from the procurement Directives.[5] Value for money – or efficiency in public spending – should be a consequence of public procurement.

This leads to the question whether increased flexibility can be an appropropriate means, i.e., create more value for money.

4 Model

4.1 Intuitition

The linear city model builds on the insight that with many things in life, people do not agree on what is best.

Examples include the choice between PlayStation and X-box (same purpose, but partly different characteristics), the choice between Kvickly and Bilka (roughly the same price and quality level, but different brands) and the choice between Netto in Frederiksberg and Netto in Nørrebro (similar quality and prices, but people living in

[4] See, for instance, Directive 2014/24/EU, recitals 47, 91, 93.

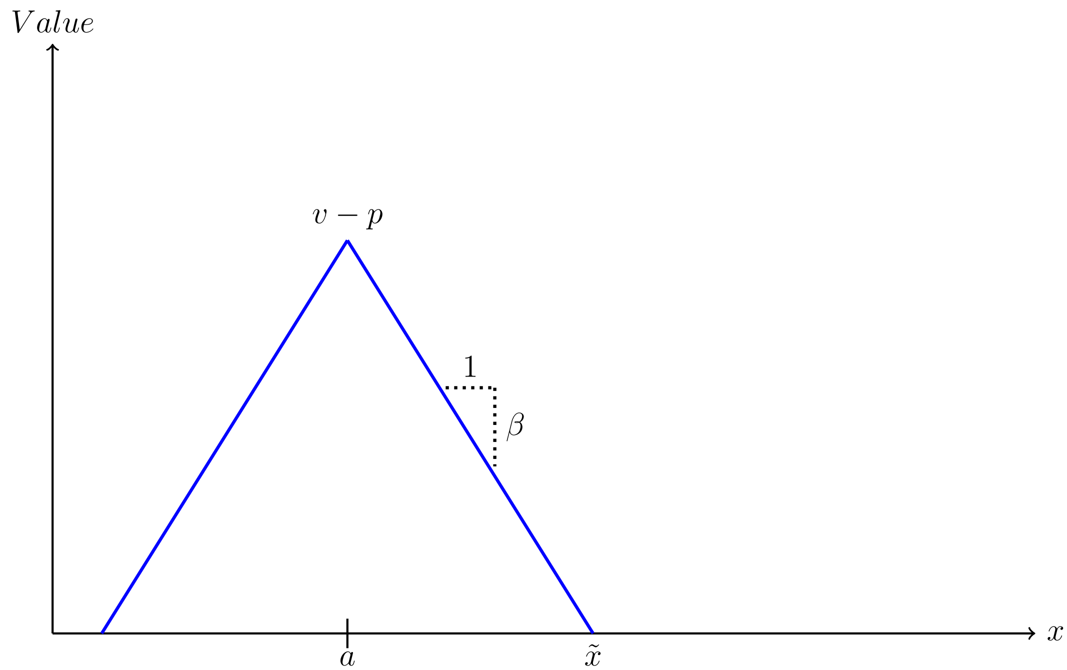
[5] Sue Arrowsmith and Peter Kunzlik, Public procurement and horizontal policies in EC law: gneral principles in: SOCIAL AND ENVIRONMENTAL POLICIES IN EC PROCUREMENT LAW. NEW DIRECTIVES AND NEW DIRECTIONS, (Sue Arrowsmith & Peter Kunzlik eds.), pp. 32-33.

Frederiksberg prefer Netto in Frederiksberg, while people in Nørrebro prefer Netto in Nørrebro).

The intuition behind the model is that what you want to buy depends on where you live (the supermarket analogy is in this case very apt). The further from a store, you live, the more costly it is for you to muy from it.

4.2 Formal Model

The model is a simple linear city set-up as seen in e.g. Tirole (1988).



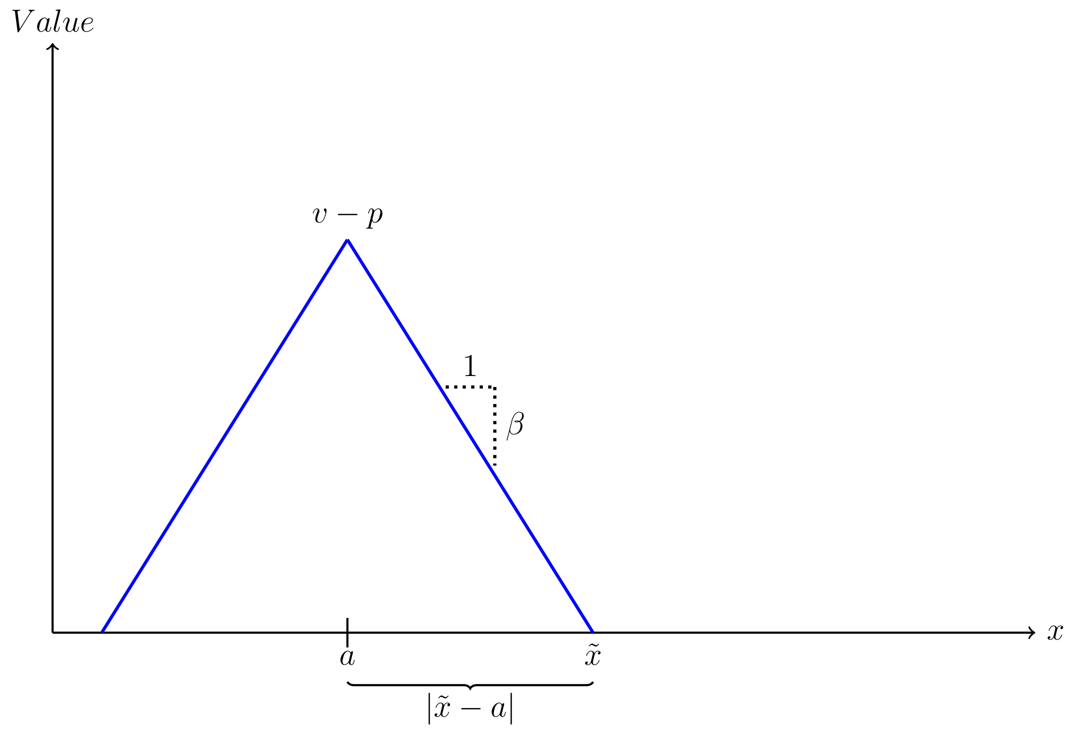
Assume unit costs c and linear transportation costs for the consumer.

The consumers value function is:

$$v - p - \beta d(x, a)$$

where $d(x,a)$ is the distance from x to a as a function of the transportation costs, and $\beta \neq 0$. We identify the one-sided demand function by observering that the marginal consumer, $\tilde{x}$, has zero value of a purchase, i.e.,

$$\begin{aligned} v - p - \beta d(\tilde{x}, a) = 0 &\iff \\ v - p = \beta d(\tilde{x}, a) &\iff \\ \frac{v-p}{\beta} = d(\tilde{x}, a) &\iff \\ \frac{v-p}{\beta} = \tilde{x} - a& \end{aligned}$$



This implies that the two-sided demand is $\frac{2}{\beta}(v-p)$.

5 The choice between one or two contracts

In this section, I explore the question of whether to create one or two contracts.

We first identify the consumer surplus under a monopoly condition and under perfect competition. We then ask the question: under what circumstances is it preferable to have competition in a single point, and when is it preferable to have two monopolists?

5.1 One contract, one seller (single monopoly)

We start by exploring pricing and consumer surplus under the monopoly condition.

With unit cost c, the monopolist's profit function is:

$$\begin{aligned}\pi &= \frac{2}{\beta}(v-p)(p-c) \\ &= \frac{2}{\beta}(vp - vc - p^2 + pc) \\ &= \frac{2}{\beta}[-p^2 + (v+c)p - vc]\end{aligned}$$

, which is a second degree polynomial in p. Taking the derivative w.r.t. p and setting this to 0, we obtain:

$$\begin{aligned}\frac{d\pi}{dp} = \frac{2}{\beta}[-2p+v+c)] = 0 &\iff \\ -2p+v+c = 0 &\iff \\ p^* = \frac{v+c}{2} & \qquad (\star)\end{aligned}$$

Max profit is then:

$$\begin{aligned}
\pi^* &= \frac{2}{\beta}(v - p^*)(p^* - c) \\
&= \frac{2}{\beta}(v - \frac{v+c}{2})(\frac{v+c}{2} - c) \\
&= \frac{2}{\beta}(\frac{2v - v - c}{2})(\frac{v + c - 2c}{2}) \\
&= \frac{2}{\beta}(\frac{v-c}{2})^2 \\
&= \frac{1}{\beta}\frac{(v-c)^2}{2}
\end{aligned}$$

Consumer surplus is the area under the curves. Because of linear transportation costs, the area is a triangle, and consumer surplus under the monopoly condition is:

$$\begin{aligned}
CS(1,1) &= \frac{1}{2}\frac{2}{\beta}(v - p^*)(v - p^*) \\
&= \frac{1}{\beta}(v - p^*)^2 \\
&= \frac{1}{\beta}(v - \frac{v+c}{2})^2 \\
&= \frac{1}{\beta}(\frac{v-c}{2})^2 \qquad (1)
\end{aligned}$$

Where $CS(i,j)$ signifies the consumer surplus of i contracts with j sellers.

Here, $(1,1)$ refers to the condition, where one contract is offered to one seller.

5.2 One contract, two sellers (Bertrand competition)

We now move on to a situation where two competitors are offered the same contract, a.

If Bertrand competition, $p = c$, and consumer surplus is:

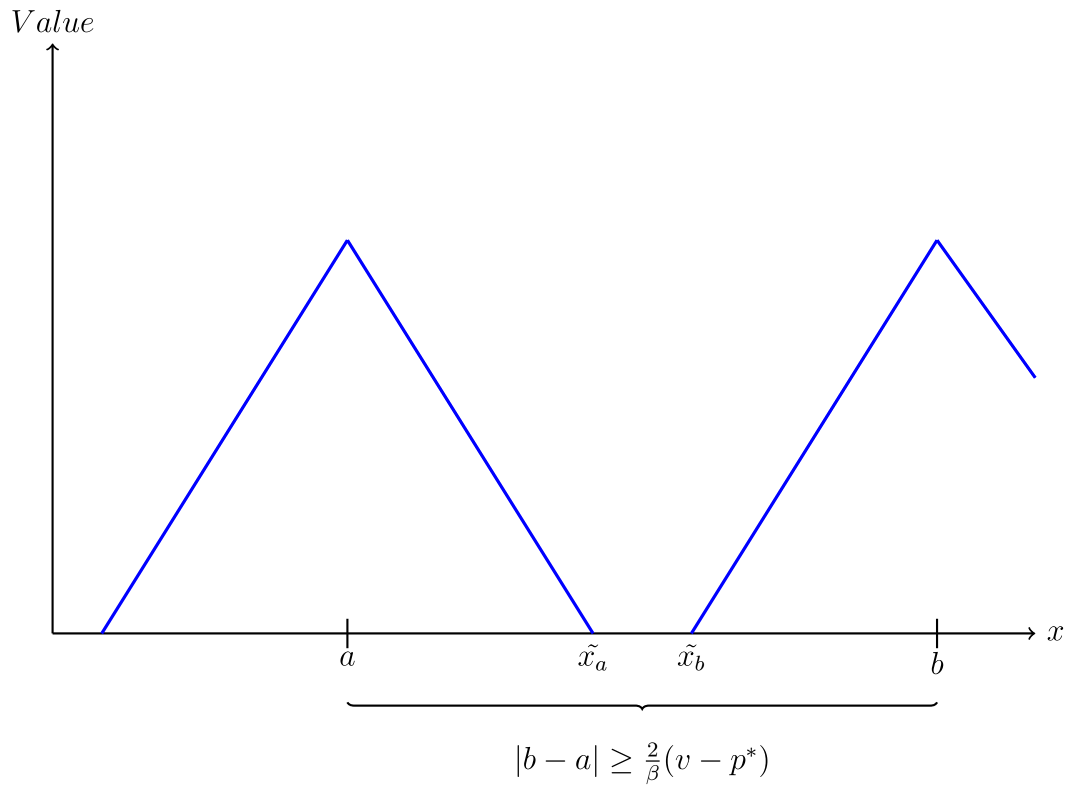
$$\begin{aligned} CS(1,2) &= \frac{1}{2}\frac{2}{\beta}(v - p^*)(v - p^*) \\ &= \frac{1}{\beta}(v - c)^2, \end{aligned} \tag{2}$$

Again, $(1, 2)$ indicates that we are in the one contract, two sellers condition. It is immediately clear that $CS_{(1,2)} = 4CS_{(1,1)}$, *i.e.*, that consumer surplus with one contract and two sellers i four times higher than consumer surplus with one contract and one seller. This, of course, mirrors common knowledge that competition all things being equal leads to higher consumer surplus than a monopoly.

Note also that demand is larger under the $(1, 2)$ condition. Total demand under the $(1, 2)$ condition is $\frac{2}{\beta}(v - c)$, while under the $(1, 1)$ condition it is $\frac{1}{\beta}(v - c)$.

5.3 Two contracts, two sellers.

Now assume that two contracts are offered, a and b, and that each contract has a single seller. Each contract is placed so far apart that optimally pricing monopolists will not compete on any one consumer:



In this case, the two tenderers act as monopolists acting as shown under subsection 6.1, which leads to consumer surplus:

$$\begin{aligned} CS(2,2) &= 2CS(1,1) \\ &= 2\frac{(v-c)^2}{4\beta} \\ &= \frac{(v-c)^2}{2\beta} < \frac{(v-c)^2}{\beta} = CS(1,2), \end{aligned} \tag{3}$$

This result holds for all v, c, and $\beta \neq 0$.

Assuming Bertrand competition, it follows that a single contract with two competitors is always better than two contracts with two monopolists.

5.4 Weaker competition

Of course, assuming Bertrand competition is somewhat heroic. We can therefore create a measure of competition as follows:

Under Bertrand Competition, $p_b^* = c$, and under the monopoly condition, $p_m^* = \frac{v+c}{2}$.

Let $\lambda \in [0, 1]$ be a measure of competition, such that:[6]

$$\begin{aligned} p(\lambda) &= \lambda p_b^* + (1-\lambda)p_m^* \\ &= \lambda c + (1-\lambda)\frac{v+c}{2} \\ &= \frac{1}{2}[(1-\lambda)v + (1+\lambda)c] \end{aligned} \tag{4}$$

Observe that for $\lambda = 1$, $p = c$ and for $\lambda = 0$, $p = \frac{v+c}{2}$.

As consumer surplus is a function of p, it is also implicitly a function of λ:

$$\begin{aligned} CS(\lambda) &= \frac{1}{\beta}[v - p(\lambda)]^2 \\ &= \frac{1}{\beta}[v^2 - 2vp(\lambda) + p(\lambda)^2] \end{aligned} \tag{5}$$

Two monopolists are preferable to competition in a single point iff:

$$\begin{aligned} 2CS(M) \geq CS(\lambda) &\iff \\ \frac{(v-c)^2}{2\beta} &\geq \frac{1}{\beta}[v^2 - 2vp(\lambda) + p(\lambda)^2] \end{aligned}$$

[6] See appendix for full calculation.

Simple but tedious calculations show that is the case for all $\lambda < 0.4$.[7] This shows that for weaker competition, more consumer surplus is created creating two distinct monopolies.

5.5 Very effective competition

Above, we have seen that two monopolies are preferable to an ineffective duopoly. Observe, however, that in the Bertrand case, perfect competition is reached already with two competitors. It follows trivially that a third competitor should be placed in her own contract.

This indicates that if competition in a single contract is already very effective, there can also here be benefits to diffusing competition.

Such a result would be on par with the insight that the determining factor is the difference between marginal competition benefits in one contract compared to the added consumer surplus from a new monopoly. Of course, this remains to be proven analytically.

6 Conclusion

In this paper, I introduce a simple linear city model to provide some initial insights as to the trade-off between lower prices and receiving preferred products.

While the model is very simple and has not yet been the subject of more generalized proofs, it does indicate a potential path of future inquiry into the policy and legal implications of increased flexibility.

I show that whether flexibility is preferred to increased competition depends on the intensity with which competition will occur. If the potential competition at point a is weak, it may be beneficial to instead diffuse competition, such that two options exist. Likewise, if competition in a is strong, it may again be beneficial to diffuse

[7] See appendix for entire calculation.

competition. This indicates that increased flexibility is not beneficial only in the Goldilocks zone of mediocre competitive pressure.

A When flexibility is better than weak competition

Under Bertrand Competition, $p_b^* = c$, and under the monopoly condition, $p_m^* = \frac{v+c}{2}$.

Let $\lambda \in [0, 1]$ be a measure of competition, such that:

$$\begin{aligned}
p(\lambda) &= \lambda p_b^* + (1-\lambda)p_m^* \\
&= \lambda c + (1-\lambda)\frac{v+c}{2} \\
&= \frac{v+c}{2} + \frac{2\lambda c}{2} - \lambda\frac{v+c}{2} \\
&= \frac{v+c}{2} + \frac{2\lambda c - \lambda v - \lambda c}{2} \\
&= \frac{v+c}{2} + \frac{\lambda c - \lambda v}{2} \\
&= \frac{v+c+\lambda c - \lambda v}{2} \\
&= \frac{1}{2}(v + c + \lambda c - \lambda v) \\
&= \frac{1}{2}[(1-\lambda)v + (1+\lambda)c]
\end{aligned} \tag{6}$$

Observe that for $\lambda = 1$, $p = c$ and for $\lambda = 0$, $p = \frac{v+c}{2}$.

Two monopolists are preferable to competition in a single point iff:

$$
\begin{aligned}
2CS(M) \geq CS(\lambda) &\iff \\
\frac{(v-c)^2}{2\beta} \geq \frac{1}{\beta}[v^2 - 2vp(\lambda) + p(\lambda)^2] &\iff \\
\frac{(v-c)^2}{2} - v^2 \geq p(\lambda)^2 - 2vp(\lambda) &\iff \\
\frac{(v-c)^2}{2} - v^2 \geq p(\lambda)(p(\lambda) - 2v)&
\end{aligned}
$$

Expanding the right hand side, we get:

$$
\begin{aligned}
p(\lambda)[p(\lambda)-2v] &= p(\lambda)[\frac{1}{2}[(1-\lambda)v+(1+\lambda)c]-2v] \\
&= p(\lambda)[\frac{1}{2}[(1-\lambda)v-4v+(1+\lambda)c]] \\
&= p(\lambda)[\frac{1}{2}[-3v-\lambda)v+(1+\lambda)c]] \\
&= p(\lambda)(\frac{1}{2}[(1+\lambda)c-(3+\lambda)v]) \\
&= \frac{1}{2}[(1-\lambda)v+(1+\lambda)c](\frac{1}{2}[(1+\lambda)c-(3+\lambda)v]) \\
&= \frac{1}{4}[(1-\lambda)v+(1+\lambda)c][(1+\lambda)c-(3+\lambda)v] \\
&= \frac{1}{4}[(1-\lambda)v+(1+\lambda)c][(1+\lambda)c-(3+\lambda)v] \\
&= \frac{1}{4}[(1-\lambda)(1+\lambda)cv-(1-\lambda)(3+\lambda)v^2+((1+\lambda)c)^2-(1+\lambda)(3+\lambda)cv] \\
&= \frac{1}{4}[[(1-\lambda)-(3+\lambda)](1+\lambda)cv-(1-\lambda)(3+\lambda)v^2+((1+\lambda)c)^2] \\
&= \frac{1}{4}[[-2-2\lambda)](1+\lambda)cv-(1-\lambda)(3+\lambda)v^2+((1+\lambda)c)^2] \\
&= \frac{1}{4}[-[1+\lambda](1+\lambda)2cv-(1-\lambda)(3+\lambda)v^2+((1+\lambda)c)^2] \\
&= \frac{1}{4}[-2cv(1+\lambda)^2-(1-\lambda)(3+\lambda)v^2+((1+\lambda)c)^2] \\
&= \frac{1}{4}[((1+\lambda)c)^2-2cv(1+\lambda)^2-(1-\lambda)(3+\lambda)v^2] \\
&= \frac{1}{4}[((1+\lambda)^2c(c-2v)-(1-\lambda)(3+\lambda)v^2] \\
&= \frac{1}{4}[((1+\lambda)^2c(c-2v)-(1-\lambda)(3+\lambda)v^2]
\end{aligned}
$$

Continuing on the inequality:

$$
\begin{aligned}
\frac{(v-c)^2}{2} - v^2 &\geq p(\lambda)(p(\lambda) - 2v) \iff \\
\frac{(v-c)^2}{2} - v^2 &\geq \frac{1}{4}[((1+\lambda)^2 c(c-v) - (1-\lambda)(3+\lambda)v^2] \iff \\
2(v-c)^2 - 4v^2 &\geq [((1+\lambda)^2 c(c-v) - (1-\lambda)(3+\lambda)v^2] \iff \\
2v^2 - 4vc + 2c^2 - 4v^2 &\geq [((1+\lambda)^2 c(c-2v) - (1-\lambda)(3+\lambda)v^2] \iff \\
-2v^2 - 4vc + 2c^2 &\geq [((1+\lambda)^2 c(c-2v) - (1-\lambda)(3+\lambda)v^2] \iff
\end{aligned}
$$

Now, expanding the right hand side a final time, we get:

$$
\begin{aligned}
RHS &= (1+2\lambda+\lambda^2)(c^2 - 2cv) - (3 - 2\lambda - \lambda^2)v^2 \\
&= c^2 - 2cv + 2\lambda c^2 - 4\lambda cv + (\lambda c)^2 - 2\lambda^2 cv + (\lambda v)^2 + 2\lambda v^2 - 3v^2
\end{aligned}
$$

Back to the inequality

$$
\begin{aligned}
-2v^2 - 4vc + 2c^2 &\geq c^2 - 2cv + 2\lambda c^2 - 4\lambda cv + (\lambda c)^2 - 2\lambda^2 cv + (\lambda v)^2 + 2\lambda v^2 - 3v^2 \iff \\
v^2 - 2cv + c^2 &\geq 2\lambda c^2 - 4\lambda cv + (\lambda c)^2 - 2\lambda^2 cv + (\lambda v)^2 + 2\lambda v^2 \iff \\
(v-c)^2 &\geq \lambda[2c^2 - 4cv + \lambda c^2 - 2\lambda cv + \lambda v^2 + 2v^2] \iff \\
(v-c)^2 &\geq \lambda[2(v^2 - 2cv + c^2) + \lambda(v^2 - 2cv + c^2)] \iff \\
(v-c)^2 &\geq \lambda[2(v-c)^2 + \lambda(v-c)^2] \iff \\
(v-c)^2 &\geq \lambda[2(v-c)^2 + \lambda(v-c)^2] \iff \\
(v-c)^2 &\geq \lambda(\lambda+2)(v-c)^2 \iff \\
1 &\geq \lambda(\lambda+2) \iff \\
-\lambda^2 - 2\lambda + 1 &\geq 0
\end{aligned}
$$

This is a second degree polynomial in λ, with the only positive solution being $\lambda = 0.414$.

B Extensions

B.1 Auction theory

The current model assumes a simpler competitive environment than what is actually used under procurement. Developing a better model of this environment may lead to other results.

B.2 Distributive concerns

Total demand under the $(2, 2)$ condition is:

$$
\begin{aligned}
D(2,2) &= 2\frac{2}{\beta}(v-p^*) \\
&= \frac{4}{\beta}(v-p^*) \\
&= \frac{4}{\beta}(v-\frac{v+c}{2}) \\
&= \frac{4}{\beta}(\frac{v-c}{2}) \\
&= \frac{2}{\beta}(v-c)
\end{aligned}
$$

which is equal to demand under the one contract, two sellers condition.

In this paper, I assume that when multiple contracts are created, no consumer has positive value from both products. This indicates that there is also a trade-off as to who will be purchasing on the contract.

This indicates that distributional concerns may affect the decision to divide up the market in to more contracts.

B.3 Incentive effects

The model does not yet ensure incentives for the individual tenderers to diffuse into the different slots. Profitmotives may ensure this, but a more advanced model should ensure incentive compatibility.

B.4 Expanding the combination options

This paper only looks at the choice between one and two contracts, and the resulting consumer surplus. It would be interesting to explore other combinations. For instance: $CS(4,4) = CS(1,2)$ and $CS(i,i) > CS(1,2), \forall i > 4$. If four or more sellers are available and the spectrum of consumers is sufficiently wide, consumer surplus is larger if at least four contracts are offered.

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