LOCAL COUNCIL PARTNERSHIPS: A THEORETICAL APPROACH

DAVID BARTOLINI FABIO FIORILLO

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David Bartolini† Fabio Fiorillo‡

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Abstract

We propose a model of local councils cooperation for provision of local public services. We define to main forms of partnership: the "consortium" and the "council union". The model allows us to shed some light on the efficiency of these two forms of cooperation with respect to the number of participants and the type of services allocated. We find that no form of partnership is optimal for all number of participants and transaction costs. In particular, for a small number of participants it is better to form a consortium, while as the number of participants increases the council union becomes more convenient. The main message is that the efficiency of one or the other form of cooperation depends on the number of participants, the type of services and the transaction costs.

Jel Classification: D23, H77, R50.
Keywords: Regional economics, Partnerships.

1 Introduction

In recent years, most OECD countries have experienced a strong wave of reforms in the governance and the administration of public policies. One of the main phenomenon is the so called governance decentralization or devolution[1]. That is a process of delegation of administrative power to lower levels of government. In some cases, this process is linked with fiscal independence and a hard budget[2] constraint. When this process reaches the level of local councils, the "hard budget" can create problems, especially in small size councils. There are at least two issues to consider. The first one is directly linked with the hard

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†University of Essex and OPERA. Email: dbarto@essex.ac.uk

‡Università di Urbino and OPERA. Email: f.fiorillo@uniurb.it

[1]See for an overview of the economic literature on this subject, Oates (1999) and Bardhan (2005).

[2]With this expression we refer to a constraint which does allow neither to create money nor to have access to unlimited credit (Weingast, 1995).

budget constraint, which would make it difficult to raise enough tax revenue to finance *adequate* levels of public services. The second concerns the existence of economies of scale in the provision of some kind of services - such as schooling, public transport, health services, etc. - so that a larger council pays a lower per capita price.

Small local councils facing this scenario have two possible solutions: either provide a lower level of services or merge with other councils. Our interest is in a midway solution, however. We want to investigate the possibility that a council cooperates with other council for the provision of some public services, while maintaining their own independent identity.

We take into consideration two specific forms of partnership, that we call "institution": *consortium* and *council union*. They differ on the degree of flexibility and integration. The union is more flexible since the whole administration for an area of services is delegated. In fact, while the union can decide on the number and quantity of services supplied, the consortium can only run the services explicitly allocated. The analysis focuses on the trade-off between economic advantages of cooperation and transaction costs arising with the negotiation progress.

The economic literature has not directly addressed the issue of local council cooperation yet. There is some work done in the field of Industrial Organization, especially about research JointVentures[3], where there are some common issues, such as the exploitation of economies of scale in the joint production of the service. However, the other main motive for developing research joint ventures, the presence of positive externalities does not necessarily apply in our context. The most important difference, perhaps, is the relevance of the political dimension when dealing with local councils.

Another strand of the literature close to our subject is Buchanan's theory of clubs. Each local council can be seen as a "club", that provides services to their members (citizens). In a way, a local council must join a club (partnership) in order to provide certain types of services, not feasible to non members. There are some major differences, however. For instance, transaction costs to create a club and to create a partnership among councils are substantially different.

A recent contribution, which can be considered an extension of the theory of clubs, is Alesina and Spolaore (2003) book on the size of nations. They analyze the size of a nation considering a trade-off between benefits and costs from a certain size[4]. In particular, they consider as a major cost for a large size the higher degree of heterogeneity in the citizens' preferences. This heterogeneity, gives raise to political and economic costs, i.e. to transaction costs. The model we present is closer to this set-up when considering a trade-off between costs and benefits in the size of the "institution". The local council can get more services the larger is the number of councils which cooperate, but, at the same time, it is more difficult to reach an agreement and there is a higher loss of political power.

However, we also consider the possibility of having two different institutions. In other words the choice is not only about the number of participants in the partnership, but also about the institutional form the cooperation among councils should take. Benefits coming from a larger size are both a higher quantity

[3]See Tirole (1988) for general references.

[4]Alesina and Spolaore consider as a size of a nation the population and the GDP.

of services and a higher number of services. We assume that citizens care not only for the quantity of services but also for variety. In this case, the benefit of a larger size comes more from the possibility of having a larger number of services than from economies of scale. Costs are modelled exogenously as transaction costs, and as previously mentioned they are mainly due to the effort to reach an agreement and the loss of political power.

The decision to focus on these two particular forms of cooperation, *consortium* and *council union*, comes from the introduction of recent laws in Italy (*L. 256/99* and *D.lgs. 267/00*). Previously, even if *unions* were possible, the main form of cooperation was the *consortium*. That is because, under the previous law (*L. 142/90*), the *union* was seen only as a first step towards a merger. That law has introduced the possibility to form a council union, without the obligation to eventually merge. An important issue, is whether the government should provide monetary incentives to local councils who decide to adopt this form of partnerships[5]. Our work addresses this question, characterizing which type of institution is more efficient for any number of participants.

The normative analysis conducted tells us which is the optimal institution for any size. The main result is that we show the existence of a lower bound in the number of members for the union to be efficient. For low number of participants the consortium is a better form of partnership. In other words, we show that the efficient way to cooperate depends both in the number of participants and the type of services that are delegated. Transaction costs are constructed in such a way that, as the number of participants increases cooperation becomes less and less efficient.

We then drop one of the assumptions of the basic model. We introduce uncertainty over the result of the negotiation process. Each council sustains a cost when starting to negotiate with the other councils, but this process does not necessarily lead to a partnership agreement. The uncertainty, actually, represents another transaction cost. However, the inclusion of this particular transaction cost allows for richer results. It appears that independently from the level of transaction costs, when elasticity of substitution among services decreases, the consortium becomes again optimal after the union, and eventually the room for a council union disappears.

Since the relative novelty of the council union as cooperative institution among local councils, there is no relevant empirical evidence yet. We dedicate a final section to discuss the implications of our model with respect to few empirical evidence, from the region Marche (Italy).

The work is organized as follows: the next section the basic model is set up, then we consider the equilibrium strategy of local councils; in the following section we consider a model in which there is uncertainty on the possibility of reaching an agreement; finally we conclude discussing the implications of our model on the light of the empirical evidence available.

2 The model

We consider a situation in which each council decides how to provide services to their citizens. The council faces a budget constraint given by the tax revenue imposed on its constituency. The council decides what institutional form to

[5]For instance, in France, the government gives monetary incentives to form council unions.

adopt and which production regime to use. The decision is made in order to maximize the welfare of its constituency. We assume that citizen are interested both in the quantity and the variety of services provided. The local council can choose between two forms of partnership, that we define as consortium and local union.

Definition 1 *A "consortium", C,* is a contract between two or more councils to produce a specified number of services. Transaction costs arise any time a consortium is formed or a service is added to an existing one.

Definition 2 *A "council union", U,* is a new institution to whom administrative functions are delegated. The administrative competence on the number and the amount of services as well as the decision on the production regime[6] is delegated to the union by each council. There are transaction costs to set up a union. Since there is no need to renegotiate the original agreement, no transaction costs arise when a service is added.

The main difference between the two forms is the degree of flexibility. In the consortium each time the members want to modify the set of services allocated they need to renegotiate, while in case of a council union there is no need for renegotiation.

2.1 Framework

There are n identical local councils endowed with the same level of resources R_A. Their objective is to maximize the citizen welfare by providing a certain amount of services (they are benevolent social planners). They can decide whether to provide services autonomously or via one of the two cooperation schemes.

The payoff of each council depends on the number of services, S, and quantity, x, provided to their citizens. To model this aspect we use a log transformation of a CES (Constant Elasticity of Substitution) utility function which represents a monotonic transformation of the aggregate utility among identical citizens.

$$U = \ln \left[\sum_{i=1}^{s} x_i^{\alpha} + \sum_{i=s+1}^{S} \left(\frac{X_i^k}{n} \right)^{\alpha} \right]^{\frac{1}{\alpha}} \qquad \text{where } k = A, C, U \tag{2.1}$$

The total number of services is $S = s + sc$, where s is the number of services directly produced by the council and sc is the number of services produced jointly with other councils. When $sc = 0$ the local council opted for no cooperation, all services are self-produced. When $s = 0$, all services are produced jointly, i.e. it is either a union or a consortium. When both sc and s are greater than zero we have a consortium. For any service s, the quantity self-produced is x_i, while for any service sc, X_i^k is the aggregate demand for each jointly produced service and $x_i^k = \frac{X_i^k}{n}$ is the demand of each council.

In order to reach an agreement each council sustains some transaction costs. These costs have a different structure whether a consortium or a union is formed.

[6] See next section for a precise definition of production regimes.

(A1) Assumption 1:

$$T_C(n, sc) \text{ for a consortium } \begin{cases} \frac{\partial T_C}{\partial sc} > 0, & \frac{\partial T_C}{\partial n} > 0; \\ \frac{\partial^2 T_C}{\partial sc^2} \leq 0, & \frac{\partial^2 T_C}{\partial n^2} \geq 0; \\ \frac{\partial^2 T_C}{\partial sc \partial n} > 0. \end{cases}$$

(A2) Assumption 2:

$$T_U(n) \text{ for a council union } \begin{cases} \frac{\partial T_U}{\partial n} > 0, \\ \frac{\partial^2 T_U}{\partial n^2} \geq 0. \end{cases}$$

We assume that these two functions are both increasing in the number of councils, n, while only T_C increases with the number of services jointly produced, sc. Moreover, we assume that $T_C(1, sc) = T_C(n, 0) = T_U(1) = T_A = 0$, i.e. there are no transaction costs if there is no joint production; and $T_U(n) = T_C(n, \overline{sc}) + \varepsilon$ for any value of n, i.e. transaction costs to form a consortium are equal to the transaction costs to form a union - but an $\varepsilon > 0$-, when the consortium receives the totality of services, $\overline{sc}$. Furthermore, we assume that councils always reach an agreement if they pay the transaction costs[7].

Each council's objective is to maximize its payoff function under a budget constraint.

$$\begin{aligned} \max_{\{sc, \mathbf{x}\}} \quad & W = U - T_k \qquad k=A,C,U \\ s.t. \quad & \sum_{1}^{s} p_i x_i + \sum_{s+1}^{S} p_i x_i^k = R^k \end{aligned} \tag{2.2}$$

where $\mathbf{x}$ is the vector of the quantity of services, both self and jointly produced, demanded by each council. The marginal rate of substitution between any two services is

$$\frac{p_i}{p_j} = \left(\frac{x_i}{x_j} \right)^{\alpha - 1} \tag{2.3}$$

2.1.1 Production technology

The service is produced in a monopoly regime. We can think of a situation in which a monopolistic firm produces the service and the local council extracts all the surplus, i.e. the profit of the firm is zero. Each service is produced by one local monopolist firm, with increasing return to scale[8]. The cost function, for $i = 1, ..., S$ is

$$r_i = a x_i + b \tag{2.4}$$

where r_i is the amount of resources needed to produce service i. Note that the following identity must be satisfied, $\sum_i r_i = R^k$.

[7] We will relax this assumption in the next section.

[8] For details see Dixit and Stiglitz (1977).

Each firm's profit is

$$\pi_i = p_i(x_i)x_i - r_i \tag{2.5}$$

The model is such that in equilibrium all firms set the same level of price,

$$p_i = \frac{a}{\alpha} \qquad \text{for all } i \tag{2.6}$$

Therefore the quantity demanded for any service, both self and jointly produced, is the same (equation 2.3). Assuming zero profit condition, the equilibrium quantity is

$$x^* \equiv x_i = \frac{b}{a}\left(\frac{\alpha}{1-\alpha}\right) \tag{2.7}$$

The resources allocated to any service are equal to $r_i = \frac{b}{1-\alpha}$.

Clearly the number of services depends on the amount of resources available to each council.

2.2 Production regimes

Firstly, we need to define what we mean for production regimes.

Definition 3 *A production regime is a way to organize production that an institutional form can choose. A regime defines the way in which local government, firms and citizens interact.*

A production regime is characterized by the quantity and number of services, the market structure and the distribution of profits.

In our model we assume as production regimes the typical regime of the three institutional form we consider:

1. Autonomous regime
2. Consortium regime
3. Union regime

Note that local governments (i.e. the councils and the union) can opt for a non-typical regime. On the contrary, a consortium can only produce according to its typical regime, since it has no administrative power. Obviously the Autonomous council cannot opt for a Union regime without joining other councils. A council union can opt for any regime.

The council does not directly choose the production regime, it will be the institution which will implement it. We extend the assumption of benevolent social planner to the council union, and therefore, the council when choosing the form of partnership can anticipate what regime it is likely to be implemented.

2.2.1 Autonomous council regime

In this case the whole lot of services are produced autonomously by each council. Therefore $sc = 0$, and

$$S_A \equiv s_A = \frac{R}{r_i} = \frac{1-\alpha}{b}R \tag{2.8}$$

where R represents the resources raised by each council through taxation. In this regime the council's utility is $U_A = \ln\left[(s_A)^{\frac{1}{\alpha}}x^*\right]$ which is also equal to each council payoff, W_A. Obviously the total amount of services the council can provide is limited by the amount of tax revenue, exogenously given and identical for all councils[9].

2.2.2 Consortium regime

The local council decides to produce jointly some of the services. The consortium produces these services as a monopolist and the monopolistic profit is distributed among the participants.

The equilibrium price set by the consortium is the same[10] as in equation 2.6. Hence $x_i^C = x^*$, i.e. the quantity demanded for any service does not depend on whether it is self or jointly produced.

For each service the Consortium supplies the quantity $X^C = nx^*$. Thus the resources the Consortium needs is obtained by substituting out X^C in equation 2.4,

$$r_i^C = n\left(b\frac{\alpha}{1-\alpha}\right) + b \tag{2.9}$$

The consortium makes a profit π_i^C for each service produced,

$$\pi_i^C = (n-1)b \tag{2.10}$$

We assume that this surplus is equally distributed among consortium members. Therefore, each council transfers $\left[\frac{r_i^C}{n}\right]$ and receives $\left[\frac{\pi_i^C}{n}\right]$, for any service. As a result the amount of resources available to each council for self-production, R_s, is obtained by subtracting to the resources raised R the amount transferred to the consortium and adding the share of profit earned. After some manipulation we get the following expression,

$$R_s = R + sc * b\left(\frac{n-2}{n} - \frac{\alpha}{1-\alpha}\right) \tag{2.11}$$

where the last term represents the difference between the resources poured into the consortium and the share of profit received. The number of services self produced is obtained by dividing the resources spared by the cost of self-producing a service, r_i,

$$s = s_A - \left[\frac{n(2\alpha-1) - 2(1-\alpha)}{n}\right] sc \tag{2.12}$$

Remark 1 *The total number of services a local council may obtain, under the consortium regime, is*

$$S_C \equiv s + sc = s_A + 2(1-\alpha)\frac{n-1}{n}sc \tag{2.13}$$

[9] An important aspect to consider is the fact that local councils differ in size and therefore in revenue. We set aside this issue, however. That is mainly because we want to focus on incentives a council may have to cooperate, other than size reasons.

[10] That is because we assume no cross-subsidization and no economies of scope among the services produced by the consortium.

Remark 2 *The maximum number of services is achieved by devoting all resources to the consortium.*

Let $\overline{sc}$ denote the maximum number of services delegated to the consortium,

$$\begin{aligned} \overline{sc} &= \frac{n}{n(2\alpha-1)+2(1-\alpha)} s_A \\ s(\overline{sc}) &= 0 \\ S(\overline{sc}) &= \overline{sc} \end{aligned} \tag{2.14}$$

Note that to have $\overline{sc} > 0$ it is sufficient[11] to assume $\alpha \geq 0.5$. That implies $\frac{\partial R(sc)}{\partial sc} < 0$, hence the resources allocated to the consortium for each service are greater than the profits (resources) received[12].

The utility function of a council which allocate all services to a consortium becomes

$$\begin{aligned} U_C &= \ln\left[\left(\tfrac{n}{n(2\alpha-1)+2(1-\alpha)} s_A\right)^{\frac{1}{\alpha}} x^*\right] = \\ &= \ln\left(\tfrac{n}{n(2\alpha-1)+2(1-\alpha)}\right)^{\frac{1}{\alpha}} + U_A \end{aligned} \tag{2.15}$$

With no transaction costs a council would always delegate all services to the consortium (or a partnership). In this case the maximum of payoff the council could reach is given by equation 2.15.

2.2.3 Council Union

In this case local councils decide to constitute a new administrative entity which is responsible for both the level and the number of services. Each council assigns to the new institution all their resources. It is easy to show that the union produces a quantity $X^U = \frac{b}{a}\frac{\alpha-1}{\alpha} \equiv x^*$ for any service, and as a result the number of services equals to

$$S_U = n\frac{1-\alpha}{b} R \equiv n * s_A \tag{2.16}$$

The utility each council receives from the services produced through a union is

$$U_U = \ln\left[n^{\frac{1-\alpha}{\alpha}} s_A^{\frac{1}{\alpha}} x^*\right] = \ln n^{\frac{1-\alpha}{\alpha}} + U_A \tag{2.17}$$

Note that $U_U(n) > U_A$ for any value of n. Without transaction costs it is always convenient to form a partnership. Not surprisingly, when there are economies of scale and love for variety, centralizing policy decisions gives a higher payoff.

Remark 3 *A council union, once formed, will never opt for an "autonomous" production regime, i.e. it will never decentralize the production at the council level.*

[11] The value of α which guarantees $\overline{sc} > 0$ depends on the number of members. As the number of members increases the value of α must increase as well, up to 0.5. The condition to be satisfied is $\left[\alpha > \frac{1}{2} \quad \frac{n-2}{n-1}\right]$ which asymptotically converges to 0.5 as $n \to \infty$.

[12] The payoff function refers to a service class, the higher is the degree of homogeneity inside the class, the lower is the value of α. If we want to compare services in different class we should use a additive separable payoff function.

3 Equilibrium

Each council decides how to organize the production of services, i.e. which institutional form. Since councils are identical, we can restrict the analysis to a representative council. We are looking for a symmetrical equilibrium, i.e. an equilibrium in which each council adopts the same strategy[13]. The analysis reduces to find the maximum among W_A, W_C, W_U, the payoffs of an autonomous council, a council in a consortium and a council in a union, respectively. In fact, we check for the highest payoff among the three institutional forms when they opt for their typical production regime. Eventually, we check if there exists a higher payoff by deviating for a non-typical production regime. We proceed by comparing couple of institutional forms.

3.1 Autonomous council vs Consortium

The maximization problem of the local council reduces to the choice of the number of services to allocate to the consortium, which maximizes the following equation,

$$\max_{sc} W(sc) = \ln\left(S(sc)^{\frac{1}{\alpha}} x^*\right) - T_C(n, sc) \tag{3.1}$$

It represents the utility from providing services to citizens minus the transaction costs necessary to set up a consortium. Given assumption A1 the payoff function of the council, W, is convex. That implies a corner solution. For a given number of councils in the consortium, we have two possible equilibrium values: either $sc = 0$ or $sc = \overline{sc}$.

Proposition 3.1 *There exists a value $\underline{n}$, $\overline{n}$ and $\overline{\overline{n}}$ such that*

1. *for $n \leq \underline{n}$ there is only a maximum at $sc = \overline{sc}$*
2. *for $\underline{n} < n \leq \overline{n}$ there are two local maxima, with the global maximum at $sc = \overline{sc}$*
3. *for $\overline{n} < n \leq \overline{\overline{n}}$ there are two local maxima, with the global one at $sc = 0$*
4. *for $\overline{\overline{n}} < n$ there is only a maximum at $sc = 0$*

where $\underline{n}$ s.t. $W'(0, \underline{n}) = 0$, and $\overline{n}$ s.t. $W(\overline{sc}, \overline{n}) = W(0, \overline{n})$, and $\overline{\overline{n}}$ s.t. $W'(\overline{sc}, \overline{\overline{n}}) = 0$.

Proof. Proof in the Appendix. ■

The threshold levels $\underline{n}$, $\overline{n}$ and $\overline{\overline{n}}$, are depicted in figure 1 - note that the value of n increases moving down towards the horizontal axes. The important threshold level for the equilibrium value of sc is $\overline{n}$. For values above that threshold the equilibrium implies $sc = 0$, while for values of n below that threshold the equilibrium is $sc = \overline{sc}$. The threshold level $\overline{n}$ decreases with α, a proxy of the elasticity of substitution, and with the transaction costs. That simply implies that an increase in the transaction cost decreases the threshold level reducing the values of n for which it is optimal to give all the service to the consortium.

[13] We won't consider the possibility that more than one coalition is formed. In fact, we do not explicitly consider the formation process of partnerships.

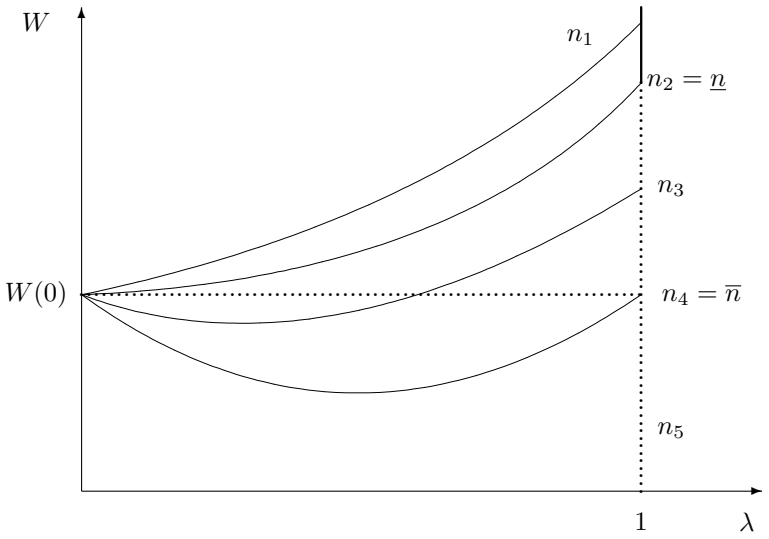

Figure 1: Council's payoff function, where $n_1 < n_2 < n_3 < n_4 < n_5 < \cdots$

Corollary 1 *Assuming that the council can contract any number of services simultaneously, the equilibrium strategy of the council is to form a consortium, delegating the production of all services to a consortium if* $n < \overline{n}$.

Corollary 2 *If it is convenient to allocate one service to a n-council consortium, then it is optimal to allocate any service to the consortium.*

Substituting out $n = 1$ in equation 2.13, we can see that a single council, $n = 1$, which mimics a "consortium production regime" will obtain the same results as opting for the "autonomous regime". Therefore each council has no incentive to deviate from its typical regime.

3.2 Autonomous council vs Union

The payoff each council receives from joining a council union is

$$W_U(n) = U_U(n) - T_U(n) \tag{3.2}$$

Given the assumption on the convexity of the transaction costs, and since $U_U > U_A$ for $n > 1$,

Proposition 3.2 *It exists a value* $\tilde{n} \in [1, \infty]$, *such that for* $n \leq \tilde{n}$, $W_U \geq W_A$, *and viceversa.*

Proof. Proof in the Appendix. ■

As for the previous form of partnership, also for the union there is a threshold level of n above which the union is no more optimal. The value of $\tilde{n}$ decreases

with α, a proxy for the elasticity of substitution between services and with the transaction costs. The level of the threshold is affected in the same way as the threshold level of the consortium. It is now important to check what is the optimal institution between the consortium and the union.

3.3 Union vs Consortium

Given the assumptions on transaction costs, $T_C(n, \overline{sc}) + \varepsilon = T_U(n)$, and equations 2.15 and 2.17, we get the following proposition

Proposition 3.3 *It exists a value $\hat{n} \in [1, \infty]$, such that for $n \leq \hat{n}$, $W_C \geq W_U$, and viceversa.*

Proof. Proof in the Appendix. ■

The importance of this proposition is two-fold. Firstly, it shows that it does not exist the "best" form of cooperation, and secondly it establishes a lower bound for the optimality of the union. For values of n below $\hat{n}$ the optimal form of cooperation is the consortium. Note that the threshold level depends only on the value of α. As the elasticity of substitution decreases, the threshold increases, reducing the space for the optimality of the union production regime.

Since a council union is not constrained to a particular production regime, the following corollary applies,

Corollary 3 *For $n < \hat{n}$ the partnership would mimic the consortium production regime*

The equilibrium strategy depends on the transaction costs. In particular, the institutional form chosen for $n \leq \hat{n}$ is the consortium if $\varepsilon > 0$, it is the union if $\varepsilon < 0$, while for $\varepsilon = 0$ a council is indifferent between these two institutional forms. Throughout the paper we assume $\varepsilon > 0$. It implies a higher transaction cost for assigning all services to a consortium rather than forming a union.

3.4 Symmetric equilibrium

From propositions 3.1, 3.2 and 3.3 we can state the following general result[14].

Case 1 If $\hat{n} \leq \overline{n} \leq \tilde{n}$, then

1. for $n \leq \hat{n}$ the optimal choice is to form a consortium
2. for $\hat{n} \leq n \leq \tilde{n}$ the optimal choice is a council union
3. for $n > \tilde{n}$ the optimal choice is to self produce every service

Case 2 If $\tilde{n} \leq \overline{n} \leq \hat{n}$, then

1. for $n \leq \overline{n}$ the optimal choice is to form a consortium
2. for $n > \overline{n}$ the optimal choice is to self-produce every service

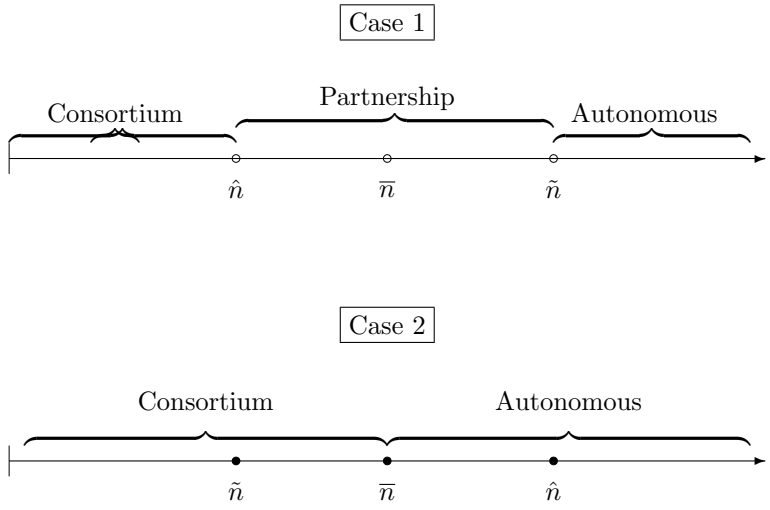

Figure 2: Efficient production regime for any value of n.

When transaction costs increase, the possibility to set up a union decreases and disappears for high transaction costs. In CASE 2 there is no room for a union, however, as the transaction costs reduce, there is a right shift of the values of both $\tilde{n}$ and $\overline{n}$, while $\hat{n}$ is unaffected. This process will eventually lead to a situation as in CASE 1, in which reappears an interval in which the union is optimal.

Moreover, when the elasticity of substitution is low the range of n for which a consortium is the optimal choice is larger. We can see that a decrease in α, produces a shift of all thresholds towards the right. As a consequence, the consortium becomes the optimal choice for larger number of members.

In any case, from the analysis conducted it appears that there is a lower bound for the efficiency of the union. For a small number of participants a consortium is more efficient than a union. In other words for the union to be convenient it needs a non very small number of members.

Transaction costs are such that there is a finite number of members in any type of partnership. For n very large it is always more efficient to remain autonomous.

The intuition behind these results stems from the love for variety. When resources are low, it is better to focus on the adequate quantity for each service, rather than variety of services. In fact, to exploit economies of scale, it needs to reach a certain "scale"; when the quantity produced of each service is very low, there are very low returns to scale. When the quantity produced is large, there are a lot of returns to scale, and it may become optimal to reduce the quantity a little for a greater level of variety. The union does that. However, to be optimal, it needs a large "enough" amount of resources. Resources that in

[14]It can be demonstrated that it does exist nor an n such that $\hat{n} \leq n \leq \overline{n}$ and $\tilde{n} < n < \overline{n}$, neither an n such that $\overline{n} < n < \tilde{n}$ and $\overline{n} < n < \hat{n}$.

our model come only from the number of participants.

4 Uncertain cooperation process

In this section, we drop the assumption of certain result of the negotiation process. Local councils when engaging in negotiations, do not know whether an agreement will eventually be reached. There are two independent negotiations for consortium and union, so that councils engaging in a negotiation for a union cannot decide to form a consortium without engaging in another negotiation from scratch.

We model this situation introducing a probability of success π. We assume that the probability of success is higher for a consortium than for a union; it decreases with the number of councils in both cases; and for a union it decreases faster. This assumption is justified by the fact that greater administrative power is delegated to a union than to a consortium.

Let us define the probability of reaching an agreement as $\pi_k(n)$ with $k = C, U$, which negatively depends on the number of councils involved in the negotiation. When councils decide whether to cooperate, they face the following expected payoff:

$$\pi_k U_k(n) + (1 - \pi_k)U_A - T_k(n) \qquad k = A, C, U \tag{4.1}$$

when the agreement is not reached they receives U_A, but they still have to pay for the transaction costs. As in the previous section we compare institutional forms in pairs.

Without loss of generality, we can assume that when councils contract for a consortium they always reach an agreement, thus $\pi_C(n) = 1 \quad \forall\, n$, while the probability of forming a partnership is decreasing in n. This is summarized in the following assumption,

(A3) Assumption 3:

$$\begin{aligned} &0 < \pi_U(n) \leq 1 \\ &\quad \pi_U(1) = 1, \quad \lim_{n\to\infty} \pi_U(n) = 0, \quad \lim_{n\to\infty} \pi_U(n)U_U(n) = 0 \\ &\frac{\partial \pi_U(n)}{\partial n} \leq 0, \qquad \frac{\partial \pi_U(1)}{\partial n} = 0, \qquad \lim_{n\to\infty} \frac{\partial \pi_U(n)}{\partial n} = 0 \end{aligned}$$

Assumption 3, describes the nature of the probability to reach an agreement for a union. Note that the probability decreases with the number of participants, and the graph of the probability plotted against n is concave near the origin, while becoming convex before n reaches infinity.

Proposition 4.1 *Results of propositions 3.2 are confirmed even when the agreement is uncertain. The threshold level $\tilde{n}$ depends negatively on the speed of decrease in probability with the number of councils.*

The proof is straightforward comparing the payoff 4.1 with U_A, i.e. when $\pi_U(U_U - U_A) > T_U$, councils start contracting to form a union.

Proposition 3.3 changes in,

Proposition 4.2 *For $\alpha < \hat{\alpha}$, $W_C \geq W_U$ for all n. Otherwise for $\alpha > \hat{\alpha}$ there exists $\hat{n} \in [1, \infty]$ and $\hat{\hat{n}} \in [\hat{n}, \infty]$, such that for $\hat{n} \leq n \leq \hat{\hat{n}}$, $W_U \geq W_C$; for $n < \hat{n}$ or $n > \hat{\hat{n}}$, $W_C \geq W_U$.*

Proof. Proof in the Appendix. ■

The proof is based on the existence of a maximum for $\pi_U(U_U - U_A)$. In this case α plays a big role. It is not just n that determines the optimality of one or the other institution, but with a low elasticity of substitution we may have that the partnership is optimal for no values of n.

The intuition behind this "negative" result is simply that the uncertainty plays the role of a further transaction cost. In fact, for very high transaction costs the partnership is never optimal also in the previous model - recall CASE 2. However, the addition of a special type of transaction cost, makes the analysis richer, as we'll see in the next proposition. In particular, when α is low there could be no room for partnership even if transaction costs are low.

Proposition 4.3 *With α sufficiently large, there exists an interval $(\hat{n}, \hat{\hat{n}})$ for which it is convenient to form a partnership. As α decreases this interval shrinks, it eventually disappears when $\alpha \leq \hat{\alpha}$.*

The symmetric equilibrium of the model with uncertainty is as follows,

Case 1a If $\hat{n} \leq \overline{n} \leq \tilde{n} \leq \hat{\hat{n}}$, then

- for $n \leq \hat{n}$ the optimal choice is to form a consortium
- for $\hat{n} \leq n \leq \tilde{n}$ the optimal choice is a union
- for $n > \tilde{n}$ the optimal choice is to self produce every service

it is the same result as case 1.

Case 2a If $\tilde{n} \leq \overline{n} \leq \hat{n} \leq \hat{\hat{n}}$, then

- for $n \leq \overline{n}$ the optimal choice is to form a consortium
- for $n > \overline{n}$ the optimal choice is to self-produce every service

it is the same result as case 2. When transaction cost increases, the possibility to set up a union decreases and disappears for high transaction cost.

Case 3 If $\hat{n} \leq \hat{\hat{n}} < \tilde{n} \leq \overline{n}$, then

- for $n \leq \hat{n}$ the optimal choice is to form a consortium
- for $\hat{n} < n \leq \hat{\hat{n}}$ the optimal choice is the union
- for $\hat{\hat{n}} \leq n \leq \overline{n}$ the optimal choice is to form a consortium
- for $n > \overline{n}$ the optimal choice is to self produce any service

Case 4 If $\hat{n}$ and $\hat{\hat{n}}$ do not exist, i.e. $\alpha \leq \hat{\alpha}$, then

- for $n \leq \overline{n}$ the optimal choice is to form a consortium
- for $n > \overline{n}$ the optimal choice is to self-produce every service

which is analogous to the result of case 2.

Each case is represented in figure 3, 4, 5 and 6, respectively; where the number of participants are plotted against the difference between the utility in each regime and the autonomous regime, and the transaction costs.

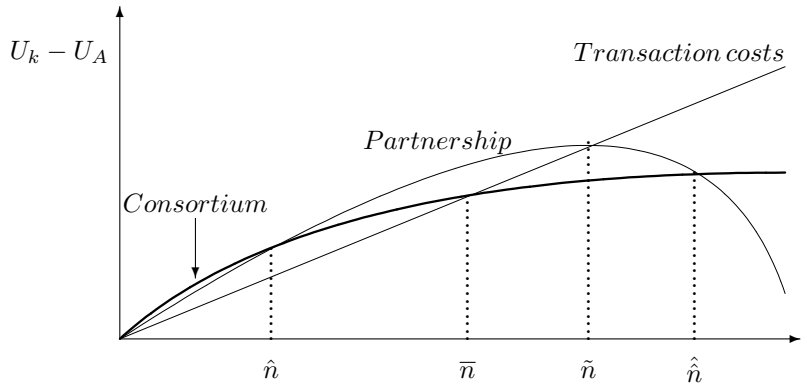

Figure 3: Case 1a

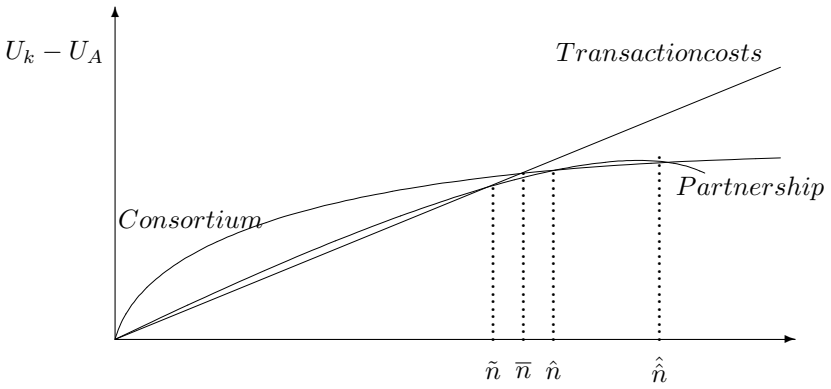

Figure 4: Case 2a

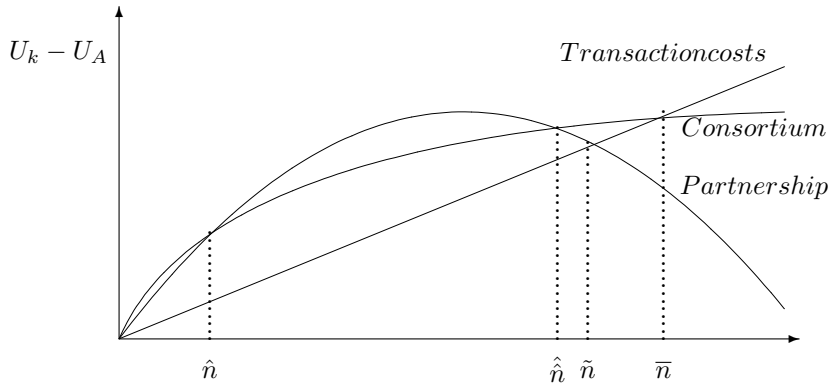

Figure 5: Case 3

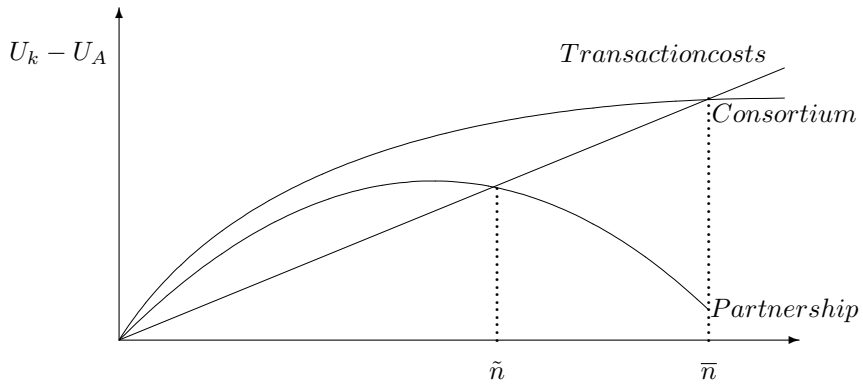

Figure 6: Case 4

The first two cases are analogous to the results we have obtained in the previous model - the model without uncertainty. The last two cases represent a novelty due to uncertainty. Although case 4 gives an outcome similar to case 2 (no room for union), the most interesting result is case 3. Here the consortium might become optimal again after the union.

Given a certain level of transaction costs, as α decreases we move from case 1a, to case 3, to case 4. Eventually, there is no room for the partnership even if the transaction costs are not too high.

5 Empirical evidence from the Italian partnerships

In Italy cooperation among local councils is closely regulated. The law precisely defines the forms cooperation may assume. Following Zuffada (2002), they can be classified according to the degree of cooperation. The tipology spans from "contractual" forms of cooperation, which do not involve any degree of integration among the local councils, to the mergers. In between there are the forms of cooperation we primary deal with in this work. The most representative of which are: *convenzioni*, *consorzi*, *comunità montane* and *unioni*, . They represent long term forms of partnership. According to Zuffada (2002), the main difference among them is the level of flexibility and the resulting level of integration among local councils. Roughly, the first three forms do not allow much flexibility. In fact, they are regulated in detail by the law. The main objective pursued with these forms of partnership is the exploitation of economies of scale. In fact, the *unione* is characterized by a higher degree of integration; a new entity is created which is responsible for the area of service allocated. In other words, the *unione* has a higher administrative independence than the other forms. These features match very well with the two forms of cooperation we analyzed in the theoretical model[15]. In particular, the *unione* can be represented as a council union, while the other forms fall into the definition of consortium.

An empirical analysis of the impact of partnerships is difficult to conduct because the phenomenon is quite recent, at least for the *unione*. Hence, analyzing the choice of local councils among the available forms is not significant. That is because until recently the main form of long term relationship has been the *consorzi*. The reason lies in the legal system that described the "Unione" as a first step towards merger. Only in 2000, laws (L. 256/99 and D.lgs. 267/00) has given the possibility to form *unioni* with no obligation to eventually merge.

We have some data about cooperation among local councils in the Italian region Marche (pop. 1504827; total local councils 246).

The first thing that emerges form the data is the small size of local councils involved in a *unione*. In particular, 40% of the local councils with a population in the range (1500-3000) have adopted this form of partnership; 47% of councils in a *unione* have a population in the range (1500-3000). Moreover, almost 70% of councils in a *unione* have a population between 1500 and 5000. These data corroborates the intuition that small local councils mainly benefit from a *unione*,

[15]Actually, the idea for the theoretical model came from the observation of the Italian reality. However, it could be applied to any country where similar institutions exists.

for reasons linked to the hard budget constraint. It also shows that most of the councils have similar size.

Another important issue is the number of councils in a coalition. It appears that on average there are 4.25 councils. The maximum size of a coalition is 7, while the minimum is 2. The theoretical model presented predicts a large number of participants when α is very high. The model also indicates a counterfactual result: a partnership is an efficient choice always for a number of councils larger than the efficient number for a consortium. Actually the average number of councils associated in an *unione* is lower than in a *consorzi*. A possible explanation is that the law which permits partnership as a reversible association is recent, partnerships with a large number of councils might eventually be realized.

Moreover, there are at least two further reasons that might explain it. Firstly, adding uncertainty, the optimality of the partnership disappears for some value (low) of α independently from the level of transaction costs; and, as the level of α decreases the consortium becomes again optimal after the partnership. Secondly, the prediction of the model are for the same type of services; changing the area of service changes the parameter α, if they are allocated with different area of services, it could be that the number of participant which makes the union convenient is much lower than the number observed for the consortium.

In this respect it is important to investigate which area of service is given to the *unione*. The previous section suggests that for low elasticity of substitution a consortium is an optimal choice for a large number of councils. For instance, in Italy large consortia are common for services which must be provided by public government and which have no substitutes (i.e. water services).

The date show that *unioni* are allocated mainly services like general schooling (transport, cleaning, etc.), metropolitan police functions, and social services. These data seem to suggest that, indeed, services with a high degree of substitutability are given to the *unioni*. Other services like integrated water service, and rubbish collection services, are given to *consortia*.

6 Concluding comments and further developments

The theoretical model shows that the "best" form of cooperation among local councils, does not exist. One type of partnership is more or less efficient according to the degree of substitutability among services, the level of transaction costs and the number of participants. One important policy indication is that the there is no reason for the government to subsidize, indiscriminately, one form of partnership over the other. It seems that each institution can play a role, depending on the type of services considered and the number of participants.

However, given the very restrictive assumptions we have made, it is difficult to extract detailed policy indications. There are at least two gaps that should be fill in. The first one is the analysis of the decision to cooperate from a political point of view, i.e. dropping the hypothesis of benevolent local councils. The second one is the analysis of the dynamic process of partnership formation. The latter issue is particularly appealing because in reality partnerships are formed through time and new members may join while other may exit and form other

partnerships. Moreover there could be overlapping partnerships, with some councils that join two separate partnerships for for different set of services[16].

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[16] Recently the economic literature on cooperative game theory has focused on the analysis of coalition formation, the topic we are dealing with could be a candidate application this theoretical approach.

Appendix

A The algebra of the model

In order to get the intuition behind the proofs, it is useful to draw a graph of the utility functions U_A, U_C and U_U and the transaction cost function $T(n,t)$, where t is a parameter which describes the strength of transaction costs. We have assumed $U_A = U_C(1) = U_U(1)$, i.e. the utility function values are the same when $n = 1$. The threshold level $\bar{n}$, $\tilde{n}$ and $\hat{n}$ can be calculated as the level for which $U_C(\bar{n}) - U_A = T(\bar{n}, t)$, $U_U(\tilde{n}) - U_A = T(\tilde{n}, t)$ and $U_U(\hat{n}) = U_C(\hat{n})$.

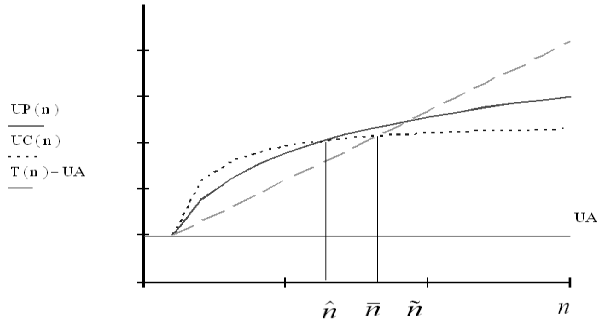

Figure 7: Utility functions and transaction costs

A.1 Proof of proposition 3.3

By assumption $U_C(1) = U_U(1) = U_A$.

As $n \to \infty$ we have

$$\lim_{n\to\infty} U_C(n) = \frac{1}{\alpha} \ln \frac{1}{2\alpha - 1} + U_A$$

and

$$\lim_{n\to\infty} U_U(n) = +\infty$$

Since both U_C and U_U are concave and always increasing in n, the existence of $\hat{n} > 1$ depends on the value of the derivative $\frac{\partial U_C(1)}{\partial n}$ and $\frac{\partial U_U(1)}{\partial n}$. Given

$$\frac{\partial U_C(1)}{\partial n} > \frac{\partial U_U(1)}{\partial n}$$

we have $U_C(1+\gamma) > U_U(1+\gamma)$ with $\gamma > 0$; this implies that $\hat{n} > 1$ always exists and that for $n < \hat{n}$, $U_C(n) > U_U(n)$, while for $n > \hat{n}$, $U_C(n) < U_U(n)$.

Using the implicit function theorem we can show how $\hat{n}$ changes with the level of some parameters. Let us define the implicit function $F(\hat{n}, \alpha) \equiv U_C(\hat{n}, \alpha) -$

$U_U(\hat{n}, \alpha) = 0$. If $n < \hat{n}$, $F(n, \alpha) > 0$, while if $n > \hat{n}$, $F(\hat{n}, \alpha) < 0$, so $\frac{\partial F(\hat{n},\alpha)}{\partial \hat{n}} < 0 \; \forall n > \hat{n}$.

Since it is possible to show[17] that the derivative $\frac{\partial F(\hat{n},\alpha)}{\partial \alpha} < 0$, applying the implicit function theorem we get $\frac{\partial \hat{n}}{\partial \alpha} < 0$.

A.2 Proof of propositions 3.1 and 3.2

The results of propositions 3.1 and 3.2 can be demonstrated in the same way. Hence, it can be demonstrated, using implicit function theorem, that $\frac{\partial \bar{n}}{\partial \alpha} < 0$, $\frac{\partial \tilde{n}}{\partial \alpha} < 0$, graphically, it means that $U_C - U_A$ and $U_U - U_A$ grow when α decreases; moreover $\frac{\partial \bar{n}}{\partial t} < 0$, $\frac{\partial \tilde{n}}{\partial t} < 0$, since T grows.

When α decreases more possibility exists both for consortium and for partnership. When Transaction cost increases first partnership then consortium possibility disappears, moving from case 1 to case 2.

A.3 Proof of proposition 4.1

Results of proposition 4.1 is demonstrated calculating the derivative of $\pi_U(n)(U_U(n) - U_A)$ in $n = 1$. It easy to show that

$$\frac{\partial \pi_U(1)}{\partial n}(U_U(1) - U_A) + \pi(1)\frac{\partial (U_U(1) - U_A)}{\partial n} = \frac{\partial (U_U(1) - U_A)}{\partial n} > 0$$

If $\frac{\partial (U_U(1) - U_A)}{\partial n} > \frac{\partial T_U(1)}{\partial n}$ then it is true that $U_U(1 + \varepsilon) - U_A > T_U(1 + \varepsilon)$ with $\varepsilon > 0$ however small. Since for $n \to \infty$, $0 = \pi_U(n)(U_U(n) - U_A) < T_U(n)$, the proposition is proved. Implicit function theorem proves that faster is the decreasing of probability lower is $\tilde{n}$.

A.4 Proof of proposition 4.2 and 4.3

The proof of proposition 4.1 suggests that $\pi_U(n)(U_U(n) - U_A)$ has a maximum, where $n^* = argmax\,[\pi_U(n)(U_U(n) - U_A)]$. Therefore if W_C cuts W_U it means that an interval $(\hat{n}, \hat{\hat{n}})$ esists where $W_U > W_C$. Sufficient condition for the existence of this interval is that

$$\pi_U(n^*)(U_U(n^*) - U_A) > \lim_{n\to\infty} [U_C(n) - U_A] = \frac{1}{\alpha} \ln\left(\frac{1}{2\alpha - 1}\right)$$

It is easy to show that if $\pi(n)$ decreases slowly, so that $\pi(8) = 1$, thus for $\alpha = .99$

$$\pi_U(n^*)(U_U(n^*) - U_A) > \pi_U(8)(U_U(8) - U_A) > \frac{1}{\alpha} \ln\left(\frac{1}{2\alpha - 1}\right)$$

Moreover since both $\pi_U(n^*)(U_U(n^*) - U_A)$ and $\lim_{n\to\infty} [U_C(n) - U_A]$ increase when α decreases, the second side increases faster when α decreases and when $\alpha = 0.5$

$$\pi_U(n^*)(U_U(n^*) - U_A) < \lim_{\alpha\to 0.5} \frac{1}{\alpha} \ln\left(\frac{1}{2\alpha - 1}\right) = +\infty$$

[17] Demonstration is based on $\frac{\partial^2 F(n,\alpha)}{\partial n \partial \alpha} < 0 \; \forall n \geq 4$ and $\forall \alpha \in (0.5, 1)$.

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There exists α^* such that for $\alpha < \alpha^*$, $\pi_U(n^*)(U_U(n^*) - U_A) > \frac{1}{\alpha} \ln(frac12\alpha - 1)$, thus proposition 4.3 is demonstrated.