Unfair division of gains under equal price in cooperative purchasing

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Summary

Cooperative purchasing is becoming more and more common practice. However, many cooperative initiatives end prematurely or do not flourish. Important reasons indicated for these problems are directly or indirectly related to the unfair division of gains. The purpose of this paper is to indicate causes of unfairness effects in current cooperative practices, aiming to enhance cooperative trust and stability. Results incorporate an extensive analysis of the most commonly used allocation concept, the Equal Price. We prove that the unfair effects of this concept are caused by neglecting a part of the added value of cooperative initiative members. Moreover, we prove that the Equal Price allocation value reaches its maximum when the volume of an organisation equals a certain percentage of the total volume of a cooperative initiative. So, when using the Equal Price organizations increasing their volume past this point will receive less gains. We conclude by emphasizing that it is highly important that cooperative members are aware of allocation concept problems. Further research will involve solutions to these problems.

***Keywords**:* Purchasing Consortia; Cooperative Purchasing; Allocation; Equal Price; Properties of Fairness

Introduction

Cooperative purchasing initiatives, such as purchasing consortia, purchasing cooperatives, purchasing groups, buying offices and pooled purchasing (Essig, 2000), are becoming more and more well-established in the public sector and gaining popularity in the private sector (Doucette, 1997; Hendrick, 1997; Macie, 1995; Major, 1997; Sickinger, 1996; Zentes, 2000).

Economies of scale, reduced double work, improved supplier relations, and improved interaction are all theoretical advantages related to cooperative purchasing. Related disadvantages to cooperative purchasing are increased complexity, decreased flexibility, loosing control, and having to adapt (see Table 1). The advantages should outweigh related disadvantages in a large number of cases (Aylesworth, 2003; Doucette, 1997; Hendrick, 1997; Ireland, 2002; Künneke, 1994; Pye, 1996; Quayle, 2002; Virolainen, 2003). However, premature endings of cooperative initiatives still occur regularly and several other cooperative initiatives do not flourish. Table 1 – advantages and disadvantages of cooperative purchasing.

Table 1 – Advantages and disadvantages of cooperative purchasing

Advantages	Disadvantages
Leveraging value-added pricing, service, reliable supply, and technology	Having to communicate, decompose tasks, coordinate, and monitor partners performance (less responsive)
Reducing transaction costs, workload, risks, and tender process time	Having to change specifications, suppliers, et cetera
Sharing purchasing experiences, information, and expertise, and learn from each other	Dealing with resistance and differences in size, commitment, competence, policy, support, et cetera
Specializing in purchasing typical products	Loosing (local) existing relations with (small) suppliers
Gaining better access to more resources	Risking disclosure of sensitive information, fear of 'parasites', and dealing with anti-trust or legal issues
Standardizing and harmonizing procedures, policies and extending the cooperation to other fields	Lacking enough knowledge, competence or having no opportunity to purchase cooperatively

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In purchasing literature many terms are used when referred to cooperative purchasing. Despite certain patterns in the use of the terms, the terminology is not yet fully stabilized (Virolainen, 2003). In this paper we define cooperative purchasing initiatives as: *Two or more organisations cooperating in one or more steps of the procurement process to improve the performance of the participating organisations.*

Cooperative purchasing has received relatively little attention in purchasing management research. In addition, cooperative purchasing research so far has focused primarily on inductive explanations of practice and qualitative deductive reasoning. The use of quantitative deductive reasoning has been limited until now (Essig, 1998; Heijboer, 2003).

The lack of cooperative purchasing research attention seems unjustified, with cooperative purchasing being more and more well-established. Reasons indicated for this positive trend are shifting agendas from a short-term view and internal focus to a long-term view and external relationship focus (Arnold, 1982; Dobler, 1996; Essig, 2000; Leenders, 1998; Lindner, 1983), e-procurement developments, increased competition, and an increased awareness and importance of purchasing activities.

One specific cooperative purchasing issue receiving minor research attention is the fair division of cooperative gains. To this end we carried out a small in-depth survey (see Appendix A). All cooperative initiatives in this survey used the Equal Price allocation concept, or in other words: all organisations pay the same price per item. Also, the actual gains in € are on average indicated as being the most important reason to purchase cooperatively.

Already it has been noted that the Equal Price can be unfair (Heijboer, 2003). However, most initiatives (73%) indicated not being aware of all possible unfairness effects when using the Equal Price concept.

It is disturbing to note that important reasons indicated for cooperative purchasing problems – dealing with differences in size, anti-trust, no commitment and 'fear of parasites' (see Table 1) - are related to gains allocation problems.

However, a clear understanding of the causes and effects of allocation problems does not yet exist. Therefore, the main questions in this paper are: What are the gain allocation causes and effects of Equal Price in cooperative purchasing? And when and how do these effects occur?

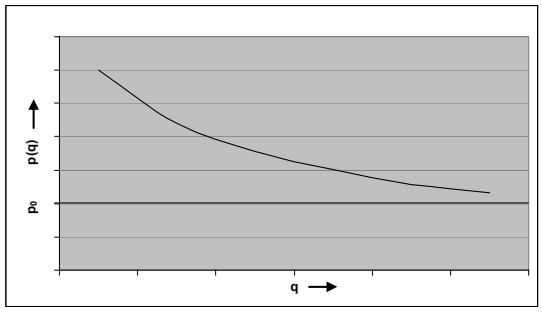
To summarize, the purpose of this paper is **(1)** to indicate gain allocation effects in cooperative purchasing, **(2)** to build further (Heijboer, 2003) on insights in unfairness effects, aiming to enhance cooperative initiative trust and stability, and **(3)** to contribute to the quantitative deductive development of purchasing management.

The model

To analyze the effects of the Equal Price allocation concept (Heijboer, 2003), we model cooperative purchasing initiatives by taking into account price reduction due to economies of scale. As mentioned in the introduction several other issues also play a role in the success of establishing and managing cooperative initiatives. Here we focus on the actual gains in € as this is indicated as being an important reason to purchase cooperatively.

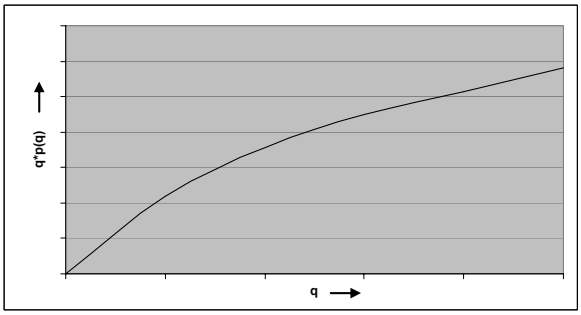
For the price per item *p(q)* we assume a decreasing volume discount is given, with more items being purchased. Of course there is a minimum price *p0*, so *p(q)* is a convex function as is shown in Figure 1.

Figure 1 – price per item as a function of the quantity



In addition, we assume the total purchasing volume $q \cdot p(q)$ to be increasing with the number of items being bought (see Figure 2). These assumptions hold for many practical situations (Dolan, 1987).

Figure 2: Total price for buying a quantity of q items



We refer to this model as a Cooperative Purchasing-game or CP-game(*N*,*q*,*p*) (Heijboer, 2003). *N* is the number of organisations, *q* is the number of items each organisation wants to purchase and *p* is the price per item. The total gains function *v*(*S*) of each coalition (cooperative initiative) *S* is defined as the gains it generates by buying items together compared to the situation where each of the organisations has to buy these items on its own:

$$v(S) = \sum_{i \in S} (q_i \cdot p(q_i)) - \sum_{i \in S} q_i \cdot p(\sum_{i \in S} q_i) \qquad (1)$$

Unfairness illustrated

With the following case we will illustrate the gain allocation effects of current practice in cooperative purchasing. Consider three organisations purchasing cooperatively 60 items. The price *p* for the items as a function of the quantity *q* that will be ordered is known as:

$$p(q_i) = p_0 \cdot (c_1 + \frac{c_2}{\sqrt{q_i}}) = € \ 959 \cdot (1 + \frac{1}{\sqrt{q_i}}) \qquad (2)$$

The three organisations use the Equal Price allocation concept: the price that can be obtained with the volume of the grand coalition *N*. We define the Equal Price concept per *organisation i* as:

$$equalprice_i(v) = q_i \cdot (p(q_i) - p(q_N)) \qquad (3)$$

This case can be modelled into a CP-game as is shown in Table 2.

Table 2: CP-game for three organisations

Coalition S	*Quantity*	*Price per item*	*Total*	*v(S)*
{1}	35	1 121	39 246	0
{2}	10	1 262	12 625	0
{3}	15	1 207	18 102	0
{1,2}	45	1 102	49 597	2 273
{1,3}	50	1 095	54 741	2 607
{2,3}	25	1 151	28 775	1 952
{1,2,3}=N	60	1 083	64 980	4 993

Now we can analyze the gains each case organisation receives when the cooperative initiative {1,2,3} uses the Equal Price allocation concept:

Organisation i gains: $q_i \cdot (p(q_i) - p(q_N))$

Organisation 1 gains: 35 · (1.121 – 1.083) = **1.341**
(largest organisation)

Organisation 2 gains: 10 · (1.262 – 1.083) = **1.795**
(smallest organisation)

Organisation 3 gains: 15 · (1.207 – 1.083) = **1.857**

Total gains: 1.341 + 1.795 + 1.857 = **4.993**

A remarkable outcome is that using the Equal Price concept leads to a situation where the largest organisation receives the smallest part of the total gains. The smallest organisation however receives the largest part of the total gains.

The largest organisation could object to this allocation, because the largest organisation adds the most value to the cooperative initiative. The smallest organisation however adds the least value in this case, as will be shown in the next section. Such an 'unfair' situation could lead to instability and distrust in the cooperative initiative.

Added value

In real life situations organisations can add value in several ways to a cooperative. Here, the added value, or in other words, the total gains an organisation creates for the cooperative initiative, is defined as the total gains of the coalition minus the value the other organisations can establish without *organisation i* (Borm, 1992):

$$M_i(v) = v(N) - v(N \setminus \{i\}) \quad (4)$$

The added value of an organisation to the initiative is equal to its maximum claim. An organisation should never receive more gains than this maximum claim. Given $M_i(v)$ we can calculate the added value of the case organisations:

Organisation i Added Value: $M_i(v) = v(\{1,2,3\}) - v(\{1,2,3\} \setminus \{i\})$

Organisation 1 Added Value: 4.993 – 1.952 = **3.041** *(largest organisation)*
Organisation 2 Added Value: 4.993 – 2.607 = **2.386** *(smallest organisation)*
Organisation 3 Added Value: 4.993 – 2.274 = **2.719**

We note that the larger the organisation is, the more value this organisation adds to the initiative.

Splitting added value

To increase the insights of added value in the case example, we split this value in three different parts: **(1)** gains for and by an organisation created by joining a cooperative initiative (m_i: equals the minimum claim of an organisation), **(2)** gains created by an organisation for the other organisations in the initiative (n_i) and, **(3)** gains for an organisation created by the other organisations in the initiative (o_i) (Schotanus 2004).

The added value M_2 of *case organisation 2* can be divided into these three types of gains as is shown in Table 3.

The calculations for the added value of *organisation 3* can be made in the same way as for *organisation 2* as is shown in Table 4.

Table 3: Type of gains of organisation 2

Gains	Description	Calculation	Total
m_i = gains for and by 2	quantity of {2} · (price(initiative without {2})-price({1,2,3}))	=10 · (1.095-1.083)	=118
n_i = gains by 2 for N \ {2}	quantity of {1,3} · (price(initiative without {2})-price({1,2,3}))	=50 · (1.095-1.083)	=591
o_i = gains for 2 by N \ {2}	quantity of {2} · (price({2})-price({1,3}))	=10 · (1.207-1.095)	=1.677
Total	maximum claim of 2	=M_2	=2.386

Table 4: Type of gains of organisation 3

Gains	Description	Calculation	Total
m_i = gains for and by 3	quantity of {3} · (price({1,2})-price({1,2,3}))	=15 · (1.102-1.083)	=287
n_i = gains by 3 for N \ {3}	quantity of {1,2} · (price({1,2})-price({1,2,3}))	=45 · (1. 102-1.083)	=862
o_i = gains for 3 by N \ {3}	quantity of {3} · (price({3})-price({1,2}))	=15 · (1.207-1.102)	=1.570
Total	maximum claim of 3	=M_3	=2.719

For *organisation 1* an exception occurs (see Table 5), because the volume of this organisation (q_2 = 35) exceeds the combined volume of *organisations 2* and *3* (q_{2+3} = 25). This influences the calculations for m_i and o_i: instead of *price*({2,3}), *price*({1}) should be used, as *price*({1}) is lower than *price*({2,3}).

Table 5: Gains of organisation 1

Gains	Description	Calculation	Total
m_i = gains for and by 1	quantity of {1} · (price({1})-price({1,2,3})) $= \begin{cases} q_i \cdot (p(\sum_{j\in S/i} q_j) - p(\sum_{i\in N} q_i)) & p(\sum_{j\in S/i} q_j) \le p(q_i) \\ q_i \cdot (p(q_i) - p(\sum_{i\in N} q_i)) & p(\sum_{j\in S/i} q_j) > p(q_i) \end{cases}$ $= q_i \cdot (\min_{S:i\in S} \left\{ p(\sum_{j\in S/i} q_j), p(q_i) \right\} - p(\sum_{i\in N} q_i))$	=35 · (1.121-1.083)	=1.341
n_i = gains by 1 for N \ {1}	quantity of {2,3} · (price (initiative without 1)-price({1,2,3})) $= \sum_{j\in S/i} q_j \cdot (p(\sum_{j\in S/i} q_j) - p(\sum_{j\in S} q_j))$	=25 · (1.151-1.083)	=1.700
o_i = gains for 1 by N \ {1}	quantity of {1} · (price({1})- price({1})) $= \begin{cases} q_i \cdot (p(q_i) - p(\sum_{j\in S/i} q_j)) & p(\sum_{j\in S/i} q_j) \le p(q_i) \\ q_i \cdot (p(q_i) - p(q_i)) = 0 & p(\sum_{j\in S/i} q_j) > p(q_i) \end{cases}$ $= \max_{S:i\in S} \left\{ q_i \cdot (p(q_i) - p(\sum_{j\in S/i} q_j)), 0 \right\}$	=35 · (1.121-1.121)	=0
Total	maximum claim of 1	$=M_1$	=3.041

Equal price neglects added value partly

It is interesting to note that the Equal Price concept can be rewritten as follows:

Hence n_i (= the gains by *organisation i* for $N \setminus \{i\}$) is completely neglected, causing the Equal Price concept to be unfair in several situations where organisations differ significantly in size.

$$
\begin{aligned}
& equalprice_i(v) = q_i \cdot (p(q_i) - p(\sum_{i\in N} q_i)) \\
& = \begin{cases} q_i \cdot (p(q_i) - p(\sum_{i\in N} q_i)) & p(\sum_{j\in S/i} q_j) \le p(q_i) \\ q_i \cdot (p(q_i) - p(\sum_{i\in N} q_i)) & p(\sum_{j\in S/i} q_j) > p(q_i) \end{cases} \\
& = \begin{cases} q_i \cdot (p(q_i) + p(\sum_{j\in S/i} q_j) - p(\sum_{j\in S/i} q_j) - p(\sum_{i\in N} q_i)) & p(\sum_{j\in S/i} q_j) \le p(q_i) \\ q_i \cdot (p(q_i) - p(\sum_{i\in N} q_i)) + 0 & p(\sum_{j\in S/i} q_j) > p(q_i) \end{cases} \\
& = q_i \cdot (\min_{S:i\in S} \left\{ p(\sum_{j\in S/i} q_j), p(q_i) \right\} - p(\sum_{i\in N} q_i)) + \max_{S:i\in S} \left\{ q_i \cdot (p(q_i) - p(\sum_{j\in S/i} q_j)), 0 \right\} \\
& = m_i + o_i
\end{aligned}
\qquad (5)
$$

For example, in our case we have shown that the largest organisation can receive the smallest part of the gains. This is caused by the missing n_i:

Organisation i Equal Price: $equalprice_i(v) = m_i + o_i$
Organisation i Added Value: $M_i(v) = m_i + o_i + n_i$

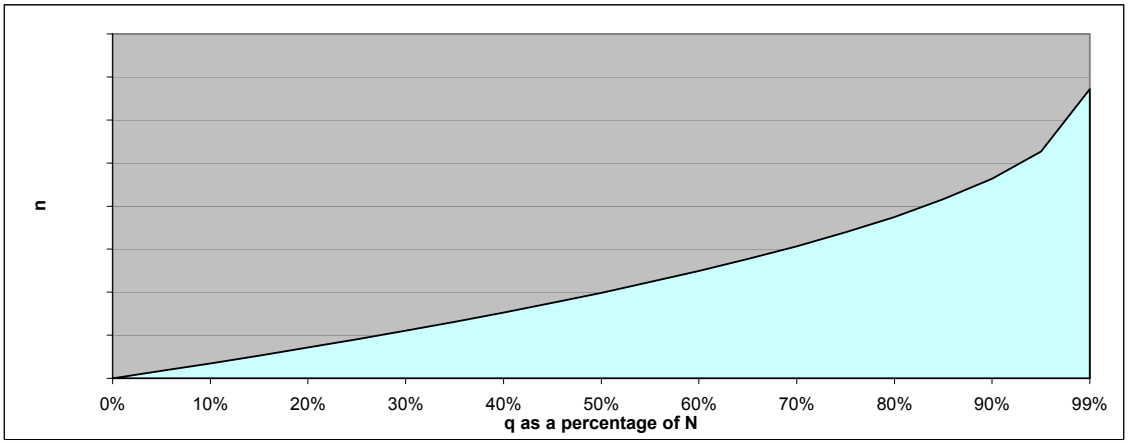
Organisation 1 Equal Price: $m_1 + o_1$ = **1.341** *(largest organisation)*
Organisation 2 Equal Price: $m_2 + o_2$ = **1.795** *(smallest organisation)*
Organisation 3 Equal Price: $m_3 + o_3$ = **1.857**

Organisation 1 Added Value: $m_1 + o_1 + n_1$ = 1.341 + **1.700** = **3.041**
Organisation 1 Added Value: $m_2 + o_2 + n_2$ = 1.795 + **591** = **2.386**
Organisation 1 Added Value: $m_3 + o_3 + n_3$ = 1.857 + **862** = **2.719**

Behaviour of added value and equal price

In our model there are three disadvantages to the Equal Price concept which apply especially to large members. First, as n_i is always increasing with more items being purchased by *organisation i* (see Figure 3), it becomes less attractive for larger cooperative members to use the Equal Price concept. After all, n_i is not incorporated in this concept, and the larger the value of n_i, the more these members are put at a disadvantage.

Figure 3: n_2 and different quantities of q_2 while $q_{1+3} = 50$ is constant



The second disadvantage is caused for the first part by o_i becoming 0 after a certain point (see Figure 4). This point is independent of the price structure, the number of organisations, and the division of the volumes of these organisations. The point were o_i becomes 0 is always reached when the volume of *organisation i* equals exactly 50% of the total volume of the initiative. In such a case a *large organisation i* using the Equal Price concept receives just the value of ($m_i + o_i = m_i + 0 =$) m_i.

Thirdly, past the point where the volume of *large organisation i* becomes higher than a certain percentage of the total cooperative volume, m_i will even become smaller by an increasing volume of *organisation i* (see Figure 5). At least past this point the total *Equal Price gains* always decrease, as o_i is already 0, even if this organisation increases its volume through the initiative. This point is independent of the number of organisations, and the division of the volumes of these organisations.

Figure 4: o_2 and different quantities of q_2 while $q_{1+3} = 50$ is constant

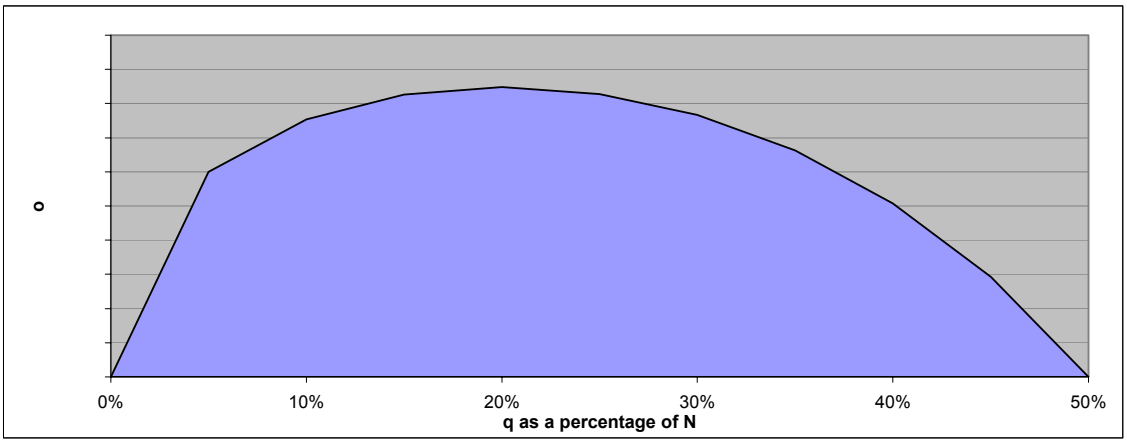


Figure 5: m_2 and different quantities of q_2 while $q_{1+3} = 50$ is constant

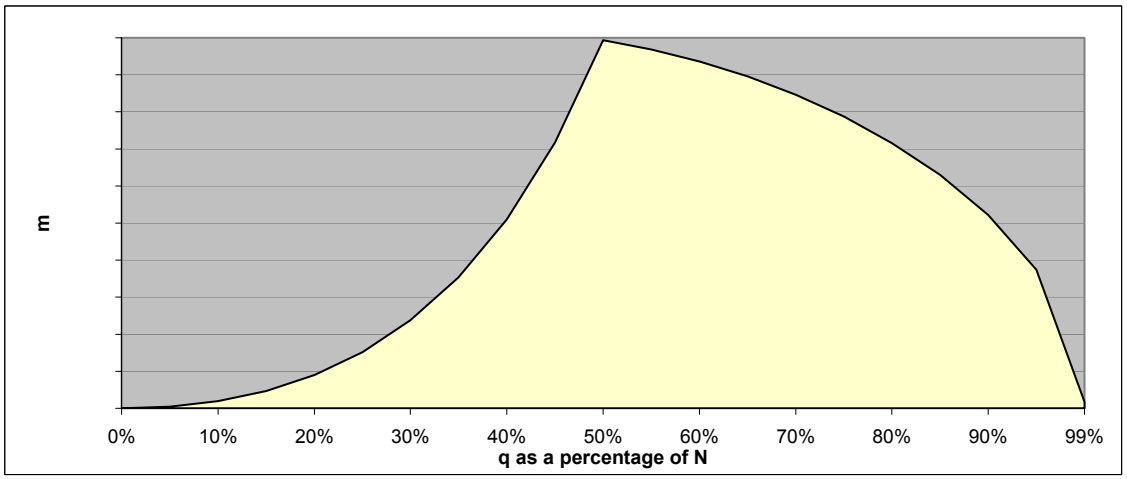
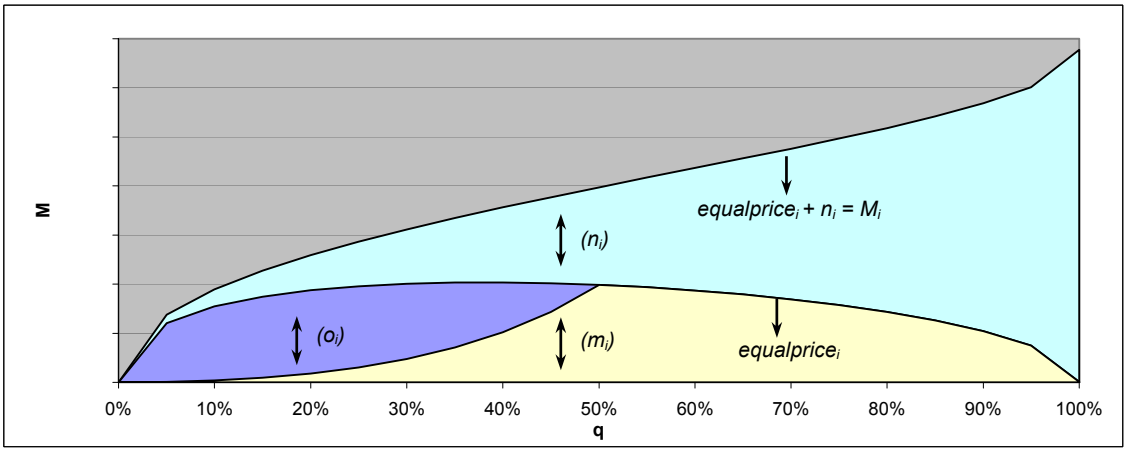


Figure 6 illustrates the combined effects on the three different types of gains when the number of needed items changes for *organisation 2*. The total number of needed items for *organisations 1* and *3* remains the same in this figure. We see in figure 6 the value of M_2 increasing with an increasing value of q_2. At a certain point, the *Equal Price value* for *organisation 2* reaches its maximum value, even though M_i and the total gains of the cooperative initiative increase.

Figure 6: type of gains for organisation 2 with different quantities of q_2 while $q_{1+3} = 50$ is constant



Properties of fairness

To assess the fairness of allocation methods in general we can use several properties of fairness from cooperative game theory relevant to cooperative initiatives. Game theory is a mathematical research field that deals with multilateral decision making. Each decision maker (player) has his own interests and has a number of possible actions open to him. By his actions, each player affects the outcomes for the other players. In cooperative game theory it is assumed that gains can be made when all players cooperate. One of the problems that are addressed in this theory is how to divide these gains in a fair way among all players. The properties of fairness we use in this paper are the following (Albizuri, 2002; Driessen, 1991; Friedman, 1999; Heijboer, 2003):

(1) EFF: efficiency. All gains are allocated back to the organisations: $\sum_{i \in N} f_i(v) = v(N)$

(2) SYM: symmetry. If for two *organisations i* and *j* can be interchanged without changing any $v(S)$ then $f_i(v) = f_j(v)$. It means that equal organisations should get equal pay-offs.

(3) DUM: dummy. If $v(S \cup \{i\}) - v(S) = v(\{i\})$ for all $S \subset N \setminus \{i\}$ then $f_i(v) = v(\{i\})$. It means that an organisation, which does not contribute anything, should not get anything.

(4) STA: stability. EFF is satisfied and for all coalitions *S* it holds that $\sum_{i \in S} f_i(v) \geq v(S)$. It means that for each organisation the pay-off of cooperation in the grand coalition is equal or higher than the pay-off of working alone or in any other sub coalition. Note that STA implies that *organisation i* cannot receive a larger pay-off than $M_i(v)$ or a smaller pay-off than the $m_i(v)$.

(5) ADD: additivity. For two games v and w with solutions $f(v)$ and $f(w)$ it holds that $f(v + w) = f(v) + f(w)$. A cooperative initiative could be used for multiple (types of) items at the same time. Each item could be treated as a separate game with a separate gain allocation. The gains from all items could also be added up and be allocated at once. It seems fair that when the same allocation concept would be used for each item separately or for all of them together the total amount allocated to each organisation should be the same. This is just another way of saying that ADD has to hold.

(6) FR: fair ranking. If for two *organisations i* and *j* $q_i \geq q_j$ then $f_i(v) \geq f_j(v)$. It means that FR is satisfied if an organisation with an equal or larger quantity of items to be purchased through a cooperative initiative receives an equal or larger share of the gains.

(7) MON: monotonicity. If for one *organisation i* $q_i' \geq q_i$ then $f_i'(v) \geq f_i(v)$. Satisfying this property means that if the quantity of items to be purchased by one organisation stays equal or becomes larger than in a former situation, this organisation should receive an equal or larger amount of gains. In other words, f_i is nondecreasing in q_i

Properties of fairness and equal price

Table 7 gives an overview of which properties of fairness are satisfied in general for CP-games for the Equal Price concept. Proofs have been omitted here.

Table 7: properties of fairness for the Equal Price concept (✓ = satisfied, ✗ = not satisfied)

Equal Price properties of fairness	Satisfied in general
Efficiency	✓
Symmetry	✓
Dummy	✓
Stability	✓
Additivity	✗
Fair ranking	✗
Monotonicity	✗

Table 7 shows that using the Equal Price concept can lead to situations where the largest organisation receives the smallest part of the total gains (FR property). Also, the situation could occur that an organisation increases its purchases through the cooperative initiative, but in return receives a smaller amount of the gains (MON property). This could slow down potential growth and harm the stability of the

cooperative initiative. ADD is not satisfied as well, making the Equal Price concept less suitable for multiple item cooperative initiatives.

The Equal Price problems occur when organisations in a cooperative initiative differ in size. The more they differ, the higher the unfair effects will be. The problematic effects usually decrease, with more organisations in a cooperative initiative. In other words, the effects are levelled out to a certain extent.

Conclusions

In this paper we build further on the link between cooperative initiatives and cooperative game theory. We prove that the Equal Price concept consequently ignores an important part of the added value of organisations, causing this concept to be unfair for large members of cooperative initiatives.

When the volume of an organisation becomes a certain percentage of the total volume of a cooperative initiative, the *Equal Price value* for this organisation reaches always its maximum. So, when using the Equal Price concept organisations increasing its volume past this point will receive fewer gains, even though its added value and the total gains of the cooperative initiative increase. For these larger organisations it becomes less attractive to cooperate in this initiative. They could even leave the initiative or join another one. Other solutions are using another allocation concept or finding new members. In our further research we will deal with solutions to these problems.

To conclude, when organisations are unequal in size and use the Equal Price concept, it is highly important that this is an intentional choice and that the cooperative members are aware that problems like Fair Ranking, and Monotonicity could arise when dividing the gains[1].

References

Albizuri, M., J. Santos and J. Zarzuello. (2002). On the serial cost sharing rule. *International Journal of Game Theory, 31*(3), 437-446.

Arnold, U. (1982). *Strategische Beschaffungspolitik: Steuerung und Kontrolle strategischer Beschaffungssubsysteme von Unternehmen*. Frankfurt/Main: Verlag Peter Lang GmbH.

Aylesworth, M. (2003). *Purchasing consortia in the public sector, models and methods for success.* Paper presented at the International Supply Management Conference and Educational Exhibit.

Borm, P., H. Keiding, R. Mclean, S. Oortwijn and S. Tijs. (1992). The Compromise Value for NTU-Games. *International Journal of Game Theory, 21*(2), 175-189.

Dobler, D. W. (1996). *Purchasing and Supply Management: Text and Cases* (6 ed.). New York: McGraw-Hill.

Dolan, R. J. (1987). Quantity discounts: managerial issues and research opportunities. *Marketing Science, 6*(1), 1-22.

Doucette, W. R. (1997). Influences on member commitment to group purchasing organizations. *Journal of Business research, 40*, 183-189.

Driessen, T. S. H. (1991). A survey of Consistency Properties in Cooperative Game Theory. *SIAM review, 33*, 43-59.

Essig, M. (1998). *Cooperative sourcing; Erklärung und Gestaltung horizontaler Beschaffungskooperationen in der Industrie.* Peter Lang.

Essig, M. (2000). Purchasing consortia as symbiotic relationships: developing the concept of consortium sourcing. *European Journal of Purchasing & Supply Management, 6*.

Friedman, E. J. (1999). Strong monotonicity in surplus sharing. *Working paper*.

Heijboer, G. (2003). *Mathematical and statistical analysis of initial purchasing decisions.* Unpublished PhD, University of Twente, Enschede.

Hendrick, T. E. (1997). *Purchasing consortiums: horizontal alliances among firms buying common goods and services what? who? why? how?*

[1] Allocation software is available for download at http://www.sms.utwente.nl/utips

Ireland, D., M. Hitt, D. Vaidyanath. (2002). Alliance management as a source of competitive advantage. *Journal of Management, 28*(3), 413-446.

Künneke, R. (1994). De betekenis van inkoopcombinaties op een liberale Europese energiemarkt. *Bestuurskundig onderzoek, 86*.

Leenders, M. (1998). *The problem with purchasing savings.* Paper presented at the Worldwide research symposium on purchasing and supply chain management IPSERA, London.

Lindner, T. (1983). *Strategische Entscheidungen im Beschaffungsbereich*.Munchen: Vahlen.

Macie, K. E. (1995). *The purchasing consortium - is it right for my company?* Paper presented at the NAPM Annual International Conference.

Major, M. J. (1997). Purchasing's best kept secret. *Purchasing Today*(May).

Pye, C. (1996). Coming together to cut costs. *Purchasing Today*(May), 32-36.

Quayle, M. (2002). Purchasing in small firms. *European Journal of Purchasing & Supply Management, 8*, 151-159.

Schotanus, F. (2004). Enhancing Trust and Stability in Purchasing Consortia: Fair Allocation of Gains, IPSERA, Catania.

Sickinger, J. L. (1996). *Coalition and consortium purchasing power: it's big, it's here, and it's the future of strategic purchasing.* Paper presented at the NAPM Conference.

Virolainen, V. (2003). *Development of purchasing partnerships- a theoretical framework and a case study.* Paper presented at the International Public Sector Procurement Event.

Zentes, J. a. S., B. (2000). Allied groups on the road to complex networks. *Technology in Society, 22*, 133-150.

Appendix A - properties of the studied cooperative purchasing initiatives

From 2003 to 2004 we carried out several semi-open structured interviews with purchasing managers within organisations active in cooperative purchasing. We studied 15 Dutch public cooperative purchasing initiatives.

Sector	Research method	Number of organisations in initiative and relative size in purchasing volume
Health	1 interview in large organisation	1 large organisation, 5 medium organisations, several small organisations
Health	1 interview in large organisation	2 large organisations, 2 small organisations
Health	1 interview in large organisation	2 large and 1 small organisation
Health	1 interview in large organisation	6 large organisations
Local government	1 interview in large organisation	1 large organisation, several small organisations
Local government	4 interviews in large, medium, and small organisations	1 large organisation, 2 medium organisations, 1 small organisation
Local government	4 interviews in large and medium organisations	1 large organisation, 2 medium organisations, 9 small organisations
Local government	1 interview in large organisation	1 large and 3 medium organisations
Local government	1 interview in medium organisation	2 medium and 1 small organisation
Local government	1 interview in medium organisation	2 medium and several small organisations
Police	1 interview in large organisation	27 large, medium, and small organisations
Police, local government	1 interview in medium organisation	1 large organisation, 1 medium organisation
Tax department, ministry	1 interview in large organisation	1 large organisation, 1 medium organisation
Tax department, ministry, local government	1 interview in large organisation	Several large, medium, and small organisations
University	1 interview in medium organisation	9 large and medium organisations
15 cooperative initiatives in total	21 interviews	