

Chander, Parkash

Working Paper

The γ -Core and Coalition Formation

Nota di Lavoro, No. 94.2003

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Chander, Parkash (2003) : The γ -Core and Coalition Formation, Nota di Lavoro, No. 94.2003, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/118126>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

**The γ -Core and
Coalition Formation**
Parkash Chander
NOTA DI LAVORO 94.2003

OCTOBER 2003

CTN – Coalition Theory Network

Parkash Chander, *National University of Singapore*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
http://www.feem.it/web/attiv/_wp.html

Social Science Research Network Electronic Paper Collection:
http://papers.ssrn.com/abstract_id=XXXXXX

The opinions expressed in this paper do not necessarily reflect the position of
Fondazione Eni Enrico Mattei

The γ -Core and Coalition Formation

Summary

This paper reinterprets the γ -core (Chander and Tulkens (1995, 1997)) and justifies it as well as its prediction that the efficient coalition structure is stable in terms of the coalition formation theory. It is assumed that coalitions can freely merge or break apart, are farsighted (that is, it is the final and not the immediate payoffs that matter to the coalitions) and a coalition may deviate *if and only if* it stands to gain from it. It is then shown that subsequent to a deviation by a coalition, the nonmembers will have incentives to break apart into singletons, as is assumed in the definition of the γ -characteristic function, and that the grand coalition is the only stable coalition structure.

Keywords: Core, Characteristic function, Strategic games, Coalition formation

JEL: C71, C72, D62

This work was completed during the author's visits to CORE in 2002 and 2003. The author wishes to thank the seminar participants for helpful comments and CORE for its hospitality. The author is also thankful to Anindya Bhattacharya and Henry Tulkens for their comments and suggestions.

Address for correspondence:

Parkash Chander
Department of Economics
National University of Singapore
1, Arts Link
AS 2, Level 6
Singapore 117570
E-mail: ecsparka@nus.edu.sg

The g -Core and Coalition Formation

1. Introduction

The concept of a characteristic function which specifies the worth of each coalition is central to the theory of cooperative games. The worth of a coalition is what it can achieve on its own without the cooperation of the nonmembers. If there are no externalities, i.e., if the payoffs to the members of a coalition do not depend on the actions of the nonmembers, then the worth can be defined without specifying the actions of the nonmembers. But if externalities are present, then in order to calculate the worth of a coalition one must also predict the actions of the nonmembers. This has been however a disputed issue and alternative assumptions in this respect lead to different concepts of characteristic functions such as the α -, β -, and g - characteristic functions.³

The γ - characteristic function was introduced most recently by Chander and Tulkens (1995, 1997) based on an assumption concerning the behavior of the nonmembers which is more plausible than those considered previously. They consider a game in strategic form with transferable utility in which it is efficient for the grand coalition to form and choose the strategy profile that maximizes the joint surplus. They assume that when a coalition forms it neither takes as given the strategies of its complement, as in the case of strong and coalition proof Nash equilibria, nor does it presume that the complement would follow minimax or maximin strategies, as in the case of the a - and b - characteristic functions, instead it looks forward to the best reply payoff corresponding to the equilibrium that its actions would induce. More specifically, when a coalition S forms it assumes that the nonmembers would not take any particular coalitional action against it, but would adopt only their individually best reply strategies. This results into a Nash equilibrium between the coalition S and the nonmembers acting individually, with the

³ These have been studied and contrasted to each other in various externalities contexts by Scarf (1971), Starret (1972), and Maler (1989) and in the public goods context by Foley (1970), Roberts (1974), Moulin (1987), and Chander (1993) among others. It is well-known that because of the underlying minimax or maximin assumptions, the a - and b - characteristic functions may lead to large cores. In fact, as noted by Maler (1989) and Ray and Vohra (1997), in some cases the a - and b - cores may include the whole set of Pareto optima.

members of S playing their joint best response strategies to the individual best response strategies of the nonmembers. The assumption that the nonmembers act individually is justified by Chander and Tulkens (1997, fn.6, p.387) by showing that if the nonmembers form one or more non-singleton coalitions then the payoff of S defined by the resulting Nash equilibrium across the coalitions would only be higher. Therefore, the assumption that the nonmembers act individually is equivalent to granting S a certain degree of pessimism.⁴ In other words, S presumes the worst possible scenario which is that the nonmembers will not form any non-singleton coalitions.⁵ Thus, the assumption is not concerning which coalitions will form, but rather which coalitions the coalition S thinks will or will not form. The uncertainty regarding the emerging coalition structure after the deviation is thus resolved by assuming that the coalition S presumes the coalition structure which is worst from its point of view. Chander and Tulkens (1997) show that the so-defined \mathbf{g} -characteristic function implies stability of the grand coalition in at least the games they consider.

This stability result has been contrasted with the inefficiency results obtained in the theory of coalition formation (see e.g. Ray and Vohra (1997), and Yi (1997)). In particular, this stability result has been attributed to the \mathbf{g} -theory assumption that the nonmembers do not form any non-singleton coalitions. It has been claimed that this is an arbitrary assumption and that which coalitions will be formed by the nonmembers after the deviation by a coalition should be determined endogenously, as in the coalition formation theory, and not assumed exogenously.

The purpose of this paper is to reinterpret the \mathbf{g} -core and justify it as well as its prediction that the efficient coalition structure is stable in terms of the coalition formation theory.

⁴ This is pessimism of a different sort: it is not concerning the strategies that will be adopted by the nonmembers (as in the case of \mathbf{a} - and \mathbf{b} - characteristic functions), but about the coalition structures that will emerge.

⁵ Chander and Tulkens (1995, 1997) consider games that imply positive externalities from coalition formation. For games that imply negative externalities from coalition formation, the corresponding assumption underlying the \mathbf{g} -characteristic function is that S assumes that the coalition $N \setminus S$ would form and its members would adopt the best response joint strategies. See Yi (1997) for the classification of games that imply positive or negative externalities from coalition formation.

Though the \mathbf{g} -core has been applied to games that are not necessarily symmetric, we consider here, as in the coalition formation theory, mainly symmetric games. Furthermore, in order to be more concrete, we consider the original economic model of Chander and Tulkens (1995, 1997) with identical agents. We show that if coalitions can freely merge or break apart, are farsighted (that is, it is the final and not the immediate payoffs that matter to the coalitions) and a coalition may deviate *if and only if* it stands to gain from it, then the nonmembers will actually not form any non-singleton coalitions, as is assumed in the definition of the \mathbf{g} -characteristic function, and the grand coalition is the only stable coalition structure. We thus justify the \mathbf{g} -core by showing that both its assumptions and predictions are consistent with the coalition formation theory.

The contents of this paper are as follows. We begin in section 2 with a simple example that illustrates the \mathbf{g} -theory and its relationship with the coalition formation theory. In section 3, we introduce the general model and the concept of indirect dominance. Section 4 presents the main results. Section 5 draws the conclusion.

2. The Illustrative Example

Consider an economy consisting of three identical countries or agents. Let $N = \{1, 2, 3\}$ denote the set of these agents. There are two kinds of commodities: a standard private good, whose quantities are denoted by y , and an environmental good (in fact, a bad), whose quantities are denoted by z . The private and the environmental good can be produced by the agents according to the following rules:

$$y_i = e_i^{\frac{1}{2}}, i \in N; \text{ and } z = \sum_{i \in N} e_i,$$

where e_i is to be interpreted as the emissions of country i . The preferences of country i are represented by the utility function:

$$u_i(y_i, z) = y_i - z, i \in N.$$

Let $T_i = \{e_i : e_i \geq 0\}$, $T = T_1 \times T_2 \times T_3$, and $u = (u_1, u_2, u_3)$.

We consider the strategic form game $[N, T, u]$. We **assume** that there are no transfers among the members of a coalition and they all get equal payoffs.⁶ We also **assume** that a coalition deviates if and only if it stands to strictly gain from it.

Standard arguments show that the game $[N, T, u]$ has a unique Nash equilibrium which induces the following state of the economy

$$\bar{e}_i = \frac{1}{4}; \bar{y}_i = \frac{1}{2}, i \in N; \bar{z} = \frac{3}{4}; \text{ and } \bar{u}_i = -\frac{1}{4}, i \in N, \quad (1)$$

where $(\bar{e}_1, \bar{e}_2, \bar{e}_3) \in T$ are the Nash equilibrium strategies. It is easily seen that a Pareto efficient state of the economy is given by

$$e_i^* = \frac{1}{36}, y_i^* = \frac{1}{6}, i \in N; z^* = \frac{1}{12}; \text{ and } u_i^* = \frac{1}{12}, i \in N, \quad (2)$$

and that the emission levels are the same for all Pareto efficient states. We claim that the strategies (e_1^*, e_2^*, e_3^*) belong to the \mathbf{g} -core. Since the players are identical, we need to consider only two types of deviations, namely: a deviation by a coalition of any two players, say $\{1,2\}$ and a deviation by a coalition of any single player, say $\{3\}$.

Define $(\tilde{e}_1, \tilde{e}_2, \tilde{e}_3)$ such that $\tilde{e}_1, \tilde{e}_2 = \operatorname{argmax} (e_1^{\frac{1}{2}} + e_2^{\frac{1}{2}} - 2e_1 - 2e_2 - 2\tilde{e}_3)$ and $\tilde{e}_3 = \operatorname{argmax} (e_3^{\frac{1}{2}} - \tilde{e}_1 - \tilde{e}_2 - e_3)$. Then,

$$\tilde{e}_1 = \tilde{e}_2 = \frac{1}{16}, \tilde{e}_3 = \frac{1}{4}, \tilde{u}_1 = \tilde{u}_2 = -\frac{1}{8} \text{ and } \tilde{u}_3 = \frac{1}{8}. \quad (3)$$

The strategies $(\tilde{e}_1, \tilde{e}_2, \tilde{e}_3)$ represent the Nash equilibrium between the coalitions $\{1,2\}$ and $\{3\}$. Comparing the payoffs of the coalition $\{1,2\}$ under the strategies $(\tilde{e}_1, \tilde{e}_2, \tilde{e}_3)$

⁶ Ray and Vohra (1999) provide a justification for the assumption of equal sharing of coalition gain among the coalition members. In an infinite-horizon model of coalition formation among symmetric players with endogenous bargaining, they show that in any equilibrium without delay there is equal sharing.

and (e_1^*, e_2^*, e_3^*) , it is seen that the coalition $\{1, 2\}$ will not gain from the deviation.⁷

We now consider deviation by $\{3\}$ which really brings into focus the said \mathbf{g} -theory assumption. When $S = \{3\}$ deviates it presumes that $N \setminus S = \{1, 2\}$ will break up into singletons and the resulting equilibrium will be the Nash equilibrium between $\{3\}, \{1\}$ and $\{2\}$, which leads to the same payoffs as in (1). From a comparison of the payoffs in (1) and (2), it follows that coalition $\{3\}$ will also not gain from its deviation. This shows that the strategies (e_1^*, e_2^*, e_3^*) are in the \mathbf{g} -core of the strategic form game $[N, T, u]$.

But why should the coalition $\{1, 2\}$ break up into singletons when $\{3\}$ deviates? The stability of the grand coalition depends crucially on the answer to this question, as $\{3\}$ will gain from its deviation if $\{1, 2\}$ did not break up (see the payoffs of $\{3\}$ in (3) and (2)) and hence would engage in deviation.

Let us consider first the argument against breaking up of $\{1, 2\}$: If $\{3\}$ deviates and $\{1, 2\}$ does not breakup into singletons, then the resulting equilibrium and the corresponding payoff of $\{1, 2\}$ is as given in (3), which as seen from (1) is higher than what its payoff would be if it were to break up and induce the coalition structure $(\{1\}, \{2\}, \{3\})$. The coalition $\{1, 2\}$ therefore should not break up. This argument however assumes implicitly either that the coalition structure $(\{1\}, \{2\}, \{3\})$ which emerges after the coalition $\{1, 2\}$ breaks apart is final or that the coalition $\{1, 2\}$ is myopic and is concerned only with its payoff at the next step.

Ray and Vohra (1997) assume the coalitions to be farsighted, but preclude the possibility of coalition merging, that is, coalitions can only become finer and not coarser. This means that the coalition structure $(\{1\}, \{2\}, \{3\})$ is final as further deviations are, by assumption, ruled out. Their analysis, therefore, implies stability of the coalition structure

⁷ It is worth noting that alternatively the \mathbf{a} - and \mathbf{b} - strategies imply $\tilde{e}_3 \rightarrow \infty$ and $\tilde{u}_1, \tilde{u}_2 \rightarrow -\infty$.

($\{1, 2\}, \{3\}$) and not of the grand coalition $\{1, 2, 3\}$. The coalition structure ($\{1, 2\}, \{3\}$) is also stable in terms of the coalition formation games considered by Carraro and Siniscalco (1993) who assume the coalitions to be myopic.⁸ The Ray and Vohra assumption that coalitions cannot merge, therefore, has similar implications as the assumption of myopia.

Let us now introduce the possibility of coalition merging (Chander (1999) and Diamantoudi and Xue (2002)) in the above story. This creates the possibility of further continuations after the coalition $\{1, 2\}$ breaks apart and the coalition structure ($\{1\}, \{2\}, \{3\}$) emerges. Indeed, the coalitions $\{1\}, \{2\},$ and $\{3\}$ may merge and form the grand coalition $\{1, 2, 3\}$ which gives to each merging coalition a higher payoff (compare the payoffs in (1) and (2)). Contrary to the argument discussed above, the farsighted coalition $\{1, 2\}$ has an incentive to break up and induce the temporary structure ($\{1\}, \{2\}, \{3\}$) as that would then lead to the formation of the grand coalition and to payoffs for its members which are strictly higher than if it did not break up⁹ (compare the payoff of $\{1, 2\}$ in (3) and (2)). Since the initial deviating coalition $\{3\}$ is farsighted, it would realize that its deviation will not benefit its members, as it would only lead back to the grand coalition via the breaking up of $\{1, 2\}$ into singletons, and hence it will not engage in deviation. This implies stability of the grand coalition.

The coalition formation theory considers alternative approaches to deal with the issue of multiple continuations after a single deviation (see e.g. Greenberg (1990), Chwe (1994), Ray and Vohra (1997) and Xue (1998)): the initial deviating coalitions may evaluate the subsequent other deviations in optimistic or pessimistic ways. For example, in the definition of the von Neumann and Morgenstern abstract stable set, a coalition deviates as long as this deviation might lead to **some final** outcome that benefits its members. In contrast, in the definition of the largest consistent set (Chwe (1994), a coalition deviates

⁸ See also d'Aspremont and Gabszewicz (1986) and Barrett (1994; 2003).

⁹ Emergence of this type of coalition structures has been observed empirically. For instance, the Comprehensive Test Ban Treaty can come into force *only* if all the current and potential nuclear powers sign it. Another case in point is the Kyoto Protocol. After the US refusal to be a party to the protocol, will the rest of the countries implement or abandon it? See Tulkens (1998) for an interesting discussion on the possibility of such coalition structures.

only if its members benefit from **all final** outcomes that its deviation may lead to. It is clear from the discussion above that the assumption underlying the **g**-theory is in the same vein, as it is equivalent to assuming that a coalition engages in deviation *if and only if* its members strictly benefit from the outcome that gives the least payoffs from among all the final outcomes its deviation may lead to.¹⁰ Any other final outcomes, even if they strictly benefit the deviating coalition, are irrelevant and the possibility of just one final outcome which does not strictly benefit the members of the deviating coalition is enough to deter it from deviation.

We have illustrated by means of a simple example why after the deviation by a coalition S , the complement $N \setminus S$ may break up into singletons and deter the deviation. We now extend this argument to the general model. Some new complications arise that have been intentionally avoided by constructing a suitable example so that we could focus on the basic argument. However, our conclusions remain the same.

3. The General Model

Let $N = \{1, 2, \dots, n\}$ be the set of identical agents and suppose that the private good and the environmental good can be produced by the agents according to the following general rules:

$$y_i = g(e_i), i \in N, \text{ and } z = \sum_{i \in N} e_i, \quad (4)$$

where $g'(e_i) > 0$ and $g''(e_i) < 0$. As before, e_i denotes the emissions of agent i . The preferences of agent i are represented by the utility function:

$$u_i(y_i, z) = y_i - v(z), i \in N, \quad (5)$$

where $v'(z) > 0$ and $v''(z) \geq 0$.

¹⁰ There might seem to be an additional assumption underlying the **g**-core which is that the deviating coalition is able to foresee the final outcome after the complement breaks apart. But this is not an additional assumption at all as the coalitions are assumed to be farsighted to begin with.

We **assume** that there exists a finite e^0 such that $g'(e^0) < v'(e^0)$ and $g'(0) > nv'(e^0)$. This assumption rules out corner solutions and ensures that the emissions of the utility maximizing agents are no higher than e^0 .

Let $(e_1^*, e_2^*, \dots, e_n^*)$ be the Pareto efficient emissions. Then, the first order conditions imply

$$g'(e_i^*) = nv'(z^*), \text{ and } e_i^* = e_j^*, i \in N. \quad (6)$$

Let $u_i^* = g(e_i^*) - v(z^*)$, $i \in N$, be the corresponding payoffs.

Let $T_i = \{e_i : 0 \leq e_i \leq e^0\}$, $T = T_1 \times T_2 \times \dots \times T_n$, and $u = (u_1, u_2, \dots, u_n)$. We consider the strategic form game $[N, T, u]$.

Let $(\bar{e}_1, \bar{e}_2, \dots, \bar{e}_n)$ denote the Nash equilibrium of the game $[N, T, u]$. Then,

$$g'(\bar{e}_i) = v'(\sum_{j \in N} \bar{e}_j), i = 1, 2, \dots, n. \quad (7)$$

Let $(\bar{u}_1, \bar{u}_2, \dots, \bar{u}_n)$ denote the payoffs corresponding to the Nash equilibrium, i.e.,

$$\bar{u}_i = g(\bar{e}_i) - v(\bar{z}), \bar{z} = \sum_{j \in N} \bar{e}_j.$$

A *partition* of N is $P = (S_1, S_2, \dots, S_m)$ such that $\bigcup_{j=1}^m S_j = N$ and for all $i \neq j$, $S_i \cap S_j = \Phi$.

Let n_j denote the cardinality of S_j , i.e., $n_j = |S_j|$. Since the players are identical, we may denote coalition S_j interchangeably by n_j . Those partitions of N that consist of a possibly non-singleton coalition S followed by one or more coalitions of singletons are of particular interest. We denote such a partition simply by $(S, 1, 1, \dots, 1)$. The finest partition of N consisting of all singletons is denoted by $(1, 1, \dots, 1)$. We shall interchangeably refer to the partition $P = (S_1, S_2, \dots, S_m)$ as the set of coalitions S_1, S_2, \dots, S_m , i.e., as $\{S_1, S_2, \dots, S_m\}$.

A partition P is called a *coalition structure* and let \wp be the *set of all coalition structures*. The idea of non-cooperative play across coalitions in a coalition structure is captured in the following definition.

Given a coalition structure $P \in \wp$, the corresponding *coalitional equilibrium* is $(\tilde{e}_1, \tilde{e}_2, \dots, \tilde{e}_n)$ defined as

$$(\tilde{e}_i)_{i \in S_j} = \operatorname{argmax} \left(\sum_{i \in S_j} [g(e_i) - v(\sum_{i \in S_j} e_i + \sum_{k \in N \setminus S_j} \tilde{e}_k)] \right), j = 1, 2, \dots, m.$$

First order conditions imply

$$g'(\tilde{e}_i) = n_j v'(\sum_{k \in N} \tilde{e}_k), i \in S_j, j = 1, 2, \dots, m. \quad (8)$$

Since g is concave, $\tilde{e}_i < \tilde{e}_j$ if $i \in S_k$ and $j \in S_l$ with $n_k > n_l$. Let $\tilde{z} = \sum_{j \in N} \tilde{e}_j$ denote the total emissions corresponding to the coalitional equilibrium. Then, $\tilde{u}_i \equiv g(\tilde{e}_i) - v(\tilde{z}) < \tilde{u}_j \equiv g(\tilde{e}_j) - v(\tilde{z})$ if $i \in S_k$ and $j \in S_l$ with $n_k > n_l$, since $\tilde{e}_i < \tilde{e}_j$. So the payoffs of the members of larger coalitions are lower. Furthermore, by comparing (8) with the optimality condition (6), it follows that $\sum_{i \in N} \tilde{u}_i < \sum_{i \in N} u_i^*$ if $P \neq N$. This leads to the following lemma

Lemma 1: The payoffs of the members of the largest coalition in a coalitional equilibrium are lower than their payoffs in the grand coalition, i.e., $\tilde{u}_i < u_i^*$ for all $i \in S_k$ such that $n_k \geq n_j$ for all j .

This lemma has the following two important implications: (a) Let $(\hat{e}_1, \hat{e}_2, \dots, \hat{e}_n)$ denote the coalitional equilibrium corresponding to the partition $(S, 1, 1, \dots, 1)$ of N with $S \neq N$ and let $(\hat{u}_1, \hat{u}_2, \dots, \hat{u}_n)$ be the corresponding payoffs. Then, $\hat{u}_i < u_i^*$ for $i \in S$, and (b) $\bar{u}_i < u_i^*, i \in N$, where, as above, \bar{u}_i 's are the payoffs corresponding to the Nash equilibrium.

The existence and uniqueness of Nash equilibrium as well as coalitional equilibria with respect to any given partition of N follow from standard arguments as the strategy sets are compact and convex and the payoff functions are concave (see e.g. Chander and Tulkens (1997))

Since the payoff of each player in a coalitional equilibrium depends on the entire coalition structure P , let $u_i: \wp \rightarrow R$ denote i 's payoff.

Given a coalition structure, either a coalition may break up into smaller coalitions or several coalitions may merge into a larger coalition. This is expressed formally as follows:

Given a coalition structure $P = \{S_1, S_2, \dots, S_m\} \in \wp$, a collection of coalitions $T = \{T_1, T_2, \dots, T_k\}$ induce a coalition structure $P' \in \wp$ such that

- (i) either $T \subset P'$ and
 $\exists S \in P$ such that $(\bigcup_{i=1}^k T_i) \subset S$ and if $(S \setminus \bigcup_{i=1}^k T_i) \neq \Phi$, then $(S \setminus \bigcup_{i=1}^k T_i) \in P'$.
- (ii) or $T \subset P$ and $\bigcup_{i=1}^k T_i \in P'$.

This means that either P is coarser than P' or P' is coarser than P . Note that any given coalition structure P' can be induced from any other coalition structure P through a sequence of steps such as (i) and (ii).

We will write $P \xrightarrow{T} P'$ to denote “ T induces P' from P ”.

Indirect Dominance¹¹: P' indirectly dominates P , if there exists a sequence of coalition structures $P^1, P^2, \dots, P^s \in \wp$, where $P^1 = P$ and $P' = P^s$, and a sequence of collection of coalitions T^1, T^2, \dots, T^{s-1} such that for all $j = 1, 2, \dots, s-1$

¹¹ See also Harsanyi (1974), Chwe (1994) and Xue (1998).

(i) $P^j \xrightarrow{T^j} P^{j+1}$ and

(ii) $u_i(P^j) < u_i(P')$ for each $i \in T_l^j$ and $T_l^j \in T^j$.

The indirect dominance relation captures the idea that farsighted coalitions consider the final coalition structure that their deviations may lead to, and that only those deviations that strictly benefit their members in the end are carried out. A coalition structure P' indirectly dominates P if P' can replace P through a sequence of deviations such that at each step all deviators would be better-off at the final coalition structure P' compared to the status-quo they face.

Lemma 2: Let $P = (S_1, S_2, \dots, S_m)$ be some coalition structure and let $P' = P$ be a coalition structure induced from P by a collection of coalitions $T = \{T_1, T_2, \dots, T_k\}$, i.e., $P \xrightarrow{T} P'$ such that $T \subset P'$ and $\bigcup_{i=1}^k T_i \in P$, i.e., P is coarser than P' . Then, $u_i(P') < u_i(P)$ for all $i \in S_j \neq \bigcup_{i=1}^k T_i, j \in \{1, 2, \dots, m\}$.

Proof of Lemma 2: Let $(\tilde{e}_1, \tilde{e}_2, \dots, \tilde{e}_n)$ and $(e'_1, e'_2, \dots, e'_n)$ be the coalitional equilibrium strategies corresponding to P and P' , respectively. Let $\tilde{z} = \sum_{i \in N} \tilde{e}_i$ and $z' = \sum_{i \in N} e'_i$. We claim that $z' > \tilde{z}$. Suppose not, i.e., let $z' \leq \tilde{z}$. Then, from (8) and convexity of v , $e'_i \geq \tilde{e}_i$ for each $i \in S_j \neq \bigcup_{i=1}^k T_i, j \in \{1, 2, \dots, m\}$, and $e'_i > \tilde{e}_i$ for each $i \in \bigcup_{j=1}^k T_j$, since $|T_j| < \left| \bigcup_{i=1}^k T_i \right|$ for each j . But this contradicts our supposition that $z' \leq \tilde{z}$. Hence $z' > \tilde{z}$ and $e'_i \leq \tilde{e}_i$ for each $i \in S_j \neq \bigcup_{i=1}^k T_i, j \in \{1, 2, \dots, m\}$. This proves the lemma as this means $u_i(P') < u_i(P)$ for $i \in S_j \neq \bigcup_{i=1}^k T_i, j \in \{1, 2, \dots, m\}$.

Lemma 2 implies that coalition formation results into positive externalities for other coalitions. Intuitively, when a coalition forms its members internalize the effect of their emissions on each other resulting into lower emissions which benefits the other coalitions as well.

Proposition 1: Let $P = (S, N \setminus S)$ for some $S \neq N$. Then, $P' = N$ indirectly dominates P .

Proof of Proposition 1: There are two possible cases: either $|S| \leq |N \setminus S|$ or $|S| > |N \setminus S|$. Consider first $|S| \leq |N \setminus S|$. Let $(\tilde{u}_1, \tilde{u}_2, \dots, \tilde{u}_n)$ be the coalitional equilibrium payoffs corresponding to the partition $(S, N \setminus S)$. Then, in view of Lemma 1, $\tilde{u}_i < u_i^*$ for all $i \in N \setminus S$. Furthermore, let $(\hat{u}_1, \hat{u}_2, \dots, \hat{u}_n)$ be the coalitional equilibrium payoffs corresponding to the partition $(S, 1, 1, \dots, 1)$. Then, $\hat{u}_i < u_i^*$ for $i \in S$. Similarly, $\bar{u}_i < u_i^*$ for $i \in N$ where \bar{u}_i 's are the Nash equilibrium payoffs. Consider the sequence of partitions P^1, P^2, P^3, P^4 with $P^1 = P (= (S, N \setminus S))$, $P^2 = (S, 1, 1, \dots, 1)$, $P^3 = (1, 1, \dots, 1)$ and $P^4 = N$. Let $P' = P^4$, $T^1 = \{\{i\} : i \in N \setminus S\}$, $T^2 = \{\{i\} : i \in S\}$, and $T^3 = \{\{i\} : i \in N\}$. Then, (i) $P^j \xrightarrow{T^j} P^{j+1}$ and $u_i(P^j) < u_i(P')$ for each $\{i\} \in T^j$, $j = 1, 2, 3$. This proves that $P' = N$ indirectly dominates $P = (S, N \setminus S)$.

If $|S| > |N \setminus S|$, then by interchanging S and $N \setminus S$ and applying the same argument as in the preceding paragraph, S may break up into singletons first, followed by the breaking up of $N \setminus S$, which would then lead to the formation of N . This completes the proof.

Notice that in the first case $N \setminus S$ has incentives to break up into singletons before S does. This is consistent with the \mathbf{g} -assumption that $N \setminus S$ breaks up into singletons after S deviates. In the second case however $N \setminus S$ breaks up into singletons after S does and this may seem to be inconsistent with the \mathbf{g} -assumption, but it is not. The reason is that when

$|S| > |N \setminus S|$ it does not matter whether or not $N \setminus S$ breaks up into singletons before S does. If $N \setminus S$ is assumed to breakup into singletons before S does then, in view of Lemma 2, the payoffs of members of S corresponding to the resulting coalition structure $(S, 1, 1, \dots, 1)$ would be even lower and S would still have incentives to break up into singletons. Therefore, assuming that $N \setminus S$ breaks up into singletons before S does is inconsequential when $|S| > |N \setminus S|$ as it does not affect the final outcome. In other words, there is no loss of generality in assuming, as the \mathbf{g} -theory does, that $N \setminus S$ breaks up into singletons.

As mentioned earlier the \mathbf{g} -theory is applicable to games that are not necessarily symmetric. Now in the asymmetric games, unlike the symmetric games, there is no relationship between the size of the coalition and the payoffs of its members, that is, ‘the size does not matter’. Therefore, in the asymmetric games there are no two distinct cases as in the proof of Proposition 1. There is just one case to deal with and only one assumption to make that can be applied uniformly to all deviating coalitions irrespective of their size. It therefore makes sense to assume that $N \setminus S$ breaks up into singletons no matter whether S is larger or smaller than $N \setminus S$.

We postpone further discussion of the asymmetric games to later sections. For the time being we return to symmetric games. We show that there is in fact no coalition structure other than N which is stable.

Proposition 2: Let $P \in \wp$ be any coalition structure such that $P \neq N$. Then, $P' = N$ indirectly dominates P and N is the only stable coalition structure.

Proof of Proposition 2: Let $P \in \wp$ be some coalition structure. If $P = (1, 1, \dots, 1)$, then $u_i(P) < u_i^*$ for all $i \in P$ and therefore $P \xrightarrow{\{\{i\}: i \in N\}} N$. If not, let $P^1 \equiv P$ and let S_1 be the largest coalition in P^1 . Then, $|S_1| > 1$ and, in view of Lemma 1, $u_i(P^1) < u_i^*$ for all $i \in S_1$. Now $P^1 \xrightarrow{\{\{i\}: i \in S_1\}} P^2$, where P^2 is the coalition structure in which S_1 has been replaced

by the coalitions $\{\{i\}:i \in S_1\}$. If $P^2 \neq (1,1,\dots,1)$, then let S_2 be the largest coalition in P^2 . Then, $|S_2| > 1$ and $u_i(P^2) < u_i^*$ for $i \in S_2$. Thus, $P^2 \xrightarrow{\{\{i\}:i \in S_2\}} P^3$, where P^3 is the coalition structure obtained by replacing S_2 by $\{\{i\}:i \in S_2\}$. We can continue in this fashion until we obtain $P^k = (1,1,\dots,1)$ for some k . This defines a sequence of collections of coalitions T^1, T^2, \dots, T^k such that $P^1 \xrightarrow{T^1} P^2 \xrightarrow{T^2} P^3 \dots \xrightarrow{T^{k-1}} P^k$ and $u_i(P^j) < u_i^*$ for each $\{i\} \in T^j, j = 1, 2, \dots, k$. Since $P^k \xrightarrow{\{\{i\}:i \in N\}} N$ and $u_i(P^k) < u_i^*$ for each $i \in N$, N indirectly dominates P^1 .

We have shown that given any coalition structure $P \neq N$, there will always be a deviation and that N indirectly dominates every coalition structure $P \neq N$. This proves that N is the only stable coalition structure.

Some remarks are in order. Chander (1999) proves the stability of the grand coalition for games with three players. Diamantoudi and Xue (2002) prove the stability of the grand coalition for games with more than three players. However, they obtain multiple \sqrt{N} -M stable sets and stability of some coalition structures other than the grand coalition. In their framework a farsighted coalition may not engage in deviation even if it stands to strictly gain from the deviation.

4. The Asymmetric Case

We show that the \mathbf{g} -core can be justified similarly in the context of the asymmetric games. We first prove a lemma and then discuss this issue in the concluding section.

If the agents are not identical, equations (4) and (5) are modified as follows:

$$y_i = g_i(e_i), i \in N, \text{ and } z = \sum_{i \in N} e_i, \quad (9)$$

where $g'_i(e_i) > 0$ and $g''_i(e_i) < 0$. As before, e_i denotes the emissions of agent i . The preferences of agent i are represented by the utility function:

$$u_i(y_i, z) = y_i - v_i(z), i \in N, \quad (10)$$

where $v'_i(z) > 0$ and $v''_i(z) \geq 0$. The subscripts in the functions g_i and v_i capture the fact that the agents are not necessarily identical.

Given a coalitional structure $P = (S_1, S_2, \dots, S_m)$, let $(\tilde{e}_1, \tilde{e}_2, \dots, \tilde{e}_n)$ be the corresponding coalitional equilibrium. Then from the first order conditions

$$g'_i(\tilde{e}_i) = \sum_{l \in S_j} v'_l(\sum_{k \in N} \tilde{e}_k), i \in S_j, j = 1, 2, \dots, m. \quad (11)$$

Lemma 3: Suppose the agents are not identical. Let $P = (S, 1, 1, \dots, 1)$ be some coalition structure and let $P' = (S, T_1, T_2, \dots, T_m)$ be a coalition structure such that $|T_k| > 1$ for at least some $k \in \{1, 2, \dots, m\}$. Then, $u_i(P') > u_i(P)$ for all $i \in S$.

Proof of Lemma 3: Let $(\hat{e}_1, \hat{e}_2, \dots, \hat{e}_n)$ and $(e'_1, e'_2, \dots, e'_n)$ be the coalitional equilibrium strategies corresponding to P and P' , respectively. Let $\hat{z} = \sum_{i \in N} \hat{e}_i$ and $z' = \sum_{i \in N} e'_i$. We claim that $z' < \hat{z}$. Suppose not, i.e., let $z' \geq \hat{z}$. Then, as seen from (11), convexity of each v_l and $|T_j| \geq 1$ for each $j = 1, 2, \dots, m$, imply that $e'_i \leq \hat{e}_i$ for each $i \in N$ and $e'_i < \hat{e}_i$ for each $i \in T_k$ such that $|T_k| > 1$. But this contradicts our supposition that $z' \geq \hat{z}$. Hence $z' < \hat{z}$ and $e'_i \geq \hat{e}_i$ for each $i \in S$. But this proves the lemma as this means $u_i(P') > u_i(P)$ for $i \in S$.

Furthermore, as shown in Chander and Tulkens (1995, 1997),¹² there exists an imputation (x_1, x_2, \dots, x_n) possibly involving transfers among the members of the grand coalition such that for all $P = (S, 1, 1, \dots, 1), S \subset N$,

$$\sum_{i \in N} x_i = \sum_{i \in N} u_i(N) \text{ and } \sum_{i \in S} x_i \geq \sum_{i \in S} u_i(P).$$

¹² See also Helms (2001).

This means that if, as in the symmetric case, the deviating coalition S presumes that $N \setminus S$ will break up into singletons, then it will have no incentive to engage in the deviation, which implies stability of the grand coalition.

5. Conclusions

The purpose of this paper is not to review the coalition formation theory, but to justify in terms of this theory the g -core and its prediction that the efficient coalition structure is stable. Some comparisons are however unavoidable. This has reference to the fact that the g -theory has been developed and applied to asymmetric games whereas the coalition formation theory has been shown to be applicable to only symmetric games. For example, if the players are not identical, what would be the equilibrium coalition structure in our game with three players after $\{3\}$ deviates? Since the payoffs of the players across the coalitions can no longer be compared, the coalition formation theory is unable to make any prediction in such cases.¹³ It is therefore reasonable to assume that in asymmetric games the deviating coalitions are also not able to predict the coalition structure subsequent to their deviations. In the face of such uncertainty, a coalition may deviate only if its members would benefit in all subsequent coalition structures. But this is precisely the assumption underlying the g -core, as Lemma 3 shows for the asymmetric case that the payoffs of the members of the deviating coalition S are minimized when $N \setminus S$ breaks up into singletons.¹⁴

We have restricted our analysis to a class of games that imply positive externalities from coalition formation. For games with negative externalities, the corresponding assumption underlying the g -characteristic function is that S assumes that the coalition $N \setminus S$ would form and its members would adopt the best response *joint* strategies. We however do not pursue this here as it is the subject matter of another paper.

¹³ An additional complication is that of transfers among the members of a coalition, which has also not been satisfactorily resolved in the coalition formation theory for asymmetric games.

¹⁴ It also clarifies that it is transfers among the members of the grand coalition and not among the members of the deviating coalitions that play an important role.

Overall, our analysis shows that in order to obtain stability of coalition structures other than the grand coalition or the efficient coalition structure one must either invoke the assumption of myopia or place some exogenous restrictions on the process of coalition formation.

References

1. Barrett, S. (1994), "Self-enforcing international environmental agreements", *Oxford Economic Papers*, 46, 804-78.
2. Barrett, S. (2003), *Environment and Statcraft*, Oxford University Press, Chapter 7.
3. Carraro, C. and D. Siniscalco (1993), "Strategies for the international protection of the environment", *Journal of Public Economics*, 52, 309-28.
4. Helms, Carsten (2001), "On the existence of a cooperative solution for a coalitional game with externalities", *International Journal of Game Theory*, 30, 141-147.
5. Chander, P. (1993), "Dynamic procedures and incentives in public good economies", *Econometrica*, 61, 1341-54.
6. Chander, P. and H. Tulkens (1995), "A core-theoretic solution for the design of cooperative agreements on transfrontier pollution", *International Tax and Public Finance*, 2, 279-93.
7. Chander, P. and H. Tulkens (1997), "The core of an economy with multilateral environmental externalities", *International Journal of Game Theory*, 26, 379-401.
8. Chander, P. (1999), "International treaties on global pollution: a dynamic time-path analysis", in G. Ranis and L.K. Raut (eds), *Trade, Growth and Development: essays in honor of T.N. Srinivasan*, Elsevier Science, Amsterdam
9. Chwe, M. S.-Y. (1994), "Farsighted coalitional stability", *Journal of Economic Theory*, 63, 299-325.
10. D'Aspremont, C. and J.J. Gabszewicz (1986), "On the stability of collusion", in J.E. Stiglitz and G.F. Mathewson (eds), *New Developments in the Analysis of Market Structure*, pp. 243-64, The MIT Press, Cambridge (MA)
11. Diamantoudi, E. and L. Xue (2002), "Coalitions, agreements and efficiency" memo (May).
12. Foley, D. (1970), "Lindahl solution and the core of an economy with public goods", *Econometrica*, 38, 66-72.
13. Greenberg, J. (1990), *The Theory of Social Situations*, Cambridge University Press, Cambridge
14. Harsanyi, J.C. (1974), "Interpretation of stable sets and a proposed alternative definition", *Management Science*, 20, 1472-95.

15. Hart, S. and M. Kurz (1983), "Endogenous formation of coalitions", *Econometrica*, 51, 1047-64.
16. Mäler, K.-G. (1989), "The acid rain game", in H. Folmer and E. van Ierland (eds), *Valuation Methods and Policy Making in Environmental Economics*, pp. 231-52, Elsevier, Amsterdam
17. Moulin, H. (1987), "Egalitarian-equivalent cost sharing of a public good", *Econometrica*, 55, 963-76.
18. Ray, D. and R. Vohra (1997), "Equilibrium binding agreements", *Journal of Economic Theory*, 73, 30-78.
19. Ray, D. and R. Vohra (1999), "A theory of endogenous coalition structures", *Games and Economic Behavior*, 26, 286-336.
20. Roberts, D.J. (1974), "The Lindahl solution for economies with public goods", *Journal of Public Economics*, 3, 23-42.
21. Scarf H. (1971), "On the existence of a cooperative solution for a general class of N -person games", *Journal of Economic Theory*, 3, 169-81.
22. Starrett D. (1972), "A note on externalities and the core", *Econometrica*, 41 (1), 179-83.
23. Tulkens, H. (1998), "Cooperation versus free-riding in international environmental affairs: two approaches" in N.Hanley and H.Folmer (eds), *Game Theory And The Environment*, pp 30-44, Edward Elgar, Cheltenham.
24. Xue, L. (1998), "Coalitional stability under perfect foresight", *Economic Theory*, 11, 603-27.
25. Yi, S. (1997), "Stable coalition structures with externalities", *Games and Economic Behavior*, 20, 201-37.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our working papers are available on the Internet at the following addresses:

<http://www.feem.it/Feem/Pub/Publications/WPapers/default.html>

<http://papers.ssrn.com>

SUST	1.2002	<i>K. TANO, M.D. FAMINOW, M. KAMUANGA and B. SWALLOW: <u>Using Conjoint Analysis to Estimate Farmers' Preferences for Cattle Traits in West Africa</u></i>
ETA	2.2002	<i>Efrem CASTELNUOVO and Paolo SURICO: <u>What Does Monetary Policy Reveal about Central Bank's Preferences?</u></i>
WAT	3.2002	<i>Duncan KNOWLER and Edward BARBIER: <u>The Economics of a "Mixed Blessing" Effect: A Case Study of the Black Sea</u></i>
CLIM	4.2002	<i>Andreas LÖSCHEL: <u>Technological Change in Economic Models of Environmental Policy: A Survey</u></i>
VOL	5.2002	<i>Carlo CARRARO and Carmen MARCHIORI: <u>Stable Coalitions</u></i>
CLIM	6.2002	<i>Marzio GALEOTTI, Alessandro LANZA and Matteo MANERA: <u>Rockets and Feathers Revisited: An International Comparison on European Gasoline Markets</u></i>
ETA	7.2002	<i>Effrosyni DIAMANTOUDI and Efthios S. SARTZETAKIS: <u>Stable International Environmental Agreements: An Analytical Approach</u></i>
KNOW	8.2002	<i>Alain DESDOIGTS: <u>Neoclassical Convergence Versus Technological Catch-up: A Contribution for Reaching a Consensus</u></i>
NRM	9.2002	<i>Giuseppe DI VITA: <u>Renewable Resources and Waste Recycling</u></i>
KNOW	10.2002	<i>Giorgio BRUNELLO: <u>Is Training More Frequent when Wage Compression is Higher? Evidence from 11 European Countries</u></i>
ETA	11.2002	<i>Mordecai KURZ, Hehui JIN and Maurizio MOTOLESE: <u>Endogenous Fluctuations and the Role of Monetary Policy</u></i>
KNOW	12.2002	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Escaping Lock-in: The Scope for a Transition towards Sustainable Growth?</u></i>
NRM	13.2002	<i>Michele MORETTO and Paolo ROSATO: <u>The Use of Common Property Resources: A Dynamic Model</u></i>
CLIM	14.2002	<i>Philippe QUIRION: <u>Macroeconomic Effects of an Energy Saving Policy in the Public Sector</u></i>
CLIM	15.2002	<i>Roberto ROSON: <u>Dynamic and Distributional Effects of Environmental Revenue Recycling Schemes: Simulations with a General Equilibrium Model of the Italian Economy</u></i>
CLIM	16.2002	<i>Francesco RICCI (I): <u>Environmental Policy Growth when Inputs are Differentiated in Pollution Intensity</u></i>
ETA	17.2002	<i>Alberto PETRUCCI: <u>Devaluation (Levels versus Rates) and Balance of Payments in a Cash-in-Advance Economy</u></i>
Coalition Theory Network	18.2002	<i>László Á. KÓCZY (liv): <u>The Core in the Presence of Externalities</u></i>
Coalition Theory Network	19.2002	<i>Steven J. BRAMS, Michael A. JONES and D. Marc KILGOUR (liv): <u>Single-Peakedness and Disconnected Coalitions</u></i>
Coalition Theory Network	20.2002	<i>Guillaume HAERINGER (liv): <u>On the Stability of Cooperation Structures</u></i>
NRM	21.2002	<i>Fausto CAVALLARO and Luigi CIRAOLO: <u>Economic and Environmental Sustainability: A Dynamic Approach in Insular Systems</u></i>
CLIM	22.2002	<i>Barbara BUCHNER, Carlo CARRARO, Igor CERSOSIMO and Carmen MARCHIORI: <u>Back to Kyoto? US Participation and the Linkage between R&D and Climate Cooperation</u></i>
CLIM	23.2002	<i>Andreas LÖSCHEL and ZhongXIANG ZHANG: <u>The Economic and Environmental Implications of the US Repudiation of the Kyoto Protocol and the Subsequent Deals in Bonn and Marrakech</u></i>
ETA	24.2002	<i>Marzio GALEOTTI, Louis J. MACCINI and Fabio SCHIANTARELLI: <u>Inventories, Employment and Hours</u></i>
CLIM	25.2002	<i>Hannes EGLI: <u>Are Cross-Country Studies of the Environmental Kuznets Curve Misleading? New Evidence from Time Series Data for Germany</u></i>
ETA	26.2002	<i>Adam B. JAFFE, Richard G. NEWELL and Robert N. STAVINS: <u>Environmental Policy and Technological Change</u></i>
SUST	27.2002	<i>Joseph C. COOPER and Giovanni SIGNORELLO: <u>Farmer Premiums for the Voluntary Adoption of Conservation Plans</u></i>
SUST	28.2002	<i><u>The ANSEA Network: Towards An Analytical Strategic Environmental Assessment</u></i>
KNOW	29.2002	<i>Paolo SURICO: <u>Geographic Concentration and Increasing Returns: a Survey of Evidence</u></i>
ETA	30.2002	<i>Robert N. STAVINS: <u>Lessons from the American Experiment with Market-Based Environmental Policies</u></i>

NRM	31.2002	<i>Carlo GIUPPONI and Paolo ROSATO: <u>Multi-Criteria Analysis and Decision-Support for Water Management at the Catchment Scale: An Application to Diffuse Pollution Control in the Venice Lagoon</u></i>
NRM	32.2002	<i>Robert N. STAVINS: <u>National Environmental Policy During the Clinton Years</u></i>
KNOW	33.2002	<i>A. SOUBEYRAN and H. STAHN : <u>Do Investments in Specialized Knowledge Lead to Composite Good Industries?</u></i>
KNOW	34.2002	<i>G. BRUNELLO, M.L. PARISI and Daniela SONEDDA: <u>Labor Taxes, Wage Setting and the Relative Wage Effect</u></i>
CLIM	35.2002	<i>C. BOEMARE and P. QUIRION (lv): <u>Implementing Greenhouse Gas Trading in Europe: Lessons from Economic Theory and International Experiences</u></i>
CLIM	36.2002	<i>T. TIETENBERG (lv): <u>The Tradable Permits Approach to Protecting the Commons: What Have We Learned?</u></i>
CLIM	37.2002	<i>K. REHDANZ and R.J.S. TOL (lv): <u>On National and International Trade in Greenhouse Gas Emission Permits</u></i>
CLIM	38.2002	<i>C. FISCHER (lv): <u>Multinational Taxation and International Emissions Trading</u></i>
SUST	39.2002	<i>G. SIGNORELLO and G. PAPPALARDO: <u>Farm Animal Biodiversity Conservation Activities in Europe under the Framework of Agenda 2000</u></i>
NRM	40.2002	<i>S.M. CAVANAGH, W. M. HANEMANN and R. N. STAVINS: <u>Muffled Price Signals: Household Water Demand under Increasing-Block Prices</u></i>
NRM	41.2002	<i>A. J. PLANTINGA, R. N. LUBOWSKI and R. N. STAVINS: <u>The Effects of Potential Land Development on Agricultural Land Prices</u></i>
CLIM	42.2002	<i>C. OHL (lvi): <u>Inducing Environmental Co-operation by the Design of Emission Permits</u></i>
CLIM	43.2002	<i>J. EYCKMANS, D. VAN REGEMORTER and V. VAN STEENBERGHE (lvi): <u>Is Kyoto Fatally Flawed? An Analysis with MacGEM</u></i>
CLIM	44.2002	<i>A. ANTOCI and S. BORGHESI (lvi): <u>Working Too Much in a Polluted World: A North-South Evolutionary Model</u></i>
ETA	45.2002	<i>P. G. FREDRIKSSON, Johan A. LIST and Daniel MILLIMET (lvi): <u>Chasing the Smokestack: Strategic Policymaking with Multiple Instruments</u></i>
ETA	46.2002	<i>Z. YU (lvi): <u>A Theory of Strategic Vertical DFI and the Missing Pollution-Haven Effect</u></i>
SUST	47.2002	<i>Y. H. FARZIN: <u>Can an Exhaustible Resource Economy Be Sustainable?</u></i>
SUST	48.2002	<i>Y. H. FARZIN: <u>Sustainability and Hamiltonian Value</u></i>
KNOW	49.2002	<i>C. PIGA and M. VIVARELLI: <u>Cooperation in R&D and Sample Selection</u></i>
Coalition Theory Network Coalition Theory Network	50.2002	<i>M. SERTEL and A. SLINKO (liv): <u>Ranking Committees, Words or Multisets</u></i>
Coalition Theory Network	51.2002	<i>Sergio CURRARINI (liv): <u>Stable Organizations with Externalities</u></i>
ETA	52.2002	<i>Robert N. STAVINS: <u>Experience with Market-Based Policy Instruments</u></i>
ETA	53.2002	<i>C.C. JAEGER, M. LEIMBACH, C. CARRARO, K. HASSELMANN, J.C. HOURCADE, A. KEELER and R. KLEIN (liii): <u>Integrated Assessment Modeling: Modules for Cooperation</u></i>
CLIM	54.2002	<i>Scott BARRETT (liii): <u>Towards a Better Climate Treaty</u></i>
ETA	55.2002	<i>Richard G. NEWELL and Robert N. STAVINS: <u>Cost Heterogeneity and the Potential Savings from Market-Based Policies</u></i>
SUST	56.2002	<i>Paolo ROSATO and Edi DEFRANCESCO: <u>Individual Travel Cost Method and Flow Fixed Costs</u></i>
SUST	57.2002	<i>Vladimir KOTOV and Elena NIKITINA (lvii): <u>Reorganisation of Environmental Policy in Russia: The Decade of Success and Failures in Implementation of Perspective Quests</u></i>
SUST	58.2002	<i>Vladimir KOTOV (lvii): <u>Policy in Transition: New Framework for Russia's Climate Policy</u></i>
SUST	59.2002	<i>Fanny MISSFELDT and Arturo VILLAVICENCO (lvii): <u>How Can Economies in Transition Pursue Emissions Trading or Joint Implementation?</u></i>
VOL	60.2002	<i>Giovanni DI BARTOLOMEO, Jacob ENGWERDA, Joseph PLASMANS and Bas VAN AARLE: <u>Staying Together or Breaking Apart: Policy-Makers' Endogenous Coalitions Formation in the European Economic and Monetary Union</u></i>
ETA	61.2002	<i>Robert N. STAVINS, Alexander F. WAGNER and Gernot WAGNER: <u>Interpreting Sustainability in Economic Terms: Dynamic Efficiency Plus Intergenerational Equity</u></i>
PRIV	62.2002	<i>Carlo CAPUANO: <u>Demand Growth, Entry and Collusion Sustainability</u></i>
PRIV	63.2002	<i>Federico MUNARI and Raffaele ORIANI: <u>Privatization and R&D Performance: An Empirical Analysis Based on Tobin's Q</u></i>
PRIV	64.2002	<i>Federico MUNARI and Maurizio SOBRERO: <u>The Effects of Privatization on R&D Investments and Patent Productivity</u></i>
SUST	65.2002	<i>Orley ASHENFELTER and Michael GREENSTONE: <u>Using Mandated Speed Limits to Measure the Value of a Statistical Life</u></i>
ETA	66.2002	<i>Paolo SURICO: <u>US Monetary Policy Rules: the Case for Asymmetric Preferences</u></i>
PRIV	67.2002	<i>Rinaldo BRAU and Massimo FLORIO: <u>Privatisations as Price Reforms: Evaluating Consumers' Welfare Changes in the U.K.</u></i>
CLIM	68.2002	<i>Barbara K. BUCHNER and Roberto ROSON: <u>Conflicting Perspectives in Trade and Environmental Negotiations</u></i>
CLIM	69.2002	<i>Philippe QUIRION: <u>Complying with the Kyoto Protocol under Uncertainty: Taxes or Tradable Permits?</u></i>
SUST	70.2002	<i>Anna ALBERINI, Patrizia RIGANTI and Alberto LONGO: <u>Can People Value the Aesthetic and Use Services of Urban Sites? Evidence from a Survey of Belfast Residents</u></i>
SUST	71.2002	<i>Marco PERCOCO: <u>Discounting Environmental Effects in Project Appraisal</u></i>

NRM	72.2002	<i>Philippe BONTEMS and Pascal FAVARD: <u>Input Use and Capacity Constraint under Uncertainty: The Case of Irrigation</u></i>
PRIV	73.2002	<i>Mohammed OMRAN: <u>The Performance of State-Owned Enterprises and Newly Privatized Firms: Empirical Evidence from Egypt</u></i>
PRIV	74.2002	<i>Mike BURKART, Fausto PANUNZI and Andrei SHLEIFER: <u>Family Firms</u></i>
PRIV	75.2002	<i>Emmanuelle AURIOL, Pierre M. PICARD: <u>Privatizations in Developing Countries and the Government Budget Constraint</u></i>
PRIV	76.2002	<i>Nichole M. CASTATER: <u>Privatization as a Means to Societal Transformation: An Empirical Study of Privatization in Central and Eastern Europe and the Former Soviet Union</u></i>
PRIV	77.2002	<i>Christoph LÜLSFESMANN: <u>Benevolent Government, Managerial Incentives, and the Virtues of Privatization</u></i>
PRIV	78.2002	<i>Kate BISHOP, Igor FILATOTCHEV and Tomasz MICKIEWICZ: <u>Endogenous Ownership Structure: Factors Affecting the Post-Privatisation Equity in Largest Hungarian Firms</u></i>
PRIV	79.2002	<i>Theodora WELCH and Rick MOLZ: <u>How Does Trade Sale Privatization Work? Evidence from the Fixed-Line Telecommunications Sector in Developing Economies</u></i>
PRIV	80.2002	<i>Alberto R. PETRUCCI: <u>Government Debt, Agent Heterogeneity and Wealth Displacement in a Small Open Economy</u></i>
CLIM	81.2002	<i>Timothy SWANSON and Robin MASON (Ivi): <u>The Impact of International Environmental Agreements: The Case of the Montreal Protocol</u></i>
PRIV	82.2002	<i>George R.G. CLARKE and Lixin Colin XU: <u>Privatization, Competition and Corruption: How Characteristics of Bribe Takers and Payers Affect Bribe Payments to Utilities</u></i>
PRIV	83.2002	<i>Massimo FLORIO and Katuscia MANZONI: <u>The Abnormal Returns of UK Privatisations: From Underpricing to Outperformance</u></i>
NRM	84.2002	<i>Nelson LOURENÇO, Carlos RUSSO MACHADO, Maria do ROSÁRIO JORGE and Luis RODRIGUES: <u>An Integrated Approach to Understand Territory Dynamics. The Coastal Alentejo (Portugal)</u></i>
CLIM	85.2002	<i>Peter ZAPFEL and Matti VAINIO (Iv): <u>Pathways to European Greenhouse Gas Emissions Trading History and Misconceptions</u></i>
CLIM	86.2002	<i>Pierre COURTOIS: <u>Influence Processes in Climate Change Negotiations: Modelling the Rounds</u></i>
ETA	87.2002	<i>Vito FRAGNELLI and Maria Erminia MARINA (Iviii): <u>Environmental Pollution Risk and Insurance</u></i>
ETA	88.2002	<i>Laurent FRANCKX (Iviii): <u>Environmental Enforcement with Endogenous Ambient Monitoring</u></i>
ETA	89.2002	<i>Timo GOESCHL and Timothy M. SWANSON (Iviii): <u>Lost Horizons. The noncooperative management of an evolutionary biological system.</u></i>
ETA	90.2002	<i>Hans KEIDING (Iviii): <u>Environmental Effects of Consumption: An Approach Using DEA and Cost Sharing</u></i>
ETA	91.2002	<i>Wietze LISE (Iviii): <u>A Game Model of People's Participation in Forest Management in Northern India</u></i>
CLIM	92.2002	<i>Jens HORBACH: <u>Structural Change and Environmental Kuznets Curves</u></i>
ETA	93.2002	<i>Martin P. GROSSKOPF: <u>Towards a More Appropriate Method for Determining the Optimal Scale of Production Units</u></i>
VOL	94.2002	<i>Scott BARRETT and Robert STAVINS: <u>Increasing Participation and Compliance in International Climate Change Agreements</u></i>
CLIM	95.2002	<i>Banu BAYRAMOGLU LISE and Wietze LISE: <u>Climate Change, Environmental NGOs and Public Awareness in the Netherlands: Perceptions and Reality</u></i>
CLIM	96.2002	<i>Matthieu GLACHANT: <u>The Political Economy of Emission Tax Design in Environmental Policy</u></i>
KNOW	97.2002	<i>Kenn ARIGA and Giorgio BRUNELLO: <u>Are the More Educated Receiving More Training? Evidence from Thailand</u></i>
ETA	98.2002	<i>Gianfranco FORTE and Matteo MANERA: <u>Forecasting Volatility in European Stock Markets with Non-linear GARCH Models</u></i>
ETA	99.2002	<i>Geoffrey HEAL: <u>Bundling Biodiversity</u></i>
ETA	100.2002	<i>Geoffrey HEAL, Brian WALKER, Simon LEVIN, Kenneth ARROW, Partha DASGUPTA, Gretchen DAILY, Paul EHRlich, Karl-Goran MALER, Nils KAUTSKY, Jane LUBCHENCO, Steve SCHNEIDER and David STARRETT: <u>Genetic Diversity and Interdependent Crop Choices in Agriculture</u></i>
ETA	101.2002	<i>Geoffrey HEAL: <u>Biodiversity and Globalization</u></i>
VOL	102.2002	<i>Andreas LANGE: <u>Heterogeneous International Agreements – If per capita emission levels matter</u></i>
ETA	103.2002	<i>Pierre-André JOUVET and Walid OUESLATI: <u>Tax Reform and Public Spending Trade-offs in an Endogenous Growth Model with Environmental Externality</u></i>
ETA	104.2002	<i>Anna BOTTASSO and Alessandro SEMBENELLI: <u>Does Ownership Affect Firms' Efficiency? Panel Data Evidence on Italy</u></i>
PRIV	105.2002	<i>Bernardo BORTOLOTTI, Frank DE JONG, Giovanna NICODANO and Ibolya SCHINDELE: <u>Privatization and Stock Market Liquidity</u></i>
ETA	106.2002	<i>Haruo IMAI and Mayumi HORIE (Iviii): <u>Pre-Negotiation for an International Emission Reduction Game</u></i>
PRIV	107.2002	<i>Sudeshna GHOSH BANERJEE and Michael C. MUNGER: <u>Move to Markets? An Empirical Analysis of Privatisation in Developing Countries</u></i>
PRIV	108.2002	<i>Guillaume GIRMENS and Michel GUILLARD: <u>Privatization and Investment: Crowding-Out Effect vs Financial Diversification</u></i>
PRIV	109.2002	<i>Alberto CHONG and Florencio LÓPEZ-DE-SILANES: <u>Privatization and Labor Force Restructuring Around the World</u></i>
PRIV	110.2002	<i>Nandini GUPTA: <u>Partial Privatization and Firm Performance</u></i>
PRIV	111.2002	<i>François DEGEORGE, Dirk JENTER, Alberto MOEL and Peter TUFANO: <u>Selling Company Shares to Reluctant Employees: France Telecom's Experience</u></i>

PRIV	112.2002	<i>Isaac OTCHERE</i> : <u>Intra-Industry Effects of Privatization Announcements: Evidence from Developed and Developing Countries</u>
PRIV	113.2002	<i>Yannis KATSOULAKOS and Elissavet LIKOYANNI</i> : <u>Fiscal and Other Macroeconomic Effects of Privatization</u>
PRIV	114.2002	<i>Guillaume GIRMENS</i> : <u>Privatization, International Asset Trade and Financial Markets</u>
PRIV	115.2002	<i>D. Teja FLOTHO</i> : <u>A Note on Consumption Correlations and European Financial Integration</u>
PRIV	116.2002	<i>Ibolya SCHINDELE and Enrico C. PEROTTI</i> : <u>Pricing Initial Public Offerings in Premature Capital Markets: The Case of Hungary</u>
PRIV	1.2003	<i>Gabriella CHIESA and Giovanna NICODANO</i> : <u>Privatization and Financial Market Development: Theoretical Issues</u>
PRIV	2.2003	<i>Ibolya SCHINDELE</i> : <u>Theory of Privatization in Eastern Europe: Literature Review</u>
PRIV	3.2003	<i>Wietze LISE, Claudia KEMFERT and Richard S.J. TOL</i> : <u>Strategic Action in the Liberalised German Electricity Market</u>
CLIM	4.2003	<i>Laura MARSILIANI and Thomas I. RENSTRÖM</i> : <u>Environmental Policy and Capital Movements: The Role of Government Commitment</u>
KNOW	5.2003	<i>Reyer GERLAGH</i> : <u>Induced Technological Change under Technological Competition</u>
ETA	6.2003	<i>Efrem CASTELNUOVO</i> : <u>Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model</u>
SIEV	7.2003	<i>Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI</i> : <u>The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers</u>
NRM	8.2003	<i>Elissaios POPYRAKIS and Reyer GERLAGH</i> : <u>Natural Resources: A Blessing or a Curse?</u>
CLIM	9.2003	<i>A. CAPARRÓS, J.-C. PEREAU and T. TAZDAÏT</i> : <u>North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information</u>
KNOW	10.2003	<i>Giorgio BRUNELLO and Daniele CHECCHI</i> : <u>School Quality and Family Background in Italy</u>
CLIM	11.2003	<i>Efrem CASTELNUOVO and Marzio GALEOTTI</i> : <u>Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis</u>
KNOW	12.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.)</i> : <u>Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art</u>
KNOW	13.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO, Dino PINELLI and Francesco RULLANI (lix)</i> : <u>Bio-Ecological Diversity vs. Socio-Economic Diversity. A Comparison of Existing Measures</u>
KNOW	14.2003	<i>Maddy JAASSENS and Chris STEYAERT (lix)</i> : <u>Theories of Diversity within Organisation Studies: Debates and Future Trajectories</u>
KNOW	15.2003	<i>Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP (lix)</i> : <u>Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Economic Life</u>
KNOW	16.2003	<i>Alexandra BITUSIKOVA (lix)</i> : <u>Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia</u>
KNOW	17.2003	<i>Billy E. VAUGHN and Katarina MLEKOV (lix)</i> : <u>A Stage Model of Developing an Inclusive Community</u>
KNOW	18.2003	<i>Selma van LONDEN and Arie de RUIJTER (lix)</i> : <u>Managing Diversity in a Globalizing World</u>
Coalition Theory Network	19.2003	<i>Sergio CURRARINI</i> : <u>On the Stability of Hierarchies in Games with Externalities</u>
PRIV	20.2003	<i>Giacomo CALZOLARI and Alessandro PAVAN (lx)</i> : <u>Monopoly with Resale</u>
PRIV	21.2003	<i>Claudio MEZZETTI (lx)</i> : <u>Auction Design with Interdependent Valuations: The Generalized Revelation Principle, Efficiency, Full Surplus Extraction and Information Acquisition</u>
PRIV	22.2003	<i>Marco LiCalzi and Alessandro PAVAN (lx)</i> : <u>Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions</u>
PRIV	23.2003	<i>David ETTINGER (lx)</i> : <u>Bidding among Friends and Enemies</u>
PRIV	24.2003	<i>Hannu VARTAINEN (lx)</i> : <u>Auction Design without Commitment</u>
PRIV	25.2003	<i>Matti KELOHARJU, Kjell G. NYBORG and Kristian RYDQVIST (lx)</i> : <u>Strategic Behavior and Underpricing in Uniform Price Auctions: Evidence from Finnish Treasury Auctions</u>
PRIV	26.2003	<i>Christine A. PARLOUR and Uday RAJAN (lx)</i> : <u>Rationing in IPOs</u>
PRIV	27.2003	<i>Kjell G. NYBORG and Ilya A. STREBULAEV (lx)</i> : <u>Multiple Unit Auctions and Short Squeezes</u>
PRIV	28.2003	<i>Anders LUNANDER and Jan-Eric NILSSON (lx)</i> : <u>Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts</u>
PRIV	29.2003	<i>TangaMcDANIEL and Karsten NEUHOFF (lx)</i> : <u>Use of Long-term Auctions for Network Investment</u>
PRIV	30.2003	<i>Emiel MAASLAND and Sander ONDERSTAL (lx)</i> : <u>Auctions with Financial Externalities</u>
ETA	31.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games</u>
KNOW	32.2003	<i>Michele MORETTO</i> : <u>Competition and Irreversible Investments under Uncertainty</u>
PRIV	33.2003	<i>Philippe QUIRION</i> : <u>Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?</u>
KNOW	34.2003	<i>Giuseppe MEDA, Claudio PIGA and Donald SIEGEL</i> : <u>On the Relationship between R&D and Productivity: A Treatment Effect Analysis</u>
ETA	35.2003	<i>Alessandra DEL BOCA, Marzio GALEOTTI and Paola ROTA</i> : <u>Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation</u>

GG	36.2003	<i>Matthieu GLACHANT</i> : <u>Voluntary Agreements under Endogenous Legislative Threats</u>
PRIV	37.2003	<i>Narjess BOUBAKRI, Jean-Claude COSSET and Omrane GUEDHAM</i> : <u>Postprivatization Corporate Governance: the Role of Ownership Structure and Investor Protection</u>
CLIM	38.2003	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Policy under Technology Spillovers</u>
KNOW	39.2003	<i>Slim BEN YOUSSEF</i> : <u>Transboundary Pollution, R&D Spillovers and International Trade</u>
CTN	40.2003	<i>Carlo CARRARO and Carmen MARCHIORI</i> : <u>Endogenous Strategic Issue Linkage in International Negotiations</u>
KNOW	41.2003	<i>Sonia OREFFICE</i> : <u>Abortion and Female Power in the Household: Evidence from Labor Supply</u>
KNOW	42.2003	<i>Timo GOESCHL and Timothy SWANSON</i> : <u>On Biology and Technology: The Economics of Managing Biotechnologies</u>
ETA	43.2003	<i>Giorgio Busetti and Matteo MANERA</i> : <u>STAR-GARCH Models for Stock Market Interactions in the Pacific Basin Region, Japan and US</u>
CLIM	44.2003	<i>Katrin MILLOCK and Céline NAUGES</i> : <u>The French Tax on Air Pollution: Some Preliminary Results on its Effectiveness</u>
PRIV	45.2003	<i>Bernardo BORTOLOTTI and Paolo PINOTTI</i> : <u>The Political Economy of Privatization</u>
SIEV	46.2003	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods</u>
ETA	47.2003	<i>Jens HORBACH</i> : <u>Employment and Innovations in the Environmental Sector: Determinants and Econometrical Results for Germany</u>
CLIM	48.2003	<i>Lori SNYDER, Nolan MILLER and Robert STAVINS</i> : <u>The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing</u>
CLIM	49.2003	<i>Lori SNYDER, Robert STAVINS and Alexander F. WAGNER</i> : <u>Private Options to Use Public Goods. Exploiting Revealed Preferences to Estimate Environmental Benefits</u>
CTN	50.2003	<i>László Á. KÓCZY and Luc LAUWERS (Ixi)</i> : <u>The Minimal Dominant Set is a Non-Empty Core-Extension</u>
CTN	51.2003	<i>Matthew O. JACKSON (Ixi)</i> : <u>Allocation Rules for Network Games</u>
CTN	52.2003	<i>Ana MAULEON and Vincent VANNEBELBOSCH (Ixi)</i> : <u>Farsightedness and Cautiousness in Coalition Formation</u>
CTN	53.2003	<i>Fernando VEGA-REDONDO (Ixi)</i> : <u>Building Up Social Capital in a Changing World: a network approach</u>
CTN	54.2003	<i>Matthew HAAG and Roger LAGUNOFF (Ixi)</i> : <u>On the Size and Structure of Group Cooperation</u>
CTN	55.2003	<i>Taiji FURUSAWA and Hideo KONISHI (Ixi)</i> : <u>Free Trade Networks</u>
CTN	56.2003	<i>Halis Murat YILDIZ (Ixi)</i> : <u>National Versus International Mergers and Trade Liberalization</u>
CTN	57.2003	<i>Santiago RUBIO and Alistair ULPH (Ixi)</i> : <u>An Infinite-Horizon Model of Dynamic Membership of International Environmental Agreements</u>
KNOW	58.2003	<i>Carole MAIGNAN, Dino PINELLI and Gianmarco I.P. OTTAVIANO</i> : <u>ICT, Clusters and Regional Cohesion: A Summary of Theoretical and Empirical Research</u>
KNOW	59.2003	<i>Giorgio BELLETTINI and Gianmarco I.P. OTTAVIANO</i> : <u>Special Interests and Technological Change</u>
ETA	60.2003	<i>Ronnie SCHÖB</i> : <u>The Double Dividend Hypothesis of Environmental Taxes: A Survey</u>
CLIM	61.2003	<i>Michael FINUS, Ekko van IERLAND and Robert DELLINK</i> : <u>Stability of Climate Coalitions in a Cartel Formation Game</u>
GG	62.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>How the Rules of Coalition Formation Affect Stability of International Environmental Agreements</u>
SIEV	63.2003	<i>Alberto PETRUCCI</i> : <u>Taxing Land Rent in an Open Economy</u>
CLIM	64.2003	<i>Joseph E. ALDY, Scott BARRETT and Robert N. STAVINS</i> : <u>Thirteen Plus One: A Comparison of Global Climate Policy Architectures</u>
SIEV	65.2003	<i>Edi DEFRANCESCO</i> : <u>The Beginning of Organic Fish Farming in Italy</u>
SIEV	66.2003	<i>Klaus CONRAD</i> : <u>Price Competition and Product Differentiation when Consumers Care for the Environment</u>
SIEV	67.2003	<i>Paulo A.L.D. NUNES, Luca ROSSETTO, Arianne DE BLAEIJ</i> : <u>Monetary Value Assessment of Clam Fishing Management Practices in the Venice Lagoon: Results from a Stated Choice Exercise</u>
CLIM	68.2003	<i>ZhongXiang ZHANG</i> : <u>Open Trade with the U.S. Without Compromising Canada's Ability to Comply with its Kyoto Target</u>
KNOW	69.2003	<i>David FRANTZ (Iix)</i> : <u>Lorenzo Market between Diversity and Mutation</u>
KNOW	70.2003	<i>Ercole SORI (Iix)</i> : <u>Mapping Diversity in Social History</u>
KNOW	71.2003	<i>Ljiljana DERU SIMIC (Iixii)</i> : <u>What is Specific about Art/Cultural Projects?</u>
KNOW	72.2003	<i>Natalya V. TARANOVA (Iixii)</i> : <u>The Role of the City in Fostering Intergroup Communication in a Multicultural Environment: Saint-Petersburg's Case</u>
KNOW	73.2003	<i>Kristine CRANE (Iixii)</i> : <u>The City as an Arena for the Expression of Multiple Identities in the Age of Globalisation and Migration</u>
KNOW	74.2003	<i>Kazuma MATOBA (Iixii)</i> : <u>Glocal Dialogue- Transformation through Transcultural Communication</u>
KNOW	75.2003	<i>Catarina REIS OLIVEIRA (Iixii)</i> : <u>Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal</u>
KNOW	76.2003	<i>Sandra WALLMAN (Iixii)</i> : <u>The Diversity of Diversity - towards a typology of urban systems</u>

KNOW	77.2003	<i>Richard PEARCE</i> (Ixii): <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK</i> (Ixii): <u>Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas</u>
KNOW	79.2003	<i>Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P. OTTAVIANO</i> : <u>Child Labor and Resistance to Change</u>
ETA	80.2003	<i>Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA</i> : <u>Investment Size and Firm's Value under Profit Sharing Regulation</u>
IEM	81.2003	<i>Alessandro LANZA, Matteo MANERA and Massimo GIOVANNINI</i> : <u>Oil and Product Dynamics in International Petroleum Markets</u>
CLIM	82.2003	<i>Y. Hossein FARZIN and Jinhua ZHAO</i> : <u>Pollution Abatement Investment When Firms Lobby Against Environmental Regulation</u>
CLIM	83.2003	<i>Giuseppe DI VITA</i> : <u>Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?</u>
CLIM	84.2003	<i>Reyer GERLAGH and Wietze LISE</i> : <u>Induced Technological Change Under Carbon Taxes</u>
NRM	85.2003	<i>Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU</i> : <u>How Fast are the Tourism Countries Growing? The cross-country evidence</u>
KNOW	86.2003	<i>Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI</i> : <u>The ICT Revolution: opportunities and risks for the Mezzogiorno</u>
SIEV	87.2003	<i>Lucas BRETSCHGER and Sjak SMULDERS</i> : <u>Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments</u>
CLIM	88.2003	<i>Johan EYCKMANS and Michael FINUS</i> : <u>New Roads to International Environmental Agreements: The Case of Global Warming</u>
CLIM	89.2003	<i>Marzio GALEOTTI</i> : <u>Economic Development and Environmental Protection</u>
CLIM	90.2003	<i>Marzio GALEOTTI</i> : <u>Environment and Economic Growth: Is Technical Change the Key to Decoupling?</u>
CLIM	91.2003	<i>Marzio GALEOTTI and Barbara BUCHNER</i> : <u>Climate Policy and Economic Growth in Developing Countries</u>
IEM	92.2003	<i>A. MARKANDYA, A. GOLUB and E. STRUKOVA</i> : <u>The Influence of Climate Change Considerations on Energy Policy: The Case of Russia</u>
ETA	93.2003	<i>Andrea BELTRATTI</i> : <u>Socially Responsible Investment in General Equilibrium</u>
CTN	94.2003	<i>Parkash CHANDER</i> : <u>The γ-Core and Coalition Formation</u>

- (l) This paper was presented at the Workshop “Growth, Environmental Policies and Sustainability” organised by the Fondazione Eni Enrico Mattei, Venice, June 1, 2001
- (li) This paper was presented at the Fourth Toulouse Conference on Environment and Resource Economics on “Property Rights, Institutions and Management of Environmental and Natural Resources”, organised by Fondazione Eni Enrico Mattei, IDEI and INRA and sponsored by MATE, Toulouse, May 3-4, 2001
- (lii) This paper was presented at the International Conference on “Economic Valuation of Environmental Goods”, organised by Fondazione Eni Enrico Mattei in cooperation with CORILA, Venice, May 11, 2001
- (liii) This paper was circulated at the International Conference on “Climate Policy – Do We Need a New Approach?”, jointly organised by Fondazione Eni Enrico Mattei, Stanford University and Venice International University, Isola di San Servolo, Venice, September 6-8, 2001
- (liv) This paper was presented at the Seventh Meeting of the Coalition Theory Network organised by the Fondazione Eni Enrico Mattei and the CORE, Université Catholique de Louvain, Venice, Italy, January 11-12, 2002
- (lv) This paper was presented at the First Workshop of the Concerted Action on Tradable Emission Permits (CATEP) organised by the Fondazione Eni Enrico Mattei, Venice, Italy, December 3-4, 2001
- (lvi) This paper was presented at the ESF EURESCO Conference on Environmental Policy in a Global Economy “The International Dimension of Environmental Policy”, organised with the collaboration of the Fondazione Eni Enrico Mattei, Acquafredda di Maratea, October 6-11, 2001
- (lvii) This paper was presented at the First Workshop of “CFEWE – Carbon Flows between Eastern and Western Europe”, organised by the Fondazione Eni Enrico Mattei and Zentrum für Europäische Integrationsforschung (ZEI), Milan, July 5-6, 2001
- (lviii) This paper was presented at the Workshop on “Game Practice and the Environment”, jointly organised by Università del Piemonte Orientale and Fondazione Eni Enrico Mattei, Alessandria, April 12-13, 2002
- (lix) This paper was presented at the ENGIME Workshop on “Mapping Diversity”, Leuven, May 16-17, 2002
- (lx) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by the Fondazione Eni Enrico Mattei, Milan, September 26-28, 2002
- (lxi) This paper was presented at the Eighth Meeting of the Coalition Theory Network organised by the GREQAM, Aix-en-Provence, France, January 24-25, 2003
- (lxii) This paper was presented at the ENGIME Workshop on “Communication across Cultures in Multicultural Cities”, The Hague, November 7-8, 2002

2002 SERIES

CLIM	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
VOL	<i>Voluntary and International Agreements</i> (Editor: Carlo Carraro)
SUST	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Carlo Carraro)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KNOW	<i>Knowledge, Technology, Human Capital</i> (Editor: Dino Pinelli)
MGMT	<i>Corporate Sustainable Management</i> (Editor: Andrea Marsanich)
PRIV	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)

2003 SERIES

CLIM	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KNOW	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSRM	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRIV	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>