

**Security of Supply for Natural
Gas Markets. What is it and
What is it not?**

Giacomo Luciani

NOTA DI LAVORO 119.2004

SEPTEMBER 2004

IEM – International Energy Markets

Giacomo Luciani, *Robert Schuman Centre, European University Institute*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
<http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm>

Social Science Research Network Electronic Paper Collection:
<http://ssrn.com/abstract=XXXXXX>

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

Security of Supply for Natural Gas Markets. What is it and What is it not?

Summary

The issue of security of gas supplies is frequently discussed on the basis of intuitive and non-systematic arguments. Greater import dependence is normally equated with greater insecurity, and strategic stocks are the risk management tool most commonly considered.

This paper strives to offer a systematic framework of analysis and shows that import dependence does not necessarily entail greater insecurity – actually, the opposite may well be the case. It also discusses several alternatives to strategic stocks for risk management, which are more interesting and promising.

Keywords: Natural gas market, Security of supply

JEL Classification: Q41, Q43

This paper was prepared in connection with the INDES Project (Insuring against Disruption of Energy Supply), a one-year project financed by the European Commission – DG TREN (Contract Number NNE5/2002/91).

Address for correspondence:

Giacomo Luciani
Robert Schuman Centre for Advanced Studies
Istituto Universitario Europeo (IUE)
Florence
Italy
E-mail: giacomo.luciani@iue.it

1. Defining security of supply

Security of supply may be defined as the guarantee that all the gas volumes, demanded by non-interruptible (firms or protected) customers, will be available at a reasonable price. The following points should be noted:

- Security of supply is primarily a concept of physical availability – the gas must be there when required.
- Nevertheless, the security of supply is also tied to contractual arrangements. Some customers may elect to give up security of supply and take the risk of not getting the gas when required. These are interruptible or non-priority customers, whose exact rights will need to be defined on a contractual basis.
- Finally, security of supply is also, albeit more loosely, tied to a concept of price. Gas must be available at a ‘reasonable’ price – not at any price. By definition, if the price is allowed to increase without a limit, there will always be a sufficiently high price at which demand will equate to available supplies – but we cannot say in this case that the security of supply was guaranteed. If we lift any restriction on the movement of prices, the issue of security of supply simply evaporates. Yet how far is it acceptable to allow prices to move in order to restrict demand and allocate scarce supplies is a question that can only be decided politically, by the government or regulator, or contractually, by the parties accepting limits to price increases – not by a theoretical discussion.¹

2. Energy market liberalisation and security of supply

The question of security of supply arises in the context of market liberalisation. The old monopolists used to claim that they guaranteed the security of supply – a statement supported by the experience of decades of service to the public, during which very little disruption was experienced.²

¹At times the Directorate-General for Energy and Transport (DG TREN) appears to consider price fluctuations themselves as a threat to security – in particular with respect to crude oil. Indeed, in the case of crude oil, the logistics are such that the risk of physical shortages is minimal and any tightness of supplies would immediately be reflected in prices. Gas, however, is different: it has different logistics, different pricing mechanisms, etc.

²The DG TREN memo “The Internal Energy Market – Improving the Security of Energy Supplies – Gas and Oil Stocks”, pg. 2, 11 September 2003, states: “The European gas industry has so far been effective in ensuring security of supply. In the new internal gas market, however, there will no longer be a single player to assume this responsibility. It is therefore uncertain whether gas suppliers will give priority to security of supply. Consequently, this responsibility cannot be left in the hands of the industry alone, which is itself dependent on

It is not clear, however, that security of supply was truly guaranteed in the past – it was in fact never challenged by any major disruption. It may be more accurate to say that the old monopolists were in a position to unilaterally decide how much security they intended to provide and did engage in some precautionary investment, thanks to their ability to pass the cost on to the final consumer. The security they provided may have been too little or too much, we simply do not know: the final customer was not asked how much security he/she wanted or how much he/she was ready to pay for it. Let us just simply note that the degree of security provided – through diversification of supplies, strategic stockpiling and redundancy of transmission capacity – was very different in the individual European countries.

The concern about security of supply in liberalised markets is connected to viewing security as a public good or externality. In liberalised markets, new competitors will be tempted to ‘free-ride’ on the security provided by the incumbent suppliers and the ‘heat of competition’ may push operators to play down security and prioritise cost-cutting. This fear is not altogether unwarranted: indeed, it is supported by negative experience with airlines, railways and electrical grids.

Yet it is also not entirely clear why security should not be ‘privatised’ or internalised in some form – i.e. offering to contracts to customers with variable guarantees of security of supply and letting them decide how much security, and at what cost, they desire.

Normally, security is viewed as a matter for governments to look after. That, however, is not true for protection against all risks, e.g. the government is expected to maintain a fire brigade, but it is up to the individual to buy insurance against fire damages. In the case of gas, there certainly are aspects that only governments can address; but we should consider the possibility of utilising contractual instruments to come to a more precise and satisfactory definition of the required minimum security.

It is reasonable to expect that the small commercial or household customer will not be in a position to exactly judge of his/her security requirements. Even in a fully liberalised market, in which all customers can choose their supplier independent of the level of consumption, the small consumer will be offered a choice among a set of standard contract formulae: it will be up to the regulator to make sure that these contracts incorporate the minimum security that the customer presumably requires.

Such minimum security is unlikely to be 100%. Gas in households and small commercial establishments is primarily used for cooking and for ambient- and water-heating. In situations of emergency, all such uses can be reasonably curbed to some extent. It is therefore reasonable to set the guaranteed level of supplies at an appropriate percentage of ‘standard’ consumption. (The problem here is rather that such rationing is difficult or impossible to implement, unless advanced meters are installed that are capable of monitoring the volumes consumed at least on a daily basis.)

external supplies.” Further, p. 3 of the same memo states that “There is currently no framework at EU or IEA level guaranteeing a minimum level of security of gas supplies in the European Union. The European gas industry has succeeded in ensuring security of supply on a constantly expanding gas market over the last 40 years. However, the European gas market is currently undergoing rapid change and the role of the traditional market players is also evolving. In the new liberalized gas market, **no player will of its own accord automatically assume responsibility for security of supply**. In a commercial market, it is not certain that gas suppliers will give strategic priority to security of supply, as companies increasingly focus on competition goals.” See also the Press Release IP/02/1288, 11 September 2003.

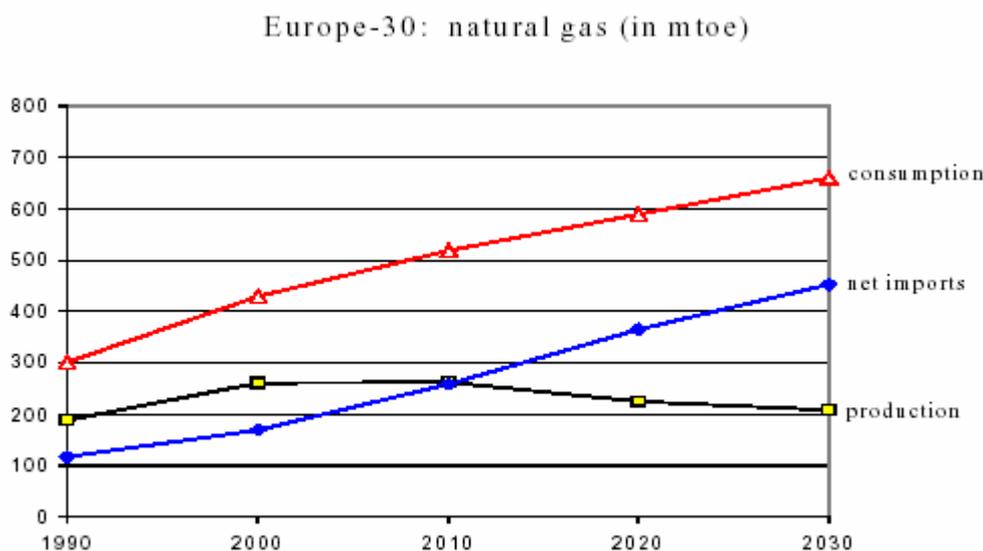
Therefore, it appears that it would be inaccurate to attribute the emergence of the security issue entirely to market liberalisation. It may be more accurate to say that, while in the past the matter was not widely discussed (and essentially left to the opinion and initiative of the monopolistic operator), market liberalisation has brought the issue to the fore. Nevertheless, we should not identify the past as being necessarily more secure than a liberalised and unified EU market.

Indeed, the Commission has frequently argued that a unified EU gas market would be intrinsically more secure than the individual member countries' markets. The reasoning here appears to be based primarily on scale: a larger market, served by a wider and well-interconnected network that receives supplies from a larger number of exporters, may be expected to be more stable. This may well be the case; however, numerous conditions need to be fulfilled, as later discussed.

3. Growing import dependence and security of supply

The second main driver of concerns about security is the expected growth of EU dependence on gas imports from outside the Union. The Commission's Green Paper³ on the security of energy supplies offers the chart in Figure 1 to show the expected growing dependence from imports.

Figure 1. Growth of natural gas consumption and dependence on imports



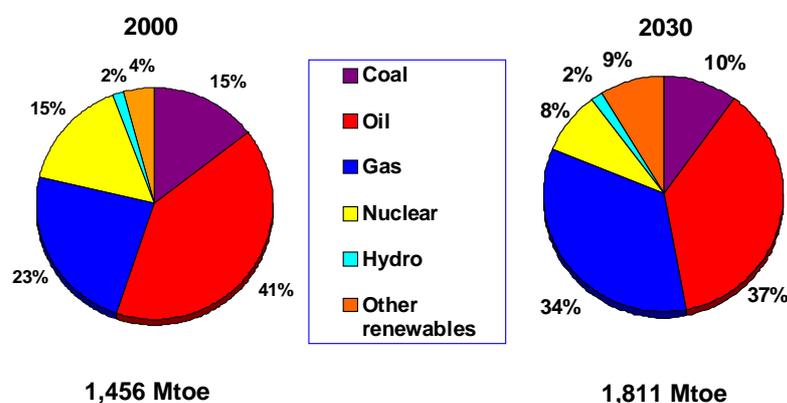
According to the International Energy Agency's (IEA) *World Energy Outlook of 2002*,⁴ the share of gas in total European primary energy consumption is expected to increase from 23 to 34%, as shown in Figure 2. This increase is certainly remarkable; however, it should be noted that overall the diversification of primary energy sources will continue to be significant.

³ See European Commission (2000), *Towards a European Strategy for the Security of Energy Supplies*, COM(2000) 769 final, p. 42, Brussels, 29.11.2000.

⁴ See IEA (2002), *World Energy Outlook 2002*, IEA Economic Analysis Division, Paris, September.

Moreover, gas is used primarily in stationary thermal uses, for which alternative sources are more readily available.

Figure 2. Expected growth of gas as a share of the total EU energy consumption



Source: IEA (2002), *World Energy Outlook 2002*, IEA Economic Analysis Division, Paris, September.

European gas imports are expected to grow from 187 to 632 Bcm between 2000 and 2030, a larger than three-fold increase. Nevertheless, the number of suppliers to the European Union is also expected to increase as shown in Figure 3, so the system may gain in diversification.

It should be noted that independence from imports is not at all a guarantee of security of supply. Indeed, the single most disastrous case of supply interruption in recent years has hit the state of Victoria in Australia in 1998, because of the failure of a processing plant serving all offshore-producing fields. The fact that the gas came from domestic fields, rather than from imports, was of no help at all. (The interruption lasted two weeks.)

It may be argued that the fact that gas is imported *adds* to the risk, because of the danger that political considerations or developments may interfere with the flow of gas. In this respect, we shall follow Jonathan Stern,⁵ who proposes that the risk associated with import dependence should be broken down into risk associated with source dependence, transit dependence and facility dependence.

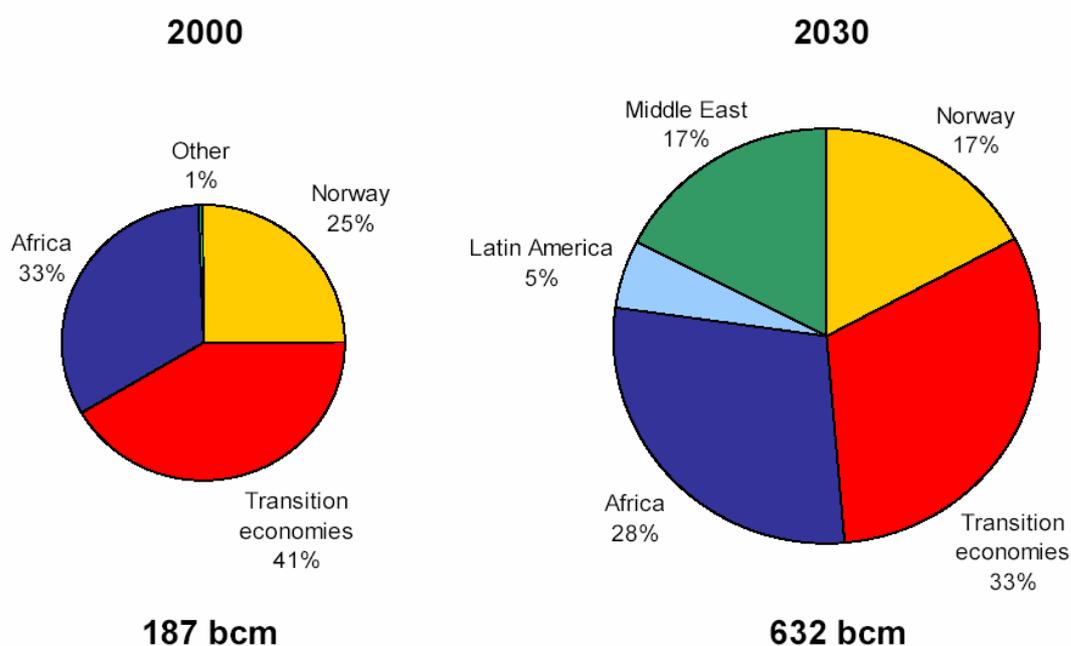
Risk associated with facility dependence is not exclusively relevant for imported gas: it is just as relevant for domestically produced gas. The point is that in order to be secure, a network, including its import inlets, should offer sufficient redundancy of capacity to allow for the redirection of flows in the event of the loss of one component. Because currently almost all gas connections between European member countries are said to be fully used,⁶ with no spare capacity available, it is evident that the European network enjoys no spare capacity at all and would in all likelihood not be able to redirect flows in the event of the failure of a major component.

⁵ See Jonathan Stern (2002), "Security of European Natural Gas Supplies – The impact of import dependence and liberalization", *Journal of the Royal Institute of International Affairs*, p. 12, London, July.

⁶ See the grid map with transmission capacities published on the GTE website (www.gte2.be).

Figure 3. Anticipated changes in the suppliers of imported gas to the EU between 2000 and 2030

European Union: Net Imports of Gas by Origin



The Middle East & to a lesser extent Latin America become major new suppliers of gas to the EU

Source: IEA (2002), *World Energy Outlook 2002*, IEA Economic Analysis Division, Paris, September.

In addition, many peripheral parts of the national networks are entirely dependent on a single feeder-line and are vulnerable to its disruption. So it must be acknowledged that it makes little sense to seek to increase the security of imported supplies if the domestic or European network is not capable of coping with the redirection of supplies.

Facility dependence is therefore a problem for the domestic network as well as for imports: it may be said to be more acute for imports to the extent that import facilities – be they pipelines or regasification terminals – are very expensive and capacity must be utilised as fully as possible. It is therefore quite normal that very little spare capacity will be available in alternative import facilities from a given source (assuming that they exist at all) to compensate for the failure of the normally used facility.

As far as source or transit dependence is concerned, in both cases the risk involved is political in nature. In other words, if the transmission facilities do not fail, gas supplies from a given source country or through a given transit country can only be restricted because of the sovereign decision of the relevant government. The political nature of the risk reinforces the presumption that the security of gas supplies is to be guaranteed by the government of the importing country.

Indeed, the security of gas supplies is best obtained through appropriate diplomacy – which is far more effective than through other technical instruments, as discussed below. We dislike the notion that dependence on gas supplies may influence the foreign policy of the importing country, as if continuing gas supplies were not a legitimate foreign policy objective itself – just as much as export or foreign investment promotion, the protection of nationals abroad, etc. But in fact, there can be little doubt that diplomacy is the first and most effective tool to guarantee gas supplies. This has been the case in the past and will continue to be the case in the future.

4. Thoughts from J. Stern

Having thus insisted on the links between the security of gas supplies, market liberalisation and import dependence, we may refer to the useful conceptualisation proposed by Jonathan Stern.⁷

As a consequence of market liberalization, European governments need to make cost/risk judgments and create a transparent security framework of standards and obligations, which set out:

- the specific security events for which responses need to be designed in order to prevent disruption of supply to firm, and specifically residential, customers;
- the obligations which should be placed on different market players for them to be able to maintain the required minimum level of supply and capacity in the event of such events;
- the costs associated with such obligations and how these should be allocated;
- whether, in the light of the foregoing analysis:
 - limits should be placed on source, transit route and facility concentration;
 - large gas consumers, such as power generators, should be obliged to have alternative fuels available for security reasons (p. 5).

Standards which governments and regulatory authorities might be required to set include specific supply security events to which market players would be expected to respond without curtailing supplies to firm gas, in particular residential, customers. The events would include:

- loss of a specific source of supply for a specific number of days during the peak demand season;
- loss of a specific facility (or facilities) through which a large percentage of national or regional supply passes, for a given number of days during the peak demand season (p. 32).

In the light of this analysis, the task of governments and regulators would be to arrive at standards sufficient for the market to withstand security events of ‘reasonable likelihood’ at ‘reasonable cost’ to market players and customers. This should involve complete transparency as to:

- which events fall within the security framework – i.e. are considered ‘likely’ – involving costs which are considered ‘reasonable’;

⁷ Stern (2002), op. cit.

- which groups of market players – network owners/operators, shippers, suppliers, traders and customers – should bear what percentage of the costs of the required responses (p. 33).

5. Defining the threat

The first task that we need to address in considering security of supply is the definition of the relevant threat. We cannot possibly aim at maintaining security of supply in any circumstance, e.g. if all major exporters to the EU simultaneously decide to interrupt exports. Depending on the severity of the threat that we assume to be realistic, guaranteeing security of supply becomes easier or more difficult. If the threat is not specifically defined, we cannot meaningfully discuss the adequacy of security provisions.

Defining the relevant threat is a political responsibility, which should be taken up by parliament or government. Ideally, these institutions should debate the issue of security of supply, both in general and specifically for imported supplies, and issue directives to the regulatory authority to guarantee the specified level of security.

In this paper we shall assume that the relevant threat is defined as the total interruption of supplies from the single most important foreign supplying country, i.e. Russia, for an extended period in excess of one calendar year. This assumption is not crucially important for our reasoning, but simply serves to facilitate some reference to actual cases and as an example to illustrate the reasoning. The reader may think that this threat is unrealistic and the EU shall never face such a negative event – in this case addressing the issue of security will simply be easier than we make it.

Assuming a total interruption of supplies from Russia poses a special security challenge not only because Russia is the single largest supplier to the EU in aggregate terms, but also because it is the dominant or sole supplier of some of the new member countries. There is no way that security of supply can presently be guaranteed to the Baltic republics, Finland, Poland,⁸ the Czech Republic or Slovakia in the event of total interruption of Russian supplies. Even assuming that other member countries could spare gas from other sources (they themselves would be seriously hit, though less seriously), the infrastructure to redirect flows is not available.

If we assume that some other supplier, different from Russia, may decide to restrict its exports, the security of supply implications would be more limited. The two EU member countries most dependent on the second-most important supplier, which is Algeria, are Portugal (85% dependent on Algeria) and Spain (55% dependent). The former would be the only critical case, as Spain imports almost as much Algerian gas as liquefied natural gas (LNG) by pipeline and may succeed in finding alternative sources of LNG. Indeed, Spain may in the end even be in a position to support Portugal.

In other words, the total interruption of supplies from Russia is probably the only event that may precipitate a critical situation for the security of European gas supplies.

⁸ Poland, however, covers about 30% of its requirements by domestic production. All other countries listed are 100% dependent on imports.

Further, let's assume that the interruption is extended for an indefinite period of time, in excess of one year.⁹ If we were to assume that the interruption is of limited and known duration, strategic stockpiles are likely to appear as a better alternative than other, potentially more expensive, solutions. Nevertheless, it seems unlikely that anyone can reasonably have the assurance that an interruption, if politically motivated, will be of a short duration. A supply interruption is a very serious act, which will not be taken lightly by either the supplier or the importer and is doubtful to be easily remedied.

6. Defining solidarity obligations

The next step in our reasoning is the definition of the extent of solidarity obligations. The political appeal of opting in favour of an extended definition of solidarity obligations – i.e. asserting that EU member countries must share available supplies in the event of a shortfall and individual gas companies may be requested to serve other companies' firm or non-interruptible customers with precedence to their own interruptible customers, or even to some extent to their own firm or non-interruptible customers – is obvious. The Commission has moved in the direction of strengthening solidarity in the energy market within the EU.¹⁰

Yet, there are important problems associated this approach. The first serious problem is that facilities may not be available to implement solidarity. If Russian supplies to the EU are interrupted, there is simply no way that countries receiving gas from other importers or enjoying domestic production can effectively share their supplies with the Baltic republics or the Central European members such as Poland and Hungary. The flow of pipelines is not automatically reversible – where pipelines exist at all. Even between the core EU gas countries – the Netherlands, Germany, France and Italy – the potential for mutual support would be limited.

The second fundamental drawback of asserting solidarity obligations is that doing so encourages free-riding and reduces the incentive for responsible behavior on the part of each member country and indeed each customer. In view of the limited availability and high cost of international interconnections, member countries should be encouraged to each address its own security problem – only assuming so much solidarity from the rest of the EU as is realistically to be expected.

To the extent that security of supply will be sought on the basis of contractual arrangements – i.e. on the basis of the distinction between guaranteed or non-interruptible customers, and non-guaranteed or interruptible ones – the customer must be in a position to reasonably

⁹ If the interruption is temporary, stocks may be a reasonable option. The DG TREN memo of 11 September 2003 (op. cit.) states, under the heading “Definition of minimum standards for security of supply – gas stocks”, that:

- “Member States should take the necessary measures to ensure that the **supply** to vital consumers, who are not in a position to replace gas with another fuel, is guaranteed **for sixty days** in average weather conditions in the event of the single most important source of gas supplies being disrupted. Other measures will be taken in order to cover this eventuality in the event of extremely low temperatures;
- The measures to be taken should include ensuring that **gas stocks** make at least a minimum contribution to achieving the security of supply standards. The level of stocks should take account of the geological and economic storage possibilities in each Member State.”

¹⁰ The internal market is also based on the need for solidarity between the member states of the EU, more especially in the gas, oil and electricity sectors so vital to our energy supply (see the DG TREN memo “The Internal Energy Market – Improving the Security of Energy Supplies – Gas and Oil Stocks”, p.1, 11 September 2003).

evaluate his/her risk. For example, a customer may prefer to sign an interruptible contract with company A in preference to company B, even if A asks for a higher price, because A has more diversified supplies and is in fact less likely to interrupt service; however, if a solidarity obligation is imposed, this difference evaporates.

The imposition of solidarity obligations, therefore, on the one hand may be impossible to implement, if the required infrastructure is not in place; on the other hand it establishes the wrong set of incentives to market players, suppliers and consumers alike. It may therefore be preferable to avoid laying stress on it, at least for as long as interconnections are not expanded and the internal market is not physically unified. Here we should highlight that *physical* unification is different from contractual unification and price equalisation. The latter can take place on the basis of extensive swapping throughout the network, but solidarity in the event of a crisis requires the availability of physical transmission capacity. (For instance, it would be possible even today for a producer in the Netherlands to sell gas to a Polish customer, but if Russian supplies were interrupted, this Polish customer would not be able to receive any gas from the Netherlands.)

Notwithstanding the creation of a unified EU gas market, the issue of security of supply is probably best discussed at the level of each member country – and possibly even at the level of individual regions within each member country.

The same reasoning applies to whether protection of priority customers should be industry-wide or supplier-specific. If effective solidarity were imposed, the appropriate protection would be industry-wide. In other words, within each national jurisdiction, available supplies in the event of a crisis would be redistributed among all suppliers to allow them to service their priority customers. There is a political logic in this, of course, and it would be difficult to envisage that residential customers of company A, which has lost its supplies, be let to suffer, while non-priority customers of company B, whose supplies have not been affected, continue to be served.

Nevertheless, if we simply assert the principle of solidarity, we destroy the incentive to take the necessary precautions to be able to honor the service obligations that each company has undertaken. The regulatory system must impose conditions on solidarity obligations, such that companies will not be tempted to simply free-ride. This can be achieved by, for example, establishing that companies having lost their supplies may have a right to acquire gas from other companies, but at a significantly higher price to compensate the other companies and those interruptible customers that may be affected as consequence of such problems.

7. Current approaches

Currently, the problem of security of supply is either ignored or it is dealt with by specifying minimum levels of storage obligations or maximum levels of import dependence from a single source or both. Countries enjoying substantial domestic production, such as the UK, or even exporting to the rest of the EU, such as the Netherlands, are obviously justified in attaching little priority to the issue of security of supply. Examples of countries addressing the problem by imposing storage obligations and maximum levels of import dependence are Italy and Spain.

The Italian legislation provides that imports from non-EU countries are subject to authorisation by the Ministry of Industry on the basis, inter alia, of the availability of strategic

storage capacity in Italy in proportion to the quantity of gas imported annually (10%). The strategic storage obligation applies to LNG imports as well, though to a lesser extent.¹¹

In the case of Spain, transporters that deliver gas to the system and traders must diversify their provisioning when the proportion of their supplies that come from the same country is over 60%, when all their supply provisioning is added together. The Ministry of Economy may modify this percentage, making it higher or lower depending on the evolution of international natural gas markets.

None of these approaches is convincing. By their very nature, storage obligations can only alleviate the problem for a limited period of time – while the strategic stocks last. There is no way to prove that any level of storage obligations that may be imposed will be adequate and not excessive. Any level that is chosen will be a ‘shot in the dark’: it may be excessive or insufficient, we just don’t know. Furthermore, it is certainly a mistake to impose storage obligations on all imports from outside the EU, independent of whether they come from an established or a new supplier, or of the composition of the customer base (between guaranteed and interruptible customers).

8. Priority and interruptible customers

As is already evident from the previous paragraphs, our reasoning is very much based on the differentiation between two groups of customers: priority (firm or non-interruptible) and interruptible.

Not all customers need to be protected against supply disruptions. Some customers may choose to maintain fuel-switching capabilities, whereby they can resort to an alternative fuel, different from natural gas. Or they may simply accept to withdraw from the market – stop production – in the event of a supply crisis.

It is only the smaller commercial and residential customers that cannot be expected to be able to either maintain an alternative fuel system or withdraw from the market. The latter should be offered protected or guaranteed supplies – which does not mean a guarantee for 100% of their regular supplies, as discussed earlier.

In theory, we may envisage more than two groupings, further distinguishing the level of guaranteed supplies or circumstances and conditions allowable for interruptions, but this would add little to our reasoning. Here we shall assume just two groups for the sake of simplicity.

The two groups may be defined contractually (interruptible versus firm customers) or by law and regulation, or by a mix of the two. If the distinction is contractual, the law or regulatory system should guarantee the meaning of contractual obligations: this requires limiting the suppliers’ ability to claim *force majeure*. In fact, at present the distinction between interruptible and firm customers is not sufficiently sharp. If a gas importer is faced with a physical shortfall in its supplies – especially if this is the case because of the sovereign act of one of the exporting or transit countries – it can effectively claim *force majeure* and interrupt supplies even to firm customers. At the same time, interruptible customers are almost never interrupted. Therefore, the market does not allow for the required price differential between interruptible and firm customers, which would pay for significant investment in security of supply.

¹¹ Art. 3, para. 2 of Legislative Decree No. 164 of 23 May 2000.

For security of supply to be guaranteed on the basis of market mechanisms, it is necessary that interruptible customers – because they do not require protection in the event of a crisis and, as we later explain, contribute to the stability of the system – be offered significantly lower prices, such that will justify maintaining an alternative fuel capacity or withdrawing from the market.

Company ‘exposure’

Based on the distinction between priority and interruptible customers, we may propose a meaningful discussion of each supplier’s ‘exposure’ to the security risk. Suppliers should be required to protect their priority customers to the extent that is specified in contractual or regulated clauses.

As long as their exposure to the possible negative event (percentage shortfall in supplies) is lower than the share of priority over total customers, they may not need to worry about security of supplies. If, on one extreme, a company only serves interruptible customers, then clearly it should not worry about security of supplies. If a company has a customer base composed of 60% priority and 40% interruptible customers, and its obligation to the priority customers is to guarantee at least 50% of their normal supplies, then in the event of a crisis this company must secure at least 30% of its normal supplies. If its portfolio of import sources is diversified, so that none supplies more than 70% of the total, the company shall always be able to honor its security commitments to its priority customers and needs no further investment.

Assigning equal obligations on all companies, notably storage obligations, independent of the structure of their customer base or gas procurement is a mistake. Importers should be encouraged to diversify their sources and activate demand flexibility. In order to encourage diversification of sources, imports from a new source should be viewed as a positive move and be free of any security-motivated obligation, while additional imports from an established source should be penalised or forbidden altogether. This can be done at the level of individual importing companies or at the national level. The right thing to do would be to implement these rules at the level of individual importers, but nation-wide implementation would be a step in the right direction.

Companies enjoying diversified supplies and a small, protected-customer base could be encouraged by allowing them to sell emergency supplies rights to other companies, whose supplies are less diversified or whose customer base is tilted more towards priority or firm customers. All gas suppliers should be required to prove their ability to meet their security requirements, i.e. serve their protected customers even in the event of a crisis. They could do so either by diversifying their sources or by limiting the share of their protected customers or both; alternatively, they could buy emergency supply rights from companies with diversified sources or small, protected-customer bases or both. In order to be effective, this approach requires that no solidarity obligation is imposed *ex-ante*, otherwise no company will have a sufficient incentive to buy emergency supply rights from other companies.

Indeed, a useful approach to explore is the creation of an agency to play the role of provider of last resort. In this role, the agency would establish transmission capacity and take all other required steps to be able to sell emergency supply rights to the commercial suppliers requiring them, in case the supply of such rights would fall short of demand and total security of the system could not otherwise be guaranteed. This may be a much more effective approach than purely mandating stocks or affirming solidarity obligations. The supplier of last resort could

be created at the EU or the member country level – the attraction of the former solution being quite evident. Even so, it is most likely that a supplier of last resort created at the EU level may not be able to sell sufficient emergency supply rights to allow some of the more exposed member countries, such as the Baltic republics, to maintain a guaranteed customer base.

9. The importance of balancing the customer base

A balanced customer base, comprising a large share of non-protected or interruptible customers is more secure. Considering that diversification of supply sources is supported by the total size of the market, if a larger share of the demand is interruptible it is likely that, in the event of interruption of one of the suppliers, the remaining sources will be sufficient to meet the needs of the protected customers.

This potential benefit of having a larger, gas-based power generation component is very important. Gas power plants can be relatively easily designed to run on alternative fuels, if an interruption of gas supplies was to occur. The price differential between interruptible and firm customers must be large enough to encourage installing dual-fuel capability and creating the necessary flexibility in demand. Presently, such flexibility is very limited, because sufficient incentive does not exist. Increasing the share of power generation that is based on gas may appear to increase vulnerability, because it increases dependence on imports; but in fact, to the extent that power plants have dual-fuel capability and can switch from gas to an alternative fuel such as LPG or diesel in emergency conditions, the stability of the system will be greatly increased. A smaller total demand composed exclusively of firm customers would be less secure, because it would not support diversification of gas import sources and would be more vulnerable to interruptions.

Therefore, it is a mistake to equate import dependence to vulnerability. What matters is the composition of the customer base and the share of interruptible customers over total demand relative to the diversification of import sources.

Demand flexibility should be encouraged. Presently, demand flexibility is very limited, because the differentiation between firm and interruptible customers is insufficient. Interruptible customers are few and do not take the risk of being interrupted too seriously. Firm customers are not sufficiently protected in the event of an emergency.

Supply flexibility

It is also very important to encourage supply flexibility. Supply flexibility is a function of diversification, mode of transmission (pipeline gas versus LNG) and redundancy in import infrastructure. The more diversified the portfolio of suppliers is, the more limited is the damage that the interruption of one of them will inflict. But the mode of transmission is also important, partly because facility dependence should also be part of the equation and diversification in the mode of transmission reduces it. But also because an LNG chain is intrinsically more flexible than a pipeline: indeed, if the regular source of LNG becomes unavailable, the importer can always look for an alternative source and substitute at least part of the lost supplies. A pipeline, being a fully dedicated transport infrastructure, does not allow for this. In addition, LNG is normally not vulnerable to the transit risk, while pipelines frequently are.

Unfortunately, supply flexibility is very expensive. In some cases, it may verge on the impossible – as presently in the case of the Baltic republics and even Poland, where it does not go much beyond token diversification. The situation may change in the future, as LNG

supplies from Norway (Snøwhit) become available. Yet, for the time being these countries must rely exclusively on demand flexibility, which means in essence that all gas customers should be interruptible and have dual-fuel capacity, or be ready to withdraw from the market. This may be feasible at lesser cost than acquiring sufficient supply flexibility. Strategic storage would be of help only for a limited time, while it lasts.

Even in cases where supply flexibility is a viable proposition, if we leave it solely to the market, the required level of supply flexibility would have to be paid exclusively by the priority customers and it may impose an excessive burden on them. The question that arises is therefore can we justify some socialisation of the cost of improving supply flexibility?

10. Security and competition

The key to arguing in favour of socialising the cost of supply flexibility is to point to the fact that diversification of sources and redundancy of import infrastructure are also tools to encourage competition. As such, they may be assumed to be a systemic priority.

The EU gas market will never become competitive and unified for as long as supplies are neatly in balance with demand or fall short of the latter. Competition assumes that suppliers should be interested in fighting for market share; and they will be, but only if they have some excess capacity that they could use to serve a larger market share. Promoting redundancy, or unused import and transmission capacity, is therefore a prerequisite of effective competition.

So is diversification. For as long as two sources dominate European gas imports, it is unlikely that competition will ever exist. Even if we manage to scrap or limit the impact of take-or-pay and destination clauses, the monopolistic exporters will find ways to prevent gas-to-gas competition. Increasing dependence on the established suppliers is incompatible with competition.

The EU and individual member countries therefore have a legitimate interest in the development of new import infrastructure. To encourage competition and diversification, new import infrastructure must be put in place – which would also contribute to creating redundancy.

This purpose can be pursued through regulatory tools that establish a framework offering incentives towards diversification, as detailed above. But there is probably more that the Commission and member countries can do.

It should be recognised, to begin with, that LNG imports may be preferable to pipeline imports with respect to encouraging diversification, competition and security of supplies. Promoting LNG import capacity requires the establishment of regasification plants, which cost a fraction of pipelines. Regasification plants can receive imports from several sources and LNG shipments can be more easily redirected in the event of a crisis. An EU gas market with a larger share of LNG imports would therefore be more easily diversified and also more effectively integrated in the event of a crisis. Establishing unused import capacity at LNG regasification terminals is not as financially burdensome as keeping unused capacity in a pipeline.

The Commission should therefore consider promoting common rules to facilitate and encourage the establishment of regasification terminals. Terminals should not be subjected to obligations under the Trade Practices Act (TPA), nor should LNG importers have to face storage obligations; terminal operators should be required to expand capacity whenever an importer is ready to contract for it and expansion is physically possible. The regulatory

framework should allow for – if not mandate – offering advantageous conditions to customers in the proximity of regasification terminals, in order to encourage local communities to accept them.

The EU has been trying to encourage the establishment of new import capacity through the Trans-European Networks or other initiatives such as the Interstate Oil and Gas Transport to Europe (INOGATE) programme. The effectiveness of these efforts has been limited: whenever some of the major energy companies have undertaken projects, they would probably have been implemented even in the absence of EU support. In cases where projects have not found a strong company sponsor, EU support has done little to make them happen. Therefore, if we believe that the EU has a legitimate public interest in promoting a new gas import infrastructure, we should provide it with some teeth that will effectively facilitate the implementation of projects that are considered a priority.

One possibility of doing so would be to establish a fund, which would underwrite transmission (for pipelines) or regasification (for LNG terminals) capacity in advance of actual market demand, thus allowing capacity to be more easily established. This would not be altogether unusual: transportation capacity is normally established in excess of forecasted traffic in the short term – to accommodate growth for some appropriate time in the future.

If a supplier of last resort is created at either the national or the EU level, it could take responsibility for this task. The fund may be financed partly with taxpayers' money and partly by selling 'emergency transmission rights' to allow importers to meet their minimum-security obligations, as suggested above.

The operation of this facility would nevertheless raise some difficult problems. How would the redundant capacity thus created be liquidated? Should it be sold to operators only in the event of an emergency? This suggestion would not be reasonable. Should it be sold at a loss, in order to encourage diversification or competition, and accelerate the partial recovery of the investment in order to promote further import capacity expansion? In this way, the market would be distorted. But if the facility is required to operate on a strictly commercial basis, then it may make little or no difference.

Conclusions

Let us offer some simple points summarising the argument, to serve as preliminary conclusions:

- 1) There have never been major gas-import supply interruptions. This point should not be forgotten.
- 2) The share of gas in the EU's primary energy demand will increase, but diversification of primary energy sources will remain healthy.
- 3) Import dependence for gas will increase, but so will the diversification of sources.
- 4) The risk of a major interruption of gas supplies is political in nature and diplomacy remains the primary tool to address it. The issue of security should be debated at the political level, to decide whether diplomacy is sufficient or more needs to be done. In the latter case, the threat against which the system needs to be protected must be clearly defined – which is again a political and not a technical issue.
- 5) The adoption of clear laws and regulations may encourage diversification and flexibility. The distinction between guaranteed and interruptible customers must be strengthened and

importers must be required to prove their ability to continue serving guaranteed customers in the event of a crisis. Diversification of sources should be encouraged.

- 6) The composition of the customer base may be expected to improve: the growing importance of gas in power generation may translate into fewer protected customers.
- 7) The EU could consider establishing a supplier of last resort or a fund to invest in expanding import capacity from new sources and maintain infrastructure redundancy.

In view of the fact that diplomacy has worked well even in difficult times, it is our guess that a well-informed political debate will scale down concerns for gas supply security. Even assuming that a pessimistic definition is given of the relevant threat – as we have done in this paper – this could be dealt with through sensible legal and regulatory approaches. Nevertheless, strengthening the hand of the Commission in promoting diversification and redundancy of import capacity may very well make sense, not only because it would improve security, but also and indeed primarily, because it would support competition in gas markets.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

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

<http://www.ssrn.com/link/feem.html>

NOTE DI LAVORO PUBLISHED IN 2003

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 Reyner 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 JANSSENS 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	19.2003	<i>Sergio CURRARINI</i> : <u>On the Stability of Hierarchies in Games with Externalities</u>
Network		
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 VARTIAINEN (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. STREBULAIEV (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 GUEDHAMI</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</i> (Ixi): <u>The Minimal Dominant Set is a Non-Empty Core-Extension</u>
CTN	51.2003	<i>Matthew O. JACKSON</i> (Ixi): <u>Allocation Rules for Network Games</u>
CTN	52.2003	<i>Ana MAULEON and Vincent VANNETELBOSCH</i> (Ixi): <u>Farsightedness and Cautiousness in Coalition Formation</u>
CTN	53.2003	<i>Fernando VEGA-REDONDO</i> (Ixi): <u>Building Up Social Capital in a Changing World: a network approach</u>
CTN	54.2003	<i>Matthew HAAG and Roger LAGUNOFF</i> (Ixi): <u>On the Size and Structure of Group Cooperation</u>
CTN	55.2003	<i>Tajji FURUSAWA and Hideo KONISHI</i> (Ixi): <u>Free Trade Networks</u>
CTN	56.2003	<i>Halis Murat YILDIZ</i> (Ixi): <u>National Versus International Mergers and Trade Liberalization</u>
CTN	57.2003	<i>Santiago RUBIO and Alistair ULPH</i> (Ixi): <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</i> (Iix): <u>Lorenzo Market between Diversity and Mutation</u>
KNOW	70.2003	<i>Ercole SORI</i> (Iix): <u>Mapping Diversity in Social History</u>
KNOW	71.2003	<i>Ljiljana DERU SIMIC</i> (Ixi): <u>What is Specific about Art/Cultural Projects?</u>
KNOW	72.2003	<i>Natalya V. TARANOVA</i> (Ixi): <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</i> (Ixi): <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</i> (Ixi): <u>Glocal Dialogue- Transformation through Transcultural Communication</u>
KNOW	75.2003	<i>Catarina REIS OLIVEIRA</i> (Ixi): <u>Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal</u>
KNOW	76.2003	<i>Sandra WALLMAN</i> (Ixi): <u>The Diversity of Diversity - towards a typology of urban systems</u>
KNOW	77.2003	<i>Richard PEARCE</i> (Ixi): <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK</i> (Ixi): <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: <u>Oil and Product Dynamics in International Petroleum Markets</u></i>
CLIM	82.2003	<i>Y. Hossein FARZIN and Jinhua ZHAO: <u>Pollution Abatement Investment When Firms Lobby Against Environmental Regulation</u></i>
CLIM	83.2003	<i>Giuseppe DI VITA: <u>Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?</u></i>
CLIM	84.2003	<i>Reyer GERLAGH and Wietze LISE: <u>Induced Technological Change Under Carbon Taxes</u></i>
NRM	85.2003	<i>Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU: <u>How Fast are the Tourism Countries Growing? The cross-country evidence</u></i>
KNOW	86.2003	<i>Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI: <u>The ICT Revolution: opportunities and risks for the Mezzogiorno</u></i>
SIEV	87.2003	<i>Lucas BRETSCGHER and Sjak SMULDERS: <u>Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments</u></i>
CLIM	88.2003	<i>Johan EYCKMANS and Michael FINUS: <u>New Roads to International Environmental Agreements: The Case of Global Warming</u></i>
CLIM	89.2003	<i>Marzio GALEOTTI: <u>Economic Development and Environmental Protection</u></i>
CLIM	90.2003	<i>Marzio GALEOTTI: <u>Environment and Economic Growth: Is Technical Change the Key to Decoupling?</u></i>
CLIM	91.2003	<i>Marzio GALEOTTI and Barbara BUCHNER: <u>Climate Policy and Economic Growth in Developing Countries</u></i>
IEM	92.2003	<i>A. MARKANDYA, A. GOLUB and E. STRUKOVA: <u>The Influence of Climate Change Considerations on Energy Policy: The Case of Russia</u></i>
ETA	93.2003	<i>Andrea BELTRATTI: <u>Socially Responsible Investment in General Equilibrium</u></i>
CTN	94.2003	<i>Parkash CHANDER: <u>The γ-Core and Coalition Formation</u></i>
IEM	95.2003	<i>Matteo MANERA and Angelo MARZULLO: <u>Modelling the Load Curve of Aggregate Electricity Consumption Using Principal Components</u></i>
IEM	96.2003	<i>Alessandro LANZA, Matteo MANERA, Margherita GRASSO and Massimo GIOVANNINI: <u>Long-run Models of Oil Stock Prices</u></i>
CTN	97.2003	<i>Steven J. BRAMS, Michael A. JONES, and D. Marc KILGOUR: <u>Forming Stable Coalitions: The Process Matters</u></i>
KNOW	98.2003	<i>John CROWLEY, Marie-Cecile NAVES (Ixxiii): <u>Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities</u></i>
KNOW	99.2003	<i>Richard THOMPSON FORD (Ixxiii): <u>Cultural Rights and Civic Virtue</u></i>
KNOW	100.2003	<i>Alaknanda PATEL (Ixxiii): <u>Cultural Diversity and Conflict in Multicultural Cities</u></i>
KNOW	101.2003	<i>David MAY (Ixxiii): <u>The Struggle of Becoming Established in a Deprived Inner-City Neighbourhood</u></i>
KNOW	102.2003	<i>Sébastien ARCAND, Danielle JUTEAU, Sirma BILGE, and Francine LEMIRE (Ixxiii) : <u>Municipal Reform on the Island of Montreal: Tensions Between Two Majority Groups in a Multicultural City</u></i>
CLIM	103.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>China and the Evolution of the Present Climate Regime</u></i>
CLIM	104.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>Emissions Trading Regimes and Incentives to Participate in International Climate Agreements</u></i>
CLIM	105.2003	<i>Anil MARKANDYA and Dirk T.G. RÜBBELKE: <u>Ancillary Benefits of Climate Policy</u></i>
NRM	106.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Management Challenges for Multiple-Species Boreal Forests</u></i>
NRM	107.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Threshold Effects in Coral Reef Fisheries</u></i>
SIEV	108.2003	<i>Sara ANIYAR (Ixiv): <u>Estimating the Value of Oil Capital in a Small Open Economy: The Venezuela's Example</u></i>
SIEV	109.2003	<i>Kenneth ARROW, Partha DASGUPTA and Karl-Göran MÄLER (Ixiv): <u>Evaluating Projects and Assessing Sustainable Development in Imperfect Economies</u></i>
NRM	110.2003	<i>Anastasios XEPAPADEAS and Catarina ROSETA-PALMA (Ixiv): <u>Instabilities and Robust Control in Fisheries</u></i>
NRM	111.2003	<i>Charles PERRINGS and Brian WALKER (Ixiv): <u>Conservation and Optimal Use of Rangelands</u></i>
ETA	112.2003	<i>Jack GOODY (Ixiv): <u>Globalisation, Population and Ecology</u></i>
CTN	113.2003	<i>Carlo CARRARO, Carmen MARCHIORI and Sonia OREFFICE: <u>Endogenous Minimum Participation in International Environmental Treaties</u></i>
CTN	114.2003	<i>Guillaume HAERINGER and Myrna WOODERS: <u>Decentralized Job Matching</u></i>
CTN	115.2003	<i>Hideo KONISHI and M. Utku UNVER: <u>Credible Group Stability in Multi-Partner Matching Problems</u></i>
CTN	116.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for the Room-Mates Problem</u></i>
CTN	117.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for a Generalized Marriage Problem</u></i>
CTN	118.2003	<i>Marita LAUKKANEN: <u>Transboundary Fisheries Management under Implementation Uncertainty</u></i>
CTN	119.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Social Conformity and Bounded Rationality in Arbitrary Games with Incomplete Information: Some First Results</u></i>
CTN	120.2003	<i>Gianluigi VERNASCA: <u>Dynamic Price Competition with Price Adjustment Costs and Product Differentiation</u></i>
CTN	121.2003	<i>Myrna WOODERS, Edward CARTWRIGHT and Reinhard SELTEN: <u>Social Conformity in Games with Many Players</u></i>
CTN	122.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>On Equilibrium in Pure Strategies in Games with Many Players</u></i>
CTN	123.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Conformity and Bounded Rationality in Games with Many Players</u></i>
	1000	Carlo CARRARO, Alessandro LANZA and Valeria PAPPONETTI: <u>One Thousand Working Papers</u>

NOTE DI LAVORO PUBLISHED IN 2004

IEM	1.2004	<i>Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB: <u>Empirical Analysis of National Income and So2 Emissions in Selected European Countries</u></i>
ETA	2.2004	<i>Masahisa FUJITA and Shlomo WEBER: <u>Strategic Immigration Policies and Welfare in Heterogeneous Countries</u></i>
PRA	3.2004	<i>Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI: <u>Do Privatizations Boost Household Shareholding? Evidence from Italy</u></i>
ETA	4.2004	<i>Victor GINSBURGH and Shlomo WEBER: <u>Languages Disenfranchisement in the European Union</u></i>
ETA	5.2004	<i>Romano PIRAS: <u>Growth, Congestion of Public Goods, and Second-Best Optimal Policy</u></i>
CCMP	6.2004	<i>Herman R.J. VOLLEBERGH: <u>Lessons from the Polder: Is Dutch CO2-Taxation Optimal</u></i>
PRA	7.2004	<i>Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxv): <u>Merger Mechanisms</u></i>
PRA	8.2004	<i>Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER (lxv): <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u></i>
PRA	9.2004	<i>Pegaret PICHLER and Alex STOMPER (lxv): <u>Primary Market Design: Direct Mechanisms and Markets</u></i>
PRA	10.2004	<i>Florian ENGLMAIER, Pablo GUILLEN, Loreto LLORENTE, Sander ONDERSTAL and Rupert SAUSGRUBER (lxv): <u>The Chopstick Auction: A Study of the Exposure Problem in Multi-Unit Auctions</u></i>
PRA	11.2004	<i>Bjarne BRENDSTRUP and Harry J. PAARSCH (lxv): <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u></i>
PRA	12.2004	<i>Ohad KADAN (lxv): <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u></i>
PRA	13.2004	<i>Maarten C.W. JANSSEN (lxv): <u>Auctions as Coordination Devices</u></i>
PRA	14.2004	<i>Gadi FIBICH, Arieh GAVIOUS and Aner SELA (lxv): <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u></i>
PRA	15.2004	<i>Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxv): <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u></i>
PRA	16.2004	<i>Marta STRYSZOWSKA (lxv): <u>Late and Multiple Bidding in Competing Second Price Internet Auctions</u></i>
CCMP	17.2004	<i>Slim Ben YOUSSEF: <u>R&D in Cleaner Technology and International Trade</u></i>
NRM	18.2004	<i>Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU (lxvi): <u>Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics</u></i>
SIEV	19.2004	<i>Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA: <u>Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice</u></i>
NRM	20.2004	<i>Guido CANDELA and Roberto CELLINI (lxvii): <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u></i>
NRM	21.2004	<i>Jacqueline M. HAMILTON (lxvii): <u>Climate and the Destination Choice of German Tourists</u></i>
NRM	22.2004	<i>Javier Rey-MAQUIEIRA PALMER, Javier LOZANO IBÁÑEZ and Carlos Mario GÓMEZ GÓMEZ (lxvii): <u>Land, Environmental Externalities and Tourism Development</u></i>
NRM	23.2004	<i>Pius ODUNGA and Henk FOLMER (lxvii): <u>Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya</u></i>
NRM	24.2004	<i>Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO (lxvii): <u>Tourism, Trade and Domestic Welfare</u></i>
NRM	25.2004	<i>Riaz SHAREEF (lxvii): <u>Country Risk Ratings of Small Island Tourism Economies</u></i>
NRM	26.2004	<i>Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxvii): <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u></i>
NRM	27.2004	<i>Raúl Hernández MARTÍN (lxvii): <u>Impact of Tourism Consumption on GDP. The Role of Imports</u></i>
CSRM	28.2004	<i>Nicoletta FERRO: <u>Cross-Country Ethical Dilemmas in Business: A Descriptive Framework</u></i>
NRM	29.2004	<i>Marian WEBER (lxvi): <u>Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest</u></i>
NRM	30.2004	<i>Trond BJORN DAL, Phoebe KOUNDOURI and Sean PASCOE (lxvi): <u>Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting</u></i>
CCMP	31.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part I: Sectoral Analysis of Climate Impacts in Italy</u></i>
CCMP	32.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part II: Individual Perception of Climate Extremes in Italy</u></i>
CTN	33.2004	<i>Wilson PEREZ: <u>Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution</u></i>
KTHC	34.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI (lxviii): <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u></i>
KTHC	35.2004	<i>Linda CHAIB (lxviii): <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u></i>
KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (lxviii): <u>Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context</u></i>
KTHC	37.2004	<i>Kristine CRANE (lxviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam HAMDE (lxviii): <u>Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm</u></i>
ETA	39.2004	<i>Alberto CAVALIERE: <u>Price Competition with Information Disparities in a Vertically Differentiated Duopoly</u></i>
PRA	40.2004	<i>Andrea BIGANO and Stef PROOST: <u>The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?</u></i>
CCMP	41.2004	<i>Micheal FINUS (lxix): <u>International Cooperation to Resolve International Pollution Problems</u></i>

KTHC	42.2004	<i>Francesco CRESPI</i> : <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u>
CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI</i> : <u>Coalition Formation in Games without Synergies</u>
CTN	44.2004	<i>Marc ESCRHUELA-VILLAR</i> : <u>Cartel Sustainability and Cartel Stability</u>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL</i> (lxvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u>
NRM	46.2004	<i>Signe ANTHON and Bo JELLESMARK THORSEN</i> (lxvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u>
NRM	47.2004	<i>John MBURU</i> (lxvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYOVAI and Melinda SMALE</i> (lxvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transitional Economy</u>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON</i> : <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u>
GG	50.2004	<i>Scott BARRETT and Michael HOEL</i> : <u>Optimal Disease Eradication</u>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG</i> : <u>Simple Priorities and Core Stability in Hedonic Games</u>
SIEV	52.2004	<i>Francesco RICCI</i> : <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON</i> : <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF</i> (lxvi): <u>Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams</u>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN</i> (lxvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u>
NRM	56.2004	<i>Tom DEDEURWAERDERE</i> (lxvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON</i> : <u>The Amenity Value of Climate to German Households</u>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN</i> : <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u>
NRM	59.2004	<i>Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA</i> (lxvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI</i> (lxvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO</i> : <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u>
NRM	62.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH</i> : <u>Resource-Abundance and Economic Growth in the U.S.</u>
NRM	63.2004	<i>Györgyi BELA, Györgyi PATAKI, Melinda SMALE and Mariann HAJDÚ</i> (lxvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN</i> (lxvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u>
NRM	65.2004	<i>E.C.M. RUIJGROK</i> (lxvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS</i> : <u>Uncertainty Aversion, Robust Control and Asset Holdings</u>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA</i> : <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u>
GG	68.2004	<i>Michael FINUS</i> : <u>Modesty Pays: Sometimes!</u>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO</i> : <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT</i> : <u>On Coalition Formation with Heterogeneous Agents</u>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA</i> : <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER</i> : <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA</i> : <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u>
CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND</i> : <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO</i> : <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u>
CTN	76.2004	<i>Salvador BARBERÀ and Matthew O. JACKSON</i> (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u>
CTN	77.2004	<i>Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERA and Fernando VEGA-REDONDO</i> (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES</i> (lxx): <u>Contracting with Externalities and Outside Options</u>

CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE</i> (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON</i> (lxx): <u>The Formation of Networks with Transfers among Players</u>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO</i> (lxx): <u>Bicameralism and Government Formation</u>
CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Annon RAPOPORT</i> (lxx): <u>Potential Maximization and Coalition Government Formation</u>
CTN	83.2004	<i>Kfir ELIAZ, Debraj RAY and Ronny RAZIN</i> (lxx): <u>Group Decision-Making in the Shadow of Disagreement</u>
CTN	84.2004	<i>Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ</i> (lxx): <u>Economics: An Emerging Small World?</u>
CTN	85.2004	<i>Edward CARTWRIGHT</i> (lxx): <u>Learning to Play Approximate Nash Equilibria in Games with Many Players</u>
IEM	86.2004	<i>Finn R. FØRSUND and Michael HOEL</i> : <u>Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power</u>
KTHC	87.2004	<i>Elissaios PAPYRAKIS and Reyer GERLAGH</i> : <u>Natural Resources, Investment and Long-Term Income</u>
CCMP	88.2004	<i>Marzio GALEOTTI and Claudia KEMFERT</i> : <u>Interactions between Climate and Trade Policies: A Survey</u>
IEM	89.2004	<i>A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE</i> : <u>Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?</u>
GG	90.2004	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Agreements and Technology Policy</u>
PRA	91.2004	<i>Sergei IZMALKOV</i> (lxx): <u>Multi-Unit Open Ascending Price Efficient Auction</u>
KTHC	92.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI</i> : <u>Cities and Cultures</u>
KTHC	93.2004	<i>Massimo DEL GATTO</i> : <u>Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution</u>
CCMP	94.2004	<i>Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON</i> : <u>Equilibrium with a Market of Permits</u>
CCMP	95.2004	<i>Bob van der ZWAAN and Reyer GERLAGH</i> : <u>Climate Uncertainty and the Necessity to Transform Global Energy Supply</u>
CCMP	96.2004	<i>Francesco BOSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL</i> : <u>Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise</u>
CTN	97.2004	<i>Gustavo BERGANTIÑOS and Juan J. VIDAL-PUGA</i> : <u>Defining Rules in Cost Spanning Tree Problems Through the Canonical Form</u>
CTN	98.2004	<i>Siddhartha BANDYOPADHYAY and Mandar OAK</i> : <u>Party Formation and Coalitional Bargaining in a Model of Proportional Representation</u>
GG	99.2004	<i>Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA</i> : <u>The Impact of Surplus Sharing on the Stability of International Climate Agreements</u>
SIEV	100.2004	<i>Chiara M. TRAVISI and Peter NIJKAMP</i> : <u>Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents</u>
SIEV	101.2004	<i>Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP</i> : <u>A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure</u>
NRM	102.2004	<i>Valentina BOSETTI and David TOMBERLIN</i> : <u>Real Options Analysis of Fishing Fleet Dynamics: A Test</u>
CCMP	103.2004	<i>Alessandra GORIA e Gretel GAMBARELLI</i> : <u>Economic Evaluation of Climate Change Impacts and Adaptability in Italy</u>
PRA	104.2004	<i>Massimo FLORIO and Mara GRASSEN</i> : <u>The Missing Shock: The Macroeconomic Impact of British Privatisation</u>
PRA	105.2004	<i>John BENNETT, Saul ESTRIN, James MAW and Giovanni URGA</i> : <u>Privatisation Methods and Economic Growth in Transition Economies</u>
PRA	106.2004	<i>Kira BÖRNER</i> : <u>The Political Economy of Privatization: Why Do Governments Want Reforms?</u>
PRA	107.2004	<i>Pehr-Johan NORBÄCK and Lars PERSSON</i> : <u>Privatization and Restructuring in Concentrated Markets</u>
SIEV	108.2004	<i>Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo MAINARDI</i> : <u>Comparison between Artisanal Fishery and Manila Clam Harvesting in the Venice Lagoon by Using Ecosystem Indicators: An Ecological Economics Perspective</u>
CTN	109.2004	<i>Somdeb LAHIRI</i> : <u>The Cooperative Theory of Two Sided Matching Problems: A Re-examination of Some Results</u>
NRM	110.2004	<i>Giuseppe DI VITA</i> : <u>Natural Resources Dynamics: Another Look</u>
SIEV	111.2004	<i>Anna ALBERINI, Alistair HUNT and Anil MARKANDYA</i> : <u>Willingness to Pay to Reduce Mortality Risks: Evidence from a Three-Country Contingent Valuation Study</u>
KTHC	112.2004	<i>Valeria PAPPONETTI and Dino PINELLI</i> : <u>Scientific Advice to Public Policy-Making</u>
SIEV	113.2004	<i>Paulo A.L.D. NUNES and Laura ONOFRI</i> : <u>The Profile of a “Warm-Glower”: A Note on Consumer’s Behavior and Public Policy Implications</u>
IEM	114.2004	<i>Patrick CAYRADE</i> : <u>Investments in Gas Pipelines and Liquefied Natural Gas Infrastructure What is the Impact on the Security of Supply?</u>
IEM	115.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA</i> : <u>Oil Security. Short- and Long-Term Policies</u>
IEM	116.2004	<i>Valeria COSTANTINI and Francesco GRACCEVA</i> : <u>Social Costs of Energy Disruptions</u>
IEM	117.2004	<i>Christian EGENHOFER, Kyriakos GIALOGLOU, Giacomo LUCIANI, Maroeska BOOTS, Martin SCHEEPERS, Valeria COSTANTINI, Francesco GRACCEVA, Anil MARKANDYA and Giorgio VICINI</i> : <u>Market-Based Options for Security of Energy Supply</u>
IEM	118.2004	<i>David FISK</i> : <u>Transport Energy Security. The Unseen Risk?</u>

- (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
- (lxiii) This paper was presented at the ENGIME Workshop on “Social dynamics and conflicts in multicultural cities”, Milan, March 20-21, 2003
- (lxiv) This paper was presented at the International Conference on “Theoretical Topics in Ecological Economics”, organised by the Abdus Salam International Centre for Theoretical Physics - ICTP, the Beijer International Institute of Ecological Economics, and Fondazione Eni Enrico Mattei – FEEM Trieste, February 10-21, 2003
- (lxv) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications” organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
- (lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL), Venice, August 28-29, 2003
- (lxvii) This paper has been presented at the international conference on “Tourism and Sustainable Economic Development – Macro and Micro Economic Issues” jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
- (lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003
- (lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference “The Future of Climate Policy”, Cagliari, Italy, 27-28 March 2003
- (lxx) This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

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)
CSR	<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>

2004 SERIES

CCMP	<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)
KTHC	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRA	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>