

**Behavioral Biases of Dealers
in U.S. Treasury Auctions**

David Goldreich

NOTA DI LAVORO 143.2004

DECEMBER 2004

PRA – Privatisation, Regulation, Antitrust

David Goldreich, *London Business School and CEPR*

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=624461>

Behavioral Biases of Dealers in U.S. Treasury Auctions

Summary

This paper provides evidence of bounded rationality by large dealers in U.S. Treasury auctions. I argue that these dealers use a heuristic of yield-space bidding which leads to biases manifested in three ways: they submit dominated bids, i.e., those that could be improved without raising the bidding price; they bid in a manner that disregards the unevenly spaced price grid; and they round bids in yield space. Consistent with bounded rationality, I show that bidders are less susceptible to bias when the cost of suboptimal bidding is high. While the literature provides substantial evidence of behavioral biases among individual investors, they are less well documented for large sophisticated institutions that are likely to be important for setting asset prices. These primary bond dealers who regularly bid for billions of dollars in Treasury bill auctions are precisely such economic agents.

Keywords: Treasury auctions, Behavioral finance

JEL Classification: H63, H74, D44

This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by Fondazione Eni Enrico Mattei and Consip and sponsored by the EU, Rome, September 23-25, 2004.

I would like to thank Nick Barberis, Joao Cocco, Denis Gromb, Tim Johnson, Anthony Neuberger, Kjell Nyborg, Sergey Sanzhar, Stephen Schaefer and seminar participants at London Business School and the FEEM Conference on Auctions and Market Design for helpful discussions. Remaining errors are my own.

Address for correspondence:

David Goldreich
London Business School
Regent's Park
London NW1 4SA
UK
Phone: +44 0 20 7272 5050
E-mail: dgoldreich@london.edu

1 Introduction

Behavioral biases among individual investors have been documented by a growing literature. In fact, casual empiricism or simple introspection confirms that economic agents do not always behave fully rationally. However, this type of behavior has been less well documented for investors who are likely to be important in the setting of asset prices, i.e., large sophisticated institutions that participate repeatedly in the marketplace.

Primary bond dealers who participate regularly in U.S. Treasury bill auctions are precisely the type of economic agents that should be expected to act according to models of rational behavior. They regularly bid for billions of dollars worth of securities in competitive auctions, which are held several times each week.

Nevertheless, this paper documents that these dealers often submit suboptimal bids, i.e., in auctions for very-short-term Treasury bills they could increase the probability of winning the auction without changing the price they would pay for the securities. The observed suboptimal bids could be explained by bounded rationality. Under bounded rationality, economic agents use heuristics to approximate an optimal action (as proposed by Simon (1955) and discussed recently in Kahneman (2003)).¹ Since Treasury auctions are held in yield space and fixed-income securities are usually quoted in yield space, i.e., the bidding decision is “framed” in yield space, I argue that the heuristic used by dealers in Treasury auctions involves choosing a bid in yield space rather than in price space. As explained below, certain bids in yield space can be shown to be suboptimal because of the details of the yield-price conversion in U.S. Treasury auctions.

Treasury auctions are conducted in yield space, and bidders that submit the lowest yields are awarded the securities. The yield is then converted into a price to be paid for the securities. For very-short-term Treasury bills, the rounding rules are such that two different yields can correspond to the same price. This occurs because the grid is finer in yield space in

¹See Gabaix and Laibson (2000) for a recent implementation.

price space. Since the auction rules specify that the lowest submitted yields win the auction, there can be two (or more) bids that are the same in price space, of which one will win the auction and one will lose. I refer to the bid with the higher yield as being “dominated” by the bid with the lower yield, as it implies the same price, but a lower probability of winning the auction.

This could simply be a curiosity in the auction rules, except that the allocation of many billions of dollars of securities are at stake in each auction; a large proportion of possible bids on the bidding grid are dominated (including more than half of the allowable bids for the weekly four-week Treasury bill auction); and most importantly, auction participants submit dominated bids regularly.

I examine the phenomenon of dominated bids under both the traditional “multiple-price” auction format and the current “single-price” auction format. Under the multiple-price format, dominated bids are never optimal, and any dominated bids should be viewed as evidence of a behavioral bias. Under the single-price format, in certain cases dominated bids could be consistent with rationality, as they could be chosen with the intention of reducing the probability of being rationed at a lower price rather than to win at the bid price. However, such bids should be observed only very infrequently.² Empirically, under both auction formats I find a large proportion of dominated bids: 28% of observed bids in multiple-price auctions and 52% of observed bids in single-price auctions are dominated (in auctions that have the potential for dominated bids). These results show that when bidding for Treasury bills, dealers do not fully optimize.

Since boundedly rational agents trade off the costs and benefits of optimization, when a bidder has a high valuation and the benefit to optimizing his bid is large, he should be less likely to use the yield-space heuristic. Therefore, I distinguish between marginal bids (i.e., those at the market clearing price) and inframarginal bids (i.e., winning bids with a bid

²Fleming, Garbade, and Keane (2004) also identify dominated bids, but only in single-price auctions, and do not recognize that under that auction format such bidding is not necessarily inconsistent with optimality.

price above the market clearing price). If inframarginal bidders anticipate a high probability of winning the auction, they have a greater incentive to choose their bids carefully. I find that among inframarginal bids under the multiple-price format dominated bids are relatively infrequent. The bias is reduced - but not eliminated - when there is both a high probability of winning the auction and the price to be paid depends on the bid. In contrast, in single-price auctions, in which the price paid by inframarginal bidders does not directly depend on their bids, there is little incentive to optimize and we observe many dominated bids.

In addition to the frequency of dominated bids, I provide further evidence that bidders use the heuristic of yield space. In the bidding for three-month Treasury bills there is no possibility of dominated bids, but for related reasons the equally spaced grid in yield space implies an uneven grid in price space. That is, the bid increment alternates between larger and smaller steps. Presumably, one would expect that the frequency of bids would differ between those that are before a large step and those that are before a small step. Nevertheless, in a sample of 760 auctions, I find that both the marginal bids and the inframarginal bids are almost exactly evenly split between bids before the smaller increment and before the larger increment. While this is not definitive on its own, as the optimal bidding strategy is model dependent, it does add to the evidence that bidders think in yield space.

As a third piece of evidence of behavioral bias, I document the tendency of bidders to bid in round numbers (e.g., 5.20% rather than 5.19% or 5.21%). This in itself is unlikely to be consistent with optimization. But the fact that the tendency to bid round numbers

here between marginal and inframarginal bids suggests that inframarginal bidders are not just those who observe a high signal. Rather, it indicates that inframarginal bidders know that they have a high probability of winning the auction, while marginal bidders know that they have a lower probability of winning. This suggests either a private-value component to the auction or a downward sloping demand curve for Treasury bills.

Because this paper considers large dealers, it complements the growing literature documenting behavior inconsistent with rational behavior by individual investors.³ The behavioral finance literature is supported by a very large experimental literature showing how individual decision making is influenced by psychological effects. In addition, a series of papers going back to Simon (1955) argues that economic agents are only boundedly rational, i.e., they only approximately optimize because of the costs of perfect optimization.⁴ The effect of framing on decision making, in the context of this paper the fact that the auction is conducted in yield space, goes back to Tversky and Kahneman (1981).

One defence of rational asset pricing models is that individual investors are often small infrequent traders and unimportant in the pricing of securities. More important, the argument goes, is the behavior of large institutions that participate on a large scale on a regular basis. So the main point of this paper is to demonstrate that even large sophisticated dealers, repeatedly bidding for billions of dollars of securities, are subject to bounded rationality.

The rest of the paper proceeds as follows. Section 2 describes the market and the institutional details that allow for dominated bids. Section 3 presents the empirical evidence of behavioral biases and bounded rationality. In Section 4, I show formally the conditions under which dominated bids are compatible or incompatible with rationality. Section 5 concludes.

³A very small sample of that literature includes the results that investors do not diversify their portfolios sufficiently (French and Poterba (1991), Huberman (2001), and Grinblatt and Keloharju (2001)); investors trade too frequently (Barber and Odean (2000)); and investors trade based on irrelevant past purchase prices (Odean (1998)). See Barberis and Thaler (2003) for a recent review of theoretical and empirical behavioral finance. See also Shleifer (2000).

⁴See Camerer (1995) for a survey of the experimental literature on psychology and decision making. See Conlisk (1996) for a review of the literature on bounded rationality.

2 The auction and the rounding rules

In this section, I describe the Treasury auction, and explain how two bids of the same price can have different priorities in Treasury auctions, i.e., for a bid to be dominated.

This paper focuses on very-short-term Treasury bills, including “cash management bills” (CMBs) of varying maturities auctioned irregularly to manage the short-term cash needs of the government, and four-week Treasury bills auctioned on a weekly basis since mid 2001. The maturity of CMBs can be from a single day to a year, but in recent years the maturity has typically been just a few weeks. The Treasury also auctions 13-week and 26-week bills on a weekly basis, as well as longer-term coupon-bearing notes, but for reasons that will soon be clear these securities are not subject to the phenomenon of dominated bids. However, longer-term bills will be relevant for the other effects documented in this paper.

The issue size of CMBs varies substantially, but in recent years has averaged over \$20 billion per auction. Since first issued, the weekly issue size of 4-week bills has averaged over \$16 billion. Some 20 to 30 primary dealers submit the vast majority of bids in the auctions for these securities. Table 1 presents summary statistics of Treasury bill auction characteristics. The auctions are oversubscribed, with the quantity of bids exceeding supply by a factor of 2.3 to 4.3 (depending on the subset considered). For the purposes of this paper, the summary statistics are broken up by auction format and by tick size.

The auction proceeds as follows: A number of days prior to the auction the quantity and maturity of the securities to be issued are announced. Immediately before the auction deadline, each bidder submits (possibly multiple) yield-quantity pairs. The yields submitted by bidders are constrained to fall on a discrete grid. Currently, the bidding increment for all Treasury bills is a half basis point (0.005%), e.g., 3.240%, 3.245% etc. In the past, bids were submitted as multiples of a whole basis point.

The auctioneer determines the stop-out yield as the lowest yield at which the quantity demanded equals or exceeds the supply of securities. Bids at lower yields are awarded their

demand in full. Bids exactly at the stop-out yield are awarded a fraction of their demand on a pro-rata basis to clear the market.

Under the traditional “multiple-price” format, used until November 1998, each winning bidder pays a price corresponding to his submitted yield. Under the newer “single-price” auction format, all winning bidders pay a price corresponding to the market-clearing stop-out yield.⁵ This paper considers auctions under both formats.

Given the yield in the auction, the price per \$100 of face value is

$$P = 100(1 - yield \times ndays/360) \text{ rounded to the nearest } \$0.001,$$

where *ndays* is the maturity of the bill measured in days. The yield used in this calculation is known as the “banker’s discount rate”.⁶

The rounding of P to the nearest \$0.001 is crucial to the present puzzle, since it generates a second grid: first, the bids are constrained to a grid of one basis point (or, more recently, a half basis point) in yield space (the “bidding grid”), second, the corresponding dollar price is rounded to fall on a grid with a tick size of \$0.001 (the “pricing grid”).

Consider a hypothetical Treasury bill with 36 days until maturity and a tick size of one basis point. For such a security, each basis point increment in the yield corresponds to a reduction of \$0.001 in price. Hence, there is a one-to-one correspondence between the bidding grid and the pricing grid. However, for bills of less than 36-days maturity, each basis point change in yield corresponds to a change of less than \$0.001 in price space. This implies that two different bids in yield space could be rounded to the same price, even though a pair of such bids would have different priorities in the determination of who wins the auction. The bid with the higher yield is dominated by the bid with the lower yield, since by lowering the yield a bidder could increase his probability of winning the auction without changing the price.

⁵In the auction literature, these formats are usually referred to as “uniform-price” and “discriminatory” mechanisms. In this paper, I use the Treasury’s terminology.

⁶See Federal Register (1999) for the official rules of the auction including the yield-price conversion.

Under the half basis point tick size, the same reasoning implies that dominated bids exist for auctions of securities with maturities of less than 72 days. For four-week Treasury bills (which have a half basis point tick size), for example, the pricing grid is $72/28 = 2.57$ times as wide as the bidding grid. As a result, some 61% ($= (2.57 - 1) / 2.57$) of all possible bids are dominated. See Table 2 for a numerical example of dominated bids.

The interpretation of dominated bids depends on the auction format. Under the multiple-price format, a rational bidder would never submit a dominated bid. Indeed, by submitting a bid at the next lower yield increment (corresponding to the same price), he could increase the likelihood of being awarded the securities precisely in those states when the auction outcome implies a high value to the securities. Under the single-price format dominated bids are not necessarily suboptimal, but should be an infrequent occurrence. It can be rational if the bidder wants to ensure that his allocation will not be reduced by rationing at the next lower price, but values the bills at less than the price of his bid. In Section 4, I formalize these arguments.

The rounding rule has a second implication. Indeed, for longer term bills there is no possibility of dominated bids. Nevertheless, the rounding rule results in a bidding grid that is not uniformly spaced in price space. (Indeed, dominated bids are merely an extreme example of unevenly spaced grid in price space.) For example, in a 13-week Treasury bill auction with a one basis point bidding increment in yield space, the increments in price space would alternate between \$0.002 and \$0.003.

3 Empirical results

In this section, I show that the observed bidding patterns in Treasury bill auctions are consistent with boundedly rational bidders using a heuristic of choosing bids in yield space. Such bidders are more likely to abandon the heuristic and optimize when the cost of deviating

from optimality is high. The main evidence is the frequency of dominated bids. As corroborating evidence, I discuss the bidding patterns in auctions with unevenly spaced grids in price space, as well as the tendency to bid in round numbers in yield space.

The data used in this paper are drawn from the summary statistics revealed by the Treasury after each auction. The statistics released by the Treasury depend on the auction format. For multiple-price auctions, the Treasury reveals the market-clearing yield and the lowest winning yield. For single-price auctions, the statistics include the market-clearing yield, the median winning yield, and the 95th-percentile winning yield (i.e., the lowest winning yield excluding the 5% tail of winning bids). Individual bids are never revealed. So although we do not observe each individual bid, the summary statistics allow one to observe the yield of the marginal bidder, as well as certain inframarginal bids.

3.1 Dominated bids

As explained above, since there is both a bidding grid in yield space and a second grid in price space, it is possible for a bid to be dominated when the maturity of a security is very short. In this section, I examine the frequency of dominated bids under both the multiple-price auction format and the single-price format. I distinguish between marginal bids and inframarginal bids to determine how a bidder's valuation affects his tendency to submit a dominated bid.

First consider multiple-price auctions. In the sample, there are 65 CMB auctions conducted under the multiple-price format. If bidders are perfectly rational, we should not observe any dominated bids. At the other extreme, if bidders only think in terms of yield, we should observe dominated bids in proportion to the number of potential bids on the bidding grid that would be dominated. The middle case is that bidders are boundedly rational and, using a heuristic of choosing bids in yield space, are likely to submit dominated bids when the cost of doing so is low, but less likely to do so when the cost is high.

The frequency of dominated bids is reported in Panel A of Table 3. Among market-clearing bids, 43% are dominated. Among observed inframarginal bids, 14% are dominated. The existence of dominated bids, especially the high percentage among market-clearing bids is strong evidence that bidders do not fully optimize, but are subject to a behavioral bias.⁷

Indeed, bidders do not think exclusively in yield space. Indeed, of all possible yields on the bidding grid for these bills, an average of 58% would be dominated, so if bidders completely disregard the rounding rule, approximately 58% of all observed bids should be dominated. In fact, fewer bids are dominated, indicating that at least some bidders are aware of this possibility and, at least sometimes, avoid dominated bids. This difference between the potential frequency of dominated bids and the observed frequency is highly statistically significant.

Moreover, the difference in the frequency of dominated bids between marginal and inframarginal bids is statistically significant at the 1% level. This is suggestive of bounded rationality. Inframarginal bidders are those that choose to bid in a manner that has a high probability of winning, while at the same time paying the higher price of such a bid (because of the multiple-price format). Therefore, an inframarginal investor has incentive to choose a bid that simultaneously increases the probability of winning without raising the price excessively. Dominated bids are precisely those that an inframarginal bidder should avoid, as they lower the probability of winning without lowering the price. In comparison, marginal (market-clearing) bidders have a lower ex-ante probability of winning the auction, so their incentive to choose an undominated bid decreases accordingly. Thus, under the multiple-price format, bounded rationality implies that marginal bidders should be more likely to use the yield-space heuristic.

⁷One could argue that bidders want to lose the auction because they view it as negative NPV, and are only bidding to satisfy the requirement that primary dealers bid meaningfully. However, the high levels of oversubscription, and the fact that the observed bids are from those that actually win the auction, suggest that bidders are actively trying to win the auctions. Moreover there is substantial evidence that bidders in Treasury auctions earn positive rents on average. (See Cammack (1991), Goldreich (2004), Nyborg and Sundaresan (1996).)

Panel B of Table 3 presents the results for 172 single-price auctions. Note that under this format, the observed inframarginal bids in the data include the median and 95th-percentile winning yields, rather than the lowest winning yield.

The results are superficially similar to those of the multiple-price auction. A large percentage of both marginal and inframarginal bids are dominated. The percentage of dominated bids among market-clearing bids and median winning bids is statistically significantly less than the 64 percent of all possible yields on the bidding grid that would be dominated. (In the case of the 95th percentile winning bids, this difference is only significant at the 10% level.)

The striking difference in contrast to the multiple-price auction is that under the single-price auction, inframarginal bids are *more* likely to be dominated than market-clearing bids. This difference is perfectly consistent with bounded rationality. Inframarginal bidders may be those with a high private valuation who knowingly submit a bid with a very high probability of winning, but since under the single-price format all winning bidders pay the same price, they have little incentive to carefully choose a bid from among those that are likely to win. However, marginal bidders are more likely to be those that only want to win if the price is sufficiently low, and are more likely to exert the effort to choose a bid carefully. Thus, marginal bidders are less likely to use a yield-space heuristic and submit dominated bids.

To summarize, the observation that bidders often submit dominated bids is evidence of a behavioral bias on behalf of the large primary dealers who participate in Treasury auctions. However, it is the pattern in the frequency of dominated bids – more frequent for marginal bids under the multiple-price format and more frequent for inframarginal bids under the single-price format – that provides evidence of bounded rationality. Bidders use the yield-space heuristic and submit dominated bids more frequently when the benefits of optimization are low.

This distinction between the bidding strategies of inframarginal bidders across auction

formats, that they are more cautious under the multiple-price format, is consistent with patterns in the observed spread of winning bids. The difference between the marginal bid and the most inframarginal observed bid is typically much wider under the single-price format than under the multiple-price format (even though the most inframarginal observed bids in single-price auctions excludes a 5% tail of winning bids). Although this could be interpreted as arising from more price uncertainty surrounding single-price auctions, in light of the evidence above it seems more likely that inframarginal bidders under the single-price format choose to bid more aggressively since their bids are unlikely to directly affect the price.

The differences between marginal and inframarginal bidders are informative about the nature of Treasury securities as common-value or private-value goods. Bidders in Treasury auctions are often modeled as homogenous investors, each with a signal of a common value. However, the results in this section suggest that bidders are not homogenous, and that inframarginal bidders are not simply those that happen to observe a high signal. Instead, they actively choose to submit a bid that has a higher probability of winning the auction. This would occur if, besides the obvious common-value component, Treasury securities also have a private value component. Bidders that have a high private value submit higher bids to ensure winning the auction and are more likely to be inframarginal.

While the evidence of behavioral bias inherent in dominated bids is clear, it is also important to discuss economic significance. The pricing grid is very small as a percentage of face value – only \$0.001 per \$100 of face value, but it is large when multiplied by more than \$40 billion of Treasury bills issued each week. However, it is not the dollar value of the tick size that is important here, since the phenomenon of dominated bids relates to allocation rather than price.

The relevant economic measure is the quantity of bills awarded to bids at the margin. Bidders who submit a dominated bid are reducing their probability of being awarded these

securities. Although this quantity is not known, it can be roughly estimated based on the summary statistics revealed after each auction. On average, the difference between the market-clearing bid and the median winning bid is 1.5 basis points, or three ticks, for four-week Treasury bills. Conservatively assuming that the distribution of bids is uniform over this range, this corresponds to \$2.7 billion at the margin for a typical \$16 billion auction.⁸ After accounting for rationing among bidders at the margin, there are some \$1.3 billion of securities that are allocated to bidders who submit the market-clearing bid. A bidder who submits a dominated bid reduces his probability of being allocated these securities.

3.2 Unevenly spaced bidding grid

The actions of bidders in the presence of the rounding rule leads to additional evidence that bidders use a heuristic of determining their bids in yield space.

The rounding rule in the yield-price conversion described above leads to an unevenly spaced bidding grid in price space. Since prices are rounded to the nearest \$0.001, the grid step in price space (i.e., the price difference between two adjacent bids) is sometimes larger and sometimes smaller. For example, changing a bid by one basis in yield may correspond to a price change of \$0.001, but the next basis point change in yield may correspond to an additional \$0.002, or vice versa. (See Table 4 for an example of uneven grid steps for 13-week bills.) Dominated bids are simply an extreme form of this in which the size of a step is zero.

The average step size in price space corresponding to an incremental change in the bid yield is $\$0.001 \times (\delta \times ndays/36)$, where δ is the bidding increment in basis points and $ndays$ is the maturity of the bill in days. Only when the maturity of a bill is such that $\delta \times ndays/36$ is equal to an integer are grid steps of constant size in price space. Otherwise there will be

⁸Since the average difference between the median winning bid and the 95th percentile winning bid (3.5 basis points) is much wider than the average difference between the market-clearing bid and the median winning bid, the assumption of a uniform distribution is conservative and it is likely that the average quantity bid at the market-clearing bid exceeds \$2.7 billion.

large steps and small steps. For thirteen-week Treasury bills (under a one basis point bidding grid), the step size averages approximately \$0.0025, so the step size almost always alternates between \$0.002 and \$0.003.

The equilibrium bidding strategy in the presence of an uneven grid is model dependent. For the purposes of this paper I do not impose any one model. Nevertheless, a bidder facing an uneven grid should consider the step size when evaluating potential bids. A bidder may optimally raise his yield by one tick if it corresponds to a substantially lower price, but not if it lowers the price by only a small amount. Of course, in equilibrium he will have to consider how other bidders respond to the uneven grid.

However, if a bidder uses a yield-space heuristic, the distribution of bids in yield space will be unaffected by the uneven steps in the pricing grid.

Since the pricing grid alternates between \$0.002 and \$0.003 for the 13-week bill (for a one basis point tick size, as was the case from 1983 to 1997), it provides an opportunity to observe bidders' response to an uneven grid. A bid can either be before a "large" step or before a "small" step (i.e., so that an increase in yield of one basis point corresponds to a reduction of \$0.003 or \$0.002 in price space, respectively). Table 5 reports the distribution of bids between those before a large step and those before a small step for 760 13-week auctions conducted under the multiple-price format. I exclude the small number of bids that are in between two large steps or in between two small steps. If bidders rationally optimize, we are likely to observe different probabilities of bids before a large step and bids before a small step. However, if bidders think in yield space, they do not distinguish between large and small steps, and we should observe each with equal probability.

I find that almost exactly 50% of bids are before large steps and 50% before small steps. This holds for both marginal and inframarginal bids. This is consistent with bidders using a yield-space heuristic and not paying attention to the uneven grid in price space. Of course, without a well-defined alternative hypothesis, which is avoided here to keep the argument

model independent, one cannot reject rationality. However, the tight confidence intervals around 50% limit the possible rational equilibria and are suggestive of bidders thinking in yield-space.

3.3 Bidding in round numbers

The third piece of evidence of behavioral biases comes from the tendency of bidders to choose “round” numbers in yield space when submitting bids. For example, in the auctions since the bidding grid was reduced from one basis point to a half basis point, more than 75% of observed bids were still submitted as multiples of whole basis points. This tendency to submit bids in round numbers is in itself difficult to reconcile with optimization, but the fact that the bids are rounded in yield space adds extra support to the hypothesis that investors think in yield space. Moreover, there is evidence that the rounding of bids is different between marginal bids and inframarginal bids in a manner suggestive of the behavioral biases proposed in this paper.

I study the rounding tendency by considering 1,826 multiple-price auctions of Treasury bills of all maturities in which there is a tick size of one basis point. This includes every Treasury bill auction until the end of 2003 conducted in yield space that had a one basis point tick size, except for the small number of single-price auctions with a one basis point tick size. Table 6 reports the distribution of the final digit in observed bids. The first result is that the distribution of final digits is not uniformly distributed (and rejected at the 1% level). Consistent with a rounding tendency, the most common final digit is zero for both market-clearing bids and for the most inframarginal bids. The frequency of zero as a final digit is statistically significantly different from 1/10 at the 1% level.

The extent of the bias towards a final digit of zero should be interpreted in light of the fact that the entire spread of winning bids in these auctions averages only 3.2 basis points. So any rounding to zero would only occur when the bid would have been very close to zero

anyway, for example when the optimal bid would have had a final digit of one or nine.

In fact, the distribution of bids allows us to see the direction of the bias. Among market-clearing bids, the least frequent final digit is nine, suggesting that the rounding tendency is manifested by bidders rounding up in yield space from nine to zero, (i.e., rounding down in price space). In contrast, the frequency of a final digit of one is not statistically different from $1/10$, so the rounding tendency is only in one direction.

The opposite result is obtained for inframarginal bids. A final digit of one is observed least frequently, while a final digit of nine occurs with a frequency not statistically different from $1/10$. Bidders round down (in yield space).

The difference in the direction of rounding between market-clearing and inframarginal bids suggests that rounding is not only a phenomenon of bidders being unable to refine their bids sufficiently, but rather it relates to bidders' valuations. As such, it is consistent with the argument that there is a private-value component to bidders' valuations. Market-clearing bidders are those that are only willing to purchase the bills if the price is sufficiently low. To the extent that they have a tendency to round, it is manifested by a tendency to bid more conservatively. In contrast, inframarginal bidders are those that deliberately submit bids with a high probability of winning, and rounding is manifested in an even more aggressive bid.

The tendency to choose round numbers in Treasury auctions is not at all the same as the tendency for stocks, or other assets, to trade on round prices (as in Harris (1991) and more recently in Ikenberry and Weston (2003)). Harris attributes the tendency to trade in round numbers to the resulting reduction in negotiation costs between the two counterparties. By contrast, in the case of Treasury auctions, there is no negotiation between counterparties. Each bidder unilaterally chooses a yield, and the auctioneer just calculates the market clearing price. Rather than reducing transaction costs, favoring round numbers can only reduce the thinking cost to the bidder. This is exactly the same concept as boundedly rational

investors using a heuristic; in this case the heuristic is to evaluate potential bids in yield space and to favor round yields.

In summary, the evidence of rounding suggests a bias in its own right, but additionally it is consistent with boundedly rational dealers using a yield space heuristic, especially when considered in conjunction with the observed frequency of dominated bids (Section 3.1) and bidders' tendency to ignore unevenness in grid steps in price space (Section 3.2).

4 Are dominated bids ever rational?

One of the central points of this paper is that the observed frequency of dominated bids is evidence of behavioral bias. In this section, in a fairly general setting, I show that dominated bids are not consistent with optimal bidding under the multiple-price auction format, and I show the conditions under which dominated bids are incompatible with optimization under the single-price format.

Consider an expected profit maximizing bidder who must choose a price for his bid. Normalize his bid quantity to one and, for simplicity, assume that this bid quantity is sufficiently small that it does not affect the market-clearing stop-out price.

Denote the bidding grid (in price space) of allowable prices as P_i , $i = 1, 2, 3, \dots$, where P_i is (weakly) increasing in i . The probability, from the bidder's perspective, of P_i being the market-clearing price is denoted $\pi_i (> 0)$.

Because Treasury bills presumably have a common value component, the bidder's valuation of the security depends on the outcome of the auction. Denote V_i as the value of the security to the bidder if the market-clearing price is P_i . (The function $V_i(P_i)$ is likely to depend on the auction format.)

Denote the bid price submitted by the bidder as P_b . If this bid is above the market-clearing price (or more precisely, if $b > m$, where P_m is the market-clearing price), the bidder

wins the auction and is awarded the security. Because in practice there is always rationing at the market-clearing price, assume that if the bid is equal to the market clearing price, (i.e., if $b = m$) the bidder is awarded half a security.

The price paid by a winning bidder depends on the auction format.

4.1 Multiple-price format

Under the multiple-price format, each winning bidder pays the price in his bid regardless of the market-clearing price. Thus, for a bid price P_b , the expected profit to a bidder is

$$Profit_b = \sum_{j=1}^{b-1} \pi_j (V_j - P_b) + \frac{1}{2} \pi_b (V_b - P_b) \quad (1)$$

For a bid P_b to be optimal, it is necessary that

$$Profit_b > 0 \quad (2)$$

$$Profit_b \geq Profit_{b+1} \quad (3)$$

$$Profit_b \geq Profit_{b-1} \quad (4)$$

Let us now consider the possibility of a bidder submitting a dominated bid P_b , where $P_b = P_{b+1}$.

Consider the expected profit (1). By assumption, V_j is increasing in j . So $(V_b - P_b)$ is similarly increasing in j . Since $Profit_b$ is positive (from (2)) and the weights π_j are non-negative, the state with the highest per-unit profit must have positive profit, i.e.,

$$V_b - P_b > 0. \quad (5)$$

For the dominated bid to be optimal, $Profit_{b+1} - Profit_b$ must be negative. From (1),

and using the definition of a dominated bid, $P_b = P_{b+1}$,

$$Profit_{b+1} - Profit_b = \frac{1}{2}\pi_b (V_b - P_b) + \frac{1}{2}\pi_{b+1} (V_{b+1} - P_b) \quad (6)$$

From (5), the first term is positive, and since V_i is an increasing function, the second term is also positive.

Thus $Profit_{b+1} - Profit_b > 0$, contradicting the optimality of the dominated bid.

Intuitively, the dominated bid P_b is suboptimal for the following reason. First, a bid of P_{b+1} does not change the profit when the market-clearing bid is below P_b . However, it awards more securities when the market-clearing bid is P_b or P_{b+1} . But since these are the states in which V_i is highest, and since $P_{b+1} = P_b$, then if it is worthwhile to bid P_b (i.e., if expected profits are positive), changing the bid to P_{b+1} can only increase expected profits.

Thus, observed dominated bids under the multiple-price format are inconsistent with dealers acting optimally.

4.2 Single-price format

Under the single-price format, all winning bidders pay the market clearing price. For a bid price P_b , the expected profit to a bidder is

$$Profit_b = \sum_{j=1}^{b-1} \pi_j (V_j - P_j) + \frac{1}{2}\pi_b (V_b - P_b) \quad (7)$$

Unlike the case of the multiple-price format I show below that under certain conditions it is possible for a rational bidder to submit a dominated bid under the single-price format. This can occur because increasing a bid from P_{b-1} to P_b (which is dominated and equal to P_{b+1}) has two effects on the bidder's allocation. It results in a (rationed) allocation when the market clearing bid is P_b , and it also results in a full allocation (rather than rationing) when the market-clearing bid is P_{b-1} . Thus, a bidder may choose to submit a dominated

bid P_b if the profit conditional on a market clearing price of P_b is negative, but the profit conditional on a market clearing price of P_{b-1} is positive and more than offsets the negative profit. Such a bidder will not increase his bid to the undominated P_{b+1} since that only increases his allocation in those states for which his profit is negative.

I now formalize the argument to show the conditions under which dominated bids are consistent with rationality and the conditions under which they are not.

As before, for a bid P_b to be optimal, it is necessary that

$$Profit_b > 0 \tag{8}$$

$$Profit_b \geq Profit_{b+1} \tag{9}$$

$$Profit_b \geq Profit_{b-1} \tag{10}$$

Substitute (7) into (9) and (10) to obtain

$$\frac{1}{2}\pi_{b+1}(V_{b+1} - P_{b+1}) + \frac{1}{2}\pi_b(V_b - P_b) \leq 0 \tag{11}$$

$$\frac{1}{2}\pi_b(V_b - P_b) + \frac{1}{2}\pi_{b-1}(V_{b-1} - P_{b-1}) \geq 0 \tag{12}$$

Noting that $(V_i - P_i)$ decreases in i , a bid P_b is optimal if both $\pi_{b+1}(V_{b+1} - P_{b+1})$ is sufficiently negative and not fully offset by (a possibly positive) $\pi_b(V_b - P_b)$, and also $\pi_{b-1}(V_{b-1} - P_{b-1})$ is sufficiently positive and not fully offset by (a possibly negative) $\pi_b(V_b - P_b)$.

For the purposes of clarity and to create a measure of the possibility that a bid will be optimal, let us add some structure and make some simplifying assumptions. Assume the following: $\pi_{b-1} = \pi_b = \pi_{b+1}$; the tick size in price space (other than for dominated bids) is a constant $\Delta = P_i - P_{i-1}$; and the increase in the bidder's valuation for an increase of δ in price (other than for dominated bids) is a constant $\alpha = V_i - V_{i-1}$, where $0 \leq \alpha < \Delta$.

With these assumptions, substituting into (11) and (12) results in

$$(\alpha - \Delta) + 2(V_b - P_b) \leq 0 \quad (13)$$

$$(\Delta - \alpha) + 2(V_b - P_b) \geq 0 \quad (14)$$

or,

$$\frac{-(\Delta - \alpha)}{2} \leq (V_b - P_b) \leq \frac{(\Delta - \alpha)}{2} \quad (15)$$

Under this condition, i.e., if the value of the security to the bidder is close to the bid price, P_b is optimal. The range of possible values for $V_b - P_b$ is of width $\Delta - \alpha$. (Note that if we allow α to be larger than Δ then there would be no finite optimal bid, as bidders would have upward sloping demand curves.)

Now consider the possibility of a dominated bid P_b . In such case $P_b - P_{b-1} = \Delta$, and $P_{b+1} - P_b = 0$. We also have to address the value function V_i . Below the dominated bid, $V_b - V_{b-1} = \alpha$ as before, but $V_{b+1} - V_b$ is ambiguous. An increase in the market-clearing bid from P_b to P_{b+1} signifies increased demand, so the value of the security surely increases. However, since this doesn't correspond to an increase in the actual price of the market-clearing bid, the increase in value may be less than α . Denote the value increase as $\beta\alpha = V_{b+1} - V_b$, where $0 < \beta < 1$. In other words, β represents the incremental increase in the value of the security as a proportion of the "normal" incremental value increase.

It follows that a dominated bid, P_b , is optimal if

$$\frac{-(\Delta - \alpha)}{2} \leq (V_b - P_b) \leq \frac{(0 - \beta\alpha)}{2} \quad (16)$$

The width of the range of possible values of $V_b - P_b$ which allow dominated bids to be optimal is

$$\frac{\Delta - (1 + \beta)\alpha}{2}$$

which is much narrower than the width $\Delta - \alpha$ that allows a bid to be optimal in the absence of dominated bids.

In particular, if $\Delta < (1 + \beta) \alpha$, then dominated bids are never optimal. In words, for an increase in the market-clearing bid from P_{b-1} to P_{b+1} , if the increase in the bill's value to the bidder exceeds a single price tick Δ , then dominated bids are incompatible with rationality. If the inequality is reversed, then dominated bids would be observed, albeit with less frequency than undominated bids.

So while the existence of dominated bids under the single-price format is not *per se* proof of behavioral bias, the frequency of the dominated bids, the differences between marginal and inframarginal bids, and the existence of dominated bids under the multiple-price format, is evidence of behavioral bias and is consistent with bounded rationality.

5 Conclusion

Complementing the literature on behavioral biases in individual investors, I have shown that even large sophisticated institutions are subject to behavioral biases. In auctions for U.S. Treasury bills, primary bond dealers regularly submit dominated bids, they disregard uneven steps in the pricing grid, and they round their bids in yield space. Most importantly, when comparing single-price and multiple-price auctions, and when comparing marginal bids and inframarginal bids, I find that dealers are less likely to be subject to this bias when the cost of suboptimal bidding is higher. These results are consistent with boundedly rational dealers, faced with a bidding problem framed in yield space, using a yield-space heuristic when choosing their bids.

References

- [1] Barber, B. and T. Odean, 2000, Trading is hazardous to your wealth: The common stock performance of individual investors, *Journal of Finance*, 55.
- [2] Barberis, N. and R. Thaler, 2003, A survey of behavioral finance, in G.M. Constantinides, M. Harris and R. Stulz, eds., *Handbook of Economics of Finance*, Elsevier.
- [3] Camerer, C., 1995, Individual decision making, in J. Kagel and A. Roth, eds., *Handbook of Experimental Economics*, Princeton University Press.
- [4] Cammack, E. B., 1991, Evidence on bidding strategies and the information in Treasury bill auctions, *Journal of Political Economy*, 99.
- [5] Conlisk, J., 1996, Why bounded rationality? *Journal of Economic Literature*, 34.
- [6] Federal Register, 1999, Sale and issue of marketable book-entry Treasury bills notes and bonds, 31 CFR Part 356.
- [7] Fleming, M. J., K. Garnade, and F. Keane, 2004, Anomalous bidding in short-term Treasury bill auctions, *Journal of Financial Research*, forthcoming.
- [8] French, K. and J. Poterba, 1991, Investor diversification and international equity markets, *American Economic Review*, 81.
- [9] Gabaix, X., and D. Laibson, 2000, Bounded rationality and directed cognition, *Working paper*, MIT and Harvard University.
- [10] Goldreich, D., 2004, Underpricing in discriminatory and uniform-price Treasury auctions, *Working paper*, London Business School.
- [11] Grinblatt, M. and M. Keloharju, 2001, How distance, language, and culture influence stockholdings and trade, *Journal of Finance*, 56.

- [12] Harris, L., 1991, Stock Price Clustering and Discreteness, *Review of Financial Studies*, 4.
- [13] Huberman, G., 2001, Familiarity breeds investment, *Review of Financial Studies*, 14.
- [14] Ikenberry, D. and J Weston, 2003, Clustering in U.S. stock prices after decimalization, *Working paper*, Rice University.
- [15] Kahneman, D., 2003, Maps of bounded rationality: Psychology for behavioral economics, *American Economic Review*, 93.
- [16] Nyborg, K. G. and Sundaresan, S., 1996, Discriminatory versus uniform Treasury auctions: Evidence from when-issued transactions, *Journal of Financial Economics*, 42.
- [17] Odean, T., 1998, Are investors reluctant to realize their losses? *Journal of Finance*, 53.
- [18] Simon, H., 1955, A behavioral model of rational choice, *Quarterly Journal of Economics*, 69.
- [19] Shleifer, A., 2000, *Inefficient markets: An Introduction to behavioral finance*, Oxford University Press.
- [20] Tversky, A. and D. Kahneman, 1981, The framing of decisions and the psychology of choice, *Science*, 211.

Table 1: Short-Term Treasury Bill Auction Summary Statistics

This table summarizes the auction characteristics for Treasury bills, including cash management bills (CMBs), four-week bills, and longer term (13-week, 26-week and 52-week) bills from April 1983 to December 2003. (Four-week bills were first auctioned in July 2001. Fifty-two week bills were discontinued in February 2001.) The statistics for CMBs are also reported excluding those with a maturity long enough to preclude the possibility of dominated bids. Under the multiple-price format, each winning bidder pays a price corresponding to his submitted bid. Under the single-price format, all winning bidders pay a price corresponding to the yield of the market-clearing bid. *Tick size* refers to the grid in yield space. *Maturity* is the number of days in the life of the security. *Bid-to-cover* is the ratio of the quantity of tenders to supply. *Bid spread* is the difference between the market clearing yield and the lowest winning yield (or, under the single-price format, the difference between the market clearing yield and the 95th percentile winning yield).

	Date range	# of auctions	Auction format	Tick size (basis points)	Avg auction size (\$ billion)	Avg maturity (days)	Average bid-to-cover	Bid spread (basis points)
CMBs	5/1983 - 8/1998	116	Multiple Price	1.0	11.6	44.3	4.3	4.6
	exclud. > 35 days	65			12.4	15.2	4.3	6.0
	11/1998 - 3/2002	33	Single Price	1.0	24.5	26.2	2.4	5.9
exclud. > 35 days	24	24.1			14.7	2.5	10.1	
	4/2002 - 12/2003	22	Single Price	0.5	16.6	8.7	3.2	4.5
	exclud. > 71 days	22			16.6	8.7	3.2	4.5
4-Week Bills	7/2001-12/2003	126	Single Price	0.5	16.3	28.0	2.3	5.0
Longer-Term Bills	4/1983-11/1997	1710	Multiple Price	1.0	9.5	161.8	3.4	3.1
	11/1997-10/1998	114	Multiple Price	0.5	7.4	160.4	3.3	2.2
	11/1998-12/2003	592	Single Price	0.5	12.0	145.0	2.0	6.0

Table 2: Example of Possible Dominated Bids

This table displays a portion of the bidding grid for a 20-day cash management bill to illustrate the possibility of dominated bids. In this example, bids are submitted in one basis point increments. Prices are rounded to the nearest \$.001 per \$100 face value. Bids marked with "D" are "dominated".

<u>Rate</u>	<u>Price (unrounded)</u>	<u>Price (rounded)</u>
3.02%	99.83222	99.832
3.03%	99.83167	99.832 D
3.04%	99.83111	99.831
3.05%	99.83056	99.831 D
3.06%	99.83000	99.830
3.07%	99.82944	99.829
3.08%	99.82889	99.829 D
3.09%	99.82833	99.828

Table 3: Frequency of Dominated Bids

This table displays the frequency of dominated bids among observed bids for short-term Treasury bill auctions under both auction formats. Cash management bill (CMB) auctions are included only when the maturity is short enough for the possibility of dominated bids. Under the multiple-price format, the market-clearing yield and the lowest winning yield are observed. Under the single-price format, the observed bids include the market-clearing yield (i.e., highest winning yield), the median winning yield, and the 95th-percentile winning yield (i.e., the lowest winning yield excluding the 5% tail of winning bids).

Panel A: Multiple-price auctions (cash management bills)

	<u>Number of dominated bids</u>	<u>Percentage of observed bids that are dominated</u>	<u>Percentage of bids on the bidding grid that would be dominated (assuming random bidding)</u>	<u>P-value of difference</u>
Market clearing yield	28	43%	58%	1.08%
Lowest winning yield	9	14%	58%	0.00%
# of auctions = 65				

Panel B: Single-price auctions (cash management bills and four-week bills)

	<u>Number of dominated bids</u>	<u>Percentage of observed bids that are dominated</u>	<u>Percentage of bids on the bidding grid that would be dominated (assuming random bidding)</u>	<u>P-value of difference</u>
Market clearing yield	75	44%	64%	0.00%
Median winning yield	92	53%	64%	0.47%
95th percentile winning yield	100	58%	64%	9.51%
# of auctions = 172				

Table 4: Example of Uneven Grid Steps (13-Week Treasury Bill)

This table displays a portion of the bidding grid for 91-day Treasury bills to illustrate the uneven grid steps in price space. In this illustration, the bidding grid is one basis point in yield space. Prices are rounded to the nearest \$.001 per \$100 face value. *Step size* is the price difference between two adjacent bids.

<u>Rate</u>	<u>Price</u>	<u>Step size</u>
4.00%	98.989	
	}	0.003
4.01%	98.986	
	}	0.002
4.02%	98.984	
	}	0.003
4.03%	98.981	
	}	0.002
4.04%	98.979	
	}	0.003
4.05%	98.976	
	}	0.002
4.06%	98.974	

Table 5: Bidding and Uneven Grid Steps

Under a one basis point bidding grid (as was the case from 1983 to 1997), the pricing grid for 91-day Treasury bills alternates between \$0.003 and \$0.002 with few exceptions. A *bid before a "large" step* is an observed bid such that an increase in one basis point in yield would correspond to \$0.003 decrease in price, i.e., $P(r) - P(r+\delta) = .003$, where $P(r)$ is the price corresponding to a yield bid of r , and δ is the one basis point bidding increment. A *bid before a "small" step* is an observed bid such that an increase in one basis point in yield would correspond to \$0.002 decrease in price, i.e., $P(r) - P(r+\delta) = .002$. Occasionally, bids are in between two large steps or in between two small steps and are thus excluded from the data. The auctions were conducted under the multiple-price format, and the observed bids are the market clearing yield and the lowest winning yield.

	<u>Bids before a "large" step</u>	<u>Bids before a "small" step</u>	χ^2_1	<u>$H_0: p = 50\%$</u> P-value
Market clearing yield	353 (49.2%)	365 (50.8%)	0.201	65.4%
Lowest winning yield	358 (50.7%)	348 (49.3%)	0.142	70.7%

of auctions = 760

Table 6: Rounding in Yield Space

This table reports the distribution of the last digit of observed bids in yield space. The data includes all Treasury bill auctions conducted under the multiple-price format with a bid increment of one basis point. The data includes 13-week, 26-week and 52-week Treasury bill auctions from 1983 until 1997 and cash management bills from 1983 until 1998. The observed bids are the market-clearing yield and the lowest winning yield.

	<u>Market clearing yield</u>			<u>Lowest winning yield</u>		
	<u>Last digit in bid yield</u>	<u>Frequency</u>	<u>H₀: p = 10% P-Value</u>	<u>Last digit in bid yield</u>	<u>Frequency</u>	<u>H₀: p = 10% P-Value</u>
Least frequent	9	140	0.1%	1	151	1.4%
.	6	154	2.6%	4	161	9.2%
.	1	165	17.0%	6	168	25.5%
.	3	175	55.3%	5	173	45.4%
.	7	180	83.9%	3	174	50.2%
.	2	188	67.4%	9	176	60.7%
.	8	188	67.4%	8	195	33.3%
.	5	207	5.7%	7	203	11.2%
.	4	208	4.8%	2	209	3.9%
Most frequent	0	221	0.3%	0	216	0.9%
Joint test of discrete uniform distribution		$\chi^2_9 = 31.7$ P-value = 0.0%			$\chi^2_9 = 23.4$ P-value = 0.5%	
# of auctions = 1826						

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 (I xv): <u>Merger Mechanisms</u></i>
PRA	8.2004	<i>Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER (I xv): <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u></i>
PRA	9.2004	<i>Pegaret PICHLER and Alex STOMPER (I xv): <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 (I xv): <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 (I xv): <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u></i>
PRA	12.2004	<i>Ohad KADAN (I xv): <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u></i>
PRA	13.2004	<i>Maarten C.W. JANSSEN (I xv): <u>Auctions as Coordination Devices</u></i>
PRA	14.2004	<i>Gadi FIBICH, Arie GAVIOUS and Aner SELA (I xv): <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u></i>
PRA	15.2004	<i>Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (I xv): <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u></i>
PRA	16.2004	<i>Marta STRYSZOWSKA (I xv): <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 (I xvi): <u>Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamhcs</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 (I xvii): <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u></i>
NRM	21.2004	<i>Jacqueline M. HAMILTON (I xvii): <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 (I xvii): <u>Land, Environmental Externalities and Tourism Development</u></i>
NRM	23.2004	<i>Pius ODUNGA and Henk FOLMER (I xvii): <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 (I xvii): <u>Tourism, Trade and Domestic Welfare</u></i>
NRM	25.2004	<i>Riaz SHAREEF (I xvii): <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 (I xvii): <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u></i>
NRM	27.2004	<i>Raúl Hernández MARTÍN (I xvii): <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 (I xvi): <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 (I xvi): <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 (I xviii): <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u></i>
KTHC	35.2004	<i>Linda CHAIB (I xviii): <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u></i>
KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (I xviii): <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 (I xviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam HAMDE (I xviii): <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 (I xix): <u>International Cooperation to Resolve International Pollution Problems</u></i>
KTHC	42.2004	<i>Francesco CRESPI: <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u></i>

CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI: <u>Coalition Formation in Games without Synergies</u></i>
CTN	44.2004	<i>Marc ESCRHUELA-VILLAR: <u>Cartel Sustainability and Cartel Stability</u></i>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL (lxvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u></i>
NRM	46.2004	<i>Signe ANTHON and Bo JELLESMARK THORSEN (lxvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u></i>
NRM	47.2004	<i>John MBURU (lxvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u></i>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYOVAI and Melinda SMALE (lxvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transitional Economy</u></i>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON: <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u></i>
GG	50.2004	<i>Scott BARRETT and Michael HOEL: <u>Optimal Disease Eradication</u></i>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG: <u>Simple Priorities and Core Stability in Hedonic Games</u></i>
SIEV	52.2004	<i>Francesco RICCI: <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u></i>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON: <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u></i>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF (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></i>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN (lxvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u></i>
NRM	56.2004	<i>Tom DEDEURWAERDERE (lxvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u></i>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON: <u>The Amenity Value of Climate to German Households</u></i>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN: <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u></i>
NRM	59.2004	<i>Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA (lxvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u></i>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI (lxvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u></i>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO: <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u></i>
NRM	62.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH: <u>Resource-Abundance and Economic Growth in the U.S.</u></i>
NRM	63.2004	<i>Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ (lxvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u></i>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN (lxvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u></i>
NRM	65.2004	<i>E.C.M. RUIJGROK (lxvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u></i>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS: <u>Uncertainty Aversion, Robust Control and Asset Holdings</u></i>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA: <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u></i>
GG	68.2004	<i>Michael FINUS: <u>Modesty Pays: Sometimes!</u></i>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO: <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u></i>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT: <u>On Coalition Formation with Heterogeneous Agents</u></i>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA: <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u></i>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER: <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u></i>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA: <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u></i>
CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND: <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u></i>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO: <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u></i>
CTN	76.2004	<i>Salvador BARBERÀ and Matthew O. JACKSON (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u></i>
CTN	77.2004	<i>Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERA and Fernando VEGA-REDONDO (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u></i>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES (lxx): <u>Contracting with Externalities and Outside Options</u></i>
CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u></i>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON (lxx): <u>The Formation of Networks with Transfers among Players</u></i>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO (lxx): <u>Bicameralism and Government Formation</u></i>

CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon 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 POPYRAKIS 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 GRASSENTI</i> : <u>The Missing Shock: The Macroeconomic Impact of British Privatisation</u>
PRA	105.2004	<i>John BENNETT, Saul ESTRIN, James MAW and Giovanni URGÀ</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>Pebr-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 Economics of Warm Glow: 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>
IEM	119.2004	<i>Giacomo LUCIANI</i> : <u>Security of Supply for Natural Gas Markets. What is it and What is it not?</u>
IEM	120.2004	<i>L.J. de VRIES and R.A. HAKVOORT</i> : <u>The Question of Generation Adequacy in Liberalised Electricity Markets</u>
KTHC	121.2004	<i>Alberto PETRUCCI</i> : <u>Asset Accumulation, Fertility Choice and Nondegenerate Dynamics in a Small Open Economy</u>
NRM	122.2004	<i>Carlo GIUPPONI, Jaroslaw MYSLAK and Anita FASSIO</i> : <u>An Integrated Assessment Framework for Water Resources Management: A DSS Tool and a Pilot Study Application</u>
NRM	123.2004	<i>Margaretha BREIL, Anita FASSIO, Carlo GIUPPONI and Paolo ROSATO</i> : <u>Evaluation of Urban Improvement on the Islands of the Venice Lagoon: A Spatially-Distributed Hedonic-Hierarchical Approach</u>

ETA	124.2004	<i>Paul MENSINK: <u>Instant Efficient Pollution Abatement Under Non-Linear Taxation and Asymmetric Information: The Differential Tax Revisited</u></i>
NRM	125.2004	<i>Mauro FABIANO, Gabriella CAMARSA, Rosanna DURSI, Roberta IVALDI, Valentina MARIN and Francesca PALMISANI: <u>Integrated Environmental Study for Beach Management: A Methodological Approach</u></i>
PRA	126.2004	<i>Irena GROSFELD and Iraj HASHI: <u>The Emergence of Large Shareholders in Mass Privatized Firms: Evidence from Poland and the Czech Republic</u></i>
CCMP	127.2004	<i>Maria BERRITTELLA, Andrea BIGANO, Roberto ROSON and Richard S.J. TOL: <u>A General Equilibrium Analysis of Climate Change Impacts on Tourism</u></i>
CCMP	128.2004	<i>Reyer GERLAGH: <u>A Climate-Change Policy Induced Shift from Innovations in Energy Production to Energy Savings</u></i>
NRM	129.2004	<i>Elissaios POPYRAKIS and Reyner GERLAGH: <u>Natural Resources, Innovation, and Growth</u></i>
PRA	130.2004	<i>Bernardo BORTOLOTTI and Mara FACCIO: <u>Reluctant Privatization</u></i>
SIEV	131.2004	<i>Riccardo SCARPA and Mara THIENE: <u>Destination Choice Models for Rock Climbing in the Northeast Alps: A Latent-Class Approach Based on Intensity of Participation</u></i>
SIEV	132.2004	<i>Riccardo SCARPA, Kenneth G. WILLIS and Melinda ACUTT: <u>Comparing Individual-Specific Benefit Estimates for Public Goods: Finite Versus Continuous Mixing in Logit Models</u></i>
IEM	133.2004	<i>Santiago J. RUBIO: <u>On Capturing Oil Rents with a National Excise Tax Revisited</u></i>
ETA	134.2004	<i>Ascensión ANDINA DÍAZ: <u>Political Competition when Media Create Candidates' Charisma</u></i>
SIEV	135.2004	<i>Anna ALBERINI: <u>Robustness of VSL Values from Contingent Valuation Surveys</u></i>
CCMP	136.2004	<i>Gernot KLEPPER and Sonja PETERSON: <u>Marginal Abatement Cost Curves in General Equilibrium: The Influence of World Energy Prices</u></i>
ETA	137.2004	<i>Herbert DAWID, Christophe DEISSENBERG and Pavel ŠEVČIK: <u>Cheap Talk, Gullibility, and Welfare in an Environmental Taxation Game</u></i>
CCMP	138.2004	<i>ZhongXiang ZHANG: <u>The World Bank's Prototype Carbon Fund and China</u></i>
CCMP	139.2004	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Time Profile of Climate Change Stabilization Policy</u></i>
NRM	140.2004	<i>Chiara D'ALPAOS and Michele MORETTO: <u>The Value of Flexibility in the Italian Water Service Sector: A Real Option Analysis</u></i>
PRA	141.2004	<i>Patrick BAJARI, Stephanie HOUGHTON and Steven TADELIS (lxxi): <u>Bidding for Incomplete Contracts</u></i>
PRA	142.2004	<i>Susan ATHEY, Jonathan LEVIN and Enrique SEIRA (lxxi): <u>Comparing Open and Sealed Bid Auctions: Theory and Evidence from Timber Auctions</u></i>
PRA	143.2004	<i>David GOLDREICH (lxxi): <u>Behavioral Biases of Dealers in U.S. Treasury Auctions</u></i>

- (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
- (lxxi) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by Fondazione Eni Enrico Mattei and Consip and sponsored by the EU, Rome, September 23-25, 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>