Introduction

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Published online: 14 March 2012
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The papers collected in this symposium are a selection of the papers presented at the CESifo Venice Summer Institute Workshop on “Advances in the Theory of Contests and its Applications” at Venice International University on the Isola di San Servolo in July of 2008. The workshop brought together 25 scholars from around the world to present and discuss 14 papers over a period of two days. We are grateful to CESifo and to its president and chief executive officer, Hans Werner Sinn, for funding the workshop and for the organizational support provided by Karin Fournier and Deirdre Hall.

The conference program included pure and applied theoretical contributions, as well as experimental tests of theory. The ten papers in this symposium are a strict subset of the papers presented, each revised based upon the comments of the conference discussants and the anonymous reviewers in the regular editorial process.

The first four of these papers present extensions of several fundamental contest models to address, respectively, risk aversion, incomplete information, richer prize structures, and externalities from bids. The first, by [Cornes and Hartley \(2012\)](#), examines

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equilibrium in contests with logistic contest success functions¹ when players are risk averse. The authors prove existence of Nash equilibrium and examine the effect of risk aversion on rent dissipation in both symmetric and asymmetric contests. They provide examples of symmetric contests, in which risk aversion leads to a multiplicity of equilibria, and formulate additional conditions guaranteeing uniqueness of equilibrium. They also examine the effects of the entry of additional players under these conditions.

[Wärneryd \(2012\)](#) examines a class of logistic contest models in which players have asymmetric information concerning the value of the prize.² Each member of a subset of the players is privately informed of the (common) value of the prize, while the remaining players know only the prior distribution of the prize. Existence of a pure-strategy Bayesian equilibrium is established, and equilibrium participation is examined. The special case of the [Tullock \(1980\)](#) lottery success function is solved in detail under the assumption that the value takes a two-point distribution with zero in the support.

The third paper, by [Akerlof and Holden \(2012\)](#), characterizes the structure of the optimal (profit maximizing) prize schedule in a multiple-prize rank-order tournament of the type examined by [Lazear and Rosen \(1981\)](#), assuming *ex ante*, but not the standard *ex post*, individual rationality constraints. This allows the authors to focus on punishment as a tool. They show that optimal prize schedules give rewards to the best performers that are not as large in magnitude as the punishments for poor performers. The degree of punishment relative to reward depends on the relative importance of risk aversion and prudence, the degree of limited liability, the distribution of the shocks to agents' outputs, and the degree of heterogeneity of agents.

In the last of the basic extensions, [Baye et al. \(2012\)](#) extend the standard symmetric two-player all-pay auction with complete information ([Hillman and Riley 1989](#)) to cover environments in which a player's bid generates affine spillover effects on himself and the opposing player that depend on the rank order of his bid. These effects arise naturally in models of contests in which players exhibit inequality aversion or regret as well as a number of important economic environments including auctions, innovation and litigation contests, and certain types of price-setting games. The authors provide a closed-form solution for the symmetric Nash equilibria in the class of games and examine how the qualitative nature of the equilibrium depends on the spillover parameters.

The next two papers in this volume present results extending the basic theory of contests to models of sequential contests. In the first of these, [Fu and Lu \(2012\)](#) examine the optimal structure of multistage sequential elimination contests using a multi-winner extension of the [Tullock \(1980\)](#) contest success function due to [Clark and Riis \(1996\)](#).³ The contest designer is allowed to control the contest sequencing,

¹ These contests include as special cases those examined by [Rosen \(1986\)](#) and [Tullock \(1980\)](#). See [Cornes and Hartley \(2005\)](#) for a comprehensive examination of equilibrium in this class of contests in the absence of risk aversion.

² Under complete information this class is a strict subset of that examined by [Cornes and Hartley \(2005\)](#) and has been axiomatized by [Skaperdas \(1996\)](#).

³ See [Groh et al. \(2012\)](#) for an examination of elimination tournaments with all-pay auction component contests.

the number of players eliminated at each stage, and the allocation of a fixed sum of prize money in order to maximize expected total effort. The authors find that with a sufficiently noisy contest technology within this class, including Tullock contests with an exponent less than or equal to one, (1) multistage contests generate more effort than single-stage contests, (2) allocating the entire prize purse to a single final prize is optimal, independent of the contest sequence, and (3) the optimal contest is one that eliminates one contestant at each stage until a single winner remains who wins the complete prize purse.

Sela (2012) examines a pair of two-player all-pay auctions, played sequentially, each with a separate but identical prize. The players may win zero, one, or two prizes and may have a diminishing, constant, or increasing marginal valuation with respect to the second prize won. Players' valuations may be heterogeneous, although it is assumed that the sign of the difference in the marginal values for the first and second units is identical across players. Sela characterizes the unique subgame perfect equilibrium of the game and provides a partial extension to the case of n players with marginal valuations that are nonincreasing.

The seventh paper in the symposium deals with the topic of static multidimensional contests. Roberson and Kvasov (2012) extend the famous Colonel Blotto game of Borel (1921) by relaxing the use-it or lose-it feature of the allocation of the constrained resource and assuming that it has an identical constant unit cost up to each player's budget constraint. In this extension, two players simultaneously allocate the resource across n contests, each with an auction contest success function. The value of winning is identical across contests, and each player's objective is to maximize the expected sum of the values of contests won, net of the cost of the resources allocated. The assumption of a positive opportunity cost of the resource means that the extended Blotto game is non-constant-sum, in contrast to the original Blotto game, which is constant-sum. The authors show that when the players' budgets are not too asymmetric, the unique set of equilibrium marginal distributions of allocations to each contest in the classical Colonel Blotto game (Roberson 2006) may be mapped one-to-one onto the set of equilibrium marginal distributions in the non-constant-sum game in an intuitive manner based on the opportunity cost of a unit allocated. With budgets that are sufficiently asymmetric, this relationship breaks down, and the authors construct equilibria of the non-constant-sum game that differ qualitatively from those of the original game.

The lone experimental paper in the symposium is the eighth contribution. Morgan et al. (2012) present an experiment on contests with endogenous entry decisions. Players have the binary once-and-for-all choice in a bounded interval of continuous time to opt into a contest with a Tullock lottery contest success function or choose an outside option of a fixed payment. All such choices are publicly observed. Once the decisions are made (with suitable default), the players choosing the contest simultaneously expend efforts in the contest itself. Theory predicts that both entry into the contest and the rent-seeking expenditures increase in the size of the prize and that expected earnings in the contest coincide with those in the outside option. The authors find that the data support the qualitative predictions when the contest prize is increased, but the quantitative levels predicted are not supported. Moreover, payoffs are not equalized across the two alternatives in the initial entry decision. When the

contest prize is large, players choosing the contest earn more than the outside option. When the prize is small, players choosing the outside option earn higher payoffs. The authors also examine how behavior varies by gender. Although there is evidence that women do not perform as well as men in the contest, they tend to participate at the same rate.

The final two papers address applications of basic contest theory. Skaperdas and Vaidya (2012) model persuasion, such as that arising in advertising, litigation, and argumentation in policy debates, as a contest. They derive different contest success functions used in the literature, including special cases of those used by Lazear and Rosen (1981) and Rosen (1986), as the result of inferential processes of an audience observing the costly presentation of evidence by adversaries. In this formulation, evidence production is a (deterministic or stochastic) function of a contestant's effort provision and the prior probability that the audience places on the correctness of each contestant's view is private information. The audience updates its beliefs about the correctness of claims based on Bayes' rule, given its prior beliefs and the evidence presented, and then makes a judgment.

Finally, Kaplan (2012) examines a contest in the context of a procurement environment in which sellers compete by offering designs to secure a contract from a single buyer. A seller's design has two components: a quality component that arises from the expenditure of effort and a style component that is exogenously determined by the seller's privately known type. Sellers' types are iid draws from a finite set T . The buyer has preferences over styles that take a very simple form: The buyer is indifferent to the types in some subset P of T and strictly prefers these types to those types in the set $T \setminus P$, over which there is also indifference. It is common knowledge that each design type is equally likely to be in buyer's preferred set, as is the fixed cardinality of the preferred set of types. However, the specific types in this set are the buyer's private information. Given these preferences, and without knowing whether or not his design, or that of any other seller, is in the preferred set or not, each seller simultaneously determines his effort expenditure on quality. The buyer's choice is determined by a modified all-pay auction in which the buyer chooses with certainty a seller offering the highest utility. If a seller happens to offer a preferred type to the buyer, the utility provided by the seller is equal to the sum of his effort on quality and a common positive constant indicating a "head-start advantage" accruing to a preferred type. If the seller offers a type not preferred by the buyer, the utility obtained by the buyer is simply the seller's effort on quality. Each seller loses the sunk expenditure on effort regardless of whether he wins the contract or not. If a seller wins the contract by providing the highest utility to the buyer, he earns a prize of value V net of a cost of post-award effort, which is decreasing in the effort expended on the quality component in procurement. This leads to an effort-dependent prize structure where a player's effort in providing quality in the procurement stage increases the value of the prize if he wins (but not too much). Kaplan characterizes equilibrium in this game and examines how equilibrium changes with changes in the underlying information about buyer preferences and the ability of sellers to change types.

In concluding, we would like to thank all of the contributors to the symposium. We are confident that their contributions will prove to be durable and will continue to stimulate work in the theoretical, experimental, and applied realms. We also hope

that the readers of this symposium find it a useful introduction to research in contest theory, an exciting area that touches on a wide range of disciplines.

References

- Akerlof, R.A., Holden, R.T.: The nature of tournaments. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-010-0523-4](https://doi.org/10.1007/s00199-010-0523-4)
- Baye, M.R., Kovenock, D., de Vries, C.G.: Contests with rank-order spillovers. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-009-0489-2](https://doi.org/10.1007/s00199-009-0489-2)
- Borel, E.: La théorie du jeu les équations intégrales à noyau symétrique. *Comptes Rendus l'Académie* 173, 1304–1308 (1921); English translation by Savage, L.: The theory of play and integral equations with skew symmetric kernels. *Econometrica* 21, 97–100 (1953)
- Clark, D.J., Riis, C.: A multiple-winner nested rent-seeking contest. *Public Choice* 87, 177–184 (1996)
- Cornes, R.C., Hartley, R.: Asymmetric contests with general technologies. *Econ Theory* 26, 923–946 (2005)
- Cornes, R.C., Hartley, R.: Risk aversion in symmetric and asymmetric contests. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-009-0490-9](https://doi.org/10.1007/s00199-009-0490-9)
- Fu, Q., Lu, J.: The optimal multi-stage contest. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-009-0463-z](https://doi.org/10.1007/s00199-009-0463-z)
- Groh, C., Moldovanu, B., Sela, A., Sunde, U.: Optimal seedings in elimination tournaments. *Econ Theory* 49, 59–80 (2012)
- Hillman, A.L., Riley, J.G.: Politically contestable rents and transfers. *Econ Polit* 1, 17–39 (1989)
- Kaplan, T.R.: Communication of preferences in contests for contracts. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-010-0525-2](https://doi.org/10.1007/s00199-010-0525-2)
- Lazear, E.P., Rosen, S.: Rank-order tournaments as optimum labor contracts. *J Polit Econ* 89, 841–864 (1981)
- Morgan, J., Orzen, H., Sefton, M.: Endogenous entry in contests. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-010-0544-z](https://doi.org/10.1007/s00199-010-0544-z)
- Roberson, B.: The Colonel Blotto game. *Econ Theory* 29, 1–24 (2006)
- Roberson, B., Kvasov, D.: The non-constant sum Colonel Blotto game. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-011-0673-z](https://doi.org/10.1007/s00199-011-0673-z)
- Rosen, S.: Prizes and incentives in elimination tournaments. *Am Econ Rev* 76, 701–715 (1986)
- Skaperdas, S.: Contest success functions. *Econ Theory* 7, 283–290 (1996)
- Skaperdas, S., Vaidya, S.: Persuasion as a contest. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-009-0497-2](https://doi.org/10.1007/s00199-009-0497-2)
- Sela, A.: Sequential two-prize contests. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-010-0547-9](https://doi.org/10.1007/s00199-010-0547-9)
- Tullock, G.: Efficient rent-seeking. In: Buchanan, J.M., Tollison, R.D., Tullock, G. (eds.) *Toward a Theory of Rent-Seeking Society*, pp. 97–112. College Station: Texas A&M University Press (1980)
- Wärneryd, K.: Multi-player contests with asymmetric information. *Econ Theory* 51 (2012, in this issue). doi:[10.1007/s00199-009-0472-y](https://doi.org/10.1007/s00199-009-0472-y)