Non-clairvoyant Dynamic Mechanism Design*

VAHAB MIRROKNI, Google Research, USA

RENATO PAES LEME, Google Research, USA

PINGZHONG TANG, Institute for Interdisciplinary Information Sciences, Tsinghua University, China

SONG ZUO, Institute for Interdisciplinary Information Sciences, Tsinghua University, China

Despite their better revenue and welfare guarantees for repeated auctions, dynamic mechanisms have not been widely adopted in practice. This is partly due to the complexity of their implementation as well as their unrealistic use of forecasting for future periods. We address these shortcomings and present a new family of dynamic mechanisms that are simple and require no distribution knowledge of future periods.

This paper introduces the concept of non-clairvoyance in dynamic mechanism design, which is a measure-theoretic restriction on the information that the seller can use. A dynamic mechanism is non-clairvoyant if the allocation and pricing rule at each period does not depend on the type distributions in future periods.

We develop a framework (bank account mechanisms) for characterizing, designing, and proving lower bounds for dynamic mechanisms (clairvoyant or non-clairvoyant). This framework is used to characterize the revenue extraction power of non-clairvoyant mechanisms with respect to mechanisms that are allowed unrestricted use of distributional knowledge.

CCS Concepts: • **Theory of computation** → **Algorithmic mechanism design; Computational pricing and auctions;** • **Applied computing** → *Economics*;

Keywords: Dynamic mechanism design; bank account mechanisms; non-clairvoyance; dynamic auctions; approximations; Internet advertising

*Thanks are due to Dirk Bergemann for his detailed comments on an early draft of this manuscript. We also thank Ilan Lobel, Santiago Balseiro and Balu Sivan, the participants of the Erice Workshop of Stochastic Methods in Game Theory and the Google Market Algorithms Workshop for their comments and suggestions.

This paper was supported in part by the National Natural Science Foundation of China Grant 61561146398, a China Youth 1000-talent program and an Alibaba Innovative Research program.

The full version of this paper is available at <https://ssrn.com/abstract=2873701>.

Authors' addresses: Vahab Mirrokni, Google Research, New York City, USA, mirrokni@google.com; Renato Paes Leme, Google Research, New York City, USA, renatoppl@google.com; Pingzhong Tang, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing, China, kenshinping@gmail.com; Song Zuo, Institute for Interdisciplinary Information Sciences, Tsinghua University, Beijing, China, songzuo.z@gmail.com.

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike International 4.0 License.

ACM EC '18, June 18–22, 2018, Ithaca, NY, USA

© 2018 Copyright held by the owner/author(s).

ACM ISBN 978-1-4503-5829-3/18/06.

<https://doi.org/10.1145/3219166.3219224>