ACADEMIC SEMINAR

Incentives and Emission Responsibility Allocation in Supply Chains

Since greenhouse gas emissions from the supply chains of just the 2,500 largest global corporations account for more than 20% of global emissions, rationalizing emissions in supply chains could make an important contribution towards meeting the global CO2 emission reduction targets agreed upon in the 2015 Paris Climate Agreement. Accordingly, in this paper, we consider supply chains with joint production of GHG emissions, operating under, either a carbon tax regime wherein a regulator levies a penalty on the emissions generated by the firms in the supply chain, or an internal carbon pricing scheme. Supply chain leaders, such as Walmart, are assumed to be environmentally motivated to induce their suppliers to abate their emissions. We adopt a cooperative game theory methodology to derive a footprint-balanced scheme for reapportioning the total carbon emissions amongst the firms in the supply chain. This emission responsibility allocation scheme, which is the Shapley value of an associated cooperative game, is shown to have several desirable characteristics. In particular, (i) it is transparent and easy to compute, (ii) when the abatement cost functions of the firms are private information, it incentivizes suppliers to exert pollution abatement efforts that, among all footprint-balanced allocation schemes, minimize the maximum deviation from the socially optimal pollution level, and (iii) the Shapley value is the unique allocation mechanism satisfying certain contextually desirable properties.

Prof. Greys Sosic

Professor and Department Chair
DSO Department in the Marshall School of Business
University of Southern California

Greys Sosic is a Professor and Department Chair of the DSO Department in the Marshall School of Business at the University of Southern California. She conducts research in the area of supply chain management, sustainable supply chains, competition and cooperation in supply chains, and applied game theory. She has published papers in journals including Management Science, Operations Research, Manufacturing and Services Operations Management, Production and Operations Management, and European Journal of Operational Research. Professor Sosic was a finalist in the 2006 JFIG competition, and received the Dean’s Awards for Research Excellence in 2007 and IIE Transactions Design & Manufacturing Best Paper Award in 2018. Dr. Sosic has served as an Associate/Senior Editor at Management Science (2014-2017), MSOM (2008-present), Operations Research (2018-present), POMS (2011-present), IIIE Transactions (2009-present), and the Decision Sciences Journal (2010-2016). She was VP for meetings of the MSOM society. She currently teaches Supply chain management, Sourcing and supplier management, and Sustainable supply chains in MBA and MSc programs.

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For enquiries, please contact 2616-8373 or email to hkbis@Ln.edu.hk
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