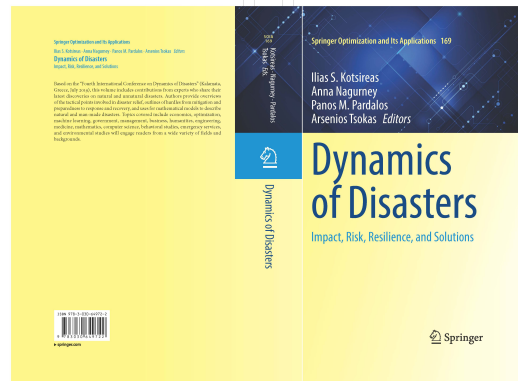


The Supernetwork Sentinel

Fall 2020

Welcome to the Fall 2020 edition of **The Supernetwork Sentinel**, the newsletter of the Virtual Center for Supernetworks at the Isenberg School of Management, UMass Amherst. This newsletter is published in Fall, Winter, and Summer editions. The newsletter's purpose is to keep you informed of events, activities, and successes of the Virtual Center for Supernetworks, the Center Associates, and the Supernetworks Laboratory for Computation and Visualization. This newsletter is the second one since the Covid-19 pandemic was declared. In it, we report on our related research and media attention and the accomplishments of Center Associates during this challenging time. As always, we include a list of our recent Center publications.



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Forthcoming New Dynamics of Disasters Book

We are delighted to announce that the book, [*Dynamics of Disasters: Impact, Risk, Resilience, and Solutions*](#), edited by Professor Ilias S. Kotsireas, the Center Director, Professor Panos M. Pardalos, and Arsenios Tsokas, is now in press with Springer. The book is based on the "Fourth International Conference on Dynamics of Disasters," which took place in Kalamata, Greece, July 2019, with additional refereed contributions from experts who share their latest discoveries on natural and unnatural disasters. Professor Anna Nagurney co-organized this conference with Kotsireas and Pardalos.



Dynamics of Disasters conferees, July 2019

This edited volume contains 16 chapters, along with a preface, and includes contributions by the Center Director on food supply chains and the impacts of labor disruptions in the pandemic and by Center Associate Professor Patrizia Daniele of the University of Catania in Italy on human migration networks. The latter paper is co-authored with the Center Director and Professor Daniele's PhD student, Giorgia Cappello. Other contributors to the volume hail from Japan, Nepal, Russia, Germany, Turkey, the United States, and other countries.

This volume is especially timely, given the pandemic, which is a disaster not limited by geography and, in a sense, even time, since it is still ongoing, although there is now progress on Covid-19 vaccines as well as some therapeutics for this horrible disease.

Center Associates Continue Pandemic Related Research

Center Associates, with their expertise in networks and supply chains, and a plethora of applications, have been very busy conducting research on topics related to the pandemic.

The Center Director has co-authored several papers on human migration and refugees with Center Associate Professor Patrizia Daniele of the University of Catania in Italy and her PhD student, Giorgia Cappello, as well as with Center Associate Professor Ladimer S. Nagurney of the University of Hartford. The Center Director has been working on problems of human migration for over 20 years. The research continues to be motivated by real-world events. According to the United Nations Department of Economic and Social Affairs, Population Division, by the end of 2019 the number of people forcibly displaced due to war, conflict, persecution, human rights violations, poverty and economic inequality but also climate change and natural disasters, had grown to 79.5 million. Furthermore, the vulnerability of millions of international migrants may be exacerbated in crisis situations, as actually is the case now with the COVID-19, and, of course, by climate change.

In addition, migration interactions will be the key to achieving the 2030 Sustainable Development Goals (SDGs) adopted by the member states of the United Nations. In the 2030 Agenda, 9 out of the 17 goals contain targets and indicators that are related to migration or mobility.

In the series of papers, we first set out to include the impacts of regulations on migratory flows and utilities, and took the perspective of migrants behaving in a user-optimizing manner, that is, choosing their locations, subject to the differential between the destination location utility and that in the origin location minus the migration cost. This led us to publishing the paper, [*International Human Migration Networks Under Regulations*](#), in the *European Journal of Operational Research*.

This paper was then extended to include multiple paths between origin and destination nodes, with each path possibly consisting of multiple links. The paper, [*Refugee Migration Networks and Regulations: A Multiclass, Multipath Variational Inequality Framework*](#), was published in the *Journal of Global Optimization*.

We also introduced, for the first time, a system-optimized perspective for human migration, in which a central authority allocates migrants to locations in a way that is optimal from a societal perspective. In the paper, published in the *International Transactions in Operational Research* (ITOR): [*Human Migration Networks and Policy Interventions: Bringing Population Distributions in Line with System Optimization*](#), we demonstrated how, through policy interventions, in the form of subsidies, a

governmental body could ensure that, once imposed the migratory flows (and associated population distributions) would generate a system optimum, although migrants were behaving in a user-optimizing manner. Those of you well-versed in transportation science can see the analogues.

And, in another recent paper on human migration, **A System-Optimization Model for Multiclass Human Migration with Migration Costs and Regulations Inspired by the Covid-19 Pandemic**, co-authored with Professor Patrizia Daniele Giorgia Cappello, we proposed novel utility functions associated with origin and destination nodes and also considered regulations as in the above work. The Covid-19 pandemic has dramatically affected global mobility in the form of blockages, restrictions, and travel disruptions, as risk mitigation measures are being implemented by numerous countries. Indeed, the International Organization for Migration (IOM) reports that between 11 March 2020, when the World Health Organization (WHO) declared COVID-19 a pandemic, and 20 April 2020, the total number of movement restrictions implemented around the world has increased to more than 48,000! This paper is now in press in the journal *Minimax Theory and Applications*.

Center Associate Professor Pritha Dutta of Pace University in NYC co-authored with Professor Anna Nagurney the paper, **A Multiclass, Multiproduct Covid-19 Convalescent Plasma Donor Equilibrium Model**.

Several other papers on various aspects of supply chains in the Covid-19 pandemic have been completed; please refer to the last section of this newsletter, whereas others are under review in journals.

Additional papers with Center Associates are presently under review. [For the full list of recent papers that have been accepted or published, see the Supernetwork Center website.](#)

Media Attention

The research conducted at the Supernetwork Center, because of its timeliness and relevance in the pandemic, has attracted media attention.

The Center Director Professor Anna Nagurney published two articles in *The Conversation* over the summer. The first article, **The Raging Competition for Medical Supplies is Not a Game, but Game Theory Can Help**, was published on August 4, 2020, and the second article, **Keeping Coronavirus Vaccines at Subzero Temperatures During Distribution Will be Hard, but Likely to Ending**

Pandemic, was published on September 18, 2020.

These articles were reprinted and reposted on many media outlets and the latter one even translated to different languages.

Over the summer, the Center Director was interviewed for multiple articles on impact of the pandemic on food supply chains, and was quoted in major media such as *The New York Times* and *The Boston Globe*. In addition she was interviewed by the Associated Press for an article on the Covid-19 vaccine cold chain. Many of the interviews can be found on the Supernetwork Center website <https://supernet.isenberg.umass.edu/media/media.htm>

[Various audio and visual recordings of podcasts as well as recent invited talks, including the Amazon Consumer Science Summit that Professor Anna Nagurney keynoted, can also be found on the Supernetwork Center website.](#)

Upcoming Conferences

Because of the Covid-19 pandemic, conferences have become exclusively virtual. Center Associates will be, nevertheless, busy presenting at upcoming conferences, including the INFORMS Annual Meeting in November as well as the DSI conference, also taking place, in virtual format, in November 2020.

The Annual INFORMS conference has always served as a special venue for a get-together of Center Associates, but it is important to stay healthy and to get through this pandemic so that we can meet together, reconnect, and celebrate, once the pandemic is behind us.

The INFORMS Annual meeting is requiring that speakers record their presentations and upload them to the conference website. Professor Anna Nagurney will be presenting an invited talk in a special session noting the 50th anniversary of the journal *Networks*, which is based, partly, on her invited paper that will be appearing in the journal in early 2021. Doctoral Student Center Associate Mojtaba Salarpour will present the paper, **A Stochastic Disaster Relief Game Theory Network Model**, co-authored with the Center Director and with Center Associates Professor June Dong of SUNY Oswego and Professor Ladimer S. Nagurney of the University of Hartford. The paper was published in the journal *SN Operations Research Forum* in January 2020. Center Associate Professor Pritha Dutta will present the paper, **Competition for Medical Supplies Under Stochastic demand in the Covid-19 Pandemic: A Generalized Nash Equilibrium Framework**. The paper is

now in press in a Springer volume edited by Professors Rassias and Pardalos. The paper was co-authored with Mojtaba Salarpour and Professor June Dong. In addition, Center Associate Professor Deniz Besik of the University of Richmond will deliver the talk, **Global Supply Chain Networks and Tariff Rate Quotas: Equilibrium Analysis with Application to Agricultural Products**. The talk is based on the paper co-authored with the Center Director and Professor Ladimer S. Nagurney and published in the *Journal of Global Optimization* in 2019. In addition, Center Associate Professor Dmytro Matsypura of the University of Sydney in Australia will have his PhD student, Jessica Leung, deliver a presentation on their joint work at the INFORMS conference!

Both Professor Pritha Dutta and Mojtaba Salarpour will also be presenting at the DSI conference, in a virtual, but live format.

Kudos and News

Kudos to Center Associate Professor Sara Saberi of the Foisie School of Business at WPI in Massachusetts for being a PI on a major NSF grant! According to the official press release, *Project RESPOND will help Massachusetts manufacturers pivot operations to address crises. The team led by UMass Lowell includes MIT, WPI, & MassTech and the collaborative \$500,000 grant builds on the success of the Massachusetts manufacturing emergency response team.* More information on this important grant and research can be found on the link below:
https://www.eurekalert.org/pub_releases/2020-10/uoml-ma100220.php

Congratulations to Center Associate Professor Ding Zhang of the School of Business at SUNY Oswego for the publication of his paper, with co-authors, entitled, **Modelling the Evolution Trajectory of COVID-19 in Wuhan, China: Experience and Suggestions**, in the journal *Public Health* in June 2020. Also, congratulations to Professor Zhang for the publication of his paper, **Competition Among Supply Chains: The Choice of Financing Strategy**, with co-authors in the journal *Operational Research* in June 2020! And his co-authored paper, **Integrated Planning for Public Health Emergencies: A Modified Model for Controlling H1N1 Pandemic**, appears in the *Journal of the Operational Research Society* **71(5)**, (2020).

Congratulations to Center Associate Professor Deniz Besik for beginning her tenure track Assistant Professorship at the Robins School of Business at the University of Richmond in Virginia! Dr. Besik is teaching face to face in the pandemic, a challenging endeavor. Dr. Besik and

Center Associate Professor Pritha Dutta of Pace University were selected to take part in the New Faculty Colloquium at the INFORMS Annual Virtual Meeting in November!

Congratulations to Doctoral Student Center Associate Mojtaba Salarpour for being selected to take part in the Doctoral Colloquium at the INFORMS Annual Virtual Meeting. He will also be taking part in the DSI Doctoral Colloquium in November. Plus, Mojtaba has been re-elected President of the UMass Amherst INFORMS Student Chapter and we have good news to share. The Chapter has been recognized by INFORMS with a Magna Cum Laude Award and will be recognized, along with other award-winning chapters, in a virtual ceremony in November, after the INFORMS conference. Congratulations! We thank Mojtaba for his excellent service as President of the UMass Amherst INFORMS Student Chapter!

Center Associate Professor Tina Wakolbinger of the Vienna University of Economics and Business was involved in the 46th Annual Meeting of the EURO Working Group on Operational Research in Health Care, e-ORAHS 2020, which took place in late July and was virtual. The official host was the University of Vienna, Austria. [Information, including presentations can be found on this link.](#)

Congratulations to Center Associate Professor Patrick Qiang of Penn State Great Valley. His co-authored paper with the Center Director, **Quantifying Supply Chain Network Synergy for Humanitarian Organizations**, published in the *IBM Journal of Research and Development* (2020), has been selected by IEEE for a compendium of papers, posted online, as relevant to assisting in the Covid-19 pandemic.

Congratulations to Center Associates Professor Trisha Anderson of Texas Wesleyan University, Professor Zugang Liu of Penn State University Hazleton, and Professor Jose M. Cruz of the University of Connecticut on the publication of their paper, **Social and Environmental Sustainability: An Empirical Analysis of Supply Chain Profitability and the Recession**, with Professor Jia Wang, in *Operations and Supply Chain Management* (2020). The paper was published in volume **13(2)**, 176-193.

Congratulations to Center Associate Professor Dong "Michelle" Li for becoming a member of the INFORMS Undergraduate Prize Committee for 2020!

The Center Director welcomes Jamie Wu as a new Doctoral Student Center Associate. Jamie will be working with the Center Director and successfully passed her core exam in the summer of 2020.

The Center Director Professor Anna Nagurney is honored and delighted that she was elected to the Board of Directors of the Kyiv School of Economics (KSE) in Ukraine at a virtual meeting in October 2020. She continues to serve on the International Academic Board of the Kyiv School of Economics and will work hard as a member of the KSE Leadership Team.

The Center Director is deeply honored to be recognized with the 2020 Harold Larnder Prize of CORS (Canadian Operational Research Society). Because of the pandemic, she will deliver her Prize lecture in the summer of 2021 at the CORS Conference, which will be virtual. Professor Anna Nagurney is only the second female recipient of this award in its 35 year history!

Recent Center Publications

Please see our center articles at:
<http://supernet.isenberg.umass.edu/dart.html>

Human Migration Networks and Policy Interventions: Bringing Population Distributions in Line with System-Optimization, A. Nagurney, P. Daniele, and G. Cappello, *International Transactions in Operational Research* (2021), **28(1)**, 5-26.

A Stochastic Disaster Relief Game Theory Network Model, A. Nagurney, M. Salarpour, J. Dong, and L.S. Nagurney, *SN Operations Research Forum* (2020), **1(10)**.

Quantifying Supply Chain Network Synergy for Humanitarian Organizations, A. Nagurney and Q. Qiang, *IBM Journal of Research and Development* (2020), **64(1/2)**, pp 12:1-12:16.

Refugee Migration Networks and Regulations: A Multiclass, Multipath Variational Inequality Framework, A. Nagurney, P. Daniele, and L.S. Nagurney, *Journal of Global Optimization* (2020), **78**, 627-649.

Competition for Medical Supplies Under Stochastic Demand in the Covid-19 Pandemic: A Generalized Nash Equilibrium Framework, A. Nagurney, M. Salarpour, J. Dong, and P. Dutta (2020), in press in: *Nonlinear Analysis and Global Optimization*, T.M. Rassias and P.M. Pardalos, Editors, Springer Nature Switzerland AG.

Perishable Food Supply Chain Networks with Labor in the Covid-19 Pandemic, A. Nagurney (2020), in press in: *Dynamics of Disasters – Impact, Risk, Resilience, and*

Solutions, I.S. Kotsireas, A. Nagurney, P.M. Pardalos, and A. Tsokas, Editors, Springer International Publishing Switzerland.

Capacitated Human Migration Networks and Subsidization, A. Nagurney, P. Daniele, and G. Cappello (2020), to appear in: *Dynamics of Disasters – Impact, Risk, Resilience, and Solutions*, I.S. Kotsireas, A. Nagurney, P.M. Pardalos, and A. Tsokas, Editors, Springer International Publishing Switzerland.

International Human Migration Networks Under Regulations, A. Nagurney and P. Daniele (2020), in press in the *European Journal of Operational Research*.

Networks in Economics and Finance in Networks and Beyond: A Half Century Retrospective, A. Nagurney, in press in *Networks* (2019).

Multitiered Blood Supply Chain Network Competition: Linking Blood Service Organizations, Hospitals, and Payers, P. Dutta and A. Nagurney, *Operations Research for Health Care* (2019), **23**, 100-230.

In Memoriam: Martin Beckmann (1924-2017), D. Boyce and A. Nagurney, *Transportation Science* (2019), **53(6)**, 1798-1799.

Strict Quotas or Tariffs? Implications for Product Quality and Consumer Welfare in Differentiated Product Supply Chains, A. Nagurney, D. Besik, and D. Li, *Transportation Research E* (2019), **29**, 136-161.

Global Supply Chain Networks and Tariff Rate Quotas: Equilibrium Analysis with Applications to Agricultural Products, A. Nagurney, D. Besik, and L.S. Nagurney, *Journal of Global Optimization* (2019), **75**, 439-460.

An Integrated Financial and Logistical Game Theory Model for Humanitarian Organizations with Purchasing Costs, Multiple Freight Service Providers, and Budget, Capacity, and Demand Constraints, A. Nagurney, M. Salarpour, and P. Daniele, *International Journal of Production Economics* (2019), **212**, 212-226.

Supply Chain Network Competition Among Blood Service Organizations: A Generalized Nash Equilibrium Framework, A. Nagurney and P. Dutta, *Annals of Operations Research* (2019), **275(2)**, 551-586.

Competition for Blood Donations, A. Nagurney and P. Dutta, *Omega* (2019), **212**, 103-114.

Tariffs and Quotas in World Trade: A Unified Variational Inequality Framework, A. Nagurney, D. Besik, and J. Dong, *European Journal of Operational Research* (2019), **275(1)**, 347-360.

How to Increase the Impact of Disaster Relief: A Study of Transportation Rates, Framework Agreements and Product Distribution, T. Gossler, T. Wakolbinger, A. Nagurney, and P. Daniele, *European Journal of Operational Research* (2019), **274(1)**, 126-141.

A Game Theory Model for Freight Service Provision Security Investments for High-Value Cargo, A. Nagurney, S. Shukla, L. S. Nagurney, and S. Saberi, *Economics of Transportation* (2018), **16**, 21-28.

Dynamics of Quality as a Strategic Variable in Complex Food Supply Chain Network Competition: The Case of Fresh Produce, A. Nagurney, D. Besik, and M. Yu, *Chaos* 28: (2018), 043124.

A Competitive Multiperiod Supply Chain Network Model with Freight Carriers and Green Technology Investment Option, S. Saberi, J.M. Cruz, J. Sarkis, and A. Nagurney, *European Journal of Operational Research* (2018), **266(3)**, 934-949.

The Center Director

Dr. Anna Nagurney
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Center Associates

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Dr. Deniz Besik
Dr. Jose M. Cruz
Dr. Patrizia Daniele
Dr. Pritha Dutta
Dr. June Dong
Dr. Ke "Grace" Ke
Dr. Dong "Michelle" Li
Dr. Zugang "Leo" Liu
Dr. Amir H. Masoumi
Dr. Dmytro Matsypura
Dr. Ladimer S. Nagurney
Dr. Qiang "Patrick" Qiang
Dr. Padma Ramanujam
Dr. Sara Saberi
Dr. Stavros Siokos
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