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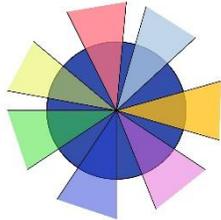International Institute Societal Complexity Europe LLC
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1st E-Conference **Societal Complexity**
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Dorien DeTombe & Gerhard-Wilhelm Weber (Eds.)
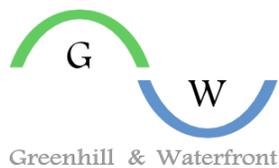
E-Conference Societal Complexity

Introduction

This conference is taking place in the times of the *Lock-Down* in Spring-time and Summer-time of 2020 which occurred by the pandemics COVID-19. This conference is another precious element in the series of workshops organized by **Prof. Dr. Dorien DeTombe** and her colleagues and friends. Like in this past, she has been the initiator, the driving force and the motor of this event. She gathered so many scholars from all over the world, prepared the conference online, collected the abstracts and the papers, and compiled them to another wonderful book, as in so many years of her unique career. In fact, this conference and this book are another testimony of *Prof. Dr. Dorien DeTombe*'s vast contribution to Operational Research and Science and to their communities, and her high impact to the world in which we are living and on the solution of its striking and urgent problems.

Gerhard-Wilhelm Weber   Poznan, Poland, June 9, 2020

In 1993 the *EWG Methodology of Societal Complexity (MSC)* was a part of the International International Research Society on Methodology of Societal Complexity (MSC), founded and chaired by *Prof. Dr. Dorien DeTombe*. The International Research Society on Methodology of Societal Complexity (MSC) and the EWG Methodology of Societal Complexity (MSC) has since 1993 organized many conferences in all continents all over the world and published many books and articles in scientific journals, see http://www.complexitycourse.org

The EWG Methodology of Societal Complexity organizes each year special sessions on this topic on the EURO conferences of the EURO Operational Research Conferences together with OR and Ethics, or of the IFORS conferences.

Methodology of Societal Complexity focuses on methodologies, methods and tools for analyzing, structuring, guiding and evaluating complex societal problems. Complex societal problems are often policy problems that can occur in many fields, like in the Agro-industry (water pollution by too much manure and fowl plague), in the transportation sector, in healthcare (Malaria, HIV/Aids, Flu), in Water affairs and in economy (credit crisis). The field focuses on handling local safety problems like large city issues and natural disasters as flood and hurricanes and global safety problems like war and terrorism. Although many of these issues have different causes, they have so much in common that they can be approached in the same way by using the Compram methodology, a methodology based on the use of experts and actors and the voice of the people in a democratic way.

Complex societal problems, as such, are unstructured, dynamical, constantly changing and have a large impact on society on macro, meso and micro level. Handling complex societal problems needs a special multi-disciplinary approach. The content knowledge comes from content experts. The process knowledge comes from facilitators. The power is in the hand of actors. The attention

of the research of *Methodology of Societal Complexity* is on the methods and tools facilitators need for guiding these kinds of problems. The facilitators use methodologies specially created for the field of societal problems combined with methods and insights derived from fields like medicine, law, economics, societal sciences, methodology, mathematics, computer sciences, technology, engineering sciences, socio-cybernetic, chaos theory and operational research combined with content knowledge. Often a combination of methods is needed as is prescribed by the Compram methodology for handling complex societal problems.

EURO Working Groups related to Societal Complexity are:
EWG OR and Ethics and OR
EWG EUROPT - EWG on Continuous Optimization
EWG OR for Development
EURO MCDA

Keywords: Methodology, Complex Societal Issues, Decisions, Sustainable Development, Healthcare, Economy, Environment, Operational Research

Amsterdam,
Dorien DeTombe & Gerhard Wilhelm Weber

Prof. Dr Dorien DeTombe, Sichuan University, Chengdu, P.R. China, detombe@nosmo.nl
EWG Methodology for Complex Societal Problems (MSC), EWG EUROPT, EWG OR for Development
Founder and Chair International Research Society on Methodology of Societal Complexity
Amsterdam, The Netherlands, Europe

Prof Dr Gerhard Wilhelm Weber, Politechnika Poznańska Wydział Inżynierii Zarządzania, ul. Jacka Rychlewskiego 2, 60-965 Poznań, Poland, gerhard.weber@put.poznan.pl,
and Institute of Applied Mathematics, METU, Ankara, Turkey

A Dynamic Model for Smart Sharia Tourism Planning

Herman Mawengkang[1], Husain[2]
[1]Department of Mathematics, Universitas Sumatera Utara, Medan, Indonesia
[2]Graduate School of Computer Science, Universitas Sumatera Utara, Medan, Indonesia
hmawengkang@yahoo.com

Abstract
The development of sustainable tourism such as dynamic and complex smart sharia tourism consists of many interrelated and diverse components of stakeholders, which each has different management objectives, which can trigger unexpected conflicts among stakeholders. Regarding the dynamic and complex challenges in the field of developing sustainable tourism, the ability of identifying is really needed. This research is carried out as an effort to look deeper into what are the factors that influence the implementation of sharia smart tourism plans and the strategies needed and analyze the dynamic causal relationships of these factors by using a system approach method using a Causal Loop Diagram model (CLD). The system approach will produce a dynamic model that would be able to represent the conditions of the aspects of the level of tourist visits, economic and environmental improvement that illustrates the relevance of interacting factors. The model is expected to be a material for consideration and decision making for the planning of sustainable tourism development for sharia smart tourism

Keywords: Dynamic Model, Causal Loop Model Diagram, Smart Sharia Tourism, Sustainable Tourism.

**Generation of and Classification of Digital Marble Art (EBRU) -
Revisiting Operational Research and Deep Learning**

Suryati Sitepu
Mathematics, University HKBP Nommensen, FMIPA USU, Medan, North Sumatra, Indonesia
Melvin Selim Atay
Institute of Neuroscience and Neurotechnology, Middle East Technical University, Ankara, Turkey
Gerhard-Wilhelm Weber
Faculty of Engineering Management, Poznan University of Technology, Poland, and IAM (UME), METU, Ankara, Turkey
Corr. Author: sitepuati@gmail.com

Abstract
In this presentation we introduce a new data collection of papers based on digital copies of traditional Turkish art named as Ebru (marbling). In this dataset there are 5 sub-classes of Ebru styles and about 200 samples per class; the total number of data is 1000. Ebru data were gathered from non-copyrighted digital copies of the real Ebru collections. To introduce this dataset we used several supervised classification methodologies from machine learning and deep learning literature. Our best performing method is based on transfer learning; pre-trained and fine-tuned Inception-Resnet V2 model for 500 epochs using Adam optimizer with learning rate set to 0.0001, nesterov momentum 0.9, we obtained test accuracy of 92% and 0.92 loss. We also propose a novel architecture (SEDNet) to classify Ebru Dataset based on inception modules; it is an optimized-shallow version of Inception-Resnet V2 architecture. Our best performing model bases on transfer learning approaches with test accuracy of 92% and 0.46 loss. SEDNet is the unique model which we developed for classification task of this kind of art, resulting in test accuracy of 56% and 3.57 loss. We also developed novel strategies of generating new digital Ebrus by approaches of generative adversarial networks and we developed a novel architecture named as SEDGAN, specifically to generate digital Ebru art. This study is the first ongoing research on traditional art generation studies by our research group.

Keywords: OR and the Arts, Analytics and Data Science, Artificial Intelligence.

Develop Voluntary Public Participation Model, Toward Sustainable Development, Key to victory over COVID-19

Amin Padash*[12], Sonia Najmeddin[3] Dorien DeTombe[4]
[1] Tarbiat Modares University, Faculty of Management, Department of Industrial Management
[2]Secretary of the Environment Committee, UNESCO Chair in Social Health and Development
[3]Department of Journalism, Faculty of Communication Sciences, Allameh Tabataba'i University
[4]Founder and Chair International Research Society on Methodology of Societal Complexity, Amsterdam, Netherlands
Corr. Author: aminpadash2003@yahoo.com;

Abstract
Concerns and social stress increased after the rapid spread of coronavirus when people around the world were exposed to the deadly disease. Lack of proper awareness of how the virus has spread and its scope, and the closure and cessation of the economic and life cycle around the world, has raised these concerns to a more critical level. On the one hand, all governments have done their best to present various programs; on the other hand, the lack of full awareness and the lack of a clear participatory program have added to the scale of these writings. At the same time, it seems that one of the main factors in the success of controlling and reducing the harmful effects of the coronavirus can be public participation and social empathy, which is one of the main pillars of sustainable development. The purpose of this short study is to determine the factors influencing and analyzing the examples of public participation alongside government policies; the results show how empathy and hope in the public participation cycle reduce stress and increase relaxation and enhance people's performance in the face of corona. Based on the analysis of the results and the opinions of experts, Voluntary Public Participation Model (VPPM) is presented between the community of people and the government organization.

Keywords: COVID-19; Voluntary Public Participation Model; Empathy; Sustainable Development; Effective Social Factors.

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[1]*Corresponding Author: Apadash@ut.ac.ir , Tarbiat Modares University, Jalal-E-Ale Ahmad St. Tehran, Iran, P.O. Box: 14115-111

Assessment of the Degree of Development of the Cities of Gilan Province, Iran (Economic Approach)

Prof. dr. Hamidreza Alipour
Asst. Professor, Department of Management & Economic, Rasht Branch, Islamic Azad University, Rasht, Iran
Alipour@iaurasht.ac.ir

Abstract
Intense population focus and imbalance are characteristic of third world countries, resulting from polarized growth policies. So, a limited number of areas have key roles and the other areas act as marginal. The first step to solve this problem is to understand disparities in economical, social, and cultural aspects. This paper seeks to measure the degree of development of the cities of Gilan province, Iran according to some development indexes in order to obtain the rates and causes of regional inequalities along with a way to reduce the underdevelopment of the region. Therefore, economic indexes have been used. After the analysis of the model, the results indicated that there is a fundamental difference among the cities with respect to development indexes; they are ranked based on developmental degrees as follow: Rasht, Bandar Anzali, Astaneh Ashrafieh, Lahijan, Roudbar, Masal, Rudsar, Amlash, Siahkal, Some'esara, Langrood, shaft, Astara, Rezvanshahr, Fuman, and Talesh.

Keywords: Morris coefficient of development, Gilan province cities, Facilities distribution.

**The Role of Emotional Accounting in Decision-Making Process
(Case study: Management and Accounting Students of IAU)**

Prof. Dr. Hamidreza Alipour, **Dr. Seyyedeh Nesa Rafkhahi**
Asst. Professor, Department of Management & Economic, Rasht Branch, Islamic Azad University, Rasht, Iran tel nr 0098 9111311776
Alipour@iaurasht.ac.ir,

Abstract
Emotion is one of the factors that influence individual's decision-making process. although extensive researches have been done in this area, the role of emotion in making decision in marketplace to purchase goods and service is empty .we also find it necessary in accounting studies ,our research results prove that people's feeling to a source of money (windfall) play a major role in their choice to how to spend it. So that people with negative feeling about the source of the money are more likely to use hedonic avoidance strategy to refrain from the pleasure of shopping and prefer to refine it by purchasing utilitarian items in order to decrease the negative feeling. We examined the role of emotion on decision-making process of accounting and management students of the Islamic Azad University of Rasht.

Keywords: Emotional Accounting; Decision-Making; Hedonic Avoidance; Money Laundering.

Estimation of Tourism Demand Function in World

Prof. Dr. Hamidreza Alipour
Asst. Professor, Department of Management & Economic,
Rasht Branch, Islamic Azad University, Rasht, Iran
Alipour@iaurasht.ac.ir

 Abstract
Tourism as an economic sector with high profitability allocates an important place to itself in the current state of the world that will be remembered as the tourism industry. With regard to tourist attractions in Iran, should be considered that the industry is able to single products out the dependence on petroleum. Therefore, the author intends in this article to show some effective factors on demand of tourism and share of each factor in Esfahan province that is one of the tourist province in our country and has an important role in this field. In this case, 8 tourist cities in a period of 2005 to 2011 were studied. By linear logarithm function and its estimation in panel data method, it was determined that variable number of hotels (TH) is the most efficient variable in the total demand for tourism. Meanwhile, the coefficient of this variable (TH), in addition, coefficient of variable of total tourism attractions (TJ) and total tourism and travel agencies(TA) is positive, showing direct relationship between number of passengers and three mentioned variables in that city. And the only negative variable factor is price of hotel(GH) and shows hotel prices are negatively relationship of number of tourists and this variable (GH), it can be justified in both foreign and domestic tourists, which caused the hotel prices have not significant effect on attract tourism.

Keywords: Tourism - Demand Function - Panel Data - Price Index - Tourist Attractions
Classification GEL: R58, R23, F22, D12, D11, C23, C33.

Time to Confront Bad Governance

Prof dr Cathal Brugha
Cathal.Brugha@ucd.ie
University College Dublin, Ireland.

Abstract
Why confront bad governance? The reason is Global Warming. Our planet is warning us that we cannot continue the way we are going, long-term into the future. Is there a good time when we should confront bad governance? People have the sense of sooner would be better than later. It will be more difficult for the next generations, if we don't start now. Whither might good governance bring us? Up to now governance has focused on institution-led competition for resources. The future will be about communities engaging in their own sustainability.
Whether we might be bothered, is the question that some people are addressing at the moment, and others are not. Signs of this include references to complacency. And to pride: increasing protestations that 'we are great'. And anger: protests against Covid-19 lockdown.
So much is strange and new about this pandemic that many may have missed that Covid-19 is one of the manifestations of the coming Global Warming. It so focuses our attention that we have already forgotten some of the other signs: fires in Australia, floods, refugees moving continents, droughts. There may come a time when Covid-19 could become a similar memory. Or people may look back on it, and see it as having been a blessing, because it gave an early warning to the need for better governance for the future, when things will get a lot more difficult.
What specifically about bad governance did the Covid-19 pandemic uncover? It is the inability, or unwillingness, of governance institutions to protect other than the privileged wealthy minorities, despite numerous warnings. Given that the pandemic is minor compared to the problems that climate change is bringing, we would do well to evaluate our approach to governance, and the business model on which it is based.
This paper will describe the two governance models, the current one and its proposed replacement.

Keywords: Good Governance, Covid-19.

Some Thoughts about the Corona Crisis as a Complex Societal Problem

Prof. dr. Cor van Dijkum
Amsterdam University / NOSMO
Associate Professor Emeritus Utrecht University
Chair Dutch Organization of Methodology in the Social Sciences, NOSMO.NL Email:
c.j.vandijkum@nosmo.nl

Abstract
Recently the world is confronted with an urgent complex societal problem: the fast spreading of a virus originated in China with severe consequences. It is a prototype of a complex societal problem the world will face in the future more and more. The question is how different actors handled this problem and how successful they were at last. From the framework of the methodology of handling complex societal problem such as is developed in the COMPRAM methodology one can set a methodological and scientific perspective on this question. We can look on open access data that available about the spreading of the disease with numbers for different countries expressing confirmed cases of contamination, people that became sick, deaths, recovered patients that became immune. But we also have to look at societal side-effects data showing: consequences in economy, the spread of information in social media about the disease, the way people react and organize themselves on the spread of disease. And we have to look at data showing the way different central institutions in our world, such as governments, non-governmental organizations, intergovernmental organization such as the WHO and scientific organizations handled the problem. To arrange, organize, explain, validate and understand all those data we start to develop a system dynamic simulation model originating from a (SIR) model of spreading of a disease in a population. With this model we will try to answer central questions: how successful this complex societal problem was handled, looking at health variables of people in the long run and other related social variables; how to explain this result and formulating new research questions. Thereby we compare two scenarios: (1) a complete lockdown of a region or country such as was practiced in China, France and Spain; (2) a more or less controlled delay of the spread of the disease such as was practiced in the Netherlands, Germany, Vietnam, South Korea and Singapore

Keywords: Societal Complexity, Compram methodology, System Dynamics, Spread of a Disease, Societal Side Effects.

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Covid-19 and Privacy: A Complex Societal Problem

Prof. Dr. Dorien DeTombe (MSc. Ph.D.)
Sichuan University, Chengdu, P.R. China
Founder and Chair International Research Society on Methodology of Societal Complexity
Amsterdam, The Netherlands, Europe
Tel: +31 20 6927526 DeTombe@nosmo.nl
www.doriendetombe.nl

Abstract
The Covid-19 pandemic has a huge influence on society because of the threat of the virus on the lives of people with a vulnerable healthcare, including those who are over the age of 70. The new coronavirus starting somewhere in November in 2019 in South of China can be a for vulnerable people a life threatening event. To prevent too many deaths and straining of the healthcare system most governments in the world decided to have some kind of lockdown. The lockdowns can be easier kept in the rich European countries than in the developing countries due to the way people live together. The lockdown has many effects on a person personal life and one's economic life. Because of the lockdown of touristic attractions including restaurants and theaters many people lost their jobs or are bound to lose their jobs. This is a stress creating event.
In order to prevent more virus outbreaks in the near future the governments created all kinds of digital control instruments, like following, by a person's phone, the movement of the person and forcing people to use governmental controlling apps.
These measurements are a threat on the democratic rules of freedom and privacy of the people. The Covid-19 pandemic is a complex societal problem and violate privacy, a democratic basic rights, is one of the aspects of this complex societal problem.
Looking what happens now and what will remain in the future is a complex societal issue. Therefor this issue should be handled according to the lines of the field of Methodology of Societal Complexity and the Compram Methodology in order to see which interventions can be taken and what the effect of the intervention on human lives and the economy is.
In many countries there is an advice boards consisting of medical people with expertise of many subfields of healthcare. Although this is a good start, these teams should be enlarged by experts of other fields such a historians, social scientist and people from law. This is a part of the advice of the Compram methodology. The Compram methodology handles the problem in a six step approach. Guided by a facilitator the problem will be analyzed, and possibilities for changes will be search, by first by experts and then by actors. The methodology emphasis knowledge acquisition and exchange of different experts and actors and takes into account the power and emotional differences.

 Keywords: Compram methodology, Covid-19, Privacy.

Sustainable Aggregate Production Planning with Overtime and Outsourcing Options under Fuzzy Seasonal Demand

Gerhard Wilhelm Weber[1,2], Erfan Babaee Tirkolaee[3,4], Alireza Goli[5], Selma Gütmen[6]
[1] Faculty of Engineering Management, Poznan University of Technology, Poznan, Poland
[2] Institute of Applied Mathematics, Middle East Technical University, Ankara, Turkey
E-mail: gerhard.weber@put.poznan.pl
Tel: +48-61-665-33-97, Skype ID: G.-W. Weber
[3] Department of Industrial Engineering, Mazandaran University of Science and Technology, Babol, Iran
[4] Department of Industrial and Systems Engineering, Istinye University, Istanbul, Turkey
E-mail: e.babaee@ustmb.ac.ir; erfansjs@gmail.com
Tel: +98-911-155-6658; Fax: +98-11-333-76173, Skype ID: erfan babaee tirkolaee
[5] Department of Industrial Engineering, Yazd University, Yazd, Iran
E-mail: a.goli@stu.yazd.ac.ir; alireza.g88@gmail.com
Tel: +98-913-866-6954
[6] Faculty of Engineering Management, Poznan University of Technology, Poznan, Poland
E-mail: selmagutmen@gmail.com
Tel: +48-61-739-667-997, Skype ID: live:selmagutmen

Abstract
Aggregate production planning (APP) is a medium-range production and employment planning that deals with the main challenges of manufacturing industries, such as production and outsourcing quantities, hiring and lay-off rates and inventory levels. On the other hand, sustainable development plays a key role in the problem based on global issues, particularly in environmental aspects. This study develops a novel multi-objective mixed-integer linear programming (MILP) model to formulate the sustainable APP problem with overtime and outsourcing options under fuzzy seasonal demand. The objectives are to concurrently minimize total cost of the production system, minimize total environmental pollution and maximize customers' satisfaction level. To deal with the multi-objectiveness of the model, the augmented ε-constraint technique is implemented. A numerical example is then investigated to test the performance and validity of the proposed mathematical model. Finally, the behavior of the objective functions is evaluated against the fluctuations of key parameters based on unstable real-world situation and managerial insights and decision aids are suggested.

Keywords: Aggregate production planning; Sustainable development; Outsourcing option; Fuzzy seasonal demand; Augmented ε-constraint technique.

Multilevel Socio-Economic Complexity: System Theory Approach

Prof. Dr. George Kleiner, Dr. Maxim Rybachuk
CEMI RAS, Financial University under the Government of the Russian Federation
george.kleiner@inbox.ru

Abstract
This paper presents an approach to the study of multi-level economic structures and identifies the sources of their complexity from the perspective of system economic theory. If in neoclassical economic theory, complexity is associated with a variety of linkages between agents, then a system approach draws attention not only to the number of relationships between agents but also to the complexity of the inner world of the agents themselves. The complexity of the world here is projected onto the complexity of the agent. System economic theory covers seven types of complexity, the sources of which are: 1) the interaction of a large number of agents, 2) the interaction of different-quality and different-dimensional systems, 3) the dynamism of the inner world of agents, 4) the increasing importance of inter-level interactions, 5) the wave-particle duality of information fields, 6) the problems of distinguishing between virtual and material reality and 7) the relationship between events at different points in space and time. Accordingly, for the sustainable development of multilevel structures in processes of making managerial decisions, it is necessary to take into consideration all these types of complexity. This approach is illustrated in the paper by the example of the management issues of an industrial enterprise.

Keywords: Socio-Economic Complexity, System Theory

Understanding Multi-methodology Interventions Through Sense Making

D. Petkov[1], O. Petkova[2], J. Wing[3], T. Andrew[3]
[1] Eastern Connecticut State University, USA, PetkovD@easternct.edu
[2] Central Connecticut State University, USA, PetkovaO@ccsu.edu;
[3] Durban University of Technology, South Africa

Abstract
Investigation of the mental processes during Problem Structuring Methods (PSM) interventions is a very little researched area. White and co-workers have suggested the use of Actor Network Theory and more recently – the Mangle of Practice Lens and also Activity Theory. A few attempts in other directions are related to Franco and separately to Ackermann, Shaw and Eden. The novel contribution of this research is that we show how the chosen techniques in two multi-methodology Operational Research (OR) interventions support sense making as a way for understanding them. Sense making in organizations according to Weick is the construction of meaning including five activities: as a retrospective process through the activity of action; as a consensual process through the activity of triangulation; as an interactive process through the activity of affiliation; as a cognitive process through the activity of deliberation and as a historical process, sense making is most visible in the process of contextualization. We illustrate how these five activities are supported in two different types of multi-methodology interventions including methods from different paradigms. The first is a recent community OR intervention for improvement of a large urban housing estate in Durban, South Africa involving several techniques (justified by Jackson's meta-methodology for mixing methods, Critical Systems Practice) from Alter's Work System Method, Soft Systems Methodology and Critical Systems Heuristics. The second is an intervention aimed at improvement of the management of an outsourced IT project (justified by Midgley's Process of Systemic Intervention meta-methodology) which utilized a mix of Soft Systems Methodology, Critical Systems Heuristics and Multi-Criteria Decision Making.

Keywords: Multi-methodology, Soft Systems Methodology, Critical Systems Heuristics, Multi-Criteria Decision Making.

Information Complexity of RANN Networks and Government Bond Market Spillovers Under TCJA and COVID-19

Kajiji, N. a*,   Dash, G. b,   Vonella, D. c,   and Marcks, S. d, a

a Department of Computer Science and Statistics, University of Rhode Island, USA, and
The NKD-Group, Inc. USA
b Finance and Decision Sciences Area, College of Business Administration and Interdisciplinary
Neuroscience Program, University of Rhode Island, USA,
c Municipal Markets Division, Refinitiv, Inc., USA,
d Department of Mathematics, University of Rhode Island, USA

*Corresponding Author: nina@nkd-group.com

Abstract
Learning in feed-forward neural network theory is a partial information study that seeks to reconstruct a desired input-output function from contributed examples (i.e., functions). While the theory of neural network complexity has its roots in classical approximation theory, neural networks are bounded by continuous complexity theory. Neural network complexity in this research is expressed through a radial basis function artificial neural network (RANN). It is well established that, given sufficient neurons in the hidden layer, the RANN topology is known to be optimal in its use of information.

The research presented in this paper utilizes recent advances in RANN learning to estimate regime dependent spillover elasticity metrics between the municipal bond returns of the U.S. SALT-impacted states and returns of the South African government 10-year bond. SALT refers to state and local income taxes. A two-regime learning simulation is proposed. The first regime is a time-frame dominated by the Tax Cuts and Jobs Act of 2017 (i.e., TCJA). The second regime applies the learning algorithm to a time-frame defined by the global identification, rise, and initial decline of the COVID-19 virus.

The TCJA was expected to increase the demand for municipal debt securities except for SALT states (tax-deduction limit of $10,000). There was also an expectation that the TCJA would encourage foreigners to invest in the United States. Passed by the U.S. Congress as an economic stimulus, complex questions now arise about spillover effects in the global fixed income markets. We investigate capital market spillover effects by mapping bond return volatility between the U.S. municipal market (state-level) and the South African bond market. Specifically, we apply the novel RANN (K4-RANN) to daily U.S. municipal bond trade data published by the Municipal Securities Rule Making Board (MSRB). After deriving a U.S. municipal credit-weighted bond return, the study controls for the noisy trade liquidity effects (Amihud illiquidity). The global return-generating elasticity estimates explain the percentage change in the bond yield index by neural network features such as the U.S. and South African short-term bond rates, lagged U.S. state bond yields, and residual lagged bond market effects across the U.S. and South Africa.

Preliminary results generated from the first panel provide a baseline set of both domestic and international spillover elasticities. The estimated RANN weights serve as normative estimates of spillover elasticity metrics such that each uniquely explains feature variability in this global returns-based setting. But, are these elasticities constant when global economies are instituting

new macro-prudential policies to respond to events like the COVID-19 pandemic. The second panel study of the research investigates this query. With the tailing of TCJA sentiment and the sudden rise of COVID-19 sentiment, we can extract comparative K4-RANN elasticity metrics from functional data describing the pandemic. The short answer to the query is – no. For example, based on the estimated bond-return elasticities, the research explores the unique business relationship between chicken farmers in the state of New Hampshire and South African consumers during TCJA and, separately, during COVID-19. The information complexity algorithm presented in this research offers new insights into how to investigate global economic input-output relationships that are embedded in the volatility of capital market instruments.

Public Health: a Complex Societal Challenge

Prof. Dr. Stephen G. Taylor, PhD
stevetaylorphd@hotmail.com

Abstract
This presentation will begin by situating health as an individual issue as well as an environmental and social problem. It will describe various dimensions of health, such as sanitation, disease prevention and treatment, as well as lifestyles and health education. It will attempt to provoke discussion about the paradox that when public health measures are successful and a society is fairly healthy, people tend to defy the process, and governments can easily reduce funding for the various activities leading to the maintenance good health. Examples relevant to the current global problem of Covid-19 will be presented.

Keywords: Covid-19, Societal Complexity, Public Health.