On The Edge:

How Economic and Social Networks Connect the World's Peripheral Cities and Regions

Perth, Australia
July 17 – 19, 2019

Overview

Network science has advanced considerably in the past 20 years toward better understanding how cities and regions are globally connected. This work examines network connectivity through human flows (e.g. migration, tourism), infrastructures (logistics, shipping), organisational structures (firm and organisational information flows), and social networks (e.g. social media, inter-locking directorates), among others.

This three-day symposium connects leading academics, strategists, economic development practitioners, and advanced students to explore how network theory and science can be applied to novel questions of economic development, particularly in peripheral cities and regions. By combining theoretical developments with empirical research, the workshop aims to connect a range of people interested in understanding urban connectivity in a globalising world.

As the symposium is located in Perth, we will focus on the city's uniqueness as a leader in the resources sector, combined with a focus on industry networks connecting cities outside of the world's 'core' economies.

Keynote lectures by leading researchers in economic geography, management, and network science will be complemented by discussion and debate regarding the potential and utility of networks in understanding economic globalisation and connectivity.

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On the Edge: Urban Networks at the Periphery
University of Western Australia, Perth
John Glover Room, Geography Building
July 17 – 19, 2019

Wednesday, July 17

8:30 **Kirsten Martinus & Thomas Sigler** – Welcome & Introduction

9:00 **Celine Rozenblat** – A multi-level networks perspective on complex urban systems

10:00 Morning Tea

10:15 New Global Connectivities: Exploring Peripheral Nodes
Julia Loginova – Territorial configurations of oil and gas networks and the state: a comparative study of Russia and Australia
Chanvoleak Ourng – Global cities network in the Arctic: The connectivity through ground and maritime transportation
Adriana Nunez-Picado – Networking practices in the globalising resource sector: Small capitalisation firms connecting Australia and Chile in the Copper and Lithium industries
Thi Minh Phuong Nguyen – How global city networks facilitate the development of the world's peripheral cities?
Leonardo Portes dos Santos – Australia as a periphery of the global economic network: a complex systems approach

12:00 Lunch

13:00 **Yasuyuki Todo** – The Role of Diversity of Networks in Economic Development and Resilience

14:00 Afternoon Tea

14:15 Economic Networks and Regional Development
Andrzej Gwizdalski – The impact of blockchain technology on Aboriginal artists in rural Australia
Cecelia Xia – Network Analysis of Air Travel in Regional Western Australia
Guanie Lim – Riding the belt and road initiative wave: Iskandar Malaysia's rise to prominence
Wilmar Salim – Urban interaction patterns in Indonesia: Correlation of air passenger flow and tertiary sector economic growth

15:45 Discussion: Reflections on Day 1 Presentations (Moderator: Sae Chi)

16:30 Bus to Perth City Centre

17:00 **Marion Fulker** – Perth on the global network peripheries
QVI Building, Level 36 (250 St Georges Terrace)

18:00 Refreshments @ The George (216 St Georges Terrace)

18:30 Walking Tour of Perth

19:30 Free evening to explore Perth (dinner on your own)

Thursday, July 18

9:00 **Zachary Neal** – Haven't I seen you here before: Using proximity to measure networks in and between cities

10:00 Morning Tea

10:30 Proximity and distance in network formation
Bo Guo – Globalisation of Australian cities: A firm-based investigation of intercity connections in the Australian resource sector
Ray Da Silva Rosa – Director Connections, Under-pricing, and Liquidity in Micro-Cap IPOs
Maedah Aboutalebi Karkavandi – How Do Perceived Brokers Interact in Collaboration Networks?
Petr Matous – The strength of long ties

12:00 Lunch

13:00 **Thomas Stemler** – The good, the bad, and the non-stationary

14:00 Afternoon Tea

14:15 The Economics of Urban Networks
Doina Olaru – Localised and global effects of urban transport networks on residential and commercial properties
Ruiqi LI – Simple Spatial Scaling Rules behind Complex Cities
Maria Podkorytova – Transformation of the interurban networks in the post-Soviet space through the structures of the global service companies
Thomas Sigler – Global Economic Networks: A Firm-Subsidiary Approach

15:45 Breakout discussions
Multi-level networks & peripheral nodes (Rozenblat & Martinus)
Economics & regional development (Todo & Stemler)
Measuring & modeling urban networks (Neal & Lusher)

17:30 Refreshments @ Bar Lafayette & Print Hall (Brookfield Place, 125 St. Georges Terrace)

19:30 Workshop dinner @ The Island Brewhouse (The Esplanade on Elizabeth Quay)

Friday, July 19

9:00 **Dean Lusher** – Coordinating innovation in knowledge-based multinational organizations

10:00 Morning Tea

10:30 Discussion: Tackling the Peripheries in Network Analysis (Moderator: Zachary Neal)

11:15 **Kirsten Martinus & Thomas Sigler** – Next steps and closing remarks

12:15 Workshop close

Abstracts

How Do Perceived Brokers Interact in Collaboration Networks?

Dr Maedeh Aboutalebi Karkavandi, Professor Dean Lusher, Dr Peng Wang, Professor Michael Gilding
Swinburne University of Technology, Australia

Some people are critical in connecting up disconnected others in collaboration networks. The aim of this study was to ascertain the location of perceived brokers within a network of collaboration ties, while at the same time investigating the role of personal attributes (e.g., sex, age, experience) that might account for one's reputation as a broker. Participants were from an Australian university (n = 162) and an Australian national research agency (n = 49). An online network survey consisted of a range of social network questions that asked about various types of collaborative activities between the university and the research organisation, and of whom they would go to for information or help in gaining access to the other partner. The network survey also asked a range of individual attribute questions about demographics. An autologistic actor attribute model (ALAAM) was run in MPNet (P. Wang et al., 2018). Results showed that perceived brokers tended to be linked together within the network. This indicates that being seen as approachable is shared within specific collaborations. Notably, perceived brokers were not active in the collaboration network more widely, tending to report fewer collaboration ties overall. Instead, their collaborations emphasized quality over quantity, with a greater number of reciprocal (mutually acknowledged) collaboration partnerships. Those in leadership positions, women, and research agency employees currently studying at the university, were also more likely to be perceived as brokers to the other organisation.

Globalisation of Australian Cities: A Firm-based Investigation of Intercity Connections in the Australian Resource Sector

Mr Bo Guo, Dr Kirsten Martinus and Professor Matthew Tonts
University of Western Australia, Australia

Globalisation has changed the way that cities interact with one another, they compete and cooperate to enforce their positions in the world economy. As one of the significant drivers for globalisation process, transnational corporation network has great impacts on world city network. Beneath the transnational firm level network, the underlying practices of corporate elites to control and manage production relations have shaped the way cities are networked together. However, the interaction among geographies of world cities, transnational corporations and corporate elites have not been frequently discussed in the same context. The aim of this project is to better understand globalisation of Australian cities by exploring impacts of both firm and corporate elite networks on the significance and position of Australian cities. The conceptual framework of this study is based on two streams of literature, World City Network (WCN) and Interlocking Directorates (ID). The former measures and interprets cities' position by looking at city and firm levels as the spatial level of analysis, and the latter examines global network of interlocking corporate directorates at firm and individual levels. While they work on different spatial levels, both of them provide valuable insights into different aspects of the globalisation process. There is a great potential to develop a framework which penetrates three different spatial levels (city, firm and corporate elite) by drawing on these two methodological streams based on their shared theoretical understandings of transnational corporate network. To explore the method being proposed, this project conducts a case study of Australian inter-city relations in the resource sector. The proposed framework no longer merely focuses on firm level analysis, but drills down to an individual level which highlights the influential role that corporate elites play in the network. The outcome of this research is expected to present a novel way through which we approach the methodological question of how networks are measured, and to examine the complex coexistence of competition and collaboration among world cities and firms.

The impact of blockchain technology on Aboriginal artists in rural Australia

Dr Andrzej Gwizdalski and Mr Leslie Delaforce
University of Western Australia, Australia

This paper explores the cultural and economic implications of using blockchain technology by Aboriginal artists in rural Australia. Blockchain technology enables permanent recording of peer-to-peer transactions in a cryptographically secured database shared in a decentralised network of computers around the world. This technology has the potential of recording, transferring and storing the rights to an artwork in a fair way that connects the creator and the buyer directly by cutting on the, often, exploitative fees of the middlemen. The technology fosters a fair business models built in a global decentralised network of value transfer. While several blockchain projects of this kind have recently emerged the technology is still relatively new and untested in practice. Furthermore, particular issues involve culture-specific complexity of rights determining who can create, transfer and access certain cultural content. This paper assesses the cultural and economic impact of blockchain technology on Aboriginal artists in rural Australia by examining the relationships between diverse actors in the network utilising the social network theory. The analysis is based on the review of relevant academic literature and emerging blockchain-based projects that facilitate art rights transfer.

Simple Spatial Scaling Rules behind Complex Cities

Professor Ruiqi Li
Beijing University of Chemical Technology, China

Although most of wealth and innovation have been the result of human interaction and cooperation, we are not yet able to quantitatively predict the spatial distributions of three main elements of cities: population, roads, and socioeconomic interactions. By a simple model mainly based on spatial attraction and matching growth mechanisms, we reveal that the spatial scaling rules of these three elements are in a consistent framework, which allows us to use any single observation to infer the others. All numerical and theoretical results are consistent with empirical data from ten representative cities. In addition, our model can also provide a general explanation of the origins of the universal super- and sub-linear aggregate scaling laws and accurately predict kilometre-level socioeconomic activity. And the theoretical analysis method is original which is based on growth instead of mean-field assumptions. The active population (AP) concept proposed by us is another contribution, which is a mixture of residential and working populations according to the duration of their activities in the region. AP is a more appropriate proxy than simply residential population for estimating socioeconomic activities. The density distribution of AP is $\rho(r) \propto r^{(-\beta)} (R_t^{(1+\beta)}-r^{(1+\beta)})\sim r^{(-\beta)}$ which can also reconcile the conflict between area-size allometry and the exponential decay of population from city centre to urban fringe found in the literature. Our work opens a new avenue for uncovering the evolution of cities in terms of the interplay among urban elements, and it has a broad range of applications.

Riding the Belt and Road Initiative Wave: Iskandar Malaysia's Rise to Prominence

Dr Guanie Lim
Nanyang Technological University, Singapore

As the perennial northern 'backyard' of wealthy Singapore, Iskandar Malaysia was conceptualized as a high-impact project in 2006 by Malaysian economic planners. The special economic zone (SEZ) at the southernmost tip of Malaysia is designed to capture the spillover effects from its tiny neighbour, with proximity to the latter one of the main selling points. Its fortunes improved vastly in the years after China's 2013 promulgation of the Belt and Road Initiative (BRI). Taking the cue from Beijing, several well-capitalized Chinese infrastructure transnational corporations (TNCs) found the SEZ conducive for their expansion into the region and invested in the construction of mega projects such as Forest City and Princess Cove. Taking advantage of the newly opened up business opportunities by these Chinese-led mega projects, airlines from the region soon offered travel routes between Iskandar Malaysia and several (semi-)peripheral cities, especially those from southern China. This paper examines whether or not, and how, the BRI was the precursor to Iskandar Malaysia becoming connected to the wider Asian region. In doing so, it measures several airline network indices to quantify the extent of the connectedness and indices' change before and after the introduction of BRI. Drawing from aviation network management literature, the paper then discusses the business and network strategies of the aforementioned airlines, underlining how they can be agents of spatial change by interconnecting semi-peripheral cities. It demonstrates that Iskandar Malaysia has seemingly 'risen' from its former lull as it is now more meaningfully connected to multiple Asian cities. The paper concludes with a discussion on how the airline network connecting Iskandar Malaysia is likely to develop in the future as the Chinese economy continues its cooling down process.

Territorial configurations of oil and gas networks and the state: a comparative study of Russia and Australia

Dr Julia Loginova[1], Dr Thomas Sigler[1], Dr Kirsten Martinus[2] and Professor Matthew Tonts[2]
University of Queensland[1], University of Western Australia[2]

The oil and gas sector is fundamental to the global economy and is changing in ways that are economically and geopolitically significant. Deeply involved into a range of global production networks, oil and gas firms create powerful interlinkages between different parts of the world. In this paper, we draw attention to the way in which particular economic and political geographies produced by the oil and gas firms are integral to the exercise of state political power using a comparative study of Russia and Australia – two large oil and gas producers with contrasting profiles of firms and state governance structures. We investigate the networked territorial configurations of the Russian and Australian oil and gas industry using a global dataset of publically-listed oil and gas firms supplemented by accounts gained from qualitative research, strategic documents and reports. First, we identify the geographical reach of oil and gas firms and the sectoral linkages spanning resource-rich regions, large cities and financial centres. Second, we link these forms to territorial and geopolitical intent of the two countries. To identify whether different energy sources produce substantially different configurations of power, the networked territorial configurations are explicated for the Russian and Australian LNG (liquefied natural gas) industry. The findings indicate that oil and gas industry-specific networked territorial configurations are both responsive and constitutive of state power.

Coordinating Innovation in Knowledge-Based Multinational Organisations

Professor Dean Lusher
Swinburne University of Technology, Australia

Integration into global supply chains is one of the fundamental challenges for manufacturing companies in Australia. In this presentation, I set out a framework to identify effective practices in designs for coordinating innovation in globally-dispersed organisations. I will discuss three mechanisms for transferring knowledge within organisations: hierarchies, communities of practice, and social networks. These mechanisms will discuss in the context of new developments in a multilevel statistical network modelling framework, and the possible organisational designs to overcome barriers to knowledge-transfer, such as language, culture and distance. The presentation will present plans for collecting data from Boeing Global Technology, the international research arm of The Boeing Company, a world leading business with major subsidiaries in Australia. I will discuss how knowledge of coordinating innovation in globally-dispersed organisations may improve Australia's competitive advantage in skill-intensive manufacturing and include improved strategies for coordinating innovation over distance and between cultures. How do we optimise organisational design to maximise the dispersion of knowledge across global sites separated by time and language? How do we enable Australian companies who sit on the periphery of the world to engage in advanced manufacturing and fully integrate into global value chains and production networks?

Urban Interaction Patterns in Indonesia: Correlation of Air Passenger Flow and Tertiary Sector Economic Growth

Mr Ganesha Mangkoesoebroto and Mr Wilmar Salim
Institut Teknologi Bandung, Indonesia

Urban interaction has been studied with aim to explain regional growth more comprehensively for more than half of the century. It was initiated to explore interaction between main city and its hinterland, then followed by other urban interactions in domestic, regional, and global scale inspired by the growth of communication and transportation technology. Various variables have been used to define urban interaction such as commodity flow, firms' interaction and the most common one, air passengers flow. However, in spite of the great attention from many scholars, there are still very limited studies about urban interaction in Indonesia. Therefore, this study aims to explain the interactions of 175 cities / regencies in Indonesia and their correlation with economic growth. The urban interactions were defined using network analysis based on air passengers' movement data in 2014 to 2016 obtained from Central Statistics Bureau and Ministry of Transportation. Employment and gross domestic regional product especially in transportation and tertiary economic sectors were used as economic variables. This study was an improvement of the previous study we conducted comprises 25 cities in Indonesia. It showed that air passenger movement in Indonesia is centered in Java Island, especially in Jakarta and Surabaya. With more cities to be included and by exploring its correlation with economic growth, this study is expected to show a better explanation of urban interaction in Indonesia.

The strength of long ties

Dr Petr Matous
University of Sydney

Mark Granovetter's seminal paper "the strength of weak ties" has famously shown that weak social links, which reach outside of one's group of good friends can provide access to crucial new information, which could not otherwise be gained through strong links within one's immediate community. Our studies from several countries and diverse contexts show that specifically long-distance links are crucial for innovation and resilience. Using data from Japan, which is the only comprehensive national goods and services supply network dataset of its kind in the world, we demonstrate that supply chains can work as important channels for the flow of information, innovation, and productivity between firms. Using original data combined with network interventions in developing countries, we show that small producers in distant regions manage their land better because they learn from experiences in different environments. Professionals who collaborate across diverse locations benefit from access to diverse types of knowledge, and slum dwellers with contacts outside of their suburbs are more likely to escape poverty. Actors on the edge of networks of in peripheral communities, who have access to other networks, play a strong role in local development. A lot is expected from new technologies to foster long links and promote the development of peripheral regions – but can we really on technology to really do that?

Haven't I seen you here before? Using proximity to measure networks in and between cities

Dr. Zachary Neal
Michigan State University, United States of America

Networks both within cities (e.g. neighborhood social networks) and between cities (e.g. economic flow networks) are challenging to measure directly. One promising method involves inferring network ties from patterns of co-locations. For example, a social tie might be inferred between two people if they attend many of the same events, while an economic tie might be inferred between two cities if they are sites of many of the same firms. Although this method has been widely adopted, it involves both theoretical and methodological pitfalls. Theoretically, a case must be made that frequent co-location is an appropriate indicator for the network tie of interest. Methodologically, inferring networks from co-locations requires the use of special-purpose statistical models. In this presentation, I will review the use of co-location as a method for measuring urban networks, with a particular focus on the challenges and ways to overcome them.

How global city networks facilitate the development of the world's peripheral cities?

Ms Thi Minh Phuong Nguyen and Dr Kathryn Davidson
University of South Australia, Australia

Cities worldwide are increasingly vulnerable to the impacts of various urban challenges including climate change, poverty, pollution or social segregation. In response to these intractable problems, a new form of city leadership has developed which favours global city networks as a new approach of city governance. Cities can derive clear benefits from participating in city networks and engaging in networking activities. While 'global cities' are more likely to become members of global city networks (and thus obtaining greater capacities to address these urban challenges), little is understood regarding how peripheral cities can participate in and develop through the apparatus of city networks. This paper focuses on investigating the role of city networks in facilitating the development of peripheral cities worldwide. For achieving this aim, a qualitative research methodology is employed within this study, which includes the application of a comparative case study approach to explore and compare experiences of two peripheral cities within city networks in which they are members (such as the United Cities and Local Governments (UCLG) or 100 Resilient Cities (100RC). The paper consists of two critical parts: (1) the first part will provide a literature review to identify key characteristics of peripheral cities and critical urban challenges that they are facing, and the importance of connectivity and city networks to the development of these cities; (2) the second part will evaluate two case studies based on the key criteria: background, how city networks support the development of these cities (demonstrating via particular projects), and investigating outcomes of those projects and 'added values' of city networks to the growth of peripheral cities. The study's results are expected to deliver a better understanding on how city networks can facilitate the development of peripheral cities and in turn present implications for traditional city planning and management.

Localised and global effects of urban transport networks on residential and commercial properties

Associate Professor Doina Olaru[1,3], Dr Frances Drake[2], Dr Brett Smith[1,3] and Professor Sharon Biermann[3]
University of Western Australia, Australia[1]
University of Leeds[2]
Planning and Transport Research Centre, Australia[3]

A broad spectrum of transport policy is supported by the estimation of hedonic prices in the residential market. Whilst it may be simpler, thus desirable, to have one model for all policy settings, an enduring issue for the estimation of hedonic models is the strong spatial aspect. Accounting for spatial dependence/variation/non-stationarity and the network effects related to the transport networks has led to two branches of spatial models. Application of a localised model is made under the assumption that the hedonic price surface over the entire region is too complicated and that pricing models are applicable in a 'neighbourhood'. When applying a global model, spatial variation may be accounted for by interacting parameters with location (fixed effects) or by accounting for spatial correlation (random effects). We are drawing on spatial analysis to identify the role transport networks have in real estate market for both residential and commercial uses, by applying both localised and global models to two case studies, Perth (WA, Australia) and Leeds (UK). The analysis is conducted using exclusively secondary data sources available on the public domain or provided by government departments. The choice of cases was determined by two main factors: the local knowledge of the researchers, but also two distinct real estate markets in terms of the housing stock or establishments, transport networks and spatial scales. We compare the models in their capacity to account for spatial effects and articulate policy questions that arise from each case study and to identify how modelling can appropriately support the relevant urban planning and transport policy.

Networking practices in the globalising resource sector: Small capitalisation firms connecting Australia and Chile in the Copper and Lithium industries

Ms Adriana Nunez-Picado[1], Dr Kirsten Martinus[1] and Dr Thomas Sigler[2]
University of Western Australia, Australia[1]
University of Queensland, Queensland[2]

Australia and Chile - in Latin America- tend to be considered as peripheral outliers in the world economic system and, as outliers, the connections between the two have been mostly disregarded in the literature. However, in a commodity dependent global economy, and in the context of a globalising resource industry, the relations between two of the largest reserve holders and producers of minerals in the world becomes salient. The aim of this paper is to develop a more nuanced understanding of cross-country mining networks, by unpacking the practices firms undertake to create and maintain network connections. This study draws on literature in international business studies, economic geography and social capital to address the cross-country connections through a practice-centred approach, which highlights the relevance of context and social interaction for the connections. The study focuses on the networking practices of small companies listed in the Australian Stock Exchange (ASX), connected to Chile in the copper and lithium industries. The paper first delves into the historical and political aspects of national context and geopolitical dynamics preconditioning the emergence of the connections. Then, it explores the networking practices of the mining firms by analysing the firms' corporate structures and strategies and the experiences key individuals have had in developing previous connections. This project uses mainly qualitative methods, including interviews with firm's key members, and documentary analysis of governmental documents and statistics, historical archives, and firms' websites and annual reports.

Global Cities Network in The Arctic: The Connectivity Through Ground And Maritime Transportation

Ms Chanvoleak Ourng and Dr Yvette Vaguet
University of Rouen, France

The circumpolar North experiences normalization through globalization as never before. The fabled Northwest Passage and the Northern Sea Route are opening as new commercial routes shortening time and cost to ship goods between Asia, Europe, and North America. However, the world has still very low knowledge on the ongoing interaction process between cities around the Arctic Ocean. The main objective of this research is to explore the network connectivity between the cities in the Arctic region through ground (road and railway) and maritime transportation. The data consists of a road, railway network datasets and place of settlements from OpenStreetMap (OSM) and transport maritime database which provide the information on the displacement of the ship from one port to another. City network connectivity through ground transportation will be performed referring to the graph theory. Network analyst toolbox in ArcGIS will be employed to create the connection between the places of settlement. For urban network connection through transport Maritimes, a trajectory analysis based on a concept of time-geography will be performed to study on the displacement of the vessel from port to port, to examine the frequency of the vessel's transportation and their type during a specific of time (monthly or seasonally), and to investigate the correlation between traffic volume, port centrality, and city size. Various tools and functions of PostgreSQL/PostGIS and ArcGIS will be used in this analysis. The outcome from this research paper will give us an overview on how the Arctic's cities are connected and to explore the pattern of interaction.

Transformation of the interurban networks in the post-Soviet space through the structures of the global service companies

Ms Maria Podkorytova
ITMO University, Russia

The study explores the process of globalization of former Soviet Union states by applying the urban network concept. The research aims to reveal the uneven transformation of the interurban networks, its premises and consequences. The paper considers the networks of the global service companies within the region and focuses on the position of cities in relation to each other. The structures of the interurban networks constructed in 2015 and in 2018 are also compared. Thus, the patterns of economic globalization are studied in the course of the political and economic uncertainty of the post-Soviet space. The research adopts and applies the interlocking network model proposed by the Globalization and World Cities (GaWC) research network to the regional level to uncover the interurban relations. The essential difference of this model and our method is the regional scope of the study. Consequently, it was possible for us to compare the interurban network patterns in different states and sub-regions of the post-Soviet space during the period of political and economic turbulence. Comparing the network patterns in 2015 and 2018 we focus on the unevenness that occurs depending on the state and the sector. In 2018 compared to 2015 the shrinkage is observed in the least dense networks: law and advertising. Meanwhile, the insurance companies demonstrate the sprawl of the corporate networks to the peripheries of the Baltic States, Western Ukraine and Moldova. Also, we observe the fall-back of the non-capital Russian cities and the significant improvement of the positions of the Middle Asian capitals in most of the networks in question.

Australia as a periphery of the global economic network: a complex systems approach

Dr Leonardo Portes dos Santos, Dr Debora Correa, Dr Thomas Jungling, Dr Kirsten Martinus and Mr Cameron Riseley
University of Western Australia, Australia

The impact of globalisation and advancing technologies on particular nations has long been of interest to geography and economics, given the interest of certain nations to influence global relations. Therefore, while shifts in the structure of the world system are not new, they have progressed in the last few decades with unprecedented intensity. The uncertainty and instability which this has generated in the global system can be seen in the rise of 'Trumpism' and 'Brexit' type responses by those who have felt most 'left-out' in the headiness of global 'progress'. From a global perspective, urban and economic geography has tended to focus on understanding these global dynamics by ranking relative network positions of cities and nations. Whilst this has significantly progress conceptual understandings of the world system and alternative globalisations, there has been limited exploration of cities and nations on the network peripheries and in the application of more complex mathematics. We address these gaps in two ways. Firstly, we examine the world system from the perspective of Australia – a nation which is peripheral to the core global economies both in a geographic and economic sense. Secondly, we innovate on current global city network analytical techniques by exploring the feasibility of integrating the concepts from both network theory and phase synchronization (PS) of nonlinear dynamical systems. We build on a recent PS analysis which unpacked the economic oscillations of various World Bank indicators: the existence of layers of synchronized business cycles between nations, as well as different clusters of countries (or markets) within these layers. Specifically, our study explores: (i) how to build a *network representation* of these layers of (phase) synchronized business cycles; (ii) how concepts of network theory (e.g. hubs, structural holes, homophily and bottlenecks) can be applied to understand flows within and characteristics of the system that would otherwise be hidden or encoded in a pure phase synchronization analysis. This framework could allow us to address pertinent questions as "is the structural role of Australia the same in all these different layers/networks?", or "could a given nation being a periphery in one layer, but a centre at other?".

A multi-level networks' perspective on complex urban systems

Professor Celine Rozenblat
University of Lausanne, Switzerland

In the context of knowledge and information societies, new tendencies in the long/medium term evolution of urban systems, together with new data and methods, require that existing theoretical assumptions and conceptualizations would be challenged as global urban hierarchies are reconfigured. The connection between urban systems at different levels of organization becomes more and more relevant for understanding urban systems and their transformations. But the inter-urban perspective is not sufficient to encompass these dynamics. Other cognitive, social, institutional proximities in the innovation processes combine with spatial proximities. It leads to consider cities in several dimensions of proximities in a multilayer perspective. The evolution of power distributions inside and between cities reshapes the world organization of central/peripheral cities and the complexity of the global urban system. Actors as multinational firms, or high level innovation centers, participate actively to these reconfigurations that imply the concentration of wealth, of control, of innovation and of attractiveness in few cities. In the complexity of this multi-level system, how regionalization of the world is reshaping in a multipolar urban world? How the multi-level perspective highlights some resilience properties? The methodologies derived from complex systems sciences bring new forms of intelligibility on worldwide urban dynamics.

Director Connections, Under-pricing, and Liquidity in Micro-Cap IPOs

Professor Raymond da Siva Rosa[1], Associate Professor Sharon Purchase[1],
Dr Daniel Schepis[1], Dr. Chloe Ho[1], and Associate Professor Marvin Wee[2]
University of Western Australia, Australia[1]
Australian National University[2]

Our study extends the literature on how investors and vendors address their information asymmetry in IPOs by examining on "sweat equity" IPOs. This focus is the mechanism by which investors identify managers to whom they entrust their capital in "sweat equity" IPOs and by which their interests are protected once capital is assigned. We test the proposition that connected directors perform, in effect, the role of intermediaries by providing assurance that the entrepreneurs are well vetted and unlikely to shirk. The typically small-scale funds raised and the high likelihood of having to raise funds repeatedly means entrepreneurs rationally fear losing their reputation more than they find shirking attractive. The more well connected the board, the higher the cost of a lost reputation. We find connected directors are associated with larger under-pricing but higher liquidity in 1,014 IPOs whose median value of funds raised is $5 million. Our findings support financial architecture theories that emphasise protection of entrepreneurs' "sweat equity" against hold-up by equity investors as a motive for going public. The contribution of our paper is to show the role of connected directors in protecting the interests of diffuse equity investors. This study also looks at the differences between lodging your IPO across the different Australian stock exchanges.

Global Economic Networks: A Firm-Subsidiary Approach

Dr Thomas J. Sigler and Dr Julia Loginova
University of Queensland, Australia

Various strands of research in economic geography have applied network analysis to understand the diverse interconnections between places within the global economy. This presentation takes a global, cross-sectoral approach to analysis firm-subsidiary relations as they produce ties between metropolitan regions. Drawing on approximately 1.2 million firm-subsidiary relations, the analysis provides empirical insights into the key connectivities that shape various global industries. It will focus on the core and periphery of the overall network as well as various industry-based subnetworks, with a view to understand the economic processes underlying how particular cities may be central to one network and peripheral to another. The example of global tax havens will be used to illustrate how cities that conventionally fall off the 'global cities' map might in fact be quite influential to the overall global financial network. The presentation concludes by focussing on how this supplements past understandings of the 'world city network' and by providing insights into the strengths and weaknesses of the so-called 'corporate approach' applied in similar research.

The Good, the Bad, the Non-Stationary

Dr Thomas Stemler
University of Western Australia, Australia

Time series analysis is a common approach to model the behaviour of complex systems. Nowadays data from complex systems is often transformed into a network representation. These network transforms allow us to apply tools and measures from statistical physics to analyse complex systems. Therefore, we are facing a new problem: what are the data requirements that allow us to use a network transformation? And consequently: is my result significant, so that I can draw some conclusion? These questions are far from obvious, in particular when dealing with non-stationary data sets. I am going to shed some light on some aspects of these questions from an applied point of view by drawing from some of the examples I worked on.

The Role of Diversity of Networks in Economic Development and Resilience

Professor Yasuyuki Todo
Waseda University, Japan

This presentation discusses what network structure promotes economic development and resilience, based on empirical analysis using data for various types of networks: social networks among farmers in rural Indonesia, information exchange networks among small- and medium-sized enterprises in suburban Vietnam, supply chains in Japan, global supply chains, and global research collaboration networks among firms. The results indicate that links with geographically distant partners (or external links) and geographic diversity of the ego-network most likely promote performance of individuals and firms, leading to economic development and resilience. We further discuss how this beneficial network structure can be achieved. Although we need more evidence on this issue, some existing studies suggest that facilitating social interactions with outsiders could generate favorable attitude to and external links with outsiders. An important implication from these results to peripheral cities and regions is that they should generate social interactions with distant cities and regions. However, because creating external links is particularly costly to peripheral cities and regions, public supports to develop transport and digital infrastructure and social programs such as student and business exchange programs are necessary.

Network Analysis of Air Travel in Regional Western Australia

Jianhong (Cecilia) Xia, Shaun Julian Glorie and Heng Zhou
Curtin University, Australia

The aviation network in Western Australia (WA) plays a vital role in transporting passengers to remote locations within the state, whether it be for mining-related activities or tourism purposes. This study performed a network analysis of total available seats between WA airports. The data captured 343 days of data totalling 109,781 flights with an estimated capacity of 18,354,526 seats. Using these data, we conducted network connectivity, node centrality and clustering analysis to understand the structure of WA aviation network, the role the regional airports plays within the flow of the network or the role it plays in the cohesiveness of the network and groups of airports which have a similar air travel pattern between them. This study is important for policy makers developing regional aviation policies to simulate the tourist industry and regional development which are key government economic and policy focus areas.

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