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**Teaching Proposal for a series of seminars for the PhD Economics and Finance
Tor Vergata Università degli Studi di Roma, over 4 weeks.**

Innovation Systems, Firm Capabilities, Complexity, Finance and Growth

Innovation is a key driver of productivity, living standards and growth. While innovation is one of the most important determinants of the performance of firms and economies, innovation systems analysis has only recently emerged as a distinct disciplinary sub-field, drawing on economics and management. The *systems of innovation* literature has its modern roots in Freeman (1987, 1997, 2019) and Lundvall (e.g. 2010) though its antecedents can be traced back to the work of List (1841), Schumpeter (1934, 1942) and the classical economists. Rather than start from firms and markets, it sees innovation as the outcome of interactions between a wider set of key players – firms, universities, research institutes, training institutes, government, financial institutions, regulatory bodies – which together shape the speed at which knowledge is generated and diffused to create and commercialise new products and processes that drive productivity growth. This approach is being developed using (i) agent-based modelling and (ii) complexity analysis, offering new insights into theory building, empirical analysis and novel understanding some of the challenges of our era, such as the productivity slowdown, the lack of convergence across regions and nations states, and the slow diffusion of vaccines and green technologies.

The sessions below are designed to be 90 minutes long, generally comprising a 45-minute presentation and 45-minute interactive discussion, including group work.

Some indicative readings – this list will be supplemented; at present it draws more extensively on my own research and that of colleagues in Tor Vergata to show where there may be synergies for a fruitful visit. I was external PhD Examiner at Tor Vergata for Juana Poala Bustamante, Beniamino Pisicoli and Angelica Sbardella and I advised Bustamante and Pisicoli on their publications below – both are in issues in which I also have an article published. I see advising on publication as an important part of PhD training.

- Asheim, B, Lawton Smith, H and Oughton, C. 2011. Regional Innovation Systems: Theory, Practice and Policy, *Regional Studies* July, 875-891.
- Bustamante, J. P. 2024. Complementarities between product and process innovation and their effects on employment: a firm-level analysis of manufacturing firms in Colombia, *International Review of Applied Economics*, 38:1-2:129-154.
- Bustamante, J, Oughton, C, Pesque-Cela, V and Tobin, T. 2023. Resolving the Patents Paradox in the Era of Covid19 and Climate Change: Towards a Patents Taxonomy, *Research Policy*.
- Bloom, N., C. I. Jones, J. Van Reenen, and M. Webb, 2020 Are Ideas Getting Harder to Find? *American Economic Review*, 110(4): 1104–1144
- Costa, S., De Santis, S., Dosi, G., Monducci, R., Sbardella, A., Virgillito, M. E. 2023. From organizational capabilities to corporate performances: at the roots of productivity slowdown. *Industrial and Corporate Change*.
- Driver, C and Oughton, C (2008) Dynamic Models of Regional Innovation: Explorations with British Time Series Data, *Cambridge Journal of Regions, Economy and Society*, Vol 1, July, 205-217.
- Foxon, T J, Köhler, J, Michie, J and Oughton, C (2013) Towards a New Complexity Economics for Sustainability, *Cambridge Journal of Economics*, 187-208.
- Freeman, C. 1987. Technology policy and economic performance: lessons from Japan, London, Pinter

Freeman, C. and Soete, L. 1997, *The Economics of Industrial Innovation* Third edition, London, Pinter

Freeman, C. 2019. History, Co-Evolution and Economic Growth, *Industrial and Corporate Change*, Vol. 28, No. 1, 1-44

Kanga, D, Oughton, C, Harris, L and Murinde, V. 2022. ‘The Diffusion of Fintech, Financial Inclusion and GDP Per Capita’, *European Journal of Finance*.

List, F. 1841. *The National System of Political Economy*. Longmans, Green, and Co.

Lundvall, B-A. 2010. *National Systems of Innovation: Toward a Theory of Innovation and Interactive Learning*, London, Anthem Press

Michie, J and Oughton, C. 2022. Measuring corporate diversity in financial services: a diversity index, *International Review of Applied Economics*, 36:3:1-30.

Oughton, C and Tobin, D. 2023. Joan Robinson: Early Endogenous Growth Theorist, *Cambridge Journal of Economics*.

Phillipon, T. 2019. *The Great Reversal: How America Gave Up on Free Markets*, The Belknap Press of Harvard University Press

Piscicoli, B. 2021. Banking diversity, financial complexity and resilience to financial shocks: evidence from Italian provinces, 36:3: 338-402.

Sbardella A., Zaccaria A., Pietronero L., and Scaramozzino P. 2021, Behind the Italian regional divide: an Economic Fitness and Complexity perspective, Sinappsi, 2021-XI, n.2.

Sbardella, A., Pugliese, E., Zaccaria, A., and Scaramozzino, P. 2018. The Role of Complex Analysis in Modelling Economic Growth, *Entropy* 20(11), 883.

Schumpeter, J. 1934. *The Theory of Economy Development*, Harvard University Press, Cambridge Mass.

Schumpeter, J. 1942. *Capitalism, Socialism and Democracy*, New York, Harper & Bros

Yuan, X., and Li, X. 2021. Mapping the technology diffusion of battery electric vehicles.

Week 1	National and Regional Systems of Innovation
Seminar 1	<i>Innovation Systems – National, Regional, Sectoral and Global Dimensions</i> This seminar will cover the evolution of the <i>Systems of Innovation</i> approach focusing on the main theoretical and empirical developments. At the end of this seminar participants should have a good understanding of the main features of the systems of innovation approach and the stylised facts, including an appreciation of the unevenness of innovation activity and its persistent concentration in certain firms and regions arising from systems effects. In the course of this session participants will gain insight into the use of systematic literature reviews in innovation and complexity analysis, and how to apply this research method to other fields.
Seminar 2	<i>Exploring systems effects using the Community Innovation Surveys (CIS), Patent and R&D data.</i> The development of the CIS from the Systems of Innovation approach provides an extensive example of how to go from theory to questionnaire design, to large scale data collection. The session will provide examples of research and papers that have used the CIS data and econometrics (e.g. Probit, systems models, cross-section and panel techniques) to explain firm, regional and national performance. It will also cover the increasing development and use of innovations surveys in low and middle-income countries, which offers new insights for economic development policies.
Week 2	Firms’ Dynamic Capabilities: Internal and External Innovation Systems
Seminar 3	<i>Inside the firm – dynamic capabilities, internal innovations systems.</i> This session will explore the theoretical and empirical literature on dynamic

	capabilities and how the management of capabilities is a key factor shaping firms productivity performance and their survival. It will use data on internal capabilities and survivor analysis to predict firm performance.
Seminar 4	<i>Integrating firm level analysis and systems level analysis</i> to explain variation in innovation and productivity performance across firms, regions and time. Exploring systems effects using the case of the Toyota's 2019 patent waiver which allowed royalty free use of 24,000 Toyota patents on electric vehicles, battery and drive chain technologies. It will show how difference in difference analysis can be used as a technique to look at the speed of innovation diffusion before and after the Toyota patent waiver.
Week 3	Financial Systems, Innovation Systems, Complexity and Growth
Seminar 5	<i>Financial and Innovation</i> Finance influences the cost, and therefore the rate at which risky innovation activities, such as R&D and the introduction of new products and processes are undertaken. This seminar will examine the financial system, focusing on the variety of financial institutions from public sector finance, mutuals, banks and venture capitalists. The objectives of different financial institutions will be identified and discussed along with measures of financial sector diversity. Participants will learn how to analyse and measure financial diversity and its effects on the cost and availability of finance.
Seminar 6	<i>Innovation and Complexity.</i> This session will explore a different but complementary approach to innovation systems, developed by Centro-Fermi drawing on physics, and show how it may be used to predict economic fitness, competitiveness and productivity growth. The session will consider how to integrate innovation systems analysis with complexity analysis to develop a stronger theoretical and empirical basis for analysis of innovation analysis and its impact on firm and economic performance at the regional and national levels. Participants will learn how to appraise and integrate different theoretical and empirical approaches, including how to theory build and how to evaluate theories using data.
Week 4	Innovation and Complexity: Re-evaluating Growth Theory and Policy
Seminar 7	<i>Revaluating Growth Theory</i> This session will explore recent attempts to incorporate innovation into New Growth Theory and compare and contrast this approach with the Systems of Innovation and Complexity approaches as well as Endogenous Growth Theory. It will consider how we can evaluate competing theories in terms of their internal consistency and their predictive power and fit with data, using a variety of empirical methods.
Seminar 8	<i>Re-thinking Policies to meet regional, national and global challenges</i> In this final session we will consider the implications of the approaches discussed in this series of seminars for the design of industrial policies to enhance innovation and growth. In particular, the session will focus on how innovation can be used to help us meet the global challenges of protecting public health (e.g. via vaccines and medicines), limiting climate change (e.g. via green technologies) and reducing inequalities between regions and between nation states.