

## MERC PhD Project Proposal

### Title of the research project:

**Economic Complexity and Fitness for Cities and Start Up Companies**

### Keywords (up to five)

Complex networks, Data Mining, Big Data, Economic Complexity, Hypergraphs

### Supervisors (at least two from two different areas):

*Supervisor 1 (name, contact details, homepage, area of expertise)*

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*Supervisor 2 (name, contact details, homepage, area of expertise)*

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Area of expertise: Statistical and Nonlinear Physics, Economic Complexity

### Project description (max 5000 characters)

**Economic Complexity (EC)** is a newly developed concept, aimed at providing holistic measures of the productive capabilities of large economic systems, usually cities, regions, or countries.

In particular, EC looks to quantify how a given knowledge or know-how is accumulated in a population, and how that is expressed in the economic activities present in a city, country, or region.

Higher economic complexity as compared to country's income level drives economic development.

The subject has been originally developed for the analysis of countries where the diversification of the products represents an essential element. The results have led to a very accurate forecasting for the GDP growth of countries which is more accurate than the standard data of the International Monetary Fund, as certified by Bloomberg News. In addition a detailed study of China has clarified the key elements for its forty years of sustained growth in terms of its Economic Fitness.

Going to smaller scales, like Regions, Cities, Companies and even Start Ups, this concept is progressively less crucial and other elements begin to play an important role. For example the patents and the relative Technological Codes are very important for the Companies and are almost the only economic data available for the Start Ups. This leads to the Technological Fitness which is an additional important element at smaller scales.

The present project aims at employing methods of economic complexity to study the specific role of some economic elements, in particular the Patents, and to understand how different factors can be extracted from various data sources. The objective is to integrate diverse economic data sources for a comprehensive analysis of the economic analysis at different scales. For instance, we look at investigating which economic elements are characterized by economic complexity when depicting trade data, and which economic elements are highlighted when using global patent data. The goal is to develop a holistic understanding of the economic panorama by coupling different economic datasets, and this way predicting the best strategies to characterize smaller scale systems like cities and even Start Ups.

The idea is to focus on how small regions and cities, as the primary entities of human activity, are interconnected during the process of globalization and how they can favour the development of Start Ups.

### Relevance to the MERC PhD Program (max 2000 characters)

The project is openly multidisciplinary, as it involves bridging methods and results of statistical physics with those of economy and data analysis.

The accomplishment of the objectives will allow elucidating many fundamental questions such as: What is the importance of a given city, or region, or country, within the globalized market? Which are the economic assets which favor the development of Start Ups?

The novel methods and tools that we will develop will therefore be of great value and large use in a variety of fields and circumstances, far beyond the practical cases to which we will apply them.

Potential applications and beneficiaries are therefore numerous, and it is easy to forecast that the results obtained will be of essential value in a wealth of circumstances along the following years.

Therefore, the project is squarely fitting within the MERC program.

### Joint supervision arrangements

The first supervisor is working at the CNR, Institute of Complex Systems, in Florence. He is a member of the Board of MERC. During the period of stay in Italy, weekly online meetings will be organized, and several visits to Naples and Florence will be made to ensure the best as possible supervision of the candidate. The second supervisor is the Director of the Centro Ricerche Enrico Fermi in Rome, and one of the major contributors to economic complexity. Various meetings in Rome will be set, as well as short periods of stay at the Centro Ricerche Fermi.

Moreover, regular online meetings (at least on a monthly basis) will be organized involving the PhD student the two supervisors during the entire duration of the project.

### Location and length of the study period abroad (min 12 months)

The project foresees a period of time of 12 months to be spent abroad.

The period abroad will be divided in two 6 months visits.

The first 6 months visit will be done in China at the Institute of New Structural Economics of the Peking University, a comprehensive college that offers a multidisciplinary environment for teaching and research in economics, management science, and public policy.

The second 6 months visit will be done at the King's College of London, Department of Mathematics, under the supervision of Prof. Tiziana Di Matteo.