The Co-Evolution of Industrial Dynamics and Urban Growth

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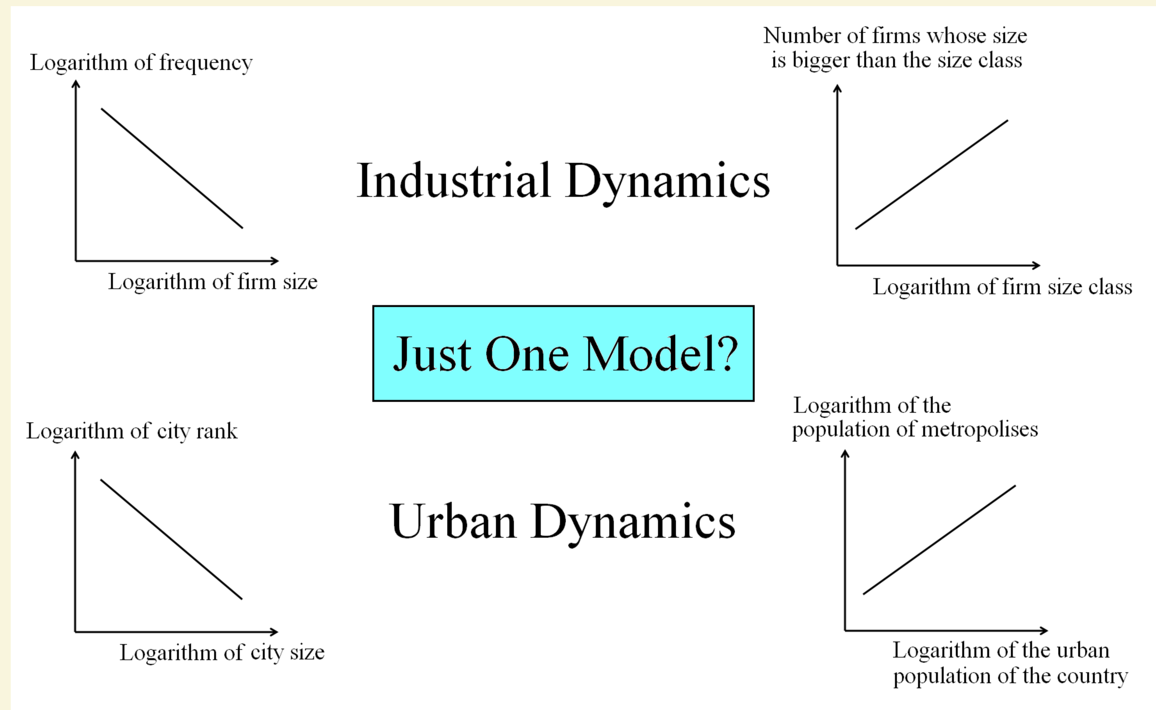
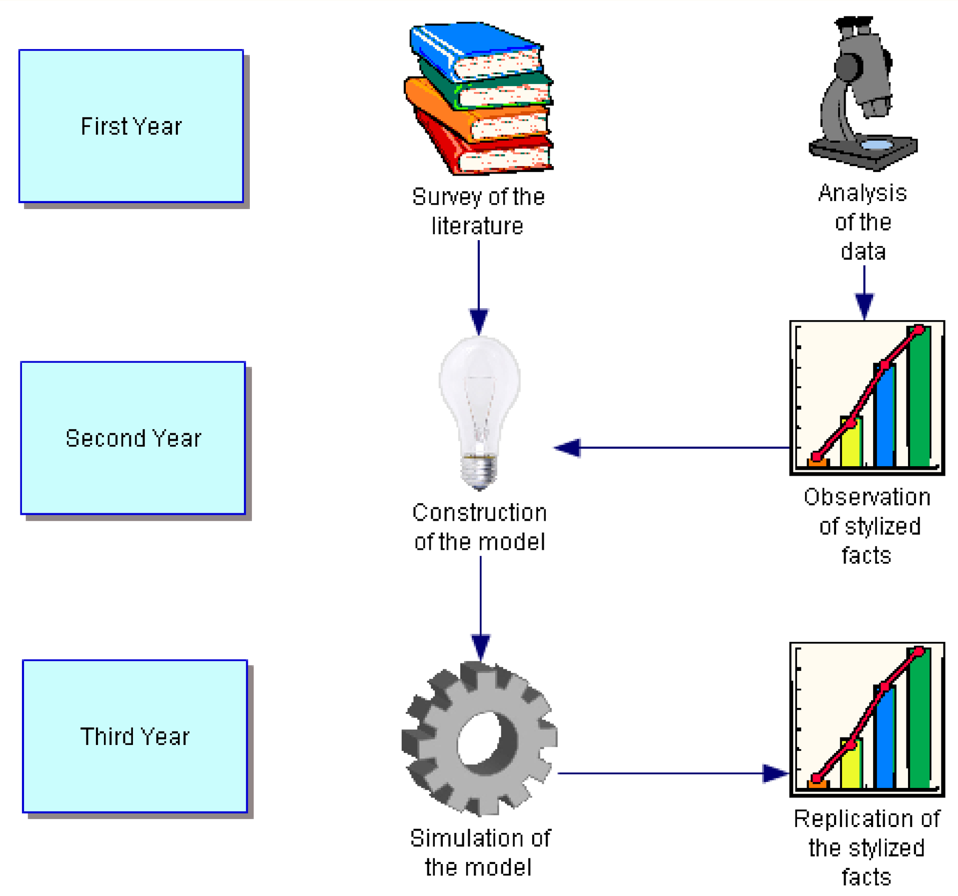
Introduction

In economics *and* geography alike, research has been dominated by static analysis of phenomena that are otherwise evolving. In particular, theories of optimal **firm size** in economics and optimal **city size** in geography can be criticised from the observation that size distributions are not normally distributed with the mean corresponding to the predicted optimal size, but are **skewed distributed** with many small entities and only few large entities regardless the level of aggregation (sector, city, country). The rank-size dynamics also show **considerable movements** of entities going up or down the size hierarchy, which further undermines the static theories of firm size and city size. Very recently, some economists and geographers have started to model the **evolution of size distributions** as **stochastic processes** including self-reinforcing mechanisms reflecting learning processes (Axtell 2001; Bottazzi and Secchi 2006; Pumain and Moriconi-Ebrard 1997). What is lacking so far is the integration, both theoretically and empirically, of geographical factors in firm growth models so as to obtain an understanding of urban growth as an aggregate of firm dynamics. This project aims to develop a **new theory** of **co-evolution of industrial and urban growth**.





Theoretical background

The main critique of traditional urban growth models is the lack of micro-foundations as urban growth is modelled as stemming from exogenous lumps rather than from agents' decisions or behaviours. This problem recently made scholars develop alternative models where urban size distributions are an outcome of location dynamics of agents' behaviour (Axtell and Florida 2006; Duranton, 2006). In an evolutionary perspective, firm dynamics ultimately drive economic growth through the **innovations** they introduce in the economic system. Evolution results from the replication of **routines** within and among firms and within and among cities, as well as from the modification of routines by firms through innovation. Once urban growth is put in relation with firm growth, **a theory of urban growth can make extensive use of theories from industrial dynamics**.

Research question

How can we model the co-evolutionary dynamics of firm growth and urban growth?

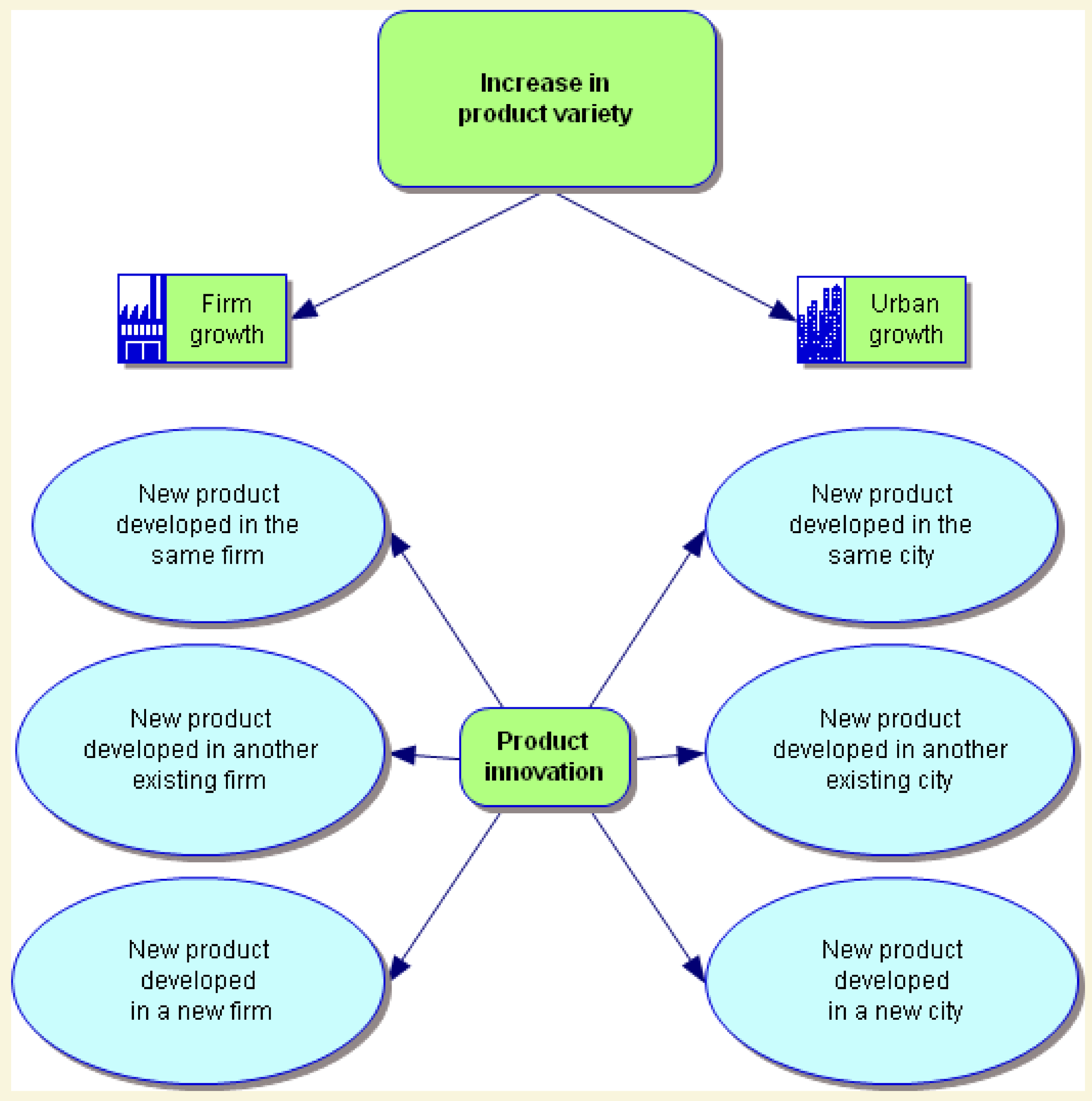
We want to analyse the dynamics that emerges if we take into consideration the mutual interdependence and the co-evolution of firms and cities. One possible way consists in assuming that **urban growth involves an increase in product variety**, an assumption that is widely accepted in new growth theory (Romer 1990; Duranton 2006) and evolutionary growth theory (Saviotti and Pyka 2004).

Following Frenken and Boschma (2007), we can assume that all product innovations originate from an employee in a pre-existing firm. With some probability the employee will commercialise the product innovation in-house, leading to a new product division within the parent firm. With the remaining probability the employee will commercialise the product innovation in another firm by changing jobs or by starting his/her own firm as a spin-off firm. **Relocation** occurs when the product innovation is commercialised outside the city of origin. With some probability the innovation will be commercialised in the city of origin, and with the remaining probability the innovation will be commercialised in another city.

This baseline model requires very few assumptions and very few parameters. Furthermore, the theoretical framework is not limited to urban size distributions, but also captures firm size distributions as both firms and cities grow proportional to their size (cf. Axtell 2001). What is more, the approach is compatible with gravity models that explain inter-city flows between two cities from the product of their respective sizes. It does replicate both the **Zipf law** of urban size and **Gibrat's law** of firm size in a single model.

The following sub-questions are addressed regarding the geographical determinants of industrial dynamics:

1. *Do firms' entry, growth, merger and exit rates systemically differ across cities, and if so, why?*
2. *How does industry aging affect the probability of relocation?*
3. *Do firms' innovations, leading to growth opportunities, differ across cities, and if so, why?*



Data

The empirical part draws on extensive datasets of micro-data concerning firms and innovation for **The Netherlands** (CBS) and **Italy** (ISTAT). For each firm, the key variables will be: Municipality; Total Sales; No. of Employees; R&D expense. We consider the time span **1993-2005**.

References

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