1. **Introduction: the university, a complex institution**

1.1 **WHO IS THIS BOOK FOR?**

This book aims to provide readers with an in-depth understanding of the many ways in which universities contribute to economic development and growth. It does so by discussing numerous theories of the micro- and macro-level causal interactions between university activities and economic outcomes, and by presenting up-to-date quantitative and qualitative evidence in support of these arguments.

By providing readers with theoretical tools and evidence to explain the channels and degrees to which university activities impact upon the economic system, the book underpins the analysis of what are the strengths and weaknesses of specific university systems; while many examples in the book are based on the case of several European countries (Italy and the United Kingdom, primarily) the application to other university systems, in a comparative perspective, is immediate.

The book is aimed at academics, policymakers, managers and professionals working in universities. It may also be of interest to a wider reading public who wish to expand their knowledge of the economic impact of academic activities and of how the structures and incentives within higher education systems can be improved to attain greater effectiveness and efficiency. With this broad potential readership in mind, the authors have avoided technical jargon as much as possible.

While national and local policymakers, university managers and lay readers at large are the key audiences for this book, it may also be used as a textbook in undergraduate and postgraduate courses. The economics of science and of the university are increasingly included in the curricula of undergraduate and postgraduate modules on the economics of innovation and/or the economics of knowledge. This book can therefore be used alongside journal articles as reading on such courses. It can also be adopted for undergraduate courses on the economics of education. Last but not least, it certainly complies with the reading lists of economics and policy modules in education degrees.

After this short introductory chapter providing the general context for
The investigation, the book is structured into two main parts. The first part includes three chapters (Chapters 2, 3 and 4) which present an analysis of the university system in light of the most recent theories developed in the fields of the economics of science and the economics of education. Here, we expand on the theoretical foundations that explain how universities impact upon the economy and the supporting international evidence. We consider issues such as why the university system, in most countries, is funded to a large extent by government; why teaching, research and knowledge transfer often coexist within the same institution. Then, what the economic returns of public and private investments in university education and research are, and whether academic research benefits innovation processes. And, if so, what these processes are, and just how research contributes to them. Then, finally, in what other ways do the activities of universities impact the competitiveness of firms and economic performance?

More specifically, Chapter 2 investigates the many pathways of causal interaction between university activities and economic outputs. It focuses on how universities can contribute to the economy through their three main activities – education, research and knowledge transfer – and on the advantages and drawbacks of combining these different activities within the same institution. This chapter concludes with a discussion of how combinations of the different university activities within the same institution affect the degree of differentiation of a university system. Chapter 3 presents a comprehensive critical review of the main micro- and macroeconomic theories and related empirical evidence of the links between higher education and economic welfare. Chapter 4 presents the principal theories justifying different models of the production and transfer of knowledge, and discusses their implications in the funding and structuring of university research and knowledge transfer. It also summarizes a range of evidence showing the economic impact of university research and knowledge transfer while reviewing the predominant policy instruments that are deployed internationally in order to ensure that these activities are performed to a socially optimal – or at least satisfactory – standard.

The second part of this work includes three chapters (5, 6 and 7) where original empirical evidence from several countries (or regions) is exploited to discuss specific issues relating to, respectively: how to measure universities’ performances, how to best fund and evaluate research, as well as through what channels universities transfer knowledge to the economy of their regions. Chapter 5 investigates in some detail the issue of measuring the performance of universities with respect to their education, research and knowledge transfer activities, and discusses different ways of aggregating indicators in order to achieve summary measures of performance.
It also presents a comparison between the higher education systems of several European countries, using an original dataset. Chapter 6 discusses the problem of how best to fund and evaluate research, through a comparative analysis of the systems adopted in the United Kingdom and in Italy. Chapter 7 explores in detail the channels and impact of the knowledge transfer of universities located within a specific region on the region’s economy. To do so, the analysis relies upon extensive and informative survey-based datasets covering the Italian region of Piedmont. The choice of focusing on a specific regional university system responds to the need to investigate the relationship between universities and the economic system they operate in from individual and company perspectives, and to use related data that are not nationally available. Finally, Chapter 8 sums up the main findings presented in the book, thus providing an overview of the key topics discussed, and puts forward a list of a set of crucial open issues for the governance and funding of European universities.

1.2 THE UNIVERSITY: A COMPLEX INSTITUTION

Even though universities in the West have enjoyed an enduring history for nearly 900 years, they have only relatively recently become centres where scientific research is also carried out. In medieval times and for most of the modern age, universities were primarily seats of learning. Generation upon generation of students were schooled in the exact same corpus of knowledge, which focused on the preservation and inviolability of the sum of learning rather than on the creation of new knowledge. In the years spanning the Scientific Revolution and Enlightenment up until the end of the seventeenth century, most research took place elsewhere. First and foremost, it was in the scientific societies and academies of science, which came into being at the beginning of the seventeenth century in Italy, England and France (Geuna 1999). From this period on, an international scientific community in the modern sense of the term began to develop and take hold, the same system of production and dissemination of scientific knowledge that still today underpins the modus operandi of the scientific community (David 2004). This system, called ‘open science’, comprises a set of shared rules and incentives including, among others: giving credit for a new scientific finding to whoever first discovered it; assessing the validity of the scientific knowledge through a process of peer review; and diffusing knowledge through publicly accessible tools such as scientific journals and conferences (Dasgupta and David 1994). The university as it is recognized today, where learning is formalized into disciplines, developed and transmitted by specialized scholars and where research and teaching activities take place
side by side, first evolved as late as the seventeenth century. The university model promoted by Wilhelm von Humboldt (1767–1835) and applied at the University of Berlin, founded in 1810, was that which influenced the creation and the reform of university systems in most Western countries, though to varying degrees and in different ways. In practice, Humboldt’s vision of the university as an institution devoted to the pursuit of scientific excellence free from political influence, while aimed at the development of knowledge in its own right, was often coupled with a strong interest in the practical applications of knowledge. For example, the development of the chemical industry in Germany in the nineteenth century was the result of an important interaction between academics and industrial researchers (Meyer-Thurow 1982). In the United States, in the second half of the nineteenth and the early twentieth century, the land-grant universities, as they were called, played a determinant role and were the first to receive federal support in exchange for their commitment to applied disciplines such as agronomy and engineering (Nelson and Rosenberg 1994).

The period spanning the late eighteenth and early nineteenth centuries saw also the inception of technical institutions of higher education, founded by the state with the specific intent of training the ‘engineers’ necessary for national industry: the École Polytechnique (1794) in France, the Scuola di Applicazione per gli Ingegneri subsequently named Politecnico di Torino (1859)1 in Turin, Italy, and later Imperial College (1907) in the United Kingdom. The need to train future workforces for the new industries was also felt in the United States, as the creation in 1861 of the Massachusetts Institute of Technology (MIT) testifies to. As well as being supported by the land-grant universities scheme, MIT also received funding from the donations of local industrialists who needed technical personnel that traditional universities did not provide. (One example of the latter was Harvard, where curricula, at its foundation in 1636, were based on the English university model of Cambridge and Oxford.)

The twentieth century, in almost all countries, further enjoyed a proliferation of different institutions of higher education. These institutions, offering education programmes in different fields and at varying levels, existed alongside traditional universities, sharing the task of education, and were in a position to carry out research and interact with industry to a greater or lesser extent. Some systems, such as that in the United States, boasting over 4000 further education institutions, and that in France with

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1 The Regio Politecnico di Torino was founded in 1906 as an institute separate from the University of Turin. The Politecnico di Milano, the first institute of tertiary education in Milan, came into being as the Istituto Tecnico Superiore in 1863, and only took the name of the Regio Politecnico in 1927.
Its hundreds of organizations, developed a very separate system both as regards the type of education offered (institutes focused on the supply of one or more of the following courses: undergraduate, graduate, first-level masters, specialized degrees, second-level masters and doctorates) and research activities carried out. Other systems, although having a much smaller variety of institutions, provided some form of differentiation. For example, in the United Kingdom, an allocation system of public funding strongly favouring the more successful scientific institutions produced a clear stratification of universities from the point of view of research, student admission criteria and, to a certain extent, also the curriculum.

Institutional diversity and the differentiation processes that have taken place in several countries mean that the term ‘university’ can signify many different things in different parts of the world. It would therefore seem more apt to speak generally of institutes of higher education, embracing all organizations that provide tertiary education (minimum requirement for qualifying as part of the category) at different levels. A number of these carry out either basic or applied research and may have the institutional goal of directly contributing to the development of the knowledge underlying business innovation processes (transfer of technology or, more generally, knowledge). Some of these are called universities, others have other names. Not all higher education institutions carry out research or technology transfer, but neither do all those institutions called universities engage in all three activities. Only a subsection of institutions provide facilities for tertiary education and research, and a further, smaller section also offers structured (in other words, institutionalized) facilities for technology transfer. Nevertheless, this stated, it must be acknowledged that academics frequently collaborate personally with firms, public authorities and other economic and political actors in circumstances where universities do not offer these facilities.

In this work, therefore, the terms ‘university’ and ‘institute of higher/tertiary’ education will be used synonymously unless otherwise stated. Moreover, by these terms we refer to institutions which provide tertiary education (colleges, technical institutes, polytechnics, and so on) at different levels and which may or may not carry out research or technology transfer activities. While in some countries (such as Italy) most institutions of higher education are called universities and qualifications carry the same legal weight, this does not necessarily mean that all universities offer, qualitatively, the same kind of higher education, research and transfer of knowledge.