

Technology transfer in europe

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Summary

The aim of this thesis is to contribute to a better understanding of formal technology transfer activities of universities, research institutes and firms in Europe. It analyses the interactions between these actors at different levels, the country, the region and the organisational level. The thesis furthermore analyses internal and external factors influencing the technology transfer activities of these actors. The thesis consists of five main chapters that draw on survey results that have been conducted to collect information on the technology transfer activities of universities, research institutes and firms. These activities have often been referred to as either knowledge transfer or technology transfer. However as discussed in Chapter 1 knowledge transfer is a broader and more encompassing concept compared to technology transfer. This thesis refers to both knowledge transfer and technology transfer but focusses on activities which are in some way recorded at universities, research institutes or firms, and often involve some form of intellectual property. The surveys which resulted in the data used in this thesis were part of larger studies on knowledge and technology transfer and funded by either the European Commission or the Norwegian Ministry of Education and Research. In general, the audience of these studies were policymakers with the aim to collect and monitor technology transfer activities and provide recommendations based on quantitative and qualitative data that was collected as part of these studies. This thesis, drawing on quantitative survey results, extends this work by conducting economic analysis aiming to contribute to the academic literature in this field to better guide policy on formal technology transfer in Europe.

Several studies have looked at the relationship of universities with their surrounding regions. Far fewer studies have examined how the national and regional environment influence the knowledge and technology transfer performance of universities and public research institutes. Chapter 2 analyses these issues and contributes to our understanding of the importance of the regional environment and other spatial levels for technology transfer. Chapter 2 examines how the national and regional economic structure as well as the institutional set-up of technology transfer influences the technology

transfer activities of universities and public research institutes. It analyses four classical technology or knowledge transfer outcomes: the number of patent applications, the number of research agreements, the number of license agreements and the number of start-ups. It recommends taking a multilevel perspective by controlling for hierarchical features when analysing the regional and national influence, to understand the role of the region and country on technology transfer outcomes. The results, drawing on data from a survey of more than 250 European institutions show that country differences are related to differences in the institutional set-up of technology transfer and to the (regional) economic environment which suggests multilevel analyses to properly take these interactions into account. Chapter 3 follows the recommendation of using a multilevel analysis, nesting university-level data (level 1) into regional-level data (level 2) into country-level ones (level 3). Universities in the same region and in the same country are likely more similar or related to each other in comparison to those selected randomly. Multilevel modelling accounts for these interdependencies by capturing residuals at different levels.

In the regional context, two key factors can influence knowledge transfer. First, the level of regional demand from firms for knowledge produced by universities located in the same region, and secondly the supply from universities of knowledge with potential commercial applications. Chapter 3 investigates these issues by continuing with the regional focus by examining the location of the university, quality-controlled competition and supply and demand factors on the technology transfer outcomes of universities. This chapter evaluates several aspects of the regional environment on the technology transfer outcomes of universities that have received little attention in the literature: the effect of regional employment in knowledge intensive services (KIS), quality weighted competition from other universities in the same region as the focal university, location in a metropolitan region, and interaction effects between the quality of the focal university and the quality of competition. Three types of commercialisation outcomes are examined: the number of research agreements, where the type of research is usually led by business partners; the number of start-ups, which are knowledge-led by university academics, and the number of licenses and

license income. Licensing can be due to a mix of partner-led and knowledge-led research activities. The results using survey data for up to 292 universities in Europe show that competition from quality-weighted universities in the same region as the focal university decreases the number of research and licensing agreements, although the highest-ranked 13.4% of universities benefit from the regional co-location of other high quality universities for licensing.

A major characteristic of innovation diffusion is the ease of exchange of information and knowledge amongst countries, individuals, as well as organisations. The market for technology in which patents are traded or licensed, is however not very transparent and has been suffering from asymmetries of information and capacity barriers. Chapter 4 focusses on the business sector and examines the role of SMEs when operating on technology licensing markets and intends to improve the understanding of the factors affecting the licensing out, and licensing-in activities of SMEs. Chapter 4 examines the barriers faced by SMEs when operating on technology licensing markets and intends to improve our understanding of the factors affecting these barriers. Drawing on survey results of 332 SMEs this chapter shows that SMEs observe barriers differently after controlling for those with experience and without. The barriers are mostly observed with organisational costs and strategic related barriers where those with licensing-out experience are less likely to give a high importance to such barriers. From the licensing-in perspective the results show that those looking for licensing-in opportunities are less likely concerned with the quality of the technology compared to those with actual experience. Given the importance of policies promoting the increased diffusion of knowledge this chapter indicates the need to address barriers related to this policy objective. Future research could for instance explore if framework, organisational barriers, and negotiation barriers can be mitigated by assisting, in particularly SMEs without experience, with designing, drafting, and negotiating contractual agreements. Barriers in relation to the quality and development stage of the technology can be addressed through increased proof of concept funding and lowering the threshold criteria for such initiatives.

Thorough analysis on how technology is transferred amongst enterprises and from the public research sector to enterprises is of key importance to innovation policy. Chapter 5 analyses the determinants of technology transfer success. The chapter develops a conceptual framework to examine, using structural equation modelling, the importance of understanding the value of technology and the ability to identify the right partner on technology transfer successfulness. The chapter contributes to the literature by showing that the measure for the ability to identify licensees contributes to the successfulness of technology licensing but that the measure of better understanding the value of the technology has a negative relationship with technology licensing successfulness. Willingness to engage in technology transfer is confirmed in the model to have a positive relationship with licensing success. These results have implications for policies aiming to improve knowledge diffusion and open innovation as on the one hand removing asymmetric information to address market thickness can improve successful technology licensing. On the other hand, Chapter 5 shows that the value of the technology as perceived by their holders, i.e. SMEs, universities and other research institutes, reduces successfulness of technology licensing. This suggests that more valuable technology is not easily transferred.

Chapter 6 addresses several gaps in the academic literature on the influence of university policies on the knowledge transfer performance of KTOs. Using survey data for 247 European universities and 40 public research organisations, the chapter investigates the influence of institutional policies on four outcomes of transfer performance (R&D agreements with companies, patent applications, license agreements, and start-ups established). The analysis shows that the influence of policies to establish clear rules, improve transparency, and provide financial or non-financial incentives vary by outcome. The results suggest that universities and research institutes should carefully consider what rules their transfer policies include and what they publish, as the effects will vary between transfer performance measures. For instance, an institution that aims to increase its licence agreements should ensure that it is clear who owns the IP of R&D conducted at the institution. Furthermore, the institution should have written rules or protocols for licensing activities. However, the chapter also recommends keeping some

flexibility when it comes to negotiating license contracts with outside parties. An institution that focuses on entrepreneurship and aims to create more start-ups should also clarify IP ownership, but at the same time avoid crushing entrepreneurial initiative by too much bureaucracy, i.e. regulations, restrictions and requirements which complicate the start-up process and demand time and resources which early entrepreneurs may lack.

Finally, Chapter 7 concludes this research with a reflection on the joint contribution of the chapters followed by a discussion on the limitations of this thesis. Chapter 7 ends with a general discussion on technology transfer by putting it in a broader perspective and presenting possible directions for future research.