

Contents

CHAPTER 1 - INTRODUCTION	11
CHAPTER 2 - R&D AND FINANCING CONSTRAINTS	21
2.1 INTRODUCTION	23
2.2 R&D AND FINANCING CONSTRAINTS	25
2.3 METHODOLOGY	32
2.3.1 <i>R&D equation</i>	32
2.3.2 <i>Nonparametric specification</i>	36
2.4 DATA	39
2.5 RESULTS	44
2.5.1 <i>EU and US in the 2000s</i>	44
2.5.2 <i>Age and financing constraints</i>	49
2.5.3 <i>Discussion</i>	59
2.6 CONCLUSION AND IMPLICATIONS	61
CHAPTER 3 - THE PRODUCTIVITY OF R&D COMPONENTS	63
3.1 INTRODUCTION	65
3.2 PATENTS, R&D AND MNEs R&D ACTIVITIES IN BELGIUM	66
3.2.1 <i>Determinants of patenting activities and S&T activities</i>	66
3.2.2 <i>The Belgian technological base</i>	71
3.3 DATA	74
3.3.1 <i>The Belgian R&D survey</i>	74
3.3.2 <i>Matching R&D to patents</i>	76
3.4 ECONOMETRIC MODELS FOR COUNT DATA	79
3.5 RESULTS	82
3.6 CONCLUSION AND IMPLICATIONS	88

CHAPTER 4 - R&D PERFORMANCE IN EUROPE, INDUSTRIAL AND INTERNATIONAL DIVERSIFICATION	91
4.1 INTRODUCTION	93
4.2 DIVERSIFICATION OF ACTIVITIES.....	95
4.3 EMPIRICAL FRAMEWORK AND DATA	98
4.3.1 <i>Empirical framework</i>	98
4.3.2 <i>Constructed data set and variables</i>	99
4.3.3 <i>Subsidiaries and diversification</i>	102
4.4 RESULTS	108
4.5 CONCLUSION AND IMPLICATIONS.....	113
CHAPTER 5 - R&D INTERNATIONALIZATION OF EU MNES AND INVENTOR LOCATION	117
5.1 INTRODUCTION	119
5.2 R&D INTERNATIONALIZATION.....	121
5.3 EMPIRICAL FRAMEWORK AND DATA	128
5.3.1 <i>Empirical framework</i>	128
5.3.2 <i>Data</i>	131
5.4 RESULTS	140
5.5 CONCLUSION AND IMPLICATIONS.....	148
CHAPTER 6 - CONCLUSION	151
REFERENCES.....	161
APPENDICES	173

Tables

Table 1. Features of some selected studies on R&D and financing constraints	28
Table 2. Descriptive statistics.....	41
Table 3. Age of the companies.....	42
Table 4. Average age by technology.....	42
Table 5. System GMM two step estimates - all firms.....	45
Table 6. System GMM two-step estimates - EU27 and US samples.....	47
Table 7. Results of an error-correction type investment model (System GMM)	49
Table 8. US and EU sensitivity and confidence intervals.....	54
Table 9. R&D sensitivity – High-tech firms.....	57
Table 10. R&D sensitivity – Medium/low-tech firms.....	58
Table 11. Hypotheses.....	71
Table 12. Sample's distribution of total R&D expenditures.....	76
Table 13. Matching patents to Belgian R&D	78
Table 14. Belgian priority filings across Patent Offices 2000-2005	78
Table 15. Nationality of applicants 2000-2005	79
Table 16. Descriptive statistics of the sample	79
Table 17. Elasticity of patents to total R&D expenditures	83
Table 18. Hypothesis H1.....	84
Table 19. Hypotheses H2-H3-H4	85
Table 20. Hypotheses H5-H6.....	87
Table 21. Data sources, variables and period covered	100
Table 22. Sample of 835 EU R&D companies	101
Table 23. Subsidiary characteristics	102
Table 24. Average geographic diversification measurements.....	104
Table 25. Share of subsidiaries (in %) by regions.....	104
Table 26. Industrial diversification measurements	105
Table 27. Descriptive statistics.....	106
Table 28. Top 20 EU firms with subsidiaries in Asia-Pacific	107
Table 29. Top 20 EU firms with subsidiaries in US-Canada	108

<i>Table 30. Estimates – Diversification indicators</i>	<i>109</i>
<i>Table 31. Concentration index estimates.....</i>	<i>111</i>
<i>Table 32. Estimates for Shares of subsidiaries in main regions.....</i>	<i>112</i>
<i>Table 33. Estimates for Shares of subsidiaries in main regions by technology level.....</i>	<i>113</i>
<i>Table 34. Largest R&D spenders in 2003 and 2009</i>	<i>122</i>
<i>Table 35. R&D in the world (2009).....</i>	<i>123</i>
<i>Table 36. Main variables of the databases</i>	<i>132</i>
<i>Table 37. Example of manual matching</i>	<i>133</i>
<i>Table 38. Sample 637 EU firms: Average regional repartition of patent inventors</i>	<i>136</i>
<i>Table 39. Descriptive statistics.....</i>	<i>137</i>
<i>Table 40. Top 20 Available EU R&D Scoreboard Companies: R&D Data</i>	<i>138</i>
<i>Table 41. Sample 637 EU firms: R&D Data by industry</i>	<i>139</i>
<i>Table 42. Cobb-Douglas production function.....</i>	<i>140</i>
<i>Table 43. Results for Specification 1 (substitution effect)</i>	<i>142</i>
<i>Table 44. Specification 2 (complementary effect)</i>	<i>144</i>
<i>Table 45. Specification 2 (8 regions).....</i>	<i>145</i>

Figures

<i>Figure 1. Outline of the thesis</i>	<i>18</i>
<i>Figure 2. Estimations of the R&D accumulation rate.....</i>	<i>51</i>
<i>Figure 3. The relationship between R&D and CF</i>	<i>52</i>
<i>Figure 4. Average sensitivity of R&D to CF</i>	<i>53</i>
<i>Figure 5. Positive and negative growth expectations</i>	<i>55</i>
<i>Figure 6. High-tech firms</i>	<i>57</i>
<i>Figure 7. Medium/low-tech</i>	<i>58</i>
<i>Figure 8. Output elasticity of R&D capital by technology level</i>	<i>110</i>
<i>Figure 9. Mapping of the matching process.....</i>	<i>134</i>