Abreu, M. 62–5, 153
absorptive capacity 52, 150, 152, 161, 163
academic research
  benefits of 13–14
  economic impact of 54, 56–65
  funding
    increased, over time 11–12
    and intellectual property 51
  international comparison 104–5
  link to quality 80–85
  link to university productivity 75
  performance based, in UK and Italy 102, 118–38
  public and private 105–11
  from third parties 97–9
  impact on innovation processes 58–9
  and knowledge transfer activities 19–21, 24–5, 64, 143
  performance indicators 80–85, 90–91, 95–9, 101
  vs. teaching 17–19, 24–5, 32, 85, 104–5, 171
Adams, J.D. 58, 59, 64, 120, 121, 123–4
Aghion, P. 10, 33
Agrawal, A. 61, 87
Andersen, B. 15, 50–51, 72–3
Angrist, J. 39–40
‘anti-commons effect’ 21–2
Antonelli, C. 14, 22, 52, 66, 141
ANVUR 116–17, 125–6, 131–3
‘appropriable’ knowledge model 50–51, 55
Arrow, K.J. 49, 52
‘Arrow’s paradox’ 50
arts and humanities
  contributions to economy 15
  less expensive research 84–5
  peer review as dominant method of assessment 126
Arundel, A. 62–3, 65, 141, 153
Asheim, B.T. 141, 157
Autant-Bernard, C. 59, 157
AUTM 70, 86
Ballarino, G. 41, 106
Barro-Lee database 29, 30
Barro, R. 29, 30, 42
basic research 13, 22, 49–50, 51, 171
Bayh–Dole Act 20, 164
bibliometric indicators 80–81, 83–4, 122–3, 126–7, 131–2
Block, F. 66, 68
Bodas Freitas, I.M. 139, 142, 150
Bonaccorsi, A. 22, 92, 128
Bowen, W. 41, 172
Bozeman, B. 64, 68
Brown, R. 121–2
Carasso, H. 121–2
Card, D. 39, 40
Cassone, A. 14, 27
Cave, M. 74, 78
Chalmers, D. 61, 76, 91
Checchi, D. 41, 106
Ciccone, A. 37–8
Cohen, W.M. 52, 53, 59, 61, 63, 65, 87, 143, 150, 153, 156
competitive advantage 139–40
Cowen, R. 52, 54
Crespi, G. 22, 87, 120
CUC (Committee of University Chairmen) 89, 91
Daraio, C. 22, 92
Dasgupta, P. 3, 50, 53
David, P.A. 3, 6, 50, 51, 60
D’Este, P. 61, 64, 142
differentiation 23–7, 168, 171–2, 175
Dosi, G. 13, 52, 107
economic growth
effects of education 32–46
impact of academic research 54, 56–65
knowledge and technological progress 8–10
university contributions to 10–16, 23, 165–6
education, effects on economic growth
macroeconomic evidence 41–5, 46
mechanisms proposed by economic theory 32–3, 165–6
microeconomic evidence 33–41, 46
Eigenfactor (EI) score 82, 90
employment
by education levels 34–6, 39–40, 41
as performance indicator 79, 90–91
in Piedmont Regional Innovation System 144–6, 153
endogenous growth models 8–10
Etzkowitz, H. 22, 143
European Commission 69, 113, 145–6
Eurostat 95, 144
Feldman, M.P. 22, 164
firms
and basic research 49–50, 51
Collaboration with universities 21–2, 53, 68–71, 139–44
Lessons for 169
Piedmont Regional Innovation System 144–64
reasons for non-interaction 151
and geographic proximity 58–9, 139, 156–61
and innovative processes 13–14, 54
Returns on private spending 60
Shared research activities 19
Tendency to protect research outcomes 57–8
University R&D funded by 106–7
Use of academic research 20, 61–5, 71–2
Fondo di Finanziamento Ordinario/Ordinary Financing Fund (FFO) 111, 115–17, 127–8, 135
Freeman, C. 6, 141
Fritsch, M. 59, 157
funding
changes in 74–6
costs 128–9
comparison with research allocation 134–6
Italy’s VQR 131–4
United Kingdom’s RAE 129–31
international comparison 103–4
public and private 105–11
research and teaching 104–5
introduction to 102–3
in Italy 114–17
models for European universities 173–6
performance-based research
in Italy 124–8
in United Kingdom 118–24
public, reasons for and models of 166–7
study conclusions 136–8
in United Kingdom 111–14
Garfield, E. 80, 81
GDP
effects of education 42, 44–5
Europe, R&D expenditure 145–6
Expenditure for university research 12
in Italy
expenditure on universities 103–4
grant-based funding through FFO 115
per capita, and degree-holders 29–30
Piedmont 144, 145–6
in OECD countries
per capita, and share of graduates 31
University expenditure by type and source 105–6
technological progress and investment 56–7, 58
geographic proximity 40, 59, 71, 139, 141, 156–61, 169
Germany
development of chemical industry 4
doctoral students 95, 96, 100
Employment and salaries 34–5, 36, 37
firms’ funding of research 69–70, 106–7
funding system 176
higher education certificates 10–11
Godin, B. 12, 48
governance
of collaborations 142–3, 149–56
models for European universities 173–6
Griliches, Z. 39, 48, 60
Gurney, K. 120, 121
H-index 83
Hansmann, H.B. 109–10
Hanushek, E.A. 10, 32, 33
Henderson, R. 59, 60, 61, 87
HESA (Higher Education Statistics Agency) 112, 130
Hicks, D. 70, 118, 138
higher education
institutions of 4–5
unprecedented growth 10–11, 29
Hughes, A. 14, 70, 122, 143
human capital
increase of stock as a mechanism to increase growth 32, 33–41, 42–3, 45, 165–6
and the university 28–32
Ichino, A. 40, 106
impact factor (IF) 81–2, 90, 126
incentives 50–51, 53–4, 166–7, 173–4, 175
industry see firms; university-industry knowledge transfer
innovation processes
and system failure 53
benefits of research activities generated through 13–14
impact of academic research on 58–9
importance of collaborations 149, 153
models of 12–13, 48–9
need for knowledge acquisition 140–141
institutional models 26
‘institutionalization’ of knowledge transfer 19, 164
institutions of higher education 4–5
intellectual property
protection system 50–51, 55, 141
sectors 6
within universities 19–20, 72, 87
‘interactive’ knowledge model 52–4, 55
international comparisons
performance measurement 89–100
university funding 103–11
ISTAT 144–5
Italy
autonomy without assessment 174–5
catering for ‘poorer’ students 27
employment and salaries 34–6, 37–8
funding 102–10, 114–17, 137, 138
performance-based research 131–6
public 67–8
graduations 29–30
higher education certificates 11
university-industry collaboration in Piedmont region 144–64
Jensen, R. 64, 143
Kline, S. 13, 141
knowledge
as economic good 8, 47, 48
‘economics of’ 52
technological progress and economic growth 8–10
theories 48–54
knowledge accumulation process 10
knowledge economy 6–7
knowledge production and transfer models
‘appropriable’ knowledge 50–51, 55
‘interactive’ knowledge 52–4, 55
‘public’ knowledge 48–50, 55, 71
and public policies 65–71, 72–3
see also knowledge transfer
knowledge spillovers 9, 54–5, 58, 61, 71, 143
knowledge transfer
and academic research 19–21, 24–5, 64, 143
channels 64, 72, 145
collaboration
The university and the economy

with firms 163–4
objectives 157
economic impact of 54, 56–65
excessive emphasis on returns 171
funding 112, 113, 114
‘institutionalization’ of 19, 164
perfect 48–9
performance indicators 85–9, 90–91
synergy with teaching 22–3, 24–5
university-industry 139–64, 169
see also knowledge production and transfer models
KPIs (key performance indicators) 89–100
Krusch Kg. A.B. 37, 39–40, 42, 43, 45
Laursen, K. 59, 61, 63, 149, 156, 157
Lawton Smith, H. 61
Lee, J.-W. 29, 30
Lepori, B. 75, 92
Levinthaf, D.A. 52, 150
Leydesdorff, L. 22, 143
Lindahl, M. 37, 42, 43
Lissoni, F. 18, 87
Lundvall, B.-A. 52, 142
Mansfield, E. 53, 58, 59, 60, 141
Martin, B. 14, 60, 70, 101, 118, 124, 134, 174
Meyer-Thurow, G. 4, 142
Mincer, J. 36–7
Mincer’s equation 36–8, 41
macro-Mincer 43–5
micro-Mincer 36, 44, 45
MIUR (Ministero dell’Istruzione Universita’ e Ricerca) 114–16, 125, 147
Molas-Gallart, J. 76, 144
Mowery, D.C. 61, 64, 67, 69, 85
Muscio, A. 19, 142–3
Nelson, R.R. 4, 13, 21, 32, 49, 52, 66, 85, 142
NPM (new public management) 74
OECD 6, 7, 11–12, 34–5, 67, 70, 77, 103–7, 110–118
‘open science’
as access channel 64, 72, 153
durability 22
nature of 3, 19
PA Consulting Group 129, 130, 134
‘Pasteur’s Quadrant’ sciences 20
Patel, P. 64, 142
patents
‘anti-commons effect’ 21–2
economic gain from 51, 72
importance as knowledge transfer
channel 153, 154, 156
legislative measures 68–9
PatVal study 62, 156
as performance indicator 86–90, 145–6, 148
protection system 50–51
spending on research 58–9
universities and firms 20, 65, 70
PatVal study 62, 156
peer review 84, 118–19, 126–7, 131–2, 137
performance-based research
Italy
costs of 131–6
research assessment 124–5
Valutazione della Qualità della Ricerca (VQR) 125–8
United Kingdom 137, 138
costs of 129–31, 134–6
Research Assessment Exercise (RAE) 118–22
Research Excellence Framework (REF) 122–4
performance measurement
need for 74–6
performance indicators 76
international comparison 89–100
knowledge transfer 85–9
limitations of 100–101, 167–8, 175–3
research 80–85
teaching 77–9
Perkmann, M. 64, 143
personal collaboration 149–52, 153–4, 161, 163–4
Peterson, P.E. 10, 32
Piedmont Regional Innovation System 144–7
collaborations
geography of 156–61
governance of 149–56
data 147–9
empirical results
PIEMINV survey 148–9, 153–6
UIPIE survey 147–8, 149–53
study conclusions 161–4
Piolatto, M. 102
Politecnico of Torino 146, 147, 158, 161
private funding 105–11
production functions 8, 9, 56–7
public funding 105–11, 166–7
‘public’ knowledge model 48–50, 55, 71
public policy 65–71, 72–3, 135, 143
quality
accommodating 171–2
international indicator for 33
measuring 90–91
research 80–85, 101, 119–21, 123–4, 126–7
teaching 75, 77–9, 101
RCUK (Research Councils UK) 134, 136
Regio Politecnico di Torino 4
regional capabilities 139, 140–141
regional technology transfer analysis 140–144
research see academic research; scientific research
Research Assessment Exercise (RAE) 84, 114, 118–22, 129–31, 133–4, 135
Research Excellence Framework (REF) 84, 122–4, 127
Rettore, E. 37, 40
return of public investment 60
Rhoades, G. 67, 70
Ritzen, J. 23, 174
Romer, P.M. 9, 32
Rosenberg, N. 4, 13, 20, 52, 66, 141
Rosli, A. 15, 86, 88, 89
Rossi, F. 15, 50, 51, 69, 86, 87, 88, 89
salaries study 35–41, 44–6
Salter, A. 61, 63, 149, 156
Sampat, B. 64, 69
Schartinger, D. 64, 142
Schubert, T. 25, 27, 168
scientific research
financed from public purse 137
incentives for investment in 106, 166
interactions with technology transfer 22, 64
models focusing on contribution to growth 9–10
place of 3–5
provision of, as role of universities 7
secrecy clauses 21
synergy with knowledge transfer 20–21
university engagement in 80–85
Scott, A. 13, 60
Sizer, J. 76, 77
Slaughter, S. 67, 70
social sciences
contributions to economy 15
less expensive research 84–5
peer review as dominant method of assessment 126
Solow, R.M. 5, 56
source normalized impact per paper (SNIP) 82–3
standards, university 33, 172
Stephan, P. 66, 136
Stokes, D.E. 13, 20
Sylos Labini, M.S. 29, 115, 116
tacit knowledge 19, 24, 52, 53–4, 141, 157
teaching
funding
international comparison 104–5
in Italy 114–17
linked to quality 75
proposals for 176
in UK 111–14
performance indicators 77–9, 90–91, 93–5, 101
vs. research activities 17–19, 24–5, 32, 85, 104–5, 171
synergy with knowledge transfer activities 22–3, 24–5
technological progress
knowledge and economic growth 8–10
scientific research as sufficient for 54, 66, 167
The university and the economy

studies into relation with university research 56–9
technologies, adoption of 32–3, 41–3, 46, 166
total factor productivity 56–8, 71

unemployment by education levels 34–6, 39–40, 41

United Kingdom
employment and salaries 34–5
firms’ use of knowledge 61–2
funding 102, 104–10, 111–14
public 5, 58, 67–8, 75
geographic proximity 59
knowledge transfer performance indicators 88, 89
KPI requirements 91
‘new universities’ 26
share of academic patents 87
support of technology transfer projects 69
teaching performance indicators 93–4

United States
Bayh–Dole Act 20, 164
employment and salaries 34–5
firms’ use of research 61
funding 66–8, 70, 103–7, 109, 110, 136
geographic proximity 59
higher education rates 10–11, 17
history 4–5, 167
impact of academic research 58–9
interaction with firms 71, 142
KPI requirements 91
teaching performance indicators 77, 79
university as source of knowledge 62

Universities UK 111, 113
university accountability 74, 129, 130, 167–8
activities combining different 168
differentiation and quality 171–2
integration of 171
time frames for assessment of outcomes 170
as complex institution 3–5
contributions to economy 10–16, 23, 165–6
diverse activities synergy 17–23, 24–6
effects on economic growth 32–46
expansion 27
funding 74–6, 102–38
and human capital 28–32
knowledge, technological progress and economic growth 8–10
models for European, in transition 173–6
organization for modern times 169–72
performance measurement 74–101, 167–8
role in knowledge economy 6–7
systemic development and 26, 168
university-industry knowledge transfer lessons for 169
Piedmont Regional Innovation System 144–7
conclusions 161–4
data 147–9
empirical results 149–61
regional technology transfer analysis 140–144
university-industry relations as source of competitive advantage 139–40

University of Gastronomic Sciences 146, 147, 148
University of Piemonte Orientale 146, 147, 148
University of Torino 116, 146–7, 148, 158–9, 161

university research see academic research; scientific research

Valutazione della Qualità della Ricerca (VQR) 125–8, 131–4, 135, 138

Van Raan, A. 80, 83
Van Reenen, J. 15, 42
Von Hippel, E. 13, 52
von Humboldt, Wilhelm 4, 28
Winston, G. 18, 109, 110