Knowledge Commercialisation Mechanisms: Views of and Usage by EU Research University Academics

Edward M. Bergman

The Commercialisation of University Research Workshop
Birkbeck Centre for Innovation Management, University of London
INTANGIBLE ASSETS AND REGIONAL ECONOMIC GROWTH

KNOWLEDGE FLOWS

SPATIAL: Uni-to-Uni
(academic mobility)

SECTORAL: Uni-to-Market
(commercialisation)

Academics’ Attempts
University Mandates
Preview

• University Missions: 1. Teach, 2. Research, 3. Service a & b
• IAREG Survey of EU Academics
• Comparative View of Selected Commercial Mechanisms
• Analysis of Academic Commercialisation
  a. Academic commercialisation factors
  b. Income effects of commercialisation activity
  c. Plans for continued commercialisation efforts
• Anatomy of Commercial Mechanism Usage
University Missions & Pecuniary Spillovers

• **Mission 1**: Knowledge transmission through *teaching*

• **Mission 2**: Knowledge generation through *research*

• **Mission 3**: Knowledge *services* to society:
  
a. Uncompensated knowledge services to public

b. Compensated knowledge services to markets*

*technological spillovers (public goods)

*pecuniary spillovers (*private commercialization*)

Breschi, Lissoni, Montobbio (2005)
University-Industry Knowledge Interaction

Technological (public good spillovers)

Teaching (M1)  Research (M2)

Hire Grads  PhD support  Published knowledge  Shared labs, resources  Joint projects, co-authors

Public Service (M3)
University-Industry Knowledge Interaction

Technological (public good spillovers)
- Public Service
  - Teaching
  - Research
    - Published knowledge
      - Shared labs, resources
    - Joint projects, co-authors

Pecuniary (market-oriented)
- Individual CMs
  - Uni Commercial Policy
    - VC
    - Technology Transfer Offices
    - Incubator
    - Fee-based research centers
    - R&D parks
    - Clusters
University-Industry Knowledge Interaction (CMs)

Technological (public good spillovers)
- Public Service
  - Teaching
  - Research
    - Published knowledge
      - PhD support
    - Shared labs, resources
    - Joint projects, co-authors

Pecuniary (market-oriented)
- Individual CMs
  - Uni Commercial Policy
  - R&D parks
  - Clusters
  - Technology Transfer Offices
  - Fee-based research centers
  - VC

Public Service
- Hire PhD Grads support

- Published knowledge
- Universal Commercialization

- Joint projects, co-authors
- Published knowledge
- Shared labs, resources

BOARD: Joined corporate board of directors as compensated member
IPR/FIRM: IPR to established enterprises in which I have a proprietary interest
SPINOFF: Launched a new firm based on my academic expertise
PUBLISH: Developed commercial book, publishing, or media contract
LICENSE: Sought to license some scientific procedure, discovery or method
CONTRES: Contractual supplier of research services to firms and organizations
PATENT: Applied for National, European or US patents
PERSCONSLT: Fee-based personal consultation with external clients
### Survey of EU Research University Academics

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<tr>
<td>United Kingdom*</td>
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</table>

### University Academic Web-surveys

**Shanghai Top 500 EU Research Universities**
*(All Austrian/Swiss/Australian Universities)*

6 disciplines/uni (>1 dept./discipline possible)
- Biological sciences: **BOHR**
- Chemical engineering: **PASTEUR**
- Computer Science: **NORTH**
- Economics
- History *(Stokes Quadrants)*

3 faculty members/dept. (including dept. director)

Survey languages: English, French, German, Italian, Spanish

Mean EU Response Rate: **20.5%** *(16% min/33% max)*

*Example: 470 Austrian faculty members (111 responses): 24%*
Do EU views differ concerning „Commercial Mechanisms“?

International Comparisons: U.S. mean-gradient of 12 Commercialisation Issues

Trans-Atlantic

Inter-Continental

University Mission Creep? Comparing EU and US Faculty Views of University Commercialization and Regional Economic Development

Harvey Goldstein, Edward M. Bergman, Gunther Maier
University Commercialisation Elements

- a. My university, in addition to its basic functions of teaching and research, should be actively and directly involved in assisting the economic development of my nation and region
- b. My university should provide *start-up assistance for technology-based firms* that grow out of university-based research
- c. My university should take *equity positions in technology-based start-up businesses* that grow out of university-based research
- d. My university should encourage and reward *faculty to engage in user-oriented, proprietary research* with industry funding
- e. My university should encourage and reward *faculty for technical and/or innovative assistance supplied to business organizations* in the region or country
- f. My university *should be actively involved in the commercialisation* of university-based academic research
- g. My university should *award faculty who produce a patentable invention* at least the same amount of credit as a peer reviewed article when making tenure and promotion decisions
- h. Knowledge *creation* in universities is best measured by scholarly, peer-reviewed publications
- i. The increasing emphasis within many universities for commercializing university research threatens the integrity of basic, scholarly research
  - a. Circulation and peer review of final scholarly findings are delayed six months at the request of a private industry/government ministry funding source
  - b. A faculty member supervises a graduate student’s dissertation research that is funded by a private company in which the faculty member has a financial interest
  - c. A faculty member has a research contract with a company in which that faculty member has a financial interest
Commercialisation Efforts by EU Academics

• **Research Question:** What principal factors are responsible for 30% of *EU university academics who attempt commercialisation of* their research or knowledge between 2004 and 2009?

• **Methodology:** Logistic Regression of survey & secondary data.

• **Survey Data:** 1798 academics holding posts in 201 European universities ranked in Shanghai Top 500. Disciplines included: *Physics, Biological Sciences, Chemical Engineering, Computer Science, Economics and History.*
Commercialisation Efforts

...are significantly more likely among EU academics who:

- are male,
- are from Nordic Europe,
- are active in uncompensated public service activities (Mission 3a),
- previously collaborated on research with industry colleagues,
- responded to questionnaire in Italian,
- hold a terminal degree that is older than average,
- consider peer-reviewed publications best evidence of knowledge generation,
- approve home university’s overall efforts to promote commercialisation,
- see local business influence on home university’s commercialisation policies.
Reasons to not consider commercialisation possibilities?

- My research is dedicated solely to advancing the core scholarship or science base of my discipline (25%)
  - My research lacks commercial possibilities (18%)
    - My university obligations do not permit sufficient time (8%)
      - I lack the knowledge to commercialize possibilities (5%)
    - No opportunities to commercialize in my local region (3%)
    - My university does not encourage commercialisation (1%)
  - Other unspecific reasons/missing (38%)
Future EU Efforts to Commercialise

• **Research Question:** What are the principal factors responsible for relative *planned efforts* (less/same/more: 1-3) by 492 academics to commercialize between 2009 and 2012?

• **Methodology:** Ordinal Logistic Regression of survey & secondary data.

• **Survey Data:** 1798 academics holding posts in 201 European universities ranked in Shanghai Top 500. Disciplines included: *Physics, Biological Sciences, Chemical Engineering, Computer Science, Economics and History.*
Future Efforts

….to commercialize are greater if an EU academic:

- sought licensing-based commercial income
- holds a terminal degree that is older than average
- works in region where home is located ("resident")
- has a lower teaching load
- sees region’s influence on Uni commercialisation rules
- publishes scientifically from funded research
- approves Uni-based technical assistance to firms
- approves academic consultations => 1 day/week
Commercialisation income compared to EU academic salary

- **Research Question:** What are the principal factors responsible for *relative income* (0-6, where 3 = base salary) realized between 2004 and 2009 from commercialisation efforts of 457 academics?

- **Methodology:** Ordinal Logistic Regression of survey & secondary data.

- **Survey Data:** 1798 academics holding posts in 201 European universities ranked in Shanghai Top 500. Disciplines included: *Physics, Biological Sciences, Chemical Engineering, Computer Science, Economics and History.*
Commercial Income relative to salary

...is greater if an EU academic:
- is an applied or social scientist (not basic),
- has earlier degree (older),
- received research-based commercial income,
- has more peer-reviewed publications,
- holds post in Italian university,
- approves of home university as equity-investor in spinoffs,
- is a non-compensated member of a public board,
- had collaborated on research with industry colleagues,
- sees no threat to basic science from commercialisation,
- commutes relatively short travel-times from home to work.
Commercialisation Mechanisms
mean usage  2004-2009

• BOARD:  Joined corporate board of directors as compensated member  (5%)

• UNIFEERES:  Launched a fee-based service or institute within my university  (6%)

• IPR/FIRM:  Transferred intellectual property rights to established enterprises in which I have a proprietary interest  (12%)

• SPINOFF:  Launched a new firm based on my academic expertise outside the university  (16%)

• PUBLISH:  Developed commercial book, publishing, or media contract  (22%)

• LICENSE:  Sought to license some scientific procedure, discovery or method  (22%)

• CONTRES:  Contractual supplier of research services to firms and organizations  (25%)

• TECHTRANS:  Consulted university TTO officials concerning possible commercialisation  (31%)

• PATENT:  Applied for National, European or US patents  (31%)

• PERSCONSLT:  Fee-based personal consultation with external clients  (33%)
Commercialisation Mechanisms mean usage 2004-2009

Which CMs by Users’ Profile?

- **BOARD**: Joined corporate board of directors as compensated member (5%)
- **UNIFEERES**: Launched a fee-based service or institute within my university (6%)
- **IPR/FIRM**: Transferred intellectual property rights to established enterprises in which I have a proprietary interest (12%)
- **SPINOFF**: Launched a new firm based on my academic expertise outside the university (16%)
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- **TECHTRANS**: Consulted university TTO officials concerning possible commercialisation (31%)
  - **PATENT**: Applied for National, European or US patents (31%)
- **PERSCONSULT**: Fee-based personal consultation with external clients (33%)
Usage by EU Country

PersConslt
Patent
TechTran
ContRes
TechTran
ContRes
License
TechTran
ContRes
License
Publish
SpinoffF
IPR/Firm
UniFeeRes
Board

AT BE CH CZ DE DK ES FI FR GR HU IE IT NL PL PT SE SI UK Total
Usage by EU Macroregion

Reduce number of usage elements + array mechanisms by order of mean ranked usage
Usage by EU Macroregions + UK, IE, DE
Usage by Future Commercialisation Effort

- PersConslt
- Patent
- TechTran
- ContRes
- License
- Publish
- Spinoff
- IPR/Firm
- UniFeeRes
- Board

Comparison: Less, Same, More
Usage by Gender

![Graph showing usage by gender across different categories.](image-url)
Usage by Provost Voice*

*attributed by academics
### Commercialisation Mechanisms used jointly?
*(selected pairwise dichotomous correlations)*

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<th>PersConslt</th>
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Compare user profiles for two sets of joint mechanisms.
Comparing Spinoff vs. Sale: Monetising IPR

-20% 0% 20% 40% 60% 80% 100% 120%

Engineering  Medical  Veterinary Med 
Agriculture

-20% 0% 20% 40% 60% 80% 100% 120%

Euro 10  Nordic  Midcontinent  Mediterranean
sh401500  sh301400  sh201300  sh101200  sh51100  sh150

Agriculture  Veterinary Med  Medical  Engineering

-20% 0% 20% 40% 60% 80% 100% 120%

PersConslt  PatenTech  ContR  Licens  Publis  Spinof  IPR/Firm  UniFeeR  Board
slt  t  Tran  es  e  h  fr  m  es  d

PersConslt  100%
Patent  1% 100%
TechTran  9% 29% 100%
ContRes  18% 0% -2% 100%
License  4% 30% 27% -5% 100%
Publish  14% -12% -9% 11% -9% 100%
SpinoffF  16% 24% 13% 10% 18% 1% 100%
IPR/Firm  11% 28% 10% 4% 16% -4% 32% 100%
UniFeeRes  12% 3% 6% 10% 4% 11% 6% 9% 100%
Board  20% 6% 7% 11% 4% 13% 15% 21% 16% 100%

Series2  Series1
Comparing Spinoff vs. Sale: Monetising IPR
Comparing Spinoff vs. Sale: Monetising IPR

Spinoff: Public Service, Physicists, Computer Scientists, Mid-Continent, High Shanghai, Rel. Income
Sale: Scientific Pubs, UK/E/FR/IT, Mediterranean, Low Shanghai, Agriculture/Vet Med

IPR/Firms
Pat/Lic

Series1
Series2

Future Effort
Rel. Income
Provost
Voice
Courses
Peer Repubs
Peer Courses
Rel. Pub Voice
Voice

Monetising
Sale:
Spinoff vs.
Comparing
Comparing Publishing/Consulting vs. Sale of IPR Mechanisms

- Engineering
- Medical
- Veterinary Med
- Agriculture
- Economics
- Physics
- History
- Computer Sci
- Chemical Engr.
- Spanish
- French
- Italian
- German
- English
- ΔY/capita
- EU10
- Nordic
- Midcontinent
- Mediterranean
- sh40150
- sh301400
- sh201300
- sh101200
- sh51100
- sh150
- Agriculture
- Veterinary Med
- Medical
- Engineering

Future Effort
Rel. Income
Courses
Peer R. Pubs
Voice
Provost Voice

Series 2
Series 1
Comparing Publishing/Consulting vs. Sale of IPR Mechanisms

Publish/Consult: Policy Pubs, History, Economics, Italy, Mediterranean, Low-Med Shanghai, Teaching
Sale: PublicService, Physicists, Computer Scientists, Mid-Continent, Med-High Shanghai, Medical
Conclusions

• Wide variety of CMs are now in active use by 30% of EU research university academics
• CMs not confined to natural science disciplines
• CM usage differs markedly by macro-region, discipline, other Uni Mission performance, prior commercialisation experience, type of university, and commercialisation governance
• CM combinations now focus on monetizing IPR
• TechTransfer offices mainly support IPR CMs
Implications

- Potential CM structures/features deserve better documentation & analysis, esp. for SSs
- Establishment and management of CMs might be reconsidered in light of all Uni strategies
- Reconfigure Uni commercialisation mission so specific CMs acquire strategic importance, e.g., recruitment/retention of key academics
- Understand better the visibility to market agents of Uni CMs on offer & CM potentials
Mission 3a: Public Service Activities
(>=4/year)

• Member of board or commission, appointed advisor, other non-academic office held

• Consultations to professional, scientific, governmental, cultural, private organizations

• Participate in non-academic conferences, symposia, congresses, seminars, workshops

• Informal meetings, discussions, popular communications or articles

• Non-academic demonstrations of university research findings or methods

• Continuing education of industry staff/public officials

• Public presentations and lectures of general topics
## European Countries with Shanghai 500 Universities

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<td>81</td>
<td>20%</td>
</tr>
<tr>
<td>SE</td>
<td>49</td>
<td>2.73</td>
<td>263</td>
<td>19%</td>
</tr>
<tr>
<td>SI</td>
<td>8</td>
<td>0.44</td>
<td>29</td>
<td>28%</td>
</tr>
<tr>
<td>UK</td>
<td>229</td>
<td>12.74</td>
<td>1428</td>
<td>16%</td>
</tr>
</tbody>
</table>

Mean Response 20.5%: varies widely across countries under 20 30 plus
### Disciplines in European Shanghai University Sample

<table>
<thead>
<tr>
<th>Discipline of European Respondents</th>
<th>Freq.</th>
<th>Percent</th>
<th>N. Sampled</th>
<th>% Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>457</td>
<td>25.42</td>
<td>2393</td>
<td>19%</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>65</td>
<td>3.62</td>
<td>406</td>
<td>16%</td>
</tr>
<tr>
<td>Physics</td>
<td>500</td>
<td>27.81</td>
<td>2436</td>
<td>21%</td>
</tr>
<tr>
<td>Economics</td>
<td>232</td>
<td>12.90</td>
<td>1090</td>
<td>21%</td>
</tr>
<tr>
<td>History</td>
<td>219</td>
<td>12.18</td>
<td>1259</td>
<td>17%</td>
</tr>
<tr>
<td>Computer Science</td>
<td>325</td>
<td>18.08</td>
<td>1797</td>
<td>18%</td>
</tr>
<tr>
<td>Total</td>
<td>1,798</td>
<td>100.00</td>
<td>8780</td>
<td>20.5%</td>
</tr>
</tbody>
</table>

Response rates **more evenly** distributed across disciplines

### Discipline of Austrian Respondents

<table>
<thead>
<tr>
<th>Discipline of Austrian Respondents</th>
<th>Freq</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology (B)</td>
<td>22</td>
<td>19.8</td>
</tr>
<tr>
<td>Chemical Engineering (P)</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Physics (B)</td>
<td>25</td>
<td>22.5</td>
</tr>
<tr>
<td>Economics (N)</td>
<td>20</td>
<td>18.0</td>
</tr>
<tr>
<td>History (N)</td>
<td>24</td>
<td>21.6</td>
</tr>
<tr>
<td>Computer Science (P)</td>
<td>17</td>
<td>15.3</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>100.00</td>
</tr>
<tr>
<td>Gender of European Respondents</td>
<td>Freq.</td>
<td>Percent</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Female</td>
<td>331</td>
<td>18.4%</td>
</tr>
<tr>
<td>Male</td>
<td>1,466</td>
<td>81.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment Contracts in European Universities</th>
<th>Percent</th>
<th>Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing</td>
<td></td>
<td>82</td>
</tr>
<tr>
<td>Limited</td>
<td>24.9%</td>
<td>527</td>
</tr>
<tr>
<td>Unlimited</td>
<td>75.1%</td>
<td>1,189</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Holds post at PhD institute</th>
<th>Percent</th>
<th>Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing</td>
<td></td>
<td>67</td>
</tr>
<tr>
<td>No</td>
<td>8.0%</td>
<td>138</td>
</tr>
<tr>
<td>Yes</td>
<td>92.0%</td>
<td>1,594</td>
</tr>
</tbody>
</table>

**with 20+ PhD students** 37.8% 602
## European Respondent Academic History

<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Tenure</th>
<th>Vintage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Years at Post</td>
<td>Degree Year</td>
</tr>
<tr>
<td>1%</td>
<td>0</td>
<td>2008</td>
</tr>
<tr>
<td>5%</td>
<td>1</td>
<td>2007</td>
</tr>
<tr>
<td>10%</td>
<td>1.5</td>
<td>2006</td>
</tr>
<tr>
<td>25%</td>
<td>4</td>
<td>2002</td>
</tr>
<tr>
<td>50%</td>
<td>9</td>
<td>1995</td>
</tr>
<tr>
<td>75%</td>
<td>18</td>
<td>1985</td>
</tr>
<tr>
<td>90%</td>
<td>26</td>
<td>1978</td>
</tr>
<tr>
<td>95%</td>
<td>30</td>
<td>1974</td>
</tr>
<tr>
<td>99%</td>
<td>38</td>
<td>1968</td>
</tr>
</tbody>
</table>
Logistic regression                                 Number of obs = 1198
LR chi2(11)     = 246.28             Prob > chi2 = 0.0000
Log likelihood = -616.62834               Pseudo R2 = 0.1665

Commercialize Model

|                | Coeff. | P>|z| |
|----------------|--------|------|
| Vintage        | 0.01   | 0.06 |
| Gender         | 0.44   | 0.03 |
| English2       | 0.42   | 0.01 |
| PubSvs         | 0.45   | 0.01 |
| PubBdMem       | 0.47   | 0.02 |
| Collaborate    | 0.84   | 0.00 |
| PeerRevKnow    | 0.19   | 0.01 |
| UniEntrep      | -0.07  | 0.00 |
| BusVoice       | 0.30   | 0.06 |
| OnlyEurope     | 0.71   | 0.02 |
| SeekSalary     | 0.28   | 0.05 |
| _cons          | -26.77 | 0.06 |
Ordered logistic regression                       Number of obs   =        457
LR chi2(11)     =     127.16                         Prob > chi2     =     0.0000
Log likelihood = -412.49499                       Pseudo R2      =     0.1336

Relative Income Model

| Coeff. | P>|z| |
|--------|-----|
| Vintage | -0.02 | 0.02 |
| Italy   | 0.69  | 0.10 |
| Pasteur | 0.50  | 0.03 |
| North   | 1.67  | 0.00 |
| ResearchIncome | 0.52 | 0.01 |
| PeerRevPubs   | 0.23  | 0.01 |
| UniFirmEquity | 0.20  | 0.03 |
| CommNoThreat  | -0.30 | 0.00 |
| PubBdMem      | 0.88  | 0.00 |
| Collaborate   | 0.67  | 0.01 |
| CommuteTime   | -0.24 | 0.09 |
Ordered logistic regression                       Number of obs   =        492
LR chi2(8)      =     107.09            Prob > chi2     =     0.0000
Log likelihood = -419.70965            Pseudo R2       =     0.1131

Future Effort Model

|               | Coeff. | P>|z| |
|---------------|--------|-----|
| LicenseIncome | 0.68   | 0.00|
| Vintage       | 0.06   | 0.00|
| Home          | 0.80   | 0.03|
| TeachLoad     | -0.18  | 0.05|
| RegionVoice   | 0.67   | 0.00|
| SciPubs       | 0.70   | 0.02|
| TechAssist    | -0.45  | 0.00|
| Consult>1     | -0.26  | 0.00|
## UK Commercial Model

Prior industry project stimulates

Scientific publishing decreases...(basic v. applied)

Public Service stimulates

DISapproval UniCommerce decreases

Mobility decreases

Age of respondent/degree increases

Logistic regression

Number of obs = 103

LR chi2(25) = 62.08
Prob > chi2 = 0.0001

Log likelihood = -33.55688 Pseudo R2 = 0.4805

More commercial in higher ranking Unis

Long-term UE depresses

"Goldilocks" conditions

High incomes depress