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Regional technology demand and the transfer strategies and performance of universities and public research institutes

Knowledge Transfer Study 2010-12
A study on behalf of the European Commission

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Covariates of KT success

- Characteristics of the knowledge transfer office (KTO)
  - Size and age of the KTO,
  - The industry background and experience of KTO staff
  - Other KTO characteristics such as level of autonomy from its affiliated university, the degree of centralization of services and transfer strategies
- Characteristics of the affiliated institution
  - Ownership (public or private),
  - Size,
  - Existence of engineering and natural sciences departments and hospitals,
  - Research excellence and business orientation
  - Institutional policies and practices
- Contextual influences
  - Laws and regulations on IP ownership
  - Economic context

Regional covariates of KT success

- Positive effects of being located in a technology-intensive region
  - in the US (Belenzon & Schankerman, 2009; Friedman & Silberman, 2003; Lach & Schankerman, 2008; Siegel, Waldman, & Link, 2003),
  - UK (Chapple, Lockett, Siegel, & Wright, 2005),
  - and Europe (using national GDP as measure) (Conti, 2009)
- No links between regional BERD and patent applications/contract research, but a positive correlation with the number of start-ups (Van Looy et al., 2011).
- No effects of the density of high tech organisations/employment on executed licences in the US AUTM survey (Sine, Shane, & Di Gregorio, 2003).
- No effects of the regional stock of knowledge per firm (measured as accumulated R&D expenses per firm) on licence agreements/spin-offs (González-Pernía, Kuechle, & Peña-Legazkue, 2013).
  - However, regional dummy variables significantly raise the explanatory power of the estimations:
    "This means that there are other regional characteristics, beyond the two that we used in our tests […], which can be useful to understand the behavior and capacity of regions for technology transfer." (ibid., p. 14)
- Wright, Clarysse, Lockett, & Knockaert (2008) suggest (but do not test) that there is a relationship between the regional environment (economic strength, presence of large companies with R&D, presence of industries with high patenting and licensing activities) and both, the mode of knowledge and technology transfer from a university as well as the degree of regional interaction.

Our objectives

1. Investigation of the relationship between regional characteristics and the KTT performance of universities and public research institutes
2. Exploration of the mediating role of transfer strategies
   a) Do institutions tailor their transfer strategies to the economic characteristics of their regional environment?
   b) Does this have an impact on their transfer performance?

Methodological approach

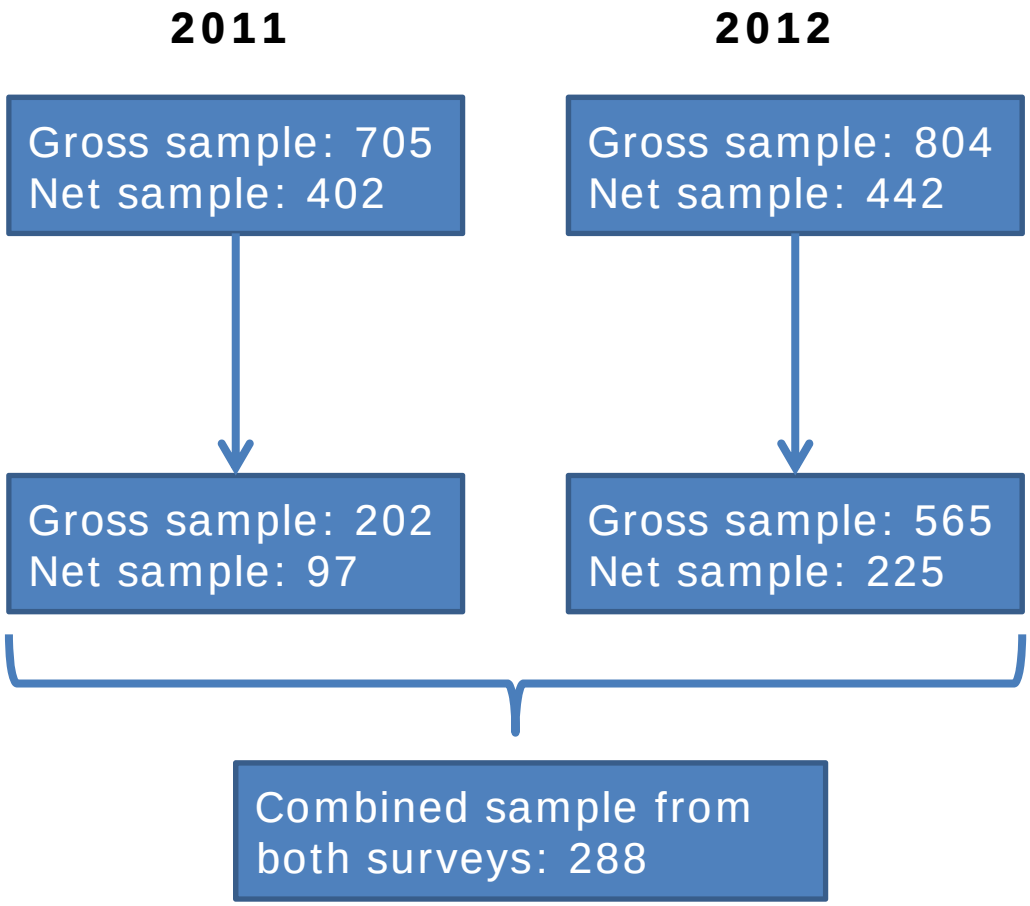
- Nested surveys of KTOs at HEI and research institutes
- Population
  - 39 countries with (estimated) 3'000 higher education institutions and 500 public/governmental research institutes
- Sampling criteria
  - Leading research institutes in the countries
  - PRO must have a KTO or dedicated personnel who provide support for knowledge transfer activities
  - Coverage of all 39 countries
- Sample
  - Inclusion of top institution in regard to research expenditures or research personnel per country (N=39)
  - Included institutions per country proportional to the share in the 39-country GOVERD+HERD total (averaged 2005-10) (N=461)

Survey approach

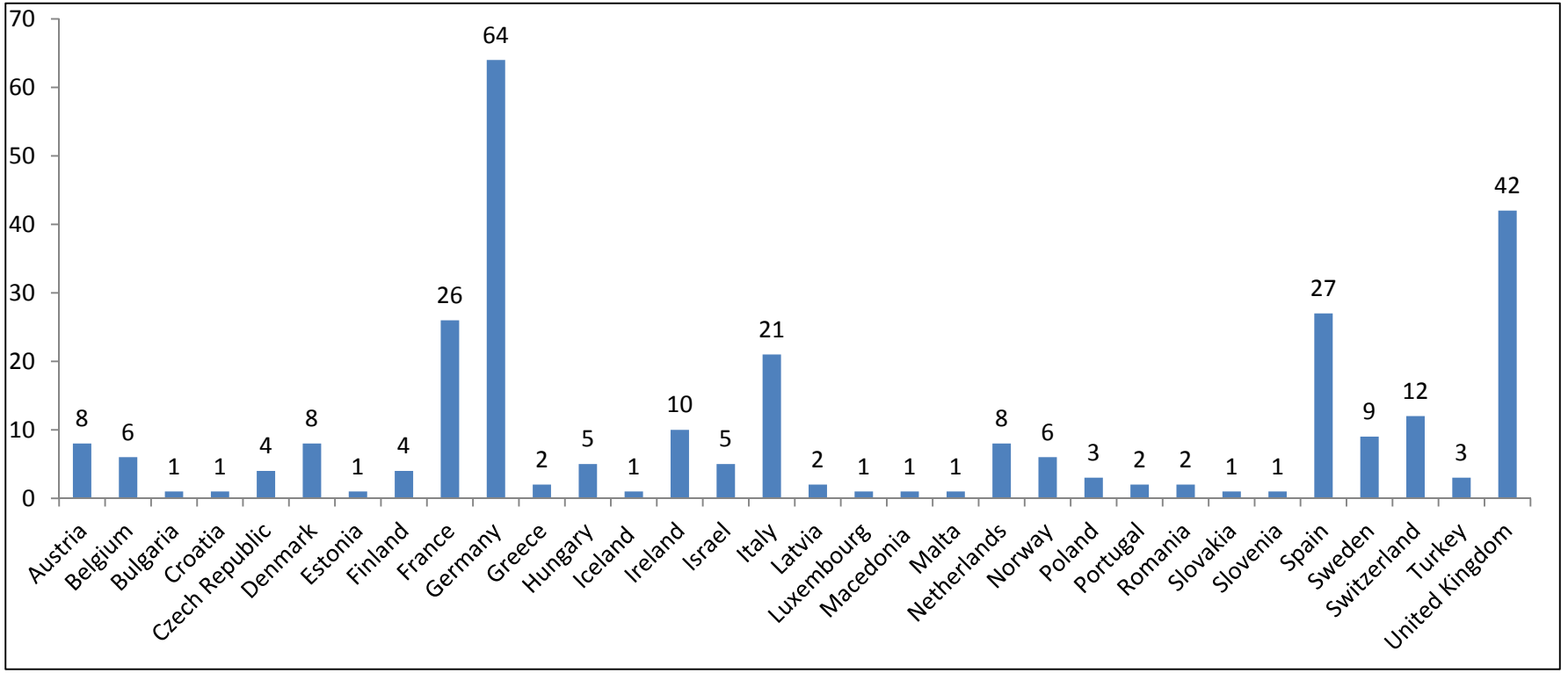
Postal European Knowledge Transfer Indicator Survey (UNU-MERIT)
plus data from national surveys

Online European Knowledge and Technology Transfer Practice Survey (FHNW)

Data basis of this analysis



Country distribution of the responses



Regional data

- NUTS 2 level
- Eurostat data with 3 year averages (2008 – 2010):
  - Employees (in 1'000)
  - GDP in mEUR PPP
  - GDP per capita
  - Business enterprise R&D expenditure (BERD) to GDP
  - Business Enterprise R&D Expenditure (BERD) to Gross Domestic R&D Expenditure (GERD)
  - Patent applications per million population
- Employment shares in manufacturing and services in 2011

Key performance indicators

	Universities				Other research organisations			
	N[1]	Mean	Median	Perc. zero[2]	N[1]	Mean	Median	Perc. zero[2]
Start-ups formed	208	5.3	2	33.2%	44	1.7	1	34.1%
Licenses executed	196	11.6	3	26.5%	41	11.8	4	14.6%
Licence income (in 1,000 €)	173	817.9	44.3	30.6%	35	625.1	140	20.0%

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.
1: Number of KTOs reporting results for each performance measure (including zero outcomes).
2: Percent of respondents reporting 'zero' for each outcome. For example, 33.2% of 208 universities reported zero start-ups in 2010 or 2011.

Baseline regressions with control variables

Dependent variable	Start-ups	Licence agreements	Licence income
Cases	231	197	170
Model	NEGBIN	NEGBIN	GENLIN
Size (# of scholars/researchers)	+++	+++	+++
Institute	---	++	
With Hospital			++
KTO size (in FTE)	+++	+++	+++
KTO funded before 2000	NS	++	++

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.
Note: NS = no significant effect, + = positive effect and p < .1; ++ = positive effect and p < .05; +++ = positive effect and p <.01; - = negative effect and p < .1; -- = negative effect and p < .05; --- = negative effect and p < .01.

Regional size and sectoral structure

Dependent variable	Start-ups	Licence agreements	Licence income
Model	NEGBIN	NEGBIN	GENLIN
Employment (size of region)	NS	+	---
GDP million PPS (size of region)	NS	NS	---
Employment share in manufacturing	-	---	--
Employment share in services	++	NS	NS

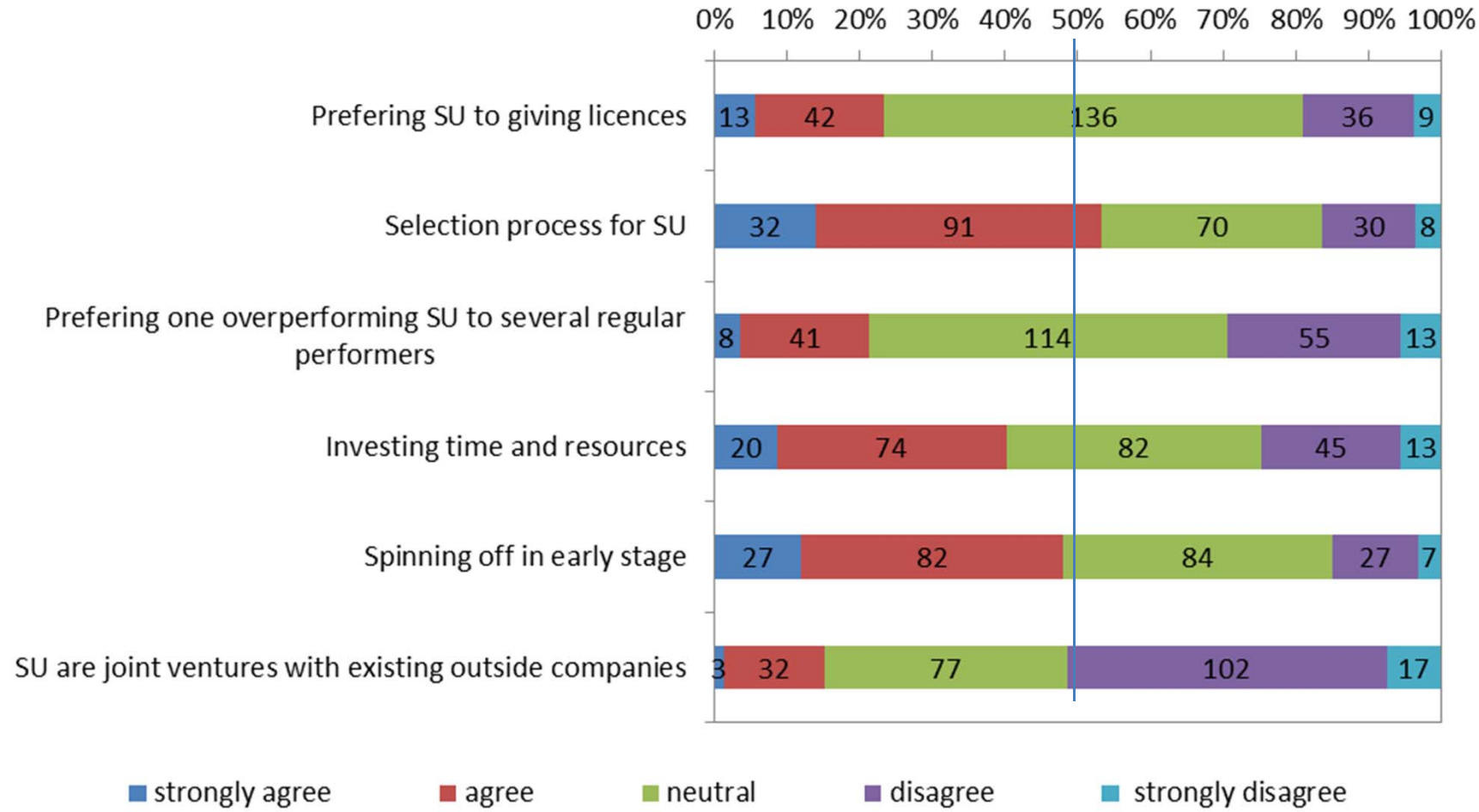
Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.
Note: NS = no significant effect, + = positive effect and $p < .1$; ++ = positive effect and $p < .05$; +++ = positive effect and $p < .01$; - = negative effect and $p < .1$; -- = negative effect and $p < .05$; --- = negative effect and $p < .01$.

Regional income and business research intensity

Dependent variable	Start-ups	Licence agreements	Licence income
Model	NEGBIN	NEGBIN	GENLIN
GDP per capita	+++	++	+
BERD (%GERD)	NS	+	+++
BERD (%GDP)	NS	NS	+++
Patent applications	NS	++	+++

Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.
Note: NS = no significant effect, + = positive effect and p < .1; ++ = positive effect and p < .05; +++ = positive effect and p <.01; - = negative effect and p < .1; -- = negative effect and p < .05; --- = negative effect and p < .01.

Start-up (SU) strategy (in % of responding PROs, N=227)



Source: FHNW / Knowledge Transfer Study 2010-2012

Hierarchical clustering of cases according to start-up preferences

	Prefering SU to giving licences	Selection process for SU	Prefering one overperformin g SU	Investing time and resources	Spinning off in early stage	SU are joint ventures with existing outside companies
"Nursing strategy" (N = 109)	3.0	2.4	3.0	3.3	3.0	3.4
"Selective support strategy" (N = 77)	2.7	2.0	2.8	2.0	1.9	3.4
"Start-up maximization strategy" (N = 29)	3.4	4.2	4.2	3.3	2.7	3.7
All (N = 215)	3.0	2.5	3.1	2.8	2.6	3.4

1 = strongly agree to 5 = strongly disagree
Source: FHNW / Knowledge Transfer Study 2010-2012

Start-up strategy and start-up success

Dependent variable	Start-ups	Start-ups	Start-ups
Model	NEGBIN	NEGBIN	NEGBIN
KTO founded before 2000		NS	NS
Regional GDP per capita			a)
Prefers SU over licences	+++	+++	+++
Selection of SU	NS	NS	NS
Prefers one successful over many regular SU	+	NS	NS
Invests time and resources in SU	+	+++	+++
Spins-off SU at early stage	NS	++	++
SU are joint ventures with firms	NS	NS	NS
SU_clust = 2 (Selective support strategy)	NS	+++	+++
SU_clust = 3 (Start-up maximization strategy)	++	NS	NS

a) partially significant, partially not
Source: MERIT/FHNW, European Knowledge Transfer Indicator Survey 2011 and 2012.
Note: NS = no significant effect, + = positive effect and p < .1; ++ = positive effect and p < .05; +++ = positive effect and p <.01; - = negative effect and p < .1; -- = negative effect and p < .05; --- = negative effect and p < .01.

Start-up strategy and licencing success

Dependent variable	Licences executed	Licences executed	Licences executed
Model	NEGBIN	NEGBIN	NEGBIN
KTO founded before 2000		+++	+++
Regional GDP per capita			++
Prefers SU over licences	---	NS	NS
SU_clust = 2 (Selective support strategy)	NS	+++	+++
SU_clust = 3 (Start-up maximization strategy)	++	+++	+++

Source: MERIT/FHNW, European Knowledge Transfer Indicator Survey 2011 and 2012.
Note: NS = no significant effect, + = positive effect and p < .1; ++ = positive effect and p < .05; +++ = positive effect and p <.01; - = negative effect and p < .1; -- = negative effect and p < .05; --- = negative effect and p < .01.

Summary

1. Institutions in manufacturing regions perform worse with regard to start-up numbers, licence agreements and licence income
2. Institutions in high income regions perform better
3. Institutions in regions with a research intensive business sector are more successful with regard to licences but not start-ups
4. Dedicated start-up focus and investment of time and resources into start-up support have an impact
   - on start-up numbers
   - on licence performance

Next steps

- Explore the relationship between strategy and regional variables
  - First analyses do not show any strong links
- Add further variables, e.g. on
  - Firm sizes
  - Innovation rates in industry (CIS data)
  - etc.