Location Choice of Academic Spin-Offs – Case Study of the German Internet Industry

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Introduction and Background

- Spin-offs from Higher Education Institutions (HEI) are a **prominent form of knowledge transfer**
- Research results and academic knowledge are used in start-ups, transformation into marketable products or processes
- **General idea of politicians & regional scientists:**

→Academic spin-off entrepreneurs settle **close to alma mater HEI**

→ Spin-offs are an instrument of structural change and regional economic development

→ High public investments to support & encourage academic spin offs

Research Objectives, Design and Methods

→ **Which German locations are most prominent for academic spin-offs?**

→ **Which HEI-type generates more spin-offs?**
(University U / Universities of Applied Sciences UAS)

→ **What role does spatial proximity to alma mater HEI play for choice of location of academic spin-off-founders?**

→ **What influence do regional factors and HEI-sided factors have on the choice of spin-off location** (Regional effectiveness)**?**

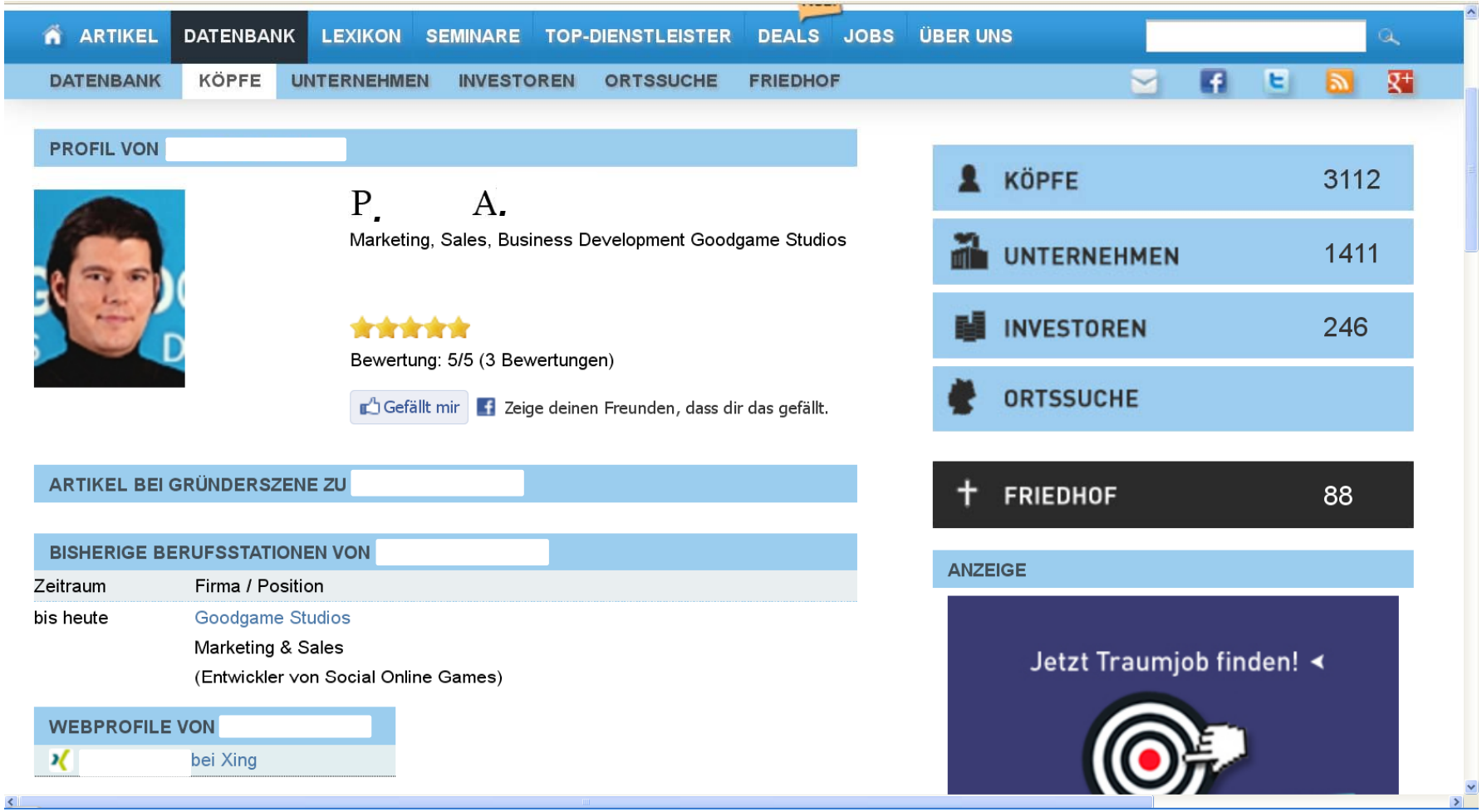
Research Objectives, Design and Methods

- **Definition of academic spin-off in this research:** start-up company founded by academic entrepreneur max. 5 years prior/after graduation
- **Data base:**
  - *Gründerszene,* digital spin-off data base of German internet industry,
  - social networks XING, Linked-In
- **Focus on German internet industry** → low market entry barriers, low demands concerning regional hard location factors

→ **Unfortunately no information about** business success, research intensity of spin-off; other industries; representativeness

Research Objectives, Design and Methods

Profile of a spin-off-founder on *www.gruenderszene.de*



Empirical Results

Gründerszene – Factsheet

→ **Basic Database** *(BD)*: N = 1,685 start-up companies; 1,067 founders

→**Spin-Off-Database:**
within 5-years prior/after graduation n = 946 spin-offs

→ **Gender** *(BD):*
94.7% of foundations by male, 5.3% by female entrepreneurs

→ **Start-ups per HEI-Type** *(BD):* **U – 1.013; TU – 242; UAS – 334;**
divided by # of students[1]: U – 0.82; TU– 0.83; UAS – 0.49

→ **Distance spin-offs→ alma mater**

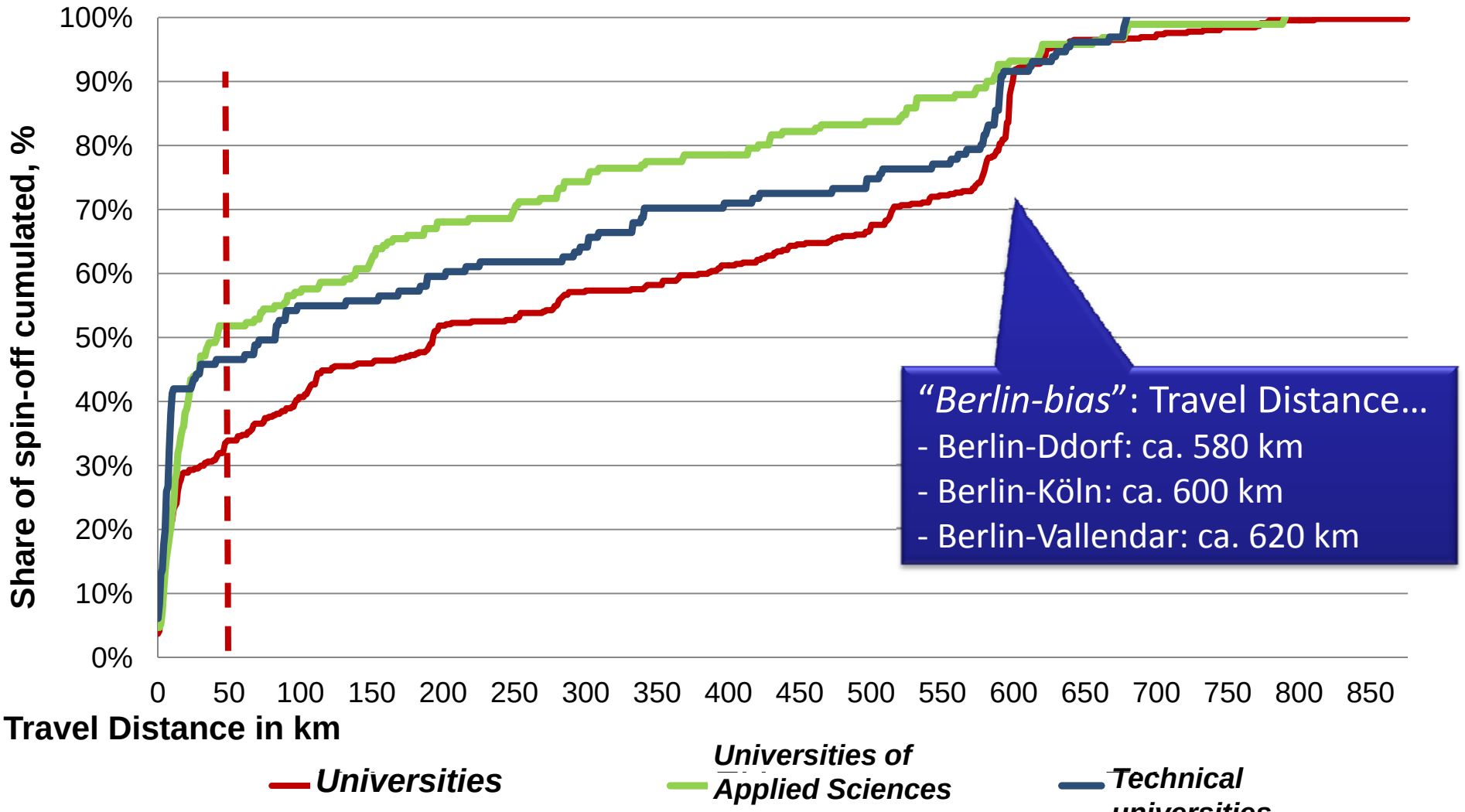
→ 40.1% of spin-offs in <50km distance to alma mater

→ U Ø → 271 km; UAS Ø → 205km

[1] Data source: Statistisches Bundesamt 2014; number of students in 2011; in 1,000

Empirical Results

Travel Distance between Spin-Off and Alma Mater



Database: *Gründerszene*, XING, Linked-In | n = 946

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Empirical Results

Top 10 – Start-up-Locations and Alma-Mater-Districts

	Location of start-up	Location of alma mater
1.	**Berlin** (651)	**Berlin** (214)
2.	**Hamburg** (190)	**Munich** (127)
3.	**Munich** (167)	**Mayen-Koblenz** (124)
4.	**Cologne** (111)	**Hamburg** (109)
5.	**Karlsruhe** (25)	**Cologne** (63)
6.	**Leipzig** (25)	**Leipzig** (49)
7.	**Dusseldorf** (24)	**Karlsruhe** (43)
8.	**Frankfurt / Main** (20)	**Mannheim** (36)
9.	**Stuttgart** (12)	**Wiesbaden** (34)
10.	**Heidelberg** (10)	**Potsdam** (28)

→ **Interesting:**
→ pull effect, e.g.
Berlin, Hamburg

→ push effect, e.g.
Vallendar, Leipzig

Empirical Results

Top 10 – Start-up-Locations and Alma-Mater-Districts with regard to number of inhabitants (in 1,000)

	Location of start-up	Location of alma mater
1.	**Berlin** (.19)	**Mayen-Koblenz** (.59)
2.	**Munich** (.16)	**Wiesbaden** (.19)
3.	**Cologne** (.11)	**Potsdam** (.19)
4.	**Hamburg** (.11)	**Heidelberg** (.17)
5.	**Karlsruhe** (.09)	**Darmstadt** (.17)
6.	**Jena** (.07)	**Mannheim** (.15)
7.	**Heidelberg** (.07)	**Karlsruhe** (.14)
8.	**Potsdam** (.05)	**Koblenz** (.13)
9.	**Darmstadt** (.05)	**Würzburg** (.11)
10.	**Leipzig** (.05)	**Erlangen** (.1)

Berlin and Munich:

→**Most important start-up locations**

But:

Also smaller districts are good "start-up-producers"

Basic database, n=1685

How do the alma mater region and the alma mater itself influence the choice of spin-off location?

→ **regional factors and HEI-sided factors**

- Binomial logistic regression model
- **Dependent variable: Regional Spin-Off (Dummy)**

  1: Spin-Off was established in <50km travel distance to alma mater

  0: Spin-Off was established in other parts of Germany

- To be considered: special role of Berlin

Variable	Variable Description	Expect. sign
Dependent var: Regional spin-off	0 = spin-off >50km distance of alma mata; 1 = > 50km	
HEI-sided variables - 2011		
Type of HEI	1= UAS, 0 = university	–
Size of HEI	Number of students in 1.000	+
Public / Private?	1 = Private HEI; 0 = Public HEI	–
Regional embeddedness	Foundation of HEI before 1990	+
Public Financial Support	Financial support for alma mater HEI (EXIST)	+
Regional influence factors – 2011, district, alma mater region		
East / West Germany	Location of HEI in East(1) /West (0) Germany	–
Degree of Agglomeration	Ordinal variable degree of agglomeration	+
Infrastructure	Ø driving time (car) to next Autobahn access in min	–
Knowledge infrastructure	Number of HEIs + scientific research institutions	+
Knowledge intensity of econ.	Number of employees in R&D per 1.000 employees	+
Economy	Unemployed inhabitants in popul. of working age	–
Start-up climate	Share of small businesses with <10 employees	+
Modernity of region	Average age of population in district	–
Tourism Attractiveness	Number of overnight stays per inhabitant	+
Mental openness of region	Share of inhabitants with foreign nationality	+
Migration balance	Net balance of Immigration – migration per 1000 inhab.	+

	1. All Spin-Offs (N = 946)		2. Non-Berlin (N = 550)	
Type of HEI	1.296 ***	(.000)	1.628***	(.000)
Public / Private	-0.664*	(.060)	-.644	(.117)
Size of HEI	.019**	(.043)	.026**	(.014)
Foundation 1990s	-.005	(.986)	-.840**	(.031)
Public Financial Support	.000	(.379)	.000	(.134)
East / West Germany	1.292**	(.010)	1.634**	(.012)
Agglomeration	.772**	(.002)	1.234***	(.000)
# Scientific Institutions	.062***	(.000)	.002	(.865)
R&D employment	-.007	(.507)	-.023*	(.082)
Infrastructure	-.060**	(.045)	-.080**	(.026)
Unemployment	-.228**	(.002)	-.232**	(.007)
Share of Small Businesses	.174**	(.034)	.359***	(.000)
Average Age	.279*	(.085)	.270	(.154)
Overnight stays	-.052	(.398)	-.081	(.309)
Share of foreigners	-.074**	(.029)	-.086**	(.032)
Migration balance	.010	(.589)	.006	(.804)
Constant	-24.005	(.009)	-38.148	(.000)
Cox & Snell/Nagelkerkes R^2	.299 / .404		.216 / 2.89	
Hosmer-Lemeshow-Test	15.302 (.054)		9.922 (.271)	

Spin-off database; p-value in parathesis, ***significant at 0.001; ** at 0.05; * at 0.10

Empirical Results

Propensity for spin-offs to be founded within the alma mater region is significantly higher, if….

→ **…** founder studies at a **UAS**
→ **…** founder studies at **a big and well-established HEI**
→ **…** alma mater region is in **East Germany**
→ **…** alma mater region is **highly agglomerated**
→ **…** there is a **well-established (road) infrastructure**
→ **… unemployment** rates are **low**
→ **…** there is a **positive start-up climate** (share of small businesses)
→ … **share of foreigners** is **low**

No clear, significant influence could be identified for…

→ … public financial support (EXIST-program), # of scientific institutions
→ … overnight stays, migration balance (mental openness of the region)

Summary

Main Results:

- → Preferred spin-off locations: metropolitan areas with good infrastructure
- → Proximity to alma mater university plays significant role for IT entrepreneurs, as 40% of spin-offs are founded in the university region
- → U. foster significantly more spin-offs than UAS, and UAS-founders remain in the alma mater region more often
- → HEI-sided and regional factors play a major role in the choice of location

Further research potential:

- → Differentiation by branches and countries would be interesting
- → Further variables, further approaches (e.g. regional factors of spin-off-location)

Thank you for your attention!

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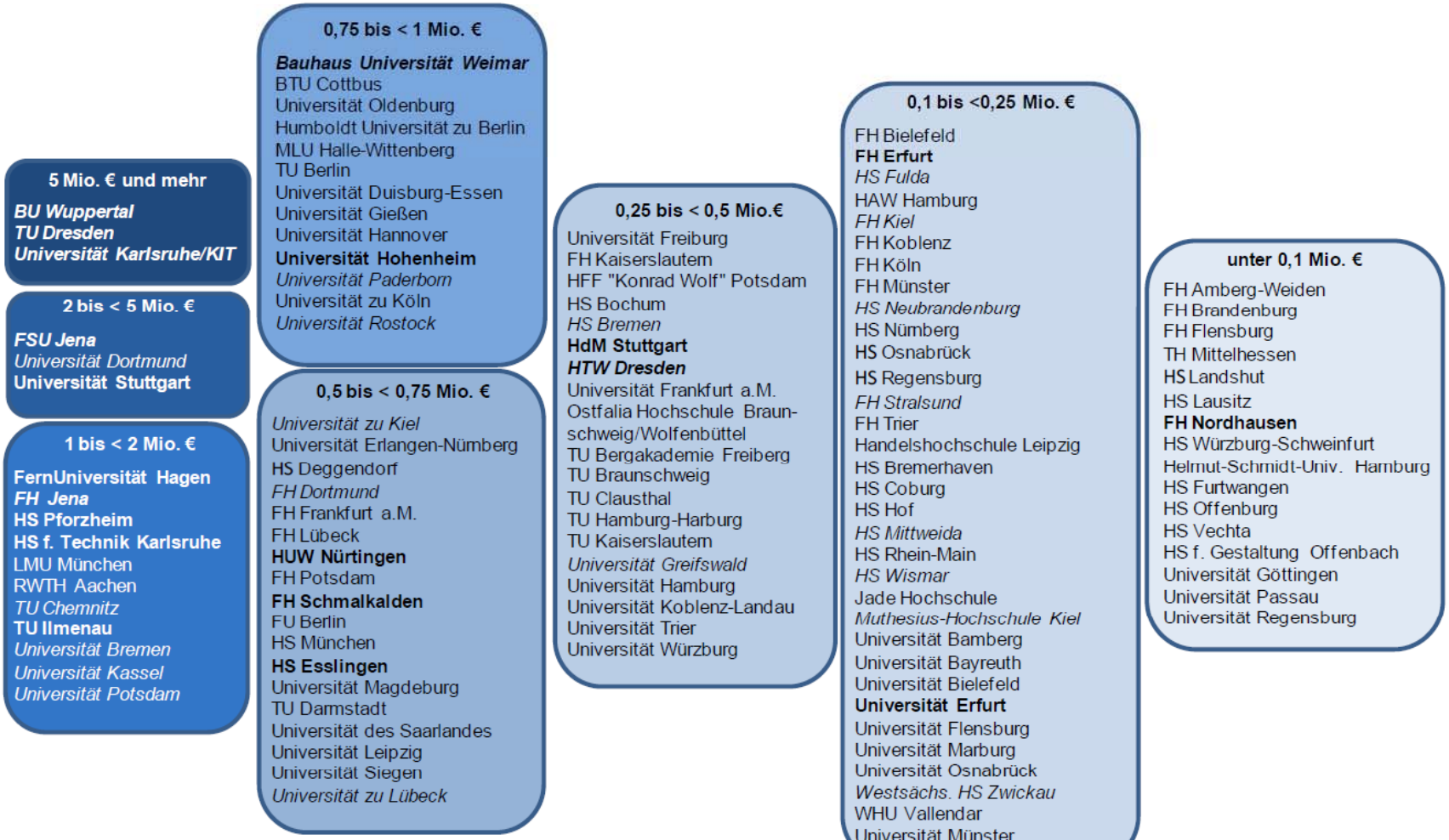
Appendix:
Literature Review for choice of variables

Regionsseitige Einflussfaktoren auf Transferkanal „Spin-Offs“			
Themen-bereich	**Subsystem**	**Indikatoren**	**Literatur**
Bevölke-rung	Agglomerations-grad	- Bevölkerungsdichte und -größe - Prognostizierte Bevölkerungsentwicklung	Heumann 2010; Fritsch/Schroeter 2011, Egeln et al. 2002
	Demografische Situation	- Altersstruktur - Bevölkerungsanteil im erwerbsfähigen Alter - Alterslastquotient	Backes-Gellner 2002
Wirt-schaft	Wirtschaftsleistung	- Regionale konjunkturelle Faktoren (Struktur-wandel)	Backes-Gellner et al. 2002, Feldman 2000
	Wirtschaftlicher Verdichtungsgrad	- MAR- und Jacobs-Diversitätsindex - Bruttowertschöpfung pro Einwohner - Arbeitsplatzdichte (Erwerbstätige am Arbeits-ort/Einwohner) - Anteil Einwohner im erwerbsfähigen Alter	Fritsch / Slavtchev 2007, Buerger et al. 2012, Eckey et al. 2009
	Diversifizierte, dienstleistungsgepr. Wirtschaftsstruktur	- Anteil der in KMUs Beschäftigten - Herfindahl Index für dienstleistungsgeprägte Branchen	Audretsch et al. 2012 Fritsch / Aamoucke 2012
	Wissens- und Inno-vationsorientierung der Wirtschaft	- Anteil der Erwerbstätigen in FuE - Anteil der Erwerbstätigen mit Abschluss in Ingenieur- und Naturwissenschaften - Anteil Erwerbstätiger in wissensintensiven Branchen / Dienstleistungen	Fritsch/Schroeter 2011, Audretsch et al. 2012 Fritsch / Aamoucke 2012
Infra-struktur	Wissens-infrastruktur	- Anzahl u. Größe der Hochschulen und wissen-schaftlichen Institutionen - Quantität u. Qualität regionaler F&E-Einrichtungen an Hochschulen - Höhe der regulären und extern eingeworbenen Drittmittel an Hochschulen	Goldstein 2005, Prevezer 1998 Fritsch / Aamoucke 2012
	Gründungsbezoge-ne Infrastruktur	- Fördermaßnahmen an reg. Hochschulen - Im Rahmen der EXIST-Programme eingewor-bene Finanzmittel an regionalen Hochschulen	Backes-Gellner et al. 2002, Kulicke et al. 2012, Egeln et al. 2002
	Verkehrs-infrastruktur	- Erreichbarkeit nächster drei nationaler Agglo-merationen via Straße und Bahn (Summe, in Min.) - Erreichbarkeit nächste EU-Metropole via Stra-ße und Flugzeug (Summe, in Min.) - Erreichbarkeit nächster Flughafen in Min. - Urbanisations- und Agglomerationsgrad	Hemer et al. 2006, Audretsch et al. 2012 Egeln et al. 2002
Weiche Stand-ort-faktoren	Gründungs- und Innovationsklima	- Durchschnittl. jährliche Anzahl u. Entwicklung von innovativen Unternehmensgründungen - Patentanmeldungen pro 1.000 Erwerbstätigen - Gründungsförderliche kulturelle Ausprägung (z.B. Risikoaversion)	Fritsch / Aamoucke 2012, Fueglistaller et al. 2008
	Regionale Bereit-schaft zur Finanzie-rungshilfe	- Regional finanzierte Beratungs- und Inkubatoreinrichtung - Reg. Bereitschaft zur Beteiligungsfinanzierung	Backes-Gellner et al. 2002, Hemer et al. 2006
	“Regional Embed-dedness” der HS	- Involvierung in reg. Unternehmensnetzwerke	Hemer et al. 2006

APPENDIX: REFERENCE FOR VARIABLE „PUBLIC FINANCIAL SUPPORT“:

KULICKE, MARIANNE / DORNBUSCH, FRIEDRICH / KRIPP, KERSTIN / SCHLEINKOFER, Michael (2012): Nachhaltigkeit der EXIST-Förderung – Gründungsunterstützung an Hochschulen, die zwischen 1998 und 2011 gefördert wurden. Bericht zur wissenschaftlichen Begleitforschung zu EXIST – Existenzgründungen aus der Wissenschaft. Fraunhofer Institut für System- und Innovationsforschung ISI, Karlsruhe, 2012.

Grafik 4: Umfang der EXIST-Förderung, von der Hochschulen partizipierten (direkt erhaltene Mittel und Mittel an Dritte, die Unterstützungsleistungen für die Hochschulen erbrachten)



Legende: fett = Hochschulen der 5 EXIST-Modellinitiativen
kursiv = Förderung in zwei Programmphasen oder Projekten

	Variable	Description	Scale / Min-Max	Expected sign
Dep. Var.	***Regional spin-off***	Dummy variable *(own Calculation)*	1 = spin-off within 50km of alma mata	
HEI-sided variables	**Type of HEI**	Type of public Higher Education Institution (Dummy variable, 2011, *DeStatis*)	0 = university; 1 = university of Applied Sciences	–
	Public / Private	Public HEI or Private HEI? (2011, Dummy)	0 = Public; 1 = Private	
	Size of HEI	Number of students in 1.000 (2011, *DeStatis*)	Minimum: 551; Maximum: 71,218	–
	Regional embeddedness	Foundations of HEI from 1990 onwards (2011, district, Dummy variable)	0 = foundation of HEI before 1990 1 = foundation of HEI from 1990 onwards	+
	Public Financial Support	Financial support for alma mater HEI of founder in EXIST-Program *(Kulicke et al. 2012)*	8 categories, min: 50,000€; max: 5,000,000€	+
Location	**East / West Germany**	Location of HEI is situated in East/West Germany (2011, Dummy variable)	0 = location in West Germany (n=1284) 1 = location in East Germany (n=160)	–
	Degree of Agglomeration	Ordinal variable representing degree of agglomeration (2011, district, *BBSR)*	4 = districts that only encompass cities; 3 = urban districts, 2 = rural districts 1 = thinly populated rural districts	–
Knowledge intensity	**Number of scientific institutions**	Number of HEIs + Fraunhofer, Helmholtz , Leibniz, Max Planck etc. in city (2012, *BMBF)*	Minimum: 1; Maximum: 65	+
	R&D employment	Number of employees in R&D per 1.000 employees (2011, district, *INKAR)*	Minimum: 0.4; Maximum: 63.1 Average: 13.64	+
Infrastructure	**Distance to Autobahn**	Average driving time (car) to next Autobahn access in min (2011, district, *INKAR)*	Minimum: 1.00; Maximum: 38.00 Average: 9.11	–
Economy	**Unemployment**	Share of unemployed inhabitants in population of working age (0-100%) (2011, district, *INKAR)*	Minimum: 1.7%; Maximum: 12.20% Average: 6.36%	-
Start-up climate	**Share of small businesses**	Share of small businesses with <10 employees in all businesses (district, *INKAR)*	Minimum: 82.79%; Maximum: 97.95% Average: 89.78%	+
Modernity	**Average Age**	Average age of population in district (district, 2011, *INKAR)*	Minimum: 37.00; Maximum: 43.00 Average: 39.11	–
Attractiveness and openness of region	**Overnight stays**	Number of overnight stays in tourism-based businesses per inhabitant (district, 2011, *INKAR)*	Minimum: 0.9; Maximum: 22.6 Average: 4.8	+
	Share of foreigners	Share of inhabitants with foreign origin in all inhabitants (district, 2011, *INKAR)*	Minimum: 1.5%; Maximum: 24.2% Average: 12.76%	+
	Migration balance	Net balance of Immigration – migration per 1000 inhabitants (district, 2011, *INKAR)*	Minimum: -6.8; Maximum: 40.1 Average:8.15	+

	HEI-type	HEI 90s	HEI size	Financ. Support	East / West	Agglo-meration	scientif. institut.	Unempl oment	Migration balance	Ø Age	Infra-structure	Small business	R&D em-ployment	Share fo-reigners	Over-night stays
HEI-type	1	,364**	-,408**	-,260**	,015	,052*	-,031	,048	,006	,103**	,002	-,023	-,018	-,016	-,101**
		,000	,000	,000	,573	,047	,235	,073	,821	,000	,935	,383	,491	,551	,000
HEI 90s	,364**	1	-,277**	-,088**	,519**	,160**	-,131**	,062*	-,112**	,265**	,140**	-,146**	-,174**	-,285**	-,066*
	,000		,000	,003	,000	,000	,000	,037	,000	,000	,000	,000	,000	,000	,026
HEI size	-,408**	-,277**	1	,292**	-,137**	-,427**	,325**	,074**	,457**	-,484**	-,261**	,182**	,326**	,480**	,347**
	,000	,000		,000	,000	,000	,000	,008	,000	,000	,000	,000	,000	,000	,000
Financ. Support	-,260**	-,088**	,292**	1	,086**	-,211**	,024	,004	,051	-,017	-,104**	-,152**	,090**	,017	-,112**
	,000	,003	,000		,001	,000	,363	,882	,056	,522	,000	,000	,001	,510	,000
East / West	,015	,519**	-,137**	,086**	1	,122**	-,156**	,356**	,000	,415**	,300**	-,282**	-,188**	-,462**	,041
	,573	,000	,000	,001		,000	,000	,000	,995	,000	,000	,000	,000	,000	,122
Agglome ration	,052*	,160**	-,427**	-,211**	,122**	1	-,398**	-,255**	-,498**	,334**	,523**	,019	-,205**	-,456**	-,162**
	,047	,000	,000	,000	,000		,000	,000	,000	,000	,000	,470	,000	,000	,000
# scientif. institut.	-,031	-,131**	,325**	,024	-,156**	-,398**	1	,514**	,331**	-,224**	-,168**	,452**	,016	,299**	,428**
	,235	,000	,000	,363	,000	,000		,000	,000	,000	,000	,000	,543	,000	,000
unemplo y- ment	,048	,062*	,074**	,004	,356**	-,255**	,514**	1	,067*	,359**	-,090**	,018	-,397**	-,218**	-,020
	,073	,037	,008	,882	,000	,000	,000		,011	,000	,001	,490	,000	,000	,453
Migration balance	,006	-,112**	,457**	,051	,000	-,498**	,331**	,067*	1	-,549**	-,207**	,085**	,371**	,341**	,354**
	,821	,000	,000	,056	,995	,000	,000	,011		,000	,000	,001	,000	,000	,000
Average Age	,103**	,265**	-,484**	-,017	,415**	,334**	-,224**	,359**	-,549**	1	,249**	-,162**	-,395**	-,498**	-,340**
	,000	,000	,000	,522	,000	,000	,000	,000	,000		,000	,000	,000	,000	,000
Infra-structure	,002	,140**	-,261**	-,104**	,300**	,523**	-,168**	-,090**	-,207**	,249**	1	,031	-,039	-,177**	,010
	,935	,000	,000	,000	,000	,000	,000	,001	,000	,000		,244	,141	,000	,699
Small business	-,023	-,146**	,182**	-,152**	-,282**	,019	,452**	,018	,085**	-,162**	,031	1	,124**	,385**	,377**
	,383	,000	,000	,000	,000	,470	,000	,490	,001	,000	,244		,000	,000	,000
R & D employm.	-,018	-,174**	,326**	,090**	-,188**	-,205**	,016	-,397**	,371**	-,395**	-,039	,124**	1	,627**	,349**
	,491	,000	,000	,001	,000	,000	,543	,000	,000	,000	,141	,000		,000	,000
Share foreigners	-,016	-,285**	,480**	,017	-,462**	-,456**	,299**	-,218**	,341**	-,498**	-,177**	,385**	,627**	1	,382**
	,551	,000	,000	,510	,000	,000	,000	,000	,000	,000	,000	,000	,000		,000
Overnight stays	-,101**	-,066*	,347**	-,112**	,041	-,162**	,428**	-,020	,354**	-,340**	,010	,377**	,349**	,382**	1
	,000	,026	,000	,000	,122	,000	,000	,453	,000	,000	,699	,000	,000	,000	

	All Spin-Offs (N = 946)		2. Berlin (N = 396)		3. Non-Berlin (N = 550)	
Type of HEI	1.296 ***	(.000)	10.730	(.999)	1.628***	(.000)
Public / Private	-0.664*	(.060)	12.602	(.999)	-.644	(.117)
Size of HEI	.019**	(.043)	.326	(1.000)	.026**	(.014)
Foundation 1990s	-.005	(.986)	23.122	(.998)	-.840**	(.031)
Public Financial Support	.000	(.379)	.000	(1.000)	.000	(.134)
Studied in Berlin			22.869	(.999)		
East / West Germany	1.292**	(.010)	35.919	(.998)	1.634**	(.012)
Agglomeration	.772**	(.002)	-2.508	(1.000)	1.234***	(.000)
# Scientific Institutions	.062***	(.000)	1.422	(.997)	.002	(.865)
R&D employment	-.007	(.507)	-1.214	(.999)	-.023*	(.082)
Infrastructure	-.060**	(.045)	1.541	(.997)	-.080**	(.026)
Unemployment	-.228**	(.002)	-9.149	(.995)	-.232**	(.007)
Share of Small Businesses	.174**	(.034)	-2.841	(.999)	.359***	(.000)
Average Age	.279*	(.085)	7.829	(.998)	.270	(.154)
Overnight stays	-.052	(.398)	2.587	(.998)	-.081	(.309)
Share of foreigners	-.074**	(.029)	1.648	(.999)	-.086**	(.032)
Migration balance	.010	(.589)	.636	(.999)	.006	(.804)
Constant	-24.005	(.009)	-118.036	(1.000)	-38.148	(.000)
Cox & Snell/Nagelkerkes R^2	.299 / .404		0.727 / 1.000		.216 / 2.89	
Hosmer-Lemeshow-Test	15.302 (.054)		0.000 (1.000)		9.922 (.271)	

p-value in parathesis, ***significant at 0.001; ** at 0.05; * at 0.10