

Regional Knowledge, Entrepreneurial Culture and Innovative Start-ups over Time and Space—An Empirical Investigation

Small Business Economics

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Table A.1. List of universities founded prior to the year 1900

Type of higher education institution	Planning region	Size (number of students 1911)
<i>Classical universities</i>		
Universitaet Berlin	1101	Large (7585)
Universitaet Muenchen	910	Large (6942)
Universitaet Leipzig	1404	Large (4088)
Universitaet Bonn	505	Large (3805)
Universitaet Freiburg	811	Large (3080)
Universitaet Goettingen	305	Large (2476)
Universitaet Heidelberg	812	Large (2452)
Universitaet Marburg	601	Large (2240)
Universitaet Halle	1503	Large (2209)
Universitaet Kiel	101	Large (2063)
Universitaet Tuebingen	806	Small (1979)
Universitaet Muenster	511	Small (1969)
Universitaet Jena	1603	Small (1902)
Universitaet Wuerzburg	918	Small (1449)
Universitaet Gießen	601	Small (1315)
Universitaet Greifswald	1303	Small (1165)
Universitaet Erlangen	906	Small (1104)
Universitaet Rostock	1302	Small (920)
<i>Technical Universities</i>		
Technische Hochschule Muenchen	910	Large (2376)
Technische Hochschule Berlin	1101	Large (1959)
Technische Hochschule Darmstadt	605	Large (1231)
Technische Hochschule Karlsruhe	805	Large (1052)
Technische Hochschule Dresden	1401	Large (1022)
Technische Hochschule Hannover	307	Small (836)
Technische Hochschule Stuttgart	810	Small (580)
Technische Hochschule Aachen	501	Small (557)
Technische Hochschule Braunschweig	301	Small (370)

Notes: The planning region 601 hosts two classical universities (Marburg; Gießen). Based on the sum of students the planning region is counted as hosting a large classical university. Source: Deutsche Hochschulstatistik (1929).

Table A.2. Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Patents (per 10,000 workforce population)																
2 Employment share of R&D employees	0.684***															
3 Start-up rate technology-intensive industries (per 10,000 workforce population)	0.693***	0.664***														
4 Distance to classical university founded before 1900	-0.28**	-0.354** *	-0.241**													
5 Distance to technical university founded before 1900	-0.446**	-0.543** *	-0.418** *	-0.012												
6 Classical university founded before 1900 (Yes=1)	0.179*	0.285**	0.122	-0.737** *	0.062											
7 Technical university founded before 1900 (Yes=1)	0.404***	0.636***	0.451***	-0.043	-0.594** *	0.032										
8 Self-employment rate in science-based industries 1907	0.053	0.144	0.149	-0.152	-0.06	0.032	0.034									
9 Self-employment rate in non-agricultural non-science based private sector industries 1907	0.098	0.282*	0.249**	-0.12	-0.099	0.106	0.252**	0.467** *								
10 Self-employment rate in science-based industries 1925	0.524***	0.604***	0.676***	-0.267**	-0.401** *	0.216**	0.336** *	0.453** *	0.345** *							
11 Self-employment rate in non-agricultural non-science based private sector industries 1925	0.265**	0.169	0.359***	-0.108	-0.041	0.114	0.114	0.29**	0.501** *	0.324**						
12 Population density 1907	0.25**	0.465***	0.341***	-0.31**	-0.317**	0.202*	0.355** *	-0.095	0.421** *	0.364** *	-0.037					
13 Population density 1925	0.251**	0.455***	0.345***	-0.283**	-0.312**	0.181*	0.346** *	-0.127	0.388** *	0.352** *	-0.076	0.994***				
14 Distance to nearest coalfield	0.109	-0.032	0.231**	0.054	0.174*	0.036	-0.062	0.139	-0.078	0.04	0.153	-0.366** *	-0.374** *			
15 Employment share in manufacturing 1907	0.193*	0.464***	0.259**	-0.258**	-0.265**	0.167	0.259**	0.3**	0.694** *	0.485** *	0.063	0.709***	0.687***	-0.358** *		
16 Employment share in manufacturing 1925	0.228**	0.47***	0.295**	-0.27**	-0.312**	0.122	0.235**	0.285**	0.585** *	0.489** *	-0.018	0.676***	0.66***	-0.313**	0.951** *	
17 Employment share in science-based	0.29**	0.554***	0.371***	-0.273**	-0.364**	0.149	0.345**	0.268**	0.399**	0.668**	0.014	0.589***	0.581***	-0.253**	0.675**	0.681**

industries 1925

* * * * *

Note: Pearson correlation coefficients. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level.

Table A.3. Persistence of regional knowledge: Distinction between small and large CUs and TUs

	I	II	III	IV	V	VI	VII	VIII
	Controls 1907				Controls 1925			
<i>Dependent variable:</i>	Patents per working age population		Employment share of R&D employees		Patents per working age population		Employment share of R&D employees	
Distance to small university founded before 1900 (Yes=1)	−0.090* (0.045)		−0.062*** (0.017)		−0.087* (0.047)		−0.061*** (0.017)	
Distance to small technical university founded before 1900 (Yes=1)	−0.137*** (0.050)		−0.116*** (0.024)		−0.136*** (0.050)		−0.117*** (0.025)	
Distance to large university founded before 1900 (Yes=1)	−0.084** (0.037)		−0.050*** (0.016)		−0.088** (0.038)		−0.052*** (0.015)	
Distance to large technical university founded before 1900 (Yes=1)	−0.249** (0.097)		−0.132*** (0.012)		−0.254** (0.097)		−0.135*** (0.020)	
Small university founded before 1900 (Yes=1)		0.312 (0.193)		0.237*** (0.065)		0.331 (0.200)		0.248*** (0.069)
Small technical University founded before 1900 (Yes=1)		0.615** (0.234)		0.541*** (0.109)		0.625*** (0.236)		0.547*** (0.119)
Large university founded before 1900 (Yes=1)		0.333* (0.177)		0.203** (0.077)		0.352* (0.182)		0.215*** (0.069)
Large technical University founded before 1900 (Yes=1)		0.985** (0.443)		0.617*** (0.083)		1.020** (0.448)		0.639*** (0.081)
Population density	−0.082 (0.136)	−0.042 (0.150)	0.164*** (0.048)	0.179*** (0.053)	−0.034 (0.128)	0.003 (0.142)	0.166*** (0.048)	0.178*** (0.054)
Distance to nearest coalfield	−0.030 (0.068)	−0.039 (0.072)	0.043* (0.023)	0.035 (0.026)	−0.007 (0.068)	−0.012 (0.071)	0.055** (0.024)	0.048* (0.026)
Employment share in manufacturing	0.823*** (0.278)	0.949*** (0.297)	0.356** (0.145)	0.427*** (0.147)	0.692*** (0.230)	0.802*** (0.248)	0.335*** (0.111)	0.404*** (0.118)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.158 (1.473)	−3.363*** (1.166)	−5.024*** (0.563)	−7.184*** (0.559)	0.661 (1.322)	−2.776*** (1.028)	−4.844*** (0.458)	−6.982*** (0.447)
Mean VIF	3.05	2.9	3.05	2.9	3.69	3.55	3.69	3.55
R-squared adj.	0.783	0.766	0.707	0.699	0.785	0.769	0.719	0.714

Notes: Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables apart from share/rate variables are log-transformed.

Table A.4. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Testing for East-West differences I

	I	II	III	IV	V	VI	VII	VIII
	Self-employment rates 1907				Self-employment rates 1925			
Self-employment rate in science-based industries	0.249** (0.121)	0.241** (0.120)	0.288** (0.117)	0.276** (0.121)	0.370*** (0.078)	0.387*** (0.090)	0.396*** (0.078)	0.405*** (0.093)
Self-employment rate in science-based industries X East	0.255 (0.396)	0.255 (0.400)	0.187 (0.397)	0.187 (0.402)	0.616*** (0.174)	0.609*** (0.178)	0.584*** (0.173)	0.580*** (0.176)
Self-employment rate in non-science based non-agricultural private sector industries		0.0343 (0.211)		0.0501 (0.209)		−0.059 (0.147)		−0.033 (0.148)
Distance to university founded before 1900 (Yes=1)	−0.013 (0.012)	−0.013 (0.012)			−0.003 (0.009)	−0.003 (0.010)		
Distance to technical university founded before 1900 (Yes=1)	−0.057*** (0.018)	−0.056*** (0.019)			−0.043*** (0.014)	−0.044*** (0.015)		
University founded before 1900 (Yes=1)			0.044 (0.050)	0.045 (0.050)			0.005 (0.039)	0.006 (0.040)
Technical University founded before 1900 (Yes=1)			0.230*** (0.083)	0.228*** (0.085)			0.175*** (0.061)	0.176*** (0.063)
Population density	0.065 (0.050)	0.065 (0.051)	0.080 (0.051)	0.080 (0.051)	0.019 (0.033)	0.014 (0.036)	0.023 (0.034)	0.020 (0.037)
Distance to nearest coalfield	−0.004 (0.025)	−0.004 (0.025)	−0.007 (0.025)	−0.007 (0.025)	0.000 (0.019)	0.000 (0.019)	−0.002 (0.019)	−0.002 (0.020)
Employment share in manufacturing	0.172* (0.096)	0.160 (0.126)	0.178* (0.098)	0.160 (0.121)	0.124* (0.073)	0.125* (0.073)	0.127* (0.074)	0.127* (0.074)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.714 (0.437)	0.657 (0.613)	0.323 (0.408)	0.240 (0.589)	1.256*** (0.344)	1.449** (0.682)	1.034*** (0.314)	1.140* (0.630)
Mean VIF	3.88	4.01	3.82	3.95	3.71	3.77	3.67	3.73
R-squared adj.	0.635	0.635	0.624	0.624	0.748	0.748	0.742	0.742

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 91 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed. To avoid any confusion, the dummy variable for East Germany is not reported. It cannot be interpreted due to perfect multicollinearity with State Dummies.

Table A.5. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Testing for East-West differences II
(Detailed analysis with historical data from 1925)

	I	II	III	IV	V	VI	VII	VIII
Self-employment rate in science-based industries	0.541*** (0.110)	0.576*** (0.143)	0.564*** (0.115)	0.587*** (0.150)	0.535*** (0.114)	0.599*** (0.152)	0.563*** (0.120)	0.610*** (0.160)
Self-employment rate in science-based industries X East	0.003 (0.222)	−0.012 (0.235)	−0.0183 (0.222)	−0.029 (0.235)	−0.007 (0.239)	−0.199 (0.296)	−0.116 (0.272)	−0.222 (0.294)
Self-employment rate in non-science based non-agricultural private sector industries		−0.101 (0.168)		−0.067 (0.169)		−0.180 (0.182)		−0.137 (0.184)
Self-employment rate in non-science based non-agricultural private sector industries X East						0.767 (0.569)		0.606 (0.597)
Distance to university founded before 1900 (Yes=1)	−0.002 (0.009)	−0.003 (0.009)			−0.001 (0.009)	0.001 (0.010)		
Distance to university 1900 X East						−0.010 (0.022)		
Distance to technical university founded before 1900 (Yes=1)	−0.048*** (0.013)	−0.049*** (0.014)			−0.048*** (0.014)	−0.050*** (0.016)		
Distance to technical university 1900 X East						−0.001 (0.031)		
University founded before 1900 (Yes=1)			0.003 (0.037)	0.005 (0.038)			−0.015 (0.044)	−0.012 (0.046)
University 1900 X East							0.078 (0.089)	0.056 (0.092)
Technical University founded before 1900 (Yes=1)			0.189*** (0.058)	0.191*** (0.060)			0.186*** (0.068)	0.190*** (0.071)
Technical University 1900 X East							0.078 (0.124)	0.047 (0.132)
Population density	0.080** (0.037)	0.074** (0.036)	0.082** (0.039)	0.079** (0.037)	0.068 (0.041)	0.058 (0.039)	0.073* (0.044)	0.064 (0.041)
Population density X East					0.184** (0.086)	0.138 (0.101)	0.124 (0.105)	0.123 (0.100)
Distance to nearest coalfield	−0.011 (0.019)	−0.012 (0.019)	−0.014 (0.020)	−0.015 (0.020)	−0.009 (0.021)	−0.010 (0.021)	−0.012 (0.022)	−0.013 (0.022)

Distance to nearest coalfield X East					−0.029 (0.041)	−0.014 (0.049)	−0.049 (0.046)	−0.026 (0.052)
Employment share in science-based industries	−0.076 (0.060)	−0.079 (0.063)	−0.070 (0.062)	−0.073 (0.065)	−0.068 (0.063)	−0.074 (0.067)	−0.063 (0.066)	−0.067 (0.069)
Employment share in science-based industries X East	0.346*** (0.090)	0.348*** (0.094)	0.338*** (0.090)	0.339*** (0.093)	0.274*** (0.093)	0.316*** (0.096)	0.301*** (0.097)	0.317*** (0.097)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.740*** (0.262)	2.076*** (0.699)	1.501*** (0.230)	1.718** (0.657)	1.764*** (0.274)	2.350*** (0.759)	1.528*** (0.252)	1.971*** (0.714)
Mean VIF	3.72	3.79	3.68	3.75	3.72	3.79	3.68	3.75
R-squared adj.	0.768	0.769	0.759	0.759	0.773	0.778	0.765	0.768

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 91 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed. To avoid any confusion, the dummy variable for East Germany is not reported. It cannot be interpreted due to perfect multicollinearity with State Dummies.

Table A.6. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Extending the definition of TUs to academies of mining (*Bergakademien*, Freiberg, Clausthal)

	I	II	III	IV	V	VI	VII	VIII
	Self-employment rates 1907				Self-employment rates 1925			
Self-employment rate in science-based industries	0.280** (0.125)	0.267** (0.130)	0.302** (0.123)	0.286** (0.131)	0.498*** (0.077)	0.539*** (0.093)	0.511*** (0.075)	0.543*** (0.093)
Self-employment rate in non-science based non-agricultural private sector industries		0.055 (0.211)		0.068 (0.210)		−0.150 (0.182)		−0.116 (0.181)
Distance to university founded before 1900 (Yes=1)	−0.010 (0.012)	−0.010 (0.012)			−0.003 (0.009)	−0.005 (0.009)		
Distance to technical university (incl. <i>Bergakademien</i>) founded before 1900 (Yes=1)	−0.043** (0.019)	−0.042** (0.019)			−0.040*** (0.014)	−0.042*** (0.014)		
University founded before 1900 (Yes=1)			0.037 (0.052)	0.039 (0.052)			0.010 (0.038)	0.013 (0.040)
Technical university (incl. <i>Bergakademien</i>) founded before 1900 (Yes=1)			0.172** (0.086)	0.169* (0.086)			0.169*** (0.057)	0.174*** (0.059)
Population density	0.080 (0.053)	0.080 (0.053)	0.090* (0.052)	0.090* (0.053)	0.024 (0.038)	0.012 (0.041)	0.027 (0.039)	0.017 (0.041)
Distance to nearest coalfield	−0.007 (0.024)	−0.008 (0.024)	−0.009 (0.024)	−0.010 (0.024)	−0.009 (0.019)	−0.010 (0.019)	−0.010 (0.020)	−0.011 (0.020)
Employment share in manufacturing	0.174* (0.097)	0.155 (0.123)	0.182* (0.098)	0.158 (0.120)	0.080 (0.079)	0.082 (0.080)	0.087 (0.079)	0.088 (0.079)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.603 (0.439)	0.509 (0.619)	0.293 (0.401)	0.182 (0.588)	1.543*** (0.376)	2.036** (0.771)	1.309*** (0.336)	1.677** (0.712)
Mean VIF	3.22	3.41	3.17	3.36	3.02	3.17	2.99	3.13
R-squared adj.	0.622	0.622	0.616	0.616	0.723	0.725	0.721	0.722

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed.

Table A.7. The interaction between historical entrepreneurial tradition and regional knowledge and its role for start-ups in technology-intensive industries today: Separate interactions

	I	II	III	IV	V	VI	VII	VIII
	Self-employment rates 1907				Self-employment rates 1925			
Self-employment rate in science-based industries	0.303** (0.125)	0.304** (0.123)	0.304** (0.118)	0.308** (0.118)	0.531*** (0.099)	0.495*** (0.088)	0.524*** (0.093)	0.507*** (0.090)
Self-employment rate in non-science based non-agricultural private sector industries	0.0574 (0.211)	0.0412 (0.210)	0.010 (0.205)	−0.001 (0.205)	−0.093 (0.178)	−0.070 (0.169)	−0.088 (0.180)	−0.095 (0.174)
University founded before 1900 (Yes=1)	0.147 (0.320)	0.038 (0.048)	−1.899** (0.876)	0.0304 (0.047)	−0.044 (0.183)	0.002 (0.036)	0.202 (0.944)	−0.005 (0.035)
Technical University founded before 1900 (Yes=1)	0.222** (0.086)	0.544 (0.372)	0.211*** (0.079)	−2.181** (1.067)	0.177*** (0.062)	0.651** (0.255)	0.177*** (0.061)	−4.825*** (1.723)
Self-employment rate in science-based industries X University 1900	0.123 (0.339)				−0.054 (0.167)			
Self-employment rate in science-based industries X Technical university 1900		0.377 (0.381)				0.570** (0.284)		
Self-employment rate in non-science based non-agricultural private sector industries X University 1900			0.775** (0.355)				−0.082 (0.404)	
Self-employment rate in non-science based non-agricultural private sector industries X Technical university 1900				0.928** (0.414)				2.096*** (0.725)
Population density	0.085 (0.056)	0.088* (0.052)	0.078 (0.053)	0.092* (0.051)	0.022 (0.041)	0.006 (0.040)	0.021 (0.041)	0.019 (0.040)
Distance to nearest coalfield	−0.008 (0.026)	−0.007 (0.026)	−0.008 (0.025)	−0.011 (0.024)	−0.010 (0.021)	−0.019 (0.020)	−0.010 (0.021)	−0.009 (0.021)
Employment share in manufacturing	0.153 (0.120)	0.160 (0.119)	0.159 (0.116)	0.180 (0.117)	0.095 (0.079)	0.116 (0.076)	0.097 (0.079)	0.102 (0.076)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.257 (0.594)	0.252 (0.596)	0.408 (0.589)	0.308 (0.583)	1.557** (0.692)	1.523** (0.653)	1.539** (0.685)	1.529** (0.683)
Mean VIF	3.95	3.95	3.95	3.95	3.73	3.73	3.73	3.73
R-squared adj.	0.635	0.637	0.651	0.649	0.722	0.732	0.722	0.732

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed. Please note that constitutive variables of interactions must not be interpreted as mean effects. The coefficients measure the effect for the case that the other constitutive variable is zero.

Table A.8. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Distinction between small and large CUs and TUs

	I	II	III	IV	V	VI	VII	VIII
	Self-employment rates 1907				Self-employment rates 1925			
Self-employment rate in science-based industries	0.343*** (0.119)	0.343*** (0.119)	0.355*** (0.114)	0.356*** (0.121)	0.483*** (0.082)	0.511*** (0.094)	0.499*** (0.076)	0.527*** (0.093)
Self-employment rate in non-science based non-agricultural private sector industries		0.000 (0.205)		−0.002 (0.207)		−0.102 (0.174)		−0.099 (0.175)
Distance to small university founded before 1900 (Yes=1)	−0.011 (0.013)	−0.011 (0.013)			−0.011 (0.012)	−0.0121 (0.012)		
Distance to small technical university founded before 1900 (Yes=1)	−0.004 (0.017)	−0.004 (0.017)			−0.003 (0.013)	−0.004 (0.013)		
Distance to large university founded before 1900 (Yes=1)	−0.000 (0.014)	−0.000 (0.014)			0.009 (0.010)	0.008 (0.010)		
Distance to large technical university founded before 1900 (Yes=1)	−0.089*** (0.023)	−0.089*** (0.023)			−0.069*** (0.018)	−0.070*** (0.018)		
Small university founded before 1900 (Yes=1)			0.029 (0.060)	0.029 (0.060)			0.034 (0.054)	0.036 (0.055)
Small technical University founded before 1900 (Yes=1)			0.060 (0.062)	0.060 (0.064)			0.054 (0.043)	0.056 (0.043)
Large university founded before 1900 (Yes=1)			0.007 (0.058)	0.007 (0.058)			−0.043 (0.041)	−0.040 (0.042)
Large technical University founded before 1900 (Yes=1)			0.374*** (0.107)	0.374*** (0.111)			0.292*** (0.080)	0.295*** (0.080)
Population density	0.082 (0.053)	0.082 (0.053)	0.087 (0.053)	0.087 (0.054)	0.020 (0.039)	0.011 (0.041)	0.024 (0.040)	0.016 (0.041)
Distance to nearest coalfield	−0.017 (0.020)	−0.017 (0.020)	−0.016 (0.022)	−0.016 (0.022)	−0.015 (0.018)	−0.015 (0.018)	−0.014 (0.019)	−0.015 (0.019)
Employment share in manufacturing	0.165* (0.094)	0.165 (0.121)	0.182* (0.095)	0.182 (0.117)	0.101 (0.077)	0.103 (0.078)	0.108 (0.077)	0.110 (0.077)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.055** (0.468)	1.054 (0.646)	0.387 (0.402)	0.390 (0.582)	1.732*** (0.378)	2.072*** (0.751)	1.280*** (0.322)	1.593** (0.681)
Mean VIF	3.82	3.95	3.65	3.78	3.63	3.69	3.5	3.56
R-squared adj.	0.673	0.673	0.658	0.658	0.744	0.745	0.738	0.738

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models.

***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables apart from share/rate variables are log-transformed.

Table A.9. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Excluding control for employment share in manufacturing

	I	II	III	IV	V	VI	VII	VIII
	Self-employment rates 1907				Self-employment rates 1925			
Self-employment rate in science-based industries	0.369*** (0.107)	0.301** (0.123)	0.399*** (0.107)	0.323** (0.124)	0.511*** (0.068)	0.542*** (0.082)	0.532*** (0.067)	0.555*** (0.083)
Self-employment rate in non-science based non-agricultural private sector industries		0.175 (0.168)		0.191 (0.173)		−0.111 (0.171)		−0.081 (0.170)
Distance to university founded before 1900 (Yes=1)	−0.013 (0.011)	−0.013 (0.011)			−0.005 (0.009)	−0.006 (0.009)		
Distance to technical university founded before 1900 (Yes=1)	−0.056*** (0.018)	−0.053*** (0.018)			−0.042*** (0.013)	−0.043*** (0.014)		
University founded before 1900 (Yes=1)			0.047 (0.049)	0.047 (0.047)			0.009 (0.038)	0.012 (0.039)
Technical University founded before 1900 (Yes=1)			0.230*** (0.081)	0.218*** (0.082)			0.176*** (0.056)	0.178*** (0.057)
Population density	0.136*** (0.051)	0.115** (0.048)	0.150*** (0.052)	0.127*** (0.048)	0.048 (0.038)	0.040 (0.043)	0.053 (0.038)	0.047 (0.043)
Distance to nearest coalfield	−0.005 (0.025)	−0.006 (0.026)	−0.008 (0.026)	−0.008 (0.026)	−0.012 (0.020)	−0.011 (0.020)	−0.012 (0.021)	−0.013 (0.021)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.105*** (0.325)	0.662 (0.616)	0.731** (0.284)	0.265 (0.593)	1.712*** (0.266)	2.077*** (0.670)	1.487*** (0.237)	1.747*** (0.631)
Mean VIF	2.96	3.08	2.9	3.02	3.02	2.96	2.76	2.91
R-squared adj.	0.632	0.637	0.622	0.628	0.719	0.720	0.715	0.715

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed.

Table A.10. The interaction between historical entrepreneurial tradition and regional knowledge and its role for start-ups in technology-intensive industries today: Excluding control for employment share in manufacturing

	I	II	III	IV	V	VI
	Self-employment rates 1907			Self-employment rates 1925		
Self-employment rate in science-based industries	0.309** (0.127)	0.318*** (0.116)	0.341*** (0.116)	0.557*** (0.090)	0.552*** (0.085)	0.560*** (0.094)
Self-employment rate in non-science based non-agricultural private sector industries	0.194 (0.178)	0.125 (0.179)	0.103 (0.180)	−0.052 (0.171)	−0.053 (0.177)	−0.043 (0.184)
University founded before 1900 (Yes=1)	0.191 (0.318)	−1.979*** (0.741)	−2.441*** (0.836)	−0.124 (0.138)	0.863 (0.873)	0.158 (0.978)
Technical University founded before 1900 (Yes=1)	0.522 (0.369)	−2.137** (1.033)	−3.886* (1.972)	0.615** (0.265)	−5.083*** (1.615)	−4.836*** (1.775)
Self-employment rate in science-based industries X University 1900	0.163 (0.341)		−0.240 (0.340)	−0.131 (0.130)		−0.193 (0.132)
Self-employment rate in science-based industries X Technical university 1900	0.351 (0.379)		−0.637 (0.641)	0.526* (0.294)		0.443** (0.209)
Self-employment rate in non-science based non-agricultural private sector industries X University 1900		0.808*** (0.299)	0.907*** (0.287)		−0.366 (0.371)	−0.152 (0.391)
Self-employment rate in non-science based non-agricultural private sector industries X Technical university 1900		0.906** (0.398)	1.369** (0.584)		2.205*** (0.680)	2.255*** (0.696)
Population density	0.121** (0.054)	0.125** (0.051)	0.136** (0.054)	0.042 (0.043)	0.050 (0.043)	0.047 (0.044)
Distance to nearest coalfield	−0.009 (0.027)	−0.013 (0.024)	−0.015 (0.024)	−0.024 (0.021)	−0.015 (0.021)	−0.024 (0.021)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.273 (0.612)	0.486 (0.600)	0.523 (0.595)	1.755*** (0.629)	1.671** (0.653)	1.714** (0.669)
Mean VIF	3.02	3.02	3.02	2.91	2.91	2.91
R-squared adj.	0.630	0.658	0.662	0.725	0.727	0.735

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed. Please note that constitutive variables of interactions must not be interpreted as mean effects. The coefficients measure the effect for the case that the other constitutive variable is zero.

Table A.11. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Including control for employment share in science-based industries in 1925

	I	II	III	IV
	Self-employment rate 1925			
Self-employment rate in science-based industries	0.586*** (0.107)	0.635*** (0.137)	0.603*** (0.109)	0.640*** (0.142)
Self-employment rate in non-science based non-agricultural private sector industries		−0.152 (0.185)		−0.116 (0.185)
Distance to university founded before 1900 (Yes=1)	−0.004 (0.009)	−0.006 (0.009)		
Distance to technical university founded before 1900 (Yes=1)	−0.043*** (0.013)	−0.045*** (0.014)		
University founded before 1900 (Yes=1)			0.007 (0.038)	0.011 (0.039)
Technical University founded before 1900 (Yes=1)			0.180*** (0.055)	0.183*** (0.057)
Population density	0.082** (0.040)	0.073* (0.038)	0.084** (0.041)	0.077* (0.039)
Distance to nearest coalfield	−0.009 (0.020)	−0.010 (0.020)	−0.011 (0.020)	−0.012 (0.021)
Employment share in science-based industries	−0.054 (0.058)	−0.059 (0.061)	−0.050 (0.059)	−0.053 (0.062)
Dummies for Federal States	Yes	Yes	Yes	Yes
Constant	1.728*** (0.272)	2.229*** (0.731)	1.495*** (0.241)	1.865*** (0.690)
Mean VIF	3.72	3.79	3.68	3.75
R-squared adj.	0.725	0.727	0.720	0.721

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed.

Table A.12. The interaction between historical entrepreneurial tradition and regional knowledge and its role for start-ups in technology-intensive industries today: Including control for employment share in science-based industries in 1925

	I	II	III
	Self-employment rate 1925		
Self-employment rate in science-based industries	0.635*** (0.155)	0.638*** (0.143)	0.641*** (0.157)
Self-employment rate in non-science based non-agricultural private sector industries	−0.085 (0.191)	−0.085 (0.190)	−0.077 (0.203)
University founded before 1900 (Yes=1)	−0.135 (0.137)	0.935 (0.907)	0.132 (0.997)
Technical University founded before 1900 (Yes=1)	0.570** (0.271)	−5.002*** (1.524)	−4.959*** (1.748)
Self-employment rate in science-based industries X University 1900	−0.142 (0.130)		−0.207 (0.129)
Self-employment rate in science-based industries X Technical university 1900	0.467 (0.309)		0.380* (0.224)
Self-employment rate in non-science based non-agricultural private sector industries X University 1900		−0.397 (0.385)	−0.147 (0.400)
Self-employment rate in non-science based non-agricultural private sector industries X Technical university 1900		2.172*** (0.639)	2.286*** (0.684)
Population density	0.070* (0.042)	0.081** (0.040)	0.076* (0.043)
Distance to nearest coalfield	−0.022 (0.021)	−0.014 (0.021)	−0.022 (0.021)
Employment share in science-based industries	−0.046 (0.064)	−0.053 (0.062)	−0.048 (0.064)
Dummies for Federal States	Yes	Yes	Yes
Constant	1.858*** (0.699)	1.783** (0.705)	1.821** (0.733)
Mean VIF	3.12	3.12	3.12
R-squared adj.	0.729	0.732	0.739

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed. Please note that constitutive variables of interactions must not be interpreted as mean effects. The coefficients measure the effect for the case that the other constitutive variable is zero.

Table A.13. Regional knowledge for start-up rates in technology-intensive industries today

	I	II
Distance to university founded before 1900 (Yes=1)	−0.014 (0.011)	
Distance to technical university founded before 1900 (Yes=1)	−0.059*** (0.019)	
University founded before 1900 (Yes=1)	0.021 (0.056)	0.022 (0.059)
Technical University founded before 1900 (Yes=1)	−0.005 (0.024)	−0.008 (0.024)
Population density		0.049 (0.047)
Distance to nearest coalfield		0.237*** (0.082)
Employment share in science-based industries	0.094* (0.056)	0.107* (0.056)
Dummies for Federal States	Yes	Yes
Constant	1.197*** (0.313)	0.822*** (0.295)
Mean VIF	3.67	3.63
R-squared adj.	0.599	0.586

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***, statistically significant at the 1% level; **, statistically significant at the 5% level; *, statistically significant at the 10% level. All continuous variables are log-transformed.

Table A.14. The role of historical entrepreneurial tradition and regional knowledge for start-ups in technology-intensive industries today: Considering the effects of CUs and TUs founded after 1900

	I	II	III	IV	V	VI	VII	VIII
	Self-employment rates 1907				Self-employment rates 1925			
Self-employment rate in science-based industries	0.292** (0.115)	0.295** (0.118)	0.322*** (0.113)	0.311** (0.120)	0.454*** (0.084)	0.503*** (0.088)	0.479*** (0.077)	0.519*** (0.084)
Self-employment rate in non-science based non-agricultural private sector industries		-0.013 (0.208)		0.042 (0.209)		-0.182 (0.171)		-0.149 (0.171)
Distance to university founded before 1900 (Yes=1)	-0.013 (0.012)	-0.013 (0.012)			-0.009 (0.010)	-0.011 (0.010)		
Distance to technical university founded before 1900 (Yes=1)	-0.074*** (0.022)	-0.074*** (0.023)			-0.047** (0.021)	-0.048** (0.021)		
Distance to university founded after 1900 (Yes=1)	-0.023* (0.012)	-0.023* (0.012)			-0.018* (0.011)	-0.020* (0.011)		
Distance to technical university founded after 1900 (Yes=1)	0.018 (0.018)	0.019 (0.018)			-0.003 (0.017)	-0.004 (0.017)		
University founded before 1900 (Yes=1)			0.073 (0.053)	0.074 (0.052)			0.042 (0.043)	0.048 (0.045)
Technical university founded before 1900 (Yes=1)			0.260*** (0.086)	0.258*** (0.087)			0.206*** (0.064)	0.212*** (0.066)
University founded after 1900 (Yes=1)			0.102** (0.048)	0.103** (0.048)			0.078* (0.042)	0.082* (0.043)
Technical university founded after 1900 (Yes=1)			-0.013 (0.079)	-0.011 (0.081)			0.078 (0.065)	0.082 (0.066)
Population density	0.072 (0.049)	0.072 (0.049)	0.073 (0.048)	0.073 (0.048)	0.009 (0.040)	-0.008 (0.042)	0.009 (0.044)	-0.004 (0.044)
Distance to nearest coalfield	-0.015 (0.024)	-0.015 (0.024)	-0.015 (0.024)	-0.015 (0.024)	-0.009 (0.019)	-0.010 (0.019)	-0.004 (0.021)	-0.005 (0.021)
Employment share in manufacturing	0.139 (0.101)	0.144 (0.125)	0.138 (0.105)	0.123 (0.123)	0.083 (0.078)	0.084 (0.078)	0.083 (0.079)	0.085 (0.079)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.948** (0.471)	0.971 (0.649)	0.507 (0.423)	0.436 (0.615)	1.655*** (0.387)	2.268*** (0.735)	1.286*** (0.327)	1.757*** (0.659)
Mean VIF	3.37	3.56	3.18	3.37	3.22	3.35	3.02	3.14
R-squared adj.	0.670	0.670	0.657	0.657	0.735	0.738	0.736	0.738

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed.

Table A.15. The interaction between historical entrepreneurial tradition and regional knowledge and its role for start-ups in technology-intensive industries today: Considering the effects of CUs and TUs founded after 1900

	I	II	III	IV	V	VI
	Self-employment rates 1907			Self-employment rates 1925		
Self-employment rate in science-based industries	0.304* (0.156)	0.305*** (0.112)	0.420*** (0.144)	0.514*** (0.122)	0.508*** (0.087)	0.534*** (0.137)
Self-employment rate in non-science based non-agricultural private sector industries	0.050 (0.226)	−0.324 (0.253)	−0.421 (0.268)	−0.134 (0.177)	−0.192 (0.207)	−0.190 (0.229)
University founded before 1900 (Yes=1)	0.210 (0.326)	−2.330*** (0.717)	−2.927*** (0.870)	−0.047 (0.157)	0.249 (0.938)	−0.348 (1.120)
Technical University founded before 1900 (Yes=1)	0.474 (0.401)	−2.740** (1.181)	−5.505*** (1.996)	0.716** (0.293)	−4.825*** (1.749)	−4.214* (2.458)
University founded after 1900 (Yes=1)	0.121 (0.203)	−1.240* (0.664)	−1.913* (0.962)	0.018 (0.178)	−0.166 (0.585)	−0.355 (0.757)
Technical university founded after 1900 (Yes=1)	−0.086 (0.206)	−0.516 (0.565)	−1.047 (2.291)	0.779* (0.443)	−1.318* (0.748)	−1.121 (1.567)
Self-employment rate in science-based industries X University 1900	0.155 (0.355)		−0.289 (0.362)	−0.080 (0.147)		−0.188 (0.168)
Self-employment rate in science-based industries X Technical university 1900	0.250 (0.413)		−1.055 (0.650)	0.631* (0.333)		0.518 (0.311)
Self-employment rate in non-science based non-agricultural private sector industries X University 1900		0.967*** (0.290)	1.109*** (0.292)		−0.092 (0.401)	0.077 (0.446)
Self-employment rate in non-science based non-agricultural private sector industries X Technical university 1900		1.170** (0.451)	1.897*** (0.590)		2.107*** (0.734)	2.027** (0.956)
Self-employment rate in science-based industries X University later than 1900	0.018 (0.215)		−0.247 (0.231)	−0.033 (0.162)		−0.056 (0.175)
Self-employment rate in science-based industries X Technical university later than 1900	−0.090 (0.208)		−0.175 (0.503)	0.592 (0.377)		0.169 (0.508)
Self-employment rate in non-science based non-agricultural private sector industries X University later than 1900		0.550** (0.271)	0.738** (0.344)		0.103 (0.249)	0.152 (0.284)
Self-employment rate in non-science based non-agricultural private sector industries X Technical university later than 1900		0.215 (0.223)	0.383 (0.747)		0.609* (0.340)	0.612 (0.483)
Population density	0.066	0.044	0.051	−0.005	0.014	0.015

	(0.055)	(0.050)	(0.053)	(0.046)	(0.046)	(0.051)
Distance to nearest coalfield	−0.015 (0.026)	−0.017 (0.023)	−0.014 (0.023)	−0.014 (0.020)	−0.000 (0.023)	−0.010 (0.022)
Employment share in manufacturing	0.127 (0.150)	0.172 (0.126)	0.135 (0.139)	0.105 (0.082)	0.072 (0.078)	0.080 (0.082)
Dummies for Federal States	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.428 (0.646)	1.310* (0.687)	1.721** (0.781)	1.724** (0.687)	1.782** (0.722)	1.833** (0.797)
Mean VIF	3.37	3.37	3.37	3.14	3.14	3.14
R-squared adj.	0.660	0.708	0.722	0.751	0.752	0.762

Notes: Dependent variable is the average start-up rate in innovative industries in the period 2000–2014. Robust standard errors in parentheses. The number of observations is 92 regions in all models. ***: statistically significant at the 1% level; **: statistically significant at the 5% level; *: statistically significant at the 10% level. All continuous variables are log-transformed.

Figs. Marginal Effects Plots

Supportive Table for reading the plots: Percentiles of historical self-employment rates

Percentile	Self-employment rate in science-based industries 1907		Self-employment rate in non-agricultural non-science based private sector industries 1907		Self-employment rate in science- based industries 1925		Self-employment rate in non-agricultural non- science based private sector industries 1925	
	No log	Log	No log	Log	No log	Log	No log	Log
10th	0.294	-1.224	9.555	2.257	0.256	-1.361	9.008	2.198
20th	0.348	-1.056	9.936	2.296	0.275	-1.290	9.431	2.244
30th	0.376	-0.979	10.794	2.379	0.308	-1.179	9.867	2.289
40th	0.389	-0.943	11.277	2.423	0.323	-1.132	10.388	2.341
Median	0.400	-0.917	11.731	2.462	0.339	-1.081	10.603	2.361
60th	0.431	-0.842	12.274	2.507	0.351	-1.046	10.852	2.384
70th	0.449	-0.800	12.952	2.561	0.380	-0.968	10.978	2.396
80th	0.475	-0.745	14.019	2.640	0.426	-0.854	11.542	2.446
90th	0.494	-0.705	14.974	2.706	0.500	-0.694	11.865	2.474

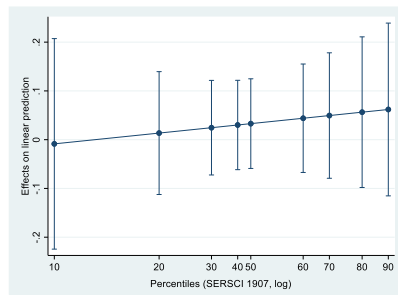


Fig.A.1 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1907 (Table 5, column I)

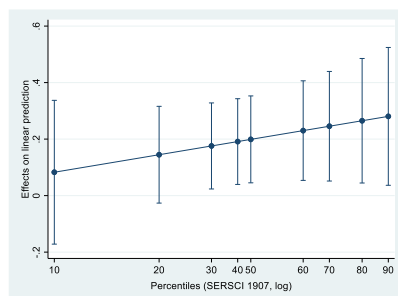


Fig.A.2 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1907 (Table 5, column I)

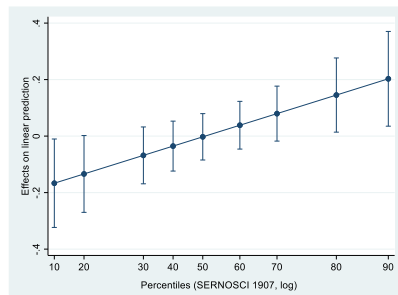


Fig.A.3 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1907 (Table 5, column II)

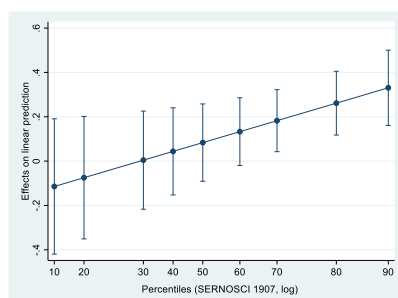


Fig.A.4 Marginal effect (with 95% CI) of hosting a university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1907 (Table 5, column II)

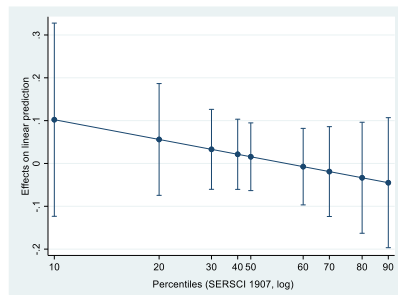


Fig.A.5 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1907 (Table 5, column III)

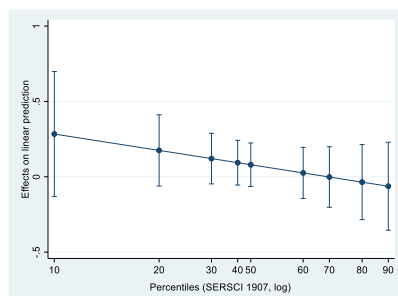


Fig.A.6 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1907 (Table 5, column III)

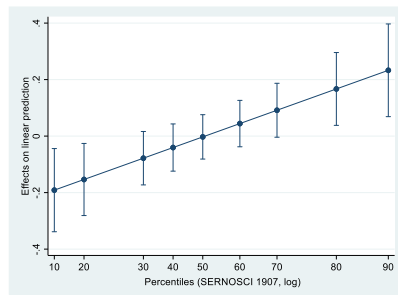


Fig.A.7 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1907 (Table 5, column III)

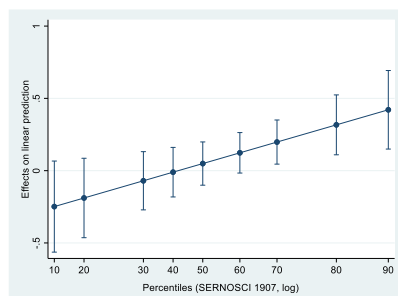


Fig.A.8 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1907 (Table 5, column III)

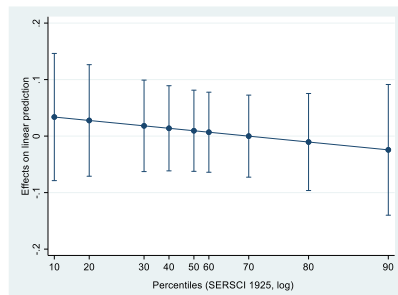


Fig.A.9 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1925 (Table 5, column IV)

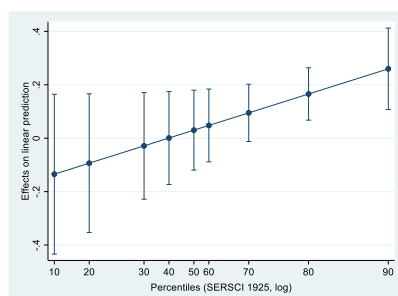


Fig.A.10 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1925 (Table 5, column IV)

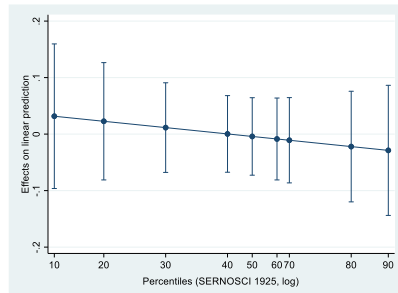


Fig.A.11 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1925 (Table 5, column V)

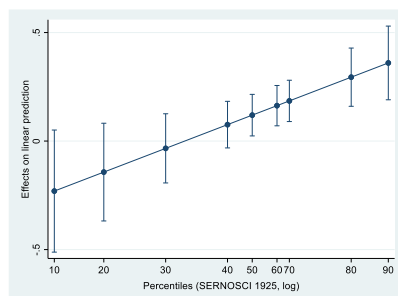


Fig.A.12 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1925 (Table 5, column V)

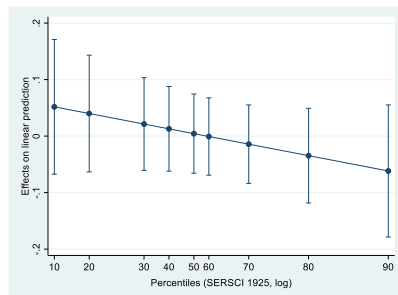


Fig.A.13 Marginal effect (with 95% CI) of hosting a classical universities on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1925 (Table 5, column VI)

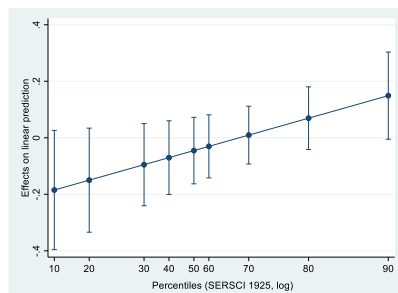


Fig.A.14 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of science-based self-employment (SERSCI) rate (log) in 1925 (Table 5, column VI)

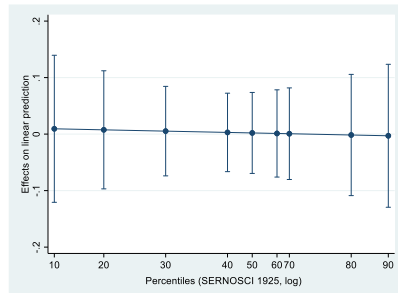


Fig.A.15 Marginal effect (with 95% CI) of hosting a classical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1925 (Table 5, column VI)

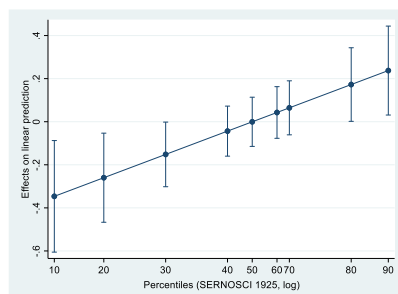


Fig.A.16 Marginal effect (with 95% CI) of hosting a technical university on current technology entrepreneurship at different levels of non-science-based self-employment (SERNOSCI) rate (log) in 1925 (Table 5, column VI)