The Impact of the Regulatory Environment on IT Entrepreneurship in the U.S. and EU[1]

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Entrepreneurship in the information technology (IT) sector has historically been an important source of innovation and growth,[4] and over the past several decades, the policy agenda in many countries has increasingly focused on how to incentivize entrepreneurial action.[5] Two important determinants of the level of entrepreneurship are a country's regulatory environment, which includes taxes on business, and its protections of property rights.[6] However, the majority of studies that analyze these determinants, as well as other drivers of entrepreneurship, lack data on levels of entrepreneurship and instead use imperfect proxies.[7] Furthermore, few studies have used data beyond 2002,[8] and to the best of our knowledge, no studies have focused specifically on the link between regulatory and legal environments and the level of entrepreneurship in the IT sector.

Our data allows us to address these shortcomings. In particular, using data from Dow Jones VentureSource, we identify the number of individuals, including their job titles, associated with a company when it received its first round of funding. We focus specifically on the IT sector in the post dot-com crash period from 2002 through 2008, which allows us to remove both the residual effects of the crash in 2000 and the post-2008 effects of the recession; this gives us a relatively steady "new state-of-the-world" perspective.

Given global policy concerns about increasing entrepreneurship, we first investigate factors that influence a country's level of IT entrepreneurship in the U.S. and EU. One possible explanation for differences in entrepreneurial activity between countries are differences in the favorability of a country's business environment that result from factors such as taxes on business and a country's protections of property rights.[9] We investigate this by analyzing the total number of newly funded entrepreneurs in the IT sector across countries over time using the following model:

$$\textit{Active Entrepreneurs}_{i,t} = \beta_0 + \beta_1\,(\textit{Regulatory Environment})_{i,t} + \beta_2\,(\textit{Stock})_{i,t} + \beta_3\,(\textit{Economy})_{i,t} + \beta_4\,(\textit{Time trend})_t + \beta_5\,(\textit{Fixed Effects})_{i,t} + \varepsilon_{i,t}$$

The dependent variable in this model, *Active Entrepreneurs*, is the number of newly funded entrepreneurs per capita. *Regulatory Environment* contains both corporate income tax rates and protection of property rights index as two measures which may influence business location choices. Tax rates are measured using the sum of (statutory) central and sub-central government corporate tax rates.[10] The property rights

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[4] See, for example, Gompers and Lerner (2001), who highlight that 60 percent of US venture capital funding was directed toward the IT sector in 1999, and that "venture capitalists backed many of the most successful high-technology companies during the 1980s and 1990s, including Apple Computer, Cisco Systems, Genetech, Microsoft, Netscape, and Sun Microsystems" (pp. 148-149).

[5] See, for example, The European Commission's "Risk Capital: Implementation of the Action Plan Proposals for moving forward," (October 1999), and Lundström, Almerud, and Stevenson (2008).

[6] See, for example, Bjørnskov and Foss (2007), Kreft and Sobel (2005), and Nystrom (2008).

[7] See, for example, Kreft and Sobel (2005, 2007), Campbell and Rogers (2007), and Nystrom (2008).

[8] *Ibid*. Using only data through the early 2000s is problematic because results may be driven by short-term phenomena, such as the dot-com bubble, and thus may not be applicable to broader circumstances.

[9] For example, specific to the IT sector, the EU has passed a series of directives on data privacy and the retention of internet data that affect online advertising and many other similar industries and may act as disincentives to IT entrepreneurship. These directives include 1995/46/EC, 2002/58/EC, and 2006/24/EC.

[10] These values are adjusted to include surtax rates and to net out any central government deductions for sub-central taxes. Data are obtained from the OECD.

index is scaled from 0-10 with higher values indicating a more "pro-business" regulatory climate in a given country.[11] *Stock* is a measure of the number of newly funded entrepreneurs in the previous year and allows us to control for the historical amount of entrepreneurial activity by country. This is important as research has shown that venture capital funding increases in areas with more entrepreneurship.[12] *Economy* contains both macroeconomic indicators and indicators for the structure of the economy. General macroeconomic conditions are controlled for using the unemployment rate and the GDP growth rate. The more general structure of the economy is measured using two variables that indicate the proportion of the employed population that works in the information and communication sector (as a proxy for the importance of the IT sector in the national economy), and the proportion of the employed population that are self-employed, which is frequently used to measure differences between countries where an "entrepreneurial attitude" is more or less common. *Time trend* is a linear time trend that controls for any systematic changes in IT entrepreneurship across all countries over time. Finally, as a robustness check, our model employs *Fixed Effects* for years and regions within Europe to capture differences in entrepreneurship across time and economic regions.

The results from the model described above are provided in Table 1 and indicate that the strength of business regulation (in the form of corporate taxes) and to a lesser extent the strength of property rights protection in a country are statistically significant determinants of the level of IT entrepreneurship. We also find evidence of a positive feedback cycle, where countries with more entrepreneurs in a year are significantly more likely to increase the number of new entrepreneurs in the following year. The macro economic variables generally exhibit the expected signs, but are statistically insignificant. With respect to the two measures of the more general structure of the economy, the ratio of workers employed in the information and communication sector has the greatest individual effect, which is consistent with our expectations that countries with a larger IT economy to have more IT entrepreneurs. Our measure of cultural propensity for entrepreneurship is insignificant, though with the expected sign.

The robustness of this model is first tested by including year fixed effects; we find that all coefficients retain their magnitude and significance. (See Table 1, Columns 2 and 6.) Including the EU regional controls (in column 3 and 7) diminishes the significance of the corporate tax measure somewhat and removes the marginal significance of property protection, indicating that these values vary more across region than over time. (See Table 1, Columns 3 and 7.) However, even controlling for year and regional fixed effects, higher corporate tax rates still significantly diminish a country's level of IT entrepreneurs.[13]

Given the explanatory significance of corporate taxes and property rights protection, and the observed differences between EU countries and the U.S., we investigate whether entrepreneurs have systematically left the EU to come to the U.S. Doing so, we find some evidence of IT serial entrepreneurs moving from the EU to the U.S.[14] Specifically, from 2002 to 2008, summary statistics indicate that only 0.66% of actively funded IT entrepreneurs in the U.S. chose to relocate to Europe, while 1.68% of all actively funded European IT entrepreneurs moved to the U.S. However, due to the relatively small population of movers between countries in any given year, the regression results were inconclusive.

[11] The property protection index comes from the Global Competitiveness Index which is the source for many comprehensive indexes such as Economic Freedom of the World Report and is widely used in the academic literature. See, for example, Bjørnskov and Foss (2007), Campbell and Rogers (2007), Kreft (2003), and Kreft and Sobel (2005). The data for this specific variable come from the World Economic Forum's Executive Opinion Survey which asks "How would you rate the protection of property rights, including financial assets, in your country?" [1 = weak and not enforced; 7 = strong and enforced]. The survey is carefully executed and responses are aggregated and weighted by country, however no supplemental confirmation of government policy is incorporated in this measure.

[12] See, for example, Kreft and Sobel (2005).

[13] To test for whether country fixed effects should be included, we regress the residuals from the model specifications in Table 1 against a full set of country controls. These results are presented in Table 2. Overall, year and regional fixed effects appear to sufficiently capture the variation in our data and the adjusted R-squared values indicate that inclusion of the country fixed effects as a set does not significantly improve our model once we control for region.

[14] Serial entrepreneurs are individual entrepreneurs who are entrepreneurs in multiple companies.

Table 1: Regression Results on the Number of Newly Funded Entrepreneurs per Capita

	Employment in Information and Communication				Self-Employment and Employment in Info/Comm Sector			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Controls	**Year Fixed Effects**	**Regional Fixed Effects**	**Year and Regional Fixed Effects**	**All Controls**	**Year Fixed Effects**	**Regional Fixed Effects**	**Year and Regional Fixed Effects**
Corporate Income Tax Rate (%)	-0.223***	-0.237***	-0.154*	-0.168*	-0.223***	-0.236***	-0.150*	-0.163*
	(0.0779)	(0.0846)	(0.0781)	(0.0874)	(0.0798)	(0.0859)	(0.0778)	(0.0864)
Property Rights Protection	1.019*	1.022*	0.675	0.675	1.014	0.988	0.732	0.744
	(0.577)	(0.541)	(0.744)	(0.653)	(0.626)	(0.600)	(0.847)	(0.767)
Ratio Working in Info/Comm	263.5**	262.4***	266.7**	266.2**	263.2***	260.9***	268.2**	267.6**
	(101.7)	(97.18)	(118.9)	(113.3)	(100.8)	(96.68)	(117.3)	(112.2)
Ratio of Self-Employed					-0.239	-1.397	2.535	2.554
					(5.134)	(5.625)	(6.003)	(5.884)
Lagged (1yr) Number of Active Ent.	0.00255***	0.00252***	-0.000829	-0.00184	0.00254***	0.00251***	-0.000867	-0.00189
	(0.000407)	(0.000463)	(0.000812)	(0.00119)	(0.000427)	(0.000483)	(0.000785)	(0.00117)
GDP Growth (%)	10.43	0.980	8.972	-2.017	10.31	-0.183	9.606	-0.581
	(14.14)	(16.13)	(14.77)	(18.19)	(14.31)	(16.48)	(14.59)	(17.49)
Unemployment Rate (%)	-0.0907	-0.0569	-0.0346	0.0203	-0.0913	-0.0604	-0.0341	0.0215
	(0.125)	(0.123)	(0.0949)	(0.0942)	(0.130)	(0.128)	(0.0953)	(0.0946)
Linear Time Trend	-0.492**		-0.528**		-0.492**		-0.529**	
	(0.222)		(0.257)		(0.223)		(0.257)	
Constant	-0.00658	-0.966	16.07*	20.11**	0.0711	-0.466	15.39	19.37*
	(3.798)	(3.127)	(9.682)	(10.01)	(4.317)	(3.799)	(10.71)	(10.94)
Observations	149	149	149	149	149	149	149	149
Adjusted R-squared	0.522	0.521	0.565	0.578	0.519	0.517	0.562	0.575

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:
[1] The dependent variable is the number of entrepreneurs per million residents of a country.
[2] Year fixed effects are with respect to 2002, regional fixed effects are with respect to the U.S. These coefficeints were not inlcuded for brevity, however, all regional dummies are significant and negative.
[3] Regions of Europe are as defined by the United Nations and we limit them to EU countries only: http://unstats.un.org/unsd/methods/m49/m49regin.htm#europe
Eastern EU contains Czech Republic, Hungary, Poland, and Slovakia. Northern EU contains Denmark, Estonia, Finland, Ireland, Sweden, and the United Kingdom. Southern EU contains Greece, Italy, Portugal, Slovenia, and Spain. Western EU contains Austria, Belgium, France, Germany, Luxembourg, and the Netherlands.
[4] The European nations of Bulgaria, Latvia, Lithuania, Malta, and Romania are omitted from all regressions due to missing corporate tax data.

Table 2: Regression Results from the Residuals of Table 1 Models on Country Dummies

	Employment in Information and Communication				Self-Employment and Employment in Info/Comm Sector			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Controls	Year Fixed Effects	Regional Fixed Effects	Year and Regional Fixed Effects	All Controls	Year Fixed Effects	Regional Fixed Effects	Year and Regional Fixed Effects
Austria	-2.152	-2.305	0.0420	0.0428	-2.143	-2.248	-0.0324	-0.0323
	(1.500)	(1.685)	(0.806)	(0.989)	(1.498)	(1.673)	(0.805)	(0.986)
Belgium	0.318	0.0938	1.711**	1.565**	0.323	0.123	1.665**	1.526**
	(1.395)	(1.506)	(0.754)	(0.768)	(1.393)	(1.494)	(0.754)	(0.770)
Czech Republic	-1.051	-1.059	0.524	0.726	-1.053	-1.070	0.458	0.663
	(1.291)	(1.503)	(0.457)	(0.754)	(1.289)	(1.492)	(0.458)	(0.750)
Denmark	1.192	0.968	0.737	0.607	1.184	0.917	0.783	0.657
	(2.070)	(2.113)	(1.666)	(1.583)	(2.069)	(2.107)	(1.660)	(1.575)
Estonia	-1.023	-0.904	-2.393	-2.236	-1.036	-0.964	-2.249	-2.101
	(1.820)	(1.968)	(1.455)	(1.563)	(1.817)	(1.953)	(1.465)	(1.575)
Finland	1.871	1.671	1.319	1.179	1.879	1.721	1.232	1.081
	(2.172)	(2.155)	(1.876)	(1.695)	(2.171)	(2.147)	(1.876)	(1.693)
France	-1.047	-1.339	1.373***	1.383**	-1.054	-1.377	1.475***	1.490**
	(1.284)	(1.493)	(0.484)	(0.677)	(1.282)	(1.480)	(0.485)	(0.678)
Germany	-3.412**	-3.640**	-1.326*	-1.345	-3.409**	-3.616**	-1.341*	-1.369
	(1.380)	(1.581)	(0.717)	(0.876)	(1.378)	(1.571)	(0.720)	(0.876)
Greece	0.358	0.0235	0.608	0.525	0.398	0.247	0.276	0.198
	(1.285)	(1.520)	(0.503)	(0.758)	(1.283)	(1.508)	(0.513)	(0.757)
Hungary	-3.912***	-4.137***	-1.558***	-1.579**	-3.928***	-4.235***	-1.429**	-1.441*
	(1.345)	(1.512)	(0.595)	(0.742)	(1.343)	(1.499)	(0.602)	(0.745)
Ireland	0.981	0.620	1.154	0.902	0.995	0.692	1.062	0.826
	(2.375)	(2.623)	(2.061)	(2.342)	(2.375)	(2.620)	(2.058)	(2.338)
Italy	-0.815	-1.161	-0.814	-0.894	-0.800	-1.085	-0.927*	-0.991
	(1.299)	(1.519)	(0.547)	(0.806)	(1.297)	(1.504)	(0.558)	(0.819)
Luxembourg	-2.123	-2.150	-0.300	-0.200	-2.123	-2.152	-0.231	-0.130
	(5.373)	(5.194)	(5.234)	(4.912)	(5.373)	(5.192)	(5.235)	(4.909)
Netherlands	-3.739***	-3.863**	-1.499**	-1.446*	-3.734***	-3.830**	-1.535**	-1.484**
	(1.340)	(1.484)	(0.702)	(0.749)	(1.338)	(1.473)	(0.707)	(0.749)
Poland	-0.281	-0.532	1.318***	1.217*	-0.263	-0.427	1.119**	1.022
	(1.275)	(1.477)	(0.478)	(0.704)	(1.273)	(1.466)	(0.484)	(0.702)
Portugal	0.672	0.266	1.255**	1.105	0.668	0.233	1.360**	1.213
	(1.312)	(1.524)	(0.571)	(0.812)	(1.310)	(1.511)	(0.578)	(0.818)
Slovakia	-1.402	-1.579	0.0931	-0.0161	-1.409	-1.611	0.172	0.0477
	(1.283)	(1.504)	(0.483)	(0.810)	(1.281)	(1.492)	(0.483)	(0.804)
Slovenia	-2.353*	-2.377	-1.555**	-1.235	-2.350*	-2.354	-1.477**	-1.175
	(1.334)	(1.601)	(0.621)	(0.992)	(1.332)	(1.589)	(0.625)	(0.995)
Spain	0.646	0.337	0.767	0.724	0.641	0.302	0.886	0.841
	(1.302)	(1.522)	(0.552)	(0.812)	(1.300)	(1.508)	(0.559)	(0.820)
Sweden	2.292	2.107	1.848	1.793	2.283	2.058	1.924	1.866
	(2.011)	(1.992)	(1.615)	(1.434)	(2.009)	(1.980)	(1.617)	(1.440)
United Kingdom	-3.437**	-3.561**	-2.664***	-2.245***	-3.430**	-3.515**	-2.752***	-2.328***
	(1.392)	(1.607)	(0.618)	(0.816)	(1.390)	(1.595)	(0.617)	(0.813)
Constant	0.869	1.051	-4.26e-09	1.92e-08	0.867	1.042	1.49e-08	6.39e-09
	(1.271)	(1.451)	(0.452)	(0.611)	(1.268)	(1.439)	(0.454)	(0.611)
Observations	149	149	149	149	149	149	149	149
Adjusted R-squared	0.0729	0.0706	-0.0173	-0.0308	0.0730	0.0713	-0.0192	-0.0322

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes:
[1] The dependent variable for each model is the residuals from the specific corresponding model (1-8) in Table 1.
[2] Country fixed effects are with respect to the U.S.
[3] The European nations of Bulgaria, Latvia, Lithuania, Malta, and Romania are omitted from all regressions due to missing corporate tax data.