performance. According to [7], venture capital is likely to improve the international competitiveness, to attract higher foreign direct investment inflows and to stimulate technologies. These start-up companies often take new innovations to market and could be important conduits to exploit and disseminate benefits from technological breakthroughs. Given this potential, the presence of venture capital could spur innovation since it could increase profitable opportunities from new discoveries. Venture capital could have contributed to 8% of industrial innovation in the late 1980's even though it only measured less than 3% of R & D during this period [1]. Venture capital contributed to productivity growth in Taiwan [9]. The rest of this paper is organized as follows. Section 2 presents the empirical methodology. Section 3 presents results and Section 4 offers concluding discussion.

2. Empirical Methodology and Data

We consider a cross section of 50 states, Washington D.C., and Puerto Rico in the United States from 2006 to 2008. We chose the years between 2006-2008 since it was the latest available years in the data set (see Tables 1 and 2 for descriptive statistics). Our dependent variable is the number of patents issued by each state in the United States and our data have been reported by [10-12]. When patent disbursements are viewed geographically, a little more than one-fourth of patents went to California; a little less than one-third goes to Texas, New York, Washington, Massachusetts, Michigan, Illinois, New Jersey, Minnesota, and Pennsylvania (Figure 1). The poorest19 states in patenting hardly pass the number of patents in Pennsylvania (the 10th lowest in the leading states) (Figure 2).

Table 1: Descriptive statistics

	Utility patents issued to state residents, 2008	Employed SEH doctorate holders, 2006a	S & E doctorates awarded, 2007	SEH postdoctorates in doctorate-granting institutions, 2006	SEH graduate students in doctorate-granting institutions, 2006	Population, 2008 (thousands)	Civilian labor force, 2008 (thousands)
Mean	1519.19	12126.8	621.62	964.31	10540.14	5961.882	3019.6
Median	586	8270	347	367	6659	4269	2043
Maximum	19181	87370	4283	7550	52480	36757	18392
Minimum	20	730	29	0	661	533	293
Std. Dev.	2835.34	14750.9	771.69	1509.668	11522.08	6724.685	3346.73

Table 2: Descriptive statistics

	Federal R & D obligations, 2006	Industry R & D, 2006	Academic R & D, 2007	SBIR awards, 2000-07	Income per capita, 2007	Gross domestic product, 2007 Total ($billions)	Venture Capital Total ($millions)
Mean	2106.78	4781.43	966.62	865.6	37825.3	269.47	520.37
Median	636	1774	587	314	36272	158	16
Maximum	21157	58424	6733	8818	62484	1813	14678
Minimum	36	27	80	28	28541	25	1
Std. Dev.	3614.47	8875.3	1189.7	1505.4	6659.69	327.97	2096.55

When patent disbursements are viewed geographically, a little more than one-fourth of patents went to California; a little less than one-third goes to Texas, New York, Washington, Massachusetts, Michigan, Illinois, New Jersey, Minnesota, and Pennsylvania (Figure 1). The poorest19 states in patenting hardly pass the number of patents in Pennsylvania (the 10th lowest in the leading states) (Figure 2).

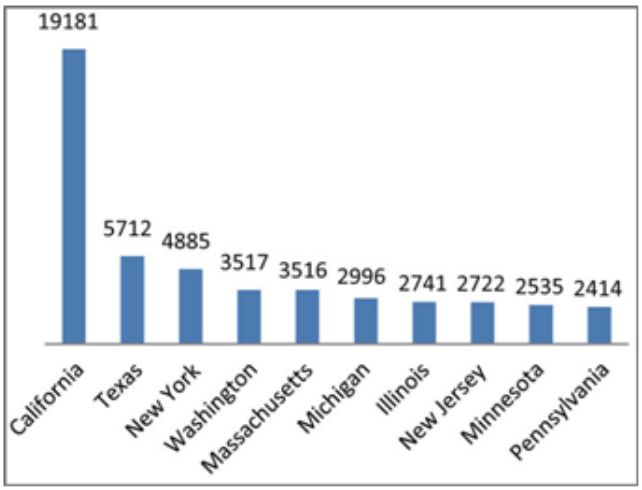

Figure 1: Top 10 leading states in patenting

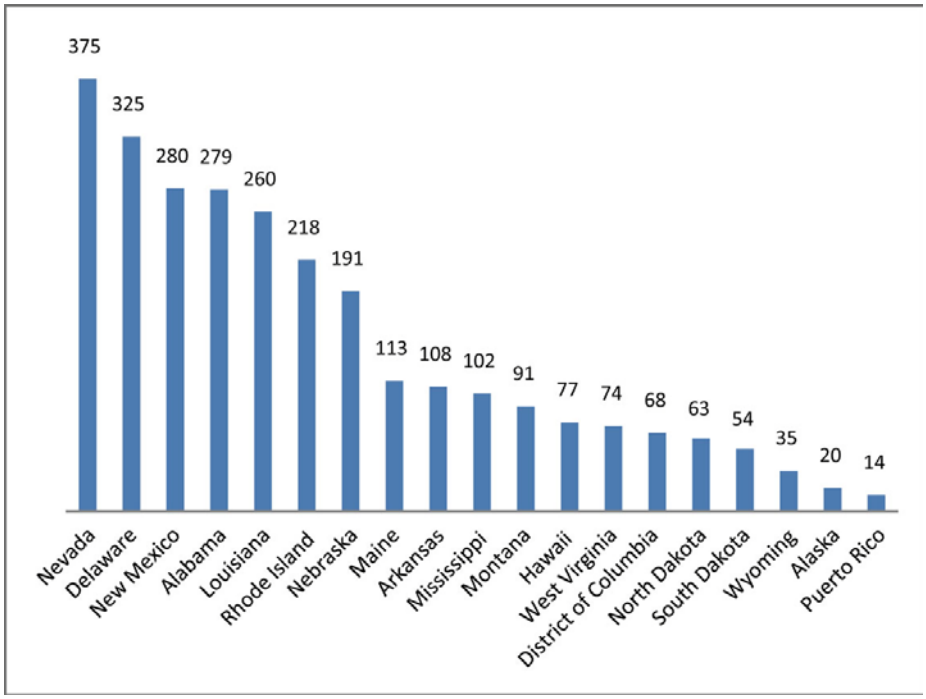

Figure 2: Poorest states in patenting (2008) (19 states)

3. Results

Table 3 presents' findings for the full sample of states and assesses human capital and income variables. Table 4 considers research fund variables.

Table 3: Dependent variable: number of patent of state.

	1	2	3	4	5	6	7
Constant	666.53 (0.99)	102.42 (0.29)	–66.89 (–0.21)	–133.21 (–0.43)	–189 (–0.62)	–288.56 (–0.58)	–223.5 (–0.48)
CAP_State	–0.036 (–1.61)	–0.0028 (–0.29)	0.003 (0.34)	0.005 (0.62)	0.0072 (0.81)	0.0062 (0.46)	0.0042 (0.34)
GDP_State	1.14 (0.63)	3.103 (2.83)***	3.79 (2.96)***	4 (8.48)***	4.82 (4.1)***		
Ph.D._SE	0.15 (2.77)***	0.022 (0.81)				0.03 (1.05)	0.029 (0.92)
VC		0.77 (13.13)***	0.81 (17.41)***	0.83 (18.87)***	0.79 (14.98)	0.77 (14.02)***	0.78 (14.06)***
Graduated_SE			0.025 (0.04)				
Postdoctorate –SE				–0.067 (–0.67)			
Gradaute_SE					–0.026 (–0.89)		
POP_State						0.12 (2.13)***	
LABOR_State							0.26 (2.11)***
R-Square	0.86	0.96	0.96	0.96	0.96	0.96	0.96
Number of Observation	52	52	52	52	52	52	52

Heteroskedastic-consistent standard errors are in parentheses. ***, **, *denotes significance at the 1%, 5%, and 10% levels.

Table 4: Dependent variable: number of patent of each state

	8	9	10	11	12
Constant	392.94 (1.22)	85.65 (0.26)	367.99	311 (0.7)	150.6 (0.38)
CAP_State	–0.008 (–0.97)	–0.0024 (–0.27)	–0.01	–0.009229 (–0.74)	–0.003 (–0.32)
GDP_State	5.47 (5.03)***	2.53 (1.86)*	2.73	3.4 (3.12)***	2.41 (2.15)***
VC	0.67 (7.24)***	0.8 (13.04)***	0.44 (5.02)***	0.75 (11.17)***	0.84 (12.9)***
Ph.D._SE	0.04 (1.61)	0.048 (1.21)	–0.0073 (1.1)	0.056712 (1.2)	0.05 (1.47)
Federal_Budget	–0.019 (–2.92)**	–0.08 (–1.44)			
Federal_ R & D		–0.08 (–1.44)			
Industry_R & D			0.14 (4.86)****		
Academic_R & D				–0.46 (–1.06)	
SBIR_Reward					–0.23 (–1.5)
R-Square	0.96	0.97	0.98	0.96	0.96
N. of Obs	52	52	52	52	52

Heteroskedastic-consistent standard errors are in parentheses. ***, **, *denotes significance at the 1%, 5%, and 10% levels.

4. Conclusions

We consider a cross section of 50 states, Washington D.C., and Puerto Rico in the United States from 2006 to 2008 to search the link between patenting and venture capital. When patent disbursements are viewed geographically, a little more than one-fourth of patents went to California; a little less than one-third goes to Texas, New York, Washington, Massachusetts, Michigan, Illinois, New Jersey, Minnesota, and Pennsylvania. The poorest19 states in patenting hardly pass the number of patents in Pennsylvania (the 10th lowest in the leading states). When venture capital (VC) disbursements are viewed geographically, half of venture capital went to California (in patenting, California was granted one-third), and the other leading states received more than one-fourth of venture capital. This indicates that there is a strong, unequal distribution of venture capital availability across the United States. This time, we needed 35 states to capture the 10th lowest leading venture capital state—Minnesota Ours findings suggest that promoting venture capital might contribute to an increase in patenting. A one billion dollar increase in venture capital is associated with an increase in 440 patents whereas a one billion dollar increase in corporate R & D is associated with an increase in 140 patents. Koru and Lerner [1] find that a dollar of venture capital is seven times more powerful in stimulating pattern than a dollar of corporate R & D. Our research suggests that this difference is three times. Size of states (GDP, population and civil labor force) does matter rather than income per capita on patenting. The human capital variables (graduate degree holders in science and engineering) lose their significance when we include venture capital. We may comment that human resources may not be sufficient unless the supporting institutions exist. In this case, VC represents a funding, an operational and a risk sharing institution. The academic and federal research fund variables are not statistically significant with patenting. A plausible suggestion is that venture capitalists put more pressure and spend more time in pursuit of results; hence they discipline the firms' holders to follow the target in timely matters. Similarly, academic life is not as competitive as business life. Therefore, academics might work with less time pressure. Another reason might be that academics try to publish papers out of work rather than just focusing on patenting. Some research in academia may deal with basic science rather than aiming for patenting and innovation, opposite to the goal of venture capitalists. So, an academic research project may aim for a pure theoretical purpose.

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