

The US bankruptcy law and private equity financing: empirical evidence

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Abstract The generous personal bankruptcy law in the United States is important to entrepreneurs because failed entrepreneurs can resort to this system to shelter part of their wealth against negative consequences of business failure. Fan and White (Journal of Law and Economics XLVI:543–567, 2003) documented that high bankruptcy exemptions provide incentives for entrepreneurs to start/own new businesses. The partial wealth insurance effect provided by the bankruptcy exemptions also has a significant and negative impact on the entrepreneurs' access to bank credits (Berkowitz and White, The Rand Journal of Economics 35(1):69–84, 2004; Gropp Scholz and White, The Quarterly Journal of Economics 112(1):217–251, 1997). In this article, we investigate whether and to what extent the US bankruptcy law has any effect on venture capital (VC) investment. Making use of company level information, we document that the amount of venture financing received is negatively related to the

bankruptcy exemption levels, and the number of rounds of financing as well as the number of VC funds involved is negatively associated with bankruptcy exemptions. Further, we report consistent evidences based on state level data with regard to the effects of the US personal bankruptcy law.

Keywords Bankruptcy · Venture capital

JEL Classifications G24 · G28 · G31 · G32 · G35 · L26

1 Introduction

Small new ventures receive significant attention recently because of their increasing importance on job creation and economic growth. It is widely recognized that new ventures are subject to the “liability of newness and smallness” (Freeman et al. 1983), and consequently, they are associated with high uncertainty as well as high failure rates. When these small ventures experience financial distress, entrepreneurs may resort to the personal bankruptcy law to relief their pain, at least in part. In the US, when filing under Chapter 7, debtors repay debts and give up all their property beyond a certain level predetermined by the bankruptcy law, which is known as bankruptcy exemption. Bankruptcy exemptions allow failed entrepreneurs to shield part of their assets, thereby functioning as a cushion against the negative consequences of business failure. This

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characteristic of the US personal bankruptcy law system makes it very important for entrepreneurship.

Quite a few previous studies, theoretically and empirically, document the effects of the US personal bankruptcy law on entrepreneurship. On the one hand, higher bankruptcy exemptions mean that more assets will be sheltered, and hence provide a stronger incentive for individuals to request for bank credit and to become self-employed. Fan and White (2003) document a positive relationship between the probability to start a new business and homestead exemption levels. On the other hand, higher exemptions increase the likelihood that entrepreneurs will default. Consequently, banks will be unwilling to extend credit to entrepreneurs facing high exemption levels. Berkowitz and White (2004) formally model this situation and present empirical evidence that higher personal bankruptcy exemptions lead to credit rationing and higher interest rates, using data of 1993 National Survey of Small Business Finance (NSSBF). Therefore, bankruptcy law tends to impact both the supply and demand sides for bank credit (Gropp et al. 1997).

Private equity is another important source of fund for entrepreneurs to pursue their entrepreneurial vision. In the last two decades, the venture capital industry has experienced an explosive growth and developed as an important intermediary in financial markets. As a subset of private equity, venture capital plays an important role in facilitating start and growth of those innovative firms with little hope to be financed by conventional investors (Gompers and Lerner 2001). In a cross-country study, Armour and Cumming (2006) document that debtor friendly bankruptcy law actually stimulates demand for venture capital. In this article, we take this line of research one step further by investigating the impact of the US personal bankruptcy law on the supply side of venture capital investments, making use of variation of bankruptcy exemptions across the states.

In general, we find that bankruptcy exemptions have a significant effect on both the amount and structure of venture financing. The amount of total venture financing received by portfolio companies is negatively related to bankruptcy exemptions. The number of financing rounds as well as the number of VC funds involved is negatively associated with bankruptcy exemptions. In order to further explore the effects of bankruptcy exemptions on regional entrepreneurial activities, we present results on how bankruptcy

exemptions may affect venture capital inflows using state level evidences. We find that bankruptcy exemptions are negatively associated with VC investment, and this finding is consistent with our prior results. Moreover, we document a positive relation between infusion of venture capital and firms' "going public," and this confirms the supportive role played by venture capitalists to bring their portfolio companies to public (Barry et al. 1990; Ljungqvist and Wilhelm 2003).

The rest of the article is organized as follows. Section 2 provides background information about the US personal bankruptcy law and related literature, and further develops our hypotheses. In Sect. 3, we describe our data collection and provide definitions of variables as well as some descriptive statistics of our sample. Section 4 presents our empirical results. Section 5 summarizes and concludes.

2 Theories and hypotheses development

2.1 Legal background

Currently, the US has one of the most generous personal bankruptcy law systems in favor of debtors. There are two separate personal bankruptcy procedures, known as Chapter 7 and Chapter 13, and debtors are allowed to choose between them (White 2005). Debtors who file under Chapter 7 should use their current wealth to repay debt to the extent that their wealth exceeds bankruptcy exemption levels. All unsecured debts that cannot be paid will be discharged, and debtors thus obtain a fresh start. Though the bankruptcy law has uniform rules across the US, individual states are authorized to set their own bankruptcy exemptions. Exemption levels are the only aspect of personal bankruptcy law that varies across the states. In most states, there are various exemption levels according to certain types of debtors' equity, such as equity in the debtors' principle residence, equity in motor vehicles and personal property. Among different kinds of equity exemptions, homestead exemptions take the largest portion and vary significantly in different states from zero to unlimited.¹ Debtors can also choose to file

¹ In 1996, seven states including Arkansas, Florida, Iowa, Kansas, Oklahoma, South Dakota, Texas have unlimited homestead exemptions, while Maryland, Delaware, New Jersey, and Pennsylvania have zero homestead exemption.

bankruptcy under Chapter 13, which allows debtors to use future earnings to repay debts but keep their current assets. Debtors should arrange a 3–5 year plan for the repayment with the approval of courts. If debtors can successfully accomplish the repayment plan, the remainder of unpaid portion of debts will be discharged.

Chapter 7 is more favorable to entrepreneurs because failed businesses usually have large amount of debts and most of them are unsecured. In addition to keeping a portion of their current assets, those failed entrepreneurs will have better chance to obtain new credit if they do not need to use their future incomes to repay debts. Since the amount repaid to creditors under Chapter 13 should be no less than the amount that would have been repaid under Chapter 7, exemption levels should have a similar effect regardless of which chapter is chosen. As evidenced by the statistical data, around 70% of all bankruptcy filings occur under Chapter 7.² Hence, in this article, we base our analyses on the assumption that filing for bankruptcy is the decision made under Chapter 7.

2.2 Why is personal bankruptcy law important to entrepreneurship?

Innovation has become the driving force of entrepreneurial activities (Cable and Shane 1997; Schumpeter 1942). To pursue one's entrepreneurial vision means to explore some untested approaches involving new means-end solutions (Saravathy 2001). Entrepreneurial activities involve a high level of uncertainties and are likely to fail frequently. Therefore, such exploration activities may require fundamentally different incentive schemes from those based on standard pay-for-performance. Manso (2005) develops a theoretical model and argue that "the optimal compensation scheme that induces exploration exhibits substantial tolerance (or even reward) for failure and reward for long-term success." Moreover, in his influential paper, Baumol (1990) argues that the relative payoffs offered by societies (e.g., policy and regulation) can heavily influence the allocation of entrepreneurship. If financially distressed entrepreneurs should liquidate all their assets to repay debt, they would be in a fragile situation and the negative

consequences would even be extended to their families. In addition, if bankruptcy law hinders failed entrepreneurs to re-enter the pool of entrepreneurs, they are then allowed to fail for only once. Harsh bankruptcy law will have significant disincentives for debtors to become self-employed and conduct innovative activities. Using household panel data from the Survey of Income and Program Participation, Fan and White (2003) document that households live in states with higher exemptions are more likely to start or own businesses.

In a recent study, Lawless and Warren (2005) challenge the conventional story that filing rate of business bankruptcy experiences a steadily decline in recent two decades.³ They argue that there is a systematic error for the current reporting system which dramatically underestimates the business filings for bankruptcy. They provide evidence that 19.5% of the cases for personal bankruptcy filings are actually connected with certain underlying businesses. Their findings heighten the importance of personal bankruptcy law for numerous entrepreneurs resorting to this system to relieve their pain and depression from failed businesses and imply that the US personal bankruptcy is crucial for entrepreneurial activities.

2.3 Venture capital investment: the relevance of personal bankruptcy law

The US personal bankruptcy law system allows failed entrepreneurs to keep at least part of their assets to prevent their consumption levels from dropping too low. This insurance effect and related consequences may impact on entrepreneurial incentives and on demand for venture capital investment.

At the pre-investment stage, an entrepreneur should use her personal wealth to cover any expense in developing certain business plans, sometimes a prototype of a product, in order to attract venture financing. Moreover, some studies documented that an entrepreneur's personal wealth invested into the project is an important signal to outside investors as

² Statistical Abstract of the US, 1994: Table 850; Personal Bankruptcy: A literature Review, CBO paper, 2000.

³ According to Lawless and Warren (2005), in the period 1954–1985, business filings based on Administrative Office averaged 12.3% of all filings. For the year 1986 through 2003, business filings average only 6.8%, and steadily decline to 2.3% in 2003.

both the project quality and her personal commitment (Amit et al. 1990; Prasad et al. 2000). After spending a large amount of personal resources, entrepreneurs would be in a fragile position with high likelihood of delinquency if they fail to secure venture capital financing (Armour and Cumming 2006). At the post-investment stage, existing research ties an entrepreneur's personal wealth closely to the outcome of the entrepreneurial venture (Holtz-Eakin et al. 1994). Moskowitz and Vissing-Jorgensen (2002) documented that investments in private equity tend to be extremely concentrated. They observed that a large percent of net worth owned by households is in the format of private equity, and moreover, households on average invest more than 70% of their private holding in a single private company in which they possess an active management interest. Thus, failure of venture-backed companies will have a significantly negative impact on the personal wealth of those entrepreneurs. A more liberal personal bankruptcy system not only provides consumption insurance for failed entrepreneurs, but also allows them to re-engage into innovative businesses with a fresh start.

The above analysis predicts that debtor-friendly personal bankruptcy law will increase demand for venture capital investment. Armour and Cumming (2006) in their cross-country study find consistent results that a liberal personal bankruptcy law is positively associated with venture capital investment. However, to our best knowledge, there is no study that focuses on the potential impact of personal bankruptcy law on the supply side of venture financing. A large body of empirical literature indicates that bankruptcy law may have wide-ranging effects on individuals' behavior and consequently, their ability to access to external financial resources (White 2005). Further understanding on how venture capitalists consider the effects of bankruptcy law on entrepreneurs' behavior and make investment decisions has important implications for both policymakers and academics. As shown by Berkowitz and White (2004), generous bankruptcy exemptions can reduce the supply of credit because of the increased likelihood of default of entrepreneurs. If small businesses are located in the states with high bankruptcy exemptions, they are more likely to be turned down for credit. In addition, entrepreneurs are more likely to obtain less credit with higher interest rates. Therefore, it is our attempt to empirically

investigate the impact of the US personal bankruptcy law on the supply side of venture financing making use of the variation of personal bankruptcy exemptions across the states.

2.4 Bankruptcy exemptions and venture capital investment

Venture capital, as a subset of private equity, is specialized in funding new ventures with high growth potential as well as great uncertainty. The explosive growth of venture capital industry in the last several decades draws the attention of many researchers. One stream of research focuses on the venture capitalist-entrepreneur relationship (Cable and Shane 1997; Sapienza and Korsgaard 1996) and its effects on the structure of venture financing (Kaplan and Stromberg 2001, 2003). The principal-agent framework is often used to analyze the relationship between entrepreneurs and venture capitalists (Admati and Pfleiderer 1994; Gompers 1995; Kaplan and Stromberg 2004; Neher 1999), because the two fundamental problems in the corporate finance theory, namely agency problems and information asymmetries, also exist in entrepreneurial situations (Denis 2004).

Agency theory is concerned with incentives and monitoring problems arising from asymmetric information. The entrepreneur, who takes on the agent's role, may not always serve for the best interest of the venture capitalist (the principal) as long as her opportunistic behavior will not be fully sanctioned. Individuals are motivated to become entrepreneurs not solely for monetary returns. Non-peculiar benefits may be an important initiative for entrepreneurs to enter into business (Hamilton 2000; Moskowitz and Vissing-Jorgensen 2002). For example, entrepreneurs may engage in wasteful expenditures (e.g., perk consumptions) (Gompers and Lerner 2001). Entrepreneurs may have incentives to continue those projects that have negative present values (Gompers 1995). Similarly, entrepreneurs may conduct projects with high private benefits (e.g., scientific research can enhance her status or reputation) but low financial return (Roberts and Weitzman 1981; Sapienza and Gupta 1994). If an entrepreneur raises funds from outside investors, she has an incentive to use superior information to maximize her own utility, because the

entrepreneur may benefit disproportionately from her action without bearing the entire cost (Jensen and Meckling 1976).

In summary, the extant literature indicates that even though entrepreneurs may hold a large stake in the portfolio companies and their personal wealth is tied closely to the outcome of their entrepreneurial ventures, their interests may not be perfectly aligned with venture capitalists. What is more, because personal bankruptcy exemptions provide consumption insurance to entrepreneurs by sheltering part of their personal wealth in case that their businesses fail, those entrepreneurs located in states with high bankruptcy exemptions may have more incentives to pursue their private benefits which may have no value to venture capitalists.

The venture capital industry has evolved operating procedures and contracting practices that are well adapted to a volatile environment with great turbulence which is characterized by uncertainty and information asymmetry (Sahlman 1990; Lerner and Schoar 2005). Wealth constrained entrepreneurs are expected to hold undiversified portfolios with large percentage of their personal wealth invested in the new ventures. As discussed above, generous bankruptcy exemptions may weaken the alignment between the principal and the agent, and increase agency cost associated with the new venture. The essence is not whether the agent actually behaves opportunistically but whether he could possibly to do so. In this situation, we are not saying that venture capitalists will base their project selections solely on the state bankruptcy law. However, conditioning on providing capital to entrepreneurs, venture capitalists will accordingly react by anticipating the likelihood of the agents' behavior to deviate and adapt their claims and monitoring efforts. Hence, holding other things constant, the amount received by an entrepreneurial company should reflect the extent of perceived agency cost induced by generous bankruptcy exemptions. We thus predict that total amount of financing received by entrepreneurial companies will be negatively affected by state bankruptcy exemptions.

Hypothesis 1 The amount of total venture funding received by portfolio companies is negatively related to state bankruptcy exemption levels according to the states in which the entrepreneurial firms are located.

Agency problem associated with new ventures also necessitates “providing monitoring and limiting the opportunistic behavior of entrepreneurs” (Gompers and Lerner 2004). Staged infusion of capital can be the most potent control mechanism (Sahlman 1990). By staging the capital infusion, venture capitalists hold an option to defer or abandon the project, and thus put a “tight leash” on entrepreneurs (Neher 1999). In practice, venture capitalists typically provide several rounds of funding to portfolio companies according to their performance and need of funding. Higher agency risk should be reflected in less rounds of financing (Gompers 1995). If generous bankruptcy exemptions allow entrepreneurs to conduct opportunistic behavior with less cost (more consumption insurance), and venture capitalists can perceive this situation, we predict that the number of venture financing rounds will be negatively affected by state bankruptcy exemptions.

Hypothesis 2 The number of financing rounds is negatively related to the state bankruptcy exemption levels according to the states in which the entrepreneurial firms are located.

Syndication of investment is another important feature and common practice of venture financing. The willingness of participation for other venture capitalists may function as a certification of the project quality and a mechanism to share risk (Lerner 1994; Wilson 1968), especially when there is high level of informational uncertainties (Venkataraman 1997). Venture capitalists are sophisticated and experienced investors (Sahlman 1990), and their willingness to share investment risk is more common in the situation that both entrepreneurs and venture capitalists are uninformed about the risk. If state bankruptcy exemptions can affect the incentives of entrepreneurs to pursue their private benefits, venture capitalists will anticipate the entrepreneurs' opportunistic behavior and be less willing to participate in joint investment when perceived agency risk is high. Hence, we predict a negative relationship between bankruptcy exemptions and the number of VC funds involved.

Hypothesis 3 The number of venture capital funds involved is negatively related to the personal bankruptcy exemption levels according to the states in which the entrepreneurial firms are located.

3 Data collection and sample description

3.1 Data collection

We rely on SDC VentureXpert⁴ as our main source for information on venture capital investment. SDC VentureXpert database provides detailed deal level information on venture financing: (1) the number of rounds of funding received; (2) the average amount of funding received per round; (3) the date of the first and the last round of funding; (4) the number of venture capital funds involved; (5) the state code of each company; (6) the industry description based on Venture Economics Industry Classification (VEIC). In order to be included in our sample, venture-backed companies should receive the first round and the last round of investments within the period 1984–2003.⁵ Buyout investments are considered as liquidation events, and thus excluded. We also retrieve company specific information (e.g., founding date) and financial information on sales. The availability of company specific information reduces our sample size. However, this further restriction does not change our final results. Our sample contains 2,753 venture-backed companies with complete information.

3.2 Variable definitions

In order to test the effects of the variety of state personal bankruptcy exemption levels on the amount and structure of venture financing, we use the following dependent variables in our empirical analyses. The amount of venture financing received by entrepreneurial companies is measured by the total amount of commitment made by venture capital funds in natural logarithm form. The natural log is

taken to both normalize the distribution and to ensure that the impact of bankruptcy exemption would vary in proportion to its size, rather than varying as an additive function of level. Furthermore, we are able to obtain sales information for portfolio companies in our sample. We scale the total VC financing by company sales and take natural logs of the ratio as another measure of the amount of venture capital investments in order to reduce the impact of company size. ROUND is the total number of financing rounds received by venture-backed companies. In addition, we collect information on the number of venture capital funds (NOFUND) involved in the investment.

Our main explanatory variable is bankruptcy exemption (EXEMPTION) defined as the sum of both the homestead exemption and the personal property exemption for a state. In our study, we use bankruptcy exemption levels of Chapter 7 reported by Hynes, Malani and Posner (2004) for the year 1996. Table 1 shows the two state bankruptcy exemptions for 1996 in nominal values. The homestead exemption is for equity in owner-occupied principle residences, and it is determined by the state in which the venture capital-backed companies are located. The homestead exemptions vary widely across the states from zero to unlimited, with a median of \$40,000. Of all the states, Arkansas, Florida, Iowa, Kansas, Oklahoma, South Dakota, Texas have unlimited homestead exemptions. Since several states have unlimited homestead exemptions, we set the homestead exemption level at \$1,000,000 (compared to the highest amount of \$200,000) to capture the unlimited effect. The personal property exemption is the sum of state exemptions for cash, equity in vehicles, and wildcard (any personal property for a specified amount of money). The personal property exemptions do not vary widely as compared to homestead exemptions and take a relatively small portion in the total exemptions. The personal exemptions range from zero to \$40,000 with a median of \$5,000. Louisiana does not have a clear limit to its personal exemption, and we enter the highest amount \$40,000. Only four states, Mississippi, Texas, Kansas, and Louisiana, have personal exemptions above \$20,000.

An important concern in our study is whether bankruptcy exemptions can be treated as exogenous. As the change of bankruptcy exemptions is unlikely to be affected by venture capital market, we therefore follow previous studies (Berkowitz and White 2000;

⁴ VentureXpert is a private database of Venture Economics, which is a division of Security Data Company. Venture Economics gather quarterly reports from VC institutions and major institutional investors on their portfolio holdings since 1960.

⁵ As part of the 1978 Bankruptcy Code, federal bankruptcy law has a uniform bankruptcy exemption levels, and Congress gave the states the right to opt out of the federal exemption by adopting their own exemptions. By 1983, all the states did so, and 14 states allow creditors who file bankruptcy to make such choice. After 1983, only a few changes are made on the exemption levels each year by individual state, and this is the reason why we select our sample from 1984 to 2003 (Berkowitz and White 2004).

Hynes Manali and Posner 2004) and treat bankruptcy exemptions as exogenous throughout this article.

We collect company sales information from the VentureXpert database, and take logs of sales (LOGSALES) and use this variable as an additional

control. Moreover, we calculate company age (AGE) as the month difference between the founding date of a company and the date of its first financing round. Harris and Raviv (1991) and Gompers (1995) argue that the nature of firm assets have important

Table 1 Nominal homestead and personal property exemptions for a household (1996)^a

State	State code	Homestead exemption	Personal property exemption	Federal exemption
Alabama	AL	10,000	6,000	No
Alaska	AK	62,100	6,900	No
Arizona	AZ	100,000	3,000	No
Arkansas	AR	Unlimited	500	Yes
California	CA	75,000	3,800	No
Colorado	CO	60,000	2,000	No
Connecticut	CT	150,000	5,000	Yes
Delaware	DE	0	10,500	No
Florida	FL	Unlimited	4,000	No
Georgia	GA	10,000	2,800	No
Hawaii	HI	50,000	2,000	Yes
Idaho	ID	100,000	3,000	No
Illinois	IL	15,000	6,400	No
Indiana	IN	15,000	8,000	No
Iowa	IA	Unlimited	2,400	No
Kansas	KS	Unlimited	40,000	No
Kentucky	KY	10,000	7,000	No
Louisiana	LA	15,000	Unlimited	No
Maine	ME	25,000	5,800	No
Maryland	MD	0	11,000	No
Massachusetts	MA	100,000	1,400	Yes
Michigan	MI	7,000	0	Yes
Minnesota	MN	200,000	6,800	Yes
Mississippi	MS	150,000	20,000	No
Missouri	MO	8,000	4,150	No
Montana	MT	80,000	2,400	No
Nebraska	NE	20,000	0	No
Nevada	NV	125,000	2,000	No
New Hampshire	NH	60,000	10,000	No
New Jersey	NJ	0	2,000	Yes
New Mexico	NM	60,000	9,000	Yes
New York	NY	20,000	4,800	No
North Carolina	NC	20,000	3,000	No
North Dakota	ND	160,000	7,400	No
Ohio	OH	10,000	2,800	No
Oklahoma	OK	Unlimited	6,000	No
Oregon	OR	33,000	4,200	No
Pennsylvania	PA	0	300	Yes

Table 1 continued

State	State code	Homestead exemption	Personal property exemption	Federal exemption
Rhode Island	RI	150,000	0	Yes
South Carolina	SC	10,000	2,400	No
South Dakota	SD	Unlimited	4,000	No
Tennessee	TN	7,500	8,000	No
Texas	TX	Unlimited	30,000	Yes
Utah	UT	11,000	3,000	No
Vermont	VT	150,000	14,800	Yes
Virginia	VA	11,000	4,000	No
Washington	WA	60,000	5,000	Yes
West Virginia	WV	30,000	6,400	No
Wisconsin	WI	40,000	4,400	Yes
Wyoming	WY	20,000	4,800	No

^a Data source: Hynes et al. (2004)

Notes: Reports the bankruptcy exemption levels under Chapter 7. All amounts are nominal dollars, and for household of four. The personal property exemption includes only the state's exemption of wildcard (any personal property for a specified amount of money) and automobile exemptions

implications for venture financing. Limited by the availability of accounting data of these private firms, we follow their studies and use industrial information from COMPUSTAT database to control for the characteristics of company assets. Specifically, we calculate the industry average ratio of intangible assets to total assets (INTANGIBLE). It is worth noting that VentureXpert database uses its own industry classification coding system,⁶ and the information recorded in COMPUSTAT database is based on Standard Industry Classification (SIC) coding system. We manually match these two coding systems.

When making investment decisions, venture capitalists may consider the local economic environment. Thus, we use the unemployment rate for each individual state matched by state and year to control for statewide economic environment. We collect this information from the US Department of Labor, Bureau of Labor Statistics (<http://www.bls.gov>).

⁶ SDC VentureXpert uses a coding system based on Venture Economics Industry Classification (VEIC) rather than Standard Industry Classification (SIC). In order to reflect the investment focus, VEIC coding system use more detailed classifications for certain industries and less detailed classifications for some other industries, compared with SIC coding system. Both coding systems provide description on each industry classification. We match these two coding system manually by read the descriptions. We use 4-digital (SIC) group as industrial benchmark if an exact match between these two coding systems is available. If there is no exact match, we use three-digit SIC group or two-digit SIC group instead.

3.3 Sample description

Our final sample includes 2,753 venture-backed companies. Table 2 provides the distribution of our sample across different states. As the homestead exemptions account for the majority part of the bankruptcy exemption for most states, we divide all the states into five subgroups according to the homestead exemption levels: \$0; \$0–20,000; \$25,000–80,000; \$100,000–200,000; and unlimited. Within each subgroup, we provide information about the number of observations, average amount of venture financing for each company, and total venture financing for each state.

In Table 3, we present both the descriptive statistics in Panel A and pairwise correlation matrix in Panel B for our sample based on company level information.

4 Empirical results

4.1 Bankruptcy exemptions and total amount of venture financing

The analyses in this section focus on how the US personal bankruptcy law affects the supply of venture capital to entrepreneurial companies. The empirical tests consist of two multiple regression equations and Table 4 presents our results.

We use both total VC financing in logs and logged ratio of VC financing to sales as our dependent

Table 2 Commitment to venture-backed companies by state and homestead

State code	Number of observations	Total venture capital investment (\$million)	Average venture capital investment (\$million)
Homestead exemption (\$0)			
DC	1	109.0	109.0
DE	4	42.8	10.7
MD	65	2128.3	32.7
NJ	105	5016.5	47.8
PA	110	5920.7	53.8
Homestead exemption (\$0–20,000)			
AL	18	400.8	22.3
GA	66	2170.4	32.9
IL	71	3446.7	48.5
IN	12	1063.8	88.6
KY	9	554.8	61.6
LA	4	172.4	43.1
MI	22	1397.2	63.5
MO	17	3856.7	226.9
NC	51	5470.6	107.3
NE	5	61.8	12.4
NY	114	6436.8	56.5
OH	57	948.5	16.6
SC	6	521.7	87.0
TN	26	835.0	32.1
UT	11	250.5	22.8
VA	57	2859.3	50.2
Homestead exemption (\$25,000–80,000)			
AK	2	50.0	25.0
CA	858	33200.5	38.7
CO	84	2592.7	30.9
HI	1	4.3	4.3
ME	9	124.5	13.8
MT	1	32.1	32.1
NH	21	547.0	26.0
NM			
OR	32	654.0	20.4
WA	61	2337.6	38.3
WI	15	323.4	21.6
WV	1	0.0	0.0
Homestead exemption (\$100,000–200,000)			
AZ	34	2192.5	64.5
CT	52	2421.8	46.6
ID	4	551.7	137.9
MA	236	7392.1	31.3
MN	62	2367.0	38.2
MS	3	22.8	7.6
NV	7	83.0	11.9
RI	9	170.2	18.9
VT	4	139.4	34.8

Table 2 continued

Notes: We divide all the states into several groups according to the state homestead exemptions. We then report our samples distribution. Specifically, for each state, we report the number of observations, total venture capital investments (\$million), and average venture capital investment (\$million)

State code	Number of observations	Total venture capital investment (\$million)	Average venture capital investment (\$million)
Homestead exemption (Unlimited)			
AR			
FL	73	2972.6	40.7
IA	7	79.7	11.4
KS	9	91.7	10.2
OK	5	32.1	6.4
SD	1	103.0	103.0
TX	151	4573.2	30.3

variables. We enter EXEMPTION as our main explanatory variable, which we treat as an exogenous variable as discussed previously. In addition, we control for company size (sales in logs), company age, state unemployment rate, the number of financing rounds and assets intangibility (INTANGIBLE). The results from both models confirm a statistically significant and negative impact of state exemptions on the availability of venture financing received by portfolio companies. We argue, in post-investment period, venture capitalists adjust their commitments to their portfolio companies according to perceived agency risk induced by bankruptcy exemptions. These findings are consistent with findings by Berkowitz and White (2000) and, in general, with our prediction based on agency theory.

In addition to our key finding above, according to other control variables, we find venture financing is positively associated with industry average assets intangibility. Since venture capitalists concentrate their investments in high-tech sectors (Gompers 1995), this result may reflect the fact that R&D intensive companies require more capital to support their growth. According to our result, more venture financing is associated with more financing rounds (Gompers 1995). Furthermore, our proxy for local economic environment, state unemployment rate, has a negative impact on the availability of venture financing. However, the coefficients of our proxy for company size (LOGSALES) have different signs in two models. To be specific, we find that company size is positively related to total amount of VC investment received by portfolio companies but negatively related to the logged ratio VC investment to sales. Our interpretation of this result is that though

large companies received more investment in general, they obtain less venture financing on a per-dollar base.

4.2 Bankruptcy exemptions and the number of financing rounds and the number of VC funds involved

In this section, we model both the number of financing rounds and the number of venture capital funds involved as functions of state bankruptcy exemptions, and empirically test our predictions. As our dependent variables, the number of financing rounds and the number of VC funds, are positive and ordinal, we therefore employ Poisson regressions to conduct our analysis (Gompers 1995). Table 5 presents our empirical results.

Venture capitalists may anticipate the likelihood of entrepreneurs to pursue opportunistic behavior, and react according to the perceived agency risk. Their investment decisions will be reflected not only by the amount of financing, but also by the structure of financing (Gompers 1995). By reducing the number of financing rounds, venture capitalists are likely to reduce their commitments to the entrepreneurial companies. As reported in Column 1 of Table 5, we find that exemption levels have a negative impact on the number of financing rounds, and this finding is consistent with our predication. We also predict that venture capitalists' willingness to participate in a joint investment may be negatively affected by perceived agency risk in the situation of high bankruptcy exemptions. In Column 2 of Table 5, we present our supportive finding that state bankruptcy exemptions are negatively associated with the

Table 3 Descriptive statistics and pairwise correlations

Variable name	<i>N</i>	Min	Max	Mean	SD					
<i>Panel A</i>										
Total VC investment (in logs)	2,573	9.10	21.91	16.59	1.48					
Total VC scaled by sales (in logs)	2,573	0.01	17.99	6.90	2.38					
ROUND	2,573	1.00	27.00	4.29	3.06					
NOFUND	2,573	1.00	45.00	7.26	5.79					
EXEMPTION	2,573	6.40	1040.00	154.07	285.16					
LOGSALES	2,573	0.34	17.08	9.72	2.20					
INTANGIBLE	2,573	0.37	1.00	0.84	0.11					
AGE	2,573	0.00	1152.00	63.59	127.02					
UNEMPLOY	2,573	2.00	10.60	5.53	1.53					
Variable name	1	2	3	4	5	6	7	8	9	
<i>Panel B</i>										
1 Total VC investment (in logs)	1									
2 Total VC scaled by sales (in logs)	0.44	1								
3 ROUND	0.26	0.27	1							
4 NOFUND	0.49	0.37	0.55	1						
5 EXEMPTION	−0.06	−0.07	−0.04	−0.04	1					
6 LOGSALES	0.17	−0.08	−0.13	−0.07	0.04	1				
7 INTANGIBLE	0.29	0.23	0.02	0.14	−0.03	−0.08	1			
8 AGE	−0.04	−0.24	−0.19	−0.22	0.02	0.25	−0.08	1		
9 UNEMPLOY	−0.015	−0.08	0.05	0.04	0.01	−0.01	−0.33	−0.07	1	

Notes: Panel A—We report summary statistics of variables used in our cross-sectional regressions. We use two measures to gauge the amount of venture financing: total VC investment in logs and logged ratio of total VC investment to sales. ROUND is the number of total financing rounds received by portfolio companies. NOFUND is the total number of venture capital firms involved in the financing for an individual entrepreneurial company. EXEMPTION is the sum of state homestead exemptions and personal property exemptions. For the state with unlimited homestead exemptions, we set \$1,000,000 for the exemption levels. AGE is measured as month difference between a company's founding date and the date of its first financing round. LOGSALES is logged sales of portfolio companies. INTANGIBLE is the industry average ratio of total intangible assets to total assets. UNEMPLOY is the unemployment rate matched by year and state according to the states in which the entrepreneurial companies are located. Panel B —We report pairwise correlation matrix

number of venture capital funds involved in a particular investment.

According to other control variables, we find that older companies need fewer rounds of financing and engage fewer VC funds. We interpret this result as old companies are approaching to the exit stage and thus require fewer rounds of financing and involvement of fewer VC funds. Interestingly, we find state unemployment rate is positively correlated with both the number of financing rounds and the number of VC funds. In last section, we find there is a negative relationship between state unemployment rate and total amount of venture financing. Taking these findings together, we argue that venture capitalists react strategically to the external environment (Kaplan and Strömberg 2004). It is plausible that in

less favorable economic environment, venture capitalists reduce their total financial commitment, but provide more rounds of financing. By doing this, they can increase the value of the real options which allow them to delay or abandon the projects. Moreover, involvement of more VC funds suggests that facing high level of external risk (Kaplan and Strömberg 2004), each individual VC fund can limit their risk by putting less money into the projects.

4.3 State level evidences: the effects of bankruptcy exemptions on venture financing

In prior sections, the overall results lend strong support to hypotheses 1–3. In order to further explore our proposed questions, we construct a panel

Table 4 OLS regression relating venture capital investment to bankruptcy exemptions

Independent variable	Dependent variable: Total VC investment	
	Total VC investment in logs	Total VC investment/sales in slogs
Constant	12.0881*** (0.3407)	12.0769*** (0.3314)
EXEMPTION	−0.2189** (0.0976)	−0.1913** (0.0933)
INTANGIBLE	3.3616*** (0.2765)	3.2728*** (0.2661)
AGE	−0.0004 (0.0003)	−0.0002 (0.0003)
UNEMPLOY	−0.0754*** (0.0190)	−0.0733*** (0.0182)
ROUND	0.1354*** (0.0093)	0.1323*** (0.0091)
LOGSALES	0.1611*** (0.0145)	−0.8288*** (0.0140)
Observations	2,573	2,573
F-statistics	91.99***	759.80***
R-square	0.1924	0.7081

Notes: Regression results using ordinary least square relating bankruptcy exemptions to venture capital investment. The dependent variable in Column 1 is the logged total venture financing. The dependent variable in Column 2 is the logged ratio of total investments to sales. Robust stand errors are reported in parentheses

*, ** and *** denotes significance at the 10, 5, and 1% levels, respectively

covering all states including Washington, D.C. for the period spanning 1991–1999. We aggregate company level venture financing information into state level. We are concerned about whether bankruptcy exemptions have consistent effects on state level venture capital inflows. In order to avoid the size effects across different states, we scale the total venture capital investment by state labor force in thousands and take logs to normalize the distribution. In addition to the control variables described previously, we collect state level information on population and population with college degrees from the Bureau of Economic Analysis (BEA). Logged state population (LOGPOP) is used to control for the state size, and the percentage of population with college degrees is a proxy for the availability of trained human capital. We further calculate average sales in logs to proxy

Table 5 Poisson regression relating the number of financing rounds and the number of VC funds involved to bankruptcy exemptions

Independent variable	Dependent variable	
	The number of rounds received	The number of VC funds involved
Constant	1.6519*** (0.1111)	0.9407*** (0.0886)
EXEMPTION	−0.0934*** (0.0349)	−0.0941*** (0.0270)
INTANGIBLE	0.0719 (0.0966)	1.1637*** (0.0769)
AGE	−0.0014*** (0.0001)	−0.0022*** (0.0001)
UNEMPLOY	0.0151** (0.0066)	0.0372*** (0.0003)
LOGSALES	−0.0259*** (0.0043)	−0.0026 (0.0034)
Observations	2,573	2,573
F-statistics	314.89***	1063.77***
Pseudo R-square	0.0242	0.0542

*, ** and *** denotes significance at the 10, 5, and 1% levels, respectively

Notes: Results relating bankruptcy exemptions to the number of financing rounds and the number of VC funds involved. The dependent variable in Column 1 is the total number of financing rounds received by portfolio companies. The dependent variable in Column 2 is the total number of VC funds involved. Standard errors are reported in parentheses

for the size of venture-backed company for each state (AVGLOGSALS).

In Column 1 of Table 6, we only enter state bankruptcy exemptions along with year dummies into the right hand side of the equation. Bankruptcy exemptions have a statistically significant and negative effect on the state VC inflows (at one percent level). In Column 2 of Table 6, we further control for state population (in logs), percentage of population with college degrees and the state unemployment rate. Year dummies are entered into the equation to control for the timely trend. Again, we find bankruptcy exemptions negatively affect the inflows of venture financing at the state level.

Though venture capitalists only provide financial resource to a small portion of entrepreneurial ventures, they contribute much to the creation of public

Table 6 State level evidence: regression relating state vc inflows to bankruptcy exemptions

Independent variable	Dependent variable state level VC inflow per 1,000 labor force in logs	
	Model 1	Model 2
Constant	3.3723*** (0.3241)	−6.5976*** (2.0380)
EXEMPTION	−1.1968*** (0.2524)	−0.7634*** (0.2279)
LOGPOP		−0.0284 (0.0871)
% Population with college degrees		1.0222*** (0.2254)
UNEMPLOY		−0.0146 (0.0737)
AVGLOGSALES		0.5363*** (0.0808)
Year dummies	YES	YES
Observations	510	510
F-statistics	8.95***	11.64***
R-square	0.1439	0.3891

*, ** and *** denotes significance at the 10, 5, and 1% levels, respectively

Notes: Results relating bankruptcy exemptions to state VC inflows. The dependent variable is logged state level venture financing scaled by labor force in thousands. Robust standard errors are reported in parentheses

companies (Barry 1990). Following Brau et al. (2003), we define a company as “going public” if it conducts an initial public offering or is acquired by another public company. For each year and each state, we collect information on firms going public as defined above from the SDC new issue database and SDC Merger/Acquisition database during the years 1991–1999, and construct two measures: (1) the total number of firms going public; (2) the percentage of venture-backed companies going public as a proportion of all firms going public. The above information is incorporated into our state panel. We are able to empirically investigate the relationship between venture capital inflows and state level liquidity events. In Table 7, the dependent variables in Column 1 and 2 are the logged total number of firms going public, and the ratio of venture-backed companies going public to all firms going public. In general, we find that venture inflows are positively related to state liquidity events (i.e., IPOs and M&As).

However, the above findings are essentially based on equation-by-equation estimations and subject to endogeneity problem. For example, in addition to providing management expertise to facilitate the growth of entrepreneurial firms, venture capitalists may choose to invest in those companies with brightest future prospects (Baum and Silverman

2004). The positively relation between firms going public and VC inflows may indicate that better companies attract more VC investment. Thus, it is difficult to infer the direction of causality. Furthermore, Stuart and Sorenson (2003) document that the liquidity events (IPOs and M&As) accelerate the founding rate of new ventures in the local markets. It is also plausible that the supply of venture capital and the demand on venture capital are simultaneous determined (Armour and Cumming 2006). Therefore, liquidity events may well reflect the demand on venture capital. Though we are not able to completely rule out alternative explanations as described above, we employ two-stage least squares (2SLS) approach to estimate a system of equations in order to further control for the endogeneity problem, and report our results in Table 8. Consistent with prior studies and our expectation, we find robust results that state VC inflows have a significantly positive relation to firms’ going public.

5 Summary and conclusion

The central thesis of this study is that the US personal bankruptcy law may affect the supply of venture capital to entrepreneurs, and therefore provides a

Table 7 Regression relating firms going public to VC inflows

Independent variables	Dependent variable	
	Number of firms going public in logs	VC-backed companies going public as a proportion of ALL firms going public
Constant	−6.1148*** (0.4752)	−0.0765** (0.0379)
VCINFLOW	0.3949*** (0.0175)	0.0121*** (0.0015)
LOGPOP	0.5136*** (0.0290)	0.006** (0.0025)
% Population with college degrees	0.0525 (0.0415)	0.0041 (0.0067)
UNEMPLOY	−0.0638** (0.0247)	−0.0005 (0.0020)
Year dummies	Yes	Yes
Observations	510	510
F-statistics	82.58***	12.76***
R-square	0.7335	0.2600

*, ** and *** denotes significance at the 10, 5, and 1% levels, respectively

Notes: Results relating VC investment to firms going public. We define a company as going public if it conducts an initial public offering or if it is acquired by another public company. The dependent variable in Column 1 is the logged total number of firms going public. The dependent variable in Column 2 is the logged ratio of VC-backed companies going public as proportion of all firms going public. Robust standard errors are reported in parentheses

robust link between law and finance. We empirically document that the bankruptcy exemptions have important and significant effects on the supply side of venture capital financing. The key finding is that the bankruptcy exemptions have negative effects on the small businesses' access to venture capital. When companies operate in states with higher bankruptcy exemption levels, venture capitalists reduce their commitments because perceived agency costs and monitoring costs are higher. Furthermore, we find that high levels of bankruptcy exemptions are associated with fewer rounds of financing and fewer VC funds involvement. In addition, we estimate a system of equations to capture the simultaneous nature of proposed questions and find consistent result that bankruptcy exemptions have a negative impact on the supply of venture financing. In line with prior

Table 8 A simultaneous equation approach

Independent variable	Dependent variable	
	VC-backed companies going public as a proportion of ALL firms going public	State level VC inflow per 1,000 labor force in logs
Constant	−0.0645* (0.0339)	−6.4661*** (1.7176)
EXEMPTION		− 0.3896*** (0.2525)
VCINFLOW	0.0075*** (0.0026)	
LOGPOP	0.0062*** (0.0021)	−0.0318 (0.0717)
% Population with college degree	0.0093** (0.0041)	1.0184*** (0.0958)
UNEMPLOY	−0.0006 (0.0019)	−0.0079 (0.0655)
AVGLOGSALES		0.5297*** (0.0778)
Year dummies	YES	YES
Observations	510	510
χ^2	91.15***	401.43***
R-square	0.2397	0.4416

*, ** and *** Significance at the 10, 5, and 1% levels, respectively

Notes: The results based on a system of equations estimated through two-stage least squares (2SLS)

research, we also find that venture capital inflows are supportive to the creation of public companies.

We think our findings are significant and novel, which have important policy implications. Recently, there are quite a few debates on whether to limit the maximum of homestead exemptions. On Oct 17th, 2005, a new bankruptcy law went into effect. Debtors who file under Chapter 7 should pass certain means test and will be charged more by lawyers. This significant change of bankruptcy law makes filing personal bankruptcy more difficult under Chapter 7. Although the intention of the proposed or enacted reform is to prevent debtors from abusing the personal bankruptcy law and taking the advantage of generous bankruptcy exemptions, we predict that this reform will make agency problem less severe and make it easier for small businesses to obtain venture financing.

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