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⁵ J. Gruber and J. Zinman, "Youth Smoking in the U.S.: Evidence and Implications," NBER Working Paper No. 7780, July 2000, and in J. Gruber, ed., *Risky Behavior Among Youth: An*

Economic Analysis, Chicago: University of Chicago Press, 2001, pp. 69-120

⁶ B. D. Bernheim and A. Rangel, "Addiction and Cue-Conditioned Cognitive Processes," NBER Working Paper No. 9329,

November 2002.

⁷ D. M. Cutler, E. Glaeser, and J. Shapiro, "Why Have Americans Become More Obese?" NBER Working Paper No. 9446, January 2003.

Venture Capitalists As Economic Principals

Steven N. Kaplan and Per Strömberg*

There is a large academic literature on the principal-agent problem in financial contracting.¹ This literature focuses on the conflicts of interest between an agent — an entrepreneur with a venture that needs financing — and a principal — an investor with the funds to finance the venture. According to these theories, there are a number of ways that the investor/principal can mitigate these conflicts. First, the investor can collect information before deciding whether to invest, in order to screen out ex ante unprofitable projects and bad entrepreneurs. Second, investors can structure financial contracts — that is, the allocation of cash flow, control and liquidation rights — between themselves and entrepreneurs to provide incentives for the entrepreneurs to behave appropriately. And third, the investors can engage both in collecting information and in monitoring it once the project is under way.

Despite the large volume of theory, the empirical work in comparing the

contracts and actions of real world principals to their counterparts in financial contracting theory has lagged behind. In this paper, we describe recent empirical work and its relation to theory for one prominent class of such principals — venture capitalists (VCs). In our view, VCs are real world entities that closely approximate the investors of theory. VCs invest in entrepreneurs who need financing to fund a promising project or company. VCs have strong incentives to maximize value, but at the same time receive few or no private benefits of control. Although they are intermediaries, VCs typically receive at least 20 percent of the profits on their portfolios.

In this article, we describe recent empirical work — both ours and others' — on the three things that VCs do: contracting, screening, and monitoring. Unlike previous empirical work that has relied largely on surveys, our work (and much of the work we describe) relies on detailed information collected from actual VC financings.

Contracting

In a forthcoming article², we compare the characteristics of real world financial contracts to their counter-

parts in financial contracting theory. We do so by conducting a detailed study of 213 actual contracts between VCs and entrepreneurs. We find first that VC financings allow VCs to separately allocate cash flow rights, voting rights, board rights, liquidation rights, and other control rights. The separation of these rights is apparent, for example, in that VCs control roughly half of the cash flow rights on average, but have a majority of board seats in only 25 percent of the investments.

Second, while convertible securities are used most frequently, VCs also implement the same set of rights using combinations of multiple classes of common stock and straight preferred stock. We also point out that VCs use a variant of convertible preferred called "participating preferred" in roughly 40 percent of the financings. Participating preferred, under most circumstances, behaves like a position of straight preferred stock and common stock rather than like a position of convertible preferred.

Third, cash flow rights, voting rights, control rights, and future financings are frequently contingent on observable measures of financial and non-financial performance. These state contingencies are more common in the early stages of the VC-entrepreneur

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neur relationships (first VC rounds) and in earlier stage investments.

Fourth, voting rights, board rights, and liquidation rights are allocated such that if the company performs poorly, the VCs obtain full control. As company performance improves, the entrepreneur retains/obtains more control rights. If the company performs very well and the VCs earn a sizable multiple of its investment, the VCs retain their cash flow rights, but relinquish most of their control and liquidation rights through the automatic conversion provision that is present in virtually all our financings.

Fifth, VCs typically include non-compete and vesting provisions that make it more expensive for the entrepreneur to leave the firm, thus mitigating the potential hold-up problem between the entrepreneur and the investor. Vesting provisions are more common in early stage financings where it is more likely that the hold-up problem is more severe.

Our results have a number of implications. For example, cash flow rights matter in a way that is consistent with standard principal-agent theories such as Holmstrom (1979)³. VCs change the entrepreneur's equity compensation function, making it more sensitive to performance when incentive and asymmetric information problems are more severe.

Further, the allocation of control rights between the VC and the entrepreneur is a central feature of the financial contracts. This strongly suggests that, despite the prevalence of contingent contracting, contracts are inherently incomplete. This finding gives support to the incomplete contracting approach pioneered by Grossman and Hart⁴ and Hart and Moore⁵.

Cash flow rights and control rights also can be separated and made contingent on observable and verifiable measures of performance. This is most supportive of theories that predict shifts of control to investors in different states, such as Aghion and Bolton (1992)⁶. Finally, the widespread use of non-compete and vesting provisions indicates that VCs care about the hold-up problem.⁷

Screening

Before making an investment and designing the financial contracts, VCs spend a significant amount of time and effort evaluating and screening the investment opportunity. In recent work⁸, we focus empirically on this information collection and evaluation.

To help the VC partnership evaluate an investment in a company, the individual VC who is sponsoring the investment often prepares a detailed investment analysis or memorandum for the other partners. In our 2002 paper, we analyze the investment memoranda from eleven VC partnerships for investments in 67 portfolio companies. We complement that analysis with information from the company business plans, as well as data on financial contracts from our previous study⁹.

The VC analyses that we describe include a set of investment theses or rationales for making the investment and a discussion of the concomitant risks. VCs explicitly consider the attractiveness of the external environment — the market size, customer adoption, and competition — the feasibility of the strategy and technology, the quality of the management team, and the deal terms. VCs also explicitly delineate the risks involved in the investments. The risks typically relate to the same characteristics that the VCs evaluate for attractiveness.

We use these assessments to form three different “risk measures”: internal uncertainty — the relevant information is internal to the firm and it is more likely that the VC is less informed than the entrepreneur; external uncertainty — the relevant information is external to the firm and it is more likely that the VC and the entrepreneur are equally informed; and difficulty of execution, different from both previous notions of risk, which captures the complexity of the task and the reliance on the entrepreneur's human capital. We compare these risk measures to the financial contracts.

If agency conflicts arising from moral hazard and asymmetric information are important, then the financial contracts should be related to internal uncertainty. The agency theories make

mixed predictions regarding external uncertainty. Traditional moral hazard theories based on risk-sharing predict performance-based pay decreases with external uncertainty. Alternatively, more recent theories¹⁰ suggest that performance-based pay and direct monitoring are substitutes. As external uncertainty increases, direct monitoring becomes less effective and principals make greater use of pay-performance incentives.

Two types of theories make predictions about execution or complexity risk. Theories of multitasking¹¹ predict that pay based on specific milestones should decrease as execution risk increases because compensation based on a signal correlated with a particular action will lead the manager to put too much emphasis on that action. Hold-up theories¹² suggest that in highly complex environments where the entrepreneur's human capital is particularly important, we should observe contracts — such as vesting provisions — that make it costlier for the entrepreneur to leave.

Consistent with the agency explanation, internal uncertainty is significantly related to many of the incentive and control mechanisms in the financial contracts. Higher internal risk is associated with more VC control, more contingent compensation to the entrepreneur, and more contingent financing in a given round.

Higher external risk, like internal risk, is associated with more VC control, and more contingent compensation. Higher external risk is also associated with increases in the strength of VC liquidation rights, and tighter staging, in the sense of a shorter period between financing rounds. These findings are highly inconsistent with optimal risk-sharing between risk-averse entrepreneurs and risk-neutral investors, a common assumption in standard agency models.

Risk related to difficulty of execution shows a (weakly) negative relation with many contractual mechanisms, such as contingent compensation and VC liquidation rights. These results suggest that for highly complex environments, where the manager's human capital is particularly important, standard incentive mechanisms are less

effective. Furthermore, execution risk is significantly positively related to founder vesting provisions. This result is consistent with the multitasking and hold-up theories.

Monitoring

Finally, several recent papers focus on post-investment information collection, monitoring, and other actions by the VC. Anecdotal accounts stress an important role for VCs in monitoring management, finding management, and providing advice. For example, Lerner¹³ finds that VCs are more likely to join or be added to the boards of private companies in periods when the chief executive officer (CEO) of the company changes. He interprets this as evidence of VC monitoring.

Hellman and Puri¹⁴ study a hand-collected sample of 173 start-up firms from California's Silicon Valley. They find that venture capital is associated with a significant reduction in the time to bring a product to market. They provide some evidence that this association holds after controlling for VC ability to select a more successful company.

Hellman and Puri¹⁵ also study another aspect of the same dataset. They find that VC-financed firms are more likely, and quicker, to professionalize by adopting stock option plans and hiring a vice president of sales, and by bringing in CEOs from outside the firm.

The three studies described in the previous paragraphs find indirect evidence of post-financing VC actions. In our 2002 paper¹⁶, we complement these studies by presenting direct evidence on VC actions or monitoring. We use the investment analyses to measure the actions that the VCs took before investing and that the VCs expect to undertake conditional on investing. In at least half of the investments, the VC expects to play an important role in recruiting management. In more than one-third of the investments, the VC expects to provide value-added services, such as strategic advice or customer introductions. Because the investment memoranda vary in the detail they provide, these results likely understate the VCs' activ-

ities in this area.

We also show that the actions the VCs expect to take are related to the contracts. Consistent with control theories, VCs are more likely to strengthen management as VC control increases. These theories show that investor control is necessary to implement actions that reduce the entrepreneur's private benefits, such as management interventions.

Consistent with theories like Inderst and Muller's¹⁷ that stress having incentives for the VC to provide value-added services, we also find that VC's value-added services increase as the VC's equity stake increases, but are not related to VC control.

Implications and Conclusion

The empirical studies of venture capitalists indicate that they attempt to mitigate principal-agent conflicts in the three ways suggested by theory: through sophisticated contracting, pre-investment screening, and post-investment monitoring and advising. The evidence also suggests that contracting, screening, and monitoring are closely interrelated. In the screening process, the VCs identify areas where they can add value through monitoring and support. In the contracting stage, the VCs allocate rights in order to facilitate monitoring and minimize the impact of the identified risk factors, for example by allocating more control to investors when management is weak, or making founder cash flow rights and release of funds contingent on management actions. Also, the allocations of equity to VCs provide incentives to engage in costly support activities that increase the upside value of the venture, rather than just minimizing potential losses. There is room for future empirical research to study these activities in greater detail, both for VCs and for other intermediaries, such as banks.

¹ For a recent summary, see O. D. Hart, "Financial Contracting," NBER Working Paper No. 8285, May 2001, and in *Journal of Economic Literature*, 39 (2001), pp. 1079-1100.

² S. N. Kaplan and P. Strömberg, "Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts," forthcoming in *the Review of Economic Studies*.

³ B. Holmström, "Moral Hazard and Observability," *Bell Journal of Economics*, 10 (1979), pp. 74-91.

⁴ S. J. Grossman and O. D. Hart, "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, 94 (1986), pp. 691-719.

⁵ O. D. Hart and J. Moore, "Property Rights and the Nature of the Firm," *Journal of Political Economy*, 98 (1990), pp. 1119-58; and "Default and Renegotiation: A Dynamic Model of Debt," NBER Working Paper No. 5907, January 1997, and in *Quarterly Journal of Economics*, 113 (1) (1998), pp. 1-41.

⁶ P. Aghion and P. Bolton, "An Incomplete Contracts Approach to Financial Contracting," *Review of Economic Studies*, 77 (1992), pp. 338-401.

⁷ O. D. Hart and J. Moore, "A Theory of Debt Based on the Inalienability of Human Capital," *Quarterly Journal of Economics*, 109 (4) (November 1994), pp. 841-79.

⁸ S. N. Kaplan and P. Strömberg, "Characteristics, Contracts, and Actions: Evidence From Venture Capitalist Analyses," NBER Working Paper No. 8764, February 2002.

⁹ See S. N. Kaplan and P. Strömberg, "Financial Contracting Theory Meets the Real World: An Empirical Analysis of Venture Capital Contracts."

¹⁰ See, for example, C. J. Prendergast, "The Tenuous Tradeoff Between Risk and Incentives," *Journal of Political Economy*, 110 (5) (2002) pp. 1071-1102.

¹¹ See, for example, B. Holmström and P. Milgrom, "Multitask Principal Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design," *Journal of Law, Economics, and Organization*, 7 (1991), pp. 24-92.

¹² See O. D. Hart and J. Moore, "A Theory of Debt Based on the Inalienability of Human Capital."

¹³ J. Lerner, "Venture Capitalists and the Oversight of Private Firms," *Journal of Finance*, 50 (March 1995), pp. 301-18.

¹⁴ T. Hellman and M. Puri, "The Interaction Between Product Market and Financial Strategy: The Role of Venture Capital," *Review of Financial Studies*, (Winter

2000), pp. 959-84.

¹⁵ T. Hellman and M. Puri. "Venture Capital and the Professionalization of Start-up Firms: Empirical Evidence," *Journal of Finance*, 57 (1) (2002), pp. 169-197.

¹⁶ See S. N. Kaplan and P. Strömberg, "Characteristics, Contracts, and Actions: Evidence From Venture Capitalist Analyses."

¹⁷ R. Inderst and H. Müller, "Competition

and Efficiency in the Market for Venture Capital", working paper, New York University, 2001.

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Joshua Angrist is a Research Associate in the NBER's Programs on Children, Education, and Labor Studies, and a Professor of Economics at MIT. A dual U.S. and Israeli citizen, he taught at the Hebrew University of Jerusalem before coming to MIT. He holds a B.A. from Oberlin College and also spent time as an undergraduate studying at the London School of Economics and as a Masters student at Hebrew University. He completed his Ph.D. in Economics at Princeton in 1989 and his first academic job was as an Assistant Professor at Harvard from 1989-91.

Angrist's research interests include the effects of school inputs and organization on student achievement, the impact of education and social programs on the labor market, immigration, labor market

regulation and institutions, and econometric methods for program and policy evaluation. Although many of his papers use data from other countries, he does not especially like to travel and prefers to get the data in the mail. He is also a Fellow of the Econometric Society and a Co-editor of the *Journal of Labor Economics*.

Angrist has a long-standing interest in public policy. In addition to his academic work, he has worked as a consultant to the U.S. Social Security Administration, The Manpower Demonstration Research Corporation, and for the Israeli government after the Oslo peace negotiations in 1994. He lives in Brookline with his wife Mira, and their two children, Adie and Noam. The Angrist family enjoy activities like hiking, skiing, skating, sailing, and eating.