Venture Capital's Role in Creating a More Sustainable Society:

The Role of Exits in Clean Energy's Investment Growth[1]

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ABSTRACT

Venture capital's role in clean energy (CE) technologies can be transformative in creating a sustainable society. Yet there are limitations on how far venture capitalists (VCs) can go in supporting these technologies. These limits exist because of the performance expectations of the main stakeholder group who hold venture capitalists accountable. The financial backers of VCs expect an exceptional return on their investment, given the high level of risk they take on when they invest in unproven startups. This chapter explores the constraints that the financial obligations VCs have to their main backers put on their role in bringing about a more sustainable global society. It investigates VC firms' responses to CE exits (IPOs and acquisitions) (3) and shows how prior CE exits affect CE investment growth when we compare VCs exit records to that of their peers. This chapter demonstrates that VCs only increase CE investments when the cumulative number of exits *substantially exceed* that of their peers, while they decrease these investments when the cumulative number of their exits only moderately outpace that of their peers. The chapter suggests that the reason VCs respond in this way is the financial pressure VCs experience because of their dependence on their financial backers.

Keywords: venture capital, clean energy, sustainability, performance expectations, risk, return

1. Introduction

Venture capital's role in CE technologies can be path-breaking in generating a sustainable society. Yet there are limitations on how far venture capitalists can go in investing in these technologies (Marcus, Malen, and Ellis, 2013). This chapter pursues the question of the promise and limitations of VC investment as a source of support for CE. VCs are constrained in how much they can invest in clean energy. Primarily concerned with the reactions of those investing in their funds, they are unlikely to place big bets in an area that promises to grow unless they have sufficient proof, that their bets will outperform those of their peers. The limitations on how far VCs can go in supporting CE technologies arise because of VCs' obligations to their primary stakeholder group. That is, the pension funds, university endowments, insurance companies, private companies, and individuals that back VCs expect accountability.

Sustainability achievements depend on stakeholder relations. Scholars have argued that in that the key stakeholders in an established firm are shareholders, and that this group, with its expectation of financial return in exchange for the risks it is taking, puts a constraint on companies from taking bold initiatives in the domain of sustainability (Friedman, 1970). If these initiatives pay off, then shareholders are satisfied, but if they do not, then shareholders are likely to put pressure on management by selling off their ownership in the firm and lowering its share price. When management job security and compensation are tied to share price then it has much to lose when its sustainability initiatives do not live up to their promise of financial as well as social return.

This relationship between shareholders and management is an important element in the influence that stakeholders have on corporate social responsibility and sustainability. As the editors of this volume argue, "business decisions relating to sustainability and corporate social responsibility (CSR) are ultimately decisions about the governance of stakeholder relations." Similarly, this chapter argues that the relation between venture capitalists (VCs) and their

financial backers limits the degree to which the VCs can take bold initiatives that might advance the cause of sustainability. The financial backers of VCs, as responsible guardians of the money they hand over to the VCs, expect a significant economic return on their investment. They hold the VCs, with whom they entrust this money, in check. The VCs can make investments that advance the cause of sustainability but these investments must also deliver some kind of above average economic return for those who entrust the VCs with their money. This point appears to be obvious. The contribution this chapter makes is in showing empirically that the expected nature of this pay-off when VCs invested in cleaner energy startup companies was not simple gain, but exceptional or extraordinary gain. The findings reported in this chapter show that when VCs were dissatisfied with the return they received, they reduced the amount of their investment in cleaner energy startups. Moreover, ordinary gains were not enough. Only when gains were exceptional did they increase this investment.

Reputational advantage can accrue in making sustainable investments like those in clean energy for VCs (Marcus, 2015) and their backers, especially if the backers are university endowments, pension funds, and some individual investors, and augment the prospect of superlative returns. Under these circumstances, the apparent payback from investing in clean energy is a win-win -- fashionable while at same time it offers the prospects of exceptional rewards. While “doing good” can motivate initial interest in a category like CE, it does not justify sticking with sustainability investments in the long run. The pressure for exceptional gain in return for the higher risk of VC investment, in the end, gains the upper hand, according to this study. The results suggest that social approval without superlative returns did not lead to an increase in VCs’ CE investments.

In this chapter, we define CE as solar and wind energy; biofuels; energy efficiency; alternative modes of transportation like hybrid, electric, and fuel cell vehicles; and such complementary technologies as storage and smart grid. Together they can decrease injurious emissions, reduce the effects of climate change, cut global dependence on commodities from

unstable regions, build new industries, and create jobs. Nevertheless, under current projections, fossil fuels will continue to dominate global energy usage (IKEA, 2016). Under these projections, CE's role in creating a more sustainable society expands, but its impact is not decisive or transformative.

This situation could be different if a major technological leap forward took place. The best hope forward would be a disruptive revolution similar in magnitude to the information technology (IT) revolution of the 1990s. This chapter suggests that VCs might well be a primary source of funding for such a revolution in CE technologies, much like the IT revolution of the 1990s. The goal of our study therefore has been to analyze the role that VCs can play in providing entrepreneurs the resources they need to move CE technologies forward. We explore how the financial obligations that VCs' main stakeholders (pension funds, university endowments, insurance companies, private companies, and individuals) impose on them put constraints on the role of VCs in bringing about a more sustainable society.

1.1 The History of VC Investment in CE

Serious VC CE investment commenced in the 21st century's first decade when VCs began to search for new sectors in which to invest. This search began because of the devastating 2000 dot.com era bust. Further accelerating this search was the financial disturbance following 9/11 that created a weak stock market in which the number of IPOS plummeted. VC firms, funds, and professionals declined, and capital under VC management fell (O'Rourke, 2009). In a bid to raise capital from their main stakeholder group - pension funds, university endowments, insurance companies, private companies, and individuals that back VCs - they turned their attention to CE. Their aim was to find promising startups, nurture their development, and look for potential exit opportunities, both IPOs and acquisitions, which would reward the pension funds, university endowments, insurance companies, private companies, and individuals that back VCs.

In this context, IPOs and acquisitions were important because they helped establish VCs' relative standing among their peers (Pollock et al., 2015; Lerner, 2002; Washington and Zajac, 2005). VC exits were widely publicized so there was enough transparent information for VCs to assess their performance against their peers (Lerner, 2002; Hochberg, Ljungqvist, and Lu, 2007). VCs benefitted from bringing the startups they supported to successful exits because it permitted them to attract both better startups and to obtain more funding from the endowments, insurance companies, wealthy individuals, and others who supported their activities.

2. Private Equity VCs

The chapter's main interest is in the role of private equity venture capital investments, a category that does about eighty percent of all VC transactions Well-known examples are Sequoia Capital, which financed Apple, and Kleiner Perkins Caufield & Byers (KPCB), which financed Genentech. VCs like Sequoia Capital and KPCB raise money for their investment funds from such groups as pension funds, university endowments, insurance companies, private companies, and individuals that became partners in their funds. These groups function as limited partners (LP) in investment funds that VCs create (see Figure 1). These funds generally have a ten-year lifespan between raising money and trying to exit from the investments they had made. A VC's role as an agent for this group is to find exceptionally promising startups, nurture their development, and look for potential exit opportunities both through IPOs in the world's stock exchanges and through acquisitions by another company. For the services the VCs render they typically obtain twenty percent of the profits if the startups they fund achieve successful exits. In the meantime, they earn management fees of two to three percent for the activities they undertake on behalf of the LPs in managing their money.

INSERT FIGURE 1 ABOUT HERE.

The startups that VCs fund typically draw on basic and applied research, which might come from universities, governments, or corporate labs. These startups need funding to develop commercially viable businesses. In taking on this task, the VCs, and in turn the limited partners (LPs) to whom they are accountable, put themselves at great risk because the failure rate of early stage businesses is quite high. The complete write-off of the investments VCs make is common. Even if not completely written-off, these investments might earn little for investors. Therefore, the VCs search for a portfolio of startups that have exceptionally strong earning potential. The pension funds, university endowments, insurance companies, private companies, and individuals, who are the VCs' main backers and hold them accountable as the stakeholder group with the highest standing, expect returns of this nature from the investments that the VCs make.

The spectacular success of VCs in the late 1990s that created these high expectations also contributed to a high-tech boom that dramatically transformed the global economy. The promise of VC investment in CE firms was that this class of investors would have a similarly transformative impact on the global economy with respect to energy generation and usage. VCs at that time began to believe that they would be able to discover and cultivate companies of comparable stature and quality that would have the capacity to usher in a sustainable revolution in energy of far-reaching proportions. This revolution could spill over beyond the CE startup firms the VCs supported to society as a whole and bring into being a world that was far more sustainable. VC supported start-ups also would have a large impact on many sectors in society beyond transportation, power generation, manufacturing, and home construction. This chapter suggests that the realization of this promise may well have depended on whether the VCs would deliver exceptional returns to the financial backers who made up their main stakeholder group and to whom they ultimately were accountable.

Clearly, VCs in the 21st century's first decade had options other than investing in CE ventures. Their past successes had been in areas such as information technology (IT), software, the Internet, medical technology, and social media. Prudence may have dictated that they stick to

these investment categories rather than investing in CE. Although the potential for a revolution in CE appeared to be similar in magnitude to the one that had taken place in other high tech areas in which the VCs had invested previously, CE was a new area that posed various kinds of additional risks to which the VCs were not accustomed. CE investment differed from earlier sectors in which VCs had invested by virtue of the need to lengthen the time horizon of involvement in these investments—in both directions, that is, more investment and involvement in firms at early stages of technology development and more investment and involvement in firms in a late stages of technology commercialization.

Successful CE investment required that VCs and their backers had to be more patient than they had been when they invested in high tech. They might not be able to realize the exceptional gains they had achieved in making these investments in the 1990s. Without the expectation of a high return on investment to the primary groups, which backed the VCs – i.e. pension funds, university endowments, insurance companies, private companies, and individuals –there were limits to how much support VCs could give to CE. They were not just undertaking the risks inherent in untested early stage companies, which they had become accustomed to managing by applying their accumulated historical knowledge. They were undertaking substantial new risks inherent in investing in an untested sector for which performance data were scarce and hard to comprehend and investors had little performance history on which to draw.

2.2 Unusual Success

In the case of emerging CE businesses, the fact that performance data were scarce and hard to comprehend and investors had little performance history on which to draw, played a major role in influencing VCs investment decisions. Whether startups in which VC invested achieved success was not well known. The exits that these startups did achieve could be dramatic and well publicized when they happened, but they were relatively unusual. When exits took place, it was hard to attach meaning and interpret the success that took place. Indeed, the number of CE exits

in the 2000-2011 period under consideration was few. Kent (1964) defines events that are almost certainly not' going to happen as those with a probability of less than twelve percent (Lampel, et al., 2009). Based on publicly available data, the number of CE exits in comparison to investments in the 2000-2011 period was under 9.4 percent (Thomson-Reuter database). From 1990 and 2002, the number of the high tech exits in comparison to investment had been about 30 percent (Laine and Torstila, 2005). From 2000-2011, the number of the high tech exits in comparison to investment was 21.7 percent.

The occurrence of VC CE exits during this period was thus a setting in which success was relatively unusual and regularly available financial information about performance outcomes was scarce. Although numerous studies have demonstrated that organizations adjust investment decisions to their performance outcomes (Shinkle, 2012; Bromiley, Miller, and Rau, 2001; Greve, 2003; Schimmer and Brauer, 2012), most of these studies deal with settings where there is an abundant history of regularly occurring financial and accounting information. The VCs' CE investment decisions analyzed in this study occurred during the 2000-2011 period when VCs did not have such information and had to draw implications from infrequently occurring performance events. As observed in the organizational decision making literature, decision makers who lack sufficient evidence from which to draw sound causal inferences, face particular ambiguity in interpreting the implications of the infrequently occurring events they encounter (Greve, 2013). This, in turn, limits their effectiveness in making good inferences about the meaning of these events (March, Sproull, and Tamuz, 1991; March 1991). Indeed, Beck and Plowman (2009) maintain that decision making under these circumstances poses very special challenges.

Existing research for the most part analyzes instances where organizations have had plentiful performance data to compare to the performance of their peers (e.g. see Audia, Locke and Smith, 2000; Baum et al., 2005; Haleblian, Kim, and Rajagopalan, 2006; Chen and Miller, 2007; Iyer and Miller, 2008; Shiplov, Li, and Greve, 2011; Kaperczyk and Beckman, 2015). Many studies

also have focused on rare negative events of great relevance like accidents and scandals (see, for example Carroll, 1998; Marcus & Nichols, 1999). However, there is very little empirical research that examines how decision makers respond to occurrences of unusual success like exits among CE startups. Theoretically, it is not clear how VCs would respond to a situation when they lacked extensive return information, exit events were uncommon, and the investment cycle was not complete.

Theory and Hypotheses

3.1 Inertia

A number of theories provide potential explanations. Ocasio (1997; 2011) proposes that without a distinct problem decision makers do not initiate a search for a solution (also see March and Shapira, 1987). The time they can devote to stimuli is limited and they cannot sustain concentration on all the stimuli they receive (Ocasio, 1997). They choose a few significant foci on which to concentrate. Without a problem to goad them, they tend to be complacent and continue moving on paths they already have chosen (Amburgey and Miner, 1992; Jansen, 2004; Greve 2013).

Thus, rare events would have to be particularly noticeable, striking, and stand out for organizations to pay attention to them (Taylor and Fiske, 1978; Cho and Hambrick, 2006; Weick and Sutcliffe, 2006). With cognitive resources and organizational processes limited, the tendency would be for decision makers to screen out infrequently occurring positive incidences of success and persist in the actions they had taken. Path dependent processes, based on initial choices and the repetition of these choices, would lead them to continue activities they had started (Stinchcombe, 1965; Marquis and Tilcsik, 2013). Their initial choices would place an indelible mark on templates (values, ideologies, roles, tasks, and routines) and narrow the range of their future actions (Sydow, Schreyögg, and Koch, 2009). Given cultural norms emphasizing the importance of steadfastness in making investment decisions, escape from initial choices is not easy (Brockner, 1992).

Decision makers tend to retain their initial judgments even in the face of compelling feedback to the contrary (Staw, 1981, Staw, et. al., 1981). Cognitions freeze and become locked-in as decision makers shift from the analytics, which lead to their initial choices to heuristic processing which governs routine behaviors (Marquis and Tilcsik, 2013). Indeed, Dimov, de Holan, and Milanov (2012) find that, everything else being equal, the impact of initial VC investments lingers and has lasting effects. This finding conforms to the literature that suggests that the tendency of decision makers is to replicate their preceding actions (Jansen, 2004). They do not readily dismantle their cognitive maps. External expectations (Hannan and Freeman, 1984) and internal power distributions (Pettigrew, 1987) support and reproduce initial behaviors with recurring execution raising the costs of reversing course (Amburgey, Kelly and Barnett, 1993:54; Levitt and March, 1988; March and Simon, 1958; Miller and Friesen, 1984; Starbuck, 1983). After forging a consensus, decision makers are slow to alter their behavior even when new conditions arise. Thus, the following propositions are likely to apply to the behavior of VCs that invest in CE:

Hypothesis 1: *The higher the initial dollar level of the VCs' CE investments, the greater is the subsequent rate of growth in their CE investments.*

Hypothesis 2: *The greater number of CE deals the VCs have made, the greater is the subsequent rate of growth in their CE investments.*

3.2 Peer Comparison

Though inertia is a powerful force, copious research also suggests that it can be thwarted when organizations compare their performance to that of their peers. This research maintains that absolute performance of organizations is less important than comparative performance (Kahneman and Tversky, 1979; Thaler and Johnson, 1990; Fiegenbaum, Hart, and Schendel, 1996; Fiegenbaum and Thomas, 1988; Wiseman and Gomez-Mejia, 1998; Madsen, 1999), where the findings of these studies are mixed. The differences in results appear to depend on the setting and the moderating variables that researchers use.

Another reason for these differences is the degree to which performance outcomes surpass that of an organization's peers. When performance outcomes *substantially* exceed those of an organization's peers, it captures the attention of decision makers and their focus shifts as they attribute the high levels of achievement to their skills (Pfeffer and Fong 2005). That is they perceive that their aptitudes and capabilities produced the performance differences, which gives them the confidence to invest and put more money at risk. This perception of relative success inspires confidence in their abilities and motivates them to do more (Audia and Brion, 2007, Jordan and Audia 2012, and Diwas, Staats, and Gino, 2013).

Supportive research for this contention exists in both the decision-making (e.g., Schimmer & Brauer, 2012) and behavioral finance literatures (e.g., Statman, Thorley and Vorkink, 2006). This research makes the point that if organizations' outcomes are *very* positive in comparison to their peers, decision makers increase their commitments (Shimizu, 2007; Boyle and Shapira, 2012). For instance, finance studies show that positive performance in comparison to peers engenders hubris (e.g., Thaler and Johnson, 1990). Mishina et al (2010; p. 705) maintain that very positive performance outcomes instill in decision makers a belief in their 'infallibility.' It injects a sense 'they cannot fail;' thus, they ignore the 'downside risk' and consider only the 'upside potential' (see also Harris and Bromiley 2007), looking forward to the possibility of

spectacular outcomes and reducing inhibitions that might otherwise deter them from making taking on additional risk. Experimental and field studies tend to support these findings (Audia and Brion, 2005).

Counterarguments to this contention, however, stem from psychological research that suggests that *weak* positive outcomes relative to peers are likely to be understood in a negative light (Kahneman and Tversky, 1979; Kahneman, 2011) and that decision makers will interpret the outcomes as a disappointment. Since these negative perceptions loom larger than positive ones, decision makers then will tend to reason that it is better to hold on to what they have achieved than to expose themselves to further risk. When outcomes are only *moderately* better than their peers' accomplishments, they generate loss aversion (Kahneman and Tversky, 1979; Kahneman, 2011). To reduce the risk of possible future losses, decision makers keep themselves from making further commitments (Hu, Blettner, and Bettis, 2011) because they do not see the performance gains that they have achieved so far as necessarily repeatable. The undesirability of possible future losses eclipses the attraction of these possible gains. Thus, the inclination is to protect the gains decision makers so far have achieved rather than taking on greater risk.

Contingent on the perceptions that dominate decision-making about their gains relative to their peers, these mechanisms suggest that the relationship between an organization's performance in comparison to its reference group and its subsequent investment behavior is likely to be U-shaped. In response to returns that *far exceed* those of their peers, VC will respond by increasing their commitment to CE, and in response to returns that *fall below* that of their peers, they will respond by lowering their commitment. Thus, the following proposition is likely to apply to the behavior of VCs that invest in CE:

Hypothesis 3: *An inverted U-shaped relationship exists between VCs' CE exit performance in comparison to peer VCs and the subsequent rate of growth in their CE investments.*

4. Methods and Analysis

4.1 Sample and Data Sources

The main data source for testing the hypotheses was the VentureXpert database Thomson-Reuters maintains, which has been used in many influential VC analyses (e.g. Guler, 2007; Hochberg, Ljungqvist, and Lu, 2007; Kaplan and Schoar, 2005; Samila and Sorensen, 2011; Sorenson and Stuart, 2008). The analysis that follows focuses on clean energy deals U.S. VCs did in 2000-2011. During this period, CE investment grew from under two percent of investments that U.S.VCs made prior to 2002 to a peak of about sixteen percent of the investments they made in 2008 (NVCA, 2011). The Cleantech Group Data Base was a source for collecting data on the number of VC deals in the state, and U.S. Energy Information Administration was a source for collecting data on the dollar amount of renewable energy generated and the price of electricity in the state.

These data were compiled on each of the variables in the model for each year during the period examined. Table 1 lists the dependent and independent variables, the internally based and externally based control variables and the measures that we in used to compute them. Table 2 presents the means, standard deviations, and correlations of these variables.

INSERT TABLES 1 and 2 ABOUT HERE.

4.2 The Dependent Variable

The dependent variable is growth in a VC's investment in CE, which we measured as the annual percentage increase in cumulative VC dollar investment in CE. Following Desai (2008), who used a size-dependent growth rate measure to examine investment behavior, the measure of VC investment growth was calculated by subtracting the current year's cumulative dollar investment from last year's and dividing by 100. Similar to capacity expansion, expansion of capital under investment was a risky decision because its consequences were uncertain and depended on

difficult to predict environmental factors (Audia and Greve, 2006; Greve, 2003).

4.3 Independent Variables

To test the first hypothesis, we measured initial CE investment as the dollar value of the VC's first CE investment. To test the second hypothesis, we measured deal making experience or deal repetition as the cumulative number of CE companies that a VC financed. To test the third hypothesis, we used a combination of IPOs and acquisitions to measure exit performance, in accordance with previous research. For example, Laine and Torstilla (2005) and Hochberg, Ljungquist, and Lu (2007) have defined VC performance as the 'exit rate;' that is it is the fraction of portfolio companies that successfully exit via IPO or acquisition. In studies they have done, they have aggregated IPOs and acquisitions and consider them to be roughly equivalent. Laine and Torstilla (2005) conducted a study of VC portfolio firms' exit rates and found the mean percentage of IPOs to be roughly the same as acquisitions. Similarly, in the study sample IPOs and acquisitions occurred at roughly the same rate, 48% were IPOs and 52% were acquisitions.

Since the way VC firms experience exits will vary as function of when they raised the investment funds from which they draw cash and how many years it has left, year-to-year comparisons are less relevant than multi-year rolling averages that smooth out year-to-year variations. Therefore, we analyzed the accumulation of VC exits over a multi-year period.

We used peer VC exit performance comparisons to measure relative exit performance. Kacperczyk et al. (2014) maintain that social comparisons are more valid indicators than historical comparisons when analyzing organizational versus individual decisions. Still another reason for focusing on social comparison of performance outcomes was that, while the findings of historical performance comparison studies are quite consistent, studies of social comparison reflect more divergent findings. Researchers typically specify the social performance reference point toward which organizations aspire as the average or median of a comparable or peer group. Therefore, we measured the peer performance discrepancy as the difference between a VC's

cumulative CE exits and the median cumulative CE exits of its peers in a year. Information about VC exits was publicly available and widely distributed (Phalippou and Gottschalg, 2009; Hochberg, Ljungqvist, and Lu, 2007; Laine and Torstila, 2005; Lerner, 2002). VCs closely watched this information since it affected their ability to raise funds (Pollock et al., 2015; Lerner, 2002; Washington and Zajac, 2005). The more exits they had, the more attractive they were to potential backers, their key stakeholder group- the pension funds, university endowments, insurance companies, private companies, and individuals that expected accountability from the VCs (Puri and Zarutskie, 2012).

We ranked VCs at, or above, the median along this dimension (Greene, 2011; Greve, 1998). Exit Performance above Par Squared signified extreme positive performance at or above the median, while Exit Performance above Par signified moderate performance at or above the median. The former indicated a very large performance gap between unusual CE investment successes relative to a VC's peers, while the later implied a smaller gap between unusual CE investment successes relative to its peers.

4.4 Control Variables.

We introduced numerous control variables into the analysis to rule out alternative explanations. The first control variable was past years' annual percentage increase in cumulative VC dollar investment. We introduced this variable to assure the analysis captured actual change in percentage of CE investment. The extent to which firms experience exits varies in accord with the vintage and maturity of their investments. Thus, the timing of VCs' first investment in CE also was a control variable. If the timing was late and investments had less time to fully mature, exits would have less impact on investment growth.

Relying on two variables - cumulative number of VC funds and new fund creation – controlled for fund influence. Among VC researchers, equally strong traditions exist for doing analyses at the VC and at the fund level (DaRin, Hellman, and Puri, 2011). Since our analysis

Focused on the VC level, we took into account fund-level factors in controlling for these variables, Timing, cumulative number of funds, and new fund creation accounted for the time VCs had been investing in CE, the backing their funds had received, and fund creation; these factors might have influenced the extent to which VCs would commit to additional CE investment.

We inserted another control variable to take into account the effects of available resources from previous IPO earnings as these earnings might make VCs more open to increasing their CE investment. If cumulatively VCs raised more money and their IPO earnings were higher than other VCs, they might be more likely to take on greater risk and increase their level of CE investment. This variable partially accounts for the influence of slack resources on the VCs' decisions (Tyler and Caner, 2015).

Still another set of control variables captured the possibility that specialization in certain kinds of investments might have changed VCs' motivation to increase their commitment to CE investing. Specifically, the less specialized in CE investment VCs had been in the past, the more likely they might be to grow their CE investing in the future. On the other hand, specializing in early stage investments might discourage VCs from increasing their CE investments because early stage investments would reduce their risk buffer. The age of the VC firms and the number of expansion and later stage deals they had done captured relevant experience. If they had been around for a long time and demonstrated staying power, they might feel secure and open enough to increase CE investing. If, in the past they did many expansion and late stage deals, which tend to be much safer bets than seed and early stage deals, then their propensity for risk might be relatively low and they would not be inclined to increase CE investing.

Below Par Peer Performance Squared and Below Par Peer Performance also were control variables because they might diminish growth in CE investments. The former was the degree to which cumulative CE exits of a VC, minus the average cumulative exits of its peers, was below a

given year's median squared. The latter was the degree to which the cumulative CE exits of a VC, minus the average cumulative exits of its peers, was below a given year's median. While the VCs' experience with failures was frequent, their successes were unusual. As common occurrences, failures were an accepted risk of doing business; the VCs tendency was to dismiss them and consider them non-events. They attended to them less than they attended to a few successful exits (March and Shapira, 1987; Weick and Sutcliffe, 2006). As DaRin, Hellman, and Puri (2011) note, VC are habituated into accepting failures. They treat frequently reported negative information as less salient than infrequently reported positive information.

The other control variables captured the institutional and economic context in which the VCs operated based on state level data. States have different institutional characteristics that reflect their level of conduciveness to CE investments, such as the number of Sierra Club members states have; the attention local media pays to CE, and the popularity of past CE investing. VCs in states with many Sierra Club members and many CE media articles in proportion to the state's population might have been more inclined to increase their CE investments. If the number of CE deals relative to the population was high, there could be a contagion effect; the VCs in that state might copy their peers and their investment in CE would grow. Many studies have found that VC investment has been inherently local, that local conditions affect investment heavily, and that the local activities of VCs has been contagious, with each VC heavily influenced by the behavior of its peers (DaRin, Hellman, and Puri, 2011).

The states in which the VCs were located also had different economic characteristics that might influence VC decision making. An important factor was the vibrancy of the market for CE products, as measured by the level of renewable power generated and sold within the state, and the attractiveness of CE markets, as reflected by the price of electricity. If the states in which the VCs were located generated a high amount of renewable power, the VC firms located in that state might be more inclined to raise their level of CE commitment. If state electric prices were high, the VCs also might increase their investment in CE because they would believe that CE

investments could earn a high return. We used dummy variables to control for year effects.

4.5 Estimation Procedure

We used a two-step generalized method of moments (GMM) dynamic panel estimator to test the hypotheses. Empirical researchers commonly use this method to analyze increases in rates of growth in phenomena like GDP (Samila and Sorenson, 2011). GMM 'relies on the fact that a moment in a population distribution can be estimated using the corresponding moment of the sample (e.g., the mean, variance, or skewness of a system parameter)' (Baum and Havemen, 1997; p. 323). Its special advantage is that it can correct for heteroskedasticity (Baum and Haveman, 1997). What necessitates the technique is consistency of estimates. Ordinary least squares (OLS) estimation would yield biased results because it does not make use of the cross-equation correlation of the disturbances in the data. (Baum, Calabrese, and Silverman, 2000; Halaby, 2004). Econometricians designed the two-step GMM dynamic panel estimator for analyses of 'small *T*, large *N*' panels like our own. In such panels, there are few periods and many observations, fixed effects, and heteroskedasticity. Using a lagged dependent variable, the estimation technique corrects for inconsistent estimates even in the presence of fixed effects especially when T is small. No strictly exogenous independent variables correlate with past or current, realizations of the error term (Arellano and Bond, 1991; Arellano and Bover, 1995; and Blundell and Bond, 1998).

In estimating the models, the analysis relied on the 'xtabond2' command in STATA. To eliminate universal time-related shocks from the errors, as indicated, we included time dummies. The other specification choices made in estimating the models were the xtabond2 commands lag (2.) collapse, nolevel, small, twostep, and robust. In showing the results, noted are the numbers of instruments generated and provided are the common diagnostic tests used in GMM – AR(1), AR (2), and Hansen – to assure that the assumptions of the model are met. The AR(1) and AR(2) tests check for autocorrelation in the idiosyncratic disturbance term to determine if the lags are valid as instruments. The Hansen test assesses the joint validity of the instruments.

We instrumented the following variables because of their reciprocal relationships with the rate of CE investment growth. Last Year CE Investment Growth, Deal Repetition, Cumulative CE Exits, or Extreme above Par Peer Exit Performance and Moderate above Par Peer Exit Performance and Extreme below Par Peer Exit Performance and Moderate below Par Peer Exit Performance, All Funds Raised, New Fund, IPO Earnings, CE Concentration, and Early Stage Concentration. Following Rodman's (2007) recommendation to reduce the number of instruments, these variables were factor analyzed. The aim was to have enough instruments for valid estimation of the endogenous variables but not so many instruments as to risk over-identification. Fitting together as single factor were Extreme above Par Peer Exit Performance and Moderate above Par Peer Exit Performance, All Funds Raised and New Fund, and Extreme below Par Peer Exit Performance and Moderate below Par Peer Exit Performance. To guard against outliers values of Extreme above Par Peer Exit Performance higher than 1.75 was eliminated. As a check on the factor manipulations, we estimated the models using both the factored values and a full set of instruments and obtained equivalent results.

5. Results

As Table 3 shows, Initial Investment and Deal Repetition (hypotheses 1 and 2) significantly influenced the rate of growth of CE investments (see Table 3), while cumulative exit events did not. VCs ignored absolute performance defined as the occurrence of rare events. They persisted in growing investment, an investment path they already had established, based on the magnitude of their initial choices and repeat decisions. However, depending on how far above the median VCs ranked in comparison to the performance of their peers (hypothesis 3), they changed their CE investment rate. Performing extremely better than the performance of their peers (Above Par Exit Performance Squared) led them to increase their CE investment growth rate, while doing only moderately better (Above Par Exit Performance) led them to decrease this rate. The former significantly raised the rate of CE investment, while the latter significantly reduced it. These

findings provided support for the prior self-enhancement and prospect theory explanations of decision- making in the third hypothesis.

INSERT TABLE 3 ABOUT HERE.

When positive performance outcomes were rare, the VCs in this study responded to an outstanding ranking in comparison to their peers with more investment. An extremely high ranking in positive performance relative to peers' performance produced more investment, while a moderately high ranking in positive performance relative to peers dampened the tendency of the VCs to invest. We used the u-test command in Stata (Lind and Mehlum, 2010) to test for the presence of this U-shaped relationship and it was significant (P>.005). A test of the presence of a u-shaped relationship for the variables Below Par Exit Performance Squared and Below Par Exit Performance, in contrast, revealed no statistical significance.

We computed the standardized betas for the variables to determine the degree to which VC ranking of exit performance in comparison to peers influenced CE investment. For Above Par Exit Performance Squared, the standardized beta was +.31. For Above Par Exit Performance it was -.31. For Initial Investment the standardized beta was +.21 and for Deal Repetition it was +.11. Based on these calculations, VC ranking of exit performance in comparison to peers had a stronger effect than the path dependent effects. Mere occurrence of unusual success did not change the direction of VC decision-making, but the ranking of these events in comparison to the average of a VC's peers did have a significant impact.

Three control variables also had significant effects on the dependent variable (see Table 4). In both models reported in Table 4, Last Year CE Investment Growth was significant. Two control variables were significant in the second model. First, Investment Timing had a significantly negative effect on investment growth. This finding too was consistent with what was expected. VCs that started to invest in CE later and whose investments therefore had less

vintage and were further from maturity were less likely to increase investment in CE. They had less feedback information on which to rely. Second, State CE VC Deals also had a negative significant relationship with increase in CE investing. This finding indicated that states with low numbers of CE deals started to grow their CE investing at a faster rate than states that already had a high number of these deals.

INSERT TABLE 4 ABOUT HERE.

5.1. Discussion of Results

In the face of an unusual event, organizations like VCs persist in the actions they have been taking. Only in examining unusual success in relation to that of peers, does the unusual event become salient. If the occurrence of unusual success is very high in relation to an organization's peers, it has a positive impact on investments (Thaler and Johnson, 1990; Mishina et. al., 2010). Comparing infrequently occurring positive performance to an organization's peers inspires confidence in the abilities of the organizations' decision makers and motivates them to become more committed to increasing the actions they have taken (Pfeffer and Fong, 2005). If the occurrence of unusual success in relation to an organization's peers is just moderately positive, it has a negative impact on investments (Fiegenbaum and Thomas, 1988; Shimizu, 2007). These moderately good outcomes in comparison to peers stimulate loss aversion concerns and lead decision makers to become less committed to actions they have taken.

Many studies demonstrate the importance of peer comparisons in influencing a wide range of organizational decisions and behaviors, when the peer comparisons are of frequent, well-documented performance indicators (Gavetti, Greve, Levinthal, and Ocasio, 2012; Shinkle, 2013). However, empirical studies of the effects of social performance comparison on organizational choices have not focused on risk preferences at extremely positive performance levels, an omission addressed in this chapter.

This chapter did not investigate VCs' decision to enter this domain (see Petkova, Wadwha, and Jain, 2014), but rather the decision to expand or contract commitment once they entered. More specifically, it presented a study that tested hypotheses regarding the relevance of complementary decision making mechanisms to explain organizational responses to unusual success by examining the investment decisions of U.S. VCs in the 1999-2011 period of CE's emergence as a sector of investment interest. The findings of this study are that prior exit events only affected subsequent CE investment growth when VCs compared their exit record with that of their peers. Both persistence that comes from the size of a CE's initial investment, the repetitive behavior of making deals, and feedback from comparison to peer performance influenced VC investment behavior. What is most important is that VC firms grew their investments when the cumulative number of exits of CE firms in which they had invested *substantially exceeded* the number of CE exits of peer VC firms that also had been investing in CE firms. At the same time, this chapter found that investment in CE ventures declined if a VC's cumulative CE firm exit record just moderately outpaced that of peer VC investors. Disappointed by the results when they did not achieve exceptional performance in comparison to their peers' performance, VCs reacted by cutting back on CE investing. When decision makers recognized that they did far better than their peers had, they increased their commitment to the path they took. If their performance was only moderately better than their peers' performance, they reduced this commitment.

VCs backing CE thus behaved as if constrained by their main backers – their main stakeholders – pension funds, university endowments, insurance companies, private companies, and individuals who expect accountability. VCs only increased their CE investments if their returns in comparison to their peers were exceptionally positive. Moderately better returns led to a reduction in commitment. The findings in this chapter are consistent with what we know about VC behavior in other realms. The motivational structure, which guides VC investment, makes this type of investment a limited vehicle for advancing CE and thus for creating a more

sustainable society in the decade in which this study was carried out. When VCs make investments, they are seeking superlative returns. Lukewarm gains are not sufficient. The reason is that VCs must compensate for the large number of losses they experience. A very high percentage of the startups in which they invest produce no real return at all. They either fail entirely or yield a net loss to their backers. Operating in this environment, the VCs have a special payback and incentive structure in which necessitates that they seek extraordinary gain. This incentive structure distinguishes them from the financial backers of publicly traded corporations, shareholders, whose return expectations are not likely to be as high because they generally compare their returns to standard indexes like Dow Jones and Standard and Poor's 500.

5.2. Implications for Sustainability and Corporate Social Responsibility

The implications for sustainability and corporate social responsibility are important. If indeed, VCs disproportionately direct innovative technology investment in society and drive economic and social progress, their role in promoting sustainability and corporate social responsibility is a peculiar one. The incentive structure in place among VCs circumscribes the role they can play as a positive force. As in the case of publicly traded corporations, the VC's relation to their main stakeholder group, their financial backers, drives this incentive structure. However, the backers of VCs manage diversified portfolios of investments and they have different expectations about the risks and rewards. To the extent that they fund VC investments, their expectation is that the risks are likely to be greater and that therefore the rewards have to be higher. In short, they are looking for exceptional and not ordinary gain. If they wanted ordinary gain, they have many other investment opportunities, of which they do take advantage, such as bonds and relatively safe dividend paying stocks. They make these investments as well as investing in VCs so when they invest in VCs they are looking for extraordinary gain, and this expectation limits what the VCs can do in the realm of sustainability and corporate social responsibility in a way that is different from how

shareholders limit the behavior of publicly traded companies. These distinctions in the governance of stakeholder relations with respect to business decisions relating to sustainability and CSR are ultimately decisions about are important to consider.

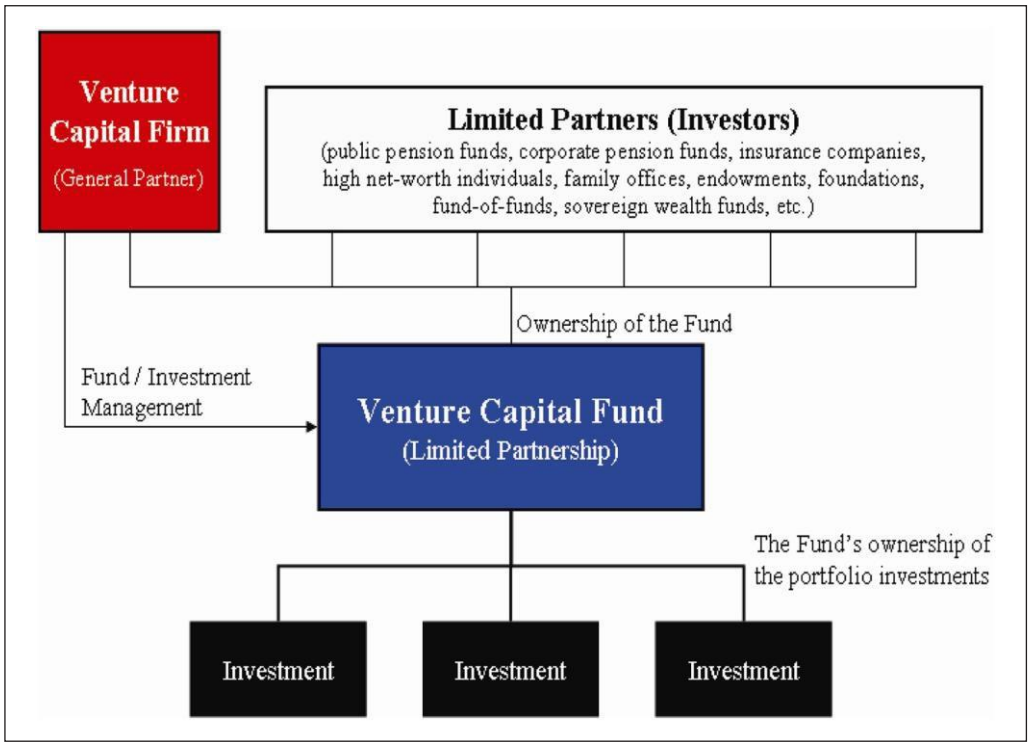
5.3. Limitations and Future Directions

Settings in which prior research has analyzed the impact of performance outcomes on investment decisions represent only a narrow range of the settings in which organizations function. The one analyzed in this chapter was a special setting from which it might not be possible to draw broad generalizations for a number of reasons. As emphasized, success in this setting, in comparison to others, had a special meaning. The VCs that invested in CE faced a unique type of pressure from their backers that might not apply in other settings. In addition, because investment in the CE category was new, VCs did not have much precedent upon which to draw. This category was not like IT or medical technology, categories in which VCs had longer investment histories. Given the partial, imprecise, and incomplete performance information VCs had, the task of assigning meaning and drawing implications about what to do, though particularly important, was difficult. Clearly, it was not the same as the task of assigning meaning and drawing implications for what to do next in settings in which there is more complete and comprehensive information about past performance. In the VC setting of CE, where there was a dearth of reliable information and scant precedent, the emphasis decision makers gave to processes of foresight appear to have been pronounced.

6. The Dilemma of Funding Sustainable Innovation

The funding limits under which VCs operate that are revealed in this chapter thus pose the following dilemma—if VCs are not in a position to help fund potentially game-changing CE technology on a large-scale basis, then who can provide this type of funding (Marcus, Malen, and Ellis, 2013)? This is the key challenge that this chapter raises for sustainability, stakeholder governance, and corporate social responsibility

Figure 1. The Typical Organization of Private Equity Venture Capital



Source. http://en.wikipedia.org/wiki/Venture_capital

Table 1. Variables and Measures

A. Dependent and independent hypotheses variables:	
Variable Label	**Measure**
CE Investment Growth	Annual percentage increase in the cumulative VC dollar investment in CE
Initial Investment	Dollar value of VC's first CE investment
Deal Repetition	Cumulative number of CE companies that VC has financed
Cumulative VC Exits	Cumulative number of exits (IPOs and acquisitions) a VC has in a given year
Extreme Above Par Peer Performance	The degree to which the cumulative CE exits of a VC minus the average cumulative exits of its peers is at or above the median in a given year squared
Moderate Above Par Peer Performance	The degree to which the cumulative CE exits of a VC minus the average cumulative exits of its peers is at or above the median in a year
B. Internally based control variables:	
Last Year CE Investment Growth	Past years' annual percentage increase in the cumulative VC dollar investment in CE
Investment Timing	Length of time between a VC's first investment in a startup firm and its first investment in a CE firm
All Funds Raised	Cumulative dollar value of money VC has raised from investors
New Fund	Whether the VC has started a new fund in a year
IPO Earnings	Cumulative dollar value of VC's IPO earnings
CE Concentration	Percentage of CE investments in VC's portfolio
Early Stage Concentration	Percentage of seed and early investments in VC's portfolio
VC Firm Age	Number of years since the VC was founded
Later Deals	Cumulative number of expansion and later deals VC has carried
Moderate Below Par Peer Performance	The degree to which the cumulative CE exits of a VC minus the average cumulative exits of its peers is below the median in a given year
Extreme Below Par Peer Performance	The degree to which the cumulative CE exits of a VC minus the average cumulative exits of its peers is below the median in a given year squared

Table 1. Variables and Measures (continued)

C. Externally based control variables:	
Sierra Club Members	Past year's number of Sierra Club members in stated divided by state's population
State CE Articles	Past year's number of articles in publications in VC's state referencing CE divided by state's population
State CE Deals	Past year's number of CE deals in VC's state divided by state's population
State Renewable Energy Sales	Past year's dollar amount of sales of renewable energy except hydro in VC's state divided by state's population
State Electricity Price	Past year's total price (dollars per kilowatt-hour) for electricity in state
Years1999-2011	Dummies for years 1999-2011

Table 2. Means, Standard Deviations and Correlation Table of Variables

		Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1	CE Investment Growth (%)	24.71	43.61	1.00										
2	Initial Investment ($M)	3	9.58	0.11	1.00									
3	Deal Repetition (# companies)	1.49	1.05	0.61	0.13	1.00								
4	Cumulative VC Exits	0.15	0.50	0.27	0.01	0.17	1.00							
5	Above Par Exit Performance Squared	0.11	0.32	0.34	-0.01	0.21	0.95	1.00						
6	Above Par Exit Performance	0.07	0.24	0.26	0.02	0.17	1.00	0.95	1.00					
7	Last Year CE Investment Growth (%)	14.1	35.17	0.91	-0.13	0.53	0.27	0.34	0.26	1.00				
8	Investment Timing (yrs.)	4.61	9.07	-0.18	0.25	-0.13	-0.04	-0.04	-0.03	-0.21	1.00			
9	All Funds Raised ($M)	173.05	820.22	0.13	0.00	0.17	0.08	0.06	0.08	0.12	-0.02	1.00		
10	New Fund (# started in that year)	0.28	0.56	0.11	0.04	0.11	0.04	0.05	0.04	0.08	0.06	0.18	1.00	
11	IPO Earnings ($M)	1293.63	3866.75	0.17	0.01	0.21	0.06	0.08	0.07	0.17	0.00	0.52	0.09	1.00
12	CE Concentration (%)	0.16	0.25	0.02	0.07	-0.03	0.01	0.00	0.00	-0.01	-0.23	-0.11	-0.18	-0.09
13	Early Stage Concentration (%)	0.34	0.22	-0.08	-0.01	-0.02	0.00	0.00	0.00	-0.05	-0.11	-0.04	-0.14	-0.08
14	VC Firm Age (yrs.)	18.54	19.32	0.06	-0.02	0.04	0.04	0.03	0.04	0.05	0.17	0.12	0.63	0.01
15	Later Deals (#)	11.84	14.55	-0.05	0.11	0.05	0.12	0.10	0.16	-0.12	0.11	0.10	-0.03	0.09
16	Below Par Exit Performance Squared	-0.05	0.06	-0.06	0.12	0.05	0.12	0.11	0.17	-0.13	0.12	0.10	-0.03	0.09
17	Below Par Exit Performance	-0.2	0.11	0.26	0.01	0.27	0.03	0.04	0.04	0.23	0.07	0.40	0.34	0.29
18	State Sierra Club Members (per pop)	0.00354	0.00136	0.04	0.03	0.09	0.03	0.04	0.03	0.04	-0.01	0.14	-0.01	0.24
19	State CE Articles (per pop)	0.00012	0.00008	0.13	-0.07	0.06	0.04	0.01	0.04	0.13	-0.08	-0.03	0.02	-0.05
20	State CE Deals (per pop)	0.00001	0.00001	0.19	-0.07	0.09	0.05	0.04	0.03	0.24	-0.16	0.04	-0.03	0.09
21	State Renewable Energy Sales (per pop)	0.25	0.25	0.20	0.02	0.15	0.04	0.04	0.04	0.18	-0.06	0.14	0.00	0.19
22	State Electricity Price ($M)	12.4	2.89	0.19	0.04	0.13	0.08	0.06	0.09	0.17	0.01	0.06	0.16	0.08

Table 2. Means, Standard Deviations and Correlation Table of Variables (continued)

		Mean	S.D.	12	13	14	15	16	17	18	19	20	21
12	CE Concentration (%)	0.16	0.25	1.00									
13	Early Stage Concentration (%)	0.34	0.22	0.32	1.00								
14	VC Firm Age (yrs.)	18.54	19.32	-0.30	-0.24	1.00							
15	Later Deals (#)	11.84	14.55	-0.04	-0.02	-0.04	1.00						
16	Below Par Exit Performance Squared	-0.05	0.06	-0.05	-0.02	-0.04	1.00	1.00					
17	Below Par Exit Performance	-0.2	0.11	-0.37	-0.13	0.31	0.09	0.08	1.00				
18	State Sierra Club Members (per pop)	0.00354	0.00136	-0.08	0.01	-0.12	0.12	0.13	0.21	1.00			
19	State CE Articles (per pop)	0.00012	0.00008	-0.02	0.01	0.08	-0.04	-0.06	0.09	-0.16	1.00		
20	State CE Deals (per pop)	0.00001	0.00001	-0.04	0.04	-0.03	-0.26	-0.28	0.16	0.23	0.62		
21	State Renewable Energy Sales (per pop)	0.25	0.25	0.00	0.06	-0.08	-0.06	-0.07	0.21	0.61	-0.21	1.00	
22	State Electricity Price ($M)	12.4	2.89	-0.03	-0.11	0.20	-0.07	-0.08	0.16	0.12	0.50	0.16	0.48

Table 3. Main Hypotheses: Step Generalized Method of Moments (GMM) Dynamic Panel Estimators of the Rate of Clean Energy Investment Growth, Years 2000-11

DEPENDENT VARIABLES	Hypotheses 1 and 2	Hypothesis 3
Cumulative VC Exits	1.76	
	(14.80)	
Initial Investment	6.45***	3.86**
	(2.86)	(1.59)
Deal Repetition	.69***	.81***
	(.27)	(.09)
Above Par Exit Performance Squared		39.94***
		(12.40)
Above Par Exit Performance		-54.4***
		(19.22)
Observations	588	588
Number of VCs	256	256
F	21.37***	43.72***
Number of Instruments	86	90
AR(1)	-1.99*	-1.69*
AR(2)	.39	.57
Hansen test	.84	.79
*** p<0.01, ** p<0.05, * p<0.1		

Table 4. Control Variables --Two-Step Generalized Method of Moments (GMM) Dynamic Panel Estimators of the Rate of Clean Energy Investment Growth, Years 2000-11

CONTROL VARIABLES		
Last Year CE Investment Growth	1.06***	1.03***
	(.16)	(.18)
Investment Timing	-.10	-0.22***
	(.16)	(.08)
All Funds Raised	-.0002	-.0001
	(.002)	(.002)
IPO Earnings	.0001	.002
	(.001)	(.001)
New Fund	-1.94	-2.89
	(5.84)	(2.784)
CE Concentration	-76.02	-15.55
	(113.18)	(9.63)
Early Stage Concentration	-.59.49	15.47
	(33.06	(9.38)
VC Firm Age	-1.49	9.74
	(5.72)	(7.93)
Later Deals	-.64	-0.035
	(.59)	(0.12)
Below Par Exit Performance Squared		423.0
		(299.0)
Below Par Exit Performance		-84.45
		(52.99)
State Sierra Club Members	-1,823	-1,326
	(5,538)	(3,183)
State CE Articles	11205	44,787
	(6991)	(32,349)
State CE VC Deals	Dropped due to collinearity	-882,96*
		(532,794)
State Renewable Energy Sales	20.90	-065
	(31.58)	(14.89)
State Electricity Price	-.67	-0.257
	(1.55)	(0.958)
Observations	588	588
Number oVCs	256	256
F	21.37***	43.72***
Number of Instruments	86	90
AR(1)	-1.99*	-1.69*
AR(2)	.39	.57
Hansen test	.94	.79
*** p<0.01, ** p<0.05, * p<0.1		

We included controls for years in all analyses but do not report the results here.

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