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## Monitoring venture capital investments through internal control prediction markets

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# MONITORING VENTURE CAPITAL INVESTMENTS THROUGH INTERNAL CONTROL PREDICTION MARKETS

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# Monitoring Venture Capital Investments through Internal Control Prediction Markets

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## **Zusammenfassung / Abstract**

This paper offers a new perspective on a fundamental issue of venture capital investments, i.e., the so-called black box of involvement that concerns the paucity of relevant information necessary for venture capital managers to evaluate investments properly. Our paper discusses the application of an internal control prediction market as a monitoring instrument for venture capital investments. We therefore gather research literature and law and financial expertise to discuss uncertain business developments, missing data, and principal–agent conflicts. The results of our paper are expected to make significant contributions to the academic discussion, providing a foundation to open the black box of involvement that current venture capital managers face daily.

**JEL-Klassifikation / JEL-Classification:** G32 Financing Policy, G34 Mergers, G39 Other

**Schlagworte / Keywords:** Venture Capital, Venture, Capital Investments, Seed Capital, Monitoring, Managing, Black Box

# 1. Introduction

We are living in a century of venture capital investments.[1] The venture capital industry has grown cyclically worldwide, with the rise of Silicon Valley, the new economy, and the new worldwide entrepreneurship culture. [2], [3] The broad topic of venture capital investments has been extensively researched discussed in its well-developed literature, given the topic's growing industry and relevance.

Despite such positive preconditions, decision making in the context of venture capital investments is financially volatile, and young companies generally face uncertain corporate development.[4] This phenomenon is likely caused by two monitoring issues.

First, early-stage companies, by nature, change and adjust to the uncertain environment in which they conduct daily business. Reliable financial data or predictions on the corporate future are therefore highly problematic to obtain. Consequently, the venture capital decision-making process depends on experience and non-financial (soft) data. More concretely, five out of 10 evaluated decision-making criteria are related to the entrepreneurs' experience or personality and not at all to the business.[5]

Second, regular methods of financial evaluation generally employed for non-venture-capital investments are unlikely to provide reliable data as they need a larger sample of statistical data. As most of the firms with venture capital investments work on new business plans, there is no statistical data available to evaluate or predict certain events or indicators.

The outlined issue of volatility and informational dearth may seem problematic, but prediction markets could provide a solution to these highly specific issues. Numerous applications of prediction markets have been discussed since research on the subject began. The spectrum is widely diversified—applications of prediction markets range from result predictions for political elections through supply chain information to project management. In contrast, the range of scientific articles on the subject is limited: while vast numbers of open-access articles on prediction markets are available, the literature on internal control prediction markets is limited.[6]

Despite the potential of internal control prediction markets as corporate governance tools, there are few relevant articles on comprehensive “real world” experiments such as the one conducted by Ortner. [7], [8] Most of the articles that have delved into internal control prediction markets focus on the accuracy and general applicability of prediction markets as an internal control instrument. The subject of venture capital investment, especially regarding the monitoring of specific investments, is not discussed from an internal control perspective or examined through a comprehensive field experiment.

Although this paper does not provide such a comprehensive field experiment, it attempts to define and evaluate the potential application of internal control prediction markets for the monitoring process of venture capital investments. Therefore, a multiple-perspective approach was adopted. The initial chapters of this study define and describe the general framework and applicability of prediction markets in an application for venture capital investment, and the later chapters evaluate the framework from financial and legal perspectives.

## 2. Defining characteristics and objective

### 2.1 Venture capital investments

The following sub-chapter outlines some characteristics of venture capital investments in depth as they are found consistently through the literature. These characteristics highlight the two monitoring issues mentioned in the Introduction and provide a more complete understanding of the underlying problem. For the purpose of this study, various groups of venture capitalists are not differentiated since that would not be relevant in the monitoring context. (The demand for reliable information may be considered equal throughout all types of venture capitalists.) In general, there are three characteristics of venture capital investments concerning the monitoring issues.

- a.) **Risk level.** Venture capital, by its very meaning, is connected to great risk. Early-stage corporations or startups that are usually the investment target of venture capital firms are naturally open to higher total risk than later-stage or more developed corporations because of multiple and variable factors such as the uncertainty surrounding the suitability of a business plan to the market or the competence of the entrepreneurial team. One of the most anticipated studies on the characteristics of venture capital investments outlined that 60 out of 67 investments had significant uncertainties. These uncertainties were linked, for example, to the business model (as already mentioned), technological risks, or competitive markets—links that were comprehensively explained by Kaplan and Strömberg in 2004.[9] For the purpose of this study, it is assumed that widely diversified, uniquely considerable risk is involved in venture capital investments.
- b.) **Data availability.** Apart from the significant higher and diversified risk involved, venture capital investments share another interesting characteristic. Because venture capital is invested in early-stage corporations, venture capital management lacks financial or corporate data in two different ways. On the one hand, data is simply not available as the business exists for a short period. On the other hand, it is highly problematic to obtain comparable data on new and sometimes highly innovative business plans, as the degree of comparability is difficult to define. [10]  
The limited data is therefore the only source for regular financial evaluation models and, in turn, monitoring instruments. As a consequence, the results of financial evaluation models for venture capital investments are imprecise and unreliable. Regular methods of financial evaluation are insufficient for monitoring venture capital investments.
- c.) **Principal–agent conflict.** Both entrepreneurs and venture capitalists suffer from a serious principal–agent conflict. Information asymmetry arising from the uncertainty of business performance and the general dearth of data pushes entrepreneurs (agents) toward venture capitalists (principals) because entrepreneurs are much more privy to the source of information.[11] Because entrepreneurs tend to use this information asymmetry opportunistically, the rational investor will suffer the consequences.[12]  
Consequences in this context arise from an even greater paucity of data, and the limited data may be opportunistically employed by the agent. The principal–agent conflict therefore exacerbates the venture capitalist’s problem of information availability. Because data and information are the basis of reliable investment monitoring, the monitoring issues described earlier in this study worsen.

As outlined in this sub-chapter, an effective instrument to monitor venture capital investments over time only needs to be able to detect multiple and highly diversified categories of risk.

Such an instrument further needs to be able to collect its own data to monitor potential investments and overcome the opportunistic actions of the agent that are not beneficial for the principal.

## 2.2 Prediction markets

With the above-mentioned requirements for potential instruments to monitor venture capital investment in mind, the following chapter takes a closer look at prediction markets, especially their ability to perform internal control.

Prediction markets in general are artificial markets wherein participants trade contracts with payoffs tied to a future event, thereby yielding prices that can be interpreted as market-aggregated forecasts.[13] Modern prediction markets are dominated by service providers (e.g., Prediki) that use a question and multiple-answer structure. Therefore, participants more specifically trade on answer-related contracts of corresponding questions. Price movement per answer can be monitored over time, which provides useful information on the probability of each answer.

Prediction markets were first specifically mentioned as instruments for internal control by Henderson and Abramowitz in 2007. In their article on prediction market applications for corporate governance, they argued that the rising costs of corporate auditing are beneficial for the use of prediction markets as internal control tool. They argued that the rising costs due to the rising demand for transparency and disclosure of relevant information challenge traditional auditing and controlling mechanisms.[7] For the detection of fraud or general risks to significant key performance indicators, prediction markets provide a much higher level of adaptation ability and therefore be a more efficient alternative.[14]

Regarding an instrument for monitoring venture capital investments, some specific characteristics are particular relevant for this study:

- 1.) **Non-selective.** Prediction markets process all information available to market participants without real-world interaction in almost real time. Although specific kinds of information (such as that about risk) are not identified, all kinds are processed. The prediction therefore contains all relevant kinds of information.
- 2.) **Conflict-resistant.** Agent conflicts may be addressed through the respective financial incentive structure. Those incentives may therefore overcome the opportunistic incentive of the principal.[15]
- 3.) **Monitoring flexibility** regarding the respective prediction target/question answer structure. Therefore, potentially unlimited kinds of financial or corporate data can be predicted/monitored over time.
- 4.) **Timeframe flexibility** means more general flexibility toward the respective time frame of the prediction. Monitoring personnel are therefore able to start or end new prediction regarding the respective situation.

As seen above, prediction markets share several common characteristics that may be relevant to the above-mentioned monitoring issues regarding venture capital investments.

## 2.3 Objective

The objective of this study is to describe a potentially applicable framework for prediction markets to function as a monitoring instrument for venture capital investments. With the conceptual framework provided, the study evaluates the realization potential of prediction markets from financial and legal perspectives. This study's multi-perspective approach

intends to evaluate not only the technical realization potential (i.e., the pure feasibility of the framework) but also the utility of the provided framework. Therefore, this study compares, in technical terms, the conceptual prediction-market framework with the current legal and financial states of venture capital investment monitoring. The findings of this study will answer the following question:

**“Can internal control prediction markets function as monitoring instruments for venture capital investments?”**

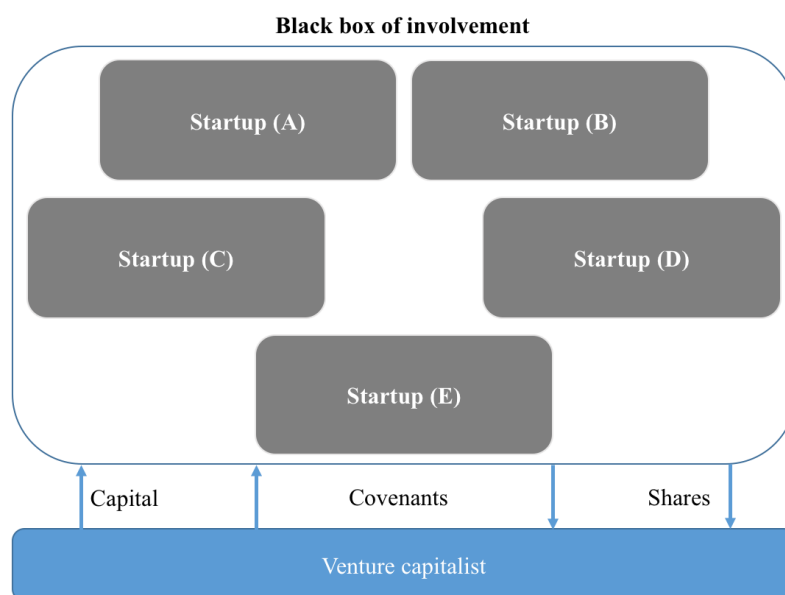
In discussing the answer to this question, the need for supplemental research will also be evaluated. Therefore, this study indicates the first step toward the realization of prediction markets in monitoring venture capital investments.

### 3. Conceptual framework

#### 3.1 Requirements

A prediction market framework able to monitor venture capital investments needs to satisfy several requirements that are related to the previously discussed monitoring issues of venture capital investments.

From the academic perspective, the black box of involvement needs to be opened.[16] When analyzing the actual investments of venture capitalists, it is the later-stage involvement that needs to be monitored. Most venture capital involvements suffer from the information asymmetry arising from the so-called black box. Contractual obligations through restrictive and non-restrictive covenants may limit the information asymmetry but only from an external uninformed and therefore inefficient perspective.[17] Figure 1 illustrates the academic perspective for better comparison with the actual conceptual framework. Regarding the identified monitoring issues, the following requirements are identified:



**Figure 1:** Academic perspective on the venture capital post-investment phase



- 1.) Regarding risk level.** Higher risk requires a highly sensitive monitoring instrument capable of processing different kinds of data into actionable information. For general comprehension, multiple perspectives on various financial and corporate data are required.

As for most monitoring instruments, data-type neutral sensitivity is highly important. Regardless of the kind of data input, the instrument needs to evaluate the data equally in respect to the respective financial or corporate information being monitored.

- 2.) Regarding data availability.** The conceptual framework needs to generate information on financial and corporate data independently. This information needs to be easily available and transferable for two reasons.

First, transferable information allows comparison. With transferable information available, regular evaluation instruments can be used to calculate comparable data. Second, as the information may be used for various reasons and by multiple information-seeking users, the accessibility needs to be ensured for a best possible spread of information. This could be visualized through a revolving information cycle.

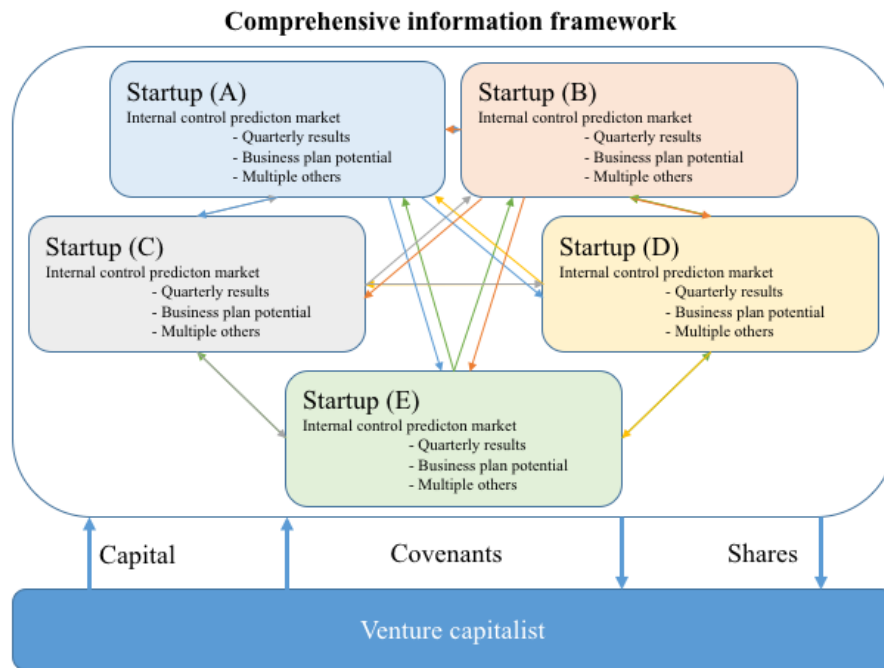
- 3.) Regarding principal–agent conflict.** As data need to be generated through the framework itself, they may be affected by principal–agent conflicts related to venture capital. Therefore, the generated data need to be neutral toward this potential conflict. Moreover, the data-generating process needs to be neutral toward informational biases in hierarchy or working groups.

### **3.2 General composition and potential**

The general composition of the conceptual framework can be regarded as a comprehensive information framework (see Figure 2). Therefore, the black box of involvement may be opened through the integration of prediction markets into the venture capital post-investment phase. For every startup within the venture capitalist’s investment portfolio, two types of prediction markets are to be considered as explained below.

The first type of prediction market is used in an internal control setting to predict relevant corporate and financial data within each startup. In Figure 2, it is symbolically represented by the colored boxes around each startup. Participants and therefore traders for those prediction markets are the entrepreneurs and employees of the respective startup. This group of traders has the majority of important and business-specific information on the startup at the earliest time possible.

The second type of prediction market is equally open to all startups within the venture capitalist’s investment portfolio. In Figure 2, it is represented through the colored arrows in between the startups of the venture capitalist’s investment portfolio.



**Figure 2:** Conceptual composition of the prediction market framework

The prediction targets are comparable to those within the internal control prediction market. Although this may seem confusing, it is an additional protection mechanism against principal–agent conflicts. As entrepreneurs and employees of each startup are heavily biased toward their own perspectives, the external perspective evaluates internal predictions and serves as an additional incentive for a more reliable prediction beside the more obvious financial perspective. For a better understanding, the second type could be considered as an external perspective on the reliability of the internal control prediction results.

The integrated framework of reciprocal evaluation can be used to evaluate the potential of complex and innovative business plans prior the actual market evaluation. As in a comparative evaluation of all business plans in the venture capital portfolio through prediction market trading, the potential of respective business plans is backed by the cumulative expert information of all entrepreneurs and employees working in the sum of all invested startups.

While the comprehensive information framework likely provides reliable information about financial and corporate data with additional usefulness in evaluation of business plans, the strength of the framework is in reprocessing information over time. Prediction markets process information with the efficiency of regular markets without the limitation of market hours. In this most efficient of markets, traders process information when it is available.[18]

The prediction market framework is capable of adapting to the highly uncertain and fast-changing environment of startups because the traders in the market are as close to the source as is possible or may even be the source itself. Hence, venture capitalists applying the conceptual framework to monitor venture capital investments possess the best-possible quantity of information in each moment in time during the framework application.

### 3.3 Exemplary prediction targets

#### 3.3.1 Financial data

Prediction markets are highly flexible regarding their prediction targets as prediction markets are, in general, share markets for answer-shares on a potentially unlimited variety of questions. This is the required characteristic of prediction markets concerning the availability to monitor the development process of various kinds of data. The following prediction targets are exemplarily provided to open the black box of involvement.

- 1.) **Total Sales.** The prediction of total sales is exemplary for the wide variety of financial data; prediction markets could potentially monitor. Total sales are equally exemplary as input data for financial analysis. Regarding the analysis application, the monitoring of quarterly total sales may be the most convenient. In general, any time frame could be chosen to monitor developments.
- 2.) **Operating expenses.** Financial analysis application for financial data is elevated through the example of operating expenses, which display the debit side of financial data. Therefore, along with total sales, operating sales exemplify the potentially unlimited variety of financial data that could be theoretically monitored for financial analysis.
- 3.) **Research expenses.** More specific financial data may also be monitored. Research expenses, which are especially relevant in the early stages of venture investing, could be monitored. Therefore, venture capitalists could not only observe the research phases and/or agreed budgets in a timely manner but also predict and, if necessary, hedge them.

#### 3.3.2 Corporate data

Financial data display the application spectrum of prediction markets on the “hard”-fact side. Corporate data, in opposition, serve as an indicator of the “soft”-fact side of the application spectrum. The following exemplary prediction targets are indicators of the actual potential of prediction markets as monitoring instruments for venture capital investments.

- 1.) **Employee satisfaction.** Although the monitoring of employee satisfaction seems to be unnecessary in the venture capital investing process, it may prove to be helpful. Young corporations are especially sensitive when it comes to employee satisfaction, embodying the concepts of venture and entrepreneurial spirit[19]. Tracking employee satisfaction might be a good indicator of early difficulties and could identify future complications in the corporation.
- 2.) **Research progress.** Although research progress could be monitored through hard facts with regard to research expenses as explained earlier, monitoring it more directly might be beneficial. While directly monitoring relevant deadlines or prototype characteristics, the prediction market may observe the progress in much greater detail. This might be particularly relevant for the observation of key performance deadlines. Again, this indirect–direct spread displays the application spectrum of the instrument.
- 3.) **Target achievement.** Startups applying for venture capital investments are usually bound to a strict schedule to achieve previously agreed milestones. Such milestones could be attained through the application of prediction markets. Therefore, venture

capitalists can predict and, if necessary, hedge potential outbreaks. While this is specifically applicable for research progress, it is listed here with respect to general application.

### ***3.3.3 Business plan potential***

The usefulness of prediction markets in evaluating business plans is especially relevant for seed investment. Most business plans have not been tested by competition, making them difficult to assess. Prediction markets provide venture investors a small but professional artificial market to assist them.

One way to evaluate market potential is to ask participants in the prediction market some indicating questions with answer-shares traded in a prediction market. Because participants are contractually bound to non-disclosure, they are excellent sources of assessment without risk of exposing sensitive information if there are no issues involving competitors. Depending on the diversity of the investment portfolio, the number of participants in the prediction market, and their expertise, the evaluation may present predictions of varying quality.

## **3.4 Framework integration**

Conceptual framework provides an interesting financial opportunity. In contrast, the conceptual prediction market framework is a substantial legal addition to the already existing procedures of venture capital investment. This sub-chapter discusses potential framework integration issues as a basis for later evaluation from the legal perspective. As already mentioned in the prior chapters, the easiest way to incorporate the framework into the venture capital investment process is by obligating all employees and entrepreneurs within the investment portfolio through covenant agreements, bound by non-disclosure clauses and a financial incentive agreement.

The first condition for the incorporation of the framework is easy to understand: all employees and entrepreneurs within the framework are prohibited from communicating in any way with people outside of the framework. Therefore, all information exchanged within the prediction market framework is confidential. This obligation equally applies to business plan information in respect to the exemplary prediction target discussed in sub-chapter 3.3.3.

The second condition is much more complicated as it directly affects general accuracy of framework's prediction and monitoring. Prediction markets need incentives to function. Although the literature discusses multiple kinds of incentives, studies generally suggest that positive financial incentives optimize prediction. Therefore, the following incentive mechanism is suggested.

All firms within the conceptual prediction market framework should pay employees and entrepreneurs in two parts—initially via a regular salary and later as a percentage share of the first payment, which is transferred to a special account overseen by the prediction market provider. Similar to the policies employed by casinos, deposited sums are sequestered until they are entirely invested within the prediction market framework. All employees and entrepreneurs must make their bets regarding the prediction market application or lose their share of income. Although this might seem disincentivizing, it is, in fact, much different. The financial incentive mechanism can be regarded as premium for good communication management, with the prediction market serving as the communication instrument. Therefore, employees and entrepreneurs with a specifically high sensitivity to news regarding the prediction targets within the framework get paid for their information. The suggested payout mechanism is equal to regular share trading at the exchange. As the share price rises and falls, the respective amount of money is gained or lost.

This chapter, in summary, discussed the potential of the conceptual prediction market framework to open the black box of involvement that many venture capitalists face with their investments. The following two chapters evaluate the possibility of the frameworks' real world application.

## **4. Financial Perspective**

From a financial perspective, which is, by nature, more focused on data-driven aspects, this chapter evaluates the conceptual prediction market framework described in this paper by, to some extent, comparing its approach to current financial evaluation procedures during venture capitalist (VC) activities in early-stage investments.

It first has to be re-emphasized that the most significant issue while evaluating and monitoring early-stage VC investments from a financial perspective is the lack of robust, forecast-qualified data. Currently, VCs attempt to compensate for this information deficit by consulting available data sources that provide approximated values, which indicate specific expectancy values such as market size and potential and possible customer penetration or revenue potential. These limited data sources also allow calculation of the expected investment potential. Understandably, VCs have a strong interest in generating sources of information.

Extensive research has been conducted to overcome imperfect and asymmetric information in monitoring early-stage investments. A theory of financial intermediation highlighting the contribution of intermediaries as informed agents in markets with suboptimal information basis was developed in 1983 [20], but it offers no solution for information deficits. Information deficits swell as distance increases between the information source (investment target/start-up) and the recipient of information (i.e., VCs). There is a strong need for an approach that generates real-time data from agents near the center of information—typically the founders of firms in which VCs invest.

### **4.1 Current general information sourcing approach by VCs**

Because VC need maximum information from those at the core of an investment, they often follow a scheme described as “advise and monitor” to continuously control the development progress of investment targets regarding their performance and growth. As an advisor, a VC provides its expertise to develop the business model and tries to increase the performance and growth of the venture; accordingly, it obtains deep insights into the venture, which provides a kind of information basis. In contrast, while monitoring the venture, VCs tend to superintend, influence, and, if necessary, interfere in the entrepreneur's activity to increase the value of their investment. As a consequence, entrepreneurs resist a) sharing information and b) allowing investors to exert too much influence on their core business model. Obviously, there is a conflict between the parties. Cumming and Johan describe the “advise and monitor” approach as generating asymmetric information on compulsion:

[A]dvise is congruent while monitoring is dissonant with respect to entrepreneurial interests. [...] Said differently, advice refers to the VCs direct contribution to the value of the venture in terms of effort or expertise, while monitoring refers to investor-

entrepreneur disagreements. The need for the latter typically arises as a consequence of asymmetric information between the two parties.[21]

## **4.2 Current financial information sourcing by VCs**

VCs face issues similar to the ones faced when sourcing valid general information when obtaining robust financial data. A common approach adopted by VCs is finding comparable data from sources that are strongly related to the business model. Before investing, VCs attempt to estimate the potential of the business model by performing financial and market due diligences. New business ideas often open up new markets or niches that do not have sufficient data sources; therefore, VCs consult comparable business models and markets with substantial databases that indicate reference values such as

- 1.) market size (players, customer potential)
- 2.) revenue potential (revenue growth rates) as measured by sales of key market players
- 3.) net profits/net profit margin
- 4.) gross profit margin/operating profit margin
- 5.) return on investment/return on equity

These reference values allow only minimal comparability to the business model and business development of an investment target, for which VCs constantly monitor several key performance indicators like the aforementioned total sales or operating and research expenses.

## **4.3 Advantage of the conceptual prediction market and information framework**

Prediction markets in VC investment portfolio monitoring are being explored so that extraction of information closest to the source is possible. This approach can lead to an information advantage for the VC compared with the aforementioned current methods of generating information regarding an investment. There are numerous examples of research providing evidence that prediction markets generate accurate information and forecasts (e.g., [22], [23]), with one study proving that “prices at any time fully reflect all available information.” [24]

However, with reference to the approach using prediction markets to build an information framework for VC investments, a strong requirement needs to be fulfilled to generate the highest possible validity for setting of a VC investment portfolio. As every valuation system requires an appropriate and statistically applicable number of data points, the prediction market for such an information-generating framework needs a quorum that ensures a kind of stability and reliability regarding the information generated by the model. For instance, if a VC only has two or three investments in its portfolio, the underlying statistical set would not be reliable.

This is all the more important because if the portfolio of a VC contains business models that strongly differ from each other regarding target markets and target customers, each participating founder will tend to evaluate the other business models with a more superficial valuation because of the lack of deep understanding of the market environment. In contrast, a portfolio of similar business models will lead to more realistic evaluations by founders as similar market and customer insights will be available to allow a more informed assessment.

## 5. Legal Perspective

Considering the applications of prediction markets to VCs and Private Equity (PE) activities from a legal standpoint, the present paragraph mainly stresses the role of such a tool in the deal-making phase and especially in the drafting of the investment agreement.

Before discussing such issues in detail, it is necessary to illustrate briefly the legal framework under which VCs and PEs carry out their operations, usually implemented through shares purchase agreements as result of a capital increase or a pure company acquisition. This section analyzes the mechanics of an acquisition independently from the state's legal regime applicable from time to time. It is assumed, for the purpose of this study, that the vast majority of countries do not regulate the negotiation phase and the documents originating from it; this grants the involved parties the freedom to provide for the "operative rules" to follow in such a preliminary passage. However, for a more detailed overview on PEs and VCs regulation in Europe, refer to Payne's study.[25]

The main legal document in these deals is the investment agreement, which identifies the modalities under which the deal will be implemented. In this regard, its main provisions deal with price per share and final consideration, governance matters, exit rights, and other covenants.

As per the scope of our analyses, core elements of the investment agreement cover, *inter alia*, clauses on representations and warranties (R&Ws).[26] Such clauses mainly minimize and, if highly detailed, completely overcome asymmetries of information between the constituents companies regarding the target's business.

Disclosing such an element in a contractual framework would allow one party to claim a breach of contract for misrepresentation easily if the other party lied about certain aspects of its business (such as asset value).

To enforce R&W provisions, parties may agree that when elements disclosed in the agreement prove false, the compliant party may terminate the agreement before closing. Parties may also create an escrow account where the final consideration will be held or paid in installments after R&Ws have been validated. Moreover, they may agree to indemnifications in case of misrepresentation.

The investment agreement almost always provides for execution of due diligence into the target's business and sets its satisfactory conclusion as a condition of implementation. Such screening may avoid asymmetries of information that could confound the transaction and, especially after closing, prompt litigation and additional transactional costs.

Thus, due diligence provides the management of the acquiring company with all the information needed to properly evaluate and decide whether the deal is to be concluded or not and the conditions to be set for the deal.

This can be summarized as follows:

- 1.) An acquirer's attorneys become informed about the target's business and industry to better understand the dynamics behind its activities;

- 2.) A company questionnaire is provided to the target to acquire all the information required under disclosure;
- 3.) Attorneys then request for a detailed document list that includes the target firm's essential documents, such as its charter and by-laws, board minutes, assets, financial statements, and information about pending (or expected) litigations.[27]
- 4.) After the management replies to the questionnaires, attorneys evaluate the material collected. If no integration of documents is required, they draft a due diligence memorandum assessing the business and issues uncovered.

Having discussed how VC and PE firms structure their investments, we have to contextualize such practices within the start-up environment.

Given the dearth of data and the complications in business planning activity, ordinary tools cannot efficiently forecast the target's business development for a period of three to five years. Also, from a legal standpoint, the main legal tools to protect the investor in its operations (i.e. the due diligence and the R&W drafting) lose their suitability.

As per the due diligence activity, it is abundantly clear that such a screening will not be efficient because of the target's early-stage existence.

On the other side, considering the contents of the R&Ws that would be drafted in a start-up company's acquisition, prediction markets represent a disruptive instrument.

The R&W drafting for the acquisition of early-stage companies is much more complex than that for the acquisition of older companies. This is because in the latter scenario, it is easier to identify the critical issues for monitoring because adequate data are available. In contrast, for start-ups, identifying possible issues in the target results is extremely difficult.

Thus, because of the exemplary nature of the acquisition of start-up companies, non-ordinary tools are required from a legal standpoint as well, and prediction markets represent a useful instrument to determine the investment-agreement features.

With the specific knowledge of industry experts and traders involved in the market, the legal advisor may draft the content of the R&Ws addressing the most peculiar issues identified by the traders as critical elements in the target's future business.

Indeed, this tool also allows a better comprehension on the target's future development. The prediction market's flexibility and setting provide attorneys a tool other than their own business acumen for identifying essential contractual covenants. Moreover, prediction markets could also be adopted for price setting in an acquisition deal.

Parties may opt for (i) a locked-box mechanism, wherein sums paid at closing are established in the signing moment plus or minus a predetermined amount or (ii) an adjustment mechanism that reflects fluctuations in the target's value (asset value or increase/decrease in net financial position).[28]



Prediction markets may also aid in pricing an acquisition by helping venture investors to forecast short-term fluctuations in the target's value (usually no more than one month), providing them with a clearer margin of negotiation in setting the final price.

## 6. Conclusion

Venture capital investments are impeded by the black box of involvement, which implies that investors do not possess reliable data after the investment has been made. This problem results in principal-agent conflicts, which is precisely why investors need a monitoring instrument.

Prediction markets appear to be suitable instruments for this proposed monitoring. Although the applicability of this instrument is supported by the literature, this study has evaluated the possibility from financial and legal perspectives.

The evaluation of prediction markets from a **financial** perspective presents the possibility of an extraordinary information advantage, which will enable the VC to improve its monitoring basis and forecast growth or exit scenarios. Regarding the number of total sales or operation and research expenses, the prediction market framework presents positive evaluation criteria for expected market growth, expected relevancy for customers (or expected reach of customers), and expected number of competitors, among other variables.

From a **legal** perspective, it may be concluded that prediction markets provide for elements useful not only in the evaluation phase of the investment agreement deal but also in the implementation of legal documents, bridging the gap between the paucity of data and the guarantees required by attorneys when drafting the investment agreement. In this sense, prediction-market-based investments and prediction-market-based legal clauses jointly contribute toward resolving issues inherent in venture capital investments, especially in those areas of negotiation wherein blind spots impede the efficiency of a contractual provision.

Therefore, the prediction market framework presents realistic and advantageous applications. As this study lacks empirical data, the next logical step would be to substantiate the conceptual idea. Therefore, we encourage researchers and investors to test the proposed prediction market network in the realm of venture capital investments and share the results with the academia.

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