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Venture Capital
An International Journal of Entrepreneurial Finance

ISSN: 1369-1066 (Print) 1464-5343 (Online) Journal homepage: http://www.tandfonline.com/loi/tvec20

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To cite this article: Antonio Gledson De Carvalho, Humberto Gallucci-Netto & Eduardo M. R. Siqueira (2017) Determinants of success in venture capital investments: evidence from Brazil, Venture Capital, 19:3, 147-161, DOI: 10.1080/13691066.2016.1247504

To link to this article: https://doi.org/10.1080/13691066.2016.1247504

VENTURE CAPITAL, 2017
VOL. 19, NO. 3, 147–161
https://doi.org/10.1080/13691066.2016.1247504

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Determinants of success in venture capital investments: evidence from Brazil

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ABSTRACT

We investigate the determinants of the success of private equity/venture capital funds. We focus specially on a Brazilian idiosyncrasy: the participation of limited partners in the investment process through investment committees (ICs) staffed with their representatives. In principle, ICs could substitute for the *ex post* screening that creditors do in levered buyouts. We find that funds with ICs underperform other funds, suggesting that ICs are not a good alternative for creditors screening. We also find that funds managed by bank affiliates underperform those managed by independent organizations. Finally, retention of equity control on portfolio companies affects positively their success.

ARTICLE HISTORY
Received 16 November 2015
Accepted 16 September 2016

KEYWORDS
Private equity; venture capital; investors committee; investment exit; investment performance

JEL CLASSIFICATION
G24

1. Introduction

Critical problems of adverse selection and moral hazard pervades the relationship between limited partners (LPs) and general partners (GPs) in private equity and venture capital (PEVC) funds. Axelson, Strömberg, and Weisbach (2009) portraits the financial structure of PEVC funds as a mechanism to mitigate some of these problems. In principle, LPs can invest in funds that can completely finance a number of future projects (*ex ante* financing) or on a deal-by-deal basis (*ex post* financing). Under *ex post* financing, PEVC fund managers (*GPs*) have incentives to propose some inferior projects when the deal flow is sparse. Since they are compensated on an individual project basis, they are not penalized when outcome is poor. *Ex ante* financing partially solves this problem because GPs get compensated by the overall fund performance and bad deals will reduce their overall compensation. *Ex ante* financing, however, does not completely solve the problem when there are no good investment opportunities. GPs would rather invest in bad projects than return capital to LPs. The need for leverage can mitigate this problem because it forces GPs to go through creditors' screening. Furthermore, banks will also help GPs to monitor portfolio companies (PCs). This reasoning explains why PEVC funds usually have covenants that prevent them from fully financing a deal, creating the need for leverage (e.g. cap on the amount of capital committed to a single PC).

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Ex ante financing would not work in economies without readily available long-term credit because there would be no creditors' screening. Brazil offers a good example. Brazilian commercial banks supply only short-term debt with maturity on average below one year. The Brazilian National Bank for Economic and Social Development (BNDES) is the only significant source of long-term debt, but the average length of its credit lines is 30 months (Brazilian Central Bank 2012). Furthermore, BNDES credit lines are limited in value and dedicated to specific purposes such as building infrastructure, incentives to export and import, and acquisition of domestically produced machinery and equipment. Because of the lack of long-term credit, buyouts are not the typical PEVC transaction in Brazil.

Retention of equity control is our second issue. To guarantee control over the decision process in the PCs, GPs use several strategies, including acquisition of equity control in PCs (Sahlman 1990) or assets that carry special rights such as vetoes, pre-emptive in case issuance of new capital, and drag along in case of exit (Casamatta 2003) and staging of capital (Gompers 1995). The effect of retention of equity control on PCs was not investigated. Brazil offers a suitable environment to test the importance of retention of control: its opaque legal infrastructure and weak enforcement is likely to increase the importance of equity control vis-à-vis other countries in which the use of complex covenants is more reliable.

The third issue that we tackle is the effect of bank affiliation. Bottazzi, Da Rin, and Hellmann (2008) report that GPs of bank affiliates, when compared to those of independent organizations, interact less with PCs and get less involved in recruiting senior managers and outside directors for them. Hellmann, Lindsey, and Puri (2008) find that bank affiliates invest less in early rounds and more in larger deals, and are more likely to invest in firms that have a larger number of VC co-investors. If the active involvement of GPs increases the likelihood of success, one would expect bank affiliates to underperform.

The literature on the success of PCs focuses on some few aspects. Sorensen (2007) finds that the experience of GPs, fund size and focus on late stage are positively correlated to success. Zarutskie (2010) finds that success is positively correlated to the task-based qualification of GPs (e.g. previous experience in managing PEVC fund or early stage companies) and industry-based qualification (e.g. consulting in strategy, management, and engineering), and negatively correlated with more general qualification (e.g. MBAs). Zarutskie (2010) also finds that success is positively correlated to fund size[1] and co-investment, and negatively correlated with a focus on seed capital. Cumming and Dai (2010) find that geographical proximity between GPs and PCs contributes to the success of investments. Cumming and Dai (2011) also find that limited attention from GPs to their PCs (measured by the relation between capital committed and the number of GPs) negatively affects performance. Fang, Ivashina, and Lerner (2013) study bank affiliation and find no consistent effect of bank affiliation. Lopez-de-Silanes, Phalippou, and Gottschalg (2015) find that investments made in periods of a high number of simultaneous investments underperform. Munari and Toschi (2015) find that the success of public VCs programs depends on regional characteristics. Siqueira, De Carvalho, and Gallucci-Netto (2011), focusing in Brazil, find that success is correlated to fund size, co-investment and GPs with foreign affiliation. Finally, in an unpublished article, Schwienbacher (2002) analyzes the effect of monitoring, but his results are not robust. To our knowledge, this is the first study to analyze the effect of investment committees (ICs), retention of control and bank affiliation on the success of PEVC investments.

We base our analysis on a unique data-set that combines information on the individual characteristics of funds, GPs, and processes used in the investment cycle. We find that funds

Table 1. Committed capital and exits.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Committed capital (US$ billion)	3.7	4.9	5.0	4.7	4.8	5.6	7.2	13.5	22.7	28.1	36.1
Committed capital (% of GDP)	0.63	0.77	0.91	0.93	0.87	0.97	0.82	1.24	1.66	1.70	2.33
Exit mechanisms											
IPO	–	–	–	–	–	5	8	17	19	1	4
Secondary sale	1	18	5	4	5	4	6	12	10	16	10
Trade sale	4	13	8	6	6	15	4	6	12	27	11
Buyback and write-off	3	5	30	20	13	14	6	7	7	17	12
Total	8	36	43	30	24	38	24	42	48	61	37

Notes: Year-end values and number of exits.
Source: De Carvalho, Ribeiro, and Furtado (2006) and ABDI (2011).

with ICs underperform those without such committees. This suggests that ICs do not mitigate the problems of *ex ante* financing. We also find that retention of control on PCs positively affects their success. Retention of control may be valuable in economies with weak legal environment and enforcement of non-standards contracts (such as Brazil). Therefore, one should be careful when generalizing this result for developed economies. Finally, contrasting with Fang, Ivashina, and Lerner (2013), we find that bank affiliates underperform independent organizations.

This article is organized as follows: Section 2 briefly describes the Brazilian PEVC industry. Section 3 explains our methodology, data, and variables. Section 4 presents our results. Section 5 concludes.

2. PEVC in Brazil

PEVC in Brazil increased sharply in recent years (Table 1). The growth rate for aggregate commitments, increased at 9% between 1999 and 2004 (from US$ 3.7 to US$ 5.6 billion), but then jumped to 45% from 2004 to 2009 when commitments reached US$ 36.1 billion. Taken as proportion of GDP, such growth represented an increase from 0.63% in 1999 to 2.33% in 2009. However, this is still low when compared to countries where PEVC is more developed such as US (3.7% of GDP) and UK (4.7%).

The size of the aggregate portfolio did not accompany this growth of the industry (Table 2). The number of PCs increased from 306 PC in 2004 to 502 in 2009. This low level of growth is explained by a change in the focus of investments. Private equity investments grew compared with venture capital investments. The proportion of PCs that received their first investment in the VC stage dropped from 67 to 47%, while in the PE stage increased from 33 to 53%. Surprisingly, investments in seed capital and start-up, that require relatively small financial commitment, fell from 11.8 and 23.5% to 7.6 and 13.2%, respectively.

Investments are concentrated in some small number of industries, although concentration has been falling (Table 3). In 2004, investments in the five most invested industries accounted for 70% of the PCs. In 2009, the share of the top five industries declined to 63%. Electronics and IT continued to attract most investments, but its share fell from 30 to 20%. The industries with highest growth were Construction (from 3 to 14%) and Energy and Fuels (from 2 to

Table 2. Stage of portfolio companies at the first finance round.

	2004		2009	
Stage	Number of firms	% of Portfolio	Number of firms	% of Portfolio
Venture capital	204	66.7	203	46.9
Seed capital	36	11.8	33	7.6
Start-up	72	23.5	57	13.2
Expansion	96	31.4	113	26.1
Private equity	102	33.3	230	53.1
Late stage	42	13.7	186	43.0
Other stages	17	5.6	17	3.9
PIPEs	43	14.1	27	6.2
Without information	0	–	69	–
Total	306	100	502	100

Notes: Distribution of investments in portfolio in December 2004 and 2009 according to the stage where it received the first finance round. S*eed capital*: pre-operational stage; *start-up*: the structuring stage of the business when the products aren't sold; *expansion*: expansion of the activities of a company that already sells its products; *late stage*: the company who has a stable growth rate and positive cash flow; and *Other stages*: acquisition finance, mezzanine, management buyout, bridge finance, turnaround, and PIPE (investment in companies already listed on stock exchanges).
Source: De Carvalho, Ribeiro, and Furtado (2006) and ABDI (2011).

Table 3. Industry of portfolio companies.

	2004		2009	
Industry	# of Firms	Percentage	# of Firms	Percentage
Electronic and TI	92	30.0	103	20.5
Building and construction	9	2.9	69	13.7
Energy and fuel	7	2.3	56	11.2
Communication	28	9.1	33	6.6
Retail	21	6.9	26	5.2
Agribusiness	8	2.6	25	4.9
Transport and logistic	18	5.9	20	3.9
Food and beverages	12	3.9	19	3.8
Infrastructure	9	2.9	19	3.8
Financial services	10	3.3	16	3.2
Medicine and cosmetic	8	2.6	15	2.9
Biotechnology	10	3.3	14	2.8
Diverse services	6	1.9	10	1.9
Education	3	0.9	8	1.6
Entertainment/tourism	9	2.9	7	1.4
Extractive industry	2	0.6	7	1.4
Diverse industries	52	16.9	55	10.9
No information	2	0.6	0	0.0
Total	306	100	502	100

Notes: Portfolio companies in the aggregated portfolio as of December 2004. Classification according to the leading economic activity. For companies that operate in more than one industry, we considered only the main activity.
Source: De Carvalho, Ribeiro, and Furtado (2006) and ABDI (2011).

11%). The increase in investments in energy is related to the growth of this industry: Brazil is expected to be the seventh largest energy market in 2030 (EYT-FGV 2008). To meet the growing demand for energy, the supply of energy must increase by 3.3% over the next three decades. Furthermore, Brazil is one of the leading countries in the development of clean energy. The growth of investments in Construction can be explained by the expansion of mortgage lending (from US$ 1.6 billion in 2002 to US$ 14 billion in 2007 according to EYT-FGV 2008), increase in the income of the poorest and chronic housing deficit (7.8 million homes in 2005; according to EYT-FGV 2008).

Table 4. Criteria of funds for approving the investment.

	2004		2009	
Level of delegation	Funds	%	Funds	%
Blind pool	27	28	19	15
Full control of the investor	7	7	1	1
Funds with the investment committee	53	55	83	65
Simple majority decision	23	24	32	25
Qualified majority decision	17	18	38	30
Unanimous decision	13	13	13	10
Pledge fund	6	6	8	6
Not applicable/no information	4	4	1	1
Other	0	0	16	13
Total	97	100	128	100

Notes: Number of funds according to the criteria for approval of new investments. Pledge Fund: where investors decide individually whether to participate in each investment. Blind Pool: investors do not participate actively in investment decisions.
Source: De Carvalho, Ribeiro, and Furtado (2006) and ABDI (2011).

Investments are geographically concentrated (ABDI 2011; De Carvalho, Ribeiro, and Furtado 2006). The South and southeast macro-regions concentrated on the majority of the portfolio: 91% of the portfolio (278 PCs) in 2004 and 92% (441 PCs) in 2009. Investments are even more concentrated in particular states within these regions: São Paulo state had 44% of the portfolio in 2004 and 57% in 2009.

The means of investment exiting also changed over time. Table 1 also reports exits in the PEVC industry from 1999 to 2009. In the first period (1999–2004), failures were frequent: buybacks and write-offs represented approximately 50% of the exits. Ribeiro and De Carvalho (2008) associate this high number of failures to investments in the dotcoms made in the late 1990s. Subsequently (2005–2009), the number of failures decreased to 23% of the exits. Exits through IPOs only began in 2004 with the rise of Novo Mercado (De Carvalho and Pennacchi 2012). This represented a milestone for the Brazilian PEVC industry, because it showed its capacity to perform the complete investment cycle. Between 2004 and 2009, there were 115 IPOs in Brazil (54 PEVC sponsored).

One of the idiosyncrasies of the Brazilian PEVC industry is the low proportion of LBOs. From the 325 deals in the portfolios of PEVC funds in 2004, only 30.4% involved the acquisition of equity control (De Carvalho, Ribeiro, and Furtado 2006). Therefore, buyouts correspond to less than 30% (unfortunately, this statistic is not available for 2009). The lack of control sometimes is compensated by veto power (38.5% of the deals) and shared control (4.9% of the deals).

A second Brazilian idiosyncrasy is the participation of LPs in the management of PEVC funds. LPs act in the investment process through ICs staffed with GPs and LPs' representatives. The influence of LPs varies significantly depending on the type of majority required for decisions in the investment committee (simple majority, qualified majority, or unanimity). LPs' influence has increased over time (Table 4). From 2004 to 2009, the proportion of funds with investment committee went from 55 to 65%. The proportion of funds that require qualified majority increased from 18 to 30%, becoming the most used structure. The proportion of blind pools (structures in which the LPs have no active participation) fell from 28 to 15%. The proportion of pledge funds (structure in which each LPs have complete control over investment decision) remained stable at near 6%.

Table 5. Variables definition.

Success-ratio	Relation between the number of successes and the number of exits
Success-number	Number of exits performed through IPO, strategic sale or secondary sale
Success	Binary variable indicating whether an individual investment was a success
Control	Percentage of companies in portfolio for which GPs hold control
Seats-to-PCs	Ratio between the number of seats on boards of PCs and number of PCs
Investment committee	Binary variable indicating whether the fund has an investment committee with limited partners in it
Bank-affiliate	Binary variable indicating if the managing organization is bank-affiliated
Seats-to-GPs	Ratio between the number of seats on boards of PCs and number of GPs
Size	Natural logarithm of the committed capital measured in US$ millions
Investments	Number of portfolio companies invested by the fund from its beginning until December 2004
Age	Natural logarithm of number of years since the fund was launched until December 2007
Late-stage	Binary variable indicating when the fund has focus on late stage: acquisition finance, management buyout/in, bridge finance or turnaround
Experience	Average experience (in years) of the management team as of December 2004
Co-investment	Proportion of the investments made by the fund under co-investment
International LP	Binary variable indicating that international investors invested in the fund
Institutional LP	Binary variable indicating that institutional investors invested in the fund

The participation of LPs in the investment process sometimes goes beyond the screening of proposals. It is not rare that LPs get in direct contact with PCs or even take part in the exit decision. From 2004 to 2009, the proportion of managing organizations that promote at least one meeting a year between LPs and PCs increased from 53 to nearly 65% (ABDI 2011). In 2004, GPs held the decision over the exits of 68% of the funds, investment committee of 17%, and GPs and LPs together of 15%.

3. Data and methodology

Our data come from three different sources: the First Brazilian PEVC Census (De Carvalho, Ribeiro, and Furtado 2006), the GVcepe-Endeavor Guide to PEVC in Brazil (GVcepe-Endeavor 2007), and the Second Brazilian PEVC Census (ABDI 2011). The first one contains information on PEVC managing organizations, the funds they managed, GPs' characteristics, and processes used in the investment cycle. We detected deal exits by comparing portfolios at different dates. We determined the outcome of exits from information in newspapers, magazines, the homepages of Brazilian stock exchange (BMFBOVESPA, www.bmfbovespa.com.br) and Brazilian security and exchange commission (Comissao de Valores Mobiliarios, www.cvm.gov.br), or through direct contact with managing organizations.

Our units of analysis are PEVC funds and individual deal exits. We analyze exits between 1999 and 2015. De Carvalho, Ribeiro, and Furtado (2006) list 97 funds raised by December 2004. We excluded seven funds *PIPE* (private investment in public companies) and eight funds with incomplete data. Our final sample consists of 709 deal exits from 82 funds (85% of total number of funds), managed by 57 managing organizations. In December 2004, these organizations managed 80% of the aggregate commitment (US$ 4.5 billion).

We measure success by the means of exit (as in Munari and Toschi 2015; Schwienbacher 2002; Sorensen 2007; Zarutskie 2010). According to Cumming and MacIntosh (2003), the most frequent forms of investment exit are IPO, trade sale (acquisition of the PC by another company), secondary sale (sale to another investor), buyback (repurchase of stocks by the entrepreneur), and write-off/down (liquidation of the PC). Gompers and Lerner (1999) report that IPOs are the most profitable form of exit, followed by trade sale and secondary sale. In

his work on profitability in PEVC, Gompers (1995) found that the average annual rate of return for IPOs is 60% while for trade sale it is only 15%. However, IPOs depends on stock market windows, whereas trade sales are more perennial (even during financial crises, some large corporations make acquisitions). This has led researchers to define success as exit through IPO or trade/secondary sale. We follow this approach. Hochberg, Ljungqvist, and Lu (2007) and Sorensen (2007) report a correlation coefficient of nearly 0.6 between this measure of success and internal rates of return.

We base our analysis on a unique database that gathers information on the characteristics of the investment fund, GPs, how investments are structured and the involvement of GPs in PCs. Table 5 lists our variables. Below we describe our variables and relate them to fund performance:

3.1. Variables measuring success

(1) The number of successes of a fund (variable *Success-number*); (2) the proportion of successes of a fund (variable *Success-ratio*); and (3) a binary variable indicating whether an individual investment was a success (variable *Success*).

3.2. Variables characterizing investment funds

(1) *Size*: natural logarithm of the committed capital measured in millions of dollars. According to Schwienbacher (2002), only GPs with a good record of accomplishment are able to raise large funds. GPs managing large funds also have large network, which is important to ensure a good deal of flow and strategic resources (e.g. potential customers, suppliers, banks, human resources). Furthermore, small funds have reduced investment opportunities because they cannot participate in deals that require high capital commitment. Summing up, we expect performance to be positively correlated to size; (2) *Investments*: number of PCs invested by the fund from its beginning until December 2004; (3) *Age*: number of years since the fund was raised until December 2007; and (4) *Investment Committee*: binary variable that indicates when the fund has an investment committee.

3.3. Variables controlling for investments' characteristics

GPs use several strategies to guarantee control over the PCs: acquisition of veto power on some decisions, preemptive rights in case of new capital infusion, and drag along rights in case of exit (Casamatta 2003); staging of capital (Gompers 1995); and co-investment (Lerner 1994). Our variables related to the structure of investments are: (1) *Control*: percentage of companies in portfolio for which PEVC investors hold control. This variable gauges the influence of GPs on the decision process of their PCs. We conjecture that the greater the control the greater the probability of success, (2) *Co-investment*: proportion of the investments by the fund that involve co-investors. The presence of other investors improves the screening of investments, increases the network, and improves monitoring on PCs (Lerner 1994). Therefore, we expect this variable to be positively correlated with success; and (3) *Late-Stage*: binary variable indicating whether the fund has focus on late stage (acquisition financing, management buyout, bridge financing, industry consolidation, and turnaround). Sorensen (2007) finds positive correlation between late stage and the probability of success.

3.4. Variables characterizing GP management style

To increase the flow of information and the likelihood of success, GPs usually get involved in the operations of their PCs (Gompers and Lerner 1999; Gorman and Sahlman 1989; Sahlman 1990). They take seats on board of directors (Lerner 1995); help to develop business strategies, recruit key employers (De Carvalho, Calomiris, and de Matos 2008), professionalize the firm (Hellmann and Puri 2002), structure deals with clients and suppliers, and act as a confidant to managers (Sahlman 1990). Our variables that capture management style are: (1) *Seats-to-PCs*: the ratio between the number of seats on boards of PCs and number of PCs; (2) *Seats-to-GPs*: the ratio between the number of seats on boards of PCs and the number of GPs in the organization; and (3) *Bank Affiliate*: binary variable indicating bank affiliation. The variables *Seats-to-PCs* and *Seats-to-GPs* are proxies for both monitoring and value addition. We expect a positive correlation between *Seats-to-PC* and performance. In contrast, we expect a negative correlation between *Seats-to-managers* and success because the participation on many boards can reduce the average time that GPs dedicate to each of the PCs (as in Cumming and Dai 2011).

3.5. Variable characterizing GPs

(1) *Experience*: average experience (in years) of the GPs in managing organization as of December 2004. Sorensen (2007) and Zarutskie (2010) find a positive correlation between experience and performance.

3.6. Variables characterizing LPs

(1) *International LP*: a binary variable that assumes the value one when non-Brazilian investors committed capital to the fund; and (2) *Institutional LP*: a binary variable that takes the value one when institutional investors committed capital to the fund. These two variables aim at capturing the smart money effect in PEVC, according to which some investors with greater experience or reputation can more efficiently select the best GPs (Lerner, Schoar, and Wongsunwai 2007; Zheng 1999). Cumming, Knill, and Syvrud (2016) find that International LPs enhance returns.

Table 6 presents summary statistics for our variables. Our final data-set covers 709 deal exits of which 58 where IPOs and 320 were trade-sale or secondary sale. The success rate across funds varies from 0 to 100% (mean is 55%). There are three funds with 100% success.

The amount of capital committed to individual funds in our sample ranges from US$ 3 to 900 million (average and median are 95 and 34 million). The number of PCs by fund varies from 2 to 57 (average and median are 11 and 8). The experience of GPs in managing organizations ranges from 3 to 25 years. In our sample, there are managing organizations for which the funds acquired control of all of their PCs. On average, 32% of investments involved taking full control. The average fund co-invested in 30% of its deals. Funds with a focus on late-stage investments amounted to 19%. Table 7 reports the correlation between our variables. In general, correlations are low and only few of them are statistically significant.

To estimate the determinants of success, we use the following econometric model:

$$SUCCESS_i = \beta_0 + \beta_1 FUND_i + \beta_2 INVESTMENTS_i + \beta_3 GP\_STYLE_i + \beta_4 GP_i + \beta_5 LP_i + \varepsilon_i,$$

Table 6. Summary statistics.

Variables	Average	Median	Standard deviation	Minimum	Maximum
Success-ratio	0.55	0.50	0.23	0.00	1.00
Success-number	4.61	3.00	4.24	0.00	23.00
Success	0.55	–	–	–	–
Control	0.32	0.00	0.43	0.00	1.00
Seats-to-PCs	0.86	0.75	0.61	0.00	4.00
Investment committee	0.56	–	–	–	–
Bank-affiliate	0.23	–	–	–	–
Seats-to-GPs	2.19	2.00	1.37	0.00	5.00
Co-investment	0.30	0.00	0.39	0.00	1.00
Late-stage	0.19	–	–	–	–
Size (US$ million)	95.27	34.30	171.90	3.00	900.00
Investments	10.98	8.00	9.79	2.00	57.00
Age (years)	8.12	7.75	4.22	3.00	26.01
Experience (years)	9.91	8.16	5.10	3.00	25.00
International LP	0.63				
Institutional LP	0.38				
Number of exits	8.64	6.00	6.91	2.00	35.00

Notes: *Success-ratio* is the ratio between the number of successes (IPO, strategic sale or secondary sale) and the number of exits; *Success-number*: number of successes; *Success*: binary variable indicating whether an individual investment was a success; *Control*: percentage of companies in portfolio for which PEVC managers hold control; *Seats-to-PCs*: ratio between the number of seats on boards of PCs and number of PCs; *Investment committee*: binary variable indicating the existence of investment committee; *Bank-affiliate*: binary variable indicating if the managing organization is bank-affiliated; *Seats-to-GPs*: ratio between the number of seats on boards of PCs and number of managers in the PEVC organization; *Size*: committed capital measured in US$ millions; *Investments*: number of portfolio companies invested by the fund from its beginning until December 2004; *Age*: number of years since the fund was raised until December 2007; *Late-stage*: binary variable indicating that the fund has focus on late stage (acquisition finance, management buyout/in, bridge finance or turnaround); *Experience*: average experience in the PEVC industry (in years) of the management team as of December 2007; *Co-investment*: proportion of the investments made by fund under co-investment; *International LP*: binary variable indicating that international investors invested in the fund; and *Institutional LP*: binary variable indicating that institutional investors invested in the fund. Sample consists of 82 PEVC funds.

where $SUCCESS_i$ measures the rate or number of successes of fund *i* or the success of investment *i*; $FUND_i$ is a vector of characteristics of fund *i* or of the fund that made investment *i*; $INVESTMENTS_i$ *is* a vector of characteristics of the investments of fund *i* or of the fund invested in *i*; GP_STYLE_i is a vector of characteristics of management style of the manager of fund *i* or of the manager of the fund that invested in *i*; GP_i is a vector of characteristics of the manager of fund *i* or of the manager of the fund that invested in *i*; and LP_i is a vector of characteristics of the investors of fund *i* or of the fund that made investment *i*;

The econometric method used in the estimations depends on the dependent variable. For variable *Success-number*, a count variable, we use Poisson regressions; for variable *Success-ratio*, a continuous variable, we use OLS regressions; and for variable *Success*, a binary variable, we use probit specification. All models were estimated using robust standard errors (White 1980).

4. Results

Table 8 reports the marginal effects of our empirical analysis on the determinants of success. Our first main result is that ICs have a negative effect on the success of PEVC investments. The marginal effects of variable Investment Committee is negative and statistically significant regardless of how success is measured. Furthermore, the economic effect is sizeable: if one focuses on the proportion of successes of a fund (Regressions 1–3), having a committee reduces this proportion by nearly 8.5% (statistically significant at the 10% level). If the focus

Table 7. Correlation matrix.

	Control	Seats-to-PCs	Investment committee	Bank affiliate	Seats-to-GPs	Size	Investments	Age	Late-stage	Co-investment	Experience	International LP
Seats-to-PCs	0.08											
Investment committee	−0.12	0.02										
Bank-affiliate	−0.12	0.11	0.19*									
Seats-to-GPs	−0.6	0.39***	0.09	−0.07								
Size	0.18*	−0.02	−0.29***	0.08	−0.15							
Investments	−0.07	−0.24**	−0.07	−0.19*	0.40***	0.05						
Age	0.10	−0.09	−0.26**	0.00	0.12	0.12	0.13					
Late-stage	0.22**	−0.06	0.06	0.02	−0.19*	0.17	−0.23**	0.04				
Co-investment	0.00	−0.14	−0.02	−0.10	−0.16	0.04	−0.13	0.30**	−0.13			
Experience	0.06	−0.19*	−0.17	0.00	0.03	0.09	0.45***	0.23**	−0.08	−0.12		
International LP	0.04	−0.17	−0.05	−0.06	−0.04	0.02	0.04	−0.01	0.05	0.19*	−0.02	
Institutional LP	−0.04	0.01	−0.01	0.22**	0.08	0.04	0.12	0.02	0.12	−0.16	0.27**	0.12

Notes: Correlation between the independent variables. *Control*: percentage of companies in portfolio for which PEVC managers hold control; *Seats-to-PCs*: ratio between the number of seats on boards of PCs and number of PCs; *Investment committee*: binary variable indicating the existence of investment committee; *Bank-affiliate*: binary variable indicating if the managing organization is bank-affiliated; *Seats-to-GPs*: ratio between the number of seats on boards of PCs and number of managers in the PEVC organization; *Size*: committed capital measured in US$ millions; *Investments*: number of portfolio companies invested by the fund from its beginning until December 2004; *Age*: number of years since the fund was raised until December 2007; *Late-stage*: binary variable indicating that the fund has focus on late stage (acquisition finance, management buyout/in, bridge finance or turnaround); *Experience*: average experience in the PEVC industry (in years) of the management team as of December 2007; *Co-investment*: proportion of the investments made by fund under co-investment; *International LP*: binary variable indicating that international investors invested in the fund; and *Institutional LP*: binary variable indicating that institutional investors invested in the fund. Sample consists of 82 PEVC funds.

*, **, *** Statistically significant at the 10%, 5%, and 1% levels respectively (in boldface).

Table 8. Determinants of success.

	Success-ratio (fund level)			Success-number (fund level)			Success (deal level)		
Regression	1	2	3	4	5	6	7	8	9
Investment committee	**−0.084***	**−0.086***	**−0.087***	**−0.831*****	**−0.817*****	**−0.828*****	**−0.133*****	**−0.129*****	**−0.130*****
	(−1.80)	**(−1.77)**	**(−1.84)**	**(−2.87)**	**(−2.66)**	**(−2.79)**	**(−2.82)**	**(−2.58)**	**(−2.72)**
Control	**0.097***		**0.104***	**0.548****		**0.545****	**0.090***		**0.088***
	(1.91)		**(1.89)**	**(2.02)**		**(1.97)**	**(1.72)**		**(1.65)**
Seats-to-PCs		−0.012	−0.029		0.130	0.022		0.031	0.017
		(−0.20)	(−0.53)		(0.46)	(0.08)		(0.58)	(0.33)
Bank-affiliate	**−0.116****	**−0.131****	**−0.113****	**−0.620****	**−0.678****	**−0.621****	**−0.093***	**−0.103****	**−0.095***
	(−2.27)	**(−2.47)**	**(−2.26)**	**(−2.09)**	**(−2.32)**	**(−2.12)**	**(−1.89)**	**(−2.06)**	**(−1.92)**
Seats-to-GPs	−0.020	−0.020	−0.012	**−0.205****	**−0.263****	**−0.210***	**−0.025***	**−0.037****	**−0.028***
	(−1.40)	(−0.98)	(−0.63)	**(−2.18)**	**(−2.46)**	**(−1.94)**	**(−1.72)**	**(−2.33)**	**(−1.69)**
Size	**0.042****	**0.048*****	**0.043*****	**0.298*****	**0.350*****	**0.298*****	**0.058*****	**0.066*****	**0.058*****
	(2.61)	**(2.93)**	**(2.67)**	**(3.71)**	**(4.31)**	**(3.71)**	**(3.62)**	**(4.05)**	**(3.62)**
Investments	−0.003	−0.004	−0.004	−0.010	−0.006	−0.009	−0.001	−0.001	−0.001
	(−1.20)	(−1.26)	(−1.28)	(−0.95)	(−0.60)	(−0.82)	(−0.60)	(−0.27)	(−0.43)
Age	−0.001	0.006	−0.006	−0.296	−0.266	−0.295	−0.055	−0.045	−0.054
	(−0.02)	(0.11)	(−0.11)	(−1.10)	(−0.97)	(−1.08)	(−1.00)	(−0.82)	(−0.99)
Late-stage	0.020	0.035	0.016	0.308	0.362	0.309	0.031	0.041	0.033
	(0.37)	(0.58)	(0.28)	(0.88)	(0.98)	(0.88)	(0.61)	(0.76)	(0.63)
Experience	**0.011****	**0.012****	**0.011****	**0.072****	**0.072****	**0.072****	**0.012****	**0.012****	**0.012****
	(2.11)	**(2.17)**	**(2.04)**	**(2.20)**	**(2.22)**	**(2.22)**	**(2.11)**	**(2.15)**	**(2.15)**
Co-investment	**0.170*****	**0.161****	**0.167*****	**1.011*****	**0.916*****	**1.012*****	**0.171*****	**0.159****	**0.174*****
	(2.90)	**(2.63)**	**(2.83)**	**(3.32)**	**(2.83)**	**(3.34)**	**(2.75)**	**(2.48)**	**(2.76)**
International LP	0.029	0.032	0.025	0.089	0.159	0.092	0.034	0.049	0.036
	(0.69)	(0.72)	(0.55)	(0.36)	(0.64)	(0.36)	(0.79)	(1.13)	(0.82)
Institutional LP	0.016	0.011	0.017	−0.043	−0.179	−0.046	−0.037	−0.059	−0.039
	(0.38)	(0.23)	(0.41)	(−0.17)	(−0.65)	(−0.17)	(−0.78)	(−1.15)	(−0.81)
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Nº of observations	82	82	82	82	82	82	709	709	709
$F(k, n)$/Wald $\chi^2(k)$	7.08	7.28	6.55	125.98	117.52	126.32	79.64	72.96	79.98
R^2 (or pseudo R^2)	0.47	0.44	0.47	0.11	0.11	0.11	0.08	0.08	0.08

Notes: Dependent variables are *Success-ratio*: ratio between number of successes (IPO, strategic sale or secondary sale) and number of exits; *Success-number*: number of successes; *Success*: binary variable indicating success. Independent variables are *Control*: proportion of companies in portfolio for which PEVC managers hold control; *Seats-to-PCs*: ratio between the number of seats on boards of PCs and number of PCs; *Investment committee*: binary variable indicating the existence of investment committee; *Bank-affiliate*: binary variable indicating that the managing organization is bank-affiliated; *Seats-to-GPs*: ratio between the number of seats on boards of PCs and number of GPs in the managing organization; *Size*: committed capital; *Investments*: number of PCs invested from the fund beginning until December/2004; *Age*: number of years since the fund was raised until December/2007; *Late-stage*: binary variable indicating fund focus on late stage (acquisition finance, management buyout/in, bridge finance, or turnaround); *Experience*: average experience of GPs in the PEVC industry (in years) December/2007; *Co-investment*: proportion of the investments made by fund under co-investment; *International LP*: binary variable indicating that International investors invested in the fund; and *Institutional LP*: binary variable indicating that institutional investors invested in the fund. Sample consists of 82 PEVC funds and 709 deals. All estimates use robust errors (White 1980). *T*-statistics in brackets.

*, **, *** Statistically significant at the 10%, 5%, and 1% levels respectively (in boldface).

is on the probability of an individual investment being successful (Regressions 7–9), the reduction is 13% (statistically significant at the 1% level). The marginal effect on the number of successes (Poisson Regressions 4–6) is about −0.8, statistically significant at the 1% level, but the coefficient does not have a direct economic interpretation. Thus, our analysis suggests that the participation of LPs in the investment process is a poor substitute for creditors screening.

Retention of equity control by PEVC investors increases the likelihood of success. The marginal effect of variable Control is always positive. Regressions 1 and 3 show that equity control increases the proportion success by nearly 10% (statistically significant at the 10% level). Regressions 7 and 9 show that it also increases the likelihood of success of an individual investment by nearly 9% (statistically significant at the 10% level). The marginal effect on the number of successes (Poisson Regressions 4–6) is about 0.54 (statistically significant at the 5% level), but the coefficient has no direct economic interpretation. One should be careful at generalizing this result. Covenants that give to GPs the right to impose some decisions can substitute for equity control. However, covenants may not be effective when the enforcement of contracts is not effective. Thus, the effect of equity control that we found could be related to the legal environment.

Bank affiliation has a negative effect on success. The marginal effect of the variable Bank Affiliate is negative and statistically significant regardless of how success is measured. Its economic effect is sizeable. If one focuses on the proportion of successes (Regressions 1–3), bank affiliation reduces the proportion by between 11.3 and 13.1% (statistically significant at the 5% level). If the focus is on the probability of individual investment (Regressions 7–9), the reduction is between 9.3 and 10.3% (statistically significant at the 10 or 5% level). The marginal effect on the number of success (Poisson Regressions 4–6) is about −0.65 (statistically significant at the 5% level), but the coefficient has no direct economic interpretation. This result contrasts with Fang, Ivashina, and Lerner (2013) who found no consistent effect for bank affiliation.

Finally, our analysis suggests that the number of board seats retained by PEVC investors per PC has no effect on success. The marginal effects are very small in terms of both size and statistical significance. This is surprising because PEVC participation on the board of directors is seen as a mechanism that improves monitoring and decision-making.

Our analysis also corroborates findings in other studies. The coefficient on fund size is positive and almost always statistically significant at the 1% level (as in Schwienbacher 2002; Sorensen 2007; Zarutskie 2010). The experience of the management team has a positive effect on the likelihood of a successful investment. The coefficient on the variable experience is positive and always statistically significant at the 5 or 10% levels (as in Sorensen 2007). As in Cumming and Dai (2010), limited attention also has a negative effect on success: the coefficient on Seats-to-GPs is negative and statistically significant in Regressions 4–9. Finally, co-investment is positive and always statistically significant at the 5 or 10% levels (as in Zarutskie 2010). Contrary to Zarutskie (2010) and Schwienbacher (2002), we did not find any robust correlation between the focus of the fund (variable Late-stage) and characteristics of investors and success.

5. Conclusion

Axelson, Strömberg, and Weisbach (2009) points out the advantages of the financial structure of PEVC in which LPs invest in funds rather than individual PCs. Their argument depends on the need for debt finance and the consequent *ex post* screening from financiers. Such a mechanism is not feasible in economies without readily available long-term debt. ICs staffed with LPs representatives could be an alternative for the screening from financiers. Brazil provides an example of an economy without long-term credit and widespread use of ICs. This article investigates whether ICs can mitigate creditor screening. We also investigate the effect of bank affiliation, and retention of equity control on PCs and board seats. Our analysis is based on a unique data-set that combines information on the structure of PEVC funds, GP characteristics, investment structure and GPs' active involvement within PCs.

We report three main results. Firstly, ICs staffed with LPs have a negative effect on the success of PEVC investments. The existence of ICs reduces by 9% the proportion of successes in a fund and by nearly 30% the probability of success of a particular PC. Secondly, funds managed by bank affiliates underperform those managed by independent organizations. Third, the retention of control is positively correlated to success. The effect of retention of control may not generalize to developed economies in which legal environment and enforcement of non-standards contracts is reliable, and GPs can force good decision-making through covenants rather than the expensive acquisition of equity control. Finally, we found no relation between retention of board seats and success.

Note

1. Ribeiro and De Carvalho (2008) provide an overview of the Brazilian PEVC industry as of December 2004.

Acknowledgment

Carvalho acknowledges financial support from FAPESP and CNPq.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the FAPESP [grant number 2016-06826-6] and CNPq [grant number 477572/2003].

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