Private Equity and Venture Capital Growth and Performance in Brazil

Abstract

Private Equity (PE) and Venture Capital (VC) investors have been allocating more capital to emerging markets. Although this increases the learning and knowledge transfer, it also raises concern if the PE/VC firms are shorthanded to absorb this growth. We investigate the impact of growth on the performance of Brazilian PE/VC industry. The results indicate that the number of deals simultaneously managed reduces the probability of total loss. However, when we exclude total losses, we find that a higher number of deals affects the performance of PE deals negatively, but that this is not the case for VC.

Keywords: Private Equity; Venture Capital; Performance Determinants

TRACK: CORPORATE FINANCE
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Abstract

Private Equity (PE) and Venture Capital (VC) investors have been allocating more capital to emerging markets. Although this increases the learning and knowledge transfer, it also raises concern if the PE/VC firms are shorthanded to absorb this growth. We investigate the impact of growth on the performance of Brazilian PE/VC industry. The results indicate that the number of deals simultaneously managed reduces the probability of total loss. However, when we exclude total losses, we find that a higher number of deals affects the performance of PE deals negatively, but that this is not the case for VC.

Keywords: Private Equity, Venture Capital, Knowledge transfer, Performance Determinants, Emerging Markets.

1. Introduction

The high competition for PE and VC global deals is forcing investors to allocate more resources to emerging markets, where the relative prices to enter a deal are still lower than those in developed countries. If a PE/VC firm manages more deals, it may benefit from knowledge transfer from managers to portfolio companies and from a portfolio company to another portfolio company (Humphery-Jenner, 2013). However, as the number of senior managers with PE and VC experience in emerging economies is limited, experienced managers may become shorthanded to accommodate this growth. If this is the case, the cost of knowledge transfer may be higher than its benefit.

To analyze the impact of growth in the performance of PE and VC in emerging markets, we study the Brazilian case. Brazil, as part of the once popular BRICS (Brazil, Russia, India, China and South Africa), ranked among the top 10 largest economies that raised the most PE funds (Johan and Zhang, 2016).

Although some few PE and VC funds operated in Brazil in the 80s, it was only after 1994 that the industry started in the country. The 23 years of PE history in Brazil is short when compared to that of more developed countries. Minardi et al. (2014) analyzed 187 PE/VC firms with funds dedicated to Brazil. The data disclosed in the article shows that 88% of the firms raised two or more funds; of those firms, 21% raised their first fund in 5 years or less, and 30% in less than 10 years. Assuming that the life of a fund is 10 years, more than 50% of the firms have barely experienced or not even experienced a whole PE/VC cycle: fundraising, investing in and divesting the portfolio companies, returning the capital to investors and liquidating the fund. The fast growth of the industry raises concern of whether experienced managers are able to accommodate the extra work of managing multiple funds. Will they be able to search companies and invest all the extra capital, monitor the companies, hire and transfer knowledge to new team members without a loss of performance?
This paper investigates whether the number of deals simultaneously managed by PE and VC firms influence performance negatively at the deal level. We innovate by separately analyzing (i) deals with total loss (write-offs) from (ii) deals that returned at least part of the invested capital.

The quality of the portfolio company and entrepreneur, or circumstances out of the control of the PE/VC firm, are the main drives of total loss, and the time that fund managers dedicate to monitor the company has little influence in the likelihood of total loss (write-off). Therefore, we expect a negative relation between the number of deals and the likelihood of total loss. Fund managers develop selection skills and access to good deals from their experience along the time, by practicing and being active in the market. Our results show that a greater number of simultaneous deals decrease the likelihood of total loss for both PE and for VC, possibly reflecting the improvement on the investment selection skill due to the learning process or preferential access to deals due to networking and firm track record.

For companies that are not written-off, if fund managers dedicate little time to implement the value creation thesis and to promote a good exit, deal performance will be below its potential. Therefore, we expect that the balance between limited attention problems, and the learning and transfer knowledge influence the performance of the deal. VC and PE are very different models, and we expect that each have a different balance between the benefit of knowledge transfer and the cost of limited attention.

When we analyze only the PE investments that returned at least part of the invested capital, our results indicate that an increase in simultaneously managed deals has a negative effect on performance, probably reflecting a drop in the efficiency of monitoring them. We find evidence of a positive impact on VC, indicating that the benefits of knowledge transfer for VCs surpass its cost. Venture Capitalists usually syndicate investments, which increases network and knowledge transfer among portfolio companies and mentors. Besides, younger VCs usually co-invest with more experienced VCs, increasing the knowledge transfer among funds (Abell and Nisar, 2007).

This study contributes to the academic literature by investigating the impact of growth on PE and VC performance in emerging markets, where the industry is younger than in developed countries, and the number of experienced managers are lower. Brazil is an emerging market that raised, in a short period, an expressive amount of PE/VC capital without having a mature industry. Analyses at the deal level with data collected from PPMs are rare in emerging markets and unprecedented in Brazil and Latin America to this date. We also analyze the impact on performance of other variables, such as the holding period of an investment, PE and VC firms’ age, control or minority stake, firms’ domicile and affiliation with banks, and stock market performance.

2. Literature Review and Hypothesis Formulation
As a PE/VC firm raises its first fund, managers have the chance to practice and learn. Usually founding partners have relevant previous experience, not necessarily within the PE/VC industry. By practicing, they learn from their mistakes and successes, thus improving their skills. They transfer the acquired knowledge to new team members and to portfolio companies. Besides, there is also knowledge sharing among portfolio companies (Hochberg, Lyungqvist and Lu, 2007). If the fund has successful deals, the PE/VC firm will raise a larger follow-on fund that will probably coexist with the first fund. Consequently, there will be more asset under management (Metrick and Yasuda, 2010). However, to cope with more asset under management, the firm will need more experienced team members. They can either promote in-house resources, or hire experienced managers in the market, or do both. The problem is when growth happens too fast on country level, and there is no time for in-house training, and not sufficient experienced managers in the market to accommodate the incremental demand. It is also difficult to bring experienced managers from other countries. According to Meuleman and Wright (2011), the knowledge required for a firm to operate in a foreign environment is different for those accumulated in the home country. In emerging markets, many peculiarities make it even more crucial to develop the PE/VC expertise locally.

When the PE/VC industry grows and firms have more deals to select, invest, monitor, implement value creation thesis and exit, a mosaic of different processes influence performance: learning, knowledge transfer and limited attention.

Humphery-Jenner (2013) investigated the effect of diversification on the performance of 1505 PE and VC funds in the USA. Diversification can create value by generating more learning and knowledge transfer opportunities, but it can also destroy value if the PE/VC firm is shorthanded. When funds engage in diverse, but tangentially related deals, managers expand their knowledge base, and build a wide-range network. This network means more connections to explore supply and demand opportunities for portfolio companies, mentorship, and access to capital. The benefits of networking plays a special role in VC firms, since they invest in startups that have a business model under construction and are buying market share. The evidences show that diversification creates value on average, and that the positive relation between diversification and return is stronger for VC funds. The author also finds evidence that diversification in prior funds increases the return on the subsequent funds of the same firm, which is in accordance with learning theory. However, when he analyzes the relation between return and diversification by the number of people in the team (number of industries and number of geographic region by number of people), he finds a negative relation, supporting the limited attention hypothesis. We expect to find the same evidence at the firm level, when the number of simultaneously deals increases.

Venture capitalists usually syndicate investments. Abell and Nisar (2007) point that syndication improves a selection process through better screening, due diligence and decision-making. However, syndication also increases the
opportunities to share complementary skills and specific knowledge among funds and, as a result, create value to portfolio companies. It allows inexperienced VCs to co-invest with more experienced VCs, and learn from them. The authors find evidence that the higher centrality degree of the VC fund, the higher is the number of successful exits (IPOs and sales to strategic buyers). For a VC, participating in more deals means co-investing with a higher number of funds, and more opportunities to transfer knowledge and create value from the networking. Therefore, we expect that the transfer knowledge benefit from managing more deals simultaneously is bigger for VC than for PE.

Nanda et al. (2017) adopted the rate of exits through IPO and strategic sale as performance measurement. They find evidence of persistence in VC firm performance. The persistence is mainly explained by the access channel, that is, preferential access to deal flow. According to the authors, the initial success of a VC firm is self-reinforcing because it gives the fund manager preferential access to and better terms in investments. Entrepreneurs value the previous experience of venture capitalists, and they will prefer to receive investments from VCs with successful track records. Access channels explain performance better than fund skills to sort or monitor a deal. Therefore, we expect that total losses and failures decrease with the number of deals simultaneously managed.

Lopez-de-Silanes et al. (2015) investigate the scale effect on the performance of PE fund investments. They analyze 7,500 investments carried out over 40 years worldwide. Some PE firms have hundreds of professionals with diverse backgrounds, performing various investments simultaneously around the world (Cornelius et al., 2007, cited in Lopez-de-Silanes et al., 2015). The main hypothesis tested by the authors comes from the idea of Holmstrom and Roberts (1998) and Garicano (2010), according to which, as a PE, or a VC firm grows, the increase in the number of difficulties in transmitting knowledge (communication) outweighs the benefit of increasing the gross amount of knowledge. The idea is related to limited attention. The authors assume that every investment requires the same amount of attention by managers, and use the number of simultaneous investments as a proxy for scale. Their results show that there is a substantial diseconomy of scale in the PE industry: the greater the number of simultaneous investments of a PE / VC firm, the lower the return will be on average.

Berk & Green (2004) argue that the size of equity mutual funds should not explain the difference in performance, since capital markets are highly competitive, and investors may migrate from less profitable to funds that are more profitable. However, in Private Equity, investments are illiquid. It is difficult for investors to sell the fund shares at a fair value. They only contribute more capital to the PE/VC firm when it raises new funds, which generally only occurs every four years. Besides, the PE/VC activity is very capital-intensive. The team has to perform many activities, often simultaneously: fundraising, generation of new deals, negotiating clauses to invest in portfolio companies, monitoring and
implementing value creation theses and exiting investments. As human capital is a finite resource in the industry, we expect that the problem of diseconomy of scale would affect the investment performance in private equity most in comparison with public equity.

The objective of this study is to investigate how the growth in PE and VC capital in emerging markets affects the performance of the deals. We use the Brazilian case, and investigate the impact of growth at the local level. The source of information is the Spectra-Insper database – built in a partnership with Spectra, a PE and VC Brazilian investor – and Insper, Institution of Education and Research, a leading Brazilian school of Business and Economics. The information is based on PPM (Private Placement Memorandum) hand collected by Spectra from 1994 to 2014. PPMs are documents used by PE/VC funds to raise capital with institutional investors, and contain information on the characteristics and performance of the deals.

We test the following hypotheses:

**H1:** The number of deals simultaneously managed by a PE/VC firm has a negative relation with the probability of total loss

**H2:** The number of deals simultaneously managed by a PE firm has a negative relation with deal performance.

**H3:** The number of deals simultaneously managed by a VC firm does not have a negative relation with deal performance.

Hypothesis 1 is related to the learning theory and access channels. PE/VC firms that have more deals under management have more opportunities to learn how to select better deals, and to write clauses in the shareholders agreement that protect their capital better. They also have a broader network to access better deals and transfer knowledge among portfolio companies. This should reflect on a lower likelihood of having total loss. We assume that the likelihood of total loss is mainly affected by the qualities of the invested company and its entrepreneur, and very little by the limited attention problem.

However, once the portfolio company is not a total loss, the attention dedicated for the PE/VC manager to monitor the company and negotiate a good exit should affect the performance. Therefore, Hypothesis 2 and 3 are related to the balance between the positive and negative effects of having more deals in the portfolio. A higher number of deals simultaneously managed create value with the increase of learning and knowledge transfer, but also decrease value if it gets superior to an optimal ratio of deals managed by experienced manager. In Brazil, as capital under management grew too fast and the industry was not mature, we expect that the benefit of knowledge sharing is lower than the cost of limited attention for PE, affecting the performance of PE’s deals negatively. As knowledge transfer benefits are higher for VC, we
expect that they are higher or at least equal to cost of limited attention. Therefore, we expect that the number of deals simultaneously managed by VC have a positive or does not affect the performance of the deals significantly.

Carvalho et al. (2017), investigated PE and VC performances in Brazil between 1999 and 2007, and used as a proxy for successful exits through IPO (Initial Public Offering), strategic sale (to another company) and secondary sale (to another fund of PE or VC). Their results indicate that as the number of investments of a fund grows, the number of successes tend to grow, but in a declining rate. The authors raise two possible explanations for this phenomenon: (1) limited ability of monitoring; when large numbers of investments need to be monitored, the process loses its efficiency, and (2) value added; since a larger number of investments allow for greater diversification, it leads managers to perform riskier investments, but with more upside. The authors also find a positive relation between performance and fund size, maturity of the company stage, firm’s experience and co-investments.

Our proxy for performance is MoM (Multiple of Money), also known as CoC (Cash on Cash) or TVPI (Total Value to Paid In). It measures the amount of money generated by one monetary unit of investment, as a proxy for performance. This allows us to discriminate between good and bad performance better, and run a more accurate analysis on the impact of increasing the number of deals simultaneously managed.

3. Database and descriptive analysis

The sample contains information about 1,243 PE and VC deals in Brazilian companies realized between 1982 and 2014. When we eliminate deals invested before 1994 and deals without an exit, the sample size drops to 311 deals.

Our sample does not include corporate and proprietary capital fund managers. However, even if it does not contemplate the whole universe of the Brazilian industry, it is quite representative. It contains information of 151 PE and VC firms active in Brazil, roughly 60% of the nearly 250 fund management firms active in Latin America surveyed by LAVCA (Latin American Venture Capital Association) for compiling the 2017 Industry Data and Analysis.1

We classified a deal as VC if it is in a company that has not reached break-even yet, and PE otherwise. Therefore, our classification is related to a company’s life cycle stage.

Figure 1 shows the average ticket size of the deals in BRL, according to the year the fund invests in the company, and Figure 2 shows the number of deals. Both Figures are related only to deals with an exit.

We observe some peaks in PE/VC activities in Brazil. Figure 1 shows a concentration in tickets above BRL50 million in three moments: (i) the privatization of public companies that took place during the President Fernando Henrique Cardoso’s government (1995 and 1998), the bull stock market window (from 2006 to 2008), and (iii) the period when Brazil

1 https://lavca.org/industry-data/2017-industry-data-analysis/ - retrieved on April 17th 2017
was popular among international institutional investors and during the fundraising boom (from 2009 to 2012). In Figure 2 we see that the periods with a higher number of deals are (i) the internet bubble (2000 and the beginning of 2001, before the bubble burst) and (ii) the bull stock market period (2004, 2006, 2007 and 2008 until September).

As we exclude deals without an exit from the sample, we observe a drop in the number of observations after 2010 in figure 2.

Figure 1. Average ticket size in BRL (million) per year of investment

![Average ticket size in BRL (million) per year of investment](image1.png)

Figure 2. Number of PE and VC deals per year of investment

![Number of PE and VC deals per year of investment](image2.png)

Our response variable is performance, and our proxy for it is MoM (Multiple of Money). This metric is also called CoC (Cash on Cash) and TVPI (Total Value to Paid In), and it is obtained by summing up cash inflows and dividing them by the sum of cash outflows. It represents how many times the deal returned the invested capital. Most of the information in
the database is denominated in USD. However, performance measured in foreign currency is subject to exchange risk: exceptional performance can turn into mediocre returns during a local currency devaluation cycle, and the opposite is also true (see Minardi et al. (2016)). In order to avoid foreign exchange distortion, we converted all MoM reported in USD into BRL according to the procedure in Equation (1).

\[
\text{MoM}_{\text{BRL}} = \text{MoM}_{\text{USD}} \times \frac{\text{Ptax}_{\text{exit}}}{\text{Ptax}_{\text{entry}}}
\]

(1)

Where Ptax\textsubscript{exit} is the exchange rate BRL / USD at the date of the divestment, and Ptax\textsubscript{entry} is the exchange rate BRL / USD at the date of the investment. Ptax is the official USD ask rate published daily by the Brazilian Central Bank.

The procedure adopted in equation (1) ignores intermediate cash flows, assuming that all cash outflows are paid out on the date of the investment, and all cash inflows are received on the date of the divestment. As dividend returns are almost irrelevant when compared to capital gains in most PE/VC deals, we expect this simplification does not cause major distortions.

We classified as write-off sales to owners for USD 1.00 (or BRL1.00) and bankruptcies. We treat all write-offs with missing information on MoM as total losses (assuming MoM equals to zero). We observe that 23.2% of investments resulted in a total loss (or near total loss). This is higher than the 10% found by Lopez-de-Silanes et al. (2015), but their research sample includes only PE deals, while our sample contains PE and VC deals. When considering only the PE deals in Brazil, the total loss percentage drops to 12.7%.

The Spectra Insper database also contains information on IRR (internal rate of return), the most popular performance measure among practitioners. However, this method has highly debated limitations in financial circles, such as multiple rates of return when there are reversed signs in the cash flow, and lack of standardization in IRR estimation by different firms. Therefore, we chose to adopt only MoM as a performance measure.

MoM has the limitation of not correcting performance, neither by the value of money over time nor by inflation. Therefore we deflate MoM by IPCA (the Brazilian consumer price index), and control the analysis by the deflated change in the IBOVESPA during the investment holding period. IBOVESPA (São Paulo Stock Exchange Index) is the most well known benchmark for the Brazilian stock market.

Figure 3 shows the distribution of investments according to deflated MoM in BRL. We observe that there is a concentration of MoM equal to 0, and that the distribution has a strong positive asymmetry (there is a concentration in the smallest values of MoM, even when we ignore total losses). This type of distribution with strong positive asymmetry
suggests that generalized linear models may be more appropriate, since they allow for the use of distributions other than normal.

As proposed by Lopes-de-Silanes et al. (2015), our variable of interest is **SIMULT**, which corresponds to the average number of deals simultaneously managed during the holding period of the particular observation. As PE/VC firms raise more capital, they have to hire new team members. This causes limited attention problem for experienced managers, which should affect performance negatively. However, this also creates more knowledge transfer among portfolio companies and co-investments. To estimate the average number of simultaneous deals, we use the complete sample, which includes investments made before 1994 and those that had no exit. Each year we count the number of deals held by the PE/VC firm. SIMULT is the average number of deals held by the PE firm during the holding period of the observation.

![Figure 3. Histogram of MoM](image)

We observe many cases in the sample in which the PE/VC firm holds, simultaneously, more than one deal in the same portfolio company. Usually these deals are reported in different funds (vehicles), but they are under the responsibility of only one PE/VC team that effectively monitors the portfolio company. Therefore, we count these cases as only one deal to calculate SIMULT.

There are many write-off observations with missing information on the exit date. In such cases, we assume a 3-year holding period. The reasoning is that three years is enough time for the management team to recognize failures. Teams usually focus attention on the most promising investments, dedicating less time to failures. Besides, one third of the write-offs with information on the exit date have a 3-year holding period.

For robustness check, we also calculate SIMULT assuming a 2-year holding period for write-offs.

We use the following control variables:
SIZE = Fund size. We use the fund’s committed capital in USD as a proxy for size. According to Metrick and Yassuda (2010), as organizations increase fund size and capital under management, the management fee also increases, reducing the power of the ‘carry’ as a mechanism of alignment of interests between GPs (General Partners) and LPs (Limited Partners). We therefore expect a negative relationship between fund size and performance.

TICKET = The capital invested in the deal in BRL. We expect that this variable will reduce the likelihood of total loss, since it is related to the life cycle of the portfolio company. Larger and more mature companies are better prepared to react to adversity. However, for the deals with successful outputs or that recover at least a significant part of the invested capital, we expect to see a negative effect on investment returns, as larger companies tend to grow more slowly than younger ones.

PERIOD = The investment holding period in years. We calculate it as the difference between the divestment (exit) and the investment (entry) dates, divided by 365 days. We expect a positive relation between this variable on MoM because the longer the time the fund holds the company in its portfolio, the greater opportunity there is to generate value (Cao, 2011). However, as the capacity of the PE / VC manager to add value to the portfolio company declines as time goes by, this effect has a decreasing marginal rate. Therefore, we also included PERIOD2, which corresponds to the square of the holding period in years.

MOMIBOV = MoM of an alternative investment in IBOVESPA, in BRL and deflated by IPCA. We calculate it as the sum of one and IBOVESPA return in real terms during the holding period of the deal. This variable controls the level of stock market activity during the holding period of the deal. We expect a positive relation with performance.

AGE = PE/VC firm’s age. It is the time in years between the founding date of the PE / VC firm and the date the fund invests in the deal. It is a proxy for management experience. We expect that greater experience bring a greater ability to select, monitor and achieve better outputs for investments, thus increasing performance.

VC = A dummy variable that assumes value 1 if the investment is VC (early stage), and 0 otherwise. It controls the stage of the life cycle of the investee company. We expect to find a positive relationship between this variable and the probability of total loss because the earlier the stage of life of the investee company, the greater the risk.

CONTROL = A dummy variable that assumes value 1 if the fund has control stake in the portfolio company and 0 otherwise.

BRAZIL = A dummy variable that assumes value 1 if the PE/VC firm is Brazilian and 0 otherwise.

BANK = A dummy variable that assumes value 1 if the PE/VC firm is affiliated with a bank and 0 otherwise. We expect a negative relationship between this variable and performance because the compensation of PE teams in firms affiliated with banks are less sensitive to performance than in independent firms.

Table 1 shows the descriptive statistics of numerical variables. Panel A refers to the total sample, panel B refers only to PE deals (late stages) and panel C refers to VC deals (at early stages). We observe for all variables a significant difference between PE and VC. The performance of PE deals was significantly higher than VC investments (MoM equal to 2.2 for PE
and equal to 1.5 for VC). PE holds a smaller number of simultaneous deals in the portfolio (9.8) than VC (13.4); PE funds are significantly larger (US $504 MM) than VC (US $107 MM); VC funds have larger holding periods than PE (5.6 years for VC and 4.1 years for PE on average); VC ticket size is significantly lower (BRL 3.6 MM for VC and BRL 84.1 MM for PE) and VC firms were older at the time they entered the deal (9.2 years for VC and 6.6 years for PE).

Table 1. Descriptive statistics of the numeric variables, segregated in total sample, PE and VC
Table 2 contains descriptive analyses of the dummy variables, discriminating between PE and VC. We observe that 23% of the sample is total loss, and that this percentage is higher for VC funds. Most of the deals are from Brazilian firms.
(63.3%) and from independent firms (84.2%). Most of the deals are acquisitions of minority stake (61.1%). We observe zero VC deals realized by firms affiliated with banks.

Table 2. Distribution of categorical variables

<table>
<thead>
<tr>
<th></th>
<th>Total Sample</th>
<th>Total Loss</th>
<th>Brazil</th>
<th>Control</th>
<th>Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>True</td>
<td>False</td>
<td>True</td>
<td>False</td>
<td>True</td>
</tr>
<tr>
<td>PE</td>
<td>204</td>
<td>178</td>
<td>103</td>
<td>101</td>
<td>67</td>
</tr>
<tr>
<td>VC</td>
<td>107</td>
<td>61</td>
<td>94</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>311</td>
<td>239</td>
<td>197</td>
<td>114</td>
<td>77</td>
</tr>
</tbody>
</table>

Table 3 segregates the sample in two: deals with total loss, and deals with MoM greater than zero. We notice that the ticket size of deals with total loss is significantly lower than those with MoM higher than zero, and so is the fund size. Total losses occur more frequently in smaller funds.

Table 3. Descriptive statistics of variables, distributed into total loss (MoM = 0) and deals with MoM>0

Table 4 shows the correlation matrix of the variables. There is, as expected, a high correlation between the fund size and the investment ticket (0.58). We also observe a high and positive correlation between the number of simultaneous deals with firm’s age, Brazilian domicile and affiliation to banks. There is a negative correlation between the number of simultaneous deals and acquisition of control stake.

Table 4. Correlation matrix of variables

Note: Grey values are statistically significant at 5%. Values in brackets represent negative correlation.
3. Methodology

The sample has a high concentration of total loss, or MoM equal to zero. Even excluding these observations, the distribution of MoM has strong positive asymmetry, as shown in Figure 3, indicating that a normal distribution is not appropriate for the analysis (Bortoluzzo et al., 2011).

Therefore, we use two regression models in our analysis:

- A Logit regression model (Cramer, 2003) to evaluate the impact of the explanatory variables on the event of total loss (MoM = 0), as expressed in (2).

\[
\ln \left( \frac{P_i}{1-P_i} \right) = \alpha_0 + \alpha_1 x_{1i} + \alpha_2 x_{2i} + \ldots + \alpha_k x_{ki},
\]

(2)

Where

\[
P \left( Y_i = 1 \right) = \frac{Y_i}{P_i} = \frac{1}{1-P_i}, \quad Y_i = \begin{cases} 1, & \text{if } MoM = 0 \\ 0, & \text{otherwise} \end{cases} \quad \text{and } i = 1, \ldots, n.
\]

- A generalized linear model (Nelder, 1972) with Exponential Distribution to analyze the relation of the explanatory variables with MoM, for those deals that do not result in total loss (MoM > 0), as expressed in (3). Generalized linear models are a generalization of the ordinary least squares regression. We choose the exponential distribution because it is more adherent to the distribution of MoM.

\[
MoM_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} + \epsilon_i, \text{if } MoM_i > 0.
\]

(3)

Where \( \epsilon_i \) is the random error. We run a residual analysis to check if the error homoscedasticity hypothesis holds, and if it is necessary to use robust standard errors.

4. Results

Table 5 contains the results for the test of Hypothesis 1, that is, a logit regression to explain total loss. We observe that the greater the number of investments managed simultaneously by the firm, the lower is the probability of a total loss (Model 3), and this result is significant for both PE and VC (Models 4 and 5). The results are in accordance with hypothesis 1. A higher number of deals may be related to a higher reputation of the firm. According to Nanda et al. (2017), reputation brings preferential access to and better terms in good deals, and this should reduce the probability of total loss. In addition, a higher number of deals also represent experience, and managers improve their sorting ability as they practice PE/VC activity, reducing the chance to select bad companies.
We confirm that ticket size decreases the likelihood of a total loss (Models 2 and 3). However, when we segregate the analysis in PE and VC, we find statistically significance only for VC (Mod 5).

Similarly, early stage deals (VC) also have a higher probability of total loss (Models 2 and 3).

Table 5. Results of logistic regressions to explain the probability of total loss (MoM = 0)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mod 1</th>
<th>Mod 2</th>
<th>Mod 3</th>
<th>PE</th>
<th>VC</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>-0.2076</td>
<td>-0.4402</td>
<td>-0.0370</td>
<td>-0.8918</td>
<td>0.6918</td>
</tr>
<tr>
<td></td>
<td>(1.1523)</td>
<td>(0.6567)</td>
<td>(0.0474)</td>
<td>(0.0469)</td>
<td>(0.3950)</td>
</tr>
<tr>
<td>SIMULT</td>
<td>-0.0368</td>
<td>-0.0583</td>
<td>-0.0661 **</td>
<td>-0.0644 **</td>
<td>-0.0654 **</td>
</tr>
<tr>
<td></td>
<td>(0.0507)</td>
<td>(0.0384)</td>
<td>(0.0261)</td>
<td>(0.0262)</td>
<td>(0.0272)</td>
</tr>
<tr>
<td>LN(SIZE)</td>
<td>-0.2097</td>
<td>-0.2097</td>
<td>-0.2097</td>
<td>-0.2097</td>
<td>-0.2097</td>
</tr>
<tr>
<td></td>
<td>(0.1692)</td>
<td>(0.1692)</td>
<td>(0.1692)</td>
<td>(0.1692)</td>
<td>(0.1692)</td>
</tr>
<tr>
<td>LN(TICKET)</td>
<td>-0.0705</td>
<td>-0.2316 *</td>
<td>-0.3171 ***</td>
<td>-0.2426</td>
<td>-0.2779 ***</td>
</tr>
<tr>
<td></td>
<td>(0.2053)</td>
<td>(0.1293)</td>
<td>(0.1199)</td>
<td>(0.1722)</td>
<td>(0.1054)</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.0232</td>
<td>-0.0250</td>
<td>-0.0250</td>
<td>-0.0250</td>
<td>-0.0250</td>
</tr>
<tr>
<td></td>
<td>(0.0407)</td>
<td>(0.0238)</td>
<td>(0.0238)</td>
<td>(0.0238)</td>
<td>(0.0238)</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>0.0978</td>
<td>0.1253</td>
<td>0.1253</td>
<td>0.1253</td>
<td>0.1253</td>
</tr>
<tr>
<td></td>
<td>(0.5595)</td>
<td>(0.4259)</td>
<td>(0.4259)</td>
<td>(0.4259)</td>
<td>(0.4259)</td>
</tr>
<tr>
<td>CONTROL</td>
<td>0.3872</td>
<td>0.2718</td>
<td>0.2718</td>
<td>0.2718</td>
<td>0.2718</td>
</tr>
<tr>
<td></td>
<td>(0.5731)</td>
<td>(0.4484)</td>
<td>(0.4484)</td>
<td>(0.4484)</td>
<td>(0.4484)</td>
</tr>
<tr>
<td>VC</td>
<td>0.8564</td>
<td>1.4219 ***</td>
<td>1.1140 **</td>
<td>0.8564</td>
<td>1.1140 **</td>
</tr>
<tr>
<td></td>
<td>(0.8143)</td>
<td>(0.4509)</td>
<td>(0.4391)</td>
<td>(0.8143)</td>
<td>(0.4509)</td>
</tr>
</tbody>
</table>

Note. The Logit regression (Newton-Raphson), with the dependent variable is a dummy variable that assumes value 1 if total loss or 0 otherwise. SIMULT is the average number of simultaneous investments in the portfolio throughout the period invested in i investment, LN (SIZE) is ln the fund size, LN (TICKET) is the ln of the ticket or amount invested in the company, AGE represents age in years in managing the time of investment, BRAZIL is a dummy variable that takes value 1 if the management is Brazilian and zero otherwise, CONTROL is a dummy variable that assumes value 1 if the fund holds a controlling interest in investment, VC is a dummy variable that assumes value 1 if the investment is in early stage and zero if otherwise. The coefficients and standard errors are disclosed in brackets, and the symbols *, ** and *** represent the significance at 10%, 5% and 1%, respectively.

Table 6 contains the results of the tests for hypothesis 2 and 3. We used only deals in the analysis, with MoM higher than zero. We run separate analyses for PE and VC.

We observe for PE that SIMULT has a negative coefficient in models 1, 2, 3 and 4, and it is significant only in Model 4. Therefore, our results indicate that as the PE firm grows and manages more investments simultaneously the performance
decreases, as expected by hypothesis 2. We find evidence that for PE the cost of limited attention is higher than the knowledge transfer benefit. Carvalho et al. (2017) found similar result and interpreted it as limited monitoring capacity.

When we analyze VC investments, the relationship between SIMULT and MoM is not consistent. It is positive in models 5 and 6, and negative in models 7 and 8. As it is significant only in Model 5, we conclude for a weak evidence of positive relation between the number of VC deals and performance, and it is in accordance with hypothesis 3. VC firms, differently than PE, gives plenty of attention to the successful investments, and decreases the level of attention to those struggling to achieve the targets, or signaling failure. Co-investments are also usual for VC, increasing knowledge sharing and learning process, and bringing more synergy opportunities for portfolio companies. For VC the benefit of keeping more investments in the portfolio exceeds or equals the potential cost of limited attention.

We do not find any relationship between fund size and performance, neither for PE nor for VC. This result does not support a drop in the interest alignment between investors and managers caused by the increase in management fee when funds get larger.

We observe that the ticket size has a negative effect (although close to zero) for the PE’s MoM (Models 2 and 4). As expected, there is evidence that investments in larger companies have a lower yield than in smaller ones. This effect, however, is stronger for VC, and we observe negative and significant relationship in Models 5, 6, 7 and 8. This result is expected because the Ticket size is a proxy for the portfolio company’s stage in the life cycle (the earliest the stages, the lower the ticket, and the latest the stage, the higher the ticket size). The smaller and younger the company, the higher growth opportunities in MoM.

The growth in holding period impacts positively the PE MoM, and as expected, with a decreasing marginal rate. Note on Table 6 that the PERIOD signal is positive and significant (Models 2 and 3) for PE, and the PERIOD2 signal is negative (Models 2 and 3). This effect is weaker for VC, and only in Model 7, the PERIOD is positive and significant.

We do not find a significant relation between the MoMs of the deals and the MoMs of IBOVESPA, either. This is probably because IBOVESPA is mainly concentrated in the largest Brazilian companies, such as Petrobras, Cia Vale do Rio Doce, AMBEV, Itau Bank, Bradesco, and it may not represent PE investments well. Interestingly and unexpectedly enough, the performance of IBOVESPA has a positive impact on the VC MoMs (models 5, 6, 7 and 8).

Other effects that are worth noting are that the Brazilian origins of the PE firm positively affected the MoM according to models 1 and 3, and affiliation with banks influenced negatively the PE performance (model 1).

5. Robustness Test

5.1 Write off Period to estimate variable SIMULT
Since we do not observe the time period for PE and VC writing-off deals, we arbitrarily adopt the period of three years, which seems realistic. In order to check the robustness of the results for different periods of write-offs, we changed this value to two years, recalculated the SIMULT variable of all deals and reran the regressions. The average number of simultaneous deals decreases from 11 to 10.7 for the whole sample, from 9.8 to 9.7 for PE, and from 13.4 to 12.7 for VC.

Table 6. Regression results to explain the performance of PE and VC sample of investments that did not have a total loss (MoM> 0)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>PRIVATE EQUITY (PE)</th>
<th>VENTURE CAPITAL (VC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>1.1752 (0.7622)</td>
<td>2.2167*** (0.4401)</td>
</tr>
<tr>
<td>AGE</td>
<td>0.0330 (0.0391)</td>
<td>0.0626* (0.0337)</td>
</tr>
<tr>
<td>PERIOD</td>
<td>0.1578 (0.1873)</td>
<td>0.3432** (0.0169)</td>
</tr>
<tr>
<td>PERIOD2</td>
<td>0.0084 (0.0169)</td>
<td>-0.0207* (0.0026)</td>
</tr>
<tr>
<td>SIMULT</td>
<td>-0.0240 (0.0452)</td>
<td>-0.0207 (0.0022)</td>
</tr>
<tr>
<td>SIZE</td>
<td>0.0001 (0.0006)</td>
<td>0.0236 (0.0035)</td>
</tr>
<tr>
<td>TICKET</td>
<td>0.0014 (0.0021)</td>
<td>-0.0010* (0.0009)</td>
</tr>
<tr>
<td>MOMIBOV</td>
<td>0.2556 (0.2755)</td>
<td>0.1808*** (0.0628)</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>1.8029*** (0.6326)</td>
<td>-5.5868** (2.4923)</td>
</tr>
<tr>
<td>CONTROL</td>
<td>0.3776 (0.4156)</td>
<td>-2.2888 (2.2852)</td>
</tr>
<tr>
<td>BANK</td>
<td>-1.1508*** (0.4256)</td>
<td>0.7265 (0.3454)</td>
</tr>
<tr>
<td>n. obs</td>
<td>88 112 141 170</td>
<td>30 31 55 60</td>
</tr>
<tr>
<td>Restr. Dev.</td>
<td>19.68** 26.50** 29.05 36.72</td>
<td>9.75* 9.77** 19.34** 20.98**</td>
</tr>
</tbody>
</table>

Note. Generalized regression with exponential distribution using dependent variable MoM> 0. AGE corresponds to the management company's age in years at the time of investment, PERIOD is the time that the fund investments are maintained in the portfolio, PERIOD2 is the squared period, SIMULT the average number of businesses managed simultaneously by the organization throughout the period invested in the company, SIZE is the committed capital of the fund, TICKET is the ticket or amount invested in the company, MOMIBOV corresponds to the Ibovespa multiple of money throughout the period that the investment is in the fund portfolio, BRAZIL is a dummy variable that assumes value 1 if the
management is Brazilian and 0 otherwise. CONTROL is a dummy variable that assumes value 1 if the fund holds a controlling interest in the investment and BANK is a dummy variable that assumes value 1 if the management is affiliated with a bank and 0 otherwise. The coefficients, robust standard errors and heteroscedasticity are disclosed in parentheses. Symbols *, ** and *** correspond to the significance 10%, 5% and 1%, respectively.

We do not observe any significant change in the explanation of total loss. The evidence that larger numbers of simultaneous deals decrease the probability of total loss for both PE and VC becomes even stronger. The shorter the time to recognize the write-off, the more beneficial it is to keep a larger number of deals, thus reducing the probability of total loss. It validates hypothesis 1.

We also confirm the previous evidence for PE and VC deals with MoM greater than zero: a higher number of deals managed simultaneously impacts PE performance negatively, but VC performance positively, and it validates hypotheses 2 and 3.

5.2. Homogenization of experience in the industry

The period we analyze, 1994 to 2012, is not homogenous in terms of industry experience, and this could have interfered with the ability of professionals to manage a greater number of deals simultaneously. Early in 1994, there were not many local PE and VC expertise, and foreign experts did not understand the specifics of an emerging country like Brazil (Minardi and Cresciullo (2014)). Over time, however, Brazilian professionals learned about PE and VC, and this knowledge was spread to more management companies through spin-offs and professionals switching firms. This change in expansion of knowledge and experience in the industry likely affected the results. Therefore, we exclude the deals generated in the first four years from the sample: 1994, 1995, 1996 and 1997.

Another point that deserves attention is the fact that the PE deals with exit, and which were invested in 2011 and 2012, are almost only successful cases. PE funds benefited from the IPO window to sell their stakes for profits, shortening the holding period and improving IRR. Probably, the deals invested in 2011 and 2012, which are still in funds’ portfolio, will have a much lower performance. Conversely, the VC deals with exit of vintages 2011 and 2012 are write-offs. As the VC ecosystem has had an expressive evolution since 2010, many VC firms have been able to raise capital for follow on rounds of promising deals, and keep them longer in the portfolio. They made a bet that these deals will have an expressive growth, and generate outstanding returns. To eliminate these distortions, we also exclude the deals invested in 2011 and 2012 from the sample.

We reran our regressions for a sample containing 272 cases: deals made between 1998 and 2010. We confirm that a larger number of simultaneous deals decrease the probability of total loss, but the evidence is weaker for VC. Although the
sign of the SIMULT coefficient is negative for both PE and for VC, it is significant only for PE. Therefore the robustness test confirms hypothesis 1.

We also confirm hypothesis 2: in PE deals, the SIMULT coefficient has a negative sign to explain performance. We do not find a significant effect of SIMULT on VC performance, confirming hypothesis 3.

7. Conclusion

Our results confirm the learning, knowledge transfer and limited attention hypotheses. We find that the higher number of simultaneously managed deals reduce the probability of total loss for both PE and VC, supporting hypothesis 1. Being exposed to a higher number of deals improve the skill to better select investee companies and give preferential access to invest and have better terms. By managing more deals, managers have the chance to practice and learn more. They also increase their networking and benefit from knowledge transfer. This is probably what explain the lower probability of total loss for both PE and VC.

We also find evidence that more deals affect PE performance negatively, but this is not the case for VC, as expected by hypotheses 2 and 3. PE deals’ performance decrease with a higher number of deals simultaneously managed. This evidence supports that the limited attention cost is higher than the knowledge transfer benefit from increasing the number of deals in PE. In order to obtain a good performance, it is necessary a greater effort to monitor a higher number of investments, and this effort is independent of the investment size. As the PE funds increase in size and the organization obtains more companies to monitor, their teams probably get overloaded and the PE firm is not able to hire, or train new professionals at the necessary speed to keep the same performance. Unfortunately, our data does not contain information on the number of professionals per firm, their background and previous work experience, and we are not able to confirm that the drop in performance related to the increase in the number of deals simultaneously managed is caused by temporary shortage in human resources.

Our results show that a higher number of deals simultaneously managed does not affect VC performance consistently. Therefore, our evidence supports the hypothesis that the benefit of knowledge transfer for VC is higher or at least equals the limited attention problem. As we noted in our descriptive analysis, VCs have a larger number of deals in their portfolio than PEs. The level of attention of VC managers is not constant among investments: the most promising investments receive more attention and the least promising ones fail to receive attention. The benefit of having more deals is in the increase in the possibility of having a *blockbuster*, a higher diversification and exposure to different businesses, as well as more co-investment and networking opportunities to help portfolio companies grow. Those benefits exceed or equal the cost of limited attention.
As expected, there is a negative relationship between performance and investment ticket for PE and VC, as reported in Metrick and Yasuda (2010), and this evidence is stronger for VC.

In addition, the longer the holding period, the greater is the MoM for PE and VC investments. This evidence is in accordance with Cao (2011), who points out that the holding period is a proxy for monitoring and opportunity for the PE/VC funds to generate value for the investee. In addition, as expected, the positive effect on the performance decreases as the holding period length increases.

Firms affiliated with banks tend to have lower performance, as discussed in the literature (see Lerner and Leamon, 2013).

It is worthy of note that the small sample size is a limitation in our analysis. The inclusion and exclusion of observations cause instability in the regression coefficients’ significance.

References


