Cash Dilution in Illiquid Funds

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Abstract

Cash dilution, the effect of performance reduction through cash, exists in almost every illiquid fund. This article provides a brief overview of the problems of cash dilution in illiquid private equity fund of funds, a formula for the calculation of the cost of cash dilution, two possible solutions for the reduction of cash dilution (namely the over-commitment strategy and a formula to calculate the optimal degree of investment in other assets), an evaluation of the effect of cash dilution in private equity fund of funds, and an evaluation of the usefulness of the over-commitment strategy.

1 Introduction

In illiquid markets, like the private equity market, committed capital can neither be invested nor liquidated at any point in time. As long as the invested capital is less than the committed capital, the fund holds cash. This cash portion of a fund reduces the performance. This performance reduction is called cash dilution or cash drag, because the performance of a fund is diluted or dragged down by cash (Liaw and Moy, 2000).

There are basically two reasons for cash dilution in private equity funds, namely the not yet invested and the already liquidated capital.

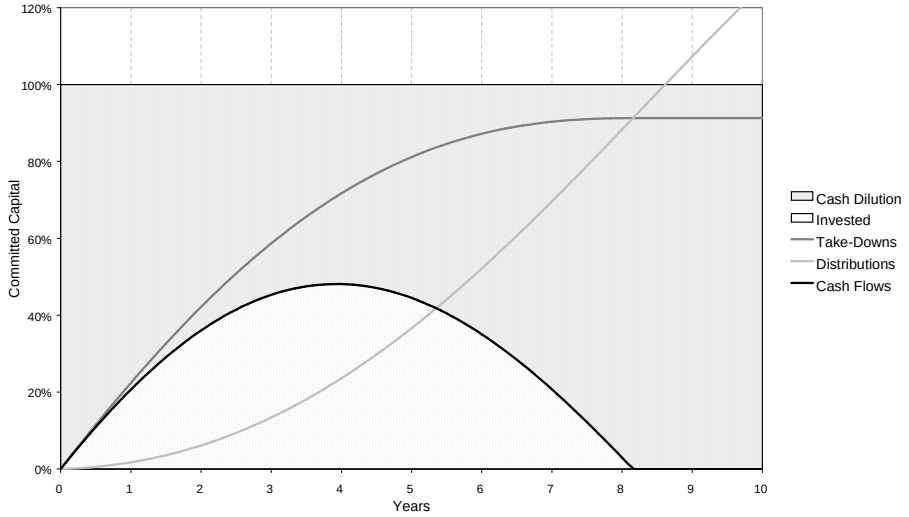
The practice shows that the average private equity fund needs up to six years to invest its committed capital. This long investment period can be traced back to limited investment possibilities and high illiquidity of assets. During the investment period the not yet invested assets consist of cash that dilutes the return. However this cash, and therefore also the first source of cash dilution, decreases with the increasing number of investments.

The second source of cash dilution in private equity funds consists of cash that accrues from the liquidation of investments. Most funds are limited to a ten-year term. Since the majority of private equity investments are middle to long term, a fund can only invest during the first six years (Toll and Galante, 2001; Fenn, Liang, and Prowse, 1995). Although the amount of committed capital is still the same, the invested capital decreases slowly. Because of this, the cash portion of a fund, and therefore also the cash dilution, increases towards the end of the term.

For the graphic illustration of the problem of cash dilution, the cumulated distributions (liquidations) are subtracted from the cumulated takedowns (investments) so that the cumulated cash flows can be seen. If these cumulated cash flows are expressed as a percentage of the committed capital, they correspond to the investment level of the fund.

The problem of cash dilution can be dealt with more easily by diversified

Figure 1: Regression of mean investment levels from private equity funds from 1986 to 1995



fund of funds than by normal funds, since the cash flows of specialized private equity funds depend greatly on macroeconomic developments (Berger and Udell, 1998). This can primary be traced back to the small number of investments as well as to the specialization in a certain investment class (venture capital, buyout or mezzanine debt), industry or region. In highly diversified private equity fund of funds, cash flows are more static and therefore also easier to analyze and anticipate. The degree of diversification and the high number of indirect investments through participation in different funds also characterize the virtual fund of funds of pension funds (Brophy and Guthner, 1988). That is why the following explanations can also be applied to virtual fund of funds.

2 Analysis of the cash flows

The problem of cash dilution can only be diminished if the investor can anticipate the cash flows of the funds, because if cash flows occur unforeseen, he must quickly buy or sell illiquid assets at possibly unfavorable prices (Bader, 1996).

In the following, the cash flow patterns (i.e. the structure and behavior of

the cash flows) shall be analyzed. The cumulated distributions and takedowns are calculated using data provided by Venture Economics. The following paragraphs will show how Venture Economics publishes the data and simplifying assumptions of the calculation.

2.1 Data characteristics and assumptions

The different investment classes, industries and regions show varying cash flow patterns. In modeling a private equity fund of funds, the question of how to diversify has to be addressed. Because of a lack of data from the European and Asian private equity markets, this study only employs data from the American market. Therefore, the cash flow patterns to be presented are not grouped by regions. For the sake of simplicity, the investment classes and industry sectors were grouped after market capitalization. The investment classes venture capital, buyout and mezzanine debt, as well as the different industry sectors will be included according to their share of the American private equity market.

The different vintage years also display varying cash flow patterns. It can be shown that the takedown patterns changed dramatically during the past few years. Since the mid-eighties, funds no longer call their capital after a fixed takedown schedule, but rather just-in-time (Toll and Galante, 2001). Moreover, the distribution patterns have also changed. In the early eighties, most funds departed from yearly distributions.

In analyzing the distribution patterns of the funds for the vintage year 1985, the yearly distributions become clearly discernible. However, as in 1986, the effect of the yearly distributions can be neglected. The takedown patterns of 1986 and the following years also do not show any fixed takedown schedules. That is why we will be considering only the vintage years 1986 to 1995.

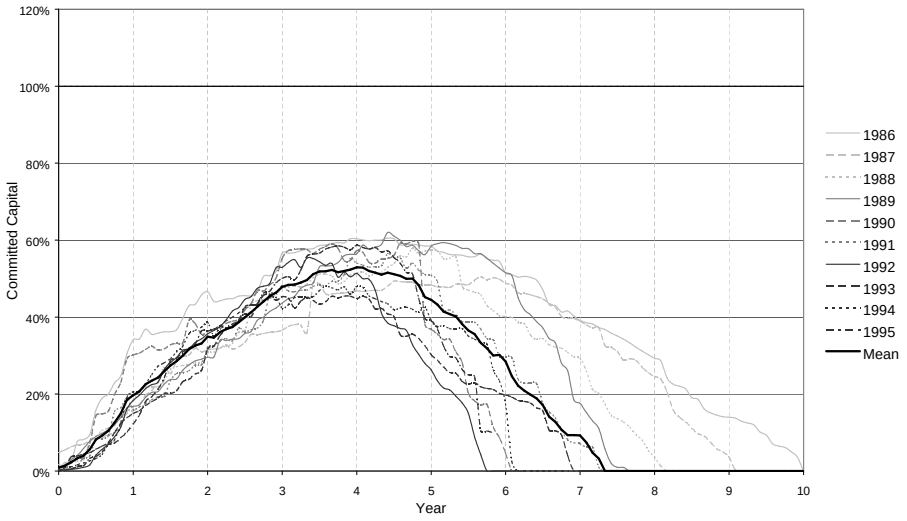
To improve the analysis of the cash flow patterns, monthly data was processed, rather than the quarterly data usual in the private equity industry. Data is available for the period from January 1986 to November 2000. According to Fenn and Liang (1998), the database of Venture Economics represents about

three-quarters of the total private equity market.

2.2 Cash flow patterns

The cash flows are calculated by subtracting the cumulated distributions from the cumulated takedowns. All ten cash flow patterns of the vintage years 1986 to 1995 have been standardized, whereas the vintage year was attributed to the year 0.

Figure 2: Cash flow patterns of the vintage years 1986 to 1995



The calculation shows that after the first year an average of 19.7% of the committed capital was invested. During the next three years the investment level slowly increased to 34.9% in the second, 47.8% in the third and 52.9% in the fourth year, with which the maximum mean investment level was reached. In the fifth year the investment level decreased to 44.5%. In the sixth year only an average of 29.3%, in the seventh only 16.5% were invested. After an average of seven years and four months, the full-invested capital was distributed. Remarkable is the fact that the overall highest investment level was reached after four years and six months by the funds of the vintage year 1989 with only 62.0% of the committed capital.

This illustration enables us to see that younger funds of the vintage year 1992 were liquidated much more quickly and therefore suffered from a higher degree of cash dilution than older funds. This can be attributed to faster distribution patterns. Funds of the vintage year 1992 paid back the committed capital the quickest. They reached an investment level of zero percent already after an average of five years and ten months. Black and Gilson (1998) and Gompers (1998) have shown that higher returns in private equity depend on the strength of the IPO market. It would therefore be interesting to investigate whether the acceleration of the distribution patterns could also be put into a direct context with better IPO conditions.

3 Costs of cash dilution

To calculate the costs of cash dilution in private equity fund of funds, a normal private equity fund of funds suffering from cash dilution will be compared with a theoretical private equity fund of funds without cash dilution.

Both fund of funds have a lifespan of ten years (which is entirely usual in the private equity industry), takedown their total committed capital on the first day and distribute their returns only on the last day of their term (which is unusual, but correct for the calculation).

To be able to calculate the return of the theoretical fund of funds without cash dilution, it has to be assumed that the total committed capital is invested at the beginning and liquidated at the end of the fund. These assumptions are extremely unrealistic - because of the high illiquidity, the total committed capital can neither be invested at time zero nor liquidated immediately at the end of the fund.

To calculate the return of the normal fund of funds with cash dilution, the mean cash flow pattern that was shown above will be used. Since a fund of funds that cannot anticipate the cash flows is not allowed to invest its cash otherwise, it is assumed that the normal fund of funds with cash dilution invests its cash

in the money market. The return for these investments is calculated with 5%, which corresponds approximately to the American money market.

3.1 Performance calculation

To find a good performance measurement turns out to be difficult, since conventional performance measurements (like the internal rate of return) are based on cash flows or invested capital, respectively. To be able to analyze the problem of cash dilution, a performance measurement that measures committed capital is needed.

Two measurements are calculated here: the ratio of distributions to committed capital and the return on committed capital, whereby both measure committed capital. The ratio of distribution to committed capital is calculated by dividing the sum of all distributions by the committed capital. The return on committed capital is calculated by dividing the distributions minus the takedowns by the committed capital.

To simulate equivalent investments by the theoretical fund of funds without cash dilution and the normal fund of funds with cash dilution, the internal rate of return of the private equity investments of the normal fund of funds with cash dilution is calculated. The investments of the theoretical fund of funds are then calculated using the same internal rate of return.

Since the theoretical fund of funds without cash dilution calculates its investments with the same internal rate of return, and only has two cash flows (the investment of the full capital at time zero and the liquidation at time ten), the capital that is distributed by the theoretical fund of funds can be calculated through transformation of the equation of the internal rate of return:

$$CF_t = CF_0(1 + IRR)^L$$

Whereby CF corresponds to the committed capital, L to the duration and IRR to the internal rate of return of the normal fund of funds with cash dilution.

Based on the mean cash flows calculated above, the normal fund of funds with cash dilution has an internal rate of return of 17.6%. The theoretical fund of funds without cash dilution therefore distributes 5.059 times its committed capital.

A mean normal fund of funds with cash dilution from the vintage years 1986 to 1995 realizes with private equity investments 1.858 times its committed capital during the ten years, and on the money market it achieves 0.553 times its committed capital. A normal fund of funds can therefore distribute 2.411 times its committed capital after ten years.

Table 1: Performance with and without cash dilution

	With cash dilution	Without cash dilution
Return on committed capital	141.1%	405.9%
Distribution to committed capital	2.411	5.059

The performance measurements can be calculated as follows: The yearly returns for fund of funds with cash dilution come to 9.2%, for the fund of funds without cash dilution to 17.6%, which corresponds exactly to the internal rate of return. In the following, only total returns will be regarded, since yearly returns for illiquid investments, which have to be held for ten years, are not really indicative.

3.2 Calculation of the costs of cash dilution

For an ended or nearly ended fund, the following formula can be used to calculate the costs of cash dilution.

$$CD = \frac{(1 + IRR)^L - \frac{D}{C}}{(1 + IRR)^L - 1}$$

Whereby CD corresponds to the cost of cash dilution, L to the duration, D to the cumulated distributions, C to the committed capital, and IRR to the

internal rate of return of the fund.

The cost of cash dilution of a fund of funds therefore equals an average performance loss of 65.2% after a ten-year period. Thus, nearly two-thirds of the return of a fund of funds are wiped out by cash dilution.

At the first glance, the enormous effect of cash dilution on private equity fund of funds is astonishing. Considering the fact that a fund of funds with cash dilution has an average investment level of only 21.4% during its ten-year period, the high loss of nearly two-thirds of the return seems plausible.

4 Reduction of cash dilution

To reduce the problem of cash dilution there are above all two possibilities. On the one hand, the cash of the not yet invested and the already liquidated capital can be invested in other assets. On the other hand, the over-commitment strategy offers another possibility to reduce the effect of cash dilution.

4.1 Reduction of cash dilution with over-commitment

If a fund of funds over-commits its capital, it is committing more capital than it actually owns. In this case, the commitments exceed the fund size. Since the commitments of a private equity fund of funds are not all called down at the same time, over-commitment strategies are possible. The aim of an over-commitment strategy should be to achieve an investment level of 100%.

There is hardly any scientific literature dealing with cash flow patterns and over-commitment strategy. The only work worthy of mention is by Robin and Marsal (2000). The authors are of the opinion that a fund of funds should over-commit its capital by 13% in order not to be underinvested. When asked, Henry Robin said that the value of 13% was not determined through empirical work, but through long practical experience. However, the above analysis of the cash flow patterns showed that the over-commitment level must be higher than 13% if a fund of funds is to be fully invested.

Supposing that the cash flows are approximately normally distributed at the point of time of the maximal investment level, the optimal over-commitment level can be calculated by means of an assessment function.

$$OC_{opt} = \frac{1}{\mu_{max} + d_{1-\alpha}\frac{\sigma_{max}}{\sqrt{n}}}$$

Whereby μ_{max} corresponds to the mean of the maximal investment level, σ_{max} to the appropriate standard deviation, n to the amount of invested funds, and α to the error possibility or the possibility of reaching an investment level over 100%.

The mean of the highest investment level can be read from the cash flow pattern above; it equals 52.9%. Unfortunately, Venture Economics could not provide this work with standard deviations, but since it can be assumed that the investment level never rises above 100%, the standard deviation can be estimated. This can be done by assuming that the over-commitment level of a fund of funds with only one investment is exactly zero. Accordingly, the standard deviation is approximately 20.2%. The value of $d_{1-\alpha}$ for a one-percent error quota comes to 2.327. If a fund of funds invests in 50 different funds, it could over-commit its capital by 67.9%. With this over-commitment level, a fund of funds reaches a maximal investment level of 88.8%. The residual 11.2% are held in cash in case the invested funds do not exactly reflect the underlying average cash flow patterns.

The question of the risk of the over-commitment strategy is justified. The risk of the over-commitment strategy consists of the illiquidity of the fund of funds. A fund of funds becomes insolvent if the maximal investment level rises above 100%. The risk of insolvency can be countered with a credit line. As long as the costs of the credit line are lower then the internal rate of return of the private equity investments, there is no loss through an over-commitment strategy. The risk of a correctly managed over-commitment strategy is therefore minimal.

4.2 Reduction of cash dilution with other assets

Another possibility of reducing the problem of cash dilution is the investment of cash in other assets. However, this strategy should not be regarded as an optimal solution. With the investment of cash in other assets, the return of a private equity fund is not as strongly diluted as it was, but the other assets are falsifying it. This return falsification leads to higher correlations of the private equity fund of funds. However, most of the time it is exactly these low correlations of private equity with other assets that are an important reason to invest in private equity fund of funds.

To be able to meaningfully plan investments and not precipitously liquidate assets at unfavorable prices, it is imperative to anticipate the cash flow patterns. Supposing that the cash flow patterns are approximately normally distributed, the optimal investment level can be calculated as follows:

$$IL_t = 1 - \left(\mu_t + d_{1-\alpha}\frac{\sigma_t}{\sqrt{n}}\right)(1 + OC)$$

Whereby IL_t corresponds to the optimal investment level of the period t, μ_t to the mean cash flow of the period t, σ_t to its standard deviation, α to the error possibility or the possibility of reaching an investment level over 100%, n to the number of invested funds, and OC to the level of over-commitment.

The risk of investing the cash in other assets equals the performance loss that arises when an asset has to be liquidated precipitously. However, as long as the total return of the investment after the precipitous liquidation is still positive, the strategy of investing the cash in other assets does not entail any costs, and the risk is therefore minimal.

4.3 Benefits of anti-dilution strategies

To calculate the benefits of the over-commitment strategy, a normal fund of funds with cash dilution is compared to a fund of funds with over-commitment and to a theoretical fund of funds without cash dilution.

Basically the same assumptions as in the calculation of the costs of cash dilution are used. For the fund of funds with over-commitment, an optimal over-commitment level of 67.9% was calculated above.

With these assumptions, a fund of funds with over-commitment is able to distribute 2.942 times its committed capital after ten years. With the formula developed above, the costs of cash dilution can easily be calculated as follows:

Table 2: Performance of different anti-dilution strategies

	With cash dilution	Over-commitment	Without cash dilution
Return on committed capital	141.1%	194.2%	405.9%
Distribution to committed capital	2.411	2.942	5.059
Cost of cash dilution	65.2%	52.2%	-

Calculations show that both the over-commitment strategy and the strategy of investing cash in other assets increase the return of a private equity fund of funds; therefore both strategies can be regarded as meaningful instruments for reducing the problem of cash dilution.

5 Conclusion

This article shows that the problem of cash dilution cannot be seen in the internal rates of return that are published by the private equity funds. On basis of a constructed mean cash flow pattern, the effect of cash dilution can be shown. A calculation showed that 65.2%, or in other words nearly two-thirds of the performance of a fund of funds are diluted by cash. This enormous performance loss is surprising and shows the significance of the problem of cash dilution in private equity fund of funds.

In this article, two strategies to reduce the problem of cash dilution were proposed: The over-commitment strategy and the strategy of investing the cash in other assets, such as public-traded private equity. For the practical implemen-

tation of these strategies, two formulas were developed to calculate the optimal over-commitment level and the optimal investment level. A universally valid over-commitment level could not be calculated, since this depends on the number of invested funds. However, it was shown that a fund of funds that invests in fifty well-diversified funds is allowed to over-commit its capital by 67.9%.

With a calculation of the theoretical benefits, it could be shown that an over-commitment strategy reduces the performance loss from 65.2% to 52.2%. If, however, the cash is invested in public-traded private equity, concurrent to the over-commitment strategy, the costs of cash dilution can be reduced even more.

To conclude, it can be said that the problem of cash dilution in private equity should not be neglected. But recognizing it is made much more difficult by the way private equity funds publish their returns. Therefore, a formula was developed in this article with which the cost of cash dilution can be calculated. Another possibility of determining the costs of cash dilution would be with the help of a performance measurement of the committed capital, not of the internal rate of return based on the invested capital. It is therefore proposed that private equity funds publish the return on committed capital in addition to the internal rate of return. The additional transparency achieved in this way would make it possible for investors to determine how effective a fund manages the problem of cash dilution.

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