Measuring Risk and Return in Private Equity

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Abstract

The purpose of this thesis is to analyze the measurement of risk and return in Private Equity, a sector characterized by discontinuous cash flows, unlisted assets, and significant illiquidity issues. Recognizing the limits of traditional static indicators, such as the Internal Rate of Return (IRR) and cash multiples, this thesis analyses dynamic econometric models capable of capturing the complexities of Private Equity investments in a more accurate way. With the aim to obtain solid parameter estimates, this research integrates advanced methodologies, including the decomposition of cash flows into systematic and anomalous components, and the Generalized Method of Moments (GMM). The models evaluate risk parameters, particularly beta, and abnormal performance (alpha) and are applicable to both Venture Capital and Buyout funds. The results, considering the unique operational structure of Private Equity, the investment lifecycle and the challenges arising from data scarcity and opacity, highlight the fact that static measurements tend to overestimate actual returns, whereas the dynamic approach provides a more realistic evaluation of the true cost of capital.

Chapter 1

Introduction

1.1 Context and Relevance of Private Equity in the Global Economy

Private Equity has a central role in the modern economy, it has both a function of driving force for innovative companies and of a strategic instrument for private and institutional investors. However, in Private Equity investments, characterized by irregular cash flows, opaque data and illiquid assets, specific analytical methods are required. The studies analyzed highlight that traditional methodologies are inadequate to obtain accurate evaluations, and that there is a need for customised approaches for comparing the returns of Private Equity funds with those of public markets. They examine the difficulties in obtaining reliable data and quantifying risk, and elaborate the intrinsic sources of risk and return dynamics in this sector, while pointing out that the timing and variability of cash flows present a crucial challenge in performance measurement.

1.2 Objectives of the Thesis and Structure of the Work

The first objective of this thesis is to identify a dynamic econometric model able to estimate reliably risk parameters (beta) and abnormal performance (alpha) in Private Equity funds by analysing cash flows. In particular Driessen, Lin and Phalippou (2011) propose an innovative approach that overcomes the traditional static IRR calculation decomposing cash flows into systematic and anomalous components. The thesis will examine the operational structure and types of Private Equity funds and will describe the proposed methodological models, integrating findings from other studies. Finally, the empirical analysis will compare the results with market benchmarks and discuss the practical implications for investors.

Chapter 2

Private Equity: Instruments, Market, and Characteristics

2.1 Definition and Types of Funds (Venture Capital, Buyout, Fund of Funds)

We can define Private Equity as capital from institutional and private investors for financing companies at various stages of their lifecycle through the collection of investments in unlisted companies. Seeing that cash flows tend to be irregular as well as the companies involved lack updated market prices continuously, these particular investments remain quite different from those inside public markets.

Venture Capital funds as well as Buyout funds are quite commonly distinguished from each other. Venture Capital funds mostly focus on both start-ups and also companies within their own development stage, investing into such firms through a high growth potential and meaningful risk due to that lack of proven track records. Buyout funds often invest in mature companies through acquisitions restructuring or optimizing management. Finally, Fund of Funds allocate capital across multiple Private Equity funds, because this approach aims for them to diversify risk.

Dynamic models, introduced by the analysed studies, use cash flow analysis so as to precisely recognize risk parameters (beta) as well as abnormal performance (alpha). This approach reveals Venture Capital funds usually show higher volatility (elevated beta) and, in most cases, perform negatively (negative alpha), while Buyout funds risk less considerably. The Fund of Funds structure is, furthermore, planned through complete portfolio diversification in reducing the definite risk associated with respective investments.

We do not stop only at just the classification for an entire comprehension of the investment strategies that are adopted by each of the types of fund. Buyout, Venture Capital, and Fund of Funds separate so evaluation methodologies adapt to risk profiles and operational characteristics, providing a basis as comparative analysis benchmarks throughout sectors.

2.2 Operational Structure of Funds: Limited Partners (LP) and General Partners (GP)

Private Equity funds operate with a structure that functions as a key element as well as bases itself on that relationship between the Limited Partners (LP) and the General Partners (GP). Usually, it is the case that the LPs invest institutionally, pension funds do fund, insurance companies can insure, or private investors may invest, and they provide the needed capital that the GPs then manage actively since they are responsible in terms of the investments.

Two figures collaborate, which is important in order to properly manage risk as well as measure it because such operating structure directly influences cash flows when they are collected and then aggregated. According to Jegadeesh, Kräussl and Pollet (2015), coordinated management for cash flows, achieved through close cooperation between LPs and GPs, helps to overcome some of those inefficiencies typical of private markets, where the lack of transparency as well as irregular data updates cause challenges when comparing with listed assets.

GPs, because of their expertise as well as knowledge of the market, not only select the most promising investment opportunities but also manage the portfolio of assets for minimising volatility's negative effects and optimising the overall return. In order to properly manage such cash flows via collection and distribution, obtaining more reliable estimates for the risk parameters is necessary, and ensuring alignment between the LPs' expectations with the GPs' strategies is important. Therefore, the operating structure is to be a planned element, and not simply just a management formality. The operating structure can influence the success of the investment decisively. Effective supervision for LPs is combined with the ability of GPs to monitor and adapt the management of funds based on market conditions, to reduce the impact of information inefficiencies and improve the accuracy of risk assessments. Such a long-term approach is promoted furthermore through the sharing of risk and benefits between those parties, particularly important inside Private Equity wherein exit times are able to be extended and assets' true value becomes only realised later during that life cycle.

2.3 The Lifecycle of a Private Equity Investment

A Private Equity investment usually cycles through many phases, and each single phase presents particular dynamics and specific challenges. These phases include investment, fundraising, holding period, and the exit phase.

GPs focus on defining an investment strategy throughout the initial fundraising phase. They do also focus only on the raising of capital just at that point in time. This phase is important in that it determines the total of the available budget. Here, the determination of the initial risk and diversification degree of the fund also happens indirectly. During the course of this phase, the objectives

of the fund are established, as well as the selection criteria that is used for target companies and the portfolio management methods that it uses. The total raised capital is allocated toward selected companies, and certain cash flows start to materialize irregularly later during the investment phase, investments occur at various times, and specific liquidation events or periodic distributions are the singular moments following which returns can occur. The distinct life cycle phases regarding these investments can influence both the timing and the amount with respect to cash flows. That particular direct effect impacts that dynamic assessment of return. Corporate growth and also the gradual realization of value characterize in particular the holding phase, and the exit phase marks the end in which the investment's created value gets realized, which can occur by way of sale, IPO, or other liquidation methods.

Driessen, Lin and Phalippou (2011) integrate analysis of all life cycle phases to propose a model that takes into account all of the cumulative effects of commissions, reinvestments, as well as cash distributions, overcoming the limitations of static methodologies such as the customary IRR for a more accurate estimate of performance parameters.

Comprehension of the life cycle for the investment helps to identify the phases where risk is more pronounced. We can exploit multiple opportunities for improving performance throughout these phases. For example, the exit phase requires a degree of special attention in risk modelling because it is often unpredictable and subject to variable market conditions, there is a risk of a degree of important variation in both the timing and realization value. The dynamic models that will be analysed allow continuous monitoring of risk parameters, providing investors with effective tools to adapt their strategies based on real market conditions.

2.4 Valuation Challenges: Illiquidity and Data Opacity

Market prices in public markets are constantly updated, but chief indicators in Private Equity suffer from infrequent updates and an absence of data transparency. Indeed, the assets are quite illiquid, and the financial information is frequently quite opaque, which critically complicates the valuing of Private Equity investments.

Cash flows for Private Equity vary because of internal factors (like operational management and reinvestment strategies) and external factors (like market conditions and asset liquidity) that affect them, so the customary evaluation of performance is unreliable. A large gap between actual market value as well as book value is the main difficulty, especially when assets are not liquidated regularly. Because of this, estimates become even more uncertain, so approaches which are integrating historical information, and also market dynamics and economic variables in a coherent and strong way must be adopted.

Jegadeesh, Kräussl and Pollet (2015) provide a number of critical understandings

as it analyses how quite incomplete and even outdated data can lead to highly distorted risk parameter estimates. This particular study stresses that developing econometric models through dynamic estimation techniques and robustness tests have the potential to compensate for information gaps typical of Private Equity funds. Because of a lack of fully transparent data, analysts make use of predictive models, integrating proxy variables as well as theoretical assumptions, to reconstruct the true picture of risk.

Private Equity, therefore, represents an opportunity to finance corporate growth. Analysts and financial operators must deal with multiple structural and informational issues which creates a difficulty. To better evaluate, and to develop more solid and resilient investment strategies, in effect, adapting to the specificities of unlisted investments and managing the challenges related to them effectively is key. By integrating financial, econometric and operational insights, we arrive at a combination of theoretical analysis and empirical applications that allows us to outline a methodological path that is replicable and adaptable to different market realities, thus bridging the gap between book value and actual market value.

Chapter 3

Return Measurement Methodologies

3.1 Traditional Metrics

Traditional metrics constitute the first approach used to evaluate performance in Private Equity funds.These methodologies are mainly reliant upon quantitative indicators that summarize cash flows into a singular performance measure. The Internal Rate of Return (IRR), as well as a number of Cash Multiples, are some common tools for it. TVPI (Total Value to Paid-In), DPI (Distribution to Paid-In), as well as RVPI (Residual Value to Paid-In) are examples of Cash Multiples. A good idea of a fund's overall lifetime performance comes from the use of these measures as being a starting point. These are comparatively simple for calculation and widely understood among investors, plus these provide an immediate numerical benchmark against which to compare many different funds.

Internal Rate of Return (IRR)

When it is applied to the cash flows that are generated by an investment, Internal Rate of Return (IRR) is the rate of return that is making the Net Present Value (NPV) equal to zero. In practice it is the discount rate r at which the present value for cash inflows is equal to the present value for cash outflows. Mathematically, IRR is defined as the rate r that satisfies the equation:

$$\sum_t \frac{D_t - T_t}{(1 + IRR)^{(t-t_0)}} = 0 \tag{3.1}$$

where:

- D_t is the amount of dividends or distributions received at time t;
- T_t represents the investments made (cash outflows) at time t;
- t_0 indicates the initial period of the investment.

This formula allows to summarize overall performance in just one indicator, and thus eases funds' comparisons with different time profiles and with cash flow

models. IRR is applied in many instances, as its return's annualized measure can easily be linked to other investments by those investing. However IRR has some limitations, which are ones that are worth noting when evaluating Private Equity funds, despite the popularity of it. Non-monotonic cash flows cause a meaningful problem for IRR. Determining the IRR can yield several solutions in instances where the investment has varied cash flows frequent in Private Equity. Since an identical collection of cash flows might solve the NPV equation for a collection of discount rates, it vaguely explains the actual rate of return. Furthermore, IRR implicitly assumes that intermediate cash flows are reinvested at the same rate as the IRR itself. As a matter of fact, this assumption seems to be unrealistic because Private Equity reinvestment can greatly vary over a period of time. As an example, that fund may generate sizable distributions during certain periods, and those market conditions unfavourable for reinvestment would not support that high reinvestment rate assumed by the IRR. The IRR is also very sensitive to the timing of cash flows. Even small receipt or payment date changes can affect it. Performance comparisons can be distorted somewhat by this sensitivity, particularly if cash flow timing is different, but overall returns remain similar, between funds.

Cash Multiples (TVPI, DPI, RVPI)

In contrast to IRR, Cash Multiples provide alternative metrics that relate the invested capital to the final or expected realized value. Key indicators in this category include TVPI, DPI, and RVPI.

- **TVPI** (Total Value to Paid-In) is calculated as the ratio of the sum of distributions and the residual value of the investment to the total paid-in capital. It provides a comprehensive picture of the overall value generated by the fund relative to the money invested.
- **DPI** (Distribution to Paid-In) focuses exclusively on the capital that has been returned to investors, measuring the ratio of cash distributions to paid-in capital. DPI is particularly useful for assessing the extent to which investors have recovered their invested capital.
- **RVPI** (Residual Value to Paid-In) measures the residual value of the fund relative to the invested capital. It indicates how much of the capital is still tied up in investments that have not yet been realized.

Investors appreciate such certain multiples since these are simple enough and these can quickly indicate the return over capital. However, the simplicity that Cash Multiples has, causes imprecision in regard to performance. Cash flows' timing is ignored notably because they fail to incorporate the time factor, and they do not explicitly take into account investment risk. For example, two of the funds may have ratios that are identical for TVPI, the one that generates its returns in a briefer duration would be viewed as better from a risk and return

standpoint. Cash Multiples necessarily need to be complemented by qualitative information and by other metrics consequently to provide a complete view of a fund's performance.

Summary of Traditional Metrics

In summary, IRR and Cash Multiples customarily assess performance initially as necessary tools for use in Private Equity. They have certain meaningful limitations, however. IRR's degree of sensitivity with respect to cash flow timing, as well as the number of solutions it provides, serve to weaken the level of its reliability. An unduly simplistic reinvestment assumption still makes IRR not reliable within particular conditions. Cash Multiples also provide for a "static" view of performance. The various risks within or temporal dynamics throughout the investment process are failed to be captured. Because of these limitations, researchers developed integrative and dynamic approaches that attempt to account for systematic risk and cash flow variability, thus accurately assessing performance.

3.2 Comparison with Public Markets

A complementary approach to traditional metrics is comparing just how Private Equity funds perform with how public markets perform. This approach aims to understand whether a private fund shows adequate performance. Does that performance truly justify the added illiquidity premium in addition to the risk versus investing within public markets? Within the comparison, the Public Market Equivalent (PME) and different variants indicate a key factor, helping people assess if the private fund performs competitively through the result from investing within a public benchmark.

Public Market Equivalent (PME)

The need for one to directly compare Private Equity investments with certain investments in public markets was what led to PME's birth. PME allowed that comparison. The process uses the same cash flows which the private fund generates in order to simulate investment inside a public index. In principle, it shows the whole life cycle of any investment such as invested capital in any benchmark index, for example, the S&P 500 or the MSCI World. In practice, PME calculates by comparing each of the cash flows realized to each of those a public index investment would obtain, also mindfully deliberating each cash flow's timing. The typical procedure for calculating PME begins with identifying all capital calls and distributions for the private fund over its life. Each cash flow is then reinvested in the chosen public market index, on the basis of the actual performance of the index over the time period. The cumulative result of this strategy represents the

value of the hypothetical outcome that invested capital would have obtained if allocated to the public market. Investors have the ability to derive such PME ratio by a comparison of the actual value that is realized by the private fund to this terminal value. A PME ratio below one indicates the private fund exceeded its public market benchmark, while a ratio above one suggests investing in the public market would exceed the private fund.

The cash flows with respect to the private fund are indeed preserved in light of their temporal information by a key strength within the PME. In Private Equity, the timing for capital calls and distributions is a critical matter. In general, performance, for example, can change quite a bit with early distributions. The PME reflects peer comparison impact upon performance when it simulates these cash flows with public market returns. For example, in a case in which a fund generates a majority of its cash inflows throughout some market downturn, the PME analysis will show that investing of those funds into the public market would have produced an underperformance. This comprehension shows a consequence that arises out of favorable timing, and not superior performance; this circumstance may offer a partial explanation for a seemingly high IRR. PME also gives help to assess performance along with a benchmark. It offers such a framework for fully assessing if all the returns achieved from and by the private fund are attributable to effective active management. Otherwise, one is merely seeing the result of wider market movements. A private fund reports on an attractive IRR in some of the cases, which then when it is evaluated through using PME, may only just have returns in line with those that are of the public market, meaning that there has been hardly any meaningful value added by the fund manager. A fund's returns, which are driven by factors that are beyond overall market performance, may be signaled by a PME ratio indicating, conversely, outperformance.

PME+ and adjusted PME for illiquidity

PME+ represents a better version of PME, with new modifications that solve the problems of irregularity and cash flow distribution. Customary PMEs simply reinvest cash flows from within the public index, but reality differs, private funds typically call large amounts of capital and then distribute irregularly. PME+ normalizes with smoothing techniques and weighting factors for these distortions by adjusting for the impact of cash flows that occur at irregular intervals. The potential for biases arising from timing differences between private cash flows and public cash flows are reduced through these adjustments that improve the accuracy of the simulated performance measure.

Another important development is the adjusted PME that does correct for the gap that is between the liquidity characteristics of Private Equity funds and of public market investments. Prices are updated in real time, and securities are traded continuously in liquid markets. Conversely, private funds lock capital away for a long time, with long holding periods and rare cash flows. The Adjusted PME incorporates correction factors that serve to "normalize" returns, and this

considers the opportunity cost associated with the illiquidity. Even though it introduces complexity into the calculation itself, the Adjusted PME modifies the rate of reinvestment as applied to the cash flows in order to reflect the liquidity of private assets in more practical terms, thus allowing for a fairer comparison between public investments and private investments.

Critical Aspects of Public Market Comparisons

PME and also its variants pose certain difficulties that are in need of careful management, though they do provide valuable understandings into private fund performance. The selection of a benchmark is the main issue. Distinct return profiles, with sector exposures, and geographical dynamics might occur. Thus, a careful selection for the benchmark index is needed. Reasonable comparisons are vital to gain through a benchmark that intimately mirrors the private fund's risk and return characteristics. Misaligned benchmarks may cause someone to make conclusions about the funds performance that are incorrect. Furthermore, given that a thorough comprehension of market situations is required to gauge the opportunity cost of illiquidity, accounting for illiquidity is complex and may entail substantial ambiguity. In a case that the liquidity premium is calibrated with incorrectness, it could end up distorting PME results; as such, performance could be over-estimated, or it could be under-estimated.

Another issue is that when comparing private fund cash flows, this is directly to a public index. In reality, certain contractual and timing specifics inside private investments can differ greatly from public market cash flow conditions. Lock-up periods, vesting schedules, as well as performance hurdles serve as examples of these specifics. Careful and contextual interpretation of PME has to be done because it provides a benchmark that is useful given these differences. Some structural differences that exist in investment vehicles as opposed to managerial performance may very well be some of the reasons for the discrepancies that exist between public and private returns.

To conclude, comparison against public markets by means of PME, PME+ and Adjusted PME gives a complementary approach to the customary metrics, so therefore investors are able to assess whether or not the returns being generated by a private fund justify the illiquidity premium with associated risks, especially when viewed against the background relating to public market performance. These methodologies help to clarify whether active management, market timing or structural factors drive apparent outperformance or underperformance, highlighting the natural trade-offs in private investments.

3.3 Limitations of Methodologies and Data Distortions

Limitations of IRR and Cash Multiples

While IRR and Cash Multiples are widely used and provide a convenient summary of performance, important limitations are suffered by them. Solutions can be produced by IRR, as discussed, when cash flows are non-monotonic, especially in the Private Equity space where investments are characterized by irregular and discontinuous cash flows that may result in more than one rate satisfying the NPV equation with. This ambiguity complicates reliable fund comparisons by far. In addition, the IRR does its calculations with the premise that all interim cash flows reinvest at the IRR, a premise that, as stated, is hardly realistic since reinvestment chances change over the fund's life. Meaningful variations in the calculated IRR can therefore exist even with further small changes in the timing of cash inflows and outflows, which can alter the investment's true performance and risk profile.

Because they do not happen to incorporate the time value of money, which is, in fact, a critical factor when understanding the true return dynamics that an investment has, cash multiples such as TVPI, DPI and RVPI, likewise, are generally "static" measures, while still providing an immediate indication of the return that is on capital. Certain funds with a shared TVPI could have quite different time profiles; a single one of the two may have generated its returns rapidly while that other's taking a longer time resulted in a higher degree of risk exposure in that case. Therefore, cash multiples fail for capturing the time dimension and the systematic risk that the investment associates with. More dynamic approaches which do consider market risk and also this component of cash flow variability in the performance measurement have been developed in order to address these limitations. The one approach is an extension of the customary IRR where the discount rate is permitted to vary alongside systematic risk factors. We can express this dynamic formulation as follows:

$$\sum_t \frac{D_t - T_t}{\prod_s (1 + rf_s + \alpha + \beta r_{m,s})} = 0 \tag{3.2}$$

where:

- rf_s is the risk-free rate in period s;
- α represents the abnormal return component (which reflects managerial performance);
- β indicates the exposure of the asset to systematic risk;
- $r_{m,s}$ is the excess return of the market with respect to the risk-free rate in period s.

This formulation allows for us to break down the total return as being two different components: overall market risk attributes for it a "normal" return component, and managerial skills reflect an "abnormal" return component (α) that adds some value. By minimizing the squared errors of the NPV for each fund, the parameters α and β can be estimated. The generalized method of moments (GMM) is quite often used to do so. This method estimates performance with accuracy since it integrates systematic risk into the discount rate, particularly if cash flow data are imperfect or reinvestment assumptions are questionable.

Data Distortions and Limitations

The PME method, while it is indeed quite useful, is subject to biases and to limitations. Picking an ideal benchmark poses a large challenge. PME analysis risks being biased if the chosen public market index does not accurately reflect the sector, geographic, or risk profile of the Private Equity fund. For example, a benchmark index focused on developed markets cannot clearly represent well a private fund that operates mainly in emerging markets. The interpretation that is of performance may be quite greatly biased. Such a bias could potentially arise from this kind of discrepancy.

Estimating what the opportunity cost of illiquidity is, represents another challenge. Private Equity investments, which require long holding periods as well as generate cash flows at irregular intervals, differ from the continuous trading environment of public markets because illiquidity forces an adjustment that estimates a premium or discount based upon expected returns in a liquid market. Meaningful uncertainty subjects these few estimates to wide variance according to market conditions. PME results, even without a very careful calibration of the illiquidity adjustments, could understate or else overstate the private fund's true performance. Data quality is also an important factor. Private Equity funds often do not completely share free cash flow information or share it so late, and reported net asset values (NAVs) often base themselves on internal valuations that actual market conditions may differ from. These data quality issues can give rise to misestimation of returns and risk, both versus customary metrics and also versus the public market. Taking into consideration each of the timing and reinvestment assumptions natural within such metrics is in consequence necessary. The level of quality of all underlying data is also a necessity for consideration. To lessen these limits, it is necessary to use a careful, multi-method strategy integrating IRR and Cash Multiples results with those from PME and dynamic risk estimation methods. Various methodologies can be combined in this way to obtain a stronger as well as more complete view of performance. The reliability of most assessments for all these indicators is thus improved.

Summary of Limitations

A number of limitations with customary metrics in addition to public market

comparisons do exist in summary. IRR as well as Cash Multiples are simple and intuitive, but they still have inadequacies. They fail in cases when they don't address systematic risk as well as the time dimension in an adequate manner. Its reinvestment assumption is frequently unrealistic, plus IRR is susceptible to multiple solution problems. Cash Multiples' static result is failing to capture the temporal dynamics within cash flows. In the meantime, benchmarking methods such as PME as well as its many variants are extremely good at providing a great deal of context, with them requiring careful selection of some benchmark and making careful adjustments in order to deal with illiquidity. The assessment is further complicated by certain data quality as well as transparency. This is particularly factual when a number of internal estimates and reporting lags are involved. The integration of dynamic approaches, represents a promising solution to all of these challenges. GMM is used by these approaches for parameter estimation, and they consider systematic risk with variable discount rates. Such methods provide a more complete and realistic view into Private Equity performance via decomposing returns into components resulting from market risk and managerial performance.

When methodologies come together, we better understand trade-offs involved and we have a solid basis for comparing private fund performance with public market investments. In summary, this shows that no single metric can fully capture the complexity in Private Equity performance. A solid and initial summary is provided through customary metrics such as IRR and Cash Multiples, yet these metrics have major limits with regard to risk and time variability management. Public market comparisons through PME, PME+ and Adjusted PME add important context; however, benchmark selection and liquidity adjustments make these uncertain, too. In the end, the approaches that integrate some cash flow variability and do systematically estimate some risk parameters (α and β) provide an advanced method when estimating returns in the sector, helping not only in order to decompose a total return into abnormal and market-driven components, but in addition in order to provide the investors with a clearer comprehension of how much return an active management earns versus what some public markets would have earned. Investors are able to then obtain a more accurate picture of performance in that they recognize the natural limitations involved with customary and benchmarking approaches and integrate more advanced dynamic techniques. For informed investment decisions, it requires such a thorough view since it highlights the true economic costs regarding illiquidity, and also the impact for cash flow timing and how systematic risk can influence total return. Ultimately, each particular method has various strengths and certain weaknesses, but when they are combined, they improve and strengthen the framework in order to assess Private Equity fund performance.

Chapter 4

Risk Measurement Methodologies

In Private Equity, also risk measurement is difficult because investments are illiquid and market prices are available in such a limited way. This section reviews such a range of methodologies that Private Equity studies do apply, focusing in on theoretical models, macroeconomic influences, and empirical assessments of systematic risk. It will be discussed how dynamic discounting, factor models, and macroeconomic indicators are integrated into risk measurement practices.

The first section of this chapter discusses about theoretical models. It focuses upon the FamaFrench Three-Factor Model and adapts the same to Private Equity. Certain macroeconomic factors, especially the impact of credit spread and GDP growth, and their relation to economic cycles are examined in the second section. The last section analyzes empirically systematic risk, as well as the role of sectoral and geographical diversification.

4.1 Theoretical Models

Fama-French Three-Factor Model

The Fama–French Three-Factor Model is actually a prominent framework that represents exactly how you can capture all of the cross-sectional variation within stock returns. The model is generally considered as being an extension of the Capital Asset Pricing Model (CAPM). It adds on two additional of the factors: the size factor (Small Minus Big, or SMB) and also the value factor (High Minus Low, or HML). The following regression equation here represents the model in its own basic form:

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + s_i \cdot SMB + h_i \cdot HML + \varepsilon_i, \tag{4.1}$$

where:

- R_i is the return on asset i,
- R_f is the risk-free rate,

- R_m is the market return,
- α_i represents abnormal performance (or "alpha"),
- β_i is the sensitivity of the asset to the market risk premium $(R_m - R_f)$,
- SMB and HML are the additional factors capturing size and value effects, respectively,
- ε_i is the error term.

The Fama–French model is used in a more straightforward way in public markets. Infrequent pricing as well as fund-level cash flows' natural opacity make it less so within Private Equity. Several studies have attempted to adapt factor-based models to Private Equity via reconstructing returns from cash flows, and via using dynamic discount rates.

For the adaptation of the Fama–French model to Private Equity, it must consider that the cash flows occur at particular irregular intervals (such as the capital calls and the distributions) instead of daily ones and the investments are illiquid, which complicates the estimation of beta and of the factor loadings greatly. Furthermore, Private Equity funds often show a high idiosyncratic volatility along with IRRs that might not perfectly align with what those public market analogues derive. The Fama–French framework provides a certain theoretical foundation, despite all these difficulties, and helps people understand the systematic risk factors on Private Equity returns.

A further key factor involves such original derivation from publicly traded stocks of the Fama–French model's size and value factors. Private Equity investments might not permit some direct translation for these factors. Deal size, strategy including venture capital and buyouts, plus operational leverage set apart Private Equity funds, thus, these funds are heterogeneous. Thus, factors such as SMB and HML might require someone to modify them even further, in going beyond estimating the market risk premium (β) or in adding new factors that capture the unique risk exposures Private Equity portfolios have.

The customary three-factor model often needs supplementing with additional factors and that is particularly factual with the model's Private Equity application. For venture capital, extra explanatory variables may be needed, also buyout investments risk factors, like calculated repositioning, operational improvements, and exit event timing. The Fama–French model is quite a strong starting point, yet its practical application in the Private Equity sector requires several adjustments. People usually calibrate the model with the historical cash flow data along with simulation techniques.

For understanding any systematic risk, the theoretical support that the Fama–French Three-Factor Model provides is quite critical. It extended to Private Equity, as dynamic discount rate methods as well as cross-sectional estimation of alpha and beta helped to improve the comprehension of how Private Equity funds respond to market forces.

4.2 Macroeconomic Factors

The valuation of all Private Equity investments and also their risk assessment depend on macroeconomic variables. GDP growth and also the credit spread are two of the most relevant macroeconomic indicators. This section explains how these few factors influence Private Equity risk, in addition to their interplay with most broader economic cycles.

Impact of Credit Spread and GDP Growth

Credit spreads are the difference between yields on corporate bonds as well as government bonds. The market views each of these spreads as being a measurement of risk appetite and regards them as indicating an underlying degree of credit risk in the economy. Often, uncertainty, deteriorating credit conditions, or elevated risk premiums are signaled. A widening credit spread is therefore often frequent. Since Private Equity funds frequently invest in leveraged buyouts or in companies with quite meaningful debt, changes in credit spreads directly impact on their cost of capital.

This means that Private Equity investments become relatively more expensive all throughout periods of financial stress along with widening credit spreads, as that cost for financing increases. The additional premium incorporated in the credit spread reflects a risk of default or deterioration in asset quality that is elevated, with both being relevant in the Private Equity context.

GDP growth runs parallel in indicating the overall health of the economy. When the GDP is growing at a quick rate, it typically can signal strong economic activity, and which then improves the way that portfolio companies operate. Poorer investment performance, higher volatility, as well as a greater likelihood of negative outcomes can conversely result from slow growth or some GDP contraction. GDP growth is frequently integrated into risk models subsequently. Market returns are impacted by GDP growth either directly as a single explanatory variable or indirectly. Thus, GDP growth has an effect of reducing upon the required return, and higher growth rates in periods of strong economic performance lower the chance premium that investors demand. Macroeconomic conditions affect market returns directly, also meaning they modulate the risk profile of Private Equity investments by altering capital's cost.

As empirical studies such the ones from Korteweg (2022), and Ljungqvist and Richardson (2003) have shown, credit spreads as well as GDP growth statistically explain variations within Private Equity returns. Narrow credit spreads and powerful GDP growth often combine together during expansions in economics and tend to lead to reductions in estimates of the cost of capital, which consequently increases the net present value (NPV) of cash flows in the future. Alternatively, credit spreads that are widened and GDP growth that is negative during recessions can greatly depress valuations through the discount rate that is increased.

Note that the nonlinear effect is frequently of credit spreads along with GDP growth. The discount rate may be negligibly affected by minor credit spread changes under calm conditions, while similar changes may affect the rate substantially when distressed. Risk models require the flexibility for such nonlinear behaviour, and they must be able to capture the regime shifts in the economic conditions using the techniques, such as regime-switching models or time-varying parameter models.

In summary, a far more complete picture of the systematic risk faced by each Private Equity fund is properly provided via the incorporation of both credit spreads as well as GDP growth into risk measurement methodologies. These macroeconomic factors help to explain the performance variations as they are integrated into the discount rate framework, thus aligning theoretical risk models with observed market behaviour.

Correlation with Economic Cycles

Economic cycles do expand, reach a peak, undergo contraction, and form a trough, characterizing these phases, and they largely influence the overall investment performance across the specific asset classes. Because Private Equity investments have long-term horizons and rely upon eventual exit events (such as IPOs or secondary buyouts), they are particularly sensitive to the economic cycle's stage at exit. Capital calls also happen, as well as distributions occurring, so cash flows cycle, with this could possibly not aligne with economic fundamentals.

It can be a useful approach for incorporating the effects of economic cycles into the estimation of the dynamic discount rate to quantify the additional risk premium by introducing an economic cycle variable or a set of dummy variables. The further additional risk premium could be relatively small or even negative if cycle effects serve in order to reduce perceived risk when expansions occur, while the additional risk premium may tend to be higher when contractions occur, which means investors then increase uncertainty and risk dislike.

Liquidity conditions along with access to credit in addition to investor sentiment are all influenced by economic cycles because they happen to be key determinants with respect to Private Equity performance. According to Ellis, Pattni, and Tailor (2012) Private Equity funds will often show decreased realized returns throughout economic crises with high market volatility periods, due in part to reduced secondary market activity in conjunction with delayed exits.

Several fund types may cause the degree of sensitivity of Private Equity returns toward economic cycles to differ. Buyout funds, targeting more mature and cash-flow-stable companies, may display a lower cyclicality than venture capital funds, which typically invest in more high-growth but in high-risk start-ups. Indeed, empirical analyses have found that several estimated beta coefficients for venture capital are often greatly higher during boom periods, which reflect both growth potential as well as higher risk throughout peak phases. These betas have the po-

tential to decline during such recessions. Instead, company-specific items eclipse the market-wide element of risk.

Therefore, Private Equity gains are linked to economic trends, basically gauging risk. Because market-wide shocks, credit conditions, and economic growth have dynamic interactions, incorporating macroeconomic indicators when measuring risk is important; this improves the robustness of risk estimates, and it lets investors better calibrate their performance metrics with prevailing economic conditions.

4.3 Empirical Analysis of Systematic Risk

Empirical research into systematic risk in Private Equity increasingly recognizes diversification affects a funds risk profile, across geographies and sectors that are changing. This section will examine systematic risk mitigation from both sectoral and geographical diversification, as well as the empirical methods frequently used for quantification of diversification benefits.

Role of Sectoral and Geographical Diversification

Sectoral Diversification

Sectoral diversification practice refers to investments across industries, with differing risk profiles and also growth dynamics. Private Equity funds face potential industry-specific shocks, regulatory changes, or technological disruptions if the funds invest solely in one industry. As a contrast, diversifying the portfolio so as to include companies out of multiple sectors has the ability to reduce overall returns' volatility via compensating for losses throughout one sector along with gains throughout another.

Empirical studies, which include Jegadeesh, Kräussl, Pollet (2015) and also Korteweg (2022), have contributed to the showing of the fact that beta-measured systematic risk changes with the degree of sectoral diversification. The correlation matrix of the returns across the different sectors can be computed for the purpose of estimating this effect, and estimating the reduction in the portfolio volatility occurs as the diversification increases. In a simplified manner, assuming that the return on a Private Equity portfolio is given by:

$$R_p = \sum_{i=1}^{n} w_i R_i$$

where w_i are the weights of individual investments and R_i are the corresponding returns, then the portfolio variance can be expressed as:

$$\sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \text{Cov}(R_i, R_j)$$

The overall variance σ_p^2 will be reduced in a diversified portfolio provided that the covariances $\text{Cov}(R_i, R_j)$ between sectors are comparatively low. Certain investments can present high idiosyncratic risk, particularly in Private Equity. Investors keep a greater portion of such priced systematic risk by diversification across several sectors. At one and the same time, diversification reduces all of the effects of unsystematic risk.

Some studies have gone on to also use regression-based techniques in order to quantify just how sectoral diversification has an influence upon a portfolio's estimated beta. As an example, a cross-sectional regression model might include several dummy variables for sector classification so it captures certain differences in risk premiums. Empirical evidence shows lower estimated betas in funds with a broader sectoral exposure when in comparison to those of portfolios more concentrated. The aggregate risk exposure of diversified portfolios aligns in a way that is closer with systemic market risk than it does with shocks specific to just a single sector, which is a finding that is consistent with that idea.

In some cases, researchers have been able to replicate the public market framework via applying a multi-factor model to include sector-specific factors and customary FamaFrench factors. This hybrid approach is able to provide additional comprehension into the ways sectoral influences interact with different types of risk under circumstances of broader market risk. The model can adjust the estimated beta based on the diverse risk-return profiles of specific sectors, like technology or healthcare. This adjustment betters the degree of accuracy in risk measurement.

Geographical Diversification

Another strategy for reducing systematic risk in Private Equity exists. Geographical diversification represents it. Funds are able to spread investments across multiple different regions so as to reduce exposure against country-specific risks, such as regulatory changes, political instability, and even localized economic downturns. Funds use geographical diversification in order to exploit growth prospects in economies and smooth the portfolio's risk-return profile.

According to understandings derived from Ljungqvist and Richardson (2003) and Korteweg (2022) wide-ranging empirical research has stressed that Private Equity returns tend to vary not only by sector but even also by geography. Funds focused on developed markets, for instance, may display less volatility when put against funds meaningfully exposed to emerging markets. Emerging markets usually present much greater risks since financial systems happen to be less mature and macroeconomic volatility tends to be higher, but still in return they offer a much higher growth potential. Researchers often assess empirically all of the benefits of geographical diversification as they use panel data techniques as well

as time-series regression models in which they include geographical dummies or regional economic indicators as explanatory variables. These models could quantify how geographical diversification affects a Private Equity portfolio's collective risk exposure level. Such quantification may allow comprehension of the extent of this effect.

Empirical findings typically indicate that funds reduce the overall portfolio volatility when they allocate geographically in such a balanced way. Economic cycles that are not synchronized, or to a minimum degree not perfectly, are usually experienced by different regions partially for the above reason. For example, North American or Asian markets could be experiencing expansionary phases while European economies may be in downturn. Risk-adjusted performance of diversified portfolios is improved, and returns are greatly stabilized. Furthermore, geographical diversification provides certain of the benefits. Also, currency risk is thereby being reduced. For Private Equity funds, fluctuations in exchange rates expose portfolios with investments that are denominated in different currencies. The investor somewhat reduces the portfolios overall exposure toward adverse currency movements, however, via combining investments across several currencies. This risk reduction mechanism is generally important in global funds in which diversification and currency hedging strategies are frequently implemented in order to manage risk in a more effective manner.

The amount of diversification gains relies on the level of integration among regional markets. Since global markets happen to be highly integrated, then regional returns correlate to a greater extent, so that diversification benefits lower. However, even in this types of environments, small differences in economic policies, market structures, and local investor behaviour can provide important diversification advantages. Stronger estimates of systematic risk tend to be produced when explicitly accounting for regional heterogeneity as a result of that.

Interplay Between Sectoral and Geographical Diversification

In practice, sectoral and geographical diversification are what determine the complete overall risk profile of certain Private Equity funds. These diversifications are, in fact, not at all mutually exclusive. More lowered overall risk levels tend to be given back through diversifying funds across each of the dimensions rather than concentrating such funds in any one area or the other. It is possible to model the joint effect of these diversification strategies using covariance matrices that incorporate sectoral and geographical correlations.

For instance, denoting the return on an investment in sector i and region j by R_{ij}, the overall portfolio variance for a diversified portfolio can be written as:

$$\sigma_p^2 = \sum_{i,j} \sum_{k,l} w_{ij} w_{kl} \operatorname{Cov}(R_{ij}, R_{kl}) \tag{4.2}$$

The portfolio weights that are for the investments in sectors i and k are represented by w_{ij} and w_{kl}. These weights are located in region j and in region

l, respectively. It is possible for one to assess the amount of total risk that is attributable to common systematic factors versus the amount to unique idiosyncratic risks, if we estimate the covariance matrix through historical return data. Many geographies and sectors of diversification are needed, according to empirical evidence supporting that conclusion to reduce idiosyncratic risk's relative weight. Factors across the market closely relate to a purer measure of systematic risk that this action leaves.

Recent studies have additionally used factor decomposition techniques for the purpose of separating sector-specific influences from regional effects. The advantage of these techniques is finding the latent factors that drive returns across different markets and industries. A principal component analysis (PCA) can reveal on common factors. These common factors are able to explain most of the return variation in the event that they are not many. Jegadeesh, Kräussl and Pollet (2015) use these methods to show that a certain degree of systematic risk is shared across regions and sectors. However, an important portion remains unique to combinations of industry and geography.

Empirical strategies typically use simulation-based approaches. They have an aim to test just how strong diversification benefits are under a variety of market scenarios. Many potential return paths according to historical correlations with volatilities are regularly used to generate, for instance, via Monte Carlo simulations. These simulations give relatively more accurate results, can be directly compared against the static IRR calculations or the dynamic discount rate approaches used within Private Equity valuation, and fully quantify the risk reduction achieved through diversification. The empirical evidence shows just how diversification strategies work in different of the economic conditions.

In conclusion, we did empirically analyze the systemic risk within Private Equity, and we showed that sector and geographical diversification fundamentally reduce the overall portfolio volatility. Private Equity funds are able to lessen localized shock impacts by allocating investments across both industries and regions, and by aligning risk profiles with market dynamics. Incorporating a number of these empirical findings into risk measurement models fundamentally evaluates the performance of Private Equity investments since improving the accuracy in beta and alpha estimates is quite useful.

Summary of risk measurement methodologies

In this section was furnished a description of a way of measuring risk in Private Equity. The Fama-French Three-Factor Model provides a theoretical foundation for the purpose of accurately estimating systematic risk, even in light of the challenges arising from infrequent pricing in addition to cash flow heterogeneity as it adapts itself to Private Equity via approaches involving dynamic discount rates. Then it has been highlighted that a number of macroeconomic factors are important, credit spread and GDP growth are particularly critical, and they fully

interact with economic cycles, explaining in which manner these variables modify the cost of capital and influence valuation. Finally, the section presented one empirical analysis, underlining certain benefits from sectoral and geographical diversification, and showed that when those investments spread across industries and regions, they help reduce idiosyncratic risk, improving systematic risk measurement. These methodologies form a number of multi-faceted approaches. It is important to understand and quantify risk in the dynamic sector of Private Equity, as market conditions and macroeconomic environments constantly change, these methods combine theoretical models with empirical evidence and address the need to consistently improve risk measurement techniques.

Chapter 5

Results and Comparisons

5.1 Comparison with Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009)

The following section analyzes the key findings obtained from applying the dynamic pricing methodology to the cash flows of Private Equity funds, focusing on two aspects:

- Riskadjusted returns and estimated alpha
- Sensitivity to the stock market and risk factors

This analysis is now presented in comparison with the literature, particularly with the studies by Kaplan and Schoar (2005) and by Phalippou and Gottschalg (2009).

Risk-Adjusted Returns and Estimated Alpha

The approach used extends the traditional IRR calculation by employing variable discount rates, expressed in the form:

$$1 + r_{f,t} + \alpha + \beta \cdot r_{m,t}$$

where $r_{f,t}$ represents the risk-free rate in period t, $r_{m,t}$ denotes the market excess return, α is representing the abnormal return, and β represents systematic sensitivity. The model estimates jointly the parameters α and β through problem optimization minimizing the sum of errors squared coming from each fund's NPV.

The results given by Driessen, Lin and Phalippou (2011) show that even though Private Equity funds seem to have relatively high IRRs on the surface, around 15% on average, the reality is different after adjusting the risk calculations: the effective returns are significantly lower. Venture Capital (VC) funds, in particular, show negative abnormal returns (α) near the order of 12% per year, whereas

Buyout funds tend to have less pronounced negative α, sometimes even considered statistically insignificant. This is a very important finding because it underlines how using just the IRR, that is based on a static discount rate, can give an overly optimistic picture of fund performance. VC funds cost close to 27% yearly following systematic risk adjustments of the returns, also assuming a risk-free rate of nearly 5% plus a risk premium of about 8%. Buyout funds cost about 15% yearly because more mature and consolidated companies typically have lower market return volatility.

Of particular importance is the comparison with the literature. Kaplan and Schoar (2005) adopted an approach that tended to overestimate returns because the IRR was directly calculated without an explicit adjustment for systematic risk considering the final NAV as the conclusive cash flow. Phalippou and Gottschalg (2009) underlined using NAV leads toward an overstatement of the real value of the investments. The overstatement is due to the infrequent updates along with a nondynamic valuation method, especially for non-liquidated funds.

Driessen, Lin, and Phalippou (2011) analyze a middle ground regarding two viewpoints: they use all observed cash flow series, similar to Kaplan and Schoar, but also correct dynamically to lower the NAV overstatement, as Phalippou and Gottschalg explain. On average, this study's model estimates a conversion ratio, this ratio makes the reported NAV fall between 21% to 38% of the nominal value. This result suggests that, once risk is considered, the effective return of the funds is significantly lower compared to that with the unadjusted IRR with a negative abnormal return that is evident within VC funds but possesses a less meaningful impact upon Buyout funds.

This difference in riskadjusted returns has important practical implications: while an investor might be attracted by a high IRR, the dynamic analysis reveals that, net of systematic risk, the real returns are lower and, in some cases, can even be negative, especially in contexts of high market volatility. This evidence reinforces the idea that assessors should assess with thoroughness and integrators should integrate risk measures of an advanced nature into decisions of capital allocation.

Sensitivity to the Stock Market and Risk Factors

For the second aspect, the analysis focuses on the sensitivity of the funds to the stock market and to risk factors, expressed primarily by the parameter β. Driessen, Lin and Phalippou (2011) utilized a dynamic model that allows β to be estimated accurately, showing that VC funds have high β values, around 2.7, while Buyout funds display more moderate β values, generally around 1.3.

These results show that VC funds are strongly exposed to stock market fluctuations meaning the value of investments can increase greatly in upturns but there is an equally accentuated risk of losses in downturns. Buyout funds in contrast, because they invest in more mature companies, exhibit a lessened reactivity to market oscillations as well as presenting a less pronounced risk profile having lower volatility.

The analysis also uses the Fama–French model, which adds the factors SMB (Small Minus Big) and HML (High Minus Low) with the usual market factor, because it permits more decomposition of return sensitivity and shows that the effect on finding the risk-adjusted return results not only from market risk (measured by β) but from the size and value traits of the firms where investments occur. In VC funds, in particular, the combination of investments into small and high-potential firms and companies that have rapid growth dynamics has the effect of increasing the overall sensitivity, leading to very high β values.

Again, the comparison with previous studies matters. Kaplan and Schoar (2005) highlight a strong correlation of fund returns to stock market performance, however, they do not explicitly integrate variables related to size or to value in their model. Phalippou and Gottschalg (2009), on the other hand, stressed upon the fact that NAV lacks frequent updates, and this could mask the true risk exposure, leading to an underestimation of β. Driessen, Lin and Phalippou (2011) present an analysis that shows market sensitivity is in fact higher than analyses do uniquely deduce out from unadjusted NAV. Furthermore, the estimation techniques adopted in this study ensure that the β estimates are strong as well as reliable because they are based on the Generalized Method of Moments (GMM) and reinforced by bootstrapping procedures, thus reducing the possible distortion of the analysis caused by the impact of idiosyncratic shocks. Grouping by vintage year the portfolios of funds (FoFs), the systematic component of risk is isolated, making it possible to compare funds and different market periods with greater precision.

Another aspect concerns the impact of operating costs, particularly fees, on the risk parameters. The study also derives information about applying a standard fee structure of 2% for management and 20% carry with a hurdle rate of 8%. When someone applies this structure, β increases, which suggests that fees are non-linear, tied to achieving specific performance targets, coupled with increased risk exposure when cash flows are high. Since VC funds have high volatility, then this effect is more pronounced in them, and also the impact of fees strengthens, so that capital cost is higher and abnormal returns are more negative.

Once again, the comparison to Kaplan and Schoar (2005) and Phalippou and Gottschalg (2009) highlights one key point. To estimate market sensitivity realistically, researchers must integrate dynamic risk measures with correct NAV values. Kaplan and Schoar relied on the static measurements, and Phalippou and Gottschalg highlighted all of the disadvantages of such an approach. The method used here provides an integrated framework under which the systematic component of risk is isolated as well as strongly quantified, avoiding potentially overstating NAV.

When we look at all of the results, it is quite clear that fund returns and the stock market strongly correlate, and that SMB and HML factors greatly contribute to explaining return variability. This risk breakdown is particularly useful for investors because it helps identify operating levers, such as portfolio selection in terms of company size and value characteristics, that influence overall performance and can be optimized to reduce market risk.

Moreover, analyzing the risk-adjusted returns, it is noted that the average "dynamic IRR," calculated integrating variable discount rates, is generally lower than the traditional static IRR. Even if not so obvious from any cash flow analysis, the systematic component impacts investment performance quite a bit. This observation leads to some reconsideration for the performance evaluation of Private Equity funds. Comparisons with the evidence from Kaplan and Schoar (2005) and from Phalippou and Gottschalg (2009) reinforce this, and they suggest dynamic measures and risk adjustments are necessary to obtain a true estimate of created value and to make more informed investment strategies. The information obtained can be used in balancing a portfolio because it allows for the choice of a combination of VC and Buyout funds that takes into account not only the nominal IRRs but, more importantly, the effective cost of capital and expected volatility, offering a stronger decision-making tool for evaluating investments in a sector characterized by high uncertainty and complexity.

Chapter 6

Conclusions

6.1 Summary of the Key Findings

The thesis has demonstrated that a dynamic approach, overcoming traditional methodologies' limitations, is needed to measure risk as well as return in the Private Equity sector. These results show nominal returns differ greatly from effective returns people get when systematic risk is factored in since they are often presented using apparently high IRRs.

It is possible to decompose the total return into two main components utilizing a method that integrates cash flow analysis along with advanced estimation techniques like the Generalized Method of Moments (GMM): a "normal" part that is attributable to market risk (β) and an "abnormal" component (α) which reflects instead the managerial effectiveness. Venture Capital funds particularly have shown negative abnormal returns while Buyout funds have recorded a performance that is only slightly less penalized even though they exhibit some risk exposure.

It is important for the analysis to reveal that cash flows that are discontinuous, if they are considered improperly, plus variability that they may have are relevant and can lead to an overestimation of returns when using static methods such as IRR or Cash Multiples (TVPI, DPI, RVPI). The dynamic models analyzed let users use changing discount rates. Variable discount rates consider market conditions along with the timing of cash flows, and the rates give a more realistic estimate for the cost of capital.

Kaplan and Schoar (2005) also as well as Phalippou and Gottschalg (2009) performed benchmark studies for that comparison. Thus, a dynamic method diminishes NAV inflation plus it gets risk's true effect with greater precision. In this context, the joint estimation for the parameters α and β becomes a necessary tool for a complete performance evaluation because it helps investors through providing them with valuable understandings for a more informed and targeted capital allocation.

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