Stockholm School of Economics
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Private Equity Valuation

–Beauty is in the eye of the beholder –

Fredrik Gardefors
20892
fredrik.gardefors@gmail.com

Henrik Videberger
20939
henrik@videberger.se

Abstract

This study compares the transaction value of 24 private equity buyouts to the calculated value using discounted cash flow valuation based on adjusted present value (APV), leverage buyout valuation (LBO) and valuation using multiples. It provides results contradicting the results of Kaplan & Ruback (1995). While Kaplan & Ruback found that discounted cash flow forecasts performs at least as well as valuation using multiples, we find that multiples perform significantly better than the cash flow based APV and LBO models. We are not convinced that APV is an appropriate model to use to value highly leveraged transations as Kaplan & Ruback suggests.

We use a dataset assembled from internal data on completed transactions from a number of Swedish private equity firms. The transaction value is used as a proxy for the market value of each company.

Private equity firms expect to be able to extract abnormal returns from their investee companies and will implement these expectations into their cash flow forecasts. We conclude that beauty is in the eye of the beholder.

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Table of contents

Introduction 4
Purpose 6
Our Contribution 7
Previous Research 7
The Valuation of Cash Flow Forecasts: An Empirical Analysis 7
Borrow cheap, buy high? The determinants of leverage and pricing in buyouts 8
Fairness opinions in mergers and acquisitions 9
About private equity 9
Theory 11
Valuation Techniques 11
APV 11
LBO 14
How leverage enhance IRR, a fictive example 15
Multiples 17
Method 19
Data 19
Multiples 20
Employee stock options 21
APV 21
LBO 22
Result 23
Analysis 26
APV 26
LBO 27
Multiples 28
Traded peers 28
Precedent transactions 29
General 29
Conclusion 32
Discussion and summary 32

Potential drawbacks 34
References 36

Introduction

In their highly interesting 1995 paper, "The Valuation of Cash Flow Forecasts: An Empirical Analysis", Steven N. Kaplan and Richard S. Ruback compares the market value of highly leveraged transactions to the discounted value of their corresponding cash flow forecasts. Focusing on cash flow forecasts found in fairness opinions, Kaplan & Ruback find that discounted cash flow valuation performs at least as well as valuation methods using multiples based upon comparable companies and comparable transactions. This provides support for the readily accepted concept of estimating market values by calculating the discounted values of the relevant cash flows. In the case of private equity buyouts it would not be surprising if the value that the private equity fund perceives is higher than the value a multiple based valuation method would find, consistent with private equity funds providing extraordinary returns.

In this paper we employ three types of models to value a set of 24 companies, the models we employ are: an adjusted present value model (APV), a leverage buyout model (LBO) and valuation using multiples. We use a dataset assembled from internal data on completed transactions from a number of Swedish private equity firms. The transaction value is used as a proxy for the market value of each company. Comparing the market value of our set of highly leveraged transaction values to the values that our models predict we find results contradicting the results of Kaplan & Ruback (1995). While Kaplan & Ruback found that discounted cash flow forecasts perform at least as well as valuation using multiples, we find that multiples perform significantly better than the cash flow based APV and LBO models.

We are not convinced that APV is an appropriate model to use to value highly leveraged transactions as Kaplan & Ruback suggests. We would argue that the dataset used by Kaplan & Ruback (1995) may be flawed. The reason for this critique is that they use a dataset compiled from data found primarily in fairness opinions. Makhija et al (2007) notes that fairness opinions commonly are criticized for not helping owners by providing an honest appraisal of deal values. The reason for this criticism is that it is in the interest of the banker, who is paid on success, to finalize a deal. A deal deemed unfair will unlikely be finalized leaving the banker without compensation for his work. This would mean that there is a sort of survivor bias in the sample that is used by Kaplan & Ruback. Thereby only cash flow projections that discounted gives a value near the transaction value will be available in the publicly available data in fairness opinions.

Studying highly leveraged transactions as we and Kaplan & Ruback do, it is crucial to remember why a buyer uses leverage. An investor will use debt when he believes that the debt will make return

on equity higher than it would have been in an all equity firm. Axelson et al (2010) notes that buyout funds typically use debt comprising 70% of the enterprise value, in public companies the relationship is inverted, with 70% equity on average. Practitioners commonly state that they will use as much leverage as possible to maximize return on equity. In their paper Axelson et al (2010) study leverage and pricing in buyouts. Not surprisingly Axelson et al (2010) observe a significant relation between leverage and valuation.

We have assembled a dataset containing valuation data for 24 private equity buyouts. The data that we use is the actual data that was used to value the company by each private equity fund. In contrast to the banker who has an incentive to execute transactions, the fund manager has an incentive to generate returns to the investor. Thereby it seems likely that a fund manager will try to make as accurate forecasts as possible while it is possible that the banker may want to provide cash flow forecasts that match a predetermined transaction value. This we believe makes our data more accurate than the data found in fairness opinions.

To compare valuation and market value we use two cash flow based models – APV and LBO. The APV analysis of our dataset indicates that private equity firms consider their investee companies to be worth significantly more than the market. While Kaplan & Ruback (1995) found that the APV model perform well when valuing companies, we find that on our sample the APV performance is poor. Using the APV model the value of the discounted cash flow forecasts is significantly above the transaction value. Our second cash flow based model is an LBO model. LBO models are a special model type which is used in leveraged buyouts. In practice a financial sponsor has a hurdle IRR. To evaluate an investment opportunity the private equity firm will make cash flow forecasts and subsequently try to find a capital structure that yields an IRR at or above the hurdle rate. Analyzing the data using the LBO we find valuations that are significantly closer to the market value than we were able to find using APV. However, the value that is generated using the LBO still is above market value with the 25th percentile at 135% of market value.

To compare the investee company to traded peers and recent transactions we use multiples. We use EV/EBITA and EV/EBITDA multiples for traded peers and EV/EBITDA multiples for comparable transactions. Not surprisingly we find that all three approaches using comparables perform quite well.

As our cash flow based models are contradicting previous research which indicate that these models should perform well we try to find the explanation to the high valuation that these models render. The explanation is likely to be found if one studies the type of buyer that we are dealing

with. Private equity firms are confident that they will be able to improve the companies that they invest in. Thereby when a private equity fund invests in a company they may believe in a better development than other buyers may expect. Another factor that likely has a significant effect on the transaction value is the leverage. While industrial buyers use relatively low levels of leverage, many financial sponsors actively try to use as much leverage as possible. The extra leverage makes it possible for the financial sponsors to realize high return on equity, thereby the value of the company increases with leverage. As different buyers have different future expectations, different time horizons and different opinions regarding capital structures, different buyers will have different perceptions as to the value of a company. Furthermore, private equity firms do expect to be able to extract abnormal returns from their investee companies and will implement these expectations into their cash flow forecasts. Hence, beauty is in the eye of the beholder.

Our interviews indicate that APV models are rarely used in practice. LBO models on the other hand seem to be widely used by financial sponsors. This implies that also industrial buyers should want to analyze potential acquisitions using an LBO model. While it should be unreasonable for an industrial buyer to base their investment decision upon an LBO it can provide useful insights on how competing bidders will act.

Our results indicate that financial sponsors commonly perceive themselves as value generators. This is a highly interesting perception as value can come in many forms. Financial sponsors typically load their portfolio companies with massive amounts of debt. However, debt is just one way to increase returns to investors. What we suggest is that it would be interesting to further study if and if so, why, private equity are better than other owners.

Purpose

It is widely accepted that a good private equity fund should generate substantial returns, often more than 20% annually. To understand how this is possible we value the companies in the sample from an ex-ante perspective using cash flow forecasts from the pre-transaction date. The tools we use to study the buyouts are an APV model, a LBO model and a model using multiples. Previous research has found that the performance of valuation using APV and comparable companies and comparable transactions is good, see Kaplan & Ruback (1995). Assuming that our models perform well we will value the companies to find out what the private equity firm believe about the value of their investee companies. Furthermore we will also try to explain how private equity firms generate returns.

Our Contribution

Private equity funds expect to generate abnormal returns but little research has previously focused on how private equity buyouts are valued in practice. Private equity is fundamentally different from other buyers as they use large amounts of debt to create leverage. Thus it is of interest to evaluate how this type of buyer value companies.

To the best knowledge of the authors of this thesis no research has previously been conducted on the Swedish market for buyouts made by private equity funds. Thereby, this thesis will add to the existing knowledge since it studies private data from a type of buyer that has not been studied previously in this context.

Previous research mainly examine public data from fairness opinions which may not reflect the true beliefs of the parties of a transaction since economic incentives may make it more rewarding to process a larger number of transactions where the banker accepts the value set by executives as a fair value rather than few well analyzed deals.

Given the increasing importance of private equity, it is interesting to investigate why private equity firms generates abnormal returns and how they value a company that is about to be bought.

Previous Research

The Valuation of Cash Flow Forecasts: An Empirical Analysis

Kaplan and Ruback (1995) studied the market value of highly leveraged transactions and compared these to the value found using four valuation methods, the discounted value of corresponding cash flow forecasts(using Compressed APV) and three multiple based methods.

The multiples that Kaplan and Ruback use are based on comparable companies, comparable transactions and comparable industry. The multiples are based on EBITDA to make the values estimated comparable to those estimated using the Compressed APV method.

Comparable companies have future cash flows expectations and risks similar to those of the firm being valued. The comparable transaction multiple uses a multiple from companies that were involved in a similar transaction to the company being valued. The comparable industry multiples were found using four digits SIC codes.

The study uses a sample that consists of management buyouts and leveraged recapitalizations. Kaplan and Ruback collect most of their information from SEC filings, in two cases the information is provided by bankers. The final sample includes 51 highly leveraged transactions that include forecasts for at least four years for:

1) Operating income before interest, depreciation amortization and taxes,
2) Depreciation and amortization,
3) Capital expenditures,
4) Changes in net working capital.

These items are the minimum required to calculate capital cash flows.

The study provides evidence of a relation between the market value of the highly leveraged transactions in the sample and the discounted value of the corresponding cash flow forecasts. The valuations using the DCF based approach were on average within 10% of the market value of the completed transaction. Kaplan and Ruback concludes that the DCF based approach perform at least as well as valuation methods using comparable companies and transactions.

While Kaplan and Ruback studies data from SEC filings we use data from private equity funds. We believe that the difference in the type of underlying data can have significant effect on the valuations that we conduct and those that Kaplan and Ruback used when they found that the valuation models on average are fairly right. Fairness opinions are crafted to deem a transaction to be fair, thus it is likely to exist a "survivor bias" where only transactions that are given a green light in the fairness opinion are executed. Thereby the SEC filings may show unrealistic cash flows just to motivate that a certain price is fair. This problem is unlikely to arise when one studies internal data, remember that internal data is compiled to find out the true value of a potential investment and that a sponsor will want to maximize their own IRR.

Borrow cheap, buy high? The determinants of leverage and pricing in buyouts

Axelson et al (2010) collected detailed information about the financing of 1,157 worldwide private equity deals from 1980 to 2008. Axelson et al investigates if theories that have been developed to explain capital structures of public firms also are applicable to buyouts.

On average debt stands for about 70 % of the enterprise value in buyouts but for public companies the situation is inverted with about 70 % equity. Factors that predict capital structure for public firms cannot explain the capital structure for buyouts.

Instead what is driving the private equity market is the availability and price of debt. When capital is available and the price is low it results in use of more leverage. In contrast no such effect can be seen among the matched public companies.

Private equity practitioners often state that they try to use as much leverage as possible to maximize the expected return of each deal. Axelson et al. (2009) formalize these ideas in their model

and their research is suggesting that the higher leverage chosen by private equity firms during boom market could reasonably not be in the interest of their investors. If private equity firms can pay more when leverage is available, then the higher leverage could drive pricing beyond what is in the best interest of the investors.

Not surprisingly Axelson et al observe a significant relation between leverage and valuation. The conclusion from this paper is interesting since it could explain some of the possible valuation difference when comparing actual transaction values compared to calculated enterprise values when using different recommended valuation tools.

Fairness opinions in mergers and acquisitions

Makhija et al (2007) empirically studies the role of fairness opinions in mergers and acquisitions. Fairness opinions have often been criticized for not helping owners by providing an honest appraisal of deal values. Critics argue that fairness opinions actually aid bankers who are trying to complete deals. The authors find empirical proof for this criticism. This implies that studies which use fairness opinions as their source of data are using cash flow projections that were assembled by an advisor who has an incentive, his fee, to deem the transaction to be fair. Thereby, to us it seems superior to use the type of internal data that we have collected and which we are using than to use data from fairness opinions.

About private equity

The Swedish market for leveraged buyouts emerged in the late 1980s with the founding of Procuritas in 1986 followed by Industri Kapital (now known as IK Investment Partners) and Nordic Capital in 1989.

Today, the private equity industry is an important part of the Swedish business life. According to SVCA (2011) approximately 7% of the Swedish workforce employed in the private sector, works for a private equity owned firm. The Swedish private equity owned companies have approximately a total annual turnover of SEK 250bn, about 8% of GNP. The Swedish private equity firms are in total managing SEK 470bn, about 15% of GNP. Thus, the private equity market plays a major role in the Swedish corporate landscape, even in the global downturn we have recently seen.

Since the dawn of private equity two sub-industries has evolved, venture capital and buyout capital. Venture capital typically invests in an early stage. As the latter category will be in the focus of this thesis it will be described in further detail.

Leveraged buyouts (LBO) emerged in the 1980s. The private equity business model relies upon highly leveraged capital structures and active corporate governance. Some academics, such as Jensen (1989) have argued that this structure is superior to those of the typical public company which has dispersed shareholders, weak corporate governance and low leverage.

A few years later it seemed as if this observation was wrong. A number of high profile LBOs resulted in default. The LBO market virtually disappeared in the early 1990's. However the market was not dead, in the 2000's the LBO market revived. LBO firms continued to buy companies in an escalating tempo. In mid-2000's a record amount of capital was committed to private equity. However, SVCA (No.2 2010) notes that with the turmoil of the financial crisis in 2008 private equity backed down again.

The typical buyout investor will focus on mature companies. Generally there are three main actors in a private partnership, namely the investor, the private equity firm and the target company. The investor is often referred to as a limited partner (LP) and the private equity firm can be referred to as a general partner (GP). LPs are typically institutional investors who commit capital to the GPs. The LP has little control over the invested capital over a fixed time period. After the fixed time period capital is returned to the LP. The GPs are responsible for the fund and thereby for identifying and acquiring investee companies.

To create value, the private equity firm tries to support its portfolio companies. Often, there is a need to assume control over the bought company to support the company by implementing changes. Thus, the private equity firm may take control of the investee company by inserting a chosen individual into the board of the investee or by replacing the managers of the company.

The typical private equity fund will use a significant amount of debt to finance their acquisitions. The usage of debt provides leverage which is an integral part of the business model that most private equity firms apply. There are a number of reasons for a private equity fund to use leverage when adding a company the portfolio. The addition of leverage to an acquisition provides added flexibility to the private equity firm by increasing its possibility to diversify its investment portfolio.

Theory

Valuation Techniques

APV

The APV method is a valuation method that typically is used when the debt level is likely to change over time. Since we are dealing with private equity buyouts, remember private equity buyers usually load the acquired company with huge loads of debt, we think that it is important to acknowledge that the debt level will change over time. Thus we think that the use of an APV model may be sane, even though it is used by few practitioners.

In its simplest form the APV model is a discounted cash flow (DCF) model. The technique used is that you calculate the net present value (NPV) of a firm as if it was all-equity financed. After this has been done you have to take into account the financing. The main benefit is usually a tax shield, remember that interest payments are tax deductible and profitable companies can lower taxes by raising debt.

In a standard DCF model you would calculate a weighted average cost of capital (WACC), which you would use as the discount factor when discounting the cash flows. With a stabile capital structure an APV model would yield exactly the same firm value as a standard DCF model. However, as we introduce changing capital structures we have to discount cash flows somewhat differently. In the APV model we discount cash flows at the unlevered cost of equity, and tax shields at the cost of debt. It is also possible to use WACC for this purpose, if recalculated every time the capital structure changes, which is time consuming. However, the APV model is recommended by academics, therefore we chose to focus on the APV model when valuing the firms, instead of using a standard DCF discounted at the WACC. (Koller et al (2005))

The benefit of using a DCF based approach such as the APV when valuing a company is that a DCF based approach relies directly on cash flows from the firm being valued and on riskiness of the business. The inherent risk of using forecasts is the accuracy of the forecasts and the assumptions used when calculating the discount rates.

The APV model separates the value of the company into two components: the value of operations as if the company was all equity financed and the value of tax shields, which comes from loading the company with debt. (Koller et al. (2005))

$$APV = \left(\left(\sum_{t=1}^{T} \frac{FCF_t}{(1+r_u)^t} + \frac{\frac{FCF_T*(1+g)}{r_u-g}}{(1+r_u)^T} \right) + \left(\sum_{t=1}^{T} \frac{(r_u * D)_t}{(1+r_u)^t} + \frac{\frac{(r_u*D)_T*(1+g)}{r_u-g}}{(1+r_u)^T} \right) \right) \quad \text{EQ 1}$$

Cost of equity

For the unlevered cost of equity we have used the capital asset pricing model (CAPM) to calculate a theoretical cost of capital. We use the unlevered cost of equity since it is a reasonable estimate of the riskiness in the firm and its assets. This argument is supported with the fact that our free cash flows include all of the cash flows which is generated by the total assets including interest tax shields. However, we assume that that the riskiness of these cash flows is the same as the firm's total assets, that way the unlevered cost of capital makes sense to use as the discount rate. (Kaplan and Ruback (1995))

$$ru = rf + Bu * (E(rM - rf) \quad \text{EQ 2}$$

Where:

r_f = *risk free rate*

B_u = *Beta unlevered*

$E(rM - r_f)$ = *Market risk premium*

Risk free rate

For the risk free rate, we have used the annual average of the interest rate for a 10 year Swedish government bond (SE GVB 10Y), calculated on the entry year of each investment. We chose the Swedish government bond since we would like to have cash flows and cost of capital denoted in the same currency, since a large majority of the firms are Swedish. Furthermore, it is the government bond with the longest maturity, and hence provides the best match of the cash flows from the firm being valued. (Koller et al. (2005))

Risk premium

In order to estimate the market risk premium, the approach of measuring and extrapolating historical returns have been used. The arithmetic average return in the years 1903-2002 was 6.2 % in the US, although one should be aware that compounded arithmetic averages tend to be biased upwards. Using the arithmetic average historical risk premium is the general recommendation in finance texts. The assumptions behind this are that returns are independent and that the underlying probability distribution is stabile (Brealey and Myers (1991)). In the end of 2003, Koller et al. believed the market risk premium to be just under 5 percent. We chose to use a market risk

premium somewhere in between, 5.5 percent in the base case. Investors are assumed to be both national and international; the US market could be seen as a good proxy since it is the largest economy in the world with large international investments. We also use bear and bull case scenarios, 4% and 7% respectively which is a common range in corporate valuation.

Beta

According to CAPM, a stock's expected return is driven by beta, which measures the covariance of the stock and the market. Ideally, to estimate beta, would be to use the unlevered industry beta for each firm and industry, since the same industry faces the same operating risks. Therefore we have used the set of unlevered betas that Professor Damodaran at NYU Stern School of Business assembles from a global sample of companies. Damodaran includes data from all publicly firms traded with a market capitalization above USD 5m. For the US firms, Value Line is used but for the non-US firms Bloomberg and Capital IQ are the sources for the data download. For US-firms, betas are estimated by regressing weekly returns on stocks against NYSE composite, using between 2-5 years of data. For all other firms, betas are estimated by regressing weekly returns on stocks against the local index e.g. CAX in France, using between 2-5 years of data. (Damodaran (2011)) This data is then merged together into a world beta divided up into different branches. As a sensitivity analysis we have also chosen to include fixed betas of 0.75, 1.0 and 1.25 in our analysis.

Cost of debt

We use the unlevered rate of return (r_u) as the discount rate for the tax shield. This is recommended in Jennergren's tutorial for valuing companies. (Jennergren (2008)).

Growth

In the base case scenario we set the long term growth to 3%, which seems reasonable and in line with long term average GDP growth of the developed world. Also one of the financial sponsors disclosed this particular growth rate. As a sensitivity analysis we have chosen to value the firms with 2% and 4% long term growth rate to compliment the analysis.

LBO

The LBO model is a central tool used to evaluate financial structure, return on investment and valuation of a potential target of a leveraged buyout.

A simple LBO model starts with free cash flow projections. To reduce leverage over time funds amortize on their debt. Commonly buyout funds use a 100% cash sweep, which means that all free cash flows after interest expense are used to repay repayable debt.

At the expected year of exit we calculate a terminal value using the Gordon growth formula. The terminal value is equal to the EV at the expected year of exit. To find the value of the equity at the expected year of exit simply deduct debt from EV. The IRR is calculated using the value of equity at entry and the value of equity at exit. While we opt for using the Gordon growth formula for simplicity, practitioners would likely use an exit multiple based on comparable companies to find the terminal value.

Financial structure

The financial structure takes a central role in LBO models. Designing the financial structure involves assessing whether the target can support a given leverage under different assumptions. To manage credit risks lenders will want to analyze the targets ability to pay annual interest and to repay debt in time. The stakeholders in an LBO transaction will use a number of different leverage and coverage ratios to assess the capital structure. Common measures include:

$$\frac{Debt}{EBITDA} \qquad \frac{Debt}{Total\ capitalization} \qquad \frac{EBITDA}{Interest\ expense}$$

In a typical LBO the financial structure involves a mix of different types of debt and equity. Buyout funds use large amounts of leverage, on average debt comprise about 70% of the total enterprise value in buyouts (Axelson et al. (2010)). Debt is divided into tranches of different seniority. The term seniority refers to in which order debt holders receive payment.

IRR

While LBO models used by practitioners are complex they boil down to one critical measure, it has to meet the hurdle IRR. Depending on the stage of investment, hurdle IRRs vary. IRR varies depending on the risk level, e.g. new ventures are more risky than well established companies and therefore venture capitalists require higher IRRs than managers of buyout funds. The funds at the focus of this thesis are buyout funds which typically have hurdle rates in the region 20-30%, which is

information we have been given during our meetings with the private equity firms that has supported us with data.

If the IRR proves to be to low it can have significant effect on the rest of the model. When this happens the fund will often reconsider their financial structure, in particular it will be of interest to adjust the equity contribution. Other common options are to try to adjust the purchase price or assumptions about the exit. (Rosenbaum and Pearl (2009))

Building the LBO the fund must decide on the use of free cash flows. It is common for buyout funds to employ a 100% cash sweep. (Rosenbaum and Pearl (2009)) Thus there will be no dividends to the buyout fund. Under the assumption of a 100% cash sweep the IRR is calculated as:

$$-CF_0 + \frac{CF_T}{(1+IRR)^T} = 0 \qquad \text{EQ 3}$$

In practice there may also be other cash flows, e.g. to extract return prior to exit, the fund may want to do a dividend recapitalization which means that the company incurs new debt in order to pay a dividend to the private equity fund. (Rosenbaum and Pearl (2009)) With inter-temporal cash flows, IRR is calculated as:

$$-CF_0 + \sum_{t=1}^{T} \frac{CF_t}{(1+IRR)^t} = 0 \qquad \text{EQ 4}$$

How leverage enhance IRR, a fictive example

LBO transactions generate returns by taking on large debts followed by debt repayments and growth in enterprise value which is made possible by skilled management and strategic decisions. A larger debt level provides the additional benefit major tax savings, since tax is deductible. This is illustrated in the fictive example below. (Rosenbaum and Pearl (2009))

LBO Example 30% Equity / 70% Debt	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Equity Contribution	-300					
Total debt (Opening balance)		700	664	625	584	541
FCF (Opening)		60	60	60	60	60
Incremental Interest Expense		-32	-29	-26	-23	-19
Interest Tax Savings		8	8	7	6	5
FCF (Closing)		**36**	**39**	**41**	**43**	**46**
Total Debt (Closing balance)	**700**	**664**	**625**	**584**	**541**	**495**
EV at Exit						**1410**
- Total Debt						-700
+ Cumulative FCF						205
Equity Value at Exit						**915**
IRR						25.0%
Cash Return						3.0%

Fig 1: LBO example

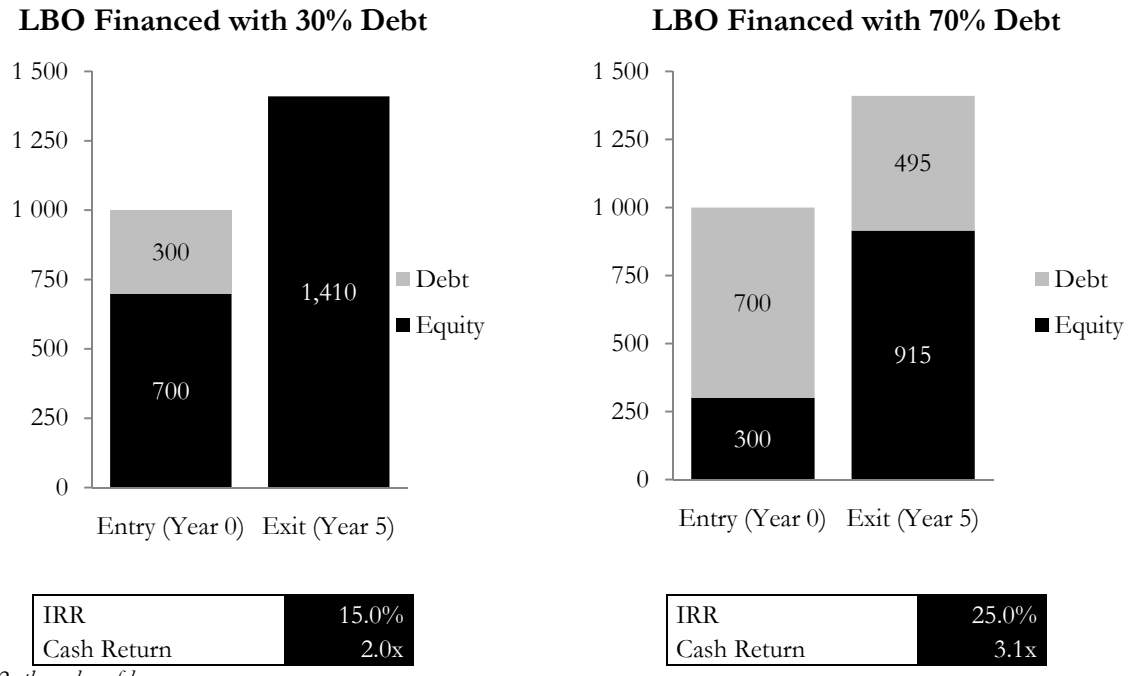


Fig 2: the value of leverage

When comparing the two different scenarios using 30% respective 70% debt, the annual free cash flow (FCF) is reduced in the latter due to the incremental annual interest expense. For year 1 the incremental annual interest expense is calculated by multiplying the additional debt (700-300 =

400) with the assumed r_d=8%, resulting in an incremental interest expense of 32 in year 1, after 26.3% corporate tax, the closing FCF is down to 36, which then is used to pay down debt. For each year of the projection period, we calculate the incremental interest expense as:

$$Interest\ cost = \left(Scenario_{70\%\ Debt,openingY1} - Scenario_{30\ \%\ Debt,openingY1}\right) * r_d * (-t)) \quad \text{EQ 5}$$

By the end of year 5, the equity in the 70% debt scenario has grown from 300 to 917, resulting in an IRR of 25% and a cash return multiple of 3.1. (Rosenbaum and Pearl (2009))

In the 30% debt scenario, FCFs are the same as for the 70% debt scenario. Each year's FCFs after interest payments are used to amortize the debt (5*60=300), resulting in an all equity company in year 5. The equity stake has then grown from 700 to 1,410, resulting in an IRR of 15% and a cash return multiple of 2.0. Clearly the higher debt level results in a higher return on equity for the investor. On the other hand higher leverage increase the risk which makes the firm potentially more vulnerable during economic downturns etc. (Rosenbaum and Pearl (2009))

Multiples

It is common that practitioners use multiples to find the value of the company they are interested in. When you want to analyze a company using a multiple, you should find a multiple that relates the enterprise value to a performance measure. Common performance measures are enterprise-value-to-earnings before interest tax depreciation and amortization (EV/EBITDA), EV/EBITA and earnings. To be meaningful, it is important that the performance measure is proportional to value. Valuing a company solely based on peer group multiples is problematic. One has to find a group of companies with similar growth prospects, profitability and level of risk. Thus, multiple valuations are to be seen more as a complement to the DCF (APV) and the LBO valuations than an actual assessment of the value.

A multiple on its own bears little information; it is meaningful only when compared to multiples of other companies. A good comparable company has two main characteristics:

1) The comparable company has future cash flow forecasts similar to the company you are interested in
2) The risks associated with the comparable are similar to the risks of the company you are interested in

In theory, if these characteristics are present and the performance measure is proportional to value, the use of comparables can provide a more accurate measure of value than any DCF method. It will provide a more accurate measure since multiples incorporate contemporaneous market predictions of cash flows and discount rates. In practice, comparable companies will never be perfect matches. Cash flows and risks are bound to differ, products are rarely perfect substitutes, managers have different management styles, capital structures differ between firms and many other factors affect cash flows and associated risk levels.

We will use two different multiple valuations, one based on traded companies and one based on recent transactions. For traded companies we use the EV/EBITA and EV/EBITDA multiples. For recent transactions we will only use the EBITDA multiple since that was the only data available in the Zephyr database (Bureau van Dijk Zephyr Database). For the recent transaction multiples we used forward looking estimates which is preferable (Koller et al. (2005)).

We chose to use multiples based on EV instead of P/E since the former takes the whole company into account, also it is industry praxis to use EV multiples.

We use multiples based on adjusted EBITA to mitigate problems with capital structure and one-time gains and losses. We also use the EBITDA multiple because depreciations is a non-cash expense, reflecting sunk costs and not future investments. When calculating EBITDA and EBITA for the traded companies we have used the latest actual values available at the time of the transaction. It would have been more appropriate to use forward looking estimates but since we did not have access to databases nor was that information provided by the sponsoring private equity firms and a historical average would have taken to long time to calculate, we found the actual values to be ok considering the circumstances.

Our first choice when selecting a peer group is to use the peer groups provided by the private equity funds, when such information is not available to us, we select peers in the same industry, taking size and location into consideration.

Method

Data

Our sample of transactions starts with a dataset collected from a number of Swedish buyout funds specifically for the purpose of this thesis. The sample consists of 24 transactions collected during 2010.

Brief company information	
Deal size range	Number of firms
100-250 MSEK	7
250-500 MSEK	8
500-750 MSEK	4
1,000-1,500 MSEK	4
1,500-2,000 MSEK	0
2,000-2,500 MSEK	1
	Total 24

Table 1

It has been estimated that there are approximately 250 companies held by buyout funds in Sweden. (SVCA, No. 3 (2010)) All companies that are included in our dataset meet 4 criteria:

1) The companies have been subject to a buyout by a Swedish private equity fund
2) The transactions were executed during the years 2001-2010
3) The transaction value is more than 100 MSEK
4) All of the transactions were highly leveraged

The forecasts that we use in our APV and LBO models were estimated by each fund, or its advisors, pre-transaction. We use the following FCF definition:

EBIT
– Corporate tax [=(EBIT – Interest)*Tax rate]
+ Depreciation
+ Amortization
– Change in net working capital
– CAPEX
+ After tax asset sales
= Free cash flow

EQ 6

It is important for us to use pre-transaction estimates as we are assessing the performance of the valuation techniques which has to be done from an ex-ante perspective.

Multiples

Buyout funds tend to be interested in EV as it measures the value of the whole entity taking debt into account. Thus it is a metric that is neutral to capital-structure which is useful for the buyout fund, since it typically will change the capital structure of the target once control is gained. We calculate EV for the comparables as:

Market cap	
+ Interest bearing debt	
+ Pensions	
+ Interest bearing provisions	
+ Preferred equity	
+ Minority interest	EQ 7
+ Capitalized operating lease	
– Associated companies	
– Stock options	
– Cash & short term investments	
= Enterprise Value	

We capitalize operating leases at the financing rate of the lease. (Koller et al. (2005))

$$value\ of\ capitalized\ operating\ lease_{t_{-1}} = \left(\frac{Rental\ expense_t}{r_d + \frac{1}{Asset\ life}} \right) \quad \text{EQ 8}$$

EBITDA and EBITA are calculated from latest ex-ante financial reporting available. For our comparable companies we adjust EBITDA and EBITA for one off items, such as impairments, restructuring costs and other non-recurring items. The adjustment is necessary to get the unbiased measure of earnings that should be used when comparing the multiple to the multiple of the target firm. (Koller et al. (2005))

Market cap is calculated as the share price at the date of the transaction multiplied by the number of undiluted shares outstanding.

Employee stock options

The value of employee stock options is deducted from the enterprise value. We use the Black-Scholes formula to price the employee stock options. (Hull (2009))

$$\text{Call option} = S_0 N(d_1) - \text{Xe}^{-rt} N(d_2) \qquad \text{EQ 9}$$

Where: $\mathrm{d}_1 = \frac{ln\left(\frac{S_0}{K}\right) + \left(\mathrm{r} + \frac{\sigma^2}{2}\right)\mathrm{T}}{\sigma\sqrt{T}}$

$\mathrm{d}_2 = d_1 - \sigma\sqrt{T}$

S = Stock price

X = Strike price

r = risk free rate (r_f)

T = time to maturity in years

N(x) = distribution function following a normal distribution

σ = Stock volatility

All the variables above were disclosed in the annual reports except stock price and stock volatility which were downloaded through DataStream. We used daily stock prices for the last year and then calculated the standard deviation.

The EV is calculated for each peer, followed by calculating the multiple by dividing by EBITDA and EBITA. Then the average ratio from each target's peer group is multiplied by the EBITDA and EBITA multiples respectively from the company being valued, resulting in the EV of the target.

In our data sample provided by the private equity firms, 16 out of 24 transactions also included information about peers, which we used. For the remaining 8 firms, using our own analysis we chose reasonable comparables after analyzing industry, market, market capitalization and sales figures. For each firm we used 3 comparable firms and calculated the average to use as the multiple when valuing our target firm. However, we had to calculate the enterprise value ourselves for the 73 comparables using the method above, since that data was not provided to us, and we did not have access to appropriate databases e.g. FactSet.

APV

When valuing the firms using the APV model we use the forecasted FCFs which were provided to us. The FCFs were discounted each year with the unlevered cost of capital (r_U). For the terminal year we enter the final projected cash flow, r_U and a terminal growth of 2%, 3% and 4% into the Gordon

growth formula to find the present value of the terminal value. The present value of the cash flows up until the terminal year and the present value of the terminal value are added to find the value excluding the value of the tax shield.

Thereafter we calculate the present value of the tax shield separately. Interest payment forecasts were provided by the private equity funds and the tax shield is calculated by multiplying each year's interest payments with the appropriate tax rate. For the tax shield we use r_U as discount rate, which is recommended (Jennergren (2008)). The present value of the terminal value is calculated with r_U and growth of 2%, 3% and 4%. We add together the present value of FCFs and the present value of tax shield to get to the EV of the firm. This process is repeated for 21 out of 24 firms. 3 firms had to be left out due to missing data.

LBO

Practitioners will test different capital structures to examine how they reach the highest IRR possible. In our simple model we adjust the return requirement to reach an assumed hurdle IRR of 20%, 25% and 30%. From the meetings with the sponsoring private equity firms we have learned that this hurdle rate interval is common in the branch which also is backed by finance texts which explicitly disclose >20% historical hurdle rates as a rule of thumb. (Rosenbaum et al. (2009)) Furthermore, in our sample of transactions, running IRR calculations on the forecasts we also find an average IRR of 25%.

As shown in the graph below, for some of the transactions forecasted IRRs are significantly below 20%. This raises the question why these transactions have been executed. We believe that the reason for the low IRRs is that we may have received data on outcomes rather than forecasts.

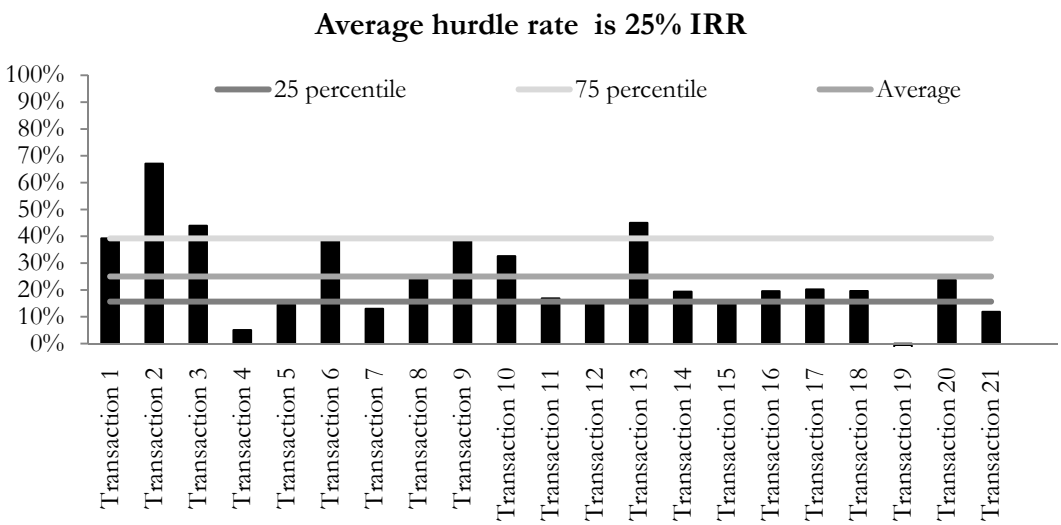


Fig 3: Average hurdle rates in our sample

Result

APV valuation		Base case		Base case					Base case	
	Growth 2%	Growth 3%	Growth 4%	Beta Damodaran	Beta 0.75	Beta 1.0	Beta 1.25	Risk premium 4%	Risk premium 5.5%	Risk premium 7%
APV 1	268%	317%	394%	317%	289%	224%	183%	409%	317%	258%
APV 2	248%	296%	371%	296%	270%	210%	172%	381%	296%	242%
APV 3	181%	208%	245%	208%	236%	183%	150%	272%	208%	167%
APV 4	198%	224%	260%	224%	253%	199%	163%	290%	224%	182%
APV 5	226%	257%	299%	257%	340%	259%	208%	346%	257%	203%
APV 6	229%	264%	315%	264%	276%	216%	176%	342%	264%	215%
APV 7	343%	404%	504%	404%	410%	302%	238%	566%	404%	313%
APV 8	214%	253%	315%	253%	233%	182%	149%	328%	253%	206%
APV 9	295%	364%	486%	364%	296%	224%	180%	485%	364%	291%
APV 10	295%	363%	480%	363%	300%	229%	184%	483%	363%	290%
APV 11	275%	315%	373%	315%	281%	229%	193%	381%	315%	268%
APV 12	250%	296%	367%	296%	240%	192%	160%	364%	296%	249%
APV 13	101%	107%	115%	107%	236%	186%	152%	145%	107%	84%
APV 14	169%	193%	230%	193%	190%	146%	118%	256%	193%	154%
APV 15	249%	284%	338%	284%	254%	204%	170%	352%	284%	239%
APV 16	323%	368%	436%	368%	320%	261%	221%	449%	368%	312%
APV 17	284%	319%	368%	319%	353%	278%	228%	411%	319%	259%
APV 18	291%	340%	417%	340%	277%	219%	181%	422%	340%	284%
APV 19	221%	241%	269%	241%	298%	233%	190%	316%	241%	194%
APV 20	308%	336%	374%	336%	409%	321%	264%	437%	336%	272%
APV 21	230%	260%	305%	260%	249%	193%	157%	335%	260%	212%
Average	**248%**	**286%**	**346%**	**286%**	**286%**	**223%**	**183%**	**370%**	**286%**	233%
Median	**249%**	**296%**	**367%**	**296%**	**277%**	**219%**	**180%**	**364%**	**296%**	242%

Table 2

100% corresponds to the transaction values supported by the private equity firms and the ratios are calculated by dividing the calculated values with the actual transaction values. When comparing the effects of changing growth, beta and risk premium we only change one variable at the time leaving the remaining two at the base case (e.g. when changing growth, beta and risk premium are fixed at the base case).

LBO Valuation		Base case	
	IRR 20%	IRR 25%	IRR 30%
LBO 1	127%	145%	171%
LBO 2	182%	201%	231%
LBO 3	114%	135%	160%
LBO 4	194%	221%	260%
LBO 5	123%	147%	180%
LBO 6	127%	149%	175%
LBO 7	310%	364%	429%
LBO 8	110%	132%	161%
LBO 9	298%	359%	432%
LBO 10	73%	92%	117%
LBO 11	218%	311%	459%
LBO 12	94%	106%	122%
LBO 13	166%	187%	213%
LBO 14	140%	158%	178%
LBO 15	96%	113%	139%
LBO 16	168%	190%	225%
LBO 17	99%	121%	152%
LBO 18	123%	144%	171%
LBO 19	147%	164%	185%
LBO 20	127%	146%	176%
LBO 21	123%	143%	175%
Median	**150%**	**178%**	**215%**
Average	**127%**	**147%**	**176%**

Table 3

For the LBO valuation, the same reasoning is adopted as above and therefore we have assumed that growth is fixed at 3%, which is our base case.

Trading multiples		
	EV/EBITA	EV/EBITDA
TM 1	136%	96%
TM 2	124%	74%
TM 3	105%	107%
TM 4	241%	300%
TM 5	129%	126%
TM 6	184%	224%
TM 7	164%	141%
TM 8	105%	97%
TM 9	117%	105%
TM 10	134%	123%
TM 11	72%	-
TM 12	144%	88%
TM 13	310%	199%
TM 14	55%	65%
TM 15	174%	205%
TM 16	54%	82%
TM 17	147%	123%
TM 18	52%	48%
TM 19	279%	186%
TM 20	257%	220%
TM 21	87%	85%
TM 22	99%	87%
TM 23	110%	94%
TM 24	95%	95%
Median	**126%**	**105%**
Average	**141%**	**129%**
25 percentile	**98%**	**88%**
75 percentile	**167%**	**163%**

Table 4

Precedent transaction multiples	
	EV/EBITDA
PTM 1	160%
PTM 2	137%
PTM 3	64%
PTM 4	196%
PTM 5	119%
PTM 6	218%
PTM 7	144%
PTM 8	108%
PTM 9	175%
PTM 10	170%
PTM 11	-
PTM 12	181%
PTM 13	120%
PTM 14	316%
PTM 15	275%
PTM 16	172%
PTM 17	111%
PTM 18	153%
PTM 19	203%
PTM 20	337%
PTM 21	75%
PTM 22	157%
PTM 23	140%
PTM 24	99%
Median	**157%**
Average	**166%**
25 percentile	**120%**
75 percentile	**188%**

Table 5

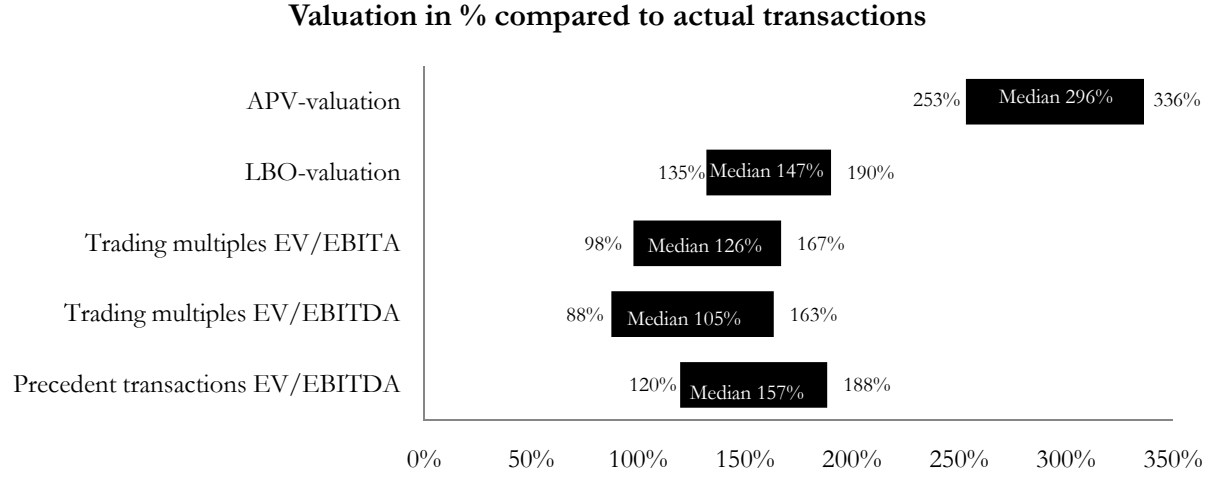


Fig 4: Football field plotting the difference between valuations using different valuation techniques.

The football field above shows the middle 50%, between the 25th and 75th quartile. Due to outliers we study medians rather than averages.

The performance of the APV model is poor. The APV model calculates median EVs almost 300% of the actual transaction value. The second cash flow based model, the LBO model performs better with a median calculated EV of 147% of the actual transaction value. Remember that for positive NPV transactions for the financial sponsor, the APV/LBO valuation will render a value above the market price. Thus it should be expected that the valuation renders a price above the transaction price. However, applying the APV model, the difference is very large. The groups of traded peers multiples seem to best predict actual transaction value, 126% and 105% of the actual transaction value for EV/EBITA and EV/EBITDA multiples respectively.

The precedent transaction multiples perform worse than the traded peers, the median for the calculated EVs is 157% of actual transaction value.

Analysis

The football field previously presented indicates that the APV method projects firm values well in excess of the actual transaction values. Furthermore the LBO model as well as multiple based valuations calculates values slightly above actual transaction values.

Previous research has indicated that the APV, comparable company multiples and comparable transaction multiples are well suited methods to value companies (Kaplan and Ruback (1995)). Why is it that the valuations in our sample consistently seem to overestimate enterprise values?

APV

Examining the ratio between the APV valuation and actual transaction value, it is striking that the APV model consistently overestimates the enterprise value by close to 300%. Under the assumptions previously stated our APV model calculates base case EV to transaction value ratios as shown in fig 5.

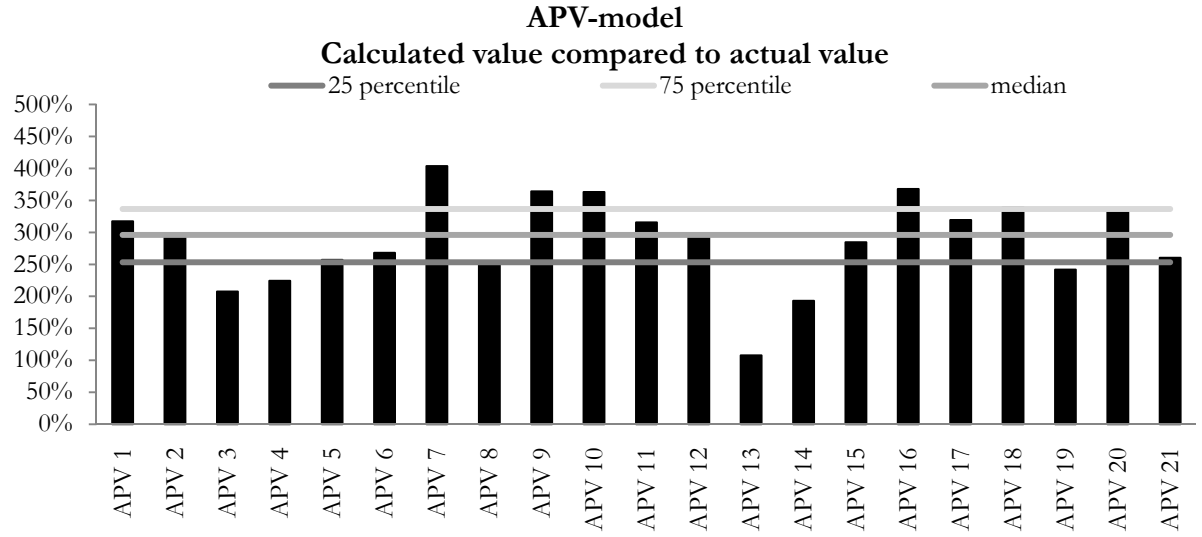


Fig 5: EV calculated using APV to actual transaction value ratios

To understand why the APV model is inappropriate to use in the case of private equity buyouts one must understand how both private equity and APV models are working.

APV is a valuation model based upon discounted cash flows. In APV models, the present value of tax shields is added. Private equity buyers typically calculate that they will be able to load their targets with massive amounts of debt.

With the addition of debt in the APV model, the buyer gets leverage on the equity invested and creates a tax shield. Combining a relatively low return requirement, calculated using CAPM, with a tax shield equates values in excess of the transaction value when using the APV.

LBO

LBO models are typically the preferred tool for private equity investors. Under the assumption that the buyers were looking for an IRR of 25% in each transaction, our LBO model calculates base case EV to transaction value ratios as shown in fig 6.

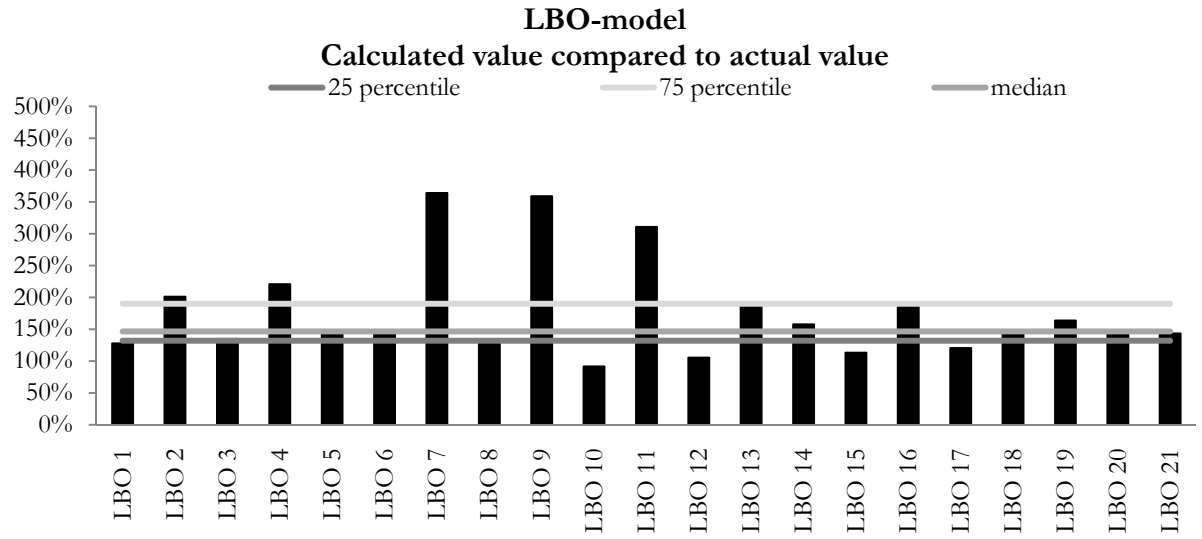


Fig 6: EV calculated using LBO to actual transaction value ratios

The median value of this ratio was 147% in our sample. This means that the LBO model calculated an enterprise value nearly 1.5 times as high as the actual transaction value. This does not necessarily imply that the LBO is in any way flawed.

In some transactions few bidders bid for the target company thereby keeping prices down. It is also worth mentioning that private equity firms, not necessarily pays what they value their buyout targets to. Remember that the IRR hurdle is the minimum IRR at which the sponsor will consider an investment. Different return on equity requirements may also explain some of the valuation difference.

Multiples

Traded peers

The multiples based on a peer group of traded companies were most successful predicting transaction values with a median of 126% and 105% for the EV/EBITA and EV EBITDA multiples respectively.

Even though considerable effort has been made by the private equity funds to assemble a relevant peer group differences between the constituting companies must be allowed for. Having differences between companies in mind it is intuitive that the EV/EBITDA multiples calculates values more aligned with actual transaction values than EV/EBITA multiples do.

EBITDA is a measure independent of the depreciation schedule that each company employs. Thereby EBITDA is less affected by accounting principles than EBITA is. This makes EBITDA a more comparable measure between companies than EBITA.

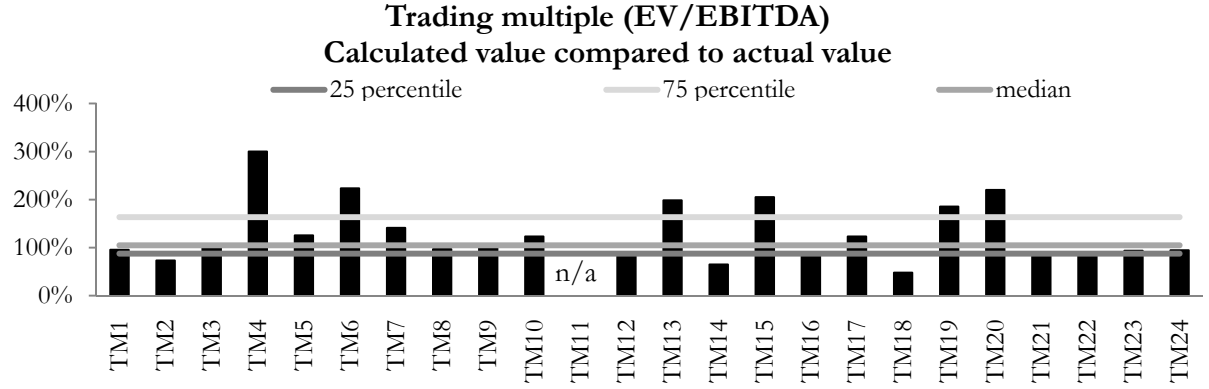


Fig 7: EV/EBITDA multiples of peers used to calculate EV to actual transaction value ratios

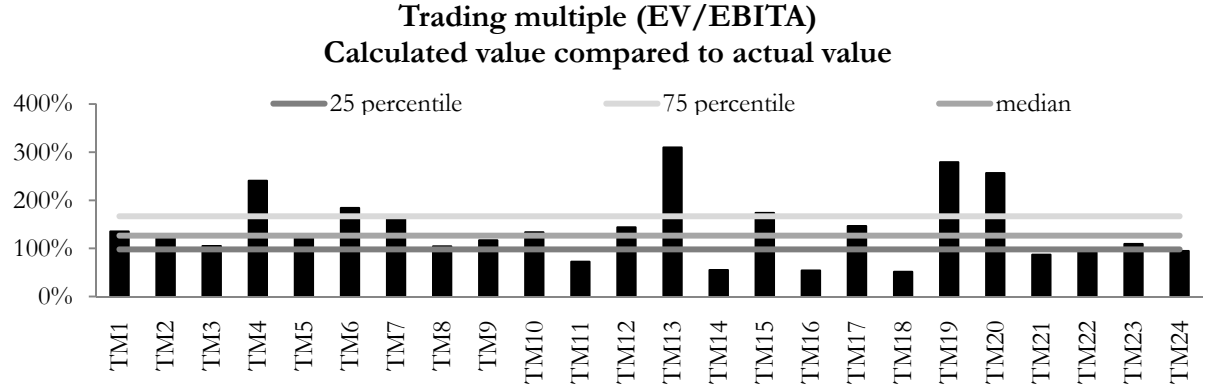


Fig 8: EV/EBITDA and EV/EBITA multiples of peers used to calculate EV to actual transaction value ratios

Precedent transactions

The valuation using comparable transactions renders higher values than the comparable companies approach. When companies change owners they are often sold at a premium. This can be for a number of reasons such as an inherent value of control, sellers may demand part of the synergies that the buyer is likely to realize etc. (DeAngelo (1990)) As companies for good reasons may be sold at a premium, we find it intuitive that multiples based on precedent transaction are higher than multiples for trading companies.

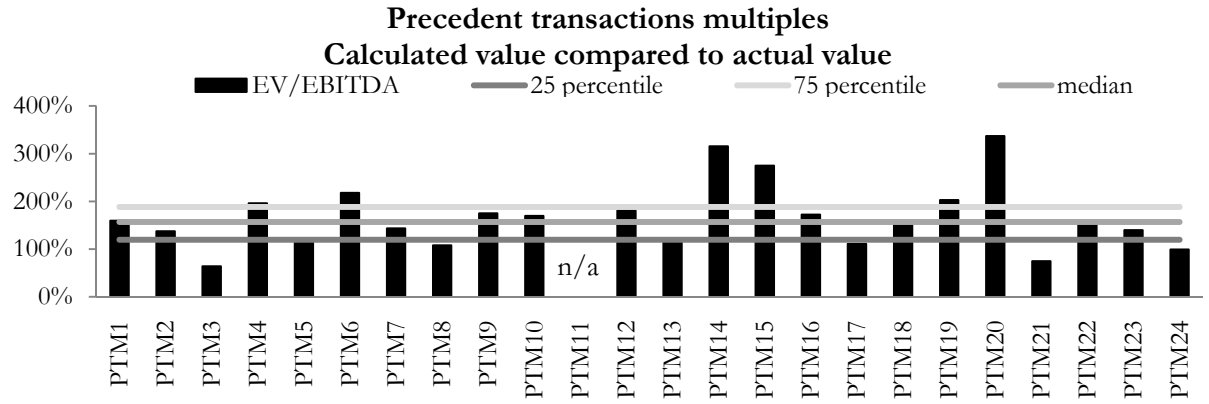


Fig 9: EV/EBITDA multiples from precedent transactions used to calculate EV to actual transaction value ratios

General

Previous research has found that transaction prices and valuation are almost perfect matches indicating that valuation models hold. However in our study we find that transaction prices for private equity buyers are below the valuations. We will try to explain some possible reasons for the mismatch in our sample and why other studies may be wrong.

Other studies commonly examine data from fairness opinions which we believe are a flawed tool to use to validate valuation models. First of all, it is likely that there is a survivor-bias in a sample that studies the valuation in a fairness opinion vs. transaction value. By this, we mean that it is unlikely that shareholders will sell when a fairness opinion states that the transaction is unfair, thereby unfair fairness opinions would not need to be filed. Furthermore, we argue that fairness opinions are flawed because bankers often have an incentive to find that the transaction is fair. Remember that bankers use transaction fees and only receive payment upon completion of the transaction. It should also be extremely rare to find a banker who has an incentive to deem a transaction unfair.

Intuitively we think that it actually makes more sense to find valuations above transaction values than to find them in a band centered around transaction values. Taking into account that financial sponsors expects abnormal returns on their investment it further makes sense to believe that the valuation should be higher than the transaction value. It is worth mentioning that success fees were possible in Sweden until 1 October 2009 when the regulation was changed, partly due to the reasons above.

As with bankers, fund managers may have incentives to execute transactions. To be able to execute a transaction the fund manager must present a compelling case to his investment committee. Thereby some fund managers may overestimate value to be able to persuade their investment committee that the value is higher than it actually is.

Furthermore, fund managers may very well be honest about their beliefs about the value of companies. After all, honesty should likely be the sanest thing to do for a fund manager in the long run. So to seek alternative explanations we turn to previous research that has tried to explain transaction prices. Grossman et al (1980) argue that there is a free rider problem which pushes transaction prices up. However, we observe transaction prices below the valuation that our models predict. This is more in line with Damodaran (2010) who argue that there should be an illiquidity rebate when private companies are sold.

We found that the trading comparable companies approach calculates enterprise values closest to the actual transaction value. Private equity funds aim to improve their investee companies. Considering improvements, projections should be higher than trailing measures. One could argue, in line with Grossman and Hart, that the transaction value should be based upon projected measures. However companies seem to have been valued using trailing multiples. The reason for this could be that the private equity fund has different beliefs than the management about the future for the company. Therefore it seems as if the sellers and the private equity firms may have valued the companies using trailing multiples when deciding on transaction prices.

We believe that part of the mismatch between valuation and transaction value that we have found may be explained by different future expectations by seller and buyer. And value added captured by PE fund.

Valuing the company using multiples, the private equity firm employs a pro forma multiple which indicate a value slightly higher than the transaction value.

In the APV model cash flows grow but are discounted at a fairly low cost of capital which makes the calculated EV higher than the actual transaction value.

In the LBO model, the mismatch from the APV model is adjusted due to a fairly high return requirement of 25%.

A significant part of the mismatch between valuation and transaction values should likely be found in the leverage that private equity funds use. Axelson et al (2010) found a significant link between leverage and valuation. Some would argue that private equity buyers overpay for the companies. However, private equity buyers set high hurdle IRRs which they manage to meet. Private equity funds manage to achieve extraordinary returns even when paying more for a standalone company than an industrial buyer could pay taking synergies into account. Thus it seems, value is subjective and beauty is in the eye of the beholder.

Conclusion

Discussion and summary

In this paper we employ three types of models to value a set of 24 companies, the models we employ are: an adjusted present value model (APV), a leverage buyout model (LBO) and valuation using multiples. We use a dataset assembled from internal data on completed transactions from a number of Swedish private equity firms. The transaction value is used as a proxy for the market value of each company. Comparing the market value of our set of highly leveraged transaction values to the values that our models predict we find results contradicting the results of Kaplan & Ruback (1995). While Kaplan & Ruback found that discounted cash flow forecasts perform at least as well as valuation using multiples, we find that multiples perform significantly better than the cash flow based APV and LBO models. We are not convinced that APV is an appropriate model to use to value highly leveraged transactions as Kaplan & Ruback suggests. We would argue that the dataset used by Kaplan & Ruback (1995) may be flawed. The reason for this critique is that they use a dataset compiled from data found primarily in fairness opinions. Makhija et al (2007) notes that fairness opinions commonly are criticized for not helping owners by providing an honest appraisal of deal values. The reason for this criticism is that it is in the interest of the banker, who is paid on success, to finalize a deal. A deal deemed unfair will unlikely be finalized leaving the banker without compensation for his work. This would mean that there is a sort of survivor bias in the sample that is used by Kaplan & Ruback. Thereby only cash flow projections that discounted gives a value near the transaction value will be available in the publicly available data in fairness opinions. The data that we use is the actual data that was used to value the company by each private equity fund. In contrast to the banker who has an incentive to execute transactions, the fund manager has an incentive to generate returns to the investor. Thereby it seems likely that a fund manager will try to make as accurate forecasts as possible while it is possible that the banker may want to provide cash flow forecasts that match a predetermined transaction value. This we believe makes our data more accurate than the data found in fairness opinions.

The APV analysis of our dataset indicates that private equity firms consider their investee companies to be worth significantly more than the market. While Kaplan & Ruback (1995) found that the APV model perform well when valuing companies, we find that on our sample the APV performance is poor. Using the APV model the value of the discounted cash flow forecasts is significantly above the transaction value. Our second cash flow based model is an LBO model. LBO

models are a special model type which is used in leveraged buyouts. In practice a financial sponsor has a hurdle IRR. To evaluate an investment opportunity the private equity firm will make cash flow forecasts and subsequently try to find a capital structure that yields an IRR at or above the hurdle rate. Analyzing the data using the LBO we find valuations that are significantly closer to the market value than we were able to find using APV. However, the value that is generated using the LBO still is above market value with the 25th percentile at 135% of market value.

To compare the investee company to traded peers and recent transactions we use multiples. We use EV/EBITA & EV/EBITDA multiples for traded peers and EV/EBITDA multiples for comparable transactions. Not surprisingly we find that all three approaches using comparables perform quite well.

As our cash flow based models are contradicting previous research which indicate that these models should perform well we try to find the explanation to the high valuation that these models render. The explanation is likely to be found if one studies the type of buyer that we are dealing with. Private equity firms are confident that they will be able to improve the companies that they invest in. Thereby when a private equity fund invests in a company they may believe in a better development than other buyers may expect. Another factor that likely has a significant effect on the transaction value is the leverage. While industrial buyers use relatively low levels of leverage, many financial sponsors actively try to use as much leverage as possible. The extra leverage makes it possible for the financial sponsors to realize high return on equity, thereby the value of the company increases with leverage. As different buyers have different future expectations, different time horizons and different thoughts regarding capital structures, different buyers will have different perceptions as to the value of a company. Furthermore, private equity firms do expect to be able to extract abnormal returns from their investee companies and will implement these expectations into their cash flow forecasts. Hence, beauty is in the eye of the beholder.

Potential drawbacks

The data provided is generally limited to FCF and capital structure projections, therefore our models are simplified but as correct as possible under the current condition.

Out of all the valuation models we have evaluated in this thesis, the LBO model is the one with most assumptions, due to the complexity of the model as well as limited data input. A full-scale LBO model has more variables affecting the outcome. In our case the capital structure was set from the beginning which never is the case in reality. In reality one would try out different capital structures with different kind of loans to reach the highest IRR possible. From the most beneficial capital structure one calculate the cost of capital to use when discounting the FCFs. Since the capital structure was fixed from the beginning and the fact that most Swedish private equity funds require 20-30% IRR, we assumed that we could modify the cost of capital to achieve an IRR of 20%, 25% and 30%, given the fixed capital structure. Having that assumption in mind, the cost of capital for each transaction was within a credible range. We also assumed 100% cash sweep for the transactions were the capital structure was not provided between entry and exit year.

After interviews with the private equity funds we found out that besides using LBO and multiple models when valuing firms, they also use a DCF model based on the WACC. We found this rather interesting since most academics would argue that the APV is superior when valuing firms with a volatile capital structure as a changing capital structure means that the WACC should be recalculated to adjust for the changing risk level in the company which in theory is more complicated and time consuming than using the APV.

When calculating the discount rate (r_u) in the APV model, we used average B_u assembled by professor Damodaran at NYU Stern School of Business. One problem with these betas is that they are global; betas from Scandinavian firms only would have been preferable in the APV valuation. Due to the shortcomings in Damodaran's beta values we also used betas of 0.75, 1.0 and 1.25 as a part of a sensitivity analysis.

In theory, a multiple valuation is superior to any other valuation form since the market should have taken into account all available information, in reality perfect peers are impossible to find. We used peers provided by the firms when possible, the problem is that the firms we are valuing are rather small and most of them have its own niche market which makes it hard to find similar firms within the same industry to compare with.

In general, considering the data, we are not sure if we were given the requested projections or realized FCF, this uncertainty is only referable to a small number of the sample. However, we have

assumed that all data are projections made by the funds at the time of the transactions. The data we were provided with consisted of a single outcome, probably the base case; it would have been interesting to see how the bullish and bearish scenarios would have affected our valuation.

Also it would have been interesting to analyze a larger sample of firms. Considering the nature of the data and the difficulty of obtaining internal data from established private equity funds we are forced to conclude that the sample may be indicative of how private equity funds value companies, but further studies must be made to find statistically significant results.

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