Can financial analysis and modelling make pricing at horse auctions more eligible?

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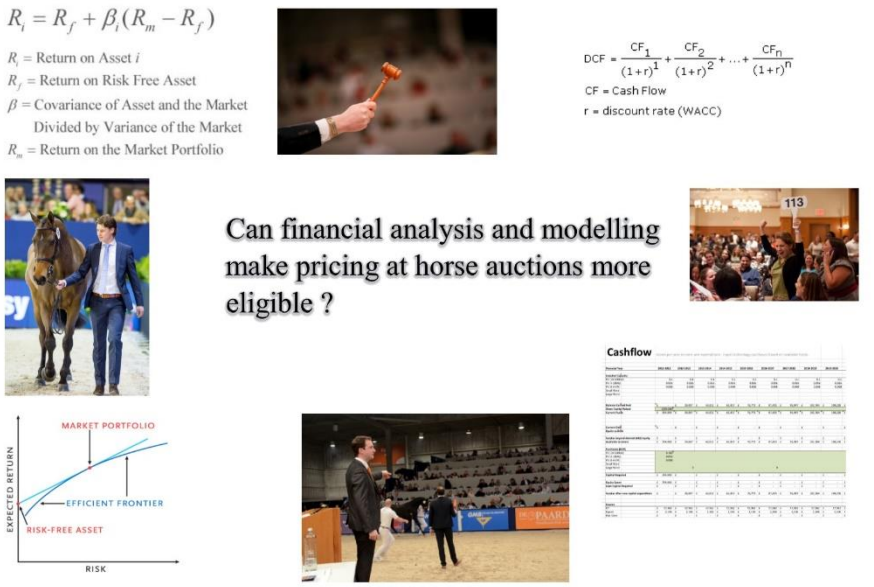

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Summary

English

This study was inspired by the seemingly incorrect valuation of investments during equine auctions and the fact that the investments are not valued in a mathematical way. Equine auctions form a tremendous place for both, traders and buyers, to gather and trade equine assets in a most efficient way. Each professional warmblood studbook creates at least twice a year such a moment, where thoughtfully selected horses can be purchased with the highest bid.

By gathering sufficient information and processing them into two datasets, it was analysed if there is a measurable correlation between the auction price and later sport performance of a horse. Aiming to answer the question if a statement regarding the over-/under- or correct valuation of horses during an auction can be made. Concluding that just a small number of horses got correct valued. Additionally, by dividing the horses into two groups, it was concluded that one group tend to be over- and the other undervalued.

Further, the investors behaviour which was concluded to be the most influencing factor, was analysed. Consequently, after analysing the results of two held interviews with different professionals, it was determined that investors do not approach the market in a mathematical kind of way and get driven by intrinsic motivation and emotion.

Additionally, two financial models were applied on equine auctions, one for valuing investments and one to calculate an expected return of securities/assets. Carefully analysing the gathered data, both models were successfully tested on the equine auction market. Resulting in the approval and disapproval of three different hypotheses. Consequently, the model for the valuation of investments proved that a comparison between horses and investments can be made as the results were close to realistic numbers and approved by professionals. On the other hand, those investors did not agree on the calculated expected return, computed with the CAPM model which is typically used for financial securities.

A final advice for future investors was formulated, encouraging them to firstly get aware of their own behaviour and intrinsic motivation during the bidding process. Further, certain advices for future research were formulated regarding psychological research but more statistical research as well, aiming that in the future prices at equine auctions become more eligible which would result in the professionalization of the whole equine sector

Dutch

Het ontbreken van wiskundige calculaties, gebaseerd op investeringen tijdens hippische veilingen, is de basis van dit onderzoek. Deze veilingen worden door handelaren en kopers gezien als een plek waar men zich richt op netwerken en efficiënt handelen. Ieder professioneel stamboek organiseert op zijn minst, twee keer per jaar een veiling, waar streng geselecteerde paarden gekocht kunnen worden.

Onderzocht is, aan de hand van bruikbare informatie, en de koppeling tussen twee verschillende datasets of er een meetbare relatie bestaat tussen veilingprijzen en sportprestaties. Uit dit onderzoek kan worden geconcludeerd dat van de twee groepen paarden, een groep wordt onder gewaardeerd, de andere groep wordt overgewaardeerd. Van beide groepen, wordt een klein aantal paarden, op correcte wijze gewaardeerd.

Tevens werd het gedrag van investeerders geanalyseerd, hieruit bleek dat dit aspect grote invloed heeft op de betaalde prijzen. Interviews met professionele ondernemers lieten zien dat deze veilingmarkt, niet op een wiskundige manier wordt benaderd. De intrinsieke motovatie en emotionele waarde spelen hier een belangrijke rol.

Twee financiële modellen worden in dit onderzoek toegepast op hippische veilingen. Een financieel model is gebaseerd op de waardering van investeringen, het andere model berekend het rendement van aandelen. Door middel van zorgvuldige analyses van de verzamelde data zijn beide modellen succesvol toegepast, dit is aan de hand van vijf hypotheses uitgelicht. Hieruit is gebleken dat het investeringsmodel realistische waarden oplevert, verschillende professionals geven aan dat deze uitkomsten kloppend zijn. De resultaten van het tweede model kwamen daarentegen volgens de professionals niet met de werkelijkheid overeen.

Het advies luidt dat men eerst inzicht moet krijgen in eigen gedragingen en intrinsieke motivatie voordat men begint met bieden. Onderzoek op het gebied van psychologische invloeden en statistische onderzoeken om de prijsvorming betrouwbaarder te maken is aan te bevelen als vervolgonderzoek. Dit onderzoek, en tevens vervolgonderzoeken ondersteunt de hippische sector op het gebied van professionalisering.

I Introduction

In this section the topic and research question are introduced and briefly discussed. Additionally, the structure of this rapport is examined.

Imagine being at a horse auction, you set a limit price for yourself until which you want to bid for a special kind of horse. The auction starts, the crowd starts bidding and your limit price is vastly reached. Would you stop bidding, aiming the limit price is the intrinsic value of this type of horse? Or would you become precarious and keep on bidding as you feel the crowd is indicating a trend?

The example above indicates two different investment theories developed by successful economist and became well known by being referenced by Burton Malkiel in his book a Random Walk Down Wall Street (Malkiel, A Random Walk Down Wall Street, 1973). While proponents of the Firm Foundation theory postulate an efficient market with every investment having its own intrinsic value, (Williams, 1997) supporters of the Castle-in-the-air theory concentrate on the psychic value and the madness of the crowd (Keynes J. M., 1936). Both approaches well known in the investment and stock market are often used by investors, what indicates that both theories are applicable. Taking a look at the horse auction market the phenomenon appears that none of those approaches are knowingly used. (Appendix A)

The question arises, on what are prices at horse auctions based and what influences them? Leading to the research question: Can financial analysis make pricing at horse auctions more eligible?

The goal of this analysis is therefore, to develop a way of making prices at horse auctions more understandable and eligible by using existing financial models, which could potentially influence the whole equine sector. Furthermore, this research aims to analyse if the horse auction market should be seen as a stock exchange, or investment market. Special focus was directed to high priced European warmblood auctions between the years 2005 and 2015 and the correlation between auction prices and the present performance of those auction horses. Therefore, five hypotheses were formulated and tested based on the following structure of the rapport. In the following section the research methods are described which were most relevant for the research project. The third section, the literature review, includes a broad literature research based on which five different hypotheses were formulated. Fourthly, the in section

three developed hypotheses were tested and depending on the results approved or disapproved. Further, a discussion can be found in section five followed by the limitations of the research discussed in section six. The conclusion with and advise for the sector and investors completes the rapport.

II Methodology

This section lays focus on the research methods practiced during the project, covering both field and desk research methods, which were used to gather sufficient relevant qualitative and quantitative data.

There were several different research methods used to gather sufficient information about the different topics discussed in this research. Firstly, a broad literature research was conducted where several scientific publications were taken into account. Those different sources, as well as certain considerable financial books, form the basis of the research, revealing the knowledge gab in the equine sector regarding price forming at horse auctions. Publications of several famous economics as for example "Counter speculation, Auctions, and Competitive Sealed Tenders" of the Nobel prize winner William Vickrey, were examined.

Secondly, a limited field research was conducted to tests the results and acquire acceptable information about the investors behavior. Therefore, a list with different open ended questions was prepared. Based on the questions two interviews with professional breeders and traders were held and analyzed. The chosen specialist, both grown up in the equine sector, are equine businessman for more than 20 years. Breeding different warmblood horses, trading self-breed horses as well as selling or buying horse at auctions, belong to their work field.

In order to acquire sufficient data to test all hypothesizes, which are proposed in the following sections, a limited statistical research was conducted to make credible claims about their accuracy. By using different desk research methods, quantitative data from a total of 11 warmblood horse auctions, which took place in Germany and the Netherlands, including price, performance and pedigree information of 289 horses was collected. While conducting this limited statistical research, and consequently accepting that the dataset is not presenting the whole sector, limits the generalizability of potential findings to a certain degree, assembling a bigger data-set, which might have involved a more diverse price-line could reveal more relevant data

Over the course of the statistical research, the results were split in two different groups, stallion auctions and saddle horse auctions. For each group pedigree, price and performance information was collected. Furthermore, the horses were divided into six different types.

Jumping Horse			Dressage horses	
Gelding	JG		Gelding	DG
Mare	JM		Mare	DM
Stallion	JS		stallion	DS

Table 1The six different horse types

Two different data-sets were created, each for one of the financial models that were used. While for the DCF model only data from KWPN stallions was used, included the data set for the CAPM model all genders of horses from the Holsteiner studbook. Receiving the auction data from the studbooks themselves, the performance data was found in the international horse database, Horsetelex. All horses, from which no performance information could be found, were stated as a non-performing horse. In order estimate the average Cash flow of a stallion, data of 60 stallions was collected, where 35 were older and already proven stallions above eleven years, and 25 younger stallions younger then eleven years. With keeping the ratio between young and old stallions at this level, the reliability of the data was insured, as knowingly older stallions already proofed themselves and can be considered as reliable. It appeared that after a certain amount of stallions, keeping the ratio between young and old the same, the results were kept on a certain range. Consequently, the outcome of the average amount of sold semen was 36, after adjusting for the highest and lowest level data. Currently, the average cash flow of a stallion per year, resulted in €50.885,99. Further, the average stallion does stay 12 years in the breeding business where he produces averagely 481 descendants.

In order to introduce the second financial model, the Capital Asset Pricing Model, a data set out of 289 horses from 11 saddle auctions from the Holsteiner studbook, was collected. The horses, in this comparably big data-set were sorted in different groups, see figure one. As the Holsteiner studbook manly breeds jumping horses only three different types of horses were found in this data-set, JG, JM and JS. Additional to all price, pedigree and birth information, the international sport performance was added to the data-set, again researched in the database Horsetelex. Only 26,99% of all 289 horses are or were competing on international level, with just 1,38% from the total population competing in grand prix level, which is the highest reachable. In order to estimate the beta (β) of the market the average prices of as well the auctions itself and the different horse types were calculated per year and further analyzed

III Literature Review and Theory development

In this section relevant literature regarding the research area is segmented in different sub areas and described. Five hypotheses are developed based on significant knowledge gabs.

II.I Historical background and pricing

According to economic literature an auction is a market institution with an explicit set of rules determining resource allocation and prices on the basis of bids from the market participants. (R. Preston McAfee, 1987) Different objects are offered to sell and bid by investors to buy, in divergent types of auctions, which are basically four types. At the English auction which is most common used to sell goods, the price will rise until one bidder remains that will receive the object, knowing all the time the level of the current best bid. Converse to that is the Dutch auction, where the auctioneer calls the price until one bidder accepts it, beginning with an initial higher price lowering it until one of the bidders agrees. Thirdly, there is a first-price sealed auction, in which all potential buyers submit a bid and the highest bidder is awarded with the object. Unlike the English auction bidders are not able to observe their rival's bid and adjust their own. Lastly, there is the second-price sealed auction, again bidders submit a bid and the highest bidder gains the object by then paying the second highest bid and not his own. (Vickrey, 1961) The question arises, which type of auction is a warmblood horse auction? It can be described as an English auction, with an auctioneer rising the prices steadily, with a prescribed amount, until no investor bids higher. The due amount that has to be paid, is regularly higher than the bid prices, as those are excluding prices.

The amount due will be calculated as follows:

knock-down price

\+ *6% of knock-down price as commission*

= *net price*

\+ *VAT according to § 12 (1) UStG (19%)*

= *gross price*

\+ *1,5% insurance (plus insurance tax 19%) plus VAT 19 %*

= A M O U N T D U E

Figure 1 Calculation of the amount due

Unlike at Quarter Horse auctions, the seller has no right to set a minimum price for the horse, which is a common buy-back practice in the US. (Mykel R. Taylos, 2006) Those buy-back practices are unlikely in the warmblood auction market, if a seller does not agree on the highest bid price, he can only keep the ownership if he imposes a higher bid. Obligated to pay the commission and all other fees, as a normal bidder would. Consequently, owners who practice buy-back methods tend to overvalue their asset, or vice versa the crowd is undervaluing it. Making a statement about over- or undervaluation during or shortly after the auction, can be problematic, as the real value of a horse can primal be detected when the horse started his sport- or breeding career. E.M. Miller simplified this issue and theorizes that all investments become overpriced when investors disagree in their value. (Miller, 1977) Not entirely agreeing on this theory I formulated the following hypothesis.

Hypothesis 1: There can no statement been made about investors tending to over- or undervalue horses during auctions.

II.II Investing theories and the equine market

At all moments where investors tent to invest their money into different objects, such as securities or sport horses, they are not only influenced by the amount they are able to spend on the object. The biggest and most pressures influence is the crowd, who is also interested in the same object and is able to keep the investor from getting the wished object, by simply be willing to be pay a higher amount of money, not being assured if the investment is truly worth it. Burton G. Malkiel describes it in his book "A Random Walk Down Wall Street" as "*a gamble whose success depends on an ability to predict the future."* (Malkiel, A Random Walk Down Wall Street, 2012) Traditionally there are two contrary famous approaches to asset valuation, the firm-foundation and the castle-in-the-air theory.

The firm foundation theory assumes that every investment instrument, a piece of real estate or a horse, has an intrinsic value, which can be estimated by analysis of present conditions and future expectations. Foundation of this theory is an efficient market where all prices that fall below this intrinsic value are a buying opportunity and all prices above a chance to sell with making a profit. There are several approaches to determine the intrinsic value, as for example using the discounting cash flow formula, which was found as the best way by John Burr Williams in 1997, arguing that the intrinsic value of a stock is equal to the present value of all

its future dividends. (Williams, 1997) Problematic with the firm foundation theory is, that it relies on a forecast of the extent of future growth, which is not always as predictable as wished. The second famous approach to asset valuation is the castle-in-the-air theory, where a stock exceeds of recede its intrinsic value, this approach concentrates on psychic values. John Maynard Keynes found this theory in 1936 based on the first big economic crash in 1928 and was able to satisfy professional investors with suggesting not to calculate an intrinsic value, and despite that concentrate on analysing how the crowd will behave in the future. Recognizing the trend, Keynes was convinced that the firm foundation theory involves too much work and the chance of receiving a doubtless value is too slight. He described the behaviour of the stock market as follows: "*It is analogous to entering a newspaper beauty-judging contest in which one must select the six prettiest faces out of hundred photographs, with the prize going to the person whose selections most nearly conform of those of the group as a whole."* (Keynes J. M., 1936) He assumes that the smart players recognize that personal criteria of beauty are irrelevant and he will select the faces that the group will most likely select, by trying to predict the average opinion. Furthermore, the way the theory works can basically be described as a way of finding the bigger fool who is willing to pay more for the investment as the crowd would.
Since the equine market does not yet use formulas to calculate the intrinsic value of a horse I formulated the following hypothesis:

Hypotheses 2: Investors behavior at horse auctions can be described with the castle-in-the-air theory.

Founding this hypothesis, another chapter of finance can be discussed, the behavioral finance which is a paradigm where financial markets are studied based on psychologic influences. The two main parts of behavioral finance are cognitive finance, which refers to how people think, and the limits to the arbitrage, predicting in what circumstances arbitrage powers will be efficient. (Ritter, 2003) A publication of 2004 by Esther-Mirjam Sent called "Behavioral Economics: How Psychology Made Its (Limited) Way Back Into Economics." exhibits the change in economics showing that with more psychological understanding the economical behavior can be described, concluding that there is an upcoming trend in the field of behavioral economics. (Esther-Mirjam Sent, 2004)

II.III The CAPM versus DCF

Research regarding hedonic pricing proposed the hypothesis that consumers value goods based on their individual attributes, as goods can be considered as bundles of those. (Lancaster, 1966) Earlier research from 2006 regarding Show Quality Quarter Horse auctions found that by including several characteristics of horses, such as genetics and performance, can significantly impact selling prices at horse auctions. (Mykel R. Taylos, 2006) This research proofs that using an economic model can help detecting horse prices, by defining horses as a consumer good. While Mykel R. Taylos and his team proofed horses being a consumer good, their research does not determine if horses can signify more for the world economics. For the consumer, the bought goods do have an emotional value but do not provide any monetary value for the buyer. Even though this condition is satisfied by a part of the equine sector, especially warmblood horses are breed to provide monetary value and be traded over the world market. Concluding warmblood horses, which will provide an increase of the owner's fortune, are not just consumer goods. Nevertheless, so far no research verified the real economical definition of horses at a horse auction.

An investment is an asset or item purchased with the ambition of that it will generate income in the future.

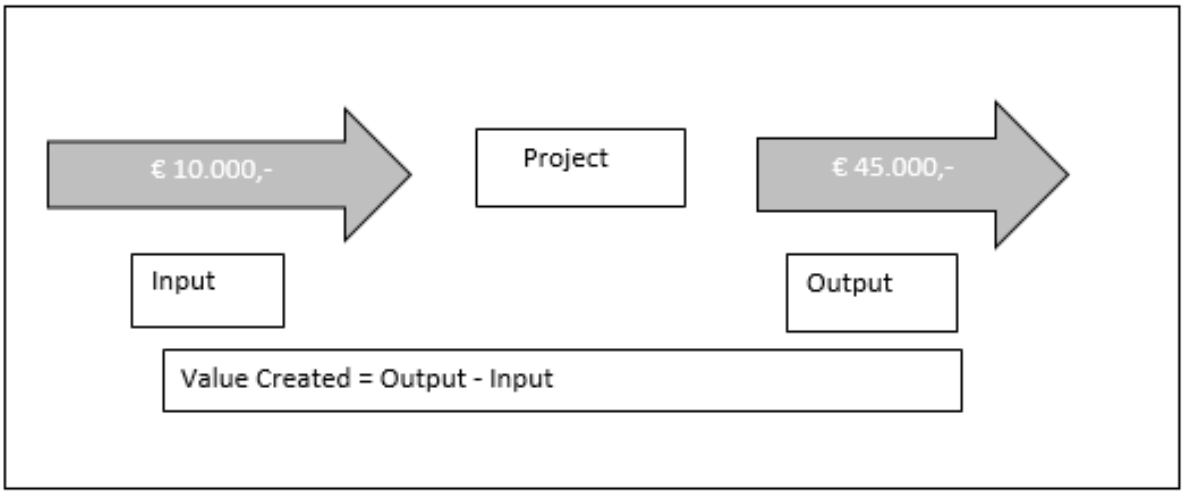


Figure 2 Investment Evaluation

To analyze project and firm valuation the investment cash flow has to be defined. According to Sheridan Titman and John D Martin, cash flows received at different times have different values, therefore need to be adjusted for the time value of money. (Sheridan Titman, 2007)

(1) DCF Formula

$$Value = \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \cdots + \frac{CF_\infty}{(1+i)^\infty} = \sum_{n=i}^{\infty} \frac{CF_n}{(1+i)^n}$$

Where

CF = Cash flow

i = discount rate

n= time periods from one to infinity

Titman and Martin found a three steps approach to perform a discounting cash flow analysis, where firstly, the amount and timing of future cash flows has to be found. *"How much cash is the project expected to generate and when?"* Secondly the estimates risk-appropriate discount rate has to be defined before the third step, discounting the cash flows can be started.

Beginning with the first step, defining the cash flow, several details have to be considered, following Titman's and Martin's approach. The relevant cash flow or the incremental cash flow, which are directly generated by the investment itself as well as indirect effects on firm's other lines of business. While hereby a scenario is described where an investment in a firm creates cash flow, the effects on other business lines should thoroughly been considered, however applying this theory on horses limits this approach to only directly generated cash flows, as there are no other business lines which can be directly affected by a horse's cash flow.

To be able to calculate the future value with assistance of the DCF formula, the relevant cash flows have to take place continual in the course of the years. Determining this limitation, the type of horses that can fulfil this requirement, emerges. While mares and gelding only produce inconsistent cash flows, if they produce cash flows at all, there is one type of horses left. Given this potential limitation I formulate a hypothesis about the effect of the sex of a horse on the possibility to characterize it as an investment.

Hypotheses 3: Only licensed stallions are profitable investments

Another approach to define horses and the auction market is in comparing them with the security market, as a consistently evolving market that serves the needs of traders. The most famous model to determine a theoretical appropriate rate of return is the capital asset pricing

model (CAPM) which is built on the Markowitz mean-variance-efficiency. (French, 2004) The model is tributary to certain limitations as; the risk-averse investors care only about expected returns and the variance of the return(risk). Only efficient portfolios are chosen by investors, giving the expected return with a minimum variance and the maximum return with the given variance. Furthermore, the market is defined as efficient regarding to the Efficient Market Hypotheses (EMH), developed by Professor Eugene Fama, assuming that stocks and securities always trade at their fair value and it is impossible to outperform the market. The only way to obtain possible higher returns is by considering a riskier investment. Further, all investors agree on being able to borrow or lend, without any limitation, at a risk free rate. This phenomenon is described with the Security Market Line in the following figure, where the blue line illustrates the risk free rate (R_f), the x-axis represents the variance of the return, also described as the risk, (β) and the y-axis represent the expected return ($E_{(ri)}$).

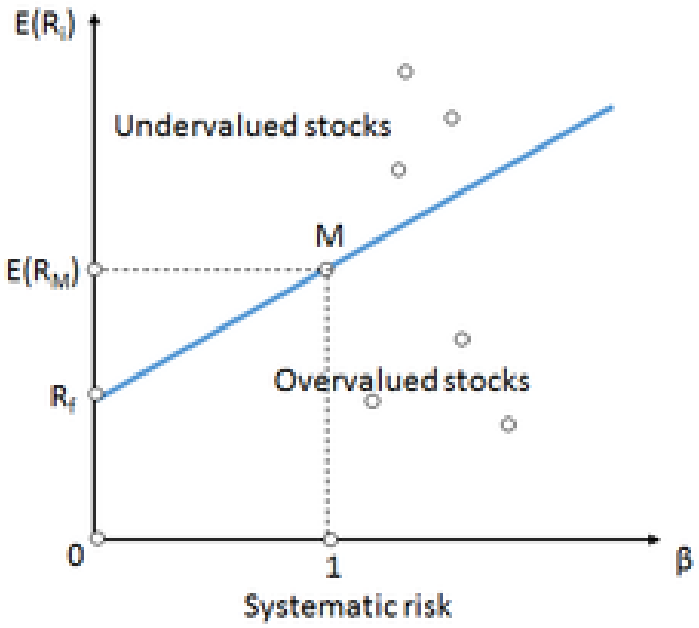


Figure 3 The security market line

All stocks above the security market line tend to be undervalued and vice versa, all stocks beneath it tend to be overvalued.

(2) CAPM Formula

$$R_i = R_f + \beta_i(R_m - R_f)$$

Where

R_i= Return on Asset i

R_f= Return in Risk Free Asset

β = Covariance of Asset and the Market Divide by Variance of the Market

R_m= Return on Market Portfolio

Applying the CAPM formula for the equine market inquires to dismantle the formula in the different components. Firstly, and most easily, the risk free rate, which is the theoretical rate of return on an investment with zero risk is common to be described with the rate of US government bonds. (Damodaran, 2008) Secondly, the beta which is a measure of volatility of a security in comparison to the market, calculated as follows.

(3)

$$\beta = \frac{Cov\ (r_a, r_b)}{Var(r_{b)}}$$

Where

Cov = Covariance of the operators

Var = Variance of the operators

Different outcomes of the beta can be explained as follows:

Value of Beta	Interpretation
β < 0	The assets movement is in the opposite direction of the benchmark
β = 0	The assets movement is uncorrelated to the benchmark
β > 0 to 1	The assets moves in the same direction, but in a lesser amount than the benchmark
β = 1	The assets moves in the same direction and in the same amount as the benchmark
β > 1	The assets moves in the same direction, but in a greater amount than the benchmark

Table 2 Interpretation of Beta

Given this definition my hypothesis is:

Hypotheses 4: Depending on the β of different types of horses, prices tend to increase/ decrease

The third variable to calculate the return on a risk free asset is the expected return on the market portfolio, described as a simple weighted average of expected returns of the individual financial assets. (Pennacchi, 2008) With regard to the different variables of the formula which are not oblique to specific characteristics of horses, I formulate the following hypotheses.

Hypotheses 5: The expected returns of jumping horses can be calculated by using the CAPM formula

IV Results

Discussed in this section are the main variables, which were utilized to determine the way of valuing horse at auctions, were the performance and the price for the entire analysis. The performance was measured, based on international standards for the dressage and show jumping sport, with 1 being the lowest and 7 the highest class that can be reached.

IV.I Over- or undervaluation?

Hypothesis 1: There can no statement been made about investors tending to over- or undervalue horses during auctions.

The first hypothesis stated that there can no such statement been made about investors at horse auctions tend to under or overvalues the investments. In order to proof the hypothesis nine years of auction data from the Holsteiner saddle horse auction was collected, where the at the moment of the auction paid prices of the investments were compared with the actual/ highest international performance. (Appendix B) The data set showed that out of the 254 sold horses only 76 had relevant international sport performances, which indicates a price performance ratio of less than 30%. The auction price in all nine years range between € 6.500, -, which was the lowest price in the year 2005 and € 92.000, - paid in 2007. In order to support the hypothesis, the different performance groups were summarized in two main groups, based on the international understanding in the equine sector, described in the following table.

Grand Prix	International Basis
1.60m	1.45m
1.55m	1.40m
1.50m	1.35m
	1.30m

Table 3 The two groups of sport horses

Further, the average price of horses in each categorie was calculated, where the average price for a grand prix horse is € € 39.083, - and for the international basis horse €26.556, -

Consequently, the investigation reveals that out of the 12 grand prix horses only two were correct valued, considering a range of +/- €2.000, -. More than half of those horses were overvalued, where certain investors paid more than twice as much as the average. Subsequently, 4 horses remain undervalued with the lowest price paid in 2008 which was more than 70% under the average. Generally speaking, more than the half of the investors in grand prix horses are overvaluing their investments.

Secondly, the same analysis was made regarding the in this data set 64 international basis horses. Calculating the average price, a benchmark of € 26.556, - was found where 20 horses where correct valued, again considering a range of +/- €2.000, -. With 37 horses, nearly 60% was undervalued, remaining 7 overvalued horses with the most expensive on costing € 72.000, - which is twice as much as the average.

Remaining are 178 sold horses that have no international references, assuming that all international horses should be found in the HorseTelex database would lead to the conclusion that al non performing horses are overvalued. As the reliability of the database is not 100% due to the fact that the systematical gathering of international performances started in 2014, further research should be conducted regarding those "non performing" horses. Therefore, the focus was laid on the grand prix and international basis horses. Summarizing the earlier analysis, 60% of the international basis horses were undervalued, 10% overvalued and 30% correct valued. Compared with the grand prix horses where 50% of the horses were overvalued, around 15% correct valued and the remaining 35% undervalued. Concluding that, with using the average price as a benchmark, grand prix horses tend to be over- and international basis horses to be undervalued. Which leads to the disapproval of hypothesis 1 as it is possible to make a statement about the tendency of the investors valuing at horse auction.

IV.II Building a castle in the air

Hypotheses 2: Investors behavior at horse auctions can be described with the castle-in-the-air theory.

Analyzing the results of the interviews with different professional investors in the equine sector demonstrated the way of decision making during a horse auction, and indicated which investment theories are applicable for the auction market. (Appendix A) All agreed that bidding at a horse auction is highly emotional and even business man get excited and nervous which leads to overbidding their own maximum price and overpaying. Further, it was clearly indicated that the price paid for a horse does depend more on what a buyer will pay for it, as on mathematical calculations. Even if an intrinsic value can be calculated, independent of it is based on the costs or the future cash flows, the emotional value which one particular investment can have for an investor determines the final price.

The results of the auctions clearly indicate that there is no measurable relationship between the paid price during an auction and the later international performance. Further, the sum of non-performing horses is remarkably high. Table 1 presents the different performance levels of sold horses during nine years of the Holsteiner saddle horse auction, where 0 is no international performance and 7 is the highest level that can be reached. (Appendix C) The numbers between the year and the performance level, indicate the amount horses in each year that reached a certain performance.

Auction year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Different performance levels									
0	28	31	19	10	27	18	15	14	16
1	2	1	3	4	0	1	7	1	2
2	0	1	0	4	2	0	2	2	4
3	0	0	0	2	1	5	2	6	1
4	0	0	0	1	1	0	5	2	2
5	0	0	2	1	1	2	0	0	0
6	0	0	0	1	0	1	0	0	0
7	1	0	3	0	0	0	0	0	0
Total amount of sold horses	31	33	27	23	32	27	31	25	25
% without performance	**90%**	**94%**	**70%**	**43%**	**84%**	**67%**	**48%**	**56%**	**64%**

Table 4

Even if a certain trend was recognizable, where the percentage of sold auctions horses without an international performance decreases by 30% between the years 2006 and 2013, the number of non-performing horses was still higher. Also significant was that the number of horses that reached the highest level of the international sport was tremendously low and the upwards trend of international performing horses does not influence the high class horses.

Subsequently, those statistical results surely indicate that the prices of the sold horse depend on other than mathematical values. Emotions as joy, anticipation, excitement but also pride and arrogance can influence the investors behaviour in a crucial way. Especial the emotions arrogance and pride were most relevant during the Hannoveraner stallion auction in 2015, were two big investors, Andreas Helgstrand and Esben Möller both Denish man, were bidding on the champion of the dressage stallions. During 20 minutes of bidding both proud businessman kept overbidding each other until Esben Möller stopt after Helgstrands bid of €1.200.000, -. With the second expensive horse of € 220.000, - professionals agreed that there was surely no lasting correlation between the quality of the horse and the paid price. Assuredly, indicating

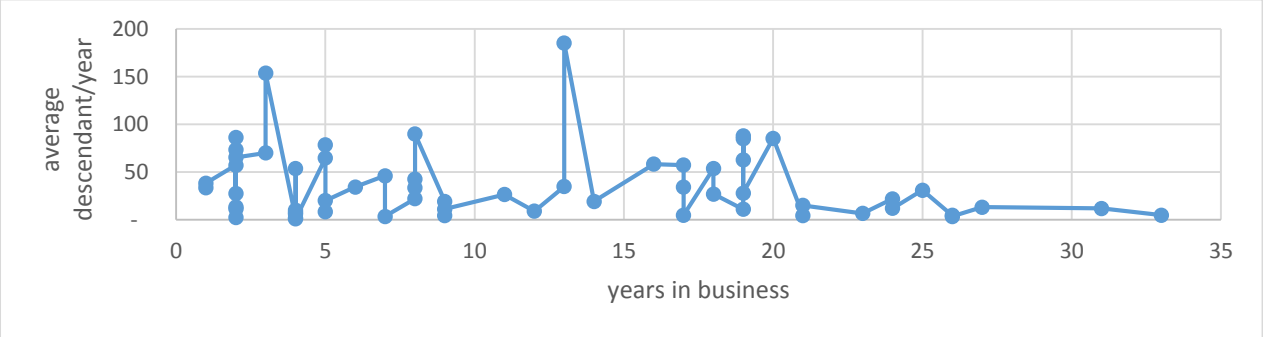
the castle in the air which Helgstrand and Möller build during their 20 minutes of fame. (Versluis-Borsboom, 2015)

Consequently, the results of the interview, the statistical research and the most relevant example at the Hannover stallion licensing, indicate that a relationship between John Maynard Keynes Castle in the air theory and the equine market exists, which proofs and support hypothesis 2

IV.III The profitability of stallions

Hypotheses 3: Only licensed stallions are profitable investments.

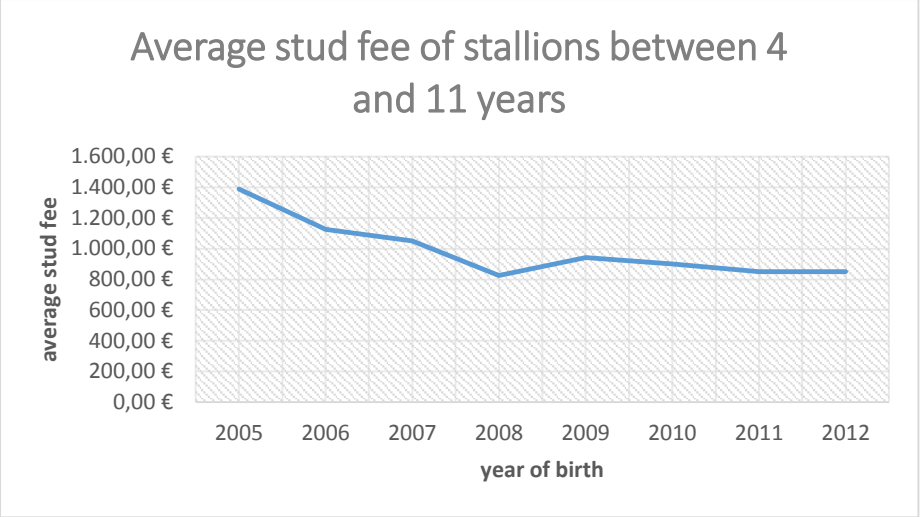
The third hypothesis established in a previous section stated that only licensed stallions can be profitable investments, as mares and geldings are not producing cash flows on a regular basis. In order to test the hypothesis 60 young and old warmblood jumping stallions of the KWPN studbook were randomly chosen and compared with each other. Data as the year of birth, years in business, total descendants and the stud fee was collected as crucial information for the further analysis. Furthermore, the average descendants per year were determined, being an important variable for the whole analysis. Additionally, the DCF formula was tested at mares, using foal prices as a cash flow.



Graph 1 Descendants per business year

Graph 1, created based on the earlier described data, indicates that the average descendant per year in relation with the years in the breeding business, is not correlated to each other. Considering this phenomenon, the average descendant per year which is 36, computed out of all 60 stallions disregarding their age of years in business, is used in the further analysis and calculations.

Further, the average stud fee of a young stallion, younger than 11 years, was calculated, using data from 25 young stallions, and resulted in and average stud fee of €908,33. (KWPN, 2016)



Graph 2 Average stud fees of young stallions

As described in graph 2 the average stud fees of young stallions are between € 850, - and € 1.387,50 per year, growing steadily with the age of the stallions. This growth is per stallion oblique to different variables, such as breeding value, sport performance and other characteristics. The low point for the year 2008 is an exception in the graph and therefore disregarded in the further analysis, as the whole picture describes a steady growth line.

year of birth	2005	2006	2007	2008	2009	2010	2011	2012
average stud fee	1,387.50 €	1,125.00 €	1,050.00 €	825.00 €	941.67 €	900.00 €	850.00 €	850.00 €

Table 5 Average stud fees compared with the year of birth

Table 2 indicates the average stud fee between the years 2005 and 2012, based on different jumping stallions of the KWPN studbook, which were considered to indicate the real stud fees and used in the further analysis and calculations.

In order to calculate the basis value of 3-year-old warmblood jumping stallion at an auction, based on the cash flow the stallion can produce in it's first year, directly after he got licensed, a common way of valuing investments is used.

(1) DCF Formula

$$Value = \frac{CF_1}{(1+i)^1} + \frac{CF_2}{(1+i)^2} + \cdots + \frac{CF_\infty}{(1+i)^\infty} = \sum_{n=i}^{\infty} \frac{CF_n}{(1+i)^n}$$

Where

CF = Cash flow

i = discount rate

n= time periods from one to infinity

Firstly, the cash flow per year had to be calculated, assuming that a stallion can have two different ways of producing cash. Firstly, a stallion's semen can be sold which is already discussed earlier in this section. Secondly, a stallion can produce cash with competing at horse shows. The second way of producing cash flows is disregarded in the further analysis as there is no reliable data base where sufficient data can be found. Regarding to the earlier analysis where a stallion has an average of the 36 descendants per year and the stud fee of €850, - keeps the same in the first two years, the yearly cash flow for the first business year of a stallion was computed as follows.

(2) Yearly Cash flow (in the first business years)

$$CF = 36 \times €850 = €30.600,-$$

Secondly, the discount rate is detected out of the average stud fees of stallions between 2012 and 2000, calculating the ratio between the stud fee of one year and the following. (Appendix E). This calculated discount rate is oblique to changes in the average stud fees, which can appear due to changes in the world economic, thinking of times as crises, recession, expansion or bubbles. Surely, changes in the volatility of the market do also influence the discount, wherefore the following analysis is performed with the calculated discount rate of 3,2% and a100 basis point higher one, to show the impact of the discounting rate and consequently the impact of the economic conditions.

Having the discount rate of 3,2% competed one variable, the time, is left which depends on the used quantity of cash flows. As with this calculation, the basis price of a three-year-old stallion was computed, based on his first breeding year, only the first year was discounted. Having all needed variables, the basis price of a 3 years old licensed stallion, using the cash flow of the first years, was calculated as follows

(3) Basis price of a 3-year-old licensed stallion

$$PV = \frac{CF_n}{(1+i)^n} = \frac{€30.600}{(1+0{,}032)^1} = € 29.651$$

$$PV(4{,}2\%) = \frac{€30.600}{(1+0{,}042)^1} = € 29.423$$

Concluding, that the basis price of a two-year-old stallion, irrespectively of other characteristics has to be € 29.651, -. To receive a more specified value per stallion those characteristics have

to be formulated in a mathematical kind of way, which is not part of this research. A way of including these variables is introduced at a later point.

For receiving a precise discounted value of a stallion, more specified values are used in another calculation, where not the basis price of a 3-year-old stallion is calculated, but the discounted value over his whole lifetime. Therefore, the average period of a stallion producing cash flows, had to be detected. Due to the technological progresses this period keeps growing and stallions can produce descendants even after their death. Assuming, to be able to introduce this second approach of using the DCF, the time during which a stallion can produce descendant is 8 years. (Appendix A) Using the already computed discount rate of 3,2 % one variable is left to be defined, the yearly cash flows. Referring therefore to table 1, where the average stud fees of a stallion compared with the year of birth is displayed. Further, using those averages and the earlier calculated average amount of descendants per year, which is 36, to calculate the yearly cash flows, displayed in table 2

year of birth	2005	2006	2007	2008	2009	2010	2011	2012
average stud fee	1,387.50 €	1,125.00 €	1,050.00 €	825.00 €	941.67 €	900.00 €	850.00 €	850.00 €
yearly cash flows	49,950.00 €	40,500.00 €	37,800.00 €	29,700.00 €	33,900.00 €	32,400.00 €	30,600.00 €	30,600.00 €

Table 6

(4) Lifetime value of a licensed warmblood jumping stallion

$$PV = \frac{€30.600}{(1+0{,}032)^1} + \frac{€30.600}{(1+0{,}032)^2} + \frac{€32.400}{(1+0{,}032)^3} + \frac{€33.900}{(1+0{,}032)^4} + \frac{€29.700}{(1+0{,}032)^5} + \frac{€37.800}{(1+0{,}032^6} + \frac{€40.500}{(1+0{,}032)^7} + \frac{€49.950}{(1+0{,}032)^8} = € 251.114,-$$

discount rate	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**PV**
0.032	48,401.16 €	38,027.31 €	34,391.63 €	26,184.10 €	28,960.18 €	26,820.50 €	24,545.03 €	23,783.94 €	**251,113.85 €**
0.042	47,936.66 €	37,300.92 €	33,410.94 €	25,193.33 €	27,596.95 €	25,312.71 €	22,942.85 €	23,783.94 €	**243,478.31 €**

Table 7 Calculating the PV with different discount rates

Table 7 displays the value of a licensed warmblood stallion calculated with two different discount rates, one being the earlier detected 3,2 %, the other the 100bp higher 4,2% which indicates a bigger difference between the stud fees of each year and more volatile market. Concluding that, how bigger the positive difference between different stud fees, the less value has one individual stallion.

Consequently, to proof the hypothesis that only stallions can be profitable investments, the same method of valuing an investment is applied on mares as well. Again, firstly the yearly cash flow of a mare has to be defined. There is one measurable way a mare can produce a cash flow, which is through breed foals. Naturally a mare can produce one foal per year, new techniques as embryo transplantation makes it possible for a mare to have more than one descendant per year, but as this is a relatively new development and not yet used throughout the whole sector, it is disregarded in the further analysis. For the well-being of a mare it is advised to breed a foal once every two years. (Appendix A) To identify the yearly cash flow, the average foal price was determined out of auction prices from 97 foals, which computed a yearly cash flow of € 6.481,25 (Holsteiner Verband, 2016)

Second and thirdly the discount rate is necessary for using the discounting cash flow formula and the maturity of the investment has to be discovered. As discovered earlier a mare has one foal every two years, with an average lifespan of 15 years a mare can have around 7 foals in her life. To make the results more comparable the discounted value of a 3-year-old mare is calculated. For simplification the same discount rate as in the stallion calculation is used which gives the following equitation.

(5) Lifetime value of a mare

$$PV = \frac{CF_n}{(1+0{,}032)^n} = \frac{€6.481{,}25}{(1+0{,}032)^1} + \frac{€6.481{,}25}{(1+0{,}032)^3} + \frac{€6.481{,}25}{(1+0{,}032)^5} + \frac{€6.481{,}25}{(1+0{,}032)^7} + \frac{€6.481{,}25}{(1+0{,}032)^9} + \frac{€6.481{,}25}{(1+0{,}032)^{11}} + \frac{€6.481{,}25}{(1+0{,}032)^{13}} = € 36.681$$

Additionally, to the calculated life time value of both a stallion and a mare, for the support or disapproval of hypothesis three the yearly costs of those investments were deducted from the total. Based on practical experience of different professionals, the average yearly costs of a sport horse are €12.000, -. (Loo, 2014) This statement was proved with the following calculation, using numbers from the benchmark of the Dutch equine sector in 2015. (University, 2015)

Training	€ 500
Stable costs	€ 350
Other costs (e.g. vet, farrier)	€ 150
Total	**€ 1.000**

Table 8 Monthly costs of a sport horse

Consequently, to proof the profitability of both investments, the following calculations were made, by deducting the total costs from the earlier calculated life time value, based on the following equitation.

$$profit = income - costs$$

Accordingly, to the earlier calculated life time value, the duration of the investments were 8 years for the stallions and respectively 13 years for the mares.

Profitability of a stallion

$$profit = 251.114 - (8\ x\ 12.000) = 155.114$$

Profitability of a mare

$$profit = 36.681 - (\ 13\ x\ 12.000) = \ -119.619$$

Comparing the calculated lifetime value and the profit of a stallion with the one of a mare, indicates that while both mares and stallions can produce cash flows, the profitability of a stallion is much higher. Even stronger, while stallions were profitable, mares were according to this calculation a bad investment and cause huge losses, which leads to the support of hypothesis 3

IV.IV Beta as a price indication?

Hypotheses 4: Depending on the β of different types of horses, prices tend to increase/ decrease

The impact of the average auction price on a certain type of horses was tested by the introduction of the variable β, which is normally used as a measure of the volatility of a portfolio or security compared with the market. As calculating a beta for a horses as an asset is not a common method in the equine sector, two different approaches to find beta's were applied using the first approach for calculating a beta of each horse asset, and the second one to calculate a beta for the whole market.

Therefore, the average price is calculated for each auction and of each type of horse per auction year. (Appendix E) For the further analysis the auction defines the whole market, consequently each horse type defines a particular type of asset. In the conducted analysis the beta for each asset was computed by calculating the covariance with the return of the asset itself and the market returns, divided by the variance of the asset returns. Therefore, the average price per horse/asset was calculated per auction year and then used to compute the return percentage by dividing the price of one year by the price of the previous year, receiving the following returns.

	JG		JM		JS		Avergage	
2015	€ 20.281,25	91,36%	€ 28.166,67	142,39%	€ 0,00	0,00%	€ 21.340,00	94,17%
2014	€ 22.200,00	165,81%	€ 19.781,25	96,49%	€ 0,00	0,00%	€ 22.660,00	125,31%
2013	€ 13.388,89	48,69%	€ 20.500,00	96,57%	€ 14.500,00	0,00%	€ 18.083,33	71,44%
2012	€ 27.500,00	105,91%	€ 21.227,27	82,30%	€ 0,00	0,00%	€ 25.312,50	119,25%
2011	€ 25.966,67	67,71%	€ 25.791,67	121,78%	€ 21.000,00	91,30%	€ 21.225,93	79,93%
2010	€ 38.350,00	244,10%	€ 21.178,57	97,50%	€ 23.000,00	156,82%	€ 26.555,56	210,61%
2009	€ 15.710,53	72,51%	€ 21.722,22	123,07%	€ 14.666,67	63,08%	€ 12.608,70	62,43%
2008	€ 21.666,67	90,16%	€ 17.650,00	43,35%	€ 23.250,00	129,17%	€ 20.195,65	72,22%
2007	€ 24.031,25	126,22%	€ 40.714,29	721,52%	€ 18.000,00	24,00%	€ 27.962,96	161,96%
2006	€ 19.038,46	74,77%	€ 5.642,86	34,68%	€ 75.000,00	750,00%	€ 17.265,63	80,66%
2005	€ 25.464,29		€ 16.269,23		€ 10.000,00		€ 21.406,25	

Table 9 Returns of the different securities

(X) calculating the beta of a security

$$\beta_p = \frac{cov(r_p, r_b)}{var(r_p)}$$

The covariance of the asset was calculated by multiplying the correlation between the return percentage of the asset and the return percentage of the market by the standard derivation of each. Further, this number was divided by the variance which measures how far each number in the data set is away from the mean by squaring the difference of each sum and the mean, and then dividing this sum by the number of values in the data set. All these different calculations were done by using the covariance and variance excel formula.

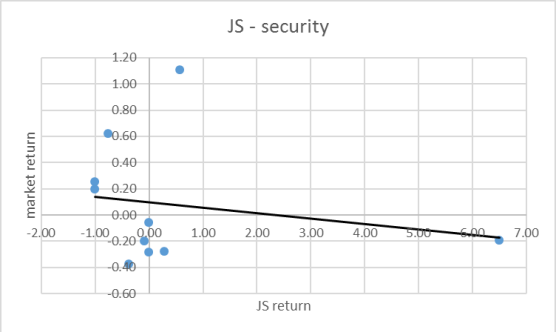
Using the in table 9 displayed returns the following beta were calculated.

JG → 1,1151

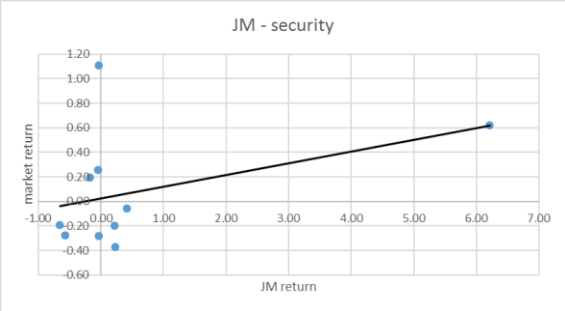
JM → 1,7165

JS → -0,8841

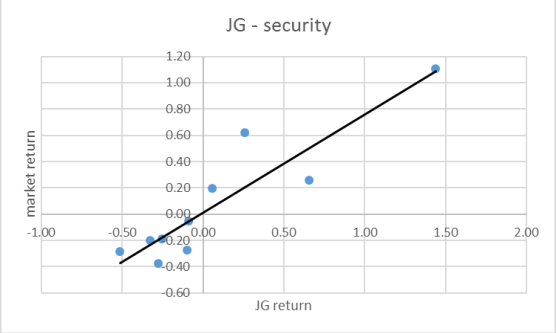
The results indicate that the JG and JM assets with a beta bigger than 1 do move in the same direction as the market, however this movement is in a greater amount for both assets than for the market. Contrary to the relation between asset JG and JM with the market, the JS asset moves in an opposite way. The JS beta, which is lower than 0 indicate that the asset moves in an adverse direction as the market. As the percentage returns of the JS-asset, in the years 2012 until 2015, were zero, the beta of this asset was highly influenced by that Graph three to five further empathizes the calculated beta with indicating a trend-line for each of the 3 different assets.



Graph 3 Trend line of the JS security



Graph 4 Trend line of the JM security



Graph 5 Trend line of the JG security

Secondly, the alternative approach was applied, where the average asset price was correlated with a the AEX index. Therefore, the monthly AEX prices of the years 2005 until 2015 were gathered and analyzed. To have comparable numbers, the monthly prices per year were averaged, resulting in eleven different year prices. As described earlier in this section, the average prices of all sold horses during each auction year were already calculated. Further, the returns of both, the AEX index and the auctions, called in the further analysis AAH, were computed.

	AEX	AAH	return AEX	return AAH
2015	467.72	€ 21,340.00	0.1432	-0.0583
2014	409.14	€ 22,660.00	0.1158	0.2531
2013	366.69	€ 18,083.33	0.1397	-0.2856
2012	321.74	€ 25,312.50	-0.0266	0.1925
2011	330.54	€ 21,225.93	-0.0019	-0.2007
2010	331.17	€ 26,555.56	-0.2611	1.1061
2009	448.16	€ 12,608.70	0.1621	-0.3757
2008	385.64	€ 20,195.65	-0.2641	-0.2778
2007	524.07	€ 27,962.96	0.1242	0.6196
2006	466.19	€ 17,265.63	0.2059	-0.1934
2005	386.60	€ 21,406.25		

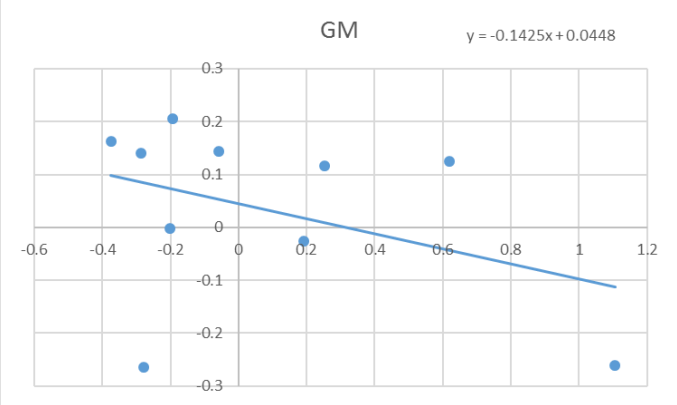
Table 10 AEX index versus AAH

Correspondingly, the beta was calculated, by again dividing the covariance of the market in correlation with the asset, by the variance of the market.

(X) calculating the beta of an asset

$$\beta_p = \frac{cov(r_p, r_b)}{var(r_p)}$$

Another common way to calculate the beta is using the slope of the linear trend line, which is the correlation between the benchmark returns and the asset returns. Undoubtedly, testing both ways, a beta of -0,1425 was computed. Certainly indicating that the asset moves in the opposite direction of the benchmark, also displayed in graph.



Graph 6 Trend line of the AAH

Consequently, the findings show that the prices of jumping horses, seen as asseta, are in negative correlation with the total AEX index and are therefore in decreasing when the AEX is increasing and vice versa, which can finally support hypothesis 4 and lead to answer hypothesis 5.

IV.V Horses and other securities

Hypotheses 5: The expected returns of jumping horse can be calculated by using the CAPM formula

The fifth and last hypothesis established in a previous section stated that all types of horses, irrespectively of their characteristics, can be compared with a financial asset and therefore their expected returns can be calculated with the CAPM formula. In order to test this hypothesis, the data-set, used to support hypothesis 4, was analyzed. Further a common model, the Capital Asset Pricing Model, which is used to price securities and other assets with describing the relationship between risk and return, was converted and applied on different horse types.

(X) The Capital Asset Pricing Model

$$R_i = R_f + \beta_i(R_m - R_f)$$

Where

R_i= Return on Asset i

R_f= Return on Risk Free Asset

β= Covariance of Asset and the Market Divide by Variance of the Market

R_m= Return on Market Portfolio

The first variable that had to be determined is the return on a risk free asset, an asset with zero risk, which practical does not exist as every investment carry a smaller or greater risk. Practically, to be able to use the CAPM, investors assume that the risk free rate is equivalent to 3 month U.S. Treasury bond which yields at this moment 0,30% and did move just a few basis points in the previous months. As this rate is tremendously low and had vinous impact on the calculation, it was adjusted to 4%. This adjustment which increased the risk free rate by more than 100%, was based on two different, but both with the same importance, variables that influence the market. Firstly, the inflation rate, desired to be between 1 and 2 %, was taken into account to give a proper indication of the risk free rate. Further, the long term average of the 3 month U.S. treasury bill, which is at this moment 4,49% was considered to be a better and more

valid indication of a risk free rate. To adjust for both, the inflation and the average risk free rate, it was supposed that the risk free rate in the following calculations is 4%.

Secondly, the beta as the covariance of the asset and the market divided by the variance of the market was determined, as described in the results that supported hypothesis 4, giving the following beta for three different assets and the beta of the total market.

JG → 1.1151

JM → 1.7165

JS → -0.8841

AAH → -0.1425

Thirdly the return on the market portfolio had to be discovered. Therefore, the returns on the market from all eleven auctions were used and averaged, which indicated the return on the market portfolio as 7,80%

	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
market return	-5.83%	25.31%	-28.56%	19.25%	-20.07%	110.61%	-37.57%	-27.78%	61.96%	-19.34%

Table 11 market return per auction year

By adjusting the CAPM formula for each asset, the different expected returns were calculated as follows.

(X) Expected return JG-asset

$$R_i = 0{,}04 + 1{,}1151(0{,}078 - 0.04) = 0{,}08 = 8\%$$

(X) Expected return JM-asset

$$R_i = 0{,}04 + 1{,}7165(0{,}078 - 0.04) = 0{,}11 = 11\%$$

X) Expected return JS-asset

$$R_i = 0{,}04 - 0{,}88(0{,}078 - 0.04) = 0{,}01 = 1\%$$

X) Expected return AAH

$$R_i = 0{,}04 - 0{,}1425\ (0{,}078 - 0.04) = 0{,}0346 = 3\%$$

The calculated expected returns show that the JM asset has the highest return and the JS the lowest, which is a consequence of the different beta. Computing the expected returns with using

the risk measure of the total market, indicates an expected return of 3%. Concluding that an expected return can be calculated, the usability of this formula in the equine auction sector was discussed with professionals, who concluded that there is no such measure as an expected return applicable. Their experience showed that disregarding the type of horse, the return can be sometimes more than 100% as well as negative. Therefore, hypothesis five is rejected which indicates that in practice, expected returns of horses can't be calculated with the CAPM formula.

V Discussion

In this section, certain results of the research are discussed and further elucidated. Further, a suggestion for future research is given.

The purpose of this research was to further explore the possibilities of comparing the equine auction market with either the investment or stock market. Given the existence of a conflict with finding a correlation between the paid price for a horse and the actual sport performance, the study was also intending to explain how it is possible and with which investment theory equine investors approach the market. With two different data sets and a number of interviews with professionals I tested five hypothesis concerning the question if financial analysis can make pricing at horse auctions more eligible. Therefore, I tested two different existing financial models, where one is used to value investments and the second to value assets.

The results show that not every type of horse can be a profitable investment, consequently supporting the statement of Sheridan Titman and John D Martin that investments need relevant cash flows to be approached with the discounting cash flow formula. A potential explanation for finding that not only stallion can be profitable investments is that not the price money but only stud fees and sold foals where considered to be a cash flow. Even though famous sport horses could have produced enough price money that it can be considered as a relevant cash flow, taking the total population would have contradicted this finding.

As already stated in an earlier section, while introducing the discounted cash flow formula, different characteristics as pedigree, exterior, gender and performance measures, were not taken into account. To estimate a more specified value for an individual horse, those characteristics need to be translated into different variables. Therefore, I want to refer to an earlier research conducted in 2006, where price determinants of Show Quality Quarter Horse Auctions were analyzed and translated to a mathematical formula. (Mykel R. Taylos, 2006) In a future research, based on both publications, a more specified formula could be acquired.

Further, the introduction of the CAPM model, with which the expected return of an asset can be calculated, resulted in two different ways to include the volatility of the asset in comparison with the market. In the first approach each type of horse was seen as a different asset, calculating the beta of each in comparison with the average horse price during the auction,

receiving three different more or less volatile assts. In the second approach a beta of the whole market, including all three different types of assets was calculated by comparing it with the AEX index, which is a common way to calculate a stocks beta. Contrasting to the first approach which indicates that the JG and JM asset move with the market, the second approach indicated that the equine market moves in the opposite direction, if the AEX changes. Both approaches resulted in measurable numbers and an expected return, which regarding to professional opinions, is not usable in the equine sector. Repeating this statistical research with a bigger data set, compiled out of more years of auction data could conclude in a more specified beta and could lead to the support of hypothesis five. Future research should be conducted to discuss the suitability of both approaches which should conclude in one compatible calculation method.

VI Limitations

In this section the limitations of this study are examined and the impact of those restrictions on the research is explained.

The presented study is subject to several limitations. First, the data used to test the proposed hypothesis included just a small number of European warmblood horse auctions. The data-set was constructed out of well-known and high classed auctions. Consequently, the results give a limited picture of the total market, as the standard of the auction, hence the horse ranged in a higher price level. If this research was conducted with a bigger and more diverse data-set stronger hypotheses would be established. Nevertheless, I believe that even though the data-set does not represent the whole market, the results still help to broaden the understanding about price forming of horses and to professionalize the auction market.

Secondly, another potential issue is that different data, such as those from eventing horses, was not considerate to equal the data. Furthermore, the data used for the DCF-model obtained only data from jumping horses from the leading studbooks in the world. The available data of dressage horses is limited as the whole market is much smaller, hence the prices range higher and are not comparable with those of the jumping horses. Although, I believe that the model is as applicable for dressage horse as it is for jumping horses, further research regarding this topic would proof that.

Another issue with the DCF model is, that it includes relevant cash flows that have to take place continual in the course of the years. First of all, the cash flows of a horse needed to be defined by conducting a smaller research on this topic. There are three possible ways for a horse to produce a cash flow, firstly, the semen of stallions can be sold, the fee for that, also called stud fee, can be described as a relevant and continual cash flow. The second way is winning price money during competitions, which is possible for mares, geldings and stallions. As winning price money is not predictable and does not take place continual during the year, it is no relevant cash flow and can't be used for the calculations. Thirdly a mare can produce a cash flow by giving birth to a foal, which can then be sold. The same problem, as with the price money appears, it is an unpredictable and not continual cash flow, and therefore, it can't be used as a relevant cash flow for the calculation.

Further, it needs to be mentioned that, again for the DCF-model, the average numbers were detected out of a limited number of Dutch Warmblood stallions. From the 60 stallions, 25 (42%) were younger than eleven and 35 (58%) older. While collecting this data, the phenomenon appeared that by keeping the ratio between young and old stallions the same, the averages do not change after a total of 50 observations. Conducting this research in a less limited way, by using data of stallions from other studbooks, the results could slightly be different. Nevertheless, I believe that this limited data set does give an adequate impression of the whole sector.

Also the research and analysis of CAPM formula, used to calculate the expected return of an asset, was limited by different factors. Firstly, regarding to a limit amount of time, the collected data set contained only horses from the Holsteiner saddle horse auction in the years 2005 until 2015. As the Holsteiner studbook is mainly breeding jumping horses, there was not enough reliable information about other types of horses, such as dressage and eventing horses. Furthermore, there was limited data about the JS-asset which made the calculation for this horse type less reliable. A more comprehensive data set with all different types of horses would have provided enough information to test the hypothesis on different horse types and improved the reliability of the results. Nevertheless, even if a bigger data set would have provided more reliable information, I believe that this would not have influenced the disapproval of hypothesis five.

Additionally, the held interviews were limited as exclusively two professionals were surveyed, exposing sufficient information to support the hypotheses. With a larger number of interviews, more specified and reliable information could have been found. Disregarding the small number of held interviews, I believe that no significant other opinions would have been revealed.

VII Conclusion

In this section are the conclusions described which were developed at the end of the research project. Further, and advice for future and current investors is given

This study was inspired by the seemingly incorrect valuation of investments during equine auctions and the fact that the investments are not valued in a mathematical way. As the results of the conducted limited statistical research show, simply labelling all investments at equine auctions as over-/under- of correct valued does not provide an accurate image. Even stronger, there can no such statement been made at all, as there are at each auction over-/undervalued horses as well as correct valued once.

Like assumed before the research, the results of the interviews proof that equine investor are approaching the auction sector with the "Castle in the Air" theory, which John Maynard Keynes found in 1936 indicating that the price of an investment can't be calculated as it entirely depends on the behaviour of the crowd. Which is a justification for not being able to make a statement about over- or undervaluation, as the crowd is sometimes right and sometimes wrong. Further, at the moment of buying, the investment is correct valued as the crowd agrees on it, however at a later point the valuation could seem less legit. Additionally, the investors behaviour is influenced by several psychological factors and different emotion that appear during the bidding process.

The analysis of the gathered data indicates that not all types of horses can be defined as profitable investments as not all of them do produce enough relevant cash flows. More sophisticated analysis exhibited that only stallions can be defined as one. Further, the interviews indicated that the calculated values were correct. Conversely to the finding that horses can be defined as an investment, it was tested if a comparison between a horse and a security can be made. However, it was possible to calculate a beta, as a measure of risk, and additionally to use the CAPM formula to calculate an expected a return, professionals stated that the calculated values were incorrect. Furthermore, they were convinced that each individual horse has its own return which can't be calculated on forehand

Finally, by testing al hypotheses the main question "Can financial analysis and modelling make pricing at horse auctions more eligible?" was answered. Showing that financial analysis is

possible by defining a horse as an investment. However, the results of the interviews indicated that even with theoretical correct calculated values, pricing at horse auctions won't become more eligible as the investors are behaving following the Castle in the Air theory, meaning that each investment is worth what the crowd is willing to pay for it. Future research about what drives the investors to pay a certain amount for a horse could exemplify the intrinsic motivation, and discover if there is a chance that mathematical calculations can be introduced into the sector, to professionalize and make it more attractive for both current but also foreign investors.

Future buyers should be more aware of the psychological factors that influence them during a horse auction, learning more about their own investment behavior. Therefore, the investment theory they are behaving after, the castle in the air theory, should be carefully studied, knowing how they can apply it and approach the market knowingly with it. Further, the discounting cash flow formula should be taken into account, as it results in measurable numbers and indicates the profitability of their investment. Even if, the sector is now not far enough and not enough reliable data is gathered, additionally to the insufficient research regarding this topic, investors should calculate before bidding for a horse until which price the investment can be profitable and result in future benefits. If all investors knowingly approach the market with the castle in the air theory and additionally calculate the intrinsic value of a horse beforehand, the equine auction market would turn into a more efficient and approachable market.

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IX Appendix

Appendix A: Interview

1) **Have you bought a horse at an auction in the past?**

Ronald Koopman: Yes

Aike Wolfs: Yes

2) **Before you go to an auction, do you study the catalogue?**

Ronald Koopman: Yes, study the catalogue and make a first selection

Aike Wolfs: Most of the time, often make a first selection

3) **Do you attend the presentations before the auction?**

Ronald Koopman: Yes, because you get a better impression of the horses.

Aike Wolfs: Yes, always.

4) **Before you start bidding to you set a maximum price you want to pay?**

Ronald Koopman: Always a maximum

Aike Wolfs: Yes, always

5) **Have you ever bid more than the maximum you set for yourself?**

Ronald Koopman: Yes, in the past more often than now as I became a better business man and business is more important than emotion

Aike Wolfs: Yes, because of the emotion during the bidding.

6) **Before you bid on a horse, which information do you gather?**

Ronald Koopman: Looking on the internet at pedigree information and sport results from the mare lines.

Aike Wolfs: Yes a lot in different databases as Horsetelex and KWPN.

7) **Which feeling do you get while you are bidding?**

Ronald Koopman: a bit nervous,

Aike Wolfs: nervous

8) **Do's the enthusiasm of the crowd influences you while bidding.**

Ronald Koopman: No, I try to think as a business man

Aike Wolfs: I try not to get influenced by it.

9) On which of the following two statements do you agree more?

A) Each horse has its own intrinsic value which can be calculated. If the price is above or beneath this value depends on the condition of the market.

B) Each horse is worth what someone else will pay for it. The price can't be calculated in a mathematical way and depends on the behaviour of the buyers.

Ronald Koopman: I think it is a mix between both statements as of course each horse has an intrinsic value and based on the costs I can calcultat what it should costs. But, if there is no one who wants to pay this price for the horse the consequence is that I have to lower the price.

Aike Wolfs: I think that statement B is correct. I a buyer wants to pay more for a horse as I think its worth, I will for sure sell it for this price. Vice versa if no one wants to pay want I ask for a horse, or what I think its worth, I have to sell it for less.

10) Do you think that you can calculate the price of a horse in a mathematical way?

Ronald Koopman: Yes, I do think. You can easily calculate the costs you have each month or year; this should then be the minimum price for the horses.
Aike Wolfs: No I do not think so, as it depends totally on the emotional value the horse has for the buyer.

11) How many years do you think does an average stallion produce descendants?

Ronald Koopman: I think between 7 and 10 years
Aike Wolfs: I think if you have a look at the total population something around 8 years.

How many descendants do you thing has a stallion in one year, averagely thinking?
Ronald Koopman: something around 50
Aike Wolfs: Probably something between 30 and 40

12) Do you think that horse ares over/under of correct valued at horse auctions?

Ronald Koopman: I think it depends on the auction, bigger auctions and more well-known ones have most of the time higher prices as there are other investors with more money. At those auctions, the prices are most of the time in no relation with the real value and talent of the horses. Probably smaller auctions, such as Veiling Dronten are the once with the most correct valued horses.

Aike Wolfs: I do think that you can make a statement about that. Different auctions value horses in a different way. At well know auctions as Jumping Talent Sale for example, the prices are tremendously high and in my opinion are the horses often overvalued. If you take smaller auctions, were less "rich" investors attend, the valuation seems more accurate and realistic.

13) If you take a three-year-old licensed stallion, disregarding his performance during the licensing and other characteristics, what do you think you such a horse cost?

a) 5000-10000
b) 10000-15000
c) 15000-20000
d) 20000-25000
e) 25000-30000
f) 30000 - +

Ronald Koopman: definetly f
Aike Wolfs: I think f

14) Regarding the cash flows of a stallion, what do you think is its lifetime value?

a) 50000 -100000
b) 100000- 150000
c) 150000-200000
d) 200000- 250000
e) 250000-300000
f) 300000 +

Ronald Koopman: I guess e
Aike Wolfs: Hard to say, probably e

15) Do you think a horse can be compared with a security or stock, concluding that an expected return can be calculated?

Ronald Koopman: I do not think that you can compare a horse with a security. It is a complete other kind of asset. Further I do not think that it is possible to calculate an expected return beforehand. Of course you can think of the return you wish to make but this is less of a calculation, more of a "feeling" you have.

Aike Wolfs: I do think that you can make this comparison. A horse is a living creature and the expected return can change daily regarding to a show performance, the training or the health of a horse.

16) How many foals has an average breeding mare in her life?

Ronald Koopman: Difficult to say as there are some mares having each year a foal and some which are also used for the sport. Those mares start their breeding career much later. If I had a breeding mare I would probably do not breed more than one foal every two years, for the well-being of the horse. If should say a number maybe something around 7 or 8 foals.

Aike Wolfs: With the new technologies as embryo transplantation the number of foals a mare can have surely grew and keeps growing in the future. The "historical" way is having one foal each two years, of course sometimes two after each other and then a stop for the sport or well-being of the mare. I think the average breeding mare has maybe max 10 foals in her life.

Appendix B: Overview 2005-2015 prices and performance

auction year	2005			2006			2007			2008			2009			2010			2011			2012			2013		
	price	perf.	val.	price	perf.	val.	price	perf.	val.	price	perf.	val.	price	perf.	val.	price	perf.	perf.	price	perf.	val.	price	perf.	val.	price	perf.	val.
Horse 1	6,500.00	-	0	7,000.00	-	0	€ 7,000.00	-	0	€ 9,000.00	1.55m	6	€ 9,000.00	-	0	9,000.00 €		0	10,000.00 €	1.30m	1	11,000.00 €		0	8,500.00 €	-	0
Horse 2	6,500.00	-	0	7,000.00	-	0	€ 9,000.00	-	0	€ 10,000.00		0	€ 9,000.00	-	0	10,000.00 €		0	10,000.00 €	1.30m	1	11,500.00 €	1.35m	2	9,000.00 €	-	0
Horse 3	8,500.00	-	0	7,500.00	-	0	€ 10,000.00	-	0	€ 11,000.00	-	0	€ 9,000.00	-	0	11,500.00 €		0	10,500.00 €		0	12,000.00 €		0	9,000.00 €	1.35m	2
Horse 4	9,000.00	-	0	10,000.00	-	0	€ 12,500.00	1.30m	1	€ 12,500.00		0	€ 9,000.00	-	0	12,000.00 €		0	11,000.00 €		0	12,500.00 €	1.40m	3	10,000.00 €	1.30m	1
Horse 5	9,000.00	-	0	10,000.00	-	0	€ 13,500.00	1.30m	1	€ 13,000.00	1.50m	5	€ 10,000.00	-	0	13,000.00 €		0	12,000.00 €	1.30m	1	13,500.00 €		0	10,000.00 €	-	0
Horse 6	10,000.00	-	0	11,000.00	-	0	€ 14,000.00	-	0	€ 13,000.00	1.35m	2	€ 11,000.00	-	0	13,000.00 €		0	12,500.00 €		0	14,000.00 €		0	11,000.00 €	-	0
Horse 7	10,000.00	-	0	11,000.00	-	0	€ 14,000.00	-	0	€ 13,500.00	-	0	€ 11,000.00	-	0	13,500.00 €		0	14,500.00 €		0	15,000.00 €		0	12,000.00 €	-	0
Horse 8	10,000.00	-	0	12,000.00	-	0	€ 16,000.00	-	0	€ 13,500.00	1.40m	3	€ 11,000.00	1.35m	2	14,000.00 €		0	15,000.00 €		0	15,000.00 €		0	12,500.00 €	1.40m	3
Horse 9	11,000.00	-	0	12,500.00	-	0	€ 17,500.00	-	0	€ 14,500.00	1.30m	1	€ 12,000.00	-	0	16,500.00 €		0	15,000.00 €	1.45m	4	15,000.00 €	1.40m	3	13,000.00 €	-	0
Horse 10	12,000.00	-	0	12,500.00	-	0	€ 18,000.00	-	0	€ 15,000.00	1.35m	2	€ 12,500.00	-	0	17,000.00 €		0	15,500.00 €	1.30m	1	15,000.00 €	1.40m	3	14,000.00 €	-	0
Horse 11	12,000.00	-	0	13,000.00	-	0	€ 18,500.00	-	0	€ 17,000.00	PSG	1	€ 12,500.00	-	0	17,000.00 €	1.50m	5	18,000.00 €		0	19,000.00 €		0	14,000.00 €	-	0
Horse 12	13,000.00	-	0	13,500.00	-	0	€ 19,000.00	-	0	€ 17,000.00	-	0	€ 12,500.00		0	18,000.00 €		0	18,000.00 €		0	19,500.00 €		0	14,000.00 €	1.35m	2
Horse 13	13,000.00	-	0	14,000.00	1.35m	2	€ 20,000.00	-	0	€ 18,000.00		0	€ 13,000.00	1.40m	3	18,000.00 €		0	18,000.00 €	1.30m	1	20,000.00 €	1.35m	2	14,000.00 €	-	0
Horse 14	14,500.00	-	0	14,000.00	-	0	€ 20,000.00	-	0	€ 18,500.00	1.30m	1	€ 13,000.00		0	20,000.00 €	1.40m	3	18,000.00 €	1.40m	3	22,000.00 €		0	14,500.00 €	1.35m	2
Horse 15	14,500.00	-	0	15,500.00	-	0	€ 21,500.00	1.60m	7	€ 21,000.00		0	€ 13,500.00		0	21,000.00 €		0	18,500.00 €		0	24,500.00 €	-	0	15,000.00 €	1.30m	1
Horse 16	15,000.00	-	0	17,000.00	-	0	€ 22,500.00	-	0	€ 23,000.00	1.45m	4	€ 14,000.00	-	0	24,500.00 €	1.55m	6	20,000.00 €		0	28,000.00 €		0	17,000.00 €	1.45m	4
Horse 17	16,000.00	-	0	17,000.00	-	0	€ 25,500.00	1.30m	1	€ 26,000.00	1.35m	2	€ 14,000.00		0	25,500.00 €		0	21,000.00 €	1.35m	2	28,000.00 €		0	18,000.00 €	-	0
Horse 18	16,000.00	1.20m	0	17,000.00	-	0	€ 28,000.00	-	0	€ 27,000.00	1.35m	2	€ 14,500.00	-	0	26,000.00 €		0	22,000.00 €		0	28,000.00 €		0	18,000.00 €	-	0
Horse 19	17,000.00	1.30m	1	17,500.00	-	0	€ 30,000.00	-	0	€ 27,000.00	-	0	€ 14,500.00	1.35m	2	28,000.00 €		0	22,000.00 €	1.35m	2	30,000.00 €	1.40m	3	19,500.00 €	-	0
Horse 20	18,000.00	-	0	18,000.00	-	0	€ 31,000.00	-	0	€ 30,000.00	1.30m	1	€ 15,500.00	-	0	29,500.00 €		0	24,000.00 €	1.40m	3	30,000.00 €		0	20,000.00 €	-	0
Horse 21	19,000.00	-	0	18,000.00	-	0	€ 32,000.00	-	0	€ 30,000.00		0	€ 15,500.00	-	0	32,000.00 €	1.40m	3	27,000.00 €		0	30,000.00 €	1.45m	4	21,000.00 €	-	0
Horse 22	21,000.00	-	0	18,000.00	-	0	€ 33,000.00	-	0	€ 35,000.00		0	€ 16,500.00	-	0	33,000.00 €		0	27,500.00 €	1.45m	4	32,000.00 €	1.30m	1	22,000.00 €	-	0
Horse 23	22,000.00	-	0	20,000.00	-	0	€ 36,500.00	-	0	€ 50,000.00	1.40m	3	€ 17,500.00	-	0	38,000.00 €	1.40m	3	28,000.00 €		0	40,000.00 €	1.45m	4	26,500.00 €	1.35m	2
Horse 24	22,500.00	-	0	20,000.00	-	0	€ 39,000.00	1.60m	7				€ 18,500.00	-	0	40,000.00 €	1.30m	1	30,000.00 €		0	58,000.00 €	1.40m	3	30,000.00 €	-	0
Horse 25	25,000.00	-	0	20,000.00	-	0	€ 65,000.00	1.50m	5				€ 20,000.00	-	0	40,000.00 €	1.50m	5	32,000.00 €		0	75,000.00 €	1.40m	3	70,000.00 €	1.45m	4
Horse 26	25,000.00	-	0	20,500.00	1.30m	1	€ 90,000.00	1.60m	7				€ 21,000.00	1.45m	4	41,000.00 €	1.40m	3	32,000.00 €	1.45m	4						
Horse 27	30,000.00	-	0	22,000.00	-	0	€ 92,000.00	1.50m	5				€ 24,000.00	-	0	65,000.00 €	1.40m	3	33,000.00 €	1.45m	4						
Horse 28	37,000.00	-	0	24,000.00	-	0							€ 26,000.00		0	80,000.00 €			48,100.00 €	1.30m	1						
Horse 29	45,000.00	1.30m	1	25,000.00	-	0							€ 30,000.00	-	0				60,000.00 €		0						
Horse 30	50,000.00	1.60m	7	28,000.00	-	0							€ 38,000.00	1.50m	5				65,000.00 €	1.45m	4						
Horse 31	70,000.00	-	0	35,000.00	1.40m	3							€ 40,000.00	-	0				0.00 €	1.30m	1						
Horse 32	77,000.00	-	0	45,000.00	-	0							€ 44,000.00	-	0												
Horse 33				53,000.00	-	0																					
Horse 34				70,000.00	-	0																					
Horse 35				75,000.00	1.40m	3																					

Appendix C: International classes

Dressage	**value**	**jumping**	**value**
PSG / Inter I	1	1.30m	1
		1.35m	2
		1.40m	3
Inter II/ A/ B	4	1.45m	4
		1.50m	5
		1.55m	6
GP	7	1.60m	7

Appendix D: CAPM average price for each type of horse per auction year

	JG	JM	JS	Market
2015	€ 20,281.25	€ 28,166.67	€ 0.00	€ 21,340.00
2014	€ 22,200.00	€ 19,781.25	€ 0.00	€ 22,660.00
2013	€ 13,388.89	€ 20,500.00	€ 14,500.00	€ 18,083.33
2012	€ 27,500.00	€ 21,227.27	€ 0.00	€ 25,312.50
2011	€ 25,966.67	€ 25,791.67	€ 21,000.00	€ 21,225.93
2010	€ 38,350.00	€ 21,178.57	€ 23,000.00	€ 26,555.56
2009	€ 15,710.53	€ 21,722.22	€ 14,666.67	€ 12,608.70
2008	€ 21,666.67	€ 17,650.00	€ 23,250.00	€ 20,195.65
2007	€ 24,031.25	€ 40,714.29	€ 18,000.00	€ 27,962.96
2006	€ 19,038.46	€ 5,642.86	€ 75,000.00	€ 17,265.63
2005	€ 25,464.29	€ 16,269.23	€ 10,000.00	€ 21,406.25

Appendix E: Discount rate

year of birth	average stud fee	ratio	discount rate/year
2000	€ 1,075.00	0.9773	-0.0227
2001	€ 1,100.00	1.1000	0.1000
2002	€ 1,000.00	0.9836	-0.0164
2004	€ 1,016.67	0.7327	-0.2673
2005	€ 1,387.50	1.2333	0.2333
2006	€ 1,125.00	1.0714	0.0714
2007	€ 1,050.00	1.2727	0.2727
2008	€ 825.00	0.8761	-0.1239
2009	€ 941.67	1.0463	0.0463
2010	€ 900.00	1.0588	0.0588
2011	€ 850.00	1.0000	0.0000
2012	€ 850.00		
	average discount rate		0.032

Appendix F: Toestemmingsformulier tot opname en beschikbaarstelling afstudeerwerkstukken in repository

Door dit Toestemmingsformulier mag een gebruiker van de digitale kennisbank het afstudeerwerkstuk geheel of gedeeltelijk kopiëren en/of geheel of gedeeltelijk bewerken. Gebruikers mogen dit alleen doen en de resultaten publiceren indien dit gebeurt voor eigen studie en/of onderwijs- en onderzoeksdoeleinden en onder de vermelding van de naam van de student en de vindplaats van het afstudeerwerkstuk

Toestemming:

Ik : Jolene Bock (3001310)

0 geef toestemming voor opname van mijn afstudeerwerkstuk in repository

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Datum: 30-05-2016

Opleiding & Major

Vilentum University of Applied Sciences Bachelor of Science Equine Business Management

(Hippische Bedrijfskunde)

Meer informatie over het auteursrecht is te lezen op http://www.surffoundation.nl/DiRECt

Appendix G: Checklist

Checklist Schriftelijk Rapporteren

Naam: Klas: Datum:

Titel verslag/rapport:

Nadat jij je verslag/rapport hebt gecontroleerd met behulp van deze checklist, voeg je deze toe als bijlage. Zonder de ingevulde checklist vindt er geen beoordeling plaats. De assessor controleert met deze checklist je rapport/verslag. De beoordelingscriteria die met een * zijn aangegeven, zijn de zogenaamde *'killing points'*. Indien de assessor meer dan vijf *'killing points'* heeft aangekruist, dien je het rapport/verslag op alle onvoldoende onderdelen te verbeteren. Voor de herbeoordeling moet je ook de oude versie inleveren. In het afstudeerwerkstuk zijn geen *'killing points'* toegestaan! AANVINKEN WAT NIET IN ORDE IS!

1. Het taalgebruik:
- ☐ Bevat niet meer dan drie grammaticale, spel- en typefouten per duizend woorden*
  Bij meer dan drie fouten per duizend woorden is het rapport/verslag afgekeurd!
- ☐ Heeft een adequate interpunctie*
- ☐ Is afgestemd op de gekozen doelgroep (juiste stijl)*
- ☐ Laat een zakelijke en actieve schrijfstijl zien*
- ☐ Bevat geen persoonlijke voornaamwoorden*

2. Het rapport/verslag:
- ☐ Is ingebonden (hard copy)*
- ☐ Is vrij van plagiaat* (zie onderwijsexamenregeling)

3. De omslag:
- ☐ Bevat de titel
- ☐ Vermeldt de auteur(s)

4. De titelpagina/het titelblad:
- ☐ Heeft een specifieke titel*
- ☐ Vermeldt de auteur(s)*
- ☐ Vermeldt de plaats en de datum*
- ☐ Vermeldt de opdrachtgever(s)*

5. Het voorwoord:
- ☐ Bevat de persoonlijke aanleiding tot het schrijven van het rapport/verslag
- ☐ Bevat persoonlijke bedankjes (persoonlijke voornaamwoorden toegestaan)

6. De inhoudsopgave:
- ☐ Vermeldt alle genummerde onderdelen van het rapport/verslag*
- ☐ Vermeldt de samenvatting en de bijlage(n)
- ☐ Is overzichtelijk
- ☐ Heeft een correcte paginaverwijzing

7. De samenvatting:
- ☐ Is een verkorte versie van het gehele rapport/verslag
- ☐ Bevat conclusies
- ☐ Bevat geen persoonlijke mening
- ☐ Is gestructureerd
- ☐ Is zakelijk geschreven
- ☐ Staat direct na de inhoudsopgave

8. De inleiding (toelichting op intranet):
- ☐ Is hoofdstuk 1*
- ☐ Beschrijft het grotere kader en aanleiding
- ☐ Beschrijft inhoudelijke achtergrondinformatie*
- ☐ Formuleert het probleem/de onderzoeksvraag*
- ☐ Vermeldt het doel*
- ☐ Bevat een leeswijzer voor het rapport/verslag*

9. Materiaal en methode:
- ☐ Beschrijft de gevolgde onderzoeksmethode
- ☐ Past bij de onderzoeksvraag/vragen*
- ☐ Beschrijft de variabelen/eenheden
- ☐ Beschrijft de methode van data-analyse

10. De (opmaak van de) kern:
- ☐ Bestaat uit genummerde hoofdstukken en (sub)paragrafen (maximaal drie niveaus)*
- ☐ Deze zijn verschillend in opmaak*
- ☐ De hoofdstukken en (sub)paragrafen hebben een passende titel
- ☐ Een hoofdstuk beslaat ten minste één pagina
- ☐ Een nieuw hoofdstuk begint op een nieuwe pagina
- ☐ De zinnen lopen door (geen 'enter' binnen een alinea gebruiken)
- ☐ De figuren zijn (door)genummerd en hebben een passende titel (onder de figuur)*
- ☐ De tabellen zijn (door) genummerd en hebben een passende titel (boven de tabel)*
- ☐ Tabellen en figuren zijn zelfstandig te begrijpen
- ☐ In de tekst zijn er verwijzingen naar figuren en/of tabellen*
- ☐ De tekst bevat verwijzing naar de desbetreffende bijlage(n)
- ☐ De tekst is ook zonder verwijzingen te begrijpen
- ☐ De pagina's zijn genummerd*

11. De discussie:
- ☐ Bevat een vergelijking met relevante literatuur
- ☐ Geeft de valide argumentatie weer
- ☐ Evalueert de gebruikte onderzoeksmethode
- ☐ Bevat een kritische reflectie op de eigen bevindingen (zie toelichting op intranet)

12. De conclusies en aanbevelingen:
- ☐ De conclusies zijn gebaseerd op relevante feiten
- ☐ De aanbevelingen zijn gebaseerd op relevante feiten
- ☐ Bevatten geen nieuwe informatie*

13. De bronvermelding:
- ☐ In de tekst is conform de geldende APA-normen* (zie toelichting op intranet)

14. De literatuurlijst:
- ☐ Is opgesteld conform de geldende APA-normen* (zie toelichting op intranet)

15. De bijlagen:
- ☐ Zijn genummerd
- ☐ Zijn voorzien van een passende titel
- ☐ Bevatten geen eigen analyse