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Baccalaureate thesis

**Collectible Investments: Understanding Value, Volatility
and Returns**

**Magic: The Gathering Cards - Building Wealth, One Card
at a Time**

Jaromír Hrazdira

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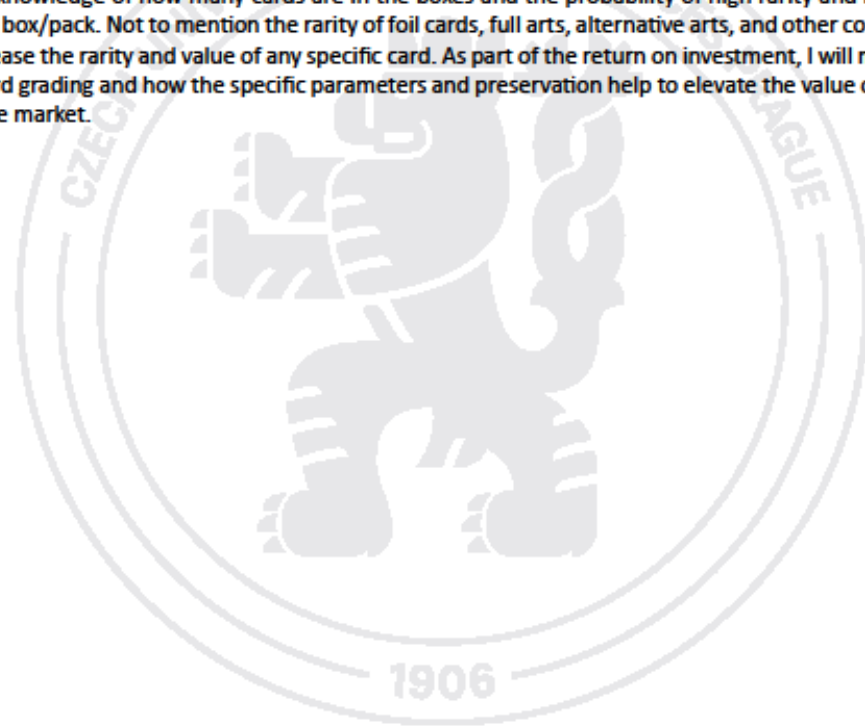
Objectives of thesis

The primary objective of this thesis is to comprehensively investigate the dynamics of collectible investments, with a focus on Magic: The Gathering (MtG) while using other collectible items such as Pokémon cards as a reference. The research will delve into how collectibles, such as the MtG trading cards, accrue and retain value over time, exploring the factors that contribute to their economic worth, examining their historical performance, assessing the volatility inherent in these markets, and calculating the returns on investment. Additionally, this study aims to shed light on the broader socio-cultural and psychological elements that influence the investment and collection of such items, contributing to an all-inclusive understanding of the collectible market. By addressing these key objectives, this thesis endeavors to provide a comprehensive and insightful analysis of the investment potential within the realm of collectible items, benefiting both scholars and enthusiasts of the field.

Methodology

The methodology used for writing this paper consists of a number of research operations. Commence your research by diving into a comprehensive literature review. Delve into articles, studies, and publications that focus on collectible investments, especially in the realm of trading cards. "The Economics of Collectible Trading Cards" by Matheson and Baade (2003) is an insightful source that offers economic perspectives on collectible card markets. Besides the literature, I will require the data to collect data. Data collection is the heart of your research lies in the collection of historical price data. Online marketplaces like eBay, with its completed listings feature, can serve as rich data sources, providing access to past sale prices of collectible cards. This real-world data collection aligns with principles of data validation found in research methodology textbooks such as Creswell's "Research Design" (2017). I will also focus on historical analysis to chart the historical performance of cards. This method applies basic principles of financial analysis and is documented in sources like "Statistics" by Witte and Witte (2017). I will attempt to uncover the economic forces at play in the collectible card market with basic economic models (mainly focused on supply and demand) as well as work with statistical analysis to identify the trends and correlations within the data gathered. Speaking of Volatility, this will be calculated by taking into account the historical prices of the valuable cards and using the volatility calculation method by averaging the prices, getting the mean of those prices, and throughout the process establishing the standard deviation thus gaining volatility of the market for a specific high-value card in MtG and Pokemon to achieve results to compare. We will also need

to find out the rate of return on investment with $ROI = \text{Net income} / \text{Cost of investment} \times 100$ to obtain the rate of return on investment on said specific cards. As a part of the methodology, I will also attempt to calculate the probability that someone will pull out a high-value card. That would require the knowledge of where Wizards of the Coast placed the rare cards (packs, booster packs, boxes, collector boxes, etc.). That includes knowledge of how many cards are in the boxes and the probability of high rarity and high-value cards per box/pack. Not to mention the rarity of foil cards, full arts, alternative arts, and other components that increase the rarity and value of any specific card. As part of the return on investment, I will make a note about card grading and how the specific parameters and preservation help to elevate the value of the card within the market.



The proposed extent of the thesis

40 pages

Keywords

Collectible Investments; Trading Card Economics; Investment Strategies; Price Volatility Analysis; Card Collecting Psychology; Historical Performance Evaluation; Rarity and Scarcity Factors; Market Trends in Collectibles; Asset Valuation in Card Collecting; Economic Models for Collectible Markets

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The Bachelor Thesis Supervisor

doc. Ing. Petr Procházka, MSc, Ph.D.

Supervising department

Department of Economics

Electronic approval: 4. 3. 2024

prof. Ing. Lukáš Čechura, Ph.D.

Head of department

Electronic approval: 5. 3. 2024

doc. Ing. Tomáš Šubrt, Ph.D.

Dean

Prague on 15. 03. 2024

Čestné prohlášení

Prohlašuji, že svou bakalářskou práci "Investice do sběratelských předmětů: Pochopení Stability, Hodnoty, a návratnosti v porovnání s investicí do Akcií a Nemovitosti." jsem vypracoval(a) samostatně pod vedením vedoucího bakalářské práce a s použitím odborné literatury a dalších informačních zdrojů, které jsou citovány v práci a uvedeny v seznamu použitých zdrojů na konci práce. Jako autor(ka) uvedené bakalářské práce dále prohlašuji, že jsem v souvislosti s jejím vytvořením neporušil autorská práva třetích osob.

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Poděkování

Rád(a) bych touto cestou poděkoval(a) doc. Ing. Petru Procházkovi, MSc, Ph.D. za asistenci a důsledné vedení při vypracování bakalářské práce. Ing.

Jaromíru Hrazdírovi za asistenci a konzultace při vypracování praktické části práce.

Investice do sběratelských předmětů: Pochopení Stability, Hodnoty, a návratnosti v porovnání s investicí do Akcií a Nemovitosti

Abstrakt

V této bakalářské práci se zaměříme na otázku, zda je investice do sběratelských karet ze hry Magic: the Gathering rozumnou investicí a zda je možné tímto způsobem postavit portfolio s vysokým výnosem a jak se tato investice staví oproti více tradičním způsobům alokace finančních prostředků v podobě nákupu akcií na burze NASDAQ, PX50 anebo nákupu nemovitostí. Na začátku práce představíme svět investování do sběratelských předmětů jako celek a odpovíme na otázku, z čehože pramení sběratelská hodnota. Poté se zaměříme na karty Magic: the Gathering a přiblížíme způsob, jakým tyto karty nabývají hodnotu. Předvedeme, jakým způsobem se pozná padělek od originálu a podíváme se na selekci karet, které jsou v komunitě výjimečné. V praktické části poté předvedeme několik scénářů investování a pojených s ekonomickými a statistickými výpočty pro čistou současnou hodnotu, cash flow, návratnosti na investici (RoI) a vnitřní procento návratnosti (IRR). Pro praktickou část bude nutné použít nerealistické odhady celkového počtu vytištěných karet, jelikož tyto informace nejsou v mnoha případech dostupné

Klíčová slova: Sběratelské investice, Návratnost investic. Magic: The Gathering karty, Budování bohatství, Alternativní investice, Tržní trendy, Diverzifikace aktiv, Investiční strategie, Čistá přítomná hodnota

Collectible Investments: Unlocking Value, Volatility, and Returns

Magic: The Gathering Cards - Building Wealth, One Card at a Time

Abstract

In this bachelor thesis, we will focus on the question of whether investing in collectible cards from the game Magic: The Gathering is a reasonable investment. We will explore the possibility of building a portfolio with high returns through this method and compare this investment to more traditional methods of allocating financial resources, such as buying stocks on the NASDAQ or PX50 exchanges, or purchasing real estate. At the beginning of the thesis, we will introduce the world of investing in collectibles as a whole and answer the question of the source of collectible value. We will then focus on Magic: The Gathering cards and explain how these cards gain value. We will demonstrate how to distinguish between a counterfeit and an original and examine the selection of cards that are considered exceptional in the community. In the practical part, we will present several investment scenarios accompanied by economic and statistical calculations for net present value, cash flow, and return on investment (RoI) and internal rate of return (IRR). For the practical section, it will be necessary to use unrealistic estimates of the total number of printed cards, as this information is not readily available in many cases.

Keywords: Collectible Investments, Return on Investment (ROI), Magic: The Gathering Cards (MtG), Wealth Building, Alternative Investments, Market Trends, Asset Diversification, Investment Strategies, Net Present Value (NVP), Internal rate of return (IRR)

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1. Introduction

Financial stability is a goal for everyone and with the inflation, assets depreciating, and overall, every good market getting more expensive, what is a solid way to achieve financial stability? Enter investment markets. Investing offers many possibilities, to store your money and hopefully have more when you decide to liquidate your investment assets. From stocks in different companies, micro bonds, real estate, rare metals or other natural resources like gas are all opportunities for an investor to place their money. But as the saying goes, it is important to not have all your eggs in one basket. Diversification of investment portfolios is the best bet to minimize one's risk of loss. In the diversification there are two items that usually get overlooked: Art and Collectibles. But firstly, what is a collectable? Collectables are defined as an object that is worth collecting because it is beautiful or may

become valuable, (Oxford University Press, 2010), and a definition by Jacoby (1995) is says that collectibles have two defining characteristics: 1) an inanimate object and 2) incapable of assisting in any production process.

This thesis will show how Collectibles, and more specifically, Magic:The Gathering (MtG) cards can be valuable as a standalone investment or whether they would be better as a simple addition used for diversification of an investor's portfolio.

Goal and Methodology

The work in front of you has the goal of introducing collectible items as a valid source of investment and shedding light into the methods and strategies that may be adopted by potential collectors and answering the question “Is it worth investing financial assets in to playing cards such as ‘Magic:The Gathering’?”

Finding the benefits and shortcomings of using collectible items as an investment opportunity, pointing out the strengths and weaknesses of such a fiscal decision and providing comprehensive comparison between collectible items; in our case MtG cards, against more mainstream options for investing one’s financial assets, such as NASDAQ, S&P 500, the real estate market and government bonds or Fixed deposits, we will provide a short history of MtG as this will be the primary focus of the thesis. We will briefly talk about investing in general, economics of collectible investments and economics of investment into MtG cards as well as some basic statistics regarding the card game and its popularity.

This work describes the methodology of probability calculation used to determine the chance of finding valuable cards in one specific booster pack. The dimension of booster packs is explained in more detail later in our work. We used the forecasting methods, discounting and the Net Present Value calculations to find out if there is any value in purchasing valuable cards and selling them after a certain time period. To determine the worth of such an endeavor, we compared the NPV and Internal Rate of Return against no risk investment such as Government bonds and Fixed deposit bank accounts that were held for 5 years at 3% compound interest. Lastly, we examined the IRR and NPV of three different markets within more mainstream industries (NASDAQ, S&P 500 and the real estate market), and analyzed the return on the investment into these streams in comparison with the NPV and IRR of the selected cards. Some information was unavailable to us and for that reason, we had to make some assumptions regarding the probability calculations to ensure that our calculations work, but only in the scenario where the collector purchased only one pack. This had to be done as we were missing the exact number of cards printed globally. The information is unavailable as Wizards of the Coast; the company behind the development, evolution and creation of MtG and Dungeons & Dragons, has multiple locations where cards are printed and we see it more fitting to avoid throwing massive numbers around as these numbers would be difficult to comprehend, thus our calculations assume that there was exactly 1 of each card in the set printed.

2 Theoretical Work

2.1 General Information

2.1.1 About Investing

Let us start with investing and what it means to invest money. Investing can be considered a cornerstone of financial management, is a strategic endeavor undertaken by individuals and institutions alike to allocate financial resources with the expectation of generating profitable returns over time. It encompasses a broad spectrum of asset classes, ranging from traditional stocks and bonds to alternative investments such as real estate and commodities and collectibles. According to Burton G. Malkiel in his seminal work "A Random Walk Down Wall Street," (Malkiel) investing involves navigating the complex interplay of risk and reward, where investors seek to optimize returns while mitigating potential losses through diversification and diligent research of the assets and opportunities presented to them via the stock exchange markets. As articulated by Lawrence J. Gitman and Michael D. Joehnk in "Fundamentals of Investing," (Gitman et al.) the overarching goal of investing is to build and preserve wealth, whether for retirement planning, wealth accumulation, or funding future aspirations.

2.1.2 About Collectible investments

Collectibles are many things. From the biggest of statues to the smallest of rare coins and anything in between these rare items can carry immense value based on the quality, rarity and overall state of preservation they have. These items are usually immune to the fluctuation of mainstream markets as they operate on different principles of evaluation. That means the value of the collectible item stays consistent or it grows its inherit value. For the purposes of our work, we will focus our attention onto the popular card game MtG. Investing into collectible items makes a captivating avenue for investments and shows collectors opportunities to diversify their portfolio with something that is a stable asset as well as provides the thrill of unconventional purchase.

2.1.3 Short history of Magic: The Gathering

As we embark onto the journey into the fascinating market of collectibles, we would like to introduce the game that will serve as our guide and on which we will focus. Magic: The Gathering. Released in 1993 by the company Wizards of the Coast, famous for the creation and continued updates of the widely popular table top role-playing game Dungeon & Dragons. MtG was a popular high fantasy card game. Wizards of the Coast is a moderately successful company that now belongs under the brand of Hasbro, they also managed to achieve 5,9 billion dollars revenue thanks to the companies care and periodical expansion of content in the form of new art, cards, stories and interesting collaborations; for example, the recent Warhammer 40 K (2022) or the more recent Lord of the Rings LOTR) (2023) as well as collaboration with the My Little Pony brand later in the year 2023. Every expansion to the card game provides more collectables of various rarities and monetary value ranging anywhere from few cents to 10 s or even hundreds of Euros.

2.1.4 Most Valuable cards to date

As time went on and more and more expansions were introduced, only a few cards managed to rise in rarity and value. One of the most valuable cards is the Black Lotus from the Alpha series. Combined with the rarity of the card, the long-standing history as one of the first cards printed and the fact that there were only 1 100 copies of Black Lotus cards in Alpha release as well as its in game ability; as one of the first cards the in-game balance was off, made it borderline broken. Nowadays the Black Lotus card can be valued at up to \$1 000 000 USD on eBay provided it is in mint condition. The process used to determine cards condition and grading will be discussed further below. On sites more focused on dealing with the trade and evaluation of MtG and similar cards, such as cardmarket.com, the card like Black Lotus can be sold at most for almost €120 000 euro. As this price seems to be more realistic and within reason for a card that was printed 1 100 times, for future price references I'll use cardmarket.com and websites comparable to it.

2.1.5 Pokémon for comparison

Now MtG is not the only brand of playing cards that can be used as a portfolio diversifier. The market is saturated with other Trading Card Games (TCG) that can produce high value collectors' items. One such game is Pokémon TCG. Entering the shelves in October of 1996 after massive success of the Pokémon Red and Green games for Gameboy released in February of 1996 the Pokémon TCG became a huge success. The first set that was released contained just 102 Pokémon cards when released in Japan. Three years later in 1999 the card game was picked up by Wizards of the Coast in North American and soon the pocket monsters took the world by storm. Similarly, MtG, Pokémon also received numerous updates and expansions. On the other hand, where MtG follows its own lore and worlds, the Pokémon TCG cards come always after the introduction of a new "generation" of Pokémon.

That means a new game must reach the market to introduce new Pokémon species so the cards can get recognition. The pricing of Pokémon cards however follows the same criteria as MtG and thus, when pricing is brought up the focus will be aimed at MtG exclusively.

The similarities keep up between the two most popular card games with each having multiple high valued cards but one that is the most well-known. For MtG that is the Black Lotus. For Pokémon, this role is filled by the first edition holographic shadowless Charizard card that was sold in an auction in 2020 for an astonishing price of \$369 000 USD.

2.2 Information important for beginner collectors

It was mentioned that collectibles are a good way to diversify the portfolio. The concept of portfolio diversification has been the bedrock of financial strategy, that states that when there are multiple varied asset classes, is key to maintain a low level of risk, while at the same time help optimize returns. (H Markowitz) Collectibles are a unique category that has the potential to provide table diversification. That's because of their low or even negative connection to the traditional financial assets. This ties well to the unique nature of MtG cards as collectibles and gameplay utility. Walgreen's study underscores collectibles have, in general, not contributed to the diversified mixed asset portfolio, the financial characteristics displayed are beneficial to possible investors. However some aspects of card collecting in conjecture to investment and portfolio diversification can be slightly neglected in the context of MtG cards, because the value of the cards is influenced by many factors that will be

discussed further in this theses, for example: unitality in the game, how the card is viewed by the community (cards banned due to unfortunate racism “Invoke prejudice” with art that is very similar to the KKK), and historical significance in the history and within the games lore (The One Ring from the LoTR expansion written in the language of Mordor). Furthermore, if the MtG cards being added into the portfolio mitigates certain risks connected with single filed portfolios, there are of course challenges tied to investing in collectibles, which will be discussed further in the thesis as well.

2.2.1 Card Packs Vs Booster Boxes

There are many possibilities in which MtG cards can be purchased, from individual cards, simple packs and prebuild decks up to booster boxes and collector boxes. In some cases, buying just the individual card that the investor made research for and knows its value makes sense. However if we want to have a chance of being the first holder of a valuable card, we need to place our focus onto the Booster and collector boxes. With enough luck, an investor can build their portfolio just on the collectible cards, however, a more appropriate decision would be to use MtG cards as a diversification of an already existing portfolio. Collectibles are by their nature unique as an asset with different qualities like being non homogenous and the hindering fact that they lack liquidity; (the ability to be sold quickly for cash injection). Collectibles in general are a good asset to use in modern portfolio theory as a diversification. A well-diversified portfolio minimizes risks and maximizes return on investment. The first proposal to include varied assets like art or collectibles was initially proposed by Markowitz. (Lintner 1965) The growth of the TCG market and MtG in particular is undeniably notable. There are studies comparing the TCG market to the sport cards market. The sport card market is projected to reach a value of \$98.75B by the year 2027. This shows the uniqueness of investing in collectibles. Another big difference comes from investing into individual cards and investing in the earlier mentioned booster boxes. The major point with this sort of investment comes from the diminishing supply of the card packs and booster boxes that comes from the fact that these items are sealed, as well as the condition-based valuation; on which we will focus later.

Now it is also important to say that the cards themselves are not the only thing that can be used as an investment asset. Because MtG is an ever-evolving brand, and as claimed earlier, new expansions are being produced periodically though out the year, every so often the older cards go out of print. That is when the sealed, mint conditioned booster box comes in to play as an asset of higher value. Some collectors are willing to pay for the opportunity to open a booster box from edition that is no longer being printed. If someone holds onto a box for long period of time, the retail value may reach a significant price multiple times over the original purchase value.

2.2.2 Evaluation of cards and card grading

As was mentioned earlier, the value of a card is based on multiple factors and small details such as the following:

- **Rarity:** Rare cards, especially those with limited print runs, often command higher prices due to their scarcity.
- **Condition:** The state of preservation significantly affects a card's value. Near-mint or pristine cards are generally more valuable than those showing signs of wear.

- **Playability:** Cards that are widely used in competitive play or are part of popular strategies tend to have higher demand and thus higher value.
- **Art and Aesthetics:** The visual appeal of a card, including the artwork and overall design, can influence its desirability and, consequently, its value.
- **Historical Significance:** Certain cards gain value based on their historical importance, such as being part of iconic decks or tournament victories.
- **Edition and Set:** Older editions and sets, especially those that are no longer in print, can contribute to a card's value as they become harder to find.
- **Grading:** Professionally graded cards, with authentication of their condition by grading services, often command higher prices in the market.
- **Supply and Demand:** Basic economic principles apply, with cards in high demand and limited supply generally seeing an increase in value.
- **Promotional Cards:** Cards distributed as part of special events or promotions may have unique attributes that contribute to their value.
- **Hype and Trends:** The influence of community discussions, social media, and tournament successes can create hype around certain cards, affecting their market value.

These factors play a role in the nuance activity of card grading. The intricacies of MtG card trading allows for the grading process to emerge and become a critical and sentimental practice. Described on the Three for One Trading website the operation spans from the newly released commons to revered and historically significant cards like earlier mentioned Beta set's Black Lotus (currently most valuable card in the world) The article on the webpage proceeds to showcase the team's proficiency in card grading. The testament to the specialized training in deciphering the subtle details and nuances of the MtG card's condition is clearly visible throughout the article. The article then delves into the methodological approach of grading, offering insight into the key points and considerations as well as the tools needed for conducting an accurate evaluation of card quality. Because card grading is not just looking at the card with a magnifying glass. The examination of even the minor details takes special care and knowledge. Not only does the grading allow for creation of additional value for the card, but it also has to identify possible counterfeits and fakes created for ill-obtained wealth. Three for One Trading's grading approach is in alignment with the European standard found at prominent online trading platforms: like an earlier mentioned Cardmarket. It is characterized by its precision and rigor that exceed the conventional norms. The grading system has its own scale on which cards are graded as a whole as well as a scale for each individual factor, the score given to each factor then presents the bases on which the card as a whole is judged and graded. This presents a bit of a double-edged sword where a card can have large monetary value; the owner will have it appraised and graded so the card retains or increases its value. However due to the poor state of the card; due to the card being used for as a playable card and thus getting damaged, the grading of said card is low, decreasing its value substantially. The main scale reaches from Near Mint condition; indicating the minimal deviation from perfect state to Poor condition, where the card has a lot of wear and tear. The "Mint" condition is reserved for either the cards that are perfect and fresh from the printers or more often, Mint condition is used for action figures or other collectables sealed in the original package. For illustration the scale on which cards are graded is as follows: Near mint, Excellent, Good, lightly played, Played and lastly Poor. It is also important to say that there are more ways to grade a card. Besides the aforementioned labels, there is a numerical scale reaching from 10-1. This scale also includes the .5 values. Each value has a precise definition and once again is judged on multitude of

factors. The grading paradigm, while simple from the first glance, permeates with the complexity of economical and collector sentiments within the MtG marketplace. The grade a card receives influences not only its economic value, but also its value as a collectible. Based on that it is safe to say that the process of card grading plays a critical role on the economic activity and market dynamics of Magic trading. The practices adopted by Three for One Trading are indicative of the intricacies at play when it comes to the condition of the cards, their market valuation and collector behavior in the realm of MtG. The adopted approach ensures the integrity of card grading, but it also reflects the ever evolving and cultural significance of the Mtg cards collector scene.

For comparison, the topic of card grading is discussed on multiple websites. For example, the Star City Games article presents a nuanced and all-around approach of the evaluation of MtG cards that transcends the judgement of casual players. The author of the article Partick Chapin introduces a methodology, the core of which is the understanding of the cards initial purpose and role within the different gameplay formats. The process requires an open mind and consideration of the card's attributes beyond apparent uses. This approach allows for deeper understanding of the cards on the strategic battlefield, that is the game of Magic: The Gathering. The article leans more towards the in-game value than the value the cards bring to the portfolio diversification. However, understanding the cards value within the ecosystem that is Magic the Gathering and understanding how the cards operate and "synergize" between each other during the different playing style of the most complicated card game ever created increases the value of the card when it comes to more casual sorts of trading between players and collectors, where the focus on monetary gain is less than the utility and usability of the cards that are being exchanged between casual players. Nonetheless the knowledge of the utility of some MtG cards can also be one of the factors used when it comes to the appraisal and evaluation of a card.

2.2.3 The "Death Effect"

The realm of collectables has a distinct aspect that is commonly referred to as the "death effect". This effect is discussed in a publication by Matheson and Baade (2004). In short, the death effect notes the increase in value of the collectible because of the death of the artist or celebrity associated with the card. It was previously attributed to the perception in the collectors' circles to the finite future supply of the collectibles. This is usually connected to the larger paintings and other forms of collectible artwork that's not printed 'en masse'. On the other hand, in a very specific turn of phrase the death can be associated with discontinuation of an expansion. The interest generated by the death effect can lead to the "nostalgia spike" where the prices soar sky-high, until the memory of the celebrity's death; or in this case the "death" of the expansion, fades and the prices return to the previously established norm.

2.2.4 TCGPlayer MID Pricing Method

Now that we have at least a basic knowledge of the card's evaluation, let's get to the pricing as well. The most prominent method is the MID pricing which represents a market-based pricing strategy. The pricing is determined by the sales data across the TCG player Platform. The prices are determined by calculating a median value, meaning the middle value in a list of prices of specific card. The prices are sorted from lowest to highest. The approach used is mitigating the impact of outliers on the average price.

The pricing used by MID is dynamic and thus changes on a regular basis in accordance with the most recent transactions and listings on the platform. This style of pricing is the assurance that the MID price reflects the current market position. This style of pricing is often viewed as a more balanced compared to the lowest/highest prices available at the market. The pricing style allows for a transparent middle ground that accounts for possible variations in cards conditions, the reputation of the seller and other factors that might influence the price outside of the catalogue of factors discussed earlier. MID pricing is not just for sellers. Buyers can use MID pricing as a gauge for fair pricing. On the other hand, sellers can place their prices around the MID value to retain the competitiveness. Overall, the MID pricing is a balance indicator between sellers and buyers. Buyers and sellers can utilize MID pricing as criterion for fair pricing, so no one gets overcharged. Besides the pricing, the MID pricing method can be used between collectors and players where this style of pricing becomes a tool for assessing the conditions and value of their collection, thus players and collectors can make an inform decision when it comes to trade or purchase of new collectibles.

To summarise the process of MID pricing strategy calculation, we split the process into two steps:

- 1) Arrange in order lowest to highest.
- 2) Find the median (the value exactly in the middle)
- 3) Those are the steps we need to calculate median, however the TCG Player MID pricing uses a method that's slightly more complex than that and the method goes as follows:
- 4) Those are the steps we need to calculate the median, however the TCG Player MID pricing uses method that's slightly more complex than that and the method goes as follows:
 - Monitor the Frequency of sales: How often is a card sold at a certain price?
 - Condition of the card: Sellers and resellers should note the quality of the card in accordance with the established ranking discussed in prior chapters.
 - Seller reputation: As places like Cardmarket, eBay, and similar auction halls are opened for everyone, the more active sellers can build up some sort of "credit" or "reputation" and thus their prices can be weight differently. Their prices can be higher than average, collectors can buy from them more frequently etc.
 - Time Factor: Purchases that were made more recently may have higher weight to them than purchases made a longer time ago.

However as with most things, there are limitations to this method. The proprietary algorithm is one of them, the limitation is that the algorithm is; as the name suggests, proprietary and thus not publicly available. The second limitation is that the prices are constantly updated and thus the median price is changing frequently.

2.2.5 Elements of luck in obtaining valuable cards

Now, it is one thing to purchase a sealed, mint condition booster box and hold onto it as it gains value through time, and to purchase the box or packs to open them yourself and have the possibility to pull out the card with immense value. In an article from 2020, an interesting observation was made in regard to the preferences of players choices in regards to rewards after a store held tournaments. Now the rewards offered in the tournament

described in the article (Weebly) the possible rewards were either any booster pack containing 15 random cards, or 3 USD worth of store credit per win; meaning that after one victorious match, competitor would receive 3 dollars of credit, upon second victory the credit is 6 dollars etc. To surprise of many, the victors opted for the booster packs in search for the valuable cards. It is important to say that the set, from which these rare and valuable cards came from was the Eldritch Moon set and the cards most desired were: Collective Brutality (ave price: €2,33) Lilliana the Last Hope (ave price: €4.48) and Emrakul the Promised End. (ave. price: €44.24) Prices in bracket do not relate to the promotional foil cards for Eldritch Moon set nor do they consider the foil version of said cards. The prices are also taken from Cardmarket website in relation to the date of 11/01/2024.

As one would imagine however, the decision to get this pack to have a chance of pulling one of the sought after cards ended in disappointment as the likelihood of getting these cards was miniscule. And now that the backstory was laid down, it is imperative to show the probability and certain luck factor that comes into play when collectors are searching for the valuable cards. The card packs, that work as a main distributing media for the MtG cards have a certain consistency to the collection of cards within the pack.

The booster packs or Boosters for short have 15 cards within, from these fifteen, one is a mythic rare or rare card, and the rest are uncommon or common rarity. To put this in numbers, the chances of unearthing a mythic rare (MR) card are 12,5% (1 in 8) and for the rare cards (R) the chances are 87,5% (7 in 8). Now these look-like good odds however, the numbers presented relate to any MR or R cards that comes in the card set. But since we are looking for a method that would allow us to determine how likely we are to get a specific high value and rarity cards; we must look into the process more deeply. We must take into consideration that MtG cards are printed on 11x11 sheets. That totals 121 cards per sheet. Now the Eldritch moon set had 205 cards; counting as a smaller set released by Wizards of the Coast. Going back to the card sheets, each sheet usually contains a single copy of MR card and doubles of each R cards. These cards are often printed together. According to this data the odds of pulling specific rare cards is 2/121 (1,65%) and MR cards 1/121 (0,83%). But why are these numbers important? The knowledge of the chances allows for a short but practical analysis. Earlier we mentioned Booster boxes. These boxes consist of 36 packs and each pack has 15 cards in it. Just this simple point of sheer number of cards increases the chances of obtaining the MR or R cards significantly. Assuming 15 mythic rare and 53 rare cards in a booster box, the chances are 1 in 3,87 (25,83%) per booster box of getting a specific mythic rare card. The rare cards have better odds of being pulled counting as 1 in 2,27 or 45,12%. However finding a specific rare or mythical rare card is not guaranteed by these odds. Circling back to the Eldritch moon set was one of the smaller releases with 205 cards total. The spread of rarity was: 74 Common, 70 Uncommon, 47 Rare, 14 Mythic rare. With that in mind, we can safely say that the odds are slightly better and in our favor. The chance for valuable MR card, stands at 6,48% and for the rare the chance is 14,81%. With simple addition the chances of pulling a card of significant value are 21,30% likelihood.

Finally, we mentioned three cards of significant value withing the Eldrich moon set (Collective Brutality, Emrakul, or Lilliana). The chances of pulling these cards from booster packs stand at an abysmal 3,70% and 74,30% odds for the booster boxes. This knowledge allows for significant influence on collectors and players decision making approaches when selecting between store credit or the enticement of potentially valuable booster pack.

2.2.6 Cards history and effect on their value

In this part we want to take a look at, and analyze the historical data of a few cards, to gain the understanding of how the price changes over time, and we will attempt to discern which factor played the biggest role in the price movements. The types of cards we want to focus on for this part are few the “Power Nine” which are cards sought after for their gameplay utility and in multiple cases for their collectible value as the age of the card plays into its monetary value. We would also want to introduce one card from the “Forbidden Seven”. These cards were banned because of the community viewed them as offensive or even racist. The banned cards have their value increased by the “Death Effect” as the cards with the specific prints or abilities cannot be printed any longer, triggering the effect discussed earlier in the thesis. Lastly, a rarity among the cards must be introduced, as this set carries a certain oddity. The Mox Necklace set had its jewels, which are members of “The Power Nine”, made into a real collectible item that was accessible for purchase on the manufacturers online store, but now lives on as a collectible item set sold on the Cardmarket website and internet auction hall.

2.2.6.1 Black Lotus

Starting this section off is the most famous card of them all, the Black Lotus. First printed in 1993 in the beginning days of Magic the Gathering only few cards could be labeled as truly powerful and for MtG players, the most powerful card in the beginning set was the Black Lotus. The card in game functions as 0 cost artifact generating 3 mana of any of the five colors. This makes it a great card for mana economy as it can be played immediately at no cost.

“Black Lotus is the centerpiece to a collection of cards nicknamed The Power Nine, all having been banned or restricted in every playable format except one, and all of which come from games debut set when designers were still learning how to balance every tiny moving part.” (Studies 00:07:27-00:07:42)

The Alpha and Beta sets and the following Unlimited set that together totaled 40+ million copies of the first cards sold before Magic could celebrate its first-year anniversary. The game itself started to create the collectable interest that in 1993 only the baseball cards have achieved When Magic came up with “The Restricted list”; that forbade the reprint of certain cards, Black Lotus landed itself on this list, definitively closing the doors on the possibility of being reprinted ever again in the future sets. To summarize why Black Lotus is the most popular and desirable among the cards in Magics’ history the card was and still is immensely powerful in the game; as it grants an immediate advantage on mana economy. The card was only printed in the year 1993 in the first ever 3 sets and then limited by the “Restricted list” In short Black lotus is powerful in the realm of the game, limited in its numbers and it is certain that it will not appear again.

In 2016 Black Lotus made headlines when one of the 1100copies was sold in an auction for \$87 000. The cards grade was 9.5, meaning almost perfect condition. Plus, this copy of Black Lotus was sign by one of the creators of Magic the Gathering.

With this bit of the card’s history at our disposal, how did the card hold in the marketplace off of the auction stage? Table 5 in the appendix shows us the average prices of Black Lotus from the year 2011 until the start of 2023. As this was a marketplace and the prices are set by the sellers, we can’t expect the average price to be tremendously high. The peak of \$21 000 reached in the year of 2019, a year before Covid when Magic the Gathering resurged in popularity once more. The massive drop in prices of the card came in in 2020

when the pandemic was in full force. Today when we look on the Cardmarket, we can see that a near mint Black Lotus card with a rating of 9.5 can be sold for €400 000 up to the date 06.03.2024.

2.2.6.2 Mox Necklace Set

Pearl, Emerald, Sapphire, Jet and Ruby. Also known as the Mox Jewels, these five cards form the larger half of the Power Nine. The five jewels are 0 mana cost artifacts that generate one mana of the designated color (Red, White, Green, Blue, Black) Essentially the Mox Jewels do what the Black Lotus does but worst. Despite that the jewels earned their spot in the Power Nine. Similarly, to the Black Lotus, the original Moxen are banned from all game formats MtG is played, except Vintage and even then the cards are restricted to one per deck, so the overwhelming power can't be exploited. That makes them one of the first cards ever banned from the games format. As the Mox Jewels are from the same three sets as the Black Lotus, that being Alpha, Beta and Unlimited and being in the Power Nine, the five jewels are in the same situation.

Placed on the Restricted list and banned from being played, the value of the cards is determined by the low supply and thus increased rarity. The place in the Power Nine also helps to add to the value.

Now what might be interesting for this specific chapter is the fact that we can find listings for individual Mox Jewels but not even once did we find someone selling the full quintet of the jewel cards. This is something we found intriguing, because collectors around the world would fall "head over heels" for such a set. Based on the median listing prices from TCGPlayer.com found on 6th March 2024, we can safely say that the listing of this quintet of card alone could be € 48 260,39, which we got from simply adding the listed prices together. Now how does all of this tie with the jewels that were made as a celebratory item? On Cardmarket.com we found a listing for the set of the neckless priced at € 9 500,00. For a moment, let's say that we have in our possession the set of jewel cards as well as all corresponding necklaces. We can safely assume that the price that we could charge for this truly one of the kind collections would be € 57 760,39 and keep in mind that this sort of collection package is nowhere to be found as of the 6th March 2024.

These jewels made in collaboration with RockLove Jewelry are a homage to the game's artistic expression and history. The cards themselves are sold only individually which opens a possible window of opportunity to strike and entice buyers with the complete set of Mox Necklace cards.

Coming back to the historical data, we must speak about the existence of the jewels as the untrained eye may be confused and by the end disappointed in their purchase. The jewels themselves have lesser value than the playing cards pooled together. Even so, the necklaces are part of a collectible set and official MtG item for collectors. And as the price for the cards can be just added together to gain rough estimate of the price that can be expected for the card set, we can look at the jewels themselves. The unfortunate truth is that on TCGPlayer, where we picked the prices from has no display of historical data available for us to display and graph on Cardmarket is for only really a short amount of time.

2.2.6.3 Invoke Prejudice

We introduced the Power Nine, but with this card we shift our attention to a different set of cards: "the Forbidden Seven". Seven cards that were banned from ever being printed

again (in the same style that caused them to be banned.) The one we chose to introduce is the blue color called “Invoke Prejudice”. This card from the Legends expansion from the year 1994, was subjected to a lot of controversy and criticism. The reason for the controversy was the artwork, the cards’ text and the name itself. The card text, which makes opponents creatures cost more mana if they are a different color, then the players creatures with the conjunction of the name made it, so the card was seen as having racist connotation. Adding onto the already disadvantage position the card had, the artwork depicts humanoid figures in long flowy robes. On the first glance figures on the card resembled the Ku Klux Klan members.

Unfortunately for the card, the bad luck followed it into the official order of the cards done by Wizards of the Coast. Invoke Prejudice landed itself onto the spot numbered 1488, which is often associated with Neo-Nazis. Truly a series of unfortunate events led to the official decision, that removed images of Invoke Prejudice and six other cards from the Gatherers database and a ban being applied to the Forbidden Seven in the sanctioned format. The ban and discontinuation of the card has earned it the Death Effect increasing its value for collectors, especially if they are after the Forbidden Seven. Nowadays according to the chart on Cardmarket the price has dropped significantly.

However, the somewhat grim tale of Invoke Prejudice has a positive outcome. The artist behind the design, Harold Arthur McNeil came forward in 2020 and said that the figures in the artwork were not meant to represent the acolytes of the most racist group in history. McNeil draw these figures as a representation of the Spanish Inquisition, where one is holding an executioner’s axe. It this claim was for better, or worst is a different topic. What it does tell us is that the public perception of a card by the community can and often will influence, how the producer will react and what steps might be taken. In the case of The Forbidden Seven the steps taken to protect the company values led to increase of value for the cards unfortunately labeled as offensive or racist. The spike in value can be arguably attributed not only to the usefulness of the card within the game itself, but also to the dark sense of humor some people possess. However that is more psychological topic and would require research based in psychology.

2.2.6.4 The One Ring

“One ring to rule them all, One ring to find them, One ring to bring them all and in the darkness bind them.” That is the text written on the Ring of Power in the Lord of the Rings books and movies. But why do we bring this up in our thesis? On June 2023 wizards of the Coast managed to create a partnership with the Lord of the Rings trademark to make a small set themed around the heroes, locations, artefacts and monsters from the iconic fantasy movies and novels. And as it stands to reason, Wizards could not make Lord of the Rings set without including The One Ring. However, what made this card so special is the fact that while there were multiple foil cards, cards with no borders and other spinoffs of The One ring, truly in the fashion of the writing on the ring and at the beginning of this chapter, there was exactly 1, no more, no less but just 1/1 rings that had a completely unique art, the text describing the cards effect was written in the language of Mordor and as we stated earlier. There was only one. This 1/1 card was placed into a collector’s box and shipped somewhere on the planet for one lucky collector to obtain it. Even before the cards were released but after the card had been shown on the internet, people were willing to pay inordinate amounts of money to possess the card. Anywhere from \$600 000 to 10 million

USD. What is amusing is that the person offering \$600 000 also offered to pay for the ticket to his home country for the owner as the potential buyer's country had a volcano, the intent was to hike up to the top of the volcano and throw the Ring of power into it akin to the final scene in the movies. None of that happened unfortunately as the card was bought by the musician Post Malone for \$800 000 despite the one ring being valued at the \$2 000 000 mark, making it the most valuable MtG card in existence as of now.

2.2.7 Identification of fraudulent cards

In this short chapter, we will introduce the steps that collectors use to determine, if the card they have purchased is the real thing or a counterfeit. Thus, allowing for at least some level of investment protection.

First there is "The Bend test" where the card is bent in half just enough so the top and bottom touches. The card is not pressed in any way. IF the card is returned to its neutral position and has no visible creases it is the real card. The bend test is looking for the material inside the cards that prevents the formation of creases, however the card may bend.

The next test requires a jeweler's loupe and is based around finding inconsistencies in the ink print. In the video by Kingslayer Games we are shown the details that should be possessed by the real cards from Unlimited set. The rules translate to most of the Magic cards. One of the dead giveaways is the layering of the text ink, where the text should be a flat back color.

Second to last is performed with the flashlight of a phone or any other bright source of light. If the card is fake, light emitted from the source can pass through the inconsistent material of the cards core or through the sectioned weaken by the printing process.

The last trick that proves the authenticity of any card are the small holographic ovals at the bottom of the card. These holographic marks fulfill the same role on the card as they do on bank notes as the stickers are hard to replicate exactly.

With these relatively simple tests collectors can verify that the card then purchased is a real and official product from the Wizards of the Coast company or if the potentially high valued card is nothing but a fake and they just lost their money. Of course, these tests do not have to be conducted when the card is pulled from a booster pack, because it came from an official source.

3 Practical Work

At the start we said we will introduce three scenarios. The first one will revolve around finding the high value cards in the booster packs, holding them for X different time periods and observing, if we can consistently make profit off of this method. We will perform this calculation in three different expansion sets to provide information about the value that the cards have gathered over time. For the new set we will use the March of the Machines, for the next set we decided on Mirage and as the oldest set, we will focus on the Alpha release from 1993.

As there is a lack of official statements available, for some calculations we will be using unrealistic estimates of the total cards printed for each set as the scenarios introduced are meant to be illustrative.

3.1 Scenario 1: Finding high value cards

This scenario will shine light onto the question whether purchasing packs and boxes of MtG cards can result in obtaining high value cards, what are the chances of that happening and will the value of the cards help us break even at the end, or is our money spent in vain?

To answer this question, we must first take into consideration a number of variables that will stay the same no matter what set or expansion are we talking about. These pointers will play a role in the probability calculations.

- 1 pack costs \$15
- There are 16 cards in 1 pack
- The composition of a pack is 10 Common 3 Uncommon 1 Rare or Mythic card, 1 Basic land or token and 1 art or promotion card
- There is always 1 in 8 chance of getting a Mythic rarity card in a pack.
- There is 7 in 8 chance that the pack will have rare card
- There are 36 packs in 1 booster box
- One printed sheet fits 11x11 cards
- There is always 1 rarity per sheet (No mythic cards on a sheet that started with rare cards)
- Exact number of cards printed is unknown and will be subjected to assumption.

It might be wise to explain that not all cards are worth checking or counting in our calculations, these being the art cards and the token cards. Art cards are exactly what they sound like : small cards with piece of artwork relevant to the set, be it nature or some sort of a monster (especially with the Dungeons and Dragons collaboration). And the token cards are simply cards that hold value in the game but outside of it are worth nothing. They are as common as they can be and serve no trading or investment value for collectors.

3.1.1 Probability calculation

Coming onto the first part of practical calculations a fitting start is to show the way to perform probability calculation to determine the chances of obtaining a card of high value. Since we already touched upon this topic in previous chapters, this will be a more detailed approach to the process itself. For reference we are going to use sets that came out in the year 2022, 2023 and 2024 as it is necessary for this calculation to be valid, that the pack can be purchased. The sets will be March of the Machines (April 2023), Dominaria United (September 2022), Lost caverns of Ixalan (November 2023) and lastly Murder at Kralov

Manor (February 2024). With the information we have stated at the beginning of this section we can start focusing onto individual cards and their probabilities.

3.1.1.1 March of the Machines: Invasion of Ikaria

Invasion of Ikaria is a rare card from the set March of the Machines. Based on what we know we have a guaranteed 7 in 8 chance from the pack that we purchase. The other information we need to know is how many rare cards are in the set, as we are searching for one specific card from the 'rare pool' with this calculation. Upon searching for this information, we learned that March of the Machines contains 281 new cards out of which 60 belongs to the rare category. That brings us to the following calculation: $P = (7/8) * (1/60)$. This calculation will show us what is the probability that we get the one specific card from the March of the Machines that card being the Invasion of Ikaria. The probability is 1,458% chance in one pack and current value of Invasion of Ikaria is \$14,40.

3.1.1.2 Dominaria United: Leyline Binding

The second card comes from the Dominaria United set and it is called Leyline Binding. The current price according to MTGGoldfish is \$10,81 and it is a rare card one again. The specs for this set are 60 rare cards and the chance for rare card in one pack is 7/8. That once again adds up to $P = (7/8) * (1/60)$ and giving us the same measly 1,458% chance of getting Leyline Binding.

3.1.1.3 Lost caverns of Ixalan: Tishana's Tidebinder

Tishana's Tidebinder is a rare card form Lost caverns of Ixalan expansion set released in November 2023 and it is one of the top 10 most valuable cards form this set. Its value standing comfortably at \$11 according to MTGGoldfish website and having the same chance of appearing in one pack as the previous two entries, that being 7/8. How ever the difference here comes from the number of rare cards in this set. The number of rare cards present is 64, altering the probability calculation in the following manner: $P = (7/8) * (1/64)$ giving us the probability 1,367 % of finding this card.

3.1.1.4 Murder at Kralov Manor: Delney, Streetwise Lookout

The last card comes from the newest set Murder at Kralov Manor. This set has the special caveat that some of the cards have invisible ink writing on them, making them even more special and more valuable, however as these cards would have altered probability, we will focus on the standard version of the cards. Standing at \$19,51 as its value on MTGGoldfish we have the first more valuable card out of the quartet that we decided to focus on. The probability is altered as the rarity of this card is Mythic, meaning that the chance of obtaining it in the pack is 1/8 and the pool of cards is also limited, only reaching 20 mythic cards. The new calculation of probability in this scenario is $P = (1/8) * (1/20)$ where P is equal to 0,625 % lowering our chances even more, to what is essentially less than half of our previous probabilities.

3.1.2 Probability calculation: Analysis

Based on our calculation we can see that the most valuable cards are very difficult to obtain. The percentage of probability reaching between 0,6% and 1,5% are truly abysmal. The fact that most of the cards from expansions that came out recently hover with their price around the price of the pack (\$15) making the strategy of purchasing booster pack until the collector gets the card they need is rendered obsolete, as the much easier solution is to find the list of most valuable cards and purchase them directly. The booster packs are a good purchase if you, as a collector and player are planning on using the cards as a playable addition to your decks. However, as an investment strategy this is not the optimal strategy as the only suggestion here is, if a collector finds a valuable card in the deck, great for them, keep the card protected and hope it will gain value as the lifespan on the edition comes to an end and death effect takes hold.

3.2 Scenario 2: Purchasing high value cards

In this part of our work, we want to showcase how the card investment can develop if we target specific cards and purchase them from the online markets such as previously mentioned Cardmarket.com or TCGplayer.com. We will work with the following trio of cards: Black Lotus (Alpha), Lion's Eye Diamond (Mirage) and Invasion of Ikororia (March of the Machines). For this scenario we propose the question, if the card bought in a defined time, will we turn it into profit, if we sell the card 5 years later? To find the desired answer we will use the calculation of net present value and price forecasting. For comparison I will be comparing the investment of card purchase with the amount of money I would get or have to invest into Fixed Deposit account with compound interest of 3%.

3.2.1 Black lotus: Basic Data collected

Once more we turn to the second most valuable card in the world for illustration. Data for black lotus were taken from MTGGoldfish (MTGGoldfish, Inc.) in the time period from the year 2011 until 2023 to the date of 1.1. for every year that is accounted for. (Table 1) and the data is forecasted until the year 2029 which for our purposes will be the year at which we will be selling the card. In the Table 5 are the prices of Black Lotus from the Alpha edition. These prices have provided the bases for the forecast and subsequent calculation.

These prices are visualized in the Graph 2. The Graph 2 displays a trend line showing the increasing tendency of the graph. It is important to declare that the decision of selecting values and prices in the manner we did was necessary because of the sheer volume of data displayed on the MTGGoldfish graphs, as the graphs contain data on a daily bases until the year 2023 where the original graph ends.

3.2.1.1 Black lotus: Forecasting

With basic data gathered, we can move to the forecasting of the future prices. As it was mentioned to create the forecast, we considered the prediction of inflation 2% from Czech National Bank (Česká Národní Banka) and the interest that banks offer on the 5-year fixed deposit account 3% (Banky.cz). We have determined that 3% is a safe rate of return for an investment. The Table 1 showcases the predicted values we got when using the "Forecasting Sheet" Function from Microsoft Excel.

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
01/01/2011	\$ 3 103,00			
01/01/2012	\$ 4 000,00			
01/01/2013	\$ 5 600,00			
01/01/2014	\$ 6 790,00			
01/01/2015	\$15 000,00			
01/01/2016	\$ 7 750,00			
01/01/2017	\$ 8 750,00			
01/01/2018	\$16 000,00			
01/01/2019	\$17 499,00			
01/01/2020	\$28 000,00			
01/01/2021	\$30 000,00			
01/01/2022	\$58 699,00			
01/01/2023	\$60 000,00	\$60 000,00	\$ 60 000,00	\$ 60 000,00
01/01/2024		\$68 144,47	\$ 46 723,76	\$ 89 565,19
01/01/2025		\$74 110,57	\$ 30 021,34	\$ 118 199,79
01/01/2026		\$80 076,66	\$ 7 386,21	\$ 152 767,10
01/01/2027		\$86 042,75	\$ -19 884,83	\$ 191 970,32
01/01/2028		\$92 008,84	\$ -51 154,67	\$ 235 172,35
01/01/2029		\$97 974,93	\$ -86 011,49	\$ 281 961,35

Table 1 Forecasted prices for Black Lotus

The Lower Confident Bound column can be omitted to a certain degree because the card will never have negative value. The Upper Confident Bound however shows unlikely but still possible scenario where the price of the card skyrockets. It is also necessary to keep in mind that this data is tied to a card that is not graded professionally, nor has the artist signature like the one in our previous chapters that now belongs to Post Malone. Shifting our focus to the forecast column, we can see that the value of Black Lotus has the potential to steadily increase its value, finishing up at comfortable \$ 97 974,93 in the year 2029. For graphical visualization see Graph 4 in the Appendix.

3.2.1.2 Black Lotus: Net present Value Calculation

With the forecast established and prepared we finally get to the Net Present Value (NPV). The result of NPV tells us what is the difference between present value of cash inflow and present value of cash outflow over selected period of time.

The NPV was calculated as:

$$NPV = \sum_{n=1}^N \frac{C_n}{(1+r)^n}$$

Where:

- N = total number of time periods
- n = time period
- C_n = Net cashflow at time period
- r = Internal rate of return

The internal rate of return is set by us at 3% which we determined was a safe rate of return as the Czech national bank (Česká Národní Banka) predicts the inflation rate to settle at 2% by the year 2025 (Česká Národní Banka) and banks like Creditas offer 3% interest rate

in a 5-year Fixed Deposit account(Banky.cz). For our calculation we used the Excel function for NPV with its syntax:

- **Rate:** Required. The rate of discount over the length of one period.
- **Value 1, value 2, ...:** Value 1 is required, subsequent values are optional. 1 to 254 arguments representing the payments and income.

Where the Rate was set as 0,03 as per Internal rate of return, to achieve the Net present value in year 5 the Values 1-4 were set as 0 and Value 5 was designated as the value in the year 2029 which differs for every forecast, based on the cards that were the main focus. To simulate the forecast, we used the “Forecast Sheet” function available in Excel. Next, we have to state that the data used for the prediction model were taken from (MTGGoldfish, Inc) on the date 8.3.2024. The year in which we decided will be the final year of us holding the card and selling it is 2029.

As per our forecast we used the forecasted value of Black Lotus in the year 2029, used the internal rate of return 0,03 (3%) and ran the NPV function in Excel to get the result of \$84 514,03 which tells us that the true value of the Black lotus card after 5 years will have the calculated value in today’s money. In other words, if we bought the Black Lotus 1.1.2023 for \$60 000 and sold it after 5 years, not only would we make \$24 514,03 profit in today’s value, our profit will be greater than that by additional \$13 460,89, giving us the total profit of \$37 974,93.

The NPV Calculation also helps us with the comparison with the Fixed Deposit account. This calculation shows us that if we want to have \$997 974,93 in our bank account after 5 years, we would have to make an initial deposit of \$84 514,03 in January 2023 on 3% interest compounded annually. Which suggests that the option of purchasing the Black Lotus card would be more profitable option.

3.2.2 Lion ‘s Eye Diamond: Data Collection

The first card we focused on was from the very beginning and reached such high value, we wanted to see how well would cards from 3 years later would do. Lion’s Eye Diamond comes from the Mirage set released in 1996, three years after the initial release. As of the beginning the creators didn’t really know how to balance the cards because there was no frame of reference; resulting in cards like Black Lotus, that are way too good to be used in a standard game and now serves only as a rare collectible item. Three years later is a solid point to see, if the cards became less valuable or even more valuable, because their utility became more balanced in the grand scheme of the game. And that’s where Lion’s Eye Diamond comes into the play.

Once again, we turned to MTGGoldfish for a long-term data about the value and its fluctuation and we came up with the Table 2. It shows that from a card with decently priced yet not value breaking card, the small pace of hardened paper can grow into much more valuable treasure. Over the 13 years the Price of the Loin’s Eye Diamond grew in its value 12 time over, and thus we can suspect that this trend will continue.

Date	Price
01/01/2011	\$ 39,80
01/01/2012	\$ 41,50
01/01/2013	\$ 67,00
01/01/2014	\$ 78,10
01/01/2015	\$ 83,30
01/01/2016	\$ 79,70
01/01/2017	\$ 133,00
01/01/2018	\$ 140,00
01/01/2019	\$ 198,30
01/01/2020	\$ 206,90
01/01/2021	\$ 347,40
01/01/2022	\$ 583,80
01/01/2023	\$ 490,00
01/01/2024	\$ 480,00

Table 2 Prices for Lion’s Eye Diamond from MTGGoldfish.com

3.2.2.1 Lion ‘s Eye Diamond: Forecasting

Utilizing the same methods, we used with Black lotus forecasting we can discern that the value has a growing tendency and with the forecast sheet from excel we can see about \$200 increase in value by the year 2029 which is not the most glamorous growth of value, however it shows that even the cards that are not breaking the game or come from the original set can grow substantially in their value. Just from the beginning Lion’s Eye Diamond increased its value 12^{-fold}. From Table Z we can see that our forecasted value, however, is the same as with the previous forecast, and we can’t ignore the lower and upper bounds. Based on our forecast and the Graph 4 in the appendix we would expect an upwards trajectory for the value, however in the everchanging world, a lot can change and reprints of the cards are possible with every new expansion. The chances of that happening however

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
01/01/2011	\$ 39,80			
01/01/2012	\$ 41,50			
01/01/2013	\$ 67,00			
01/01/2014	\$ 78,10			
01/01/2015	\$ 83,30			
01/01/2016	\$ 79,70			
01/01/2017	\$ 133,00			
01/01/2018	\$ 140,00			
01/01/2019	\$ 198,30			
01/01/2020	\$ 206,90			
01/01/2021	\$ 347,40			
01/01/2022	\$ 583,80			
01/01/2023	\$ 490,00			
01/01/2024	\$ 480,00	\$ 480,00	\$ 480,00	\$ 480,00
01/01/2025		\$ 519,94	\$ 321,38	\$ 718,50
01/01/2026		\$ 559,88	\$ 279,22	\$ 840,55
01/01/2027		\$ 599,82	\$ 256,02	\$ 943,62
01/01/2028		\$ 639,76	\$ 242,64	\$ 1 036,88
01/01/2029		\$ 679,71	\$ 235,53	\$ 1 123,88

Table 3 Lion’s Eye Diamond Forecasted Values

decrease for older cards as the reprints have happened already and what is reprinted are the newer versions of the card. The Lower Bound represents the possibility of the card losing value rapidly, but as we said, this situation is highly unlikely. The upper bound shows us the possible higher profits in a scenario where the card becomes by some means more exclusive, be it high grading or being signed by one of the creators or the artist of the card.

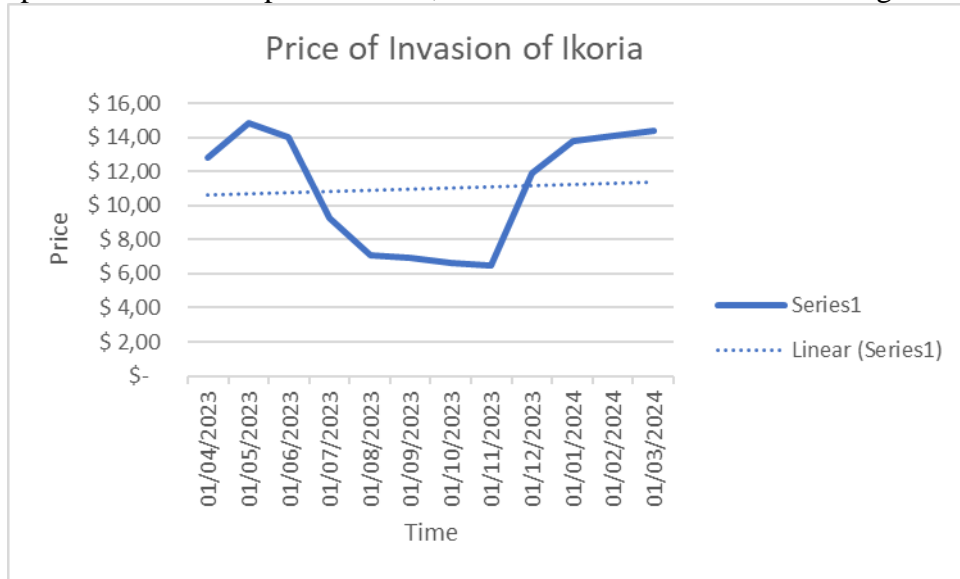
3.2.2.2 Lion ‘s Eye Diamond: NPV calculation

Running the same calculation as with Black Lotus under the same circumstances gives us the value of \$586,32. This price is how much the card would be worth in today’s money in the 5 years. Once again, the Net Present Value can be seen as a comparison with

the banks. To achieve the profit gained from the card one would have to put \$ 586,32 into the Fixed Deposit account in the year 2024 so the investor can reach the \$ 679,71 after 5 years. That would equate to \$ 93,39 profit received on compound interest. The gain is much smaller than buying the card for \$ 480 and holding it for 5 years, then selling it to a collector. This method allows for \$ 199,71 of profit made against the purchasing costs.

3.2.3 Invasion of Ikorla: Data Collection

The last card on our list for this scenario is Invasion of Ikorla. This card came out in March of the Machines expansion that was made in collaboration with a different table top game, that being Warhammer 40K. Because it is a set that came out very recently and thus can show if investing in newer sets will also help us turn profit in the future. It is important to say that this portion of our work is highly theoretical as the March of the Machines is a new set released in April 2023 and the data does not reach as far into the past as the data from the previous two examples and thus, we must take these results with a grain of salt.



Graph 1 Price of Invasion of Ikorla in time

3.2.3.1 Invasion of Ikorla: NPV Calculation

As per previous claim this calculation will be slightly different. First of all, it will only reach to the year of 2028 as that is as far as our Excel calculation would let us go with the amount of data that we have started with. Second, even though that the Table 7 in the appendix shows multitude of data and predictions on a monthly bases, for the calculation of NPV we are keeping the trend of calculating NPV annually. This keeps the calculation cleaner and easier to comprehend as well as allowing for better comparison with the Fixed Deposit account later on.

3.2.3.2 Invasion of Ikorla: Forecasting

As we complete the net present value calculation dated to 1.3.2028 and started on 1.3.2024, we can see that this card after 4 years will be worth only \$12,82 which is less than its current price tag of \$14,40. This can be based on multiple reasons, but the one that is glaringly obvious is that the amount of data that we have is just way too short to give us any precise predictions. Where in the previous examples we had over a decade worth of data and past prices, with Invasion of Ikorla we don't even have a full year. Thus, for now it would seem that instead of buying this specific card, we would be better off with simply placing our money into the bank.

3.2.4 Scenario 2: Conclusion

Over all, what did we learn in this section? We talked about the possibility of profiting off of buying cards from collectors, keeping them for an extended period of time and then selling them for, hopefully, profit. We talked about two older cards one of which cannot be played in a tournament format and the other is still an old card, but does not have the additional value of being one of the firsts or having the power to turn the tides in the battlefield. The last card discussed was one from very recent history that had little to no backing and yet, for brief period of time it stood amongst the sets most valuable cards. We examined the cards from the perspective of us gaining profits and used Net present value as our alpha and omega argument, showing that when it comes to the older cards that cannot be obtained from packs simply because their specific edition is not printed and was not printed for quite a while, they seem to be much better investment asset than something a bank would offer us. On the other hand, we have a card from a set that is still running and cards from the set are printed and sold in packs and boxes. Our calculation is built upon very small amount of data and thus can and probably will be inaccurate as the years go by and March of the Machines falls from its relevancy.

What we can say with certainty is that when it comes to the truly old cards from the beginnings of the game, the value they hold, while not earthshaking has its potential in preserving, protecting and even allowing collectors to make a better profit off them, than an ordinary bank would. When it comes to the new sets, we will simply have to wait, as only time will tell if the cards we obtained when they were released will be worth something or if they fall into obscurity.

3.3 Scenario 3: Comparison of cards internal rate of return against Stock investment and real estate bonds

The last scenario we will face in our work is the comparison of card investments and the more ordinary investment methods, those being NASDAQ for the foreign investments, PX50 the Prague stock exchange and lastly a real estate bonds investment. For that we will need to know the internal rate of return for each fund as well as the cards that we have used in scenario 2. The calculation for IRR may be complex yet very similar to what we have done already in the previous scenario.

The IRR is calculated as:

$$NPV = \sum_{t=0}^n \frac{CF_t}{(1+r)^t} - C_0$$

For this equation we assume that:

- NPV is the Net Present Value,
- t represents the time period,
- n is the total number of time periods
- CF_t is the net cash flow during time period t,
- r is the discount rate,
- C_0 is the initial investment cost

When calculating IRR we must find discount rate (r) that makes the $NPV = 0$. Due to the nonlinear nature of the equation and the simple fact that analytical solving is quite a

complex task, use of our Excel sheets is once again employed. In Excel we can find the IRR function described with the following syntax: =IRR (Values; guess).

- Values refers to the cells with values from which we want the IRR to be calculated
- guess is an optional variable that we can, but don't have to insert. It refers to what we think will be the closest percentile of IRR.

“Returns the internal rate of return for a series of cash flows represented by the numbers in values. These cash flows do not have to be even, as they would be for an annuity. However, the cash flows must occur at regular intervals, such as monthly or annually. The internal rate of return is the interest rate received for an investment consisting of payments (negative values) and income (positive values) that occur at regular periods.” (Microsoft)

For the calculations regarding NASDAQ, PX50 and Real Estate, we will calculate Net Present Value and perform forecasting in a same manner as in scenario 2, unless these values are provided on the source webpage.

Scenario 3 is done to answer the question of collectible items; in our case MtG cards, are strong enough investment to serve as a sole focus for building wealth or if our theoretical assumption about collectibles working more as a diversification of portfolio is closer to the truth.

3.3.1 Internal Rate of Return: MtG cards

For the last section of our work, we will work with the cards from Scenario 2, that being Black Lotus, Lion's Eye Diamond and Invasion of Ikorja. We will group these calculations into one section as they function in the same way. While performing the IRR calculation in Excel we ran into an unexpected issue with the function. When the values forecasted were inserted into the dialogue window, the #NUM error kept flashing. After additional research about the proper use of the IRR function we learned that the value of initial investment must be a negative number as it counts as the money spend to initialize the investment. How the process works is that when we calculate the IRR, we provide a range of values. Excel then uses the function to calculate the discount rate at which the NPV is equal to 0 to achieve the correct numbers. We will use the initial investment and the price of the card in the year 2029. For example, for the Black Lotus the initial investment is \$60 000, so we write it into the function as (600000). The price of the card at the end of our designated period of time is \$97 974 and thus will be the last number placed into the function. This gives us the result: $IRR_{Black\ Lotus} = 8,516\%$ which tells us that while the initial investment was \$60 000 by the January 1st 2029 when we decide to sell the card, we would have made profit equal to 8,516% on the initial investment. The calculation process was repeated for all three of the selected cards with various outcomes seen in Table 4.

3.3.1 Internal Rate of Return: NASDAQ, S&P 500, Real Estate Bonds

The second part of our work consisted of repeated calculations for NPV and IRR that we performed in Scenario 2 however this time with the focus on regular or more popular investment options, that being shares and real estate. For the NPV calculation we will continue using the 3% discounting rate from the second scenario. For shares we decided to provide two examples. The first one is the well know foreign stock market NASDAQ, our second selection was S&P 500 as it represents 500 most profitable companies and the third selection is simply titled Real Estate Bonds. All our data for these calculations was from

Yahoo Finance and Kurzy.cz. Regarding the prices taken from Yahoo Finance, we decided to take our values from the “Closed” line on the summary as it stands to reason to use the closing balance from the day rather than opening balance from the day before. The process of calculation was showcased in the Scenario 2 and all graphs relating to the calculation done can be found in the Appendix.

Data taken for NPV and IRR for NASDAQ and S&P 500 were taken from the 1.1.2013 and finished 1.6.2023. Unfortunately, Yahoo Finance does not provide data of this magnitude for its Real Estate section. The Real Estate data begins 1.1.2018 and it continues until present. Based on that we decided that the best course of action and for the most accurate forecast, we will collect data every quarter of the year and with this change we should be able to negate some of the inaccuracy. It is also necessary to say that while Nasdaq and S&P 500 provide us with decently high IRR, they are also very turbulent and prone to unforeseen collapses, unlike the Real Estate market which provides more stable investment opportunities with the caveat of having lower IRR.

3.3.2 Internal Rate of Return: Comparison

At this point, we have calculated the net present value and internal rate of return for all three sources of more conventional investments. Now what remains is to somehow evaluate their viability against the chosen cards. Table 4 shows us the data calculated for all cards as well as the other sources of investment. As we may see in Table 4 we see the value in the final year, the NPV calculated and the IRR that comes from the theoretical scenarios we presented in the previous chapters. What is a very visible fact from the table is that both Black Lotus and Lion’s Eye Diamond provide higher Internal Rate of return than NASDAQ, S&P 500 and the Real Estate market, however only one card also provides us with possibly the highest financial profit after the 5 years of holding our assets and selling on the sixth year. With that in mind we cannot forget to consider that Black Lotus has also the highest initial investment standing at \$60 000 if we bought the card in 2023. Contrary to what we assumed at the beginning, Real Estate bonds are showing the highest Internal Rate of Return which may also be a show of better stability where the prices of real estate keep their slow rise whereas NASDAQs bonds and the shares that fall under S&P 500 experience a few drops in their value, which happened in the past and can be expected to occur again as we may see in the Graph 6 and Graph 9 respectively. Another detail to consider while observing Table 4 is that when looking at Lion’s Eye Diamond, we are looking at a profitable purchase, on the other hand the 7,2% profit that we make on the investment into this specific card is only a small margin when placed against the return on interest of any other mainstream assets. We used Invasion of Ikorria as an illustration that even the newer, more recent cards can become valuable over time, which we proved in scenario 2 but in comparison to the real estate market or purchasing of shares on the stock market it is without a doubt pointless to aim for such cards specifically at the beginning of their lifespans and collectors are much better off profiting from these cards, that can no longer be obtained from available packs and boxes that are still in print

	Final Value	NPV	IRR
Black Lotus	\$ 97 974,93	\$ 84 514,03	8,5160 %
Lion’s Eye Diamond	\$ 679,71	\$ 586,32	7,2052 %
Invasion of Ikorria	\$ 14,98	\$ 12,82	0,0795 %
NASDAQ	\$ 20 750,75	\$ 17 899,78	6,4741 %
S&P500	\$ 6 011,18	\$ 5 034,27	5,6694 %
Real Estate Bonds	\$ 1 983 812,71	\$ 1 613 021,28	7,0975 %

Table 4 Cards against stock market comparison

and circulating around the general public. If collector finds such a card that is new and appears valuable it is a lucky result for sure and we would suggest keeping the card well protected on the off chance that it becomes more valuable as the time progresses.

4 Results and discussions

Now that we have gone through all three scenarios, we will summarize the results in this chapter as well as clarify the meaning of the results presented. We will also propose some questions to further the research of the chosen topic.

4.1 Scenario 1

This scenario talked about strategy revolving around purchasing random booster packs and the probability of obtaining high value cards. This scenario had a number of weaknesses for it to be truly considered a valid strategy. The number one weakness is definitely the fact that the selection is limited to the sets that came out recently. With that comes the issue of the calculation. The probability works only when tied to a singular booster pack. The next problem we have run into is the fact that to enhance our probability calculation we would have to use Booster boxes as they contain 36 packs. However, that would require us to know the total number of cards printed worldwide. That information is however unobtainable without wild speculations.

All these inaccuracies make the analysis inaccurate for a large number of packs opened, however its accuracy is impeccable for the one pack. What we can get from the analysis is the fact that purchasing individual packs in hopes of getting high value cards is not a reasonable use of funds and thus this activity should be done by the players that will get the most use from the cards received, regardless of value or rarity.

4.2 Scenario 2

Scenario 2 took deal with the Net present Value of cards that we purchased from other collectors based on the evaluation of MTGGoldfish, TCGPlayer and Cardmarket.com. We showed that the net present value calculated with the discounting 3%; which were taken as a safe margin above the predicted line of inflation as well as being the same percentage that is offered on fixed deposit bank account with compound interest or what the government uses for its government bonds.

As we performed the calculations, we have learned that when it comes to older more valuable cards like Black Lotus, it is worth more to target the card specifically as their rate of return exceeds the offers from banks or government bonds. This is true with the cards of remarkable value or cards that are somehow limited in existence, such an example being The One Ring. When it comes to valuable cards from 10 years ago, the value is still significant (in the ballpark of hundreds of dollars), but it is not a value that someone would put in a bank for just 5 years, as the value of the card is just few hundred dollars and the profit gained is small and not worth going to the bank for.

Regarding the newest sets, it can prove to be a valid strategy to buy the cards that are currently worth 15 to 30 dollars or Euro or what other currency is the card offered for, as in the future, when the Death effect takes place, the card may gain more value. This may happen as soon as 3 years after the release because then the set becomes illegal for tournament formats and becomes obsolete for the players. However, the death effect may never come and that would result in the set becoming forgotten and worth very little money.

4.3 Scenario 3

The last scenario we have worked with and have taken into consideration are the mainstream sources of investing opportunities like NASDAQ Index, S&P500 Index and real estate bonds and calculated the net present value for the indexes and bonds as well as their IRR for the time period of 2023 until 2029, that being the discounted period and the time frame in which we keep the cards and then sell them on the available platforms.

What we discovered was that on average the Indexes and bonds are still more profitable option in long term, however Black Lotus being the valuable card that it is, still comes out with higher IRR in the situation we assumed at the beginning of the practical portion of our thesis. We learned that if we are willing to pay larger sums (60 000 USD for Black Lotus in 2023) we might end up with slightly higher profit compared to the other indexes. On the other hand, we have cards that have greater value but are not big enough to substitute the possible gains from the investment into selected indexes or bonds. Yes, we could invest the same amount as is the price of; in our example Lion's Eye Diamond and we would receive almost the same amount in profits as if we bought the card and sold it after 5 years.

It must be said that this scenario assumes that the investor decides to sell after the 5-year period we have selected in our scenarios.

Lastly the cards from the newest sets are incomparable against the Indexes and Bonds as the IRR these cards possess is negligible against these possible opportunities for investments, at least not in the 5-year period and unless the card or set experience some sort of massive increase in value be it by the death effect or some other way.

5 Conclusion

We have set out to shine a light on the world of collectible investments and provide comprehensive analysis of multiple strategies. We attempted to answer the question, if it is worth it to hunt for valuable cards by buying them online or trying to find them in the packs, just so we can hold onto the cards as a valuable asset, that we would eventually sell for profit, and if so, how does this strategy stand against more mainstream sources of investment opportunities, such as NASDAQ, S&P 500 or the loss volatile real estate market. We explained what is Investing, what would be collectible investments and then we talked about the history of Magic the Gathering and the company that made the game and is continuously updating and balancing it. We showed the comparison to Pokémon TCG and examined a phenomenon called Death Effect, that causes collectibles such as art to gain value after the artists passes away.

We then proceeded to introduce the MID Pricing method that is used by one of the online markets named TCGPlayer.com, where collectors can sell their cards to other collectors. We explored the fine principles on which cards are being appraised and we touched upon card grading, what to look for and gave tips that even novice can look out for to estimate the value of the collection he has. We talked about the elements of luck needed in card collecting and how the craving for valuable can brew into a race between collectors during competitions and tournaments. Almost at the end of our Theoretical part we took it upon ourselves to introduce four cards that have something special about them and attempted to explain how this effected their price and value in the eyes of investors and collectors alike. We had Black lotus on our agenda and we retold the story of the Alpha edition, the creation of Power Nine and the downfall that was brought forth by the creation of a list containing cards that will never be reprinted, as well as a causing the cards of Power Nine being banned from any and all formats of the game. We spoke about the 5 cards forming a set of necklaces that got itself a boost in popularity when Wizards of the Coast formed a partnership with a jewelry company and made the neckless into real fashion items and we uncovered a hole in the market as there was not a single entry selling both the playable cards and the jewels. The third card marked the start of Forbidden seven and in this case, we have seen how visuals are an important part of perception of reality as the card was condemned and branded as “racist” based on the misunderstanding created by the visuals on the card Invoke Prejudice. And lastly, we have ventured across the Middle earth to find the most expensive card in the world where we talked about the card’s rarity and how decreasing number of reprints make the cards more and more valuable. Especially when it comes to The One Ring and its 1/1 print, propelling the card’s value to 2 million, marks solidifying it as the most valuable card as of now. The last topic explored before we moved to the practical portion was the introduction of selected methods, used by novices and sometimes experts in the field, to identify a falsified or “fake” card. Some methods required some specialized equipment such as a clocksmiths magnifying glass, but other methods can be used without any equipment.

In the practical portion of our work, we proposed 3 scenarios. The first was based on the probability of the collector finding a specific high value card from 3 different sets. For this calculation a number of parameters were set that stayed unchanging regardless of the set or of the card’s rarity. However, for our calculation to work, a number of assumptions had to be taken into consideration. Factors such as, if a collector buys just one pack of the set, or if there is exactly one copy of any card. As our calculation worked on the premise that there would be a 1 in 8 or a 7 in 8 chance of getting a rare or mythic card respectively from the pool of cards of the specified rarity (Mythic card was based on the pool involving total

number of mythic cards in the specific set. The same logic applied for rare cards.). Other creative liberty had to be taken in the assumption of cards produced. Our calculation omits the existence of duplicates as well as the total number of cards printed as finding this information is close to impossible, as the company has multiple printers available and it never reveals the total numbers printed. In our own little side theory, this is supposed to prevent anyone to simply calculating the odds of valuable cards appearing and exploiting the system by purchasing just enough boxes and packs to guarantee themselves the chance of having multiple high value cards. By the end of the first scenario, it became obvious that blindly hunting for packs in hopes of obtaining cards with high value is not a reliable strategy, especially when it comes to newly released sets, where the value of cards hovers around the price of the pack from which the card was drawn.

The second scenario brings us the calculation of Net present value and Internal rate of return under the premise of 3% interest rate in the world where inflation has dropped to 2% as per prediction based by Czech National Bank. In this scenario we are not blindly hunting for cards in sealed packs essentially gambling our money away but, armed with research and knowledge we target specific cards that we purchase and hold onto for 5 years, before selling them to new owners. During the process of calculation, we ran into some syntax problems that we managed to solve by adjusting the value settings for our Excel sheet. The process started with us selecting three cards from the MtG set timeline and creating a pool of data; values and prices throughout the years, based on which we created the forecast tables and graphs that can be seen in the appendix. Once all the calculations were completed, we compared our net present values and internal rates of return against government bonds and Fixed Deposits for a 5-year period with 3% compound interest. We learned that in many scenarios, the cards have a higher rate of return than the bank offered fixed deposit accounts. On the other hand, in order to truly utilize this advantage, we would have to focus on cards with a value above 10 000 at a minimum, because amounts any lower are just not worth placing into the bank account as the rate of return is abysmal at best. That leads us to the conclusion where while cards have a higher rate of return, the true use of this advantage with the cards already starting at a high price, if we are going to hold them for just a 5-year period.

The final scenario sees us comparing the results from the second scenario with NPV and IRR of stock exchange options that are more mainstream than collectibles. The comparison revealed that while collectibles are less volatile assets for one's portfolio, their profitability is too low to supplement the use of company shares. According to our calculation and comparison, only Black Lotus was capable to barely catch up with NASDAQ index, tied S&P 500, but was still ahead of real estate market. To be fair real estate is generally known for slow profit climbs, however this market is one of the most stable markets, making it a great diversifier. Cards with their value in the hundreds of dollars cannot really hold a candle to the stock market no matter how high their IRR is, as they are just too small of an investment. However, if someone would invest the same amount as they would pay for the card, making low value investment into any of the named indexes, the lower value cards would have a chance of at least tying the total profit made. Cards from the newest sets are a completely different story, as their value is essentially nonexistent in the grand scheme of things and making the comparison of 14 USD card against NASDAQ seem obsolete in retrospective.

In conclusion, is it worth it to hunt for or purchase high valuable cards as a collectible item that will generate some sort of profit once it is sold? The answer is not a resounding 'yes', but neither it is a resounding 'no'. The cards Magic the Gathering are first and foremost an ever-evolving card game and thus purchasing of cards is a necessity if the player wishes

to stay comparatively viable and participate in tournaments. And if by chance they find a card of high value, well great for them! But to truly unlock the value that these pieces of hard paper have, one must focus their attention on the true and elusive cards from the beginning of the game's history, or, what might seem easier, look for cards that are highly viable in the game itself and sell them to active players. This method is more of an entrepreneurial activity and less of a long-term investment, however it is one of the possible ways to unlock the value of the cards. And in the world of investment the high value cards work wonders as a diversification as collectibles which tend to keep their value and are less prone to be volatile.

Overall MtG cards are not on the peak of collectibles to invest in, but in combination of entertainment, valuable investment, rich history and amazing artwork, we came to the conclusion that as a portfolio diversification MtG cards would function well. As a solo investment not so much due to the high cost of initial investment, if we are talking about the cards with highest value.

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7.2 List of Graphs

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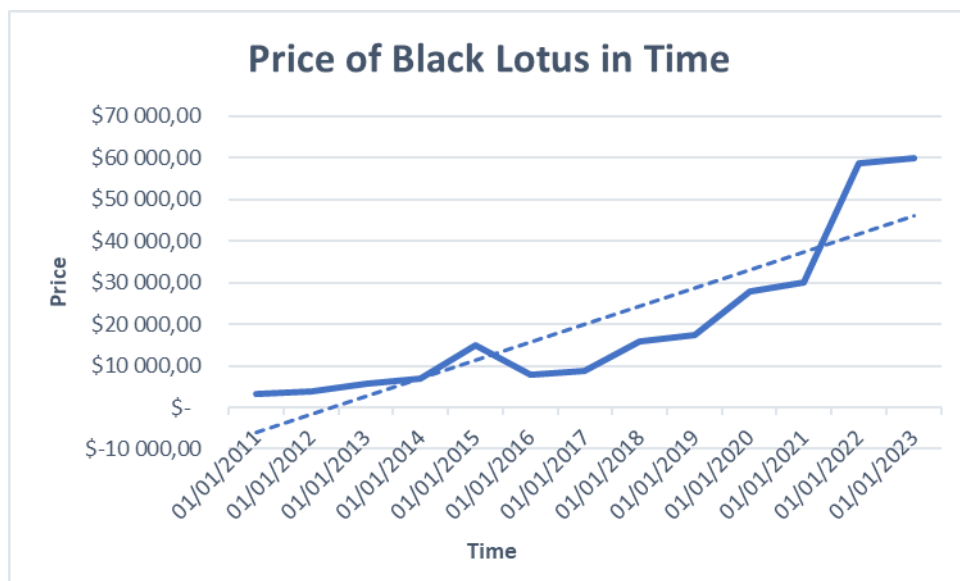
7.3 List of Abbreviations

MtG – Magic the Gathering
IRR – Internal Rate of Return
NPV – Net Present Value

Appendix

Date	Price
01/01/2011	\$ 3 103,00
01/01/2012	\$ 4 000,00
01/01/2013	\$ 5 600,00
01/01/2014	\$ 6 790,00
01/01/2015	\$15 000,00
01/01/2016	\$ 7 750,00
01/01/2017	\$ 8 750,00
01/01/2018	\$16 000,00
01/01/2019	\$17 499,00
01/01/2020	\$28 000,00
01/01/2021	\$30 000,00
01/01/2022	\$58 699,00
01/01/2023	\$60 000,00

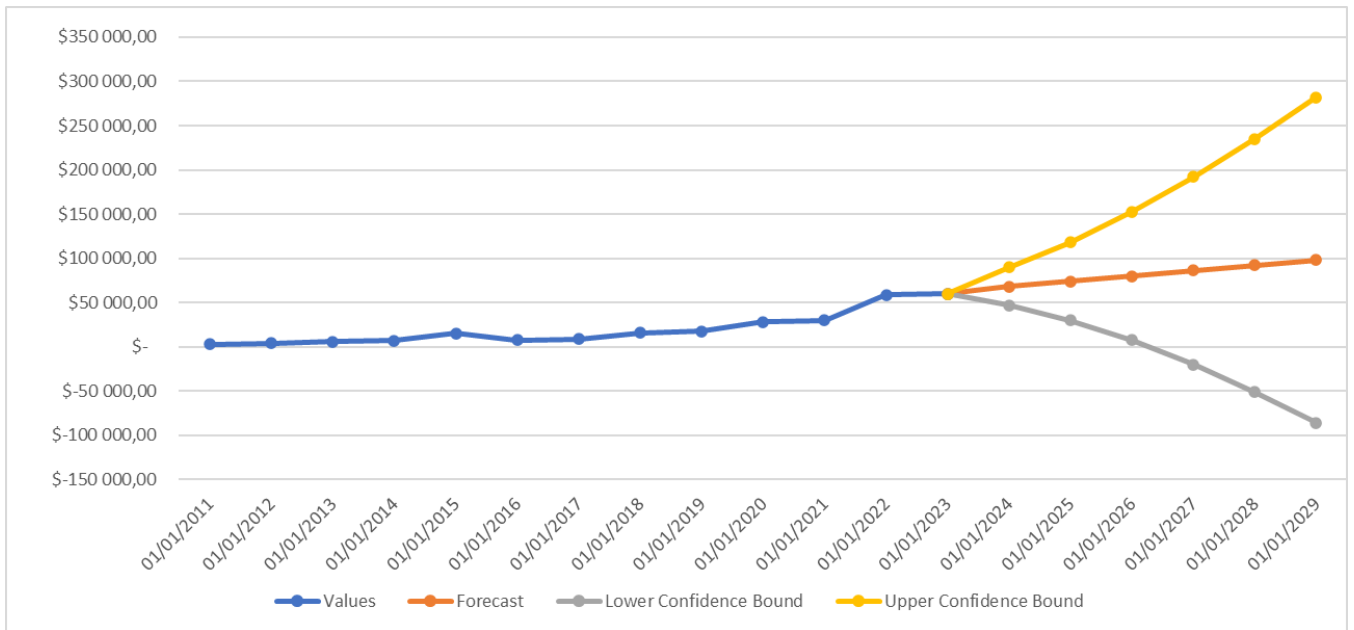
Table 5 Prices of Black Lotus from MTGGoldfish.com



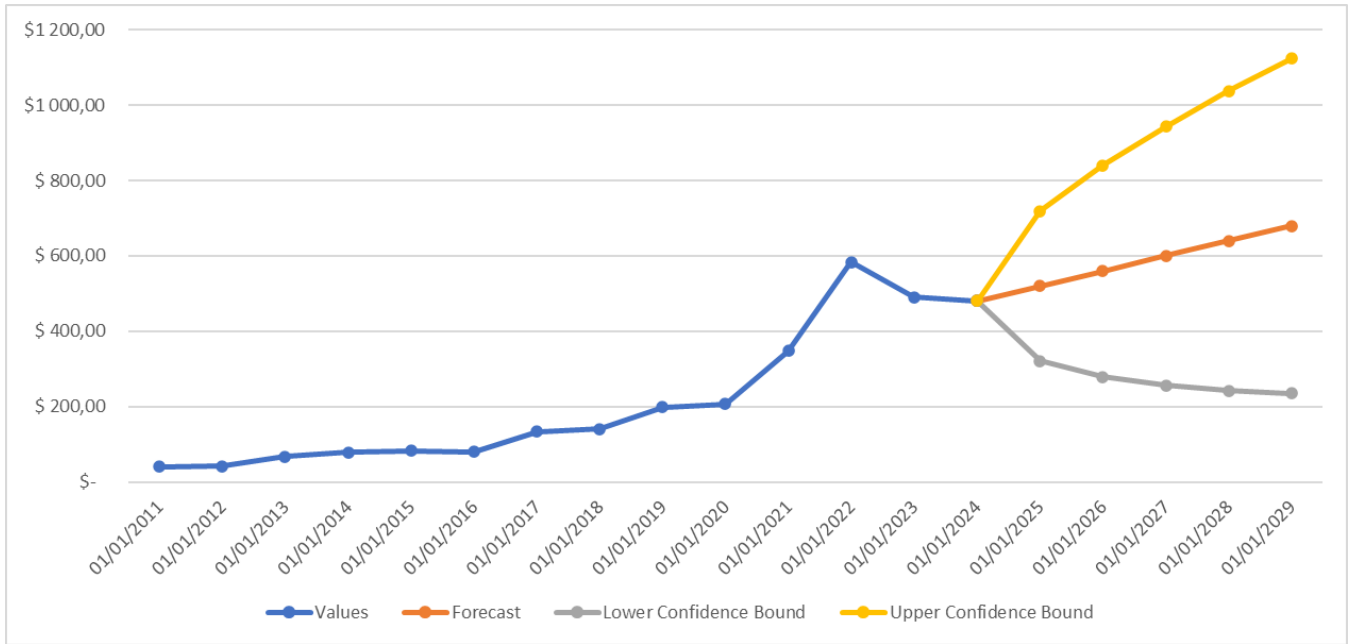
Graph 2 Prices of Black Lotus in time



Graph 4 Price of Lion's Eye Diamond in time



Graph 3 Black Lotus Forecasted Prices



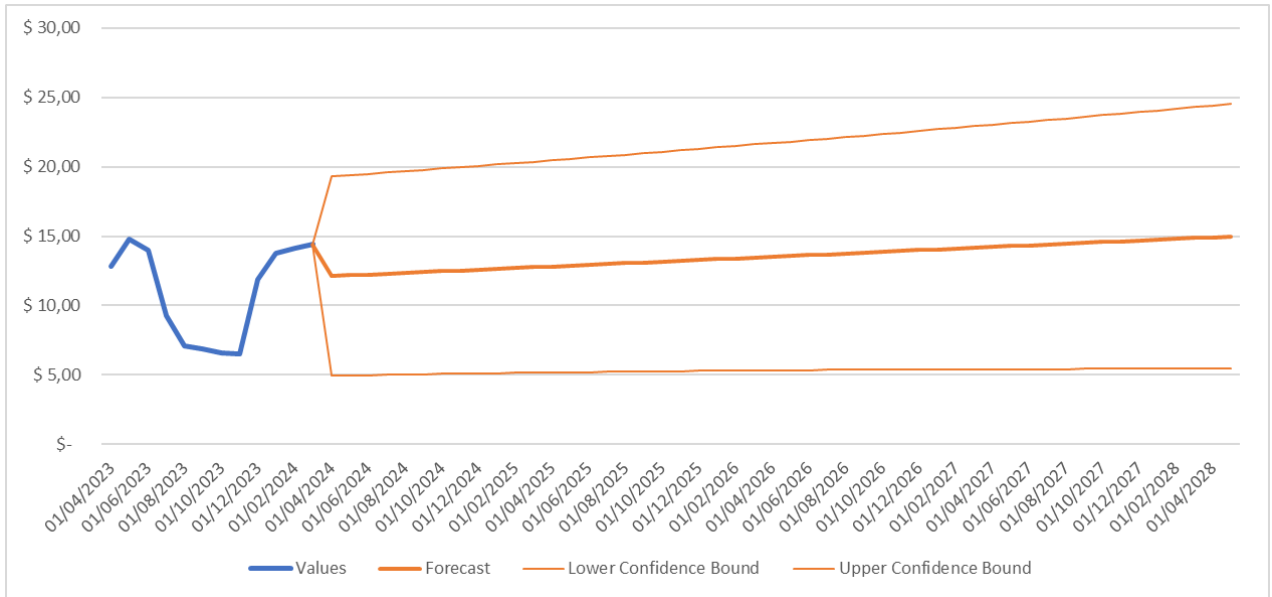
Graph 5 Lion's Eye Diamond Forecasted prices

Price	Date
\$ 12,80	01/04/2023
\$ 14,80	01/05/2023
\$ 14,00	01/06/2023
\$ 9,30	01/07/2023
\$ 7,10	01/08/2023
\$ 6,90	01/09/2023
\$ 6,60	01/10/2023
\$ 6,50	01/11/2023
\$ 11,90	01/12/2023
\$ 13,80	01/01/2024
\$ 14,10	01/02/2024
\$ 14,40	01/03/2024

Table 6 Prices of Invasion of Ikorra from MTGGoldfish

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
01/04/2023	\$ 12,80			
01/05/2023	\$ 14,80			
01/06/2023	\$ 14,00			
01/07/2023	\$ 9,30			
01/08/2023	\$ 7,10			
01/09/2023	\$ 6,90			
01/10/2023	\$ 6,60			
01/11/2023	\$ 6,50			
01/12/2023	\$ 11,90			
01/01/2024	\$ 13,80			
01/02/2024	\$ 14,10			
01/03/2024	\$ 14,40	\$ 14,40	\$ 14,40	\$ 14,40
01/04/2024		\$ 12,12	\$ 4,95	\$ 19,29
01/05/2024		\$ 12,18	\$ 4,97	\$ 19,38
01/06/2024		\$ 12,24	\$ 4,99	\$ 19,48
01/07/2024		\$ 12,29	\$ 5,01	\$ 19,57
01/08/2024		\$ 12,35	\$ 5,03	\$ 19,67
01/09/2024		\$ 12,41	\$ 5,05	\$ 19,77
01/10/2024		\$ 12,47	\$ 5,07	\$ 19,86
01/11/2024		\$ 12,53	\$ 5,09	\$ 19,96
01/12/2024		\$ 12,59	\$ 5,11	\$ 20,06
01/01/2025		\$ 12,64	\$ 5,13	\$ 20,16
01/02/2025		\$ 12,70	\$ 5,15	\$ 20,26
01/03/2025		\$ 12,76	\$ 5,16	\$ 20,36
01/04/2025		\$ 12,82	\$ 5,18	\$ 20,46
01/05/2025		\$ 12,88	\$ 5,19	\$ 20,56
01/06/2025		\$ 12,94	\$ 5,21	\$ 20,66
01/07/2025		\$ 13,00	\$ 5,22	\$ 20,77
01/08/2025		\$ 13,05	\$ 5,24	\$ 20,87
01/09/2025		\$ 13,11	\$ 5,25	\$ 20,97
01/10/2025		\$ 13,17	\$ 5,26	\$ 21,08
01/11/2025		\$ 13,23	\$ 5,28	\$ 21,18
01/12/2025		\$ 13,29	\$ 5,29	\$ 21,29
01/01/2026		\$ 13,35	\$ 5,30	\$ 21,39
01/02/2026		\$ 13,40	\$ 5,31	\$ 21,50
01/03/2026		\$ 13,46	\$ 5,32	\$ 21,60
01/04/2026		\$ 13,52	\$ 5,33	\$ 21,71
01/05/2026		\$ 13,58	\$ 5,34	\$ 21,82
01/06/2026		\$ 13,64	\$ 5,35	\$ 21,93
01/07/2026		\$ 13,70	\$ 5,36	\$ 22,03
01/08/2026		\$ 13,76	\$ 5,37	\$ 22,14
01/09/2026		\$ 13,81	\$ 5,38	\$ 22,25
01/10/2026		\$ 13,87	\$ 5,38	\$ 22,36
01/11/2026		\$ 13,93	\$ 5,39	\$ 22,47
01/12/2026		\$ 13,99	\$ 5,40	\$ 22,58
01/01/2027		\$ 14,05	\$ 5,40	\$ 22,69
01/02/2027		\$ 14,11	\$ 5,41	\$ 22,81
01/03/2027		\$ 14,17	\$ 5,41	\$ 22,92
01/04/2027		\$ 14,22	\$ 5,42	\$ 23,03
01/05/2027		\$ 14,28	\$ 5,42	\$ 23,14
01/06/2027		\$ 14,34	\$ 5,42	\$ 23,26
01/07/2027		\$ 14,40	\$ 5,43	\$ 23,37
01/08/2027		\$ 14,46	\$ 5,43	\$ 23,49
01/09/2027		\$ 14,52	\$ 5,43	\$ 23,60
01/10/2027		\$ 14,57	\$ 5,43	\$ 23,72
01/11/2027		\$ 14,63	\$ 5,43	\$ 23,83
01/12/2027		\$ 14,69	\$ 5,43	\$ 23,95
01/01/2028		\$ 14,75	\$ 5,44	\$ 24,06
01/02/2028		\$ 14,81	\$ 5,43	\$ 24,18
01/03/2028		\$ 14,87	\$ 5,43	\$ 24,30
01/04/2028		\$ 14,93	\$ 5,43	\$ 24,42
01/05/2028		\$ 14,98	\$ 5,43	\$ 24,54

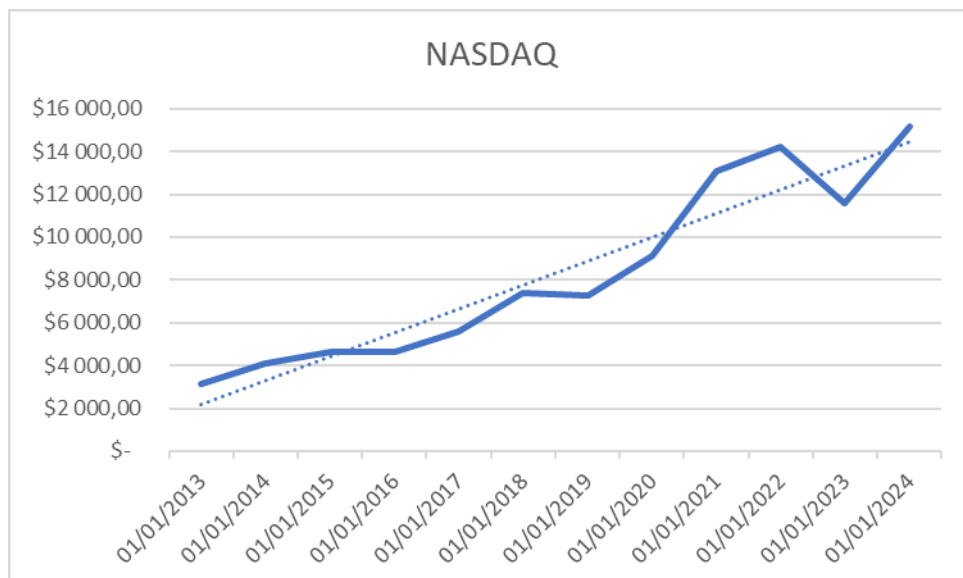
Table 7 Invasion of Ikorja Forecast



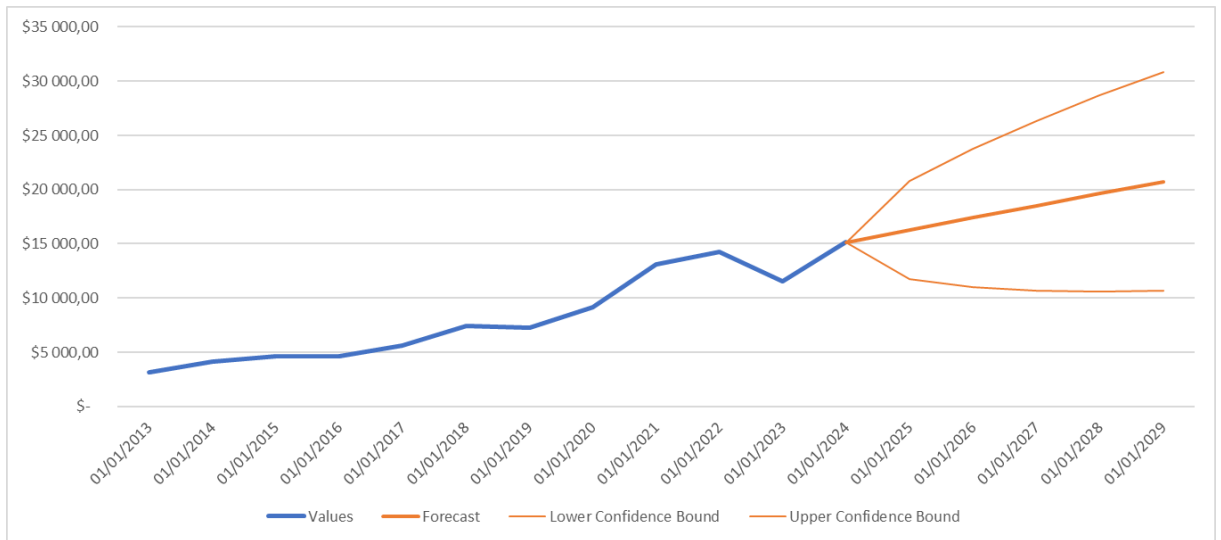
Graph 6 Invasion of Ikorria Forecast in time

Date	Price
01/01/2013	\$ 3 142,13
01/01/2014	\$ 4 103,88
01/01/2015	\$ 4 635,24
01/01/2016	\$ 4 613,95
01/01/2017	\$ 5 614,79
01/01/2018	\$ 7 411,48
01/01/2019	\$ 7 281,74
01/01/2020	\$ 9 150,94
01/01/2021	\$ 13 070,69
01/01/2022	\$ 14 239,88
01/01/2023	\$ 11 584,55
01/01/2024	\$ 15 164,01

Table 8 Prices NASDAQ



Graph 7 NASDAQ forecast in time



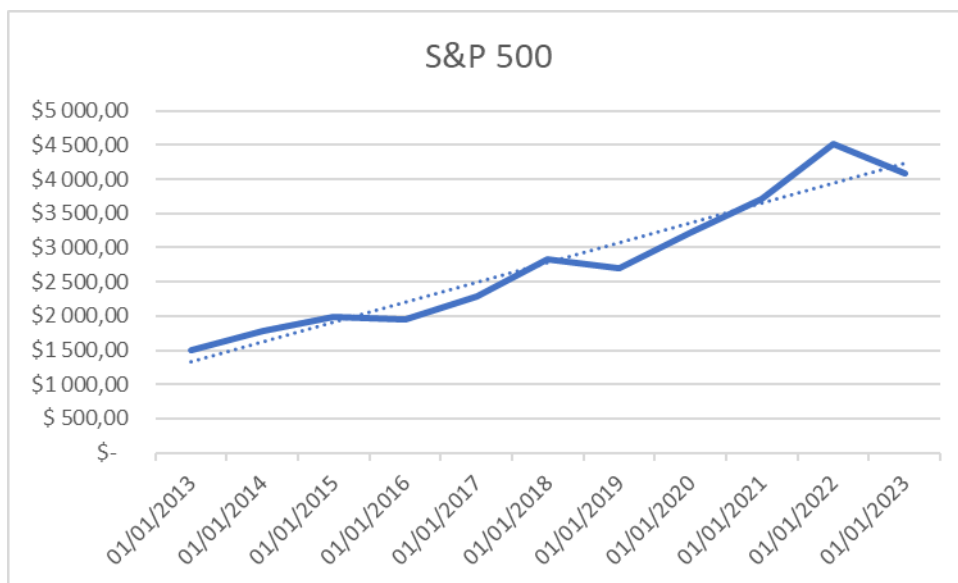
Graph 8 Prices of NASDAQ Forecast in time

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
01/01/2013	\$ 3 142,13			
01/01/2014	\$ 4 103,88			
01/01/2015	\$ 4 635,24			
01/01/2016	\$ 4 613,95			
01/01/2017	\$ 5 614,79			
01/01/2018	\$ 7 411,48			
01/01/2019	\$ 7 281,74			
01/01/2020	\$ 9 150,94			
01/01/2021	\$ 13 070,69			
01/01/2022	\$ 14 239,88			
01/01/2023	\$ 11 584,55			
01/01/2024	\$ 15 164,01	\$ 15 164,01	\$ 15 164,01	\$ 15 164,01
01/01/2025		\$ 16 281,36	\$ 11 764,58	\$ 20 798,14
01/01/2026		\$ 17 398,71	\$ 11 014,21	\$ 23 783,21
01/01/2027		\$ 18 516,05	\$ 10 695,37	\$ 26 336,74
01/01/2028		\$ 19 633,40	\$ 10 599,84	\$ 28 666,97
01/01/2029		\$ 20 750,75	\$ 10 646,88	\$ 30 854,63

Table 9 NASDAQ Forecast

Date	Price
01/01/2013	\$ 1 498,11
01/01/2014	\$ 1 782,59
01/01/2015	\$ 1 994,99
01/01/2016	\$ 1 940,24
01/01/2017	\$ 2 278,87
01/01/2018	\$ 2 823,81
01/01/2019	\$ 2 704,10
01/01/2020	\$ 3 225,52
01/01/2021	\$ 3 714,24
01/01/2022	\$ 4 515,55
01/01/2023	\$ 4 076,60

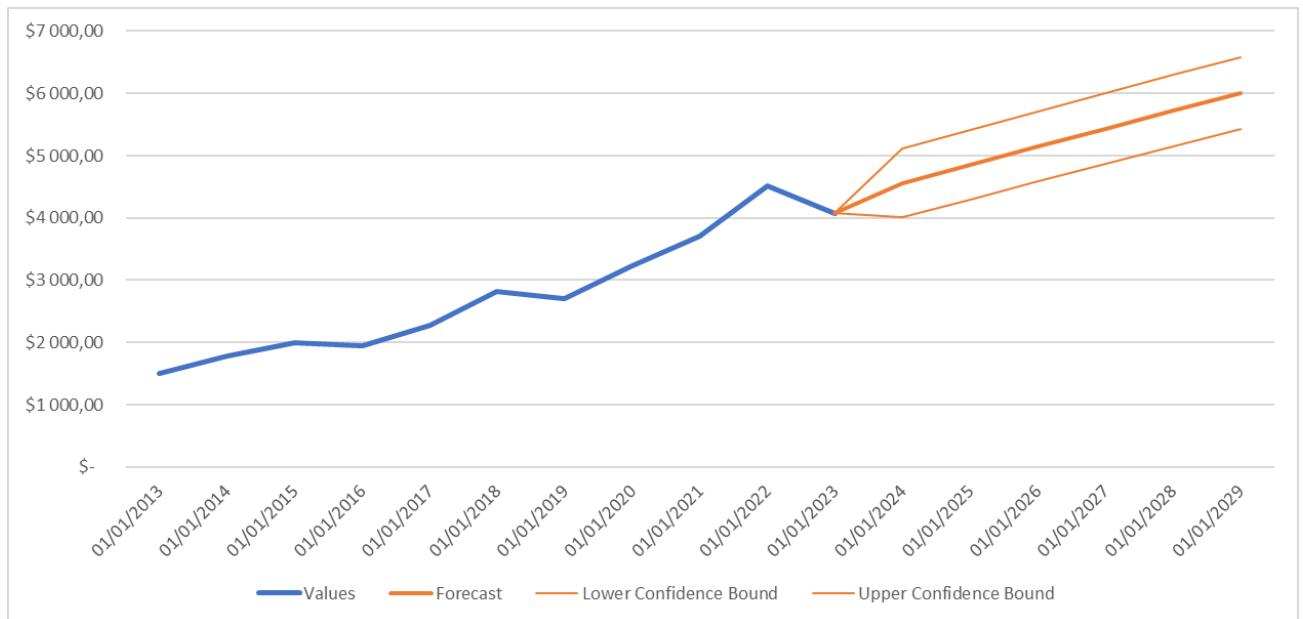
Table 10 S&P 500 Prices



Graph 9 Prices of S&P 500 In time

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
01/01/2013	\$ 1 498,11			
01/01/2014	\$ 1 782,59			
01/01/2015	\$ 1 994,99			
01/01/2016	\$ 1 940,24			
01/01/2017	\$ 2 278,87			
01/01/2018	\$ 2 823,81			
01/01/2019	\$ 2 704,10			
01/01/2020	\$ 3 225,52			
01/01/2021	\$ 3 714,24			
01/01/2022	\$ 4 515,55			
01/01/2023	\$ 4 076,60	\$ 4 076,60	\$ 4 076,60	\$ 4 076,60
01/01/2024		\$ 4 562,61	\$ 4 009,21	\$ 5 116,02
01/01/2025		\$ 4 852,33	\$ 4 294,48	\$ 5 410,18
01/01/2026		\$ 5 142,04	\$ 4 579,71	\$ 5 704,37
01/01/2027		\$ 5 431,76	\$ 4 864,92	\$ 5 998,60
01/01/2028		\$ 5 721,47	\$ 5 150,08	\$ 6 292,86
01/01/2029		\$ 6 011,18	\$ 5 435,22	\$ 6 587,15

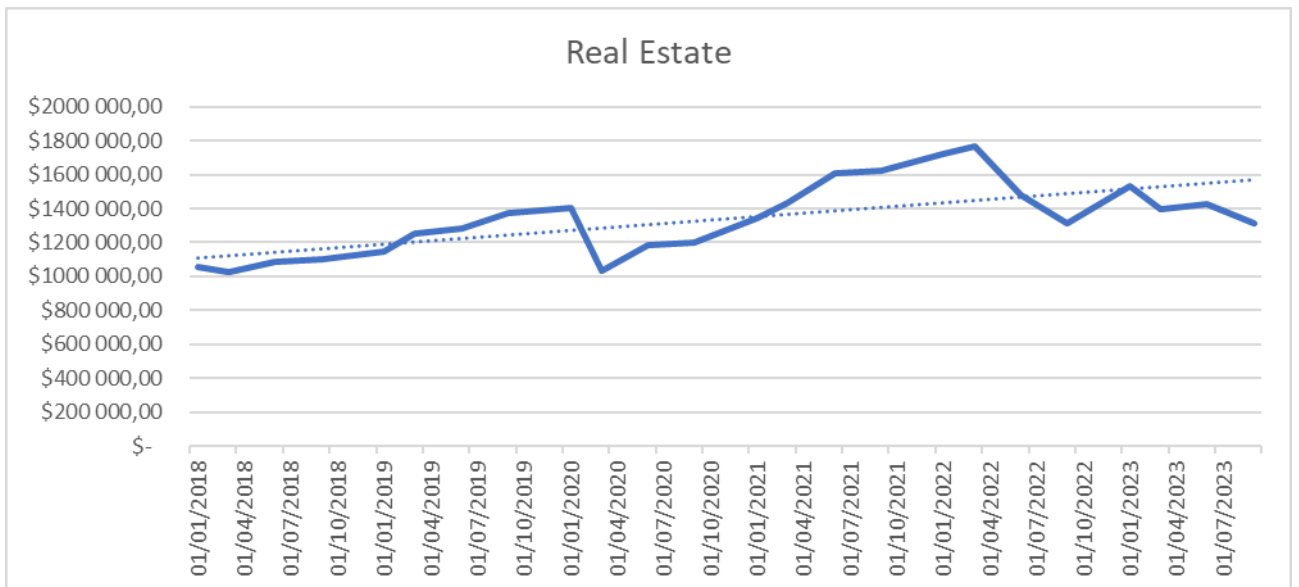
Table 11 S&P 500 Forecast



Graph 10 S&P 500 Forecast in time

Date	Price
01/01/2018	\$ 1 053 393,63
01/03/2018	\$ 1 022 172,31
01/06/2018	\$ 1 088 777,50
01/09/2018	\$ 1 103 498,75
01/01/2019	\$ 1 149 839,63
01/03/2019	\$ 1 251 457,75
01/06/2019	\$ 1 279 810,25
01/09/2019	\$ 1 377 318,50
01/01/2020	\$ 1 407 210,25
01/03/2020	\$ 1 036 688,75
01/06/2020	\$ 1 182 409,50
01/09/2020	\$ 1 201 699,25
01/01/2021	\$ 1 346 913,63
01/03/2021	\$ 1 438 042,25
01/06/2021	\$ 1 605 747,13
01/09/2021	\$ 1 622 942,38
01/01/2022	\$ 1 720 907,25
01/03/2022	\$ 1 764 308,00
01/06/2022	\$ 1 482 889,38
01/09/2022	\$ 1 315 971,38
01/01/2023	\$ 1 534 983,00
01/03/2023	\$ 1 399 104,75
01/06/2023	\$ 1 424 667,50
01/09/2023	\$ 1 314 696,13

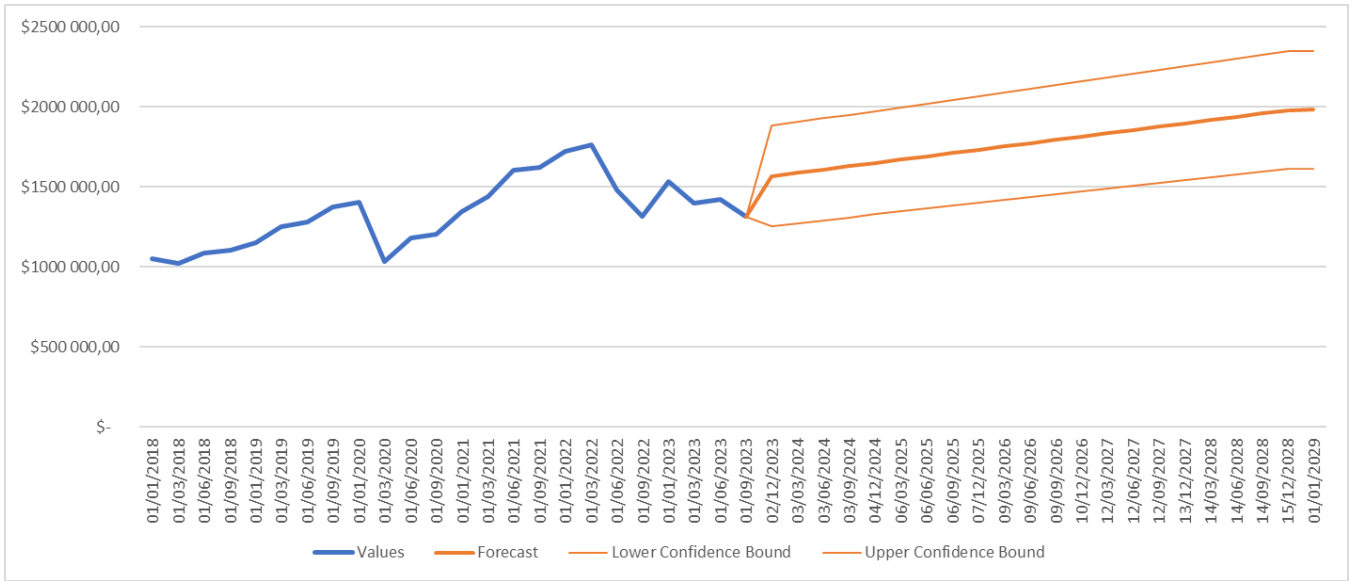
Table 12 Prices Real Estate



Graph 11 Real Estate prices in time

Timeline	Values	Forecast	Lower Confidence Bound	Upper Confidence Bound
01/01/2018	\$ 1 053 393,63			
01/03/2018	\$ 1 022 172,31			
01/06/2018	\$ 1 088 777,50			
01/09/2018	\$ 1 103 498,75			
01/01/2019	\$ 1 149 839,63			
01/03/2019	\$ 1 251 457,75			
01/06/2019	\$ 1 279 810,25			
01/09/2019	\$ 1 377 318,50			
01/01/2020	\$ 1 407 210,25			
01/03/2020	\$ 1 036 688,75			
01/06/2020	\$ 1 182 409,50			
01/09/2020	\$ 1 201 699,25			
01/01/2021	\$ 1 346 913,63			
01/03/2021	\$ 1 438 042,25			
01/06/2021	\$ 1 605 747,13			
01/09/2021	\$ 1 622 942,38			
01/01/2022	\$ 1 720 907,25			
01/03/2022	\$ 1 764 308,00			
01/06/2022	\$ 1 482 889,38			
01/09/2022	\$ 1 315 971,38			
01/01/2023	\$ 1 534 983,00			
01/03/2023	\$ 1 399 104,75			
01/06/2023	\$ 1 424 667,50			
01/09/2023	\$ 1 314 696,13	\$ 1 314 696,13	\$ 1 314 696,13	\$ 1 314 696,13
02/12/2023		\$ 1 569 389,40	\$ 1 256 368,31	\$ 1 882 410,49
03/03/2024		\$ 1 589 920,87	\$ 1 274 385,52	\$ 1 905 456,23
03/06/2024		\$ 1 610 452,35	\$ 1 292 383,33	\$ 1 928 521,36
03/09/2024		\$ 1 630 983,82	\$ 1 310 361,89	\$ 1 951 605,75
04/12/2024		\$ 1 651 515,29	\$ 1 328 321,36	\$ 1 974 709,23
06/03/2025		\$ 1 672 046,76	\$ 1 346 261,88	\$ 1 997 831,65
06/06/2025		\$ 1 692 578,24	\$ 1 364 183,60	\$ 2 020 972,87
06/09/2025		\$ 1 713 109,71	\$ 1 382 086,69	\$ 2 044 132,73
07/12/2025		\$ 1 733 641,18	\$ 1 399 971,27	\$ 2 067 311,09
09/03/2026		\$ 1 754 172,65	\$ 1 417 837,50	\$ 2 090 507,81
09/06/2026		\$ 1 774 704,13	\$ 1 435 685,52	\$ 2 113 722,73
09/09/2026		\$ 1 795 235,60	\$ 1 453 515,48	\$ 2 136 955,72
10/12/2026		\$ 1 815 767,07	\$ 1 471 327,50	\$ 2 160 206,64
12/03/2027		\$ 1 836 298,55	\$ 1 489 121,75	\$ 2 183 475,34
12/06/2027		\$ 1 856 830,02	\$ 1 506 898,34	\$ 2 206 761,70
12/09/2027		\$ 1 877 361,49	\$ 1 524 657,41	\$ 2 230 065,57
13/12/2027		\$ 1 897 892,96	\$ 1 542 399,11	\$ 2 253 386,81
14/03/2028		\$ 1 918 424,44	\$ 1 560 123,56	\$ 2 276 725,31
14/06/2028		\$ 1 938 955,91	\$ 1 577 830,89	\$ 2 300 080,92
14/09/2028		\$ 1 959 487,38	\$ 1 595 521,24	\$ 2 323 453,52
15/12/2028		\$ 1 980 018,85	\$ 1 613 194,73	\$ 2 346 842,98
01/01/2029		\$ 1 983 812,71	\$ 1 616 455,69	\$ 2 351 169,73

Table 13 Real Estate Forecasted prices



Graph 12 Real Estate Forecast in time