UNIVERSITY OF TURKU

ABSTRACT

☐ Bachelor's thesis
☒ Master's thesis
☐ Licentiate's thesis
☐ Doctoral dissertation

Subject	Futures studies	Date	4.8.2020
Author(s)	Jyri Karhapää	Number of pages	94 + appendices
Title	Trend impact analysis in stock valuation: An application with a dividend discount model		
Supervisor(s)	Prof. Toni Ahlqvist, Prof. Mika Vaihekoski		

Abstract

There exist undiscussed parallels between futures studies and finance, in both theory and practice. The objective of this thesis is to demonstrate how Gordon's (2009a) Trend Impact Analysis could be combined with a dividend discount model (DDM) in order to value the publicly traded stock of a Case Company (Olvi Oyj), explicitly taking into account the estimated impacts and probabilities of a few uncertain future phenomena. DDMs are understood as a simple version of discounted cash flow (DCF) methods, and TIA could be possibly applicable with more advanced DCFs as well. There exist no published applications of TIA with DCFs. Among the scenario methods used in finance with DCFs, simulation approaches have the highest similarity to TIA.

Primary data was collected with two online surveys. Anonymous retail investors interested in the Case Company were used as experts. They provided a source of potentially significant future phenomena, and defined subjective judgments of related probabilities and impacts on net profit. Experts focused almost exclusively on phenomena related to the end products of the Case Company, instead of "less visible" aspects of the business. Replicating Gordon's (2009a) TIA process, aggregated expert judgments were combined with an extrapolated base scenario, and a Monte Carlo simulation of 10,000 probabilistic modified trends (PMT) scenarios of net profit was performed. The simulation revealed that the expected combined effect of the few studied phenomena would be relatively unimportant. Dividends were assumed based on the dividend policy of the Case Company, and a DDM was used to value main PMT scenarios. The DDM suggests that the stock is most likely overvalued. However, the stock price could be considered fair if one specific analyzed future phenomenon occurs soon. Several reasons suggest that all the overall result may be too conservative. Further research is required to conclude if TIA is applicable in the analysis of free cash flows in DCF models.

Key words	trend impact analysis, dividend discount model, discounted cash flow, probabilistic modified trends, stock valuation

TIIVISTELMÄ

☐	Kandidaatintutkielma
x	Pro gradu -tutkielma
☐	Lisensiaatintutkielma
☐	Väitöskirja

Oppiaine	Tulevaisuudentutkimus	Päivämäärä	4.8.2020
Tekijä(t)	Jyri Karhapää	Sivumäärä	94 + liitteet
Otsikko	Trend impact analysis in stock valuation: An application with a dividend discount model		
Ohjaaja(t)	Prof. Toni Ahlqvist, Prof. Mika Vaihekoski		

Tiivistelmä

Tulevaisuudentutkimuksen ja rahoituksen välillä on aiemmin käsittelemättömiä yhtäläisyyksiä sekä teoriassa ja käytännössä. Tämän pro gradu -työn tarkoitus on näyttää kuinka Gordonin (2009a) trendien vaikutus-analyysi (TIA) voidaan yhdistää osinko-diskonttausmallin kanssa Case-yrityksen (Olvi Oyj) julkisesti vaihdetun osakkeen arvon määritykseen, ottaen eksplisiittisesti huomioon muutamien epävarmojen tulevaisuuden ilmiöiden vaikutukset ja todennäköisyydet. Osinko-diskonttausmallit voidaan ymmärtää yksinkertaisena versiona kassavirran diskonttausmalleista (DCF), joten TIA voisi mahdollisesti olla sovellettavissa myös kehittyneempien DCF-mallien kanssa. Ei ole julkaisuja, joissa TIAa olisi käytetty DCF-mallien kanssa. Niistä skenaariometodeista, joita käytetään rahoituksessa kassavirran diskonttausmallien kanssa, simulaatiotyökalut ovat lähimpänä TIAa.

Perustietoa kerättiin kahden internet-kyselytutkimuksen kautta. Nimettömiä yksityissijoittajia, jotka ovat kiinnostuneita Case-yrityksestä, käytettiin asiantuntijoina. He toimivat lähteenä mahdollisesti merkittäville tulevaisuuden ilmiöille, ja määrittivät subjektiiviset arvionsa ilmiöiden todennäköisyyksistä ja vaikutuksista nettovoittoon. Asiantuntijat keskittyivät lähes ainoastaan sellaisiin ilmiöihin, jotka koskevat Case-yrityksen lopputuotteita, liiketoiminnan “vähemmän näkyvien” osien sijasta. Gordonin (2009a) TIA-metodia replikoitiin yhdistämällä koostetut asiantuntijoiden arviot ekstrapoloidun perusskenaarion kanssa, ja Monte Carlo -simulaatiolla tehtiin 10,000 probabilistic modified trends (PMT) skenaariota nettovoitosta. Simulaatio paljasti, että tutkittujen ilmiöiden odotettu yhteinen vaikutus ei todennäköisesti olisi kovin merkittävä. Osingot oletettiin perustuen yrityksen osinkopolitiikkaan, ja osinko-diskonttausmallia käytettiin arvostamaan keskeisimmät PMT-skenaariot. Osinko-diskonttausmallin tulos viittaa siihen, että osake on oletettavasti yliarvostettu. Osakkeen hintaa voitaisiin pitää kuitenkin kohtuullisena, jos yksi tietty tutkituista tulevaisuuden ilmiöistä tapahtuisi pian. Muutamat seikat viittavat sihen, että lopputulos voi olla liian konservatiivinen. Jatkotutkimusta tarvitaan, jotta voidaan ymmärtää, onko TIA soveltuva vapaiden kassavirtojen analysointiin DCF-malleissa.

Avainsanat: trendien vaikutus-analyysi, osinkojen diskonttaus, kassavirran diskonttaus, probabilistic modified trends, osakkeen arvon määrittäminen

UNIVERSITY
OF TURKU
Turku School of
Economics

TREND IMPACT ANALYSIS IN STOCK VALUATION

An application with a dividend discount model

Master's Thesis
in Futures Studies

Author:
Jyri Karhapää

Supervisors:
Prof. Toni Ahlqvist
Prof. Mika Vaihekoski

04.08.2020
Turku

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF KEY TERMS, ACRONYMS AND ABBREVIATIONS

CAPM	Capital Asset Pricing Model
DCF	Discounted Cash Flow
DDM	Dividend Discount Model
FCFE	Free Cash Flow to Equity
PMT	Probabilistic Modified Trends
TIA	Trend Impact Analysis

1 INTRODUCTION

1.1 Background

There are undiscussed commonalities and links between the academic fields of futures studies and finance. Like futures studies, the act of investing for profit (in a broad sense) is inherently concerned with trying to make sense of the range of possible futures. Yet despite the obvious connection, it is remarkable how little has been published specifically about potential applications of futures studies theories, concepts and methods to finance and investing. Such parallels are not only philosophical but might also extend to methodology. This observation is the initial motivation for this thesis.

A central future-oriented problem in finance is that of valuation. A method called discounted cash flow (DCF) is based on the idea that a cash-generating asset, such as a stock or a bond, is intrinsically worth the sum of all the cash flows it will ever produce, discounted back to the present by applying an appropriate discount rate (Damodaran 2006, 117). It is recognized in DCFs that there is an inherent uncertainty in the estimation of those future cash flows, and the use of various scenario methods is not new in DCFs. The main objective in this thesis is to demonstrate how scenarios created with Gordon's (2009a) explorative futures studies method trend impact analysis (TIA) might be applicable in combination with a simple dividend discount model (DDM) in order to value a stock, depending on how a specified list of uncertain future events may take place. TIA produces quantitative scenarios in the probabilistic modified trends (PMT) school of scenarios (Bradfield et al. 2005, 800), which could be inputs in valuation methods. TIA offers a structured way to explicitly state assumptions about the future, which might be beneficial for thinking and decision-making in valuation.

While this thesis will only demonstrate a simple application with a DDM, it can be considered to be in the DCF family of methods (Damodaran 2006, 14). The larger argument is that TIA might possibly be applicable to other variants of DCFs, not only to a DDM. The publicly traded share of a Finnish company called Olvi Oyj is used as the subject ("Case Company") in this thesis. It must be underlined that none of the companies or persons named in this thesis have participated in its creation in any way, and no collaboration with them is implied.

The research approach is critical realism, where it is supposed that generative mechanisms are the deepest level of an objective reality, which is not observable directly, but it could be possibly understood through the study of events and experiences (Fisher 2010, 261). In critical realism, systematic knowledge of the world can be obtainable, but it is inevitably influenced by subjectivity (ibid, 17). Mixed methods are used in the thesis; while the TIA and DDM methods result in quantitative outputs, most of their inputs are also based on qualitative and subjective judgments of the world.

1.2 Research questions

There is a total of four research questions posed in this thesis. The questions are listed in the same order that they are answered.

Research question 1: “In futures studies literature, has trend impact analysis ever been used in any applications with discounted cash flow methods or similar valuation methods?” The question is straightforward and is answered with a literature review. If any documented cases do exist, they would provide important material.

Research question 2: “In finance literature, what are the main scenario methods that are used in combination with discounted cash flow analyses, and how are those methods different from trend impact analysis?” This is also answered through the literature review. Different types of scenario methods in DCFs can be listed and compared against each other, as well with the TIA method.

Research question 3: “What kinds of possible future phenomena does a small group of Finnish retail investors consider most impactful for Olvi Oyj’s net profit towards 2030?” The subjective opinions of a small group of retail investors are used as a primary data source in the application of TIA, and the answer to research question 3 comes from categories of phenomena given by these persons. The question is specifically narrowed to “a small group”, as there is no claim that conclusions about all Finnish retail investors could be made.

Research question 4: “What range of valuation is found for Olvi Oyj through a trend impact analysis combined with a dividend discount model?” The question is answered by creating PMT scenarios with a TIA and valuing resulting main scenarios with a DDM.

1.3 Thesis structure

This thesis builds gradually from theory through a literature review to the practical application of the TIA & DDM methods. The structure is visualized in Figure 1.

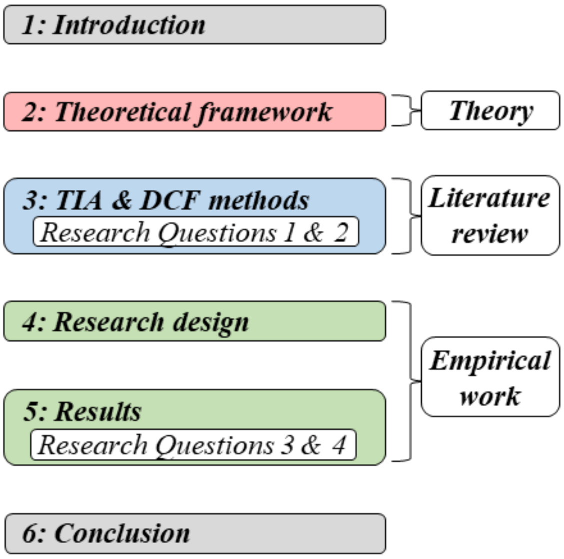


Figure 1. Structure of the thesis.

The second section discusses the main theoretical ideas that shape this thesis. Those theories are again referred to throughout the work, where relevant. The third section is an examination of the TIA & DCF methods through a systematic literature review. The fourth section discusses what exactly is studied and how it is to be done. This includes rationale for why specific data collection choices are made, specific details on how TIA & DDM methods are applied, and what kinds of adjustments are made so that they can fit each other. The fifth section shows the results of the TIA and DDM processes, step-by-step, arriving at a range of valuation for the publicly traded share of the Case Company. The sixth section summarizes the answers to the research questions and outlines main limitations. It also gives suggestions for what parties might be potential users of TIA with DCFs, and for specific further areas of research. Appendices in the end consist of details related to the collection and processing of primary and secondary data.

1.4 Semantic clarifications

There are three semantic clarifications that should be made to avoid any confusion. One of the main authors associated with the development of DDMs is economist Myron Gordon, and the DDM is often called the “Gordon growth model” (Pratt & Grabowski 2014, 40). However, any references attributed to “Gordon” in this document only refer to the futurist Theodore Gordon.

The meanings of the word “scenario” and related methods are inconsistent across academic literature. The primary intended meaning of a “scenario” in this thesis is a PMT scenario, which are the output created by TIA. In finance, the word “scenario” is not necessarily understood and used with the same meaning(s) as in futures studies. Also within futures studies, there exist multiple meanings and debate over how “scenarios” are defined (Börjeson et al. 2006, 724).

The word “futures” in this document never refers to the types of derivative financial instruments of that name. Instead, the word is mainly used with the meaning of “possible futures”, as widely understood in futures studies. This refers to the broad notion that there are alternative possible futures that may or may not become real, see Bell (1997, 75-80) among others. There are also references to the academic journal titled “Futures”.

2 THEORETICAL FRAMEWORK

2.1 Overview

This section is about the main theoretical assumptions that inform this thesis. First, the concept of intrinsic value in finance is explained. Second, through the futures cone framework, it is shown that a vast range of possible alternative futures is not studied at all in common DCF models. Third, PMT scenarios are suggested as a way to illustrate alternative futures in DCFs. Fourth, it is discussed how traditional value investing philosophy has a notably cautious approach towards the futures and forecasting, which might be a counterargument to the use of futures studies in investing, and acts here as a sort of an antithesis against the active study of futures.

2.2 Intrinsic value

Williams (1938) is credited with differentiating that an asset like a stock or a bond has an "intrinsic value". This is explicitly a different figure from whatever price the same asset has on capital markets. This separation between intrinsic value and market price has been called the "foundation of modern finance" (Carlisle 2014, 44). In the same work, Williams (1938) also defined formulae like the DDM to calculate intrinsic value through the income that will be received in the future from an investment. This might be considered the formal beginning of the DCF group of methods, although one interpretation of the 1202 book "Liber Abaci" by Fibonacci is that it includes the earliest documented DCF calculation (Goetzmann 2004, 29).

For those investors who are mainly concerned with the fundamentals of assets (rather than with only the trading of them) it should logically be a priority to find out the intrinsic value of an asset, before looking at what its current market price is. The problem is that intrinsic value remains an epistemologically distant concept, because it cannot ever be determined for certain; instead, it merely can be approximated using various valuation methods. An accurate calculation of intrinsic value would require perfect knowledge of all information, that of a "Laplace's demon" (Mauboussin 2007, 223). Valuation is a "complex ill-structured task", meaning that there is no obvious best way to solve the problem, and the quality of the process cannot be perfectly compared against a standard benchmark, due to the uniqueness of each situation (Olsen 2002, 162). This means that it is impossible to fully understand how far a valuation analysis is from the true intrinsic value, which also makes it problematic to distinguish analyst skill from luck (Damodaran 2007, 10).

2.3 Futures cone

The futures cone by Voros (2003, 16) is a generic framework for gaining perspective to the range of alternative futures, applicable to any subject. The cone, and the different kinds of futures in it, are a major paradigm in futures studies overall. Perhaps the earliest version of the cone may have been created by Taylor (1990); Voros (2003, 16) also gives credit to Hancock & Bezold (1994).

The futures cone is a visualization of existing categorizations of the alternative futures, including by Amara (1991, 647-649) and Henchey (1978). Even though time is linear and not all possible alternative futures will be realized (Bell 1997, 140-142), the future (singular) is assumed to be open and not predetermined, which is why it is justifiable to study alternative futures (ibid, 150-154). Henchey (1978, 26) summarizes the four kinds of futures as "*possible* futures (what may be); *preferable* futures (what should be); *plausible* futures (what could be); and *probable* futures (what will likely be)". The value of these four futures is especially in understanding their interrelationships (ibid).

"Possible futures" is the broadest category and the easiest to define objectively. It is a set of futures encompassing everything that may happen, including all other kinds of futures. A possible future simply has a greater probability than zero of being realized. There are still impossible futures that clearly cannot become true (e.g. due to the laws of physics being a limiting factor) but researchers in the futures studies field prefer to avoid rejecting new ideas about the future just because they sound impossible in a conventional sense (Bell 1997, 79).

"Plausible futures" are considered a subset of possible futures in the futures cone (Voros 2003, 16-17), though some authors like Amara (1991) do not make the explicit distinction. Plausible futures could be imagined as real and achievable, based on current knowledge of the world that already exists. Plausible futures can act as a bridge of sorts to envisioning how preferable futures could be reached (Henchey 1978, 27).

"Preferable futures" are, by contrast, highly subjective and implicitly normative: human actors define what their preferable future for a given issue is. This is directly connected to ethical principles that are used to justify the reasons why one future would be more preferable than another (ibid, 87). Since this thesis has to do with investing on a general level, it may be worth discussing in more detail what preferable can mean for investors. It could be those futures where specific investment objectives are achieved over a given time horizon. Objectives related to profit may be defined in terms of total return, by either matching or outperforming a benchmark (e.g. a market index). However, they can include something else – here, the subjectivity in "preferable" is demonstrated in the real world. For example, it may be considered better to achieve equal returns to a benchmark but with lower measures of portfolio volatility. The use of such statistical measures in portfolio evaluation was originally started by Markowitz (1952), in the context of modern portfolio theory (Hitchner 2017, 193). Another example of a different objective is the growing popularity of ESG investing ("Environmental, Social and Corporate Governance"): for some, a "preferable" future also means satisfying ethical objectives, alongside with return (MSCI Inc., 2020). In other words, some investors are not only concerned with the size of returns but also with where those returns originate from.

The fourth major type of futures, "probable futures", are "what the most likely future[s] of some specified phenomenon would be within some stated time period and under specified contingencies" (Bell 1997, 80). Amara (1991, 647) states probable futures are about mapping out the "structure of possible paths" and the relationships of futures phenomena "to understand the situation as a whole". Within the area of probable futures, Voros (2015) has further defined the "projected" future as "the default, business as usual, extrapolated 'continuation of the past through the present' 'baseline' future". The projected future is also synonymous with some, but not all, common definitions of the word "prediction", when it is taken as an expression of an expected outcome (Bell 1997, 97-99).

A caveat with thinking about the future through the futures cone is that it can only ever be mapped out partially: "the future will never be completely known or even knowable" (Gordon 1992, 26). Futures that are possible, yet unknowable and unimaginable, are located outside the scope of the futures cone and have been termed "potential" futures by Voros (2003, 16). Despite this limit to knowledge, it is a basic stance in futures studies that it is still worthwhile to attempt to systematically explore the possible futures (Gordon 1992, 26), instead of giving up in the face of the unknown. Based on the futures cone by Voros (2003, 16), Figure 2 illustrates the main theoretical framework of this thesis.

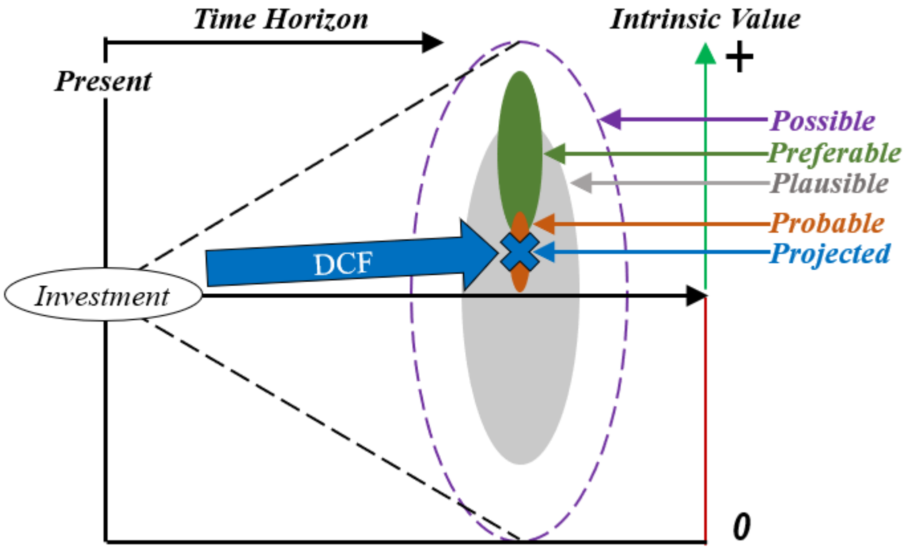


Figure 2. A DCF in the futures cone. Adapted from Voros (2003, 16).

It is proposed in this theoretical framework that most DCF analyses generally intend to reflect the projected future, which lies at the center of the probable futures. If a DCF fulfills its purpose and is performed with analytical rigor, it should be a calculation of intrinsic value, where various possible outcomes are assessed relevant weights according to their probability, to arrive at a probability-weighted "expected value".

In practice, the locations and sizes of the different areas representing alternative futures are not always necessarily as visualized in Figure 2. A DCF could also sometimes be an explicitly stated expression of preferable futures, instead of the probable futures. This could be the case when using DCFs as a demonstration of what would need to happen for a valuation outcome to be realized. Perhaps in an ideal situation for investors, it *can* be possible for the area between the preferable futures, probable futures and the projected future to be overlapping. However, criticality in assessing what a DCF truly reflects is required. For example, model assumptions may be based more on hopes than facts, which might steer a projection only toward the preferable futures, but not the probable futures – something that could become apparent only after a critical re-examination of the model. Also, a DCF could fall outside the entire futures cone, following impossible assumptions and/or analytical error. To summarize the argument, the true position of a DCF in the futures cone is not necessarily readily apparent, although the intention of DCFs might be a projected future, in the center of probable futures.

2.4 Probabilistic modified trends (PMT) scenarios

Probabilistic modified trends (PMT) scenarios are specifically the only types of scenarios produced in this thesis. Bishop et al. (2007, 8) found that in futures studies, the word "scenario" has dozens of definitions and there is no exact fixed meaning. Glenn (2009, 2) puts this more bluntly, writing that the word "is probably the most abused term in futures research". In contrast with the relatively accepted concept of alternative futures, there is less universal agreement on what scenarios are (Börjeson et al. 2006, 724). Alternative futures and scenarios may have some overlap, but are not the same (Bishop et al. 2007, 6). A single scenario contains a description of some chain(s) of events leading to some future state (ibid) (Amer et al. 2013, 23). Scenarios are made with different mixes of underlying assumptions, and using combinations of one or more methods; these are main reasons for why definitions are so varying (Bishop et al. 2007, 7).

In this thesis, scenarios are not necessarily understood as either a theory or a method, but as a way of presenting research outputs, and Bell (1997, 316) offers a description for this understanding of scenarios as "a way of summarizing the results of futures research". In this view, scenarios are a way to describe the plurality of futures. By comparing different scenarios with each other, meaningful narratives about the range of possible futures could be told (ibid). According to Meadows (2009, 47), the decision-making value of scenario studies of dynamic systems is not in predicting the future with pinpoint accuracy, but in exploring "what would happen, if a number of driving factors unfold in a range of different ways". Specifically, when scenario thinking might be applied to DCFs, this "dynamic system" would be the business being studied.

The school of PMT scenarios was created by futurists Theodore Gordon and Olaf Helmer. This origin is directly linked with the development of the associated methods trend impact analysis (TIA) and cross impact analysis (CIA) (Bishop et al. 2007, 9). These are the main – or even the only – methods that produce PMT scenarios (Bradfield et al. 2005, 800). It should be noted that Gordon (2009a; 2009b) does not actually refer to PMT scenarios, and the grouping of TIA and CIA into that category was originally done by Bradfield et al. (2005, 805). In their classification, PMT scenarios are one of three major schools of scenarios in futures studies; the other two are "intuitive logics" and "La prospective" (ibid). The classification to three schools has gained some level of recognition (Amer et al. 2013, 26-30) and is an useful way to understand how PMT scenarios are different from most scenarios.

The distinctive feature of PMT scenarios is that they are expressed in quantitative and probabilistic statements which are narrow in scope, focusing on specified lists of variables that could affect a specific trend (Bradfield et al. 2005, 806). For example, the only practical distinguishing feature between two PMT scenarios may be a difference in a single value in a database. In contrast, qualitative scenarios, like those in the intuitive logics category, exclude assumptions about probability, and instead include custom-written discursive narratives detailing fictional storylines for each scenario (ibid, 808). Glenn (2009, 2-3) insists that narration about causes and effects is integral to scenarios, and purely quantitative models of the future should be called "projections". However, Bradfield et al. (2005, 801) point out how PMT scenarios are still justifiably called scenarios, and not something else like projections, for the key reason that the methods of their creation, like TIA and CIA, do involve human narratives and judgments about the future.

Users of intuitive logics scenarios have traditionally expressed strong opposition to combining probabilities with scenarios (Millett 2009, 63). This opposition includes that probabilities cannot be assigned with certainty, that they can be misleading by implying "too much precision", and the lack of imagination involved in their creation (ibid). A major counterargument that defends PMT scenarios is that in most contexts, decision-makers *will* be thinking about the likelihoods of scenarios, so scenarios should include a structured way to express those odds explicitly (Millett 2009, 65; Gordon 2009a, 7). Ramirez & Selin (2014, 61) explain that for many futurists, the epistemological differences between qualitative and quantitative scenarios (or the "plausible" and "probable" futures) are too much to reconcile. However, the exception seems to be the third school, La prospective, which can include both storytelling as well as probabilities (Amer et al. 2013, 28). Bridging such philosophical gaps is out of the scope of this thesis, but it is recognized that some futurists do not necessarily consider PMT scenarios or quantitative scenarios to be as valid as those in the more qualitative schools.

PMT scenarios could be concerned with both uncertainty and risk. "Knightian uncertainty" applies to possible future events that are unprecedented, contrary to "risk", which is something measurable based on existing statistics (Ben-Haim & Demertzis 2015, 2). Numbers assigned to measure Knightian uncertainty may come from subjective probability estimates, which are different from objective or frequency probabilities that are based on statistical observations of the past. A good definition for subjective probabilities from Barnes (2016, 329) is: "[they] relate to single events (rather than repetitions of the same action, such as a coin toss) and are an expression of personal belief in the accuracy of a statement or the likelihood of an outcome". The subjective probabilities of any individual combine known frequency probabilities with more qualitative estimations that can be drawn from past experiences of oneself and others (Bell 1997, 153). An important property of subjective probabilities is that they can be freely altered over time, as known information changes (ibid). Tetlock & Gardner (2015, 100) claim that such conscious frequent updating of subjective probability judgments improves their reliability.

No analysis of coherency or consistency is necessarily done for PMT scenarios, but they must be verifiable in retrospect (Bradfield et al. 205, 810). If PMT scenarios are used consistently for a long period on similar subjects, analysts could build a forecasting "track record" and observe how valid their estimates of future probabilities really were – this is widely considered a key strength of quantified scenarios (Hirsch et al. 2013, 366; Millett 2009, 65; Gordon 2009a, 7).

2.5 Value investing & margin of safety

There appear to be two main ways to define what "value investing" is. One definition is buying assets that have some objectively measurable financial characteristic that can be compared against its market price; this can be called the "value factor" (MSCI Inc., 2018). Factor definitions of value often mean stocks with a low price divided by their book value (value of equity on the balance sheet), called the price-to-book ratio, or its inverse, the book-to-market ratio, a measure popularized after research by Fama & French (1993).

By contrast, the second definition for "value investing" refers to a more loosely articulated philosophy or framework of purchasing assets at a discount to their estimated intrinsic value (Klarman 1991, xiii). Instead of constructing portfolios based on readily observable ratios and formulae that capture historical data (ibid, 17), this view of value investing means studying individual assets on a fundamental level (ibid, xiv). It is this definition that will be used in this thesis. This type of value investing can be a form of "systems thinking", because the underlying assets themselves are the primary focus of study, instead of their prices on financial markets; analyzing price changes is after-the-fact narrative that does not give insight into the asset itself (Meadows 2009, 89).

A cornerstone of the value investing philosophy is called "margin of safety", coined by Graham & Dodd (1951, 17)[1]. Their thesis is that the future is epistemically not forecastable, and therefore it is irresponsible to invest based on assumptions of future growth,

---

[1] Originally in 1934, in the first edition of "Security Analysis" (Carlisle 2014, 21).

without ensuring that capital can be recovered. “Margin” refers to buying investments below what their intrinsic value is, so that there is less downside in unpreferable futures. The margin of safety idea also means that *lower risk could sometimes lead to higher returns*, which is notably the polar opposite of “orthodox” finance theory, where risk and return follow a directional relationship (Carlisle 2014, 21). Finding opportunities with a margin of safety would be possible by being a contrarian and investing in unpopular assets. The most obvious investment ideas are not necessarily a good place to begin: “if the future of an industry is definitely rosy, stock prices will almost always reflect this element quite fully” (Graham & Dodd 1951, 69). When buying undervalued assets, a long-term orientation is required for success, because it can take an unknowable period of time for asset prices to align with their intrinsic value.

Graham & Dodd (1951, 71-72) also recognized that all financial forecasts (including DCFs) are highly subjective and qualitative:

“Financial theory […] has sometimes sought to estimate future earnings by projecting the past trend into the future, and it has then used this projection as a basis for valuing the business. Because figures are used in this process, people mistakenly believe that it is “mathematically sound”. But while a trend shown in the past is a fact, a “future trend” is only an assumption.” (Graham & Dodd 1951, 71)

Their conclusion is to only invest in assets that are “protected against change”, and that possess “inherently stable character than one subject to wide variations” (ibid). Effectively, investments where capital is protected in as many futures as possible. After Graham & Dodd, value practitioners such as Klarman (1991) or Pabrai (2007) follow the margin of safety idea by defining similar conservative asset choice rules, such as buying “simple businesses in industries with an ultra-slow rate of change” (Pabrai 2007, 35), and putting little to no value on research and development (ibid, 46) or intangible assets (Klarman 1991, 93-94). The assumption is that simpler businesses in secular (as opposed to cyclical) industries are more easily forecastable than complex businesses that operate in rapidly changing environments. There also exists some empirical evidence for simplicity and stability improving actual predictability. For instance, a study by Dichev & Wei Tang (2009) shows that based on the historical trend of earnings, analysts are most accurately able to predict future earnings for companies whose earnings were the least volatile (most stable) in the past, up to five years to the future.

Despite strong dismissals of making claims about the future, even traditional value investors must still perform at least one active exercise in foresight, because they have to somehow try to identify businesses that are resistant to change. This is a difficult process and highly qualitative, and one area where investing might lean towards being art, not science, which is how futures studies is commonly characterized (Bell 1997, 167-168). One fast way to qualitatively identify businesses that are resistant to change could be to utilize the Taleb's (2012, 316-318) Lindy effect heuristic, where the probable lifespan of a non-perishable concept increases with every moment that it continues to exist; a longer historical life of such a system means that it is likely to live longer than new innovations. In businesses, things that might have this Lindy characteristic could be identifiable as business models, brands, production processes or other intangible assets or parts of a company, as long as their recorded lifespan is extraordinarily long.

Therefore, traditional value investors emphasize historical and present-day knowledge, and avoid actively forecasting the future; it may appear that is directly opposed to what is being done in this thesis. However, that is not necessarily the case – a value framework could support the objective. If there exists a business characteristic of "predictability" (as a consequence of the simple, stable and slow-to-change nature of a business), then extrapolative methods should be less difficult to apply on those types of businesses. In other words, if one is going to attempt any kind of financial forecasting exercise, then it is better to try that with a subject that is *easier* to forecast. DCFs (and by extension, DDMs) are the most suitable financial tool when analyzing stable business landscapes, where there is "structural predictability […] at the expense of limited opportunities for growth and new businesses" (Mauboussin 2007, 156-157). Therefore, the business that will be studied in this thesis should possess value characteristics of simplicity, stability and a slow rate of change.

3 TIA & DCF METHODS

3.1 Overview

This section is based on a systematic literature review of TIAs and DCFs. Through this examination, some possible common ground between the academic disciplines of finance and futures studies is partially exposed. The purpose of this section is to find answers to research questions 1 and 2.

In the literature review, a limited set of the most prominent journals in accounting and finance and futures studies is explored, and some databases are searched using a standardized set of keywords. Only a fraction of all existing material can be covered, which is an unavoidable limitation. The search is also limited to the English language. To identify influential accounting and finance journals, the Scimago website is used as a starting point. The website ranks journals according to their academic influence (Scimago 2020). Twelve journals are identified in the "Finance" subcategory. Due to futures studies being a relatively small field, there is no category for it on Scimago, but a list of prominent journals is made based on the thesis author's professional knowledge. Six such journals are identified. Appendix 1 lists the journals used.

Based on a choice of topical keywords, applied to all parts of the search results (including article titles, abstracts, the main body of text and others), a manual examination through the search results is performed. The keyword combinations used in this activity are in Appendix 1. Only articles that have a seemingly directly relevant title and/or abstract are studied further. This involves a degree of qualitative judgment by the author of this thesis and may be significantly influenced by his perception. The same keywords are also searched using Google, a conventional web search engine. Also, some relevant books are used. Especially for the DCF method, a popular textbook about investment valuation by Damodaran (2006) is a critical resource throughout this thesis.

To summarize overall findings, the studied finance journals do not appear to contain anything directly referring TIA, and most futures studies journals rarely contain direct references to DCFs. In hindsight, it is possible that the choice of finance journals should be more focused specifically on investment finance, and more keywords could be used.

3.2 Trend impact analysis (TIA)

The first version of trend impact analysis was created in the 1970s by Theodore Gordon with a consulting firm called The Futures Group (Gordon 2009a, 1). The purpose of the method is to analyze how a list of unprecedented future events and trends might influence a single extrapolated trend. Most methods of forecasting by extrapolation practically leave such surprising future events out of consideration, and TIA was developed as a response to that (ibid). The output of a TIA are PMT scenarios.

TIA is done for a specific time horizon that stays constant throughout the process. For consistency of terminology, this is referred to as the "forecast period" hereafter in this thesis. Even though the need to have a precise time horizon should be obvious in any kind of forecasting activity, in practice many expert forecasts still often do *not* define them, which leads to vagueness, and an impossibility of verifying, testing or improving forecasts later (Tetlock & Gardner 2015, 30).

There is always only one main trend that is analyzed in a TIA. Extrapolating this trend to the future time horizon is the first step of the process. This extrapolation is simply a projection how the trend would continue if all known factors influencing it stayed the same. To determine which type of function to use for extrapolation, several alternatives need to be compared against each other. This is done by fitting various types of trendlines/ curves functions to the historical time series (Gordon 2009a, 2). Algorithms for finding trendlines are available in statistics related software (ibid, 10). Then, it is possible to identify the one function that best fits the historical time series by comparing a coefficient of determination, R^2, computed individually for each function, against the historical time series of the trend (ibid, 2, 10). The function with the highest R^2 is taken as the "best-fit function", and values for future time periods are input to that function, which creates an extrapolated time series (ibid, 2). This type of simple trend extrapolation assumes "a continuation of past change, that is, unchanging change" (Bell 1997, 250). For clarity, this resulting extrapolated time series is called a "base scenario" – this is not a general term, but one that is merely used in this thesis.

After extrapolation, the next step in TIA is creating a list of future trends and events that could affect the base scenario. In this thesis, these future trends and events are named "TIA statements" (again, this is not a general term). The list of sources that is used to create the TIA statements can include one or more methods, like horizon scanning, literature reviews or simply asking experts (Gordon 2009a, 4). There are several criteria to qualify phenomena as TIA statements. Most importantly, the potential impacts of these phenomena on the base scenario should be independent, meaning that if two will occur at the same time, there would not be an emergent, additional impact created from the combination of the two events. If the events do have some potential combined effects, where their simultaneous impact could conceivably create new phenomena and become more or less than their sum, other methods like cross impact analysis may be considered instead of TIA (Gordon 2009a, 4).

Three further criteria for the TIA statements are defined by Gordon (2009a, 3-4) as “plausible, potentially powerful in impact, and verifiable in retrospect”. “Plausibility” can be understood in a futures studies context as “what could happen” and ties back to the futures cone framework, in Figure 2. “Potentially powerful in impact”, can be highly subjective, and impact is only analyzed in the next step of a TIA. However, it makes sense to exclude phenomena that do not have any conceivable chance of significantly altering the base trend. The last criterion, “verifiable”, is here interpreted to mean that the TIA statements should be expressed in very concrete terms, rather than vaguely, so that it is possible to conclude later if the TIA statement came true or not. It is noted that in half (7 out of 14) of the examples presented by Gordon (2009a, 11-16), the TIA statement given to experts is explicitly quantified. A potential benefit of statements that include numbers is that people analyzing them will have a similar understanding of their scale, and will work from a similar base of understanding when making their judgments.

Subjective judgments of the probability and impact of each TIA statement must be made for each time period in the future. Both are expressed as percentages. “Probability” is an estimate of how likely it is that the TIA statement will come true in a specified time period – assuming it did not already happen in previous time periods. “Impact” is an estimate of how much a TIA statement would alter the base scenario (negatively or positively) in each time period, starting from the initial occurrence of that TIA statement. Because impact is also expressed as a percentage, and not in absolute values, it is possible to apply any impact judgment to any individual point in the projected time series.

The expert judgments can be defined at various levels of detail; theoretically, the most precise way would be to individually consider each time period. Instead of that, to manage the workload of estimating, Gordon (2009a, 4) suggests several simple structured systems that break down the whole forecast period to a few distinct multi-year periods. Then, experts only need to give judgments for those. For impact, the simplest system involves just two judgments: first, a definition of the maximum/steady-state level of impact (peak), and second, how much time from the beginning of the event would it take until that maximum impact level has been reached (ibid). This allows creating a basic "impact curve", where impact gradually (linearly) advances towards its defined peak over the given time period. After this, impact is assumed to stay at the steady-state level for every subsequent time period. For simplifying the probability judgment, it might be even understood as a simple total probability figure for the forecast period (ibid, 6).

Expert judgments must be ultimately recorded in an aggregated format. French (2011, 183-187) distinguishes between the two main categories of aggregating numeric expert judgments. In "behavioral aggregation", a group of experts interacts in a panel or workshop and forms a single consensus response as a group. Gordon's (2009a) TIA process description only includes this kind of aggregation. Behavioral aggregation is also done in the Delphi method and other futures studies methods that utilize formats resembling a panel or workshop (Amara 1991, 645). The other main category is "mathematical aggregation", where individual expert responses are combined by simple or complex formulae. Despite the fact that Gordon only discusses behavioral aggregation, a lack of expert interaction does not necessarily invalidate the TIA method. For example, Hennen & Benninga (2009, 18-19) have applied TIA by interviewing their experts individually, and aggregated results mathematically.

The computation of the PMT scenarios involves combining the base scenario with the expert judgments. Gordon (2009a, 5) suggests three ways to do this, the most advanced of these being a Monte Carlo simulation, where individual, independent scenarios are calculated a very large number of times. This thesis only focuses on the Monte Carlo approach. To outline the computation process of a single PMT scenario in a TIA, based on the author's reading and understanding of Gordon (2009a):

1) Start from the first time period in the forecast period.
2) Check individually for each TIA statement if it occurred or not, based on aggregate probability judgments. This is done by randomization (effectively by rolling a hundred-sided die); if the randomly generated figure is between 0 and the probability judged for the TIA statement, it is considered as having occurred. If a TIA statement occurred, the base scenario value for that time period is multiplied by the aggregate impact judgment. These products caused by each TIA statement are summed algebraically to obtain a modifier value that is added on the base

scenario value in that year. For TIA statements that have not occurred, nothing is done (their impact is zero).

3) After all TIA statements were checked, the next time period is moved onto. It is again checked if TIA statements occurred or not, with the important exception that those that occurred already in the earlier time period(s) are treated as having “begun” in all subsequent periods. For those, the impact figure used is for the *n*th time period after the initial occurrence, where *n* is time periods after initial occurrence.
4) The process is repeated for each time period until the end of the forecast period is reached. The resulting values for each time period consist a single PMT scenario. It is possible that some or all TIA statements did not ever happen in a scenario. It is also common that some of the TIA statements began, but the forecast period simply ended before their impacts were fully realized.
5) The PMT scenario is saved to a database, including the full calculation details of each time period.

After independently calculating scenarios a large number of times, the complete output is a full range of scenarios. A practical way to summarize the results is to show the directly observed range and quartiles, or any other measures of variability, as well as possibly the arithmetic mean of scenarios. These summaries can be understood as scenarios of their own (Gordon 2009a, 5), and allow showing a range of thousands of simulated scenarios on a single graph. Any and all of them may be compared against the initial base scenario which is free from expert judgments.

3.2.1 Critical evaluation of TIA

The author has written about TIA before (Karhapää 2019), and some of the same findings are repeated here. The most obvious criticism of TIA is the questionable nature of expert judgments about the future, on a general level. This subject echoes the anti-forecasting philosophy of value investors and is also connected to the necessary use of projection in DCFs. Expert judgment is a common information source in other (more popular) futures studies methods than TIA, such as the Delphi method. However, just because experts are used widely does not mean that their use should be immune to criticism. Armstrong (1980) showed through numerous examples that formal expertise in a subject is not helpful in forecasting future changes, beyond a minimum threshold of understanding the basics of the subject being evaluated, and that a high level of expertise can *reduce* judgment accuracy. Makridakis & Taleb (2009, 717) take this to the extreme, stating that "in the great majority of situations, predictions are never accurate", and arguing that only in the domains of physics and engineering can experts reliably assess the probability and uncertainty of future events in advance. Makridakis & Taleb (2009, 727) also suggest that finance is conclusive proof that human expert judgment is no better or even worse than random chance, as the majority of professional investors tend to underperform a simple market capitalization weighted stock index over a long period of time. In psychology literature, judgment failures are attributed to behavioral errors, such as "anchoring, dominance effects, and overconfidence, which can severely distort technical judgments" (Hanea et al. 2018, 1781). However, Koehler & Tversky (1994, 565) researched the ways in which experts form subjective probability judgments, and concluded that despite real challenges, subjective probability should not be dismissed because "in general, there are no alternative procedures for assessing uncertainty". The application of any methods that use expert judgment – including TIA – requires, at least, an understanding that the scientific basis of making expert judgments about the future is still underdeveloped and inherently risky.

Gordon has consistently argued, since the origins of the TIA method, that its usefulness is not in better objective predictive accuracy, but in making stakeholders *think* about the probabilities and impacts of future events using a systematic process, in a way that is not done by most quantitative forecasting methods (Gordon & Stover 1976, 192; Gordon 2009a, 7). Humans may find it difficult, awkward, or even offensive to be asked to place numeric odds on forecasts, "but that's a weak argument against change" (Tetlock & Gardner 2015, 33). The simple act of estimating probabilities can reveal unspoken assumptions behind the subject discussed, may lead to the new sharing of relevant information (ibid, 134) and potentially increases awareness that the real range of possible outcomes is probabilistic – not only a binary "fifty-fifty" situation. Such results were found by Barnes (2016, 333) and others. Based on results collected from multiple annual forecasting competitions, Tetlock & Gardner (2015, 132) claim that carefully composed small teams of experts could cooperatively make probability judgments that are 10-20% more accurate than the aggregated judgment of randomly chosen individuals and prediction markets ("the wisdom of the crowds").

The probability and impact judgments taken individually do not provide the full value of the TIA method. After running a simulation, it is possible to compare scenarios and obtain a weighted picture of probability and impact – the mean of all scenarios is essentially the "expected value" of the simulation. Perhaps TIA could help conclude that a probable TIA statement on its own would not be that impactful compared to other statements, or maybe an unlikely but high impact statement should not be dismissed, because it alone can completely alter the base scenario to a larger degree than the combined effect of some other statements. Because TIA provides this comparison of how different phenomena are estimated to act together, a concrete decision-making contribution of TIA may be that it directs attention to the most critical phenomena, and also helps exclude unimportant trends and events from further analysis (Gordon 2009a, 6).

After identifying the most critical TIA statements, its users could in some cases even *affect* the related odds and impacts by taking some action in the present, altering the future to their favor (Gordon 2009a, 7). This may be the most concrete way how TIA can translate from simulations to strategic action. A clear prerequisite in practice is that the users must be somehow capable of influencing the phenomena in question. This is very context-specific and depends on the actor's relation to the subject.

Referring back to the futures cone, PMT scenarios and TIA do *not* ask what preferable futures would be like. Gordon (1992, 26-27) classifies TIA in the category of explorative methods, where plausible or probable futures are studied, instead of preferable futures. The starting point of TIA, trend extrapolation, is quite literally only about asking what would happen if the current trend continues when nothing changes in the conditions affecting it. It appears that at least beginning from value-neutrality is a necessity for performing a TIA in a logical fashion. However, in further stages/rounds of analysis, there is no reason why one could not add or eliminate trends based on normative criteria, to show how preferable futures could be reached. Normative statements can very realistically enter TIA via the participation of experts, especially because interpersonal debate about the trends and events is encouraged by Gordon (2009a, 7). On the other hand, there is some evidence that personal values could distort forecasting accuracy (Tetlock & Gardner 2015, 134). Still, ultimately "forecasting is not value-free" (Gordon 1992, 26).

A concern with using best-fit functions in extrapolating the base scenario is that this is not necessarily at all realistic, even when working with simple, narrowly defined trends. Yet, Gordon (2009a, 3) has used the best-fit function approach to extrapolate trends as complex as global gross domestic product (GDP) per capita, ten years to the future. Bell (1997, 80-81) argues that trend extrapolation is incorrect *most of the time* in cases where the subject is a system affected by human behavior. Gordon (1992, 32) has clearly acknowledged this, emphasizing that trend extrapolation is just a starting point, and Gordon & Stover (1976, 197) mention that human judgment may act as a substitute for best-fit functions in extrapolation for the base scenario. However, making many human judgments about the trend already before the actual judgment stage arguably defeats the entire purpose of the TIA process. Therefore, it seems like "interfering" with the extrapolation should be done only when there is a very clear reason to "correct" it. For example, it may be that a trend does have a known, inarguably definite, lower or upper limit, like in natural sciences.

In his writings about TIA, Gordon does not discuss whether the initial list of TIA statements should strive to contain a balanced ratio of phenomena that might have positive or negative impacts on the trend. The answer can be deduced to be no, for two reasons. First, there is no reason to assume that the full range of generated PMT scenarios should necessarily represent a normal or symmetric distribution. Doing so might be resorting to *argumentum ad temperantiam*, the idea that there must be a balance or a golden mean (Fisher 2010, 113). In reality, asymmetry does exist, and might create opportunity to some who are able to spot it and act on it. The second reason is that before the expert judgments are given, there is actually no way to tell whether impacts will be judged as positive or negative. That is up to the experts involved, not the initial list. Additionally, the direction of impacts could vary temporally; e.g. an event can have a negative effect on the trend for the first few time periods, but then turn positive.

In theory, a longer list of TIA statements could result in more accurate or realistic PMT scenarios, and there is no upper limit. In practice, the tradeoff is that each statement adds several demanding mental tasks to the experts participating in the judgment process. In this respect, TIA also compares much more favorably against its close relative, the CIA method, where the same number of statements being evaluated requires almost a squared number of individual estimates (Gordon 2009b, 13). Additionally, it must be understood as a prerequisite of using TIA that the list of events analyzed will *never* be exhaustive, and Gordon (2009a, 7) has very clearly addressed this criticism. Only a strictly defined list of phenomena is explicitly analyzed. TIA does not attempt to map out the entire futures cone.

For summarizing and analyzing the scenarios produced, Gordon (2009a, 5) does not suggest going further than showing descriptive measures of variability in the form of the minimum, quartiles and maximum, as well as the mean. Indeed, statistical inference does not seem necessary or useful, due to the fact that a TIA is based on subjective judgments to begin with.

As a matter of practicality, it is remarkable that TIA has become considerably easier to perform since the 1970's when the method was first developed. In particular, the computing power required to run thousands of Monte Carlo simulations in a short time is no longer a costly barrier. On the other hand, it should be noted that at the time of writing, no special-purpose software for performing TIA appears to be available publicly. Gordon (2009a) implies that all applications by The Futures Group were done using proprietary programs, and Bradfield et al. (2005, 809) have reasoned that this lack of publicly available tools could be a reason for why TIA and CIA are not very popular. However, each step of the required calculations in TIA can be coded into programs like Microsoft Excel by following Gordon's (2009a) clearly written description of the process, as is done in this thesis.

Like most methods in futures studies, TIA seems to be used for specific cases and projects that are surrounded by unique circumstances. The method is simple and very flexible: it could be used with most, if not all, quantifiable trends, regardless of the field or domain. Thanks to its simplicity and its rather adaptable nature, TIA can be easily used in conjunction with other methods, like "to add quantification" to scenarios in the other non-PMT schools of scenarios (Gordon 2009a, 7). However, due to the case nature of applications, documented cases of TIA are not fully replicable and have limited external validity. This makes it challenging to truly evaluate or improve the method. There do exist newer versions of TIA, created by researchers other than Gordon. Some of them could have advantages over the original method. For instance, as an additional dimension of depth, Agami et al. (2008, 1441) applied three degrees of severity (low, medium and high) to the estimations of impact. On the more complex end of modifications, Lee et al. (2015) incorporate neural networks and fuzzy logic to TIA. In this thesis, the original TIA method as described by Gordon (2009a) is chosen over any variants because of its relative simplicity and because there is no clear evidence that the variants are better. Additionally, publicly documented use of the original version is limited to begin with; this thesis could contribute one more such case.

While Gordon (2009a) has suggested that TIA is used frequently, actual references in journal articles seem very limited, based on the systematic literature review. This is not a new finding, as researchers including Bradfield et al. (2005, 801), Hennen & Benninga (2009, 19), and Amer et al. (2013) have made the exact same remark. It appears that TIA has become rare, even obscure, since the 1970's when it was invented. In that sense, it is still not fully proven as a method.

3.2.2 Existing use of TIA with DCFs

The literature review did not find *any* occurrences of TIA being used to analyze the future cash flows of an investment from journal articles. Likewise, generic internet searches do not appear to find any cases. In an earlier essay by the author (Karhapää 2019, 121), applications of TIA and CIA were reviewed on a general level, but no applications to financial topics were identified.

However, even though there is no published evidence, it is still possible that something similar to what is proposed in this thesis has been performed before. Gordon's use of the method with The Futures Group appears to have been mainly in the context of confidential consulting projects with clients (Gordon & Stover 1976, 211). Some of those cases may well have involved cash flow forecasting. At least sales and costs trends were analyzed in the early projects of The Futures Group (ibid, 200-202), and those financial accounts are ultimately connected to a cash flow statement.

According to Jain (1984, 125), at least 83 (45% of 186 surveyed) CEOs of Fortune 500 companies in the United States had used TIA at least once to process the results of horizon scanning activities between 1982-1984. That result suggests that TIA may have been popular in high-level corporate strategy at that time, although the figure can be questioned, compared to the rarity of publicly documented uses of the TIA method. Nevertheless, as those TIAs were performed by highly competitive multinational corporations, it is very plausible that a part of the applications could have involved cash flow forecasting. As a named example from the same time, General Electric used TIA in the mid-stage of a larger scenario planning process, apparently for forecasting industrial indicators (Taylor 1984, 61). To contextualize the scope of this, General Electric was the 10th largest company in the Fortune 500 in 1984 (Fortune Magazine 2005). However, at the time of writing this thesis, there is no evidence that TIA is at all used in corporate strategy, and it appears TIA's real popularity has considerably fallen since the 1980's.

In the 1970's, when the TIA and CIA methods were recently invented, Blackman Jr. (1973, 242) suggested using CIA for cash flows and profit. Jensen (1979, 194) did also call for using CIA and related probabilistic methods (which include TIA) in accounting research, emphasizing the argument that qualitative human input should be integrated to quantitative forecasting. Ultimately, it does not appear that the call has ever been responded to.

3.2.3 Other futures studies methods in finance

As a side result of the literature search, some applications of futures studies methods (other than TIA) to financial and valuation related issues were found.

Estimating the "social net present value" of public projects and societal phenomena has been an area of study in futures studies. Examples published in the journal "Futures" include Anderson (2013), Greene et al. (2014), and Kula (2015). Evans et al. (1992) applied the Delphi method to the budgeting of socially responsible capital spending, for net present value calculations in different scenarios where corporate projects may have value for external stakeholders (as opposed to only shareholders).

Specifically related to private investment in the real estate industry, in a survey of 71 professionals in the field, Brodowicz (2013, 236) found that only a minority would have been interested in applying futures studies methods to the valuation of real estate. However, the result is limited to a specific context and is inconclusive about the extent to which futures studies methods are applicable to valuation topics, or not.

Fontela (2000) recognized that there exists an academic gap between futurists and economists: "the lack of confidence of econometric modellers in futures research is only equalled by its reverse" (ibid, 11). He hypothesized that the reason is that futures studies is more interested in long-term structural changes in society, while models of economic phenomena may be more short-term oriented and exclude non-economic causes of systemic changes (ibid, 12). Based on the literature review here, this disconnect appears to apply not only to economics, but also to accounting and finance.

3.3 Discounted cash flow (DCF)

Discounted cash flow (DCF) models are essentially mathematical formulae that estimate the intrinsic value of an asset. There exist many different variants, but equation (1) from Damodaran (2006, 117) represents a generic DCF model for valuing a business.

$$Value\ of\ Firm = \sum_{t=1}^{t=n} \frac{E(CF)_t}{(1+r)^t} + \frac{TV_n}{(1+r)^n}, \tag{1}$$

where $E(CF_t)$ is expected cash flow, t is individual time periods, n is a forecast period defined in years, TV is terminal value, and r is the discount rate. The valuation output is an estimation of the present value of all cash flows that will be earned in the future. Individual time periods t in a DCF are mainly years, the most common unit of temporal measurement in accounting and finance. n is a defined period for which cash flows are forecasted; its length in DCFs is up to 10 years (Damodaran 2006, 118). This period is similar to the forecast period in a TIA.

Expected cash flows, $E(CF_t)$, are defined differently in each specific DCF variant. "Free cash flow", in general, is the difference of cash inflows and outflows. It is cash available for allocation to strategic expansion, debt paydowns, dividends or share repurchases (Damodaran 2006, 79-80). There are two main categorizations of cash flow, depending on who the cash flows are attributable to (Hitchner 2017, 128). The most complete definition used in free cash flow to firm (FCFF) models is free cash flow to all investors, debt and equity. Free cash flow to equity (FCFE) variants assign value to the free cash flows that "belong" to only equity holders. Lastly, a dividend discount model (DDM) is the simplest possible DCF that ignores the complete picture of cash flow and only focuses on a part of it, dividends that are paid to shareholders (Damodaran 2006, 14).

Regardless of how cash flows are defined, the main approaches to find their expected future values are to either extrapolate historical data, or to create a detailed forecast for each individual period (year) in the forecast period, by fundamental analysis of the business and its operating environment (Ruback 2011, 8). The consensus of such forecasts by multiple analysts can be used (Damodaran 2006, 15), which is interestingly not unlike the aggregation of expert opinions that is used as a source in some futures studies methods. Either way, a typical single-scenario DCF model shows one set of expected cash flows, that can be theoretically understood as a projected future in the futures cone framework.

Terminal value TV is an abstraction of the future value of the business, after the forecast period has ended (Damodaran 2006, 143). The most common assumption for terminal value is that the business will settle to a stable growth rate that it could sustain theoretically forever (ibid, 117), which is represented in equation (1) above. It is important to note that the rate of terminal growth is an average, not an exact figure that will definitely be realized every year in the future (Hitchner 2017, 146). A general test of plausibility for terminal growth rates is that they should be in the low single digits, not above known averages of GDP growth (Pratt & Grabowski 2014, 461; Hitchner 2017, 1215).

The discount rate, *r*, adds the concepts of timing and risk to the calculation (Damodaran 2006, 27-28). Klarman (1991, 231) defines the discount rate as "the rate of interest that would make an investor indifferent between present and future dollars". The "time value of money" is a central concept here: any given amount of cash is assumedly worth more now than in the future, even if its face value remains the same (Rutherford 2013, 596), due to the opportunity cost of *not* investing (and inflation). The discount rate also reflects risk, which is variation from the expected cash flows $E(CF_t)$, not only to the downside but also to the upside (Damodaran 2006, 27-28). There is a recognition that the expected cash flows are not necessarily going to be realized as projected. The effect of the discount rate *r* in equation (1) is that when the discount rate is increased, the more is "demanded" from an investment, and so the resulting value will be lower. This relationship works inversely, too. Therefore, less risky investments would be discounted at a lower rate than higher risk investments.

There are a few distinct ways to determine the discount rate *r*. Two explained here are the "cost of capital" and the "hurdle rate". Both are relevant for this thesis and will be used later. The cost of capital is the return that all investors (in equity and debt) demand from a particular investment. For FCFE and DDM models, the cost of equity is applicable as a discount rate. It is the cost of the share capital, specific to the business being analyzed in the DCF (Damodaran 2007, 28). In practice, it is not a real figure that can be read from any price tag. The cost of equity is modelled using (academic) risk and return models (ibid, 29). Of those, the most common, "default" model used to find the cost of equity is the capital asset pricing model (CAPM) which can be used to compare the risk of investing in a particular business against others (Pratt & Grabowski 2014, 89). This is called "systematic risk" (Hitchner 2017, 194). CAPM is applied in this thesis as a comparison against the hurdle rate approach.

A very different way to determine the discount rate is the hurdle rate. The hurdle rate is an entirely subjective figure. Broadly it is "the minimum rate of return to an investment project to justify it being undertaken" (Rutherford 2013, 274). The hurdle rate is determined by the actor who performs the DCF, and it is not necessarily arrived to using any real methods. For example, Klarman (1991, 127) explains that some analysts simply demand a 10% annual return from every investment they analyze, using that fixed figure as an "all-purpose" discount rate.

3.3.1 Critical evaluation of DCFs

As theorized, it is not objectively clear what kind of a future a DCF actually represents in the futures cone, even if it aims to show the expected value, the projected future in the center of probable futures. Criticisms against all forecasting of future financial data, from practitioners of value investing, naturally apply to DCFs. The same issues of accuracy that TIA has seem to be also directly shared by DCFs when forecasting expected cash flows, whether this is done with trend extrapolation or expert judgment, or a mix of both.

Indeed, a key problem that applies to all variations of DCFs is how to accurately estimate the three main inputs: future cash flows, their growth rate, and the discount rate, and how to evaluate the quality of these estimations (Carlisle 2014, 112). For instance, a landmark statistical study on several hundred publicly listed companies across many industries by Little (1962) found that past earnings growth is not correlated with realized future earnings beyond a period of four years. 30 years later, a direct response made by Fuller et al. (1992) did not offer countering evidence, but instead reframed the issue by concluding that a marketplace as an aggregate is usually able to forecast business growth prospects, at least better than individuals. However, that offers little comfort to those parties who are interested in actively improving their DCF inputs.

Errors in the DCF inputs will inform the valuation output. This is known as the “garbage in, garbage out” concept (Damodaran 2007, 155). The percentage rates used for growth and discounting will compound in the long-term. DCF mistakes are not obvious in advance. Their “seeming precision” can cause “a false sense of certainty” in decision-makers, which ultimately can lead to poor investments (Klarman 1991, 119). There is a similarity to TIA here. Both TIA and DCF are built on equations that appear theoretically sound, but their practical application is extremely sensitive to subjective inputs. There is no certain way to tell how correct inputs were, mainly because these models are used in non-repeatable contexts.

All ways of finding discount rates have challenges. On the risk and return models, when it comes to the CAPM, its underlying assumptions are the most frequent area of criticism (Rutherford 2013, 71-72). Those assumptions include that the financial markets have perfect competition, where investors are rational actors that hold diversified portfolios and are able to borrow unlimited money at “risk-free rates” (the practically guaranteed rate of return that can be received from government bonds) (ibid). Fama & French (2004) argue that not only are the assumptions of the CAPM questionable, but that most of its empirical applications are not necessarily valid, despite the fact that it remains in widespread use. On the other hand, countering findings continue to exist; for example, Hundal et al. (2019) have recently shown, using historical data from the Finnish stock market, that the CAPM could have been used to create stock portfolios with less volatility and the same returns as the market in a specific time period.

The subjective hurdle rate approach to find discount rates is also inherently problematic. While the CAPM is critiqued for idealistic assumptions, subjective discount rates *do not have* any standardized set of assumptions that they are based on. They are simply up to what a decision-maker demands from an investment. This approach may lead to oversimplification, because investments with different risk profiles should be discounted at different rates (Klarman 1991, 126). This seems to apply regardless if "risk" is defined as price volatility, or as more fundamental risk, related to the idiosyncratic underlying characteristics of a particular asset.

While Doganova (2013, 3-7) writes about how DCFs may be created as deceitfully optimistic projections, "political tools" to persuade decision-makers with too optimistic assumptions (of the preferable futures), the opposite is also possible. Ruback (2011) discusses how the discount rate is often inflated artificially to draw valuation results down, with the purpose of combating overly optimistic growth assumptions, and to account for unlikely downside risks. The simple act of raising the discount rate can be considered a replacement for more detailed scenario analysis, because it immediately makes any valuation more conservative, increasing the margin of safety. In practice, it is much faster to increase the discount rate figure than perform more detailed analyses of the assumed cash flows. This could be judged as lazy, but the idea is not necessarily a poor one, as it can also be viewed as an explicit acknowledgment of the difficulty of analyzing the future. Such modification of the discount rate is a form of "sensitivity analysis", defined later.

When DCFs are applied to equity investments, Jensen (1986) defined the "agency issue of cash flows": even if a DCF projects cash flows in a realistic manner, there is a real possibility that cash flows belong only theoretically to the minority shareholders, because it is practically company management and/or the board that chooses how to allocate capital. As an outsider, a way to impact what ultimately is done with cash flows is to acquire a large enough holding of shares with voting power, or to convince other shareholders to vote similarly to oneself, at which point one becomes an "activist investor" (Carlisle 2014, 14). This matter is similar to discussed agency limitations that may arise in TIA, when it comes to trying to affect critical future phenomena.

There is a temporal aspect to the work of valuation: DCFs done once should be updated as known information changes. For example, when DCFs are used in a business strategy context to value internal projects, a strategy itself is often updated regularly, while the related DCFs might not be (Whipple III 1989, 82). Whether *intrinsic value itself* changes over time, or just the best estimations of it do, is a deep philosophical question.

Terminal value forms a large portion, most often a majority, of the total value calculated (Steiger 2010, 14; Hitchner 2017, 146). Therefore, it is very easy to create both overly positive and negative valuations just with that part of the equation. When a fixed terminal growth rate is assumed to perpetuity, the theoretical assumption is that cash flows will continue to grow, stay flat, or decline, at some average rate forever. This is not fully descriptive of the real world, even by common sense. From a legal standpoint, when the terminal growth rate is positive, assumptions of perpetual growth have been judged too speculative in court decisions (Pratt & Grabowski 2014, 42).

Terminal value and terminal growth rates are relevant from a futures studies perspective as well. As the time horizon advances, it seems like a cash flow trend that exists into perpetuity will inevitably steer outside the plausible and eventually the possible futures (though some businesses have existed for hundreds of years). Historical average GDP growth is the typical upper limit to the growth rate that can be assumed, but the usefulness of past GDP growth as a guidepost to its future can be questioned. The long-term viability of economic expansion has been a subject of research in futures studies, most famously in the simulation work “The Limits to Growth” by Meadows et. al (1972), where it is argued that global economic growth does have real limits imposed by the natural environment, and that those limits may be reached before the end of the current century (ibid, 23, 142).

Other approaches to the matter of terminal value may circumvent the imperfections of the perpetual growth rate. For example, one could assume that the business is liquidated or sold to an acquirer after the end of the DCF forecast period, to determine a value at that point (Hitchner 2017, 147-151). Such end date approaches can also be inaccurate, for example by being too conservative (Pearson 1986, 19). However, the terminal growth rate approach is simple and easy to perform, which may explain why it remains commonly used. Its practical application does not necessarily require holding an uncompromising belief in its assumptions.

3.3.2 Existing scenario methods with DCFs

In finance literature, there seem to be at least two recognized main reasons to incorporate scenario thinking to valuation. The first is to influence how the future is thought about. Damodaran (2018, 6) argues that the single figures that are the output of most DCFs can fool some decision-makers into believing in the "precision" of that number – this could be the case even if the DCF is a result of real probabilistic weighting work that was carried out in the background, but is omitted from the presentation of results. Graham & Dodd's (1951, 71) criticism of financial projections, that they can be misunderstood as if they are a fact, is similar. Therefore, an explicitly shown range of valuation could perhaps communicate the uncertainty of valuation better than one figure does. The other reason is that scenario thinking in valuation could perhaps improve its predictive power. This idea is supported by some empirical studies, like Joos et al. (2016), who compared analyst estimations against realized outcomes, and found that a narrower range of analyst-made scenarios did imply higher realized certainty in the future, or Kadous et al. (2006), who presented counterfactuals about the future to analysts as a balance to optimistic forecasts.

The most comprehensive existing summary of scenario methods with DCFs is written by Damodaran (2018), and methods from that piece are summarized in Table 1.

Table 1. Scenario methods used with DCFs. Adapted from Damodaran (2018).

Name of method	Purpose	Number of scenarios	Logic of scenario creation
Expected value	Find probability-weighted average of valuation	One	Forecast cash flows, and implicitly build-in assumptions for all possible future values multiplied by their probabilities
Sensitivity analysis	Test model robustness to changes in inputs	Unlimited	Quantitative manipulation of model inputs
Three-point estimation	Find value in "base-case," "best-case" & "worst-case"	Three	Take expected value as "base-case", and define "best-case" & "worst-case" using an optimism-pessimism axis
Multiple scenarios	Find value in discrete, unique scenarios	Few	Create qualitatively distinctive scenarios, forecast cash flows separately for each
Simulation approaches	Simulate expected value & valuation distribution across large number of scenarios	>100	Define probability distributions for all parameters in DCF and run a Monte Carlo simulation

“Expected value” is the probability-weighted average of future cash flows. This is what is intended in the conventional single-scenario DCF. All possible future values multiplied by their probabilities are supposed to be built into expected value – however, analyses actually attempting to do so are likely not commonly performed in practice when doing DCFs (Ruback 2011, 8; Klarman 1991, 128). This observation might support the use of methods that take more explicit practical steps to define probabilistic outcomes. The term “expected value” originates from gambling calculations, reflecting how much can theoretically be lost in or gained from a bet (Vogt 2005, 111). Yet this gambling analogue does not necessarily fully extend to investing; games of chance are closed systems that can be reliably studied in repeated experiments, and so are more predictable than unique businesses at a specific point in time.

“Sensitivity analysis” refers to modifying one or more inputs in a systems model and observing how that change affects the output. This simple exercise can logically reveal which inputs (assumptions) are the most critical for the end result. It could also be used to find potential errors in the logic of models. Sensitivity analyses do not originate from finance and are used frequently in different disciplines for various modeling purposes. In a DCF, the most important variables of a sensitivity analysis include the cash flows, the discount rate and the terminal growth rate; Klarman (1991, 128) suggests that these are what sensitivity analyses should focus on, although any and all of the smaller sub-parameters in a DCF could also be tested separately. One obvious strength of sensitivity analysis is that it takes little to no effort. A weakness is that on its own, it does not study the reasons or explanations for why the inputs would actually change. In their classification of scenario methods in futures studies, Bishop et al. (2007, 16-17) classify both sensitivity analyses and TIA in their “Modeling” category. It is highly questionable if the result of a sensitivity analysis can be considered a “scenario”, if it is nothing more than the manipulation of a single variable without any more narration or judgment (Glenn 2009, 2).

In “three-point estimation” DCFs, first the expected value is taken as a base-case scenario. Then, the analyst considers two extreme alternative futures from the point of view of the investor. These are the “worst” and “best” scenarios. Cash flows are estimated for both of these extreme scenarios to define a valuation range. For instance, the investment bank Morgan Stanley has moved from using expected value as the standard, to three-point estimation, in order to better estimate and show the inherent uncertainty in valuation (Joos et al. 2016, 646). An advantage of three-point estimation can be that it is relatively easily processed and understood by decision-makers, given the ease of visualizing three lines on a graph. How exactly are “worst” and “best” defined? This is not only a rhetorical question, because the terms do not seem to have universally standardized meanings. For example, for any equity investment, a “worst” case would always be zero, which in itself is not very useful information (Damodaran 2018, 6). As a remarkable parallel in futures studies, Herman Kahn, who may be called the “father” of scenarios (Glenn 2009, 1), also did promote thinking in terms a base scenario, a best case, and a worst case (ibid), though since the 1970’s, the scenario paradigm in futures studies has shifted to other approaches. Kahn’s definition of the “best case” involved a combination of good luck and good management, and vice versa for the “worst case” (ibid).

The “multiple scenarios” approach works by identifying the fundamentally most important drivers of a business, and then imagining what its operating environment would be like in qualitatively distinctive scenarios that are combinations of extreme ends of those key drivers. For example, with two key drivers, the result could be visualized as a two-by-two matrix. A separate DCF is then done for each scenario. It is possible to add subjective estimates of probabilities, which allows for an odds-weighted range of valuation, but this is not necessary. These scenarios should be very different, in some ways opposite from each other, so that the analysis captures a large range of outcomes (Damodaran 2018, 7; Klarman 1991, 128). Compared to three-point estimation, the process by which multiple scenarios are created is arguably more rigorous and deductive, because the analysts do not begin by thinking by conclusive statements like “best-case”.

Notably, the multiple scenarios method in valuation is very similar to the popular intuitive logics school of scenarios in futures studies. It could well be that there has been some historical link in the development of these approaches in the two disciplines, perhaps because the intuitive logics school was originally popularized after its successful use in a corporate context at Shell International (Glenn 2009, 1). The potentially significant overlap – or even identicality – between “multiple scenarios” and “intuitive logics” appears to be a ripe area of further study for any futurists seeking to make their scenarios more tangible for those stakeholders who are also concerned with the financial outcomes in each scenario. The simplest practical suggestion to do so would be to add a DCF calculation to each scenario in an intuitive logics work. Like believers in intuitive logics scenarios in futures studies, users of multiple scenarios DCFs in finance seem to emphasize the inherent unpredictability of the operating environment: “scenario reasoning […] is a reaction to the fact that most predictions are mistaken” (Mills & Weinstein 1996, 79).

"Simulation approaches" create a range of quantitative outputs, that might be classifiable as scenarios, by defining probabilistic distributions to many of the sub-parameters that form the main parameters of the DCF (e.g. profit margins, business growth and the like) and then running a very high number of independent simulations of the model, generally with the Monte Carlo approach (Damodaran 2018, 21-24). Not every parameter is necessarily treated as independent; interrelationships may be taken into account with correlations (ibid). Probabilities are continuous, in that some scenarios will contain elements of other scenarios. An advantage of using simulations with DCFs is that they might be the most realistic approach, as not only the extreme ends of key drivers, but also other unintuitive combinations, are explored. A main challenge is deciding what are the parameters that should be simulated, and what is their source, especially if historical data is unavailable (Damodaran 2018, 22).

Out of the DCF scenario methods examined, it is simulation approaches that seem to be the closest to what is done in TIA, though there are significant differences. In both, the Monte Carlo simulation is common, and the result is a range of scenarios that can be described in probabilistic terms. A central difference is how probability inputs are given. TIA works with subjective probabilities that are more or less just opinions, expressed as numbers. TIA is also done "bottom-up", individually for possible statements that are causally independent from each other, and never assumes that the whole range of possible futures can be described; the set of TIA statements is always limited. Conversely, in simulation approaches to valuation, as described by Damodaran (2018, 22-47), the main approach to probability is objective probability, based primarily on historical data. Compared to TIA, distributions are defined for each parameter more in a "top-down" manner, where it may be even assumed that every possible event, risk and outcome is captured by chosen probability distributions. TIA seems to require less statistical and mathematical expertise, because users do not have to be intimately familiar with different types of distributions. It also explicitly invites the use of imagination and interpersonal discourse to the analysis of unprecedented events, even where historical data does not exist.

What can be concluded at this stage is that TIA is distinct from the types of scenario methods that are already used with DCFs, particularly in how TIA works through a specific list of impactful future events or trends. Each of the methods listed in Table 1 have slightly different purposes and produce different types of scenarios. There does not seem to exist any conclusive comparison study that would indicate which of them is overall "best" by some definition. Practical choice between methods can be a matter of how much time and resources are available for analysis work, what level of analysis is warranted, and even preferences: e.g. it can be that a simple sensitivity analysis is more often justified than a complex simulation. TIA is not necessarily superior to the rest, either – it should be tried in practice to be able to conclude more.

4 RESEARCH DESIGN

4.1 Overview

This section explains the empirical research design choices made in this particular project. It needs to be noted that actual data collected and other realized results are not discussed in this section; they are only discussed in the next section. The intended output of the research is a DDM valuation of the stock of a "Case Company" (Olvi Oyj), based on 10,000 PMT scenarios made using TIA. It is vital to understand that prioritizing that end result is the main factor that influences how all other choices in research design are made. Another important influencing factor is to stay within the practical limits of a master's thesis format. Figure 3 is a flowchart presentation of the research design.

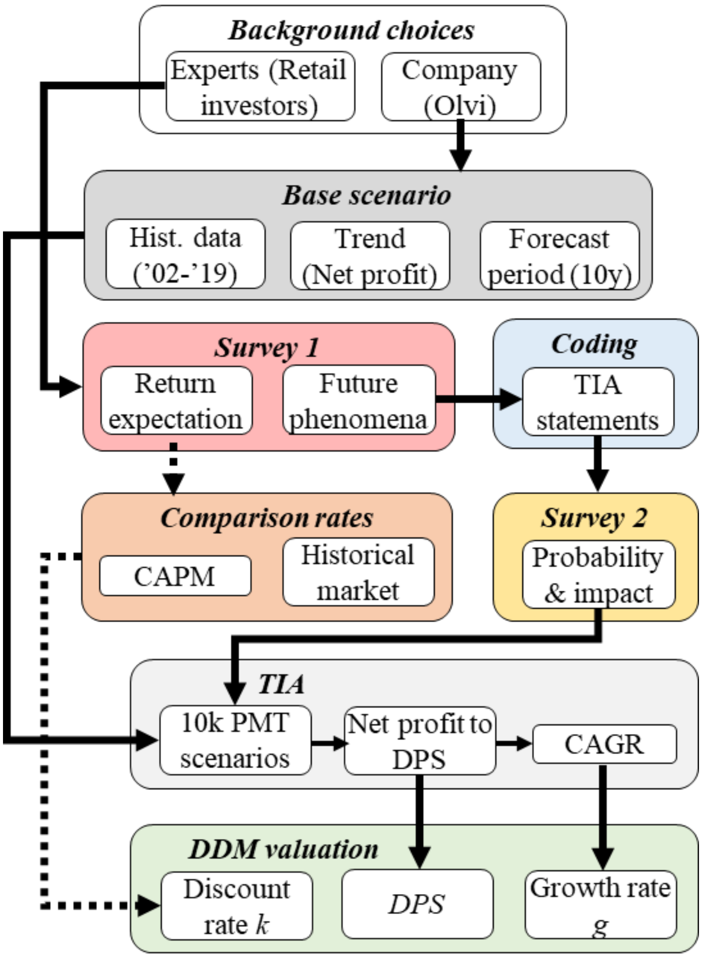


Figure 3. Research design.

The main processes and methods are grouped into areas, and the important “moving parts” between them are shown in Figure 3. The following subsections describe these choices in detail, including how TIA and DDM methods are adapted in order to combine them, and how choices guide other decisions in other parts of the process.

4.2 Participants: Retail investors

The use of expert judgment is a defining part of the traditional form of TIA by Gordon (2009a), and in this thesis, the role of experts is to be filled by retail (amateur) investors who are familiar with the Case Company. This is done mainly for a practical reason: there is no easy access to a group of professionals in the industry, like equity analysts or portfolio managers, who would be willing to participate in this project. Professionals would also potentially undertake career risks if they contributed to a project like this, depending on their individual circumstances; e.g. equity analysts can have a strict set of guidelines about what they can communicate to external parties about the companies they analyze.

The choice of retail investors is also backed up by arguments discussed earlier – when making judgments or forecasts about the future, there may be no meaningful provable difference between the abilities of professional experts and ordinary people. “Don't hire the best expert, hire the cheapest expert”, as Armstrong (1980, 16) concluded. Mauboussin (2007, 44) implies that the conclusion seems to extend to probabilistic domains with high degrees of freedom, specifically including the analysis of publicly traded stocks.

As for the level of competence that should be assumed from participants, it is supposed here that average retail investors are familiar with at least income statements, but not necessarily with a combination of all three financial statements (income statements, balance sheets and cash flow statements). For example, a recent study of Swedish retail investors by Stålnacke (2019) suggests that individuals are more likely to make their stock investment decisions using filtered information, such as news media or discussions with friends, than unfiltered information which means financial statements from primary sources, the company whose stock is being analyzed. However, because the purpose here is to create inputs for a DDM rather than a “fuller” DCF, this should be acceptable. More advanced DCF variants would likely require a more trained participant base, where it could be reasonably assumed that they have a high familiarity with accounting.

When it comes to collecting expert judgments, Gordon’s writings on the subject mainly describe a situation of behavioral aggregation, where the experts are able discuss each judgment together and reach a consensus. In this thesis project, it is a real practical concern how much time and effort participants are willing to dedicate to it. It is not plausible to invite participants to an extensive workshop session where they could debate the topics in depth. The best option for data collection appears to be via online survey tools – especially because the time of data collection happens to be May 2020, during a national state of emergency caused by the COVID-19 pandemic.

Potential participants are contacted through Shareville, a social network site for Nordic retail investors created by the Nordnet brokerage (Shareville AB 2020). On the website, there are discussion pages for individual companies listed on the Nordic stock markets, including the Case Company of this project. Participants will be people invited from the pool of investors who read discussions on the Shareville page of the Case Company.

Communication with participants is the main ethical (and legal) area of concern in this project, especially because the topic could involve their personal wealth if they are invested in the Case Company. To minimize such concerns, several disclaimers are clearly stated to the participants before they can participate to the project. The disclaimer text is in its original Finnish language in Appendix 2. The content is summarized here:

1) Shareville, Nordnet or the Case Company do not have any involvement in the project.
2) Participation is voluntary and anonymous. Participants will not be contacted about the project later.
3) The Surveys are not a recommendation to trade any stocks or other securities.
4) The thesis author does not own investments in the Case Company and will not initiate any positions in a month after the Surveys.
5) The project is non-profit seeking and experimental in nature.

Contact information of the thesis author is also shared with participants.

4.3 Case Company: Olvi Oyj

In this thesis, it is not of primary importance which exact company is studied, as the main objective is more related to a demonstration of methods. With this in mind, criteria for company choice are defined to support the research process, not to pursue an actual investment. In addition to the requirement of it being a publicly listed company, four criteria are considered:

1) Availability of historical data about the business, to create the TIA base scenario
2) Financial year aligned with the calendar year, for fitment of TIA & DDM methods
3) Presence on "Shareville" investor social media site, for access to retail investors who could participate in this study
4) Simplicity, stability and slow change in the industry and business, to potentially improve predictability, following value investing philosophy

Olvi Oyj (Olvi) is a company that is judged to fulfill the four criteria. It is a producer of alcoholic and nonalcoholic drinks, listed on the Nasdaq Helsinki stock exchange, with a market capitalization of ~843 M € at the time of writing (Morningstar 2020a). The business is headquartered in Iisalmi, Finland. Other markets and countries of operation are Estonia, Latvia, Lithuania and Belarus. Individual countries are also the reporting segments of the company.

Olvi has two classes of shares (Olvi Group 2020a, 4). 82% of these are the publicly traded "class A" shares. These "class A" shares are the subject of analysis in this thesis. These shares trade with the ticker "OLVAS". The remaining 18% portion of shares are "class K", and are not traded publicly. The fundamental difference is that each "class K" share provides twenty times more votes than one "class A" share does. Both classes of shares have equal rights to dividends (ibid).

For the first criterion, the historical data that is immediately available for Olvi is mainly in the form of annual reports for the years 2002-2019 (Olvi Group 2020b). Key figures from that data are provided in Appendix 3. This 18-year long documented history serves as a source that can be extrapolated from to create a TIA base scenario. Crucially, the time period captures more than one economic cycle in Olvi's markets. For example, in Finland the years 2009 to 2017 may be considered a long recessionary or stagnant period, due to unemployment rates never reaching the 2008 lows of 6.37% (Plecher 2020). It seems like using data that broadly captures both "good" and "bad" macroeconomic times might be a realistic starting point for extrapolation.

For the second criterion, Olvi's financial year is fully aligned with the calendar year from January 1 to December 31. This is very useful, because time periods in a TIA are generally understood in calendar years, while a DDM works with financial years. If they are equivalent, then the task of making expert judgments does not require any further temporal adjustment, and a potential source of confusion can be avoided. For the third criterion, at the time of writing, Olvi had 853 verified retail shareholders on the Shareville social network, and potentially more people following the page (Shareville AB 2020).

The fourth criterion originates from theoretical characteristics of a value investing framework. Olvi, as a business, is a relatively simple system. It operates in just one industry, consumer nondurables, that changes slowly. The industry is secular in nature – there is a degree of seasonality within years, but no cyclicality across them (Olvi 2020c, 15). Also, the business typically provides high returns in a very consistent manner, as may be observed from Morningstar's (2020b) summary about Olvi's operating performance. Metrics that measure returns on capital, such as return on equity or return on invested capital, tend to be greater than 15% (ibid). Olvi has not made a net loss during the entire 18-year period in Appendix 3. Sales revenue grew in all of those years except 2015. The products or operations of the company do not require major ongoing research and development activities to achieve new innovation: annual research and development spending is approximately 0.2% of revenue (Olvi Group 2020a, 34).

Furthermore, Olvi has demonstrated its longevity by simply surviving multiple times longer than the average business does. It has existed since 1878, making it technically older than the country in which it is headquartered (Olvi Group 2020c). Olvi is arguably a living example of Taleb's (2012, 316-318) Lindy heuristic, explained earlier: while the world has changed massively around Olvi in the past century, with society-shaping events like wars and the industrialization megatrend passing on around it, the consumption of mass-produced beer, soft drinks and other beverages continues with no end in sight. These facts should arguably make it easier to do any kind of forecasts or judgments about Olvi than most businesses.

4.4 Base scenario creation

The classic form of TIA is built around a base scenario, made by trend extrapolation. Two beginning considerations are defining the forecast period and the trend that is analyzed in TIA. The forecast period for the TIA is defined as 2020-2029, which is ten years (or actually about nine and half). Ten years seems like a fairly standard time horizon in both TIAs and DDMs. While the accuracy of extrapolating a trend ten years to the future may be lower than with a shorter time period, it also would allow the inclusion of a wider range of future phenomena in the TIA. Ten years is more than what might be considered "short-term" in futures studies (Masini 1993, 32).

In this TIA, the trend that is analyzed is the net profit of Olvi, even though it is dividends that will be the input to a DDM. For TIA purposes, net profit seems like a more appropriate trend to make expert judgments about than dividends, because profit is more directly an output of the performance of the business and will not require the participating experts to make their own assumptions about dividend policy. How the simulated net profit is converted to dividends for the purpose of the DDM is explained in more detail later.

A potential problem with directly extrapolating Olvi's net profit account for the base scenario is that its definition may have changed multiple times in the past, due to real changes in accounting. Such changes may come from the International Financial Reporting Standards (IFRS) that the company follows (Olvi Group 2020d, 13) but also possibly from the accounting choices that the company itself makes. Given that net profit is at the bottom of any income statement, it is impacted by all other accounts before it, and their definitions may have varied historically. Compensating for this would require a detailed study of Olvi's accounting going back 18 years and adjusting the data to correct for any changes in all items that affect net profit.

For the sake of saving resources, a shortcut is applied here. The definition of revenue probably has changed less than that of net profit, since revenue is the very first item of an income statement and is not as dependent on the rest of the accounts. It is still possible that revenue recognition policies have changed, but assumedly not as much as the definition of net profit may have changed. The importance of revenue and how it trickles down to profits has been articulated by Hitchner (2017, 1193): "All things being equal, trends in revenues will translate into trends in profit margins, as well as the Company's ultimate fate. [sic]" Therefore, by first extrapolating revenue using a best-fit function, and then naively applying the 2019 net profit margin (10.3%) on the extrapolated revenue, it is possible to create a base scenario of net profit where business will continue, quite literally, as usual. The 2019 margin is used instead of its historical average, again simply because the profit data may not be internally consistent. This simplification could be more justified with Olvi than with more cyclical companies that experience greater fluctuation in their net profit margins.

To extrapolate revenue data, the curve-fitting approach is used as described by Gordon (2009a, 3). The fit of seven different functions to the 2002-2019 revenue trend can be tested using Microsoft Excel's built-in "Trendline" feature. This feature fits generic trendline functions to a given series of data, with the least-squares of fit (Microsoft 2020).

For each function, the feature finds a set of constant values that lead to the highest coefficient of determination, R^2, a number between 0 and 1 describing “how closely the estimated values for the trendline correspond to […] actual data” (ibid). Table 2 shows a list of the types of trendlines and their equations.

Table 2. Trendline types and their equations. Adapted from Microsoft (2020)

Trendline	Equation
Linear	$y = mx + b$ where m is the slope and b is the intercept.
Logarithmic	$y = c\ln(x) + b$ where c and b are constants, and ln is the natural logarithm function.
2nd order Polynomial	$y = b + c_1x + c_2x^2$ where b , c_1 and c_2 are constants.
3rd order Polynomial	$y = b + c_1x + c_2x^2 + c_3x^3$ where b , c_1 , c_2 and c_3 are constants.
4th order Polynomial	$y = b + c_1x + c_2x^2 + c_3x^3 + c_4x^4$ where b , c_1 , c_2 , c_3 and c_4 are constants.
Power	$y = cx^b$ where b and c are constants.
Exponential	$y = ce^{bx}$ where c and b are constants and e is the base of the natural logarithm.

To describe Olvi’s historical revenue data using the functions in Table 2, revenue can be assigned as dependent variable y, and years in the time series can be assigned as independent variable x. Any function can then be extrapolated by substituting x with future years in the time series, though principally the one with the highest R^2 should be chosen (Gordon 2009a, 2, 10). This kind of trend extrapolation is regularly done in finance, for economic benefit streams like profits or cash flows (Hitchner 2017, 132). As such, the way that TIA extrapolates the base scenario is not in any way a novel suggestion for a DDM or DCF context. According to Hitchner (ibid), extrapolation in this manner requires that historical data spans a period of five years or more, and that the data is directionally consistent. Both conditions are well satisfied with the data about Olvi.

4.5 Survey 1

Survey 1 is designed to obtain two important subjective estimations from the pool of participants: their return expectation for the Olvi stock and potentially impactful future phenomena to create the list of TIA statements. This survey is created using the Webropol tool (Webropol 2020). A copy of the actual survey form (in Finnish) is available in Appendix 4.

Questions 1 and 2 are “screening questions” in the beginning of the survey, used to confirm that the participants possess at least an elementary factual knowledge of the subject. The full survey responses of those participants who failed at least one of the screening questions are simply excluded from any further analysis. A minimal level of expertise is deemed important by Armstrong (1980, 16), and these screening questions attempt to confirm that participants qualify. The screening questions are aided recall questions, in the broad category of knowledge questions (Lavrakas 2011, 412), where participants are provided with multiple options about specific facts and are asked to choose the right option. Question 1 is about which set of geographical markets does Olvi operate in. Question 2 is about the simple accounting definition of net profit. Both questions 1 and 2 are multiple choice questions. Answering them is not a difficult task if the participant has an elementary understanding of Olvi and the income statement. As a limitation, it must be also acknowledged that a participant might misbehave and look up the correct answers from public sources while filling in their response. They might also only get lucky and pick the right answer without knowing it. Still, the inclusion of these screening questions might filter out some participants who lack a passing knowledge of the subject.

Question 3 is where the participants indicate what is their expected rate of return (annual average, excluding capital gains tax) for Olvi’s “class A” stock over the next decade. Return expectations may be used as the discount rate in a DDM, explained later in this section. This is expressed with a freely movable slider format with a range from -25% to +25%, starting from 0 and with increments of one decimal point. It is not expected that a participant would truly want to indicate a higher or lower figure; an average return greater than 25% in either direction compounds to massive changes very quickly.

Question 4 is an open request to write down one possible future phenomenon that the participants consider as potentially most impactful on Olvi’s net profit trend in the next decade. In this study, experts’ answers are used as the source for generating the TIA statements, which is one of the options recommended by Gordon (2009a, 4). Question 4 is kept intentionally broad and open in that it is only about “phenomena”. There is no narrowing down by any common futures studies categorization of phenomena like weak signals, trends, and megatrends, or a STEEP categorization, etc. The purpose is simply to ask for the one possibly impactful phenomenon that comes to the participants’ minds.

In survey 1, it is mandatory for participants to read and accept the disclaimer in the beginning (in Appendix 2), and to answer all four questions. The ending page contains a message explaining that there will be a second optional survey, which will partially be based on the answers collected in survey 1.

4.6 Coding to TIA statements

After survey 1 is finished, and before the process of making expert judgments of the probabilities and impacts can be started, a necessary step in between is crafting the list TIA statements. These will be created based on answers to question 4, described above.

All answers cannot be used directly as originally submitted for two reasons. First, related to the TIA method in general, the TIA statements must fulfill criteria of plausibility, potential power, and verifiability. Second, even though there is no technical maximum limit to them, restricting the number of statements to only a few is necessary to manage the length of the second survey. Phenomena that have a similar theme are to be grouped together by any qualitative similarity by the author of this thesis. This is "coding" (Fisher 2010, 199). Specific grouped phenomena mentioned the most times by participants will be reformulated into TIA statements. Only phenomena mentioned by more than one expert are considered.

As a limitation, it is acknowledged that the author's own interpretation and bias may greatly influence how answers are translated into TIA statements. Consequently, the wording of the TIA statements is going to influence the way that experts make their judgments about them. According to the "support theory" in psychology by Koehler & Tversky (1994, 548-549), the wording and specific details mentioned in each TIA statement could evoke memories, stereotypes or other mental processes that directly affect how experts will form their numeric judgments. Gordon (1992, 26) observed that "we tend to give higher probabilities to desired future events than undesired". This is unavoidable, but it is recognized.

4.7 Survey 2

In survey 2, expert judgments of probability and impact are to be made about the TIA statements. Survey 2 is also created with the same Webropol tool as survey 1. A copy of the final survey form used (in Finnish) is available in Appendix 5.

The main design consideration is the required detail of data collection. The priority is to ensure that a few complete responses are received. This means the time and effort required from participants must be kept low; for master's thesis projects, any survey should not be more than a few pages in length (Fisher 2010, 210). Therefore, it is sensible to collect the expert judgments following the lowest possible level of detail, shown in Gordon (2009a, 6), with three variables being a total probability, the level of maximum/steady-state impact, and time from the start of an event to its maximum/steady-state level, even though the TIA method would be capable of much more varying judgment inputs as well.

As done before in survey 1, survey 2 also begins with two screening questions, to confirm if participants have minimal expertise in the subject area. Again, if one of the screening questions is not passed, participants' further answers are excluded from further analysis. Question 1 is about Olvi's product categories. Question 2 is about the range by which Olvi's net profit fluctuates historically from year-to-year, with the options being 0-1%, 10-50% or 100-200%. This is intentionally slightly more difficult than question 1. Answering correctly (10-50%) requires that participants grasp the order of magnitude of change that is normal for this variable. The ease of this task for any participant is assumed to be dependent on how many Olvi income statements the individual has studied in the past. It is important that participants can choose the correct answer, because it is directly related to the trend that they make judgments about in the remaining questions.

For each TIA statement, there is a consistent one-page format, where the TIA statement is presented without comment at the top of the page. There is a total of four questions on each of these pages. First, a "probability question" asks the participants' subjective estimate of the probability of the statement happening before 2030 on a sliding interval scale from 0% to 100% with 1% increments. The extreme ends have precise verbal definitions ("impossible" and "certain"). Some degree of standardizing the meanings of language is recommendable in projects that deal with numeric probabilities (Barnes 2016, 335), and here at least the extreme ends are clearly defined.

Second, in the "impact question", participants must subjectively estimate the level of impact on Olvi's net profit, at the point in time where it is at its highest – compared to if the event did not happen at all. This is asked on a freely sliding interval scale, with the range limited from -50% to +50%, again with 1% increments. It is assumed here that any single TIA statement will not cause an impact that continues at a level greater than +/-50% every year: if a single phenomenon is to have a recurring annual impact greater than

50%, its compounding effect will be very dramatic very soon within the 10-year forecast period. It should be noted that the participants are not actually shown a projection of the net profit trend here. The intention is not to predict absolute figures, but to collect estimations of the rough scale of profit impact.

Third, a "time until maximum impact question" is about defining how many years would it take for the level of maximum impact to be reached. The wording of this question refers directly to the answer that participants give to the previous question. This is also a sliding interval scale with 11 steps, ranging from 0 years (immediate) and up to 10 years (and beyond), with increments of 1 year.

Fourth, there is also an open-ended optional comment box for participants to explain in free writing what kind of rationale do they base their probability and impact judgments on. Such information is not the focus, but may be interesting supplementary information for understanding how the task of estimating probability and impact is approached or perceived. There is also an "I don't know" option for all of the four questions. By choosing this, participants can effectively skip a question. This is again included to increase the response rate. It is expected to lead to some incomplete survey answers, which is acceptable.

4.8 TIA simulation

After survey 2, all the necessary expert judgments to perform TIA will be available, but they will need to be aggregated in a format that can be used as inputs in TIA. The two categories of aggregation defined in the literature review are behavioral and mathematical. As the information is collected in a manner where experts respond individually, behavioral aggregation is not possible. In terms of mathematical aggregation approaches, Hanea et al. (2018, 1783) remark that simple equal-weighting using an arithmetic mean outperforms most of the other, more complicated, aggregation methods in judgment accuracy. The only clearly better option would be weighting based on the participants' track record in similar forecasting tasks (ibid), but it is not possible in the scope of this project, and therefore using an average to aggregate the probability and impact judgments is justified.

After the aggregation of answers to the probability question, it still needs to be determined what would be the implied probability of a TIA statement happening in any individual year in the forecast period. This may be found from the total probability of a statement happening before 2030, with a simple application of the binomial distribution

(Jaynes 2003, 70). The objective is to represent the inverse of a TIA statement *not* happening in any given year, with an independent “Bernoulli trial” (ibid, 164) in each year. It is assumed that a TIA statement either happens, or does not happen, in any given year. This is expressed in equation (2).

$$p = 1 - (1 - P)^{(\frac{1}{T})}, \tag{2}$$

where p is the probability in any single given year before 2030, P is its total probability before 2030, T is the number of years before 2030. P is the aggregate expert judgment for each TIA statement. T is, in this case, equal to 10.

If the probability of a TIA statement comes true in any time period, then the TIA simulation must begin applying some level of impact on the base scenario from that point on. For this purpose, the participants’ judgments of impact, and the time to maximum impact, are also aggregated with the equal-weighted mean. The impact curves of each TIA statement can be drawn with the simplest possible shape described by Gordon (2009a) where the maximum impact level is reached gradually, following a linear increase that lasts until the time until maximum impact is finished. After this, the impact level stays at a constant maximum/steady-state level.

After expert judgments are aggregated, it is possible to perform the simulation. This is to be done by directly replicating the steps outlined by Gordon (2009a), and practically performed in Microsoft Excel using a custom spreadsheet. How each cell in the spreadsheet is coded is not explained here, but importantly, the “RAND” function serves as the generator of random numbers between 0 and 1 and the “IF” statement handles all of the logical “decisions” involved in the process.

The simulation is individually repeated 10,000 times, in the Monte Carlo manner. The total number 10,000 is chosen somewhat arbitrarily, but with two practical reasons in mind. First, it makes intuitive sense to use a multiplier of 10 for the purpose of interpreting the results. Second, because there is no real unit cost associated with running more Monte Carlo simulations than less, it is logical to choose a higher number than 100 (Damodaran 2018, 24). This could be interpreted analogously to increasing the sample size in data collection. The 10,000 runs are done by applying a very simple macro program which creates one new scenario, copies and pastes it to another sheet containing the database of created scenarios, moves to the next row in this database sheet, returns to the first sheet, and repeats itself 10,000 times. The complete information that is saved includes details of which TIA statements caused how much impact and when. This enables comparisons of the different PMT scenarios at the highest possible level of detail.

The summary of all 10,000 scenarios can be presented following Gordon (2009a, 5), by directly observing measures of variability and the arithmetic mean from the simulated data. These summary scenarios are called “main scenarios” in this work. They include the minimum, maximum, first quartile, median, third quartile and the mean. The unmodified base scenario by itself is to be presented with the six main scenarios, to understand what the TIA statements contribute to the base scenario.

The exact process of defining these main scenarios is that values are observed directly and separately at the level of individual years, from the database of all 10,000 scenarios. To give an example, a “minimum scenario” can be compiled by finding the lowest simulated value in 2020 across all simulations, followed by finding the lowest value in 2021, moving through every year in that manner, and constructing a series of minimum values from those observations. Thus, a minimum scenario represents the individually identified lowest values across all scenarios, compiled together in one sequence. That logic applies to how all of the other scenarios named after measures of variability are defined.

A “mean scenario” has a slight difference to the others, because it is compiled from the arithmetic mean of values in every year. Thus, a mean scenario can end up containing values that are not direct observations of actually simulated values, but are their averages. Therefore, a mean scenario is a result of a probability-impact weighting process, and in that way may be the closest thing to an “expected value” that TIA can offer. The mean is not always included in TIA; often just a median scenario is shown as a measure of central tendency (Gordon 2009a, 5).

4.9 DDM inputs

The main scenarios that summarize the results of TIA (range, quartiles, mean) are to be valued using a DDM. Valuation is not done separately for each of the individual 10,000 PMT scenarios, because their information is already captured in the main scenarios.

DDMs are the simplest possible type of a DCF. Williams (1938, 55) argued that the value of a firm is based only on the future dividends paid out to shareholders. Dividends are merely a subset of complete cash flow, but are favored especially by traditional value investors, because they are practically “the only cash flow from the firm that is tangible to investors” (Damodaran 2006, 169). Thus, DDMs are the most conservative, compared to more advanced DCF methods. In other words, valuation results may be less susceptible to being overly high. Graham (1939, 278) expressed strong support for valuing stocks with DDMs, specifically citing conservativism as the key reason. This is especially notable in the context that Graham & Dodd's (1951, 17) "margin of safety" philosophy is generally mostly against making financial projections.

On the other hand, the main weakness of a DDM has also to do with its conservative nature. Damodaran (2006, 654) suggests that DDMs are almost always less realistic than FCFE models. This is because a sole focus on dividends leaves out a number of other items that do create shareholder value. As a simple example, the possibility of share buybacks – an activity that Olvi has sometimes engaged in – is not considered in a DDM, even though buybacks are effectively similar to dividend payouts (as the act of reducing the number of shares outstanding directly increases the value of each remaining share).

Still, a DDM can be an appropriate choice of tool for valuing Olvi, because the business is characterized by slow change, a lack of cyclicality, and consistently high returns. Mauboussin (2007, 156) and Klarman (1991, 135) consider a DDM particularly suitable for analyzing businesses that possess those properties. The specific equation (3) used here is a multi-stage dividend discount formula, adapted from Damodaran (2006, 161).

$$Value\ of\ Share = \frac{DPS_1}{(1+k)^1} + \frac{DPS_2}{(1+k)^2} + \cdots \frac{DPS_{10}}{(1+k)^{10}} + \frac{DPS_{10}(1+g)}{(k-g)(1+k)^{10}}, \tag{3}$$

where DPS_t is the expected dividends per share in year t, k is the discount rate, and g is the terminal growth rate. A separation to multiple periods is normally done to allow using different growth rates and discount rates. In this project, the reason for multiple periods is simply to clearly differentiate the individual years of the TIA forecast period (2020-2029) from the terminal period, because a TIA has to end at a defined point.

Here, to find the dividend from the TIA net profit output, it is assumed that there is a constant dependent relationship between profits and dividends. The measure of this relationship is called the "payout ratio", which may be defined as dividends paid out in one year, divided by the net profit in the preceding year (Merriam-Webster 2020). Olvi appears to manage its dividends by following a target payout ratio, using the above definition. The openly communicated long-term policy of the company is to keep a payout ratio of 40-60% (Olvi Group 2020a, 10). By studying the available annual reports, summarized in Appendix 3, the arithmetic mean payout ratio from 2003-2019 is found to be ~52% (though the median is ~45%). In this project, it is assumed that 50% is a reasonable, stable payout ratio that Olvi can sustain in the future: 50% is at the middle of the range in Olvi's dividend policy, and is also slightly below the historical average. As a limitation, it needs to be acknowledged that such translations of net profits to dividends can be erroneous (Pratt & Grabowski 2014, 163).

It must also be noted that Olvi's regular practice of paying dividends from the previous year's profits means that the TIA output, the simulated net profit in any year, is connected to the DPS for the next year. This means that while the forecast period of the TIA is years 2020-2029, the corresponding dividends in the DDM would be paid to shareholders in 2021-2030. Using the 50% payout ratio assumption, to find the DPS_t for any year in a scenario, the total dividend payout in any year t is divided by the number of shares outstanding. There is a total of 20,722,232 shares, including both "class A" and "class K". (Olvi Group 2020a, 4). Even though it is "class A" that is analyzed, the total dividend per share should be calculated on the basis of both classes, due to their dividend equivalence – despite the fact that the "class K" shares are not publicly traded, they still exist, and must be accounted for. This is expressed in equation (4).

$$DPS_t = \frac{\left(Net\ profit_{(t-1)} * 0.5\right)}{20722232}, \tag{4}$$

where DPS_t is the dividend per share in year t, and *Net profit* is the simulated value from TIA.

As for discount rate k in equation (3), the "hurdle rate" approach is used by asking participants about their return expectation. k is the average of the answers to question 3 in survey 1. Notably, the discount rate is the only variable of the DDM that is intended to stay constant across all scenarios, as its purpose is to be a standard "yardstick" that all scenarios are valued with. By using a rate provided by the participant pool, the valuation in a sense can become a mirror that reflects their expectations about the future.

For comparison purposes with a cost of equity approach, the capital asset pricing model (CAPM) is used to calculate an alternative rate, simply because of its widespread commonality in academic finance for estimating cost of equity. The classic CAPM formula is available in many sources, including Hundal et al. (2019, 9), in equation (5).

$$E[R_i] = R_f + \beta_i(E[R_m - R_f]), \tag{5}$$

where $E[R_i]$ is the expected return of the investment, R_f is the risk-free rate, β_i is the beta of the investment, and $(E[R_m\text{-}R_f])$ is the market equity risk premium. The risk-free rate R_f measures the virtually risk-free yield available on the financial markets, which practically exists in the form of government bonds (Hundal et al. 2019, 3). Beta β_i is the covariance of an asset with a market portfolio divided by the variance of the market portfolio, measured over some historical time frame, and is intended to describe the risk (volatility) that the asset would add to a diversified portfolio (Damodaran 2006, 32). The market risk premium is the "extra return that would be demanded by investors for shifting their money from a riskless investment to an average-risk investment" (ibid, 37-38), and can be measured in equation (5) by a historical average return of stocks R_m less the risk-free return R_f (ibid). Other methods also do exist for its definition. In addition to CAPM, for another comparison discount rate, the historical return of Finnish equities as a whole can be used.

Growth in the terminal period g in the DDM is estimated by applying the geometric average growth rate, commonly called the compound average growth rate ("CAGR"), of the *DPS* from the beginning of the forecast period until the end, shown in equation (6).

$$g = (\frac{DPS_{10}}{DPS_1})^{(\frac{1}{10})} - 1 \ , \tag{6}$$

In other words, it is assumed that the implied average annual growth rate of net profit and dividends during the forecast period will also continue indefinitely afterwards. Additionally, a quick analysis of the coherency of results may be done by comparing g against historical GDP growth. It is acknowledged that the approach in equation (6) is clearly an imperfect assumption. It is debatable to what extent the terminal growth rate should really be connected to how a business grows in the preceding ten years. Though it is intuitive for there to be some linkage, it can also be better to assume that there is no connection at all, in light of research such as Little (1962). Furthermore, it is not necessarily obvious to what degree the terminal growth rate should vary across the different TIA scenarios. Here, the approach is to calculate g for each scenario individually, but it can also be that the rate from the base scenario or the median should be applied to every scenario, as a constant. The approach here is a compromise, and there may well exist a better way to handle this.

5 RESULTS

5.1 Overview

This section presents and discusses data that is collected and simulated, and what interpretations are made of them. It is vital to note that the previous section should be read first to understand the methods and some concepts in this section. Answers to research questions 3 and 4 should emerge from results discussed in this section.

The base scenario is created with historical income sheet data. Survey 1 collects expert opinions on subjective discount rates and impactful future phenomena. Phenomena are coded to group them together, and recurring phenomena are written into TIA statements. In survey 2, experts give their judgments of probability and impact for the TIA statements. A simulation of 10,000 PMT scenarios is done by combining expert judgments about TIA statements with the base scenario. Finally, by processing the main scenarios through the DDM, a valuation range for the Olvi "class A" share is found, and implications and a comparison to the share price are discussed.

5.2 Base scenario

To create the TIA base scenario for the net profit trend, it was explained in the previous section that in order to use a trend that has a more or less constant historical definition, the primary basis for extrapolation used here is actually Olvi's revenue. After a function with the best fit is identified and a revenue extrapolation is made using it, future net profit could be assumed naively by applying the 2019 net margin (10.3%) on the extrapolated revenue, which forms the base scenario.

For this curve-fitting, the Excel Trendline feature is used to define seven functions, listed in Table 2. The inputs for variables y and x are based on Olvi's historical revenue data, in Appendix 3. y is a revenue figure in M € and x is a year in the data, starting from 1 at 2002, which is the first year in the sequence. Functions found are ordered by their coefficient of determination R^2 to the historical data in Table 3.

Table 3. Fit of trendline functions to revenue data from 2002-2019.

Trendline type	Equation	R^2
4th order polynomial	$y = 26.997x^4 - 1015.8x^3 + 12110x^2 - 30875x + 133599$	0.992
3rd order polynomial	$y = 10.035x^3 - 659.13x^2 + 26574x + 65890$	0.972
2nd order polynomial	$y = -373.15x^2 + 24341x + 69894$	0.972
Linear	$y = 17252x + 93527$	0.962
Power	$y = 84987x^{0.5106}$	0.944
Exponential	$y = 116376e^{0.0756x}$	0.917
Logarithmic	$y = 110135\ln(x) + 34727$	0.885

where y is a revenue figure in M €, x is a year in the time series, ln is the natural logarithm function, e is the base of the natural logarithm.

As observed from Table 3, especially the polynomial functions seem to have a high fit to Olvi's revenue history. However, Gordon (2009a, 3) has remarked that selecting the function that is used to create the extrapolation is not always as easy as picking the one that has the highest coefficient of determination:

"Selection of the proper general curve shape can be difficult. Two different curve shapes, for example, can each fit the historical data well and yet produce markedly different extrapolations." (ibid)

Therefore, a closer comparison of the extrapolations produced by the functions in Table 3 should be done. Extrapolations to the end of the forecast period in 2029 for all functions in Table 3 are achieved by simply substituting variable x with future years in the time series, beginning from 19 at 2020, due to it being the 19th year in the whole time series. Figure 4 demonstrates how radically varying the extrapolated results of all functions are.

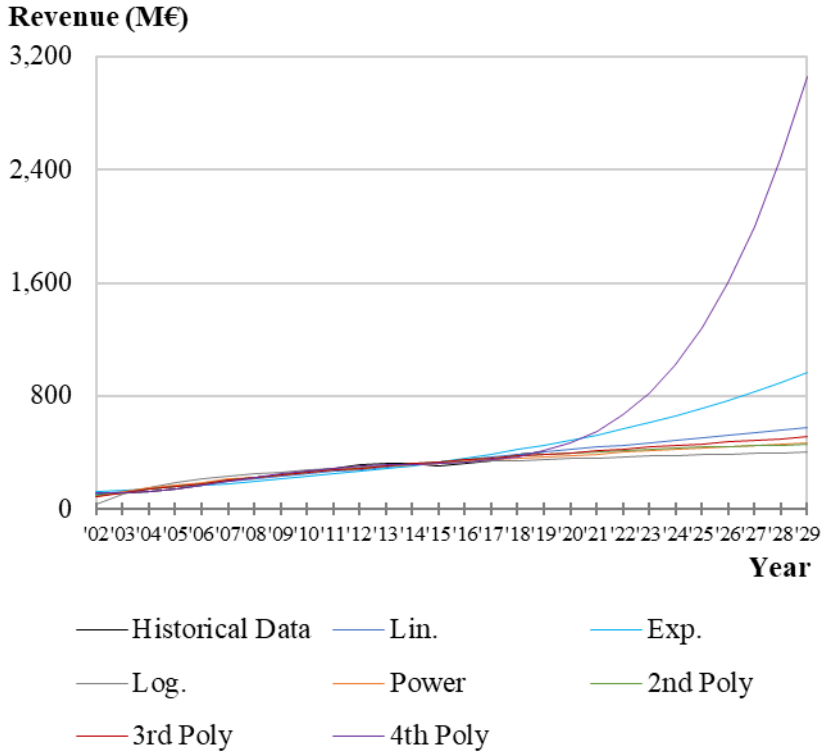


Figure 4. Extrapolation of all functions from Table 3.

As seen in Figure 4, the 4th order polynomial and the exponential functions lead to orders of magnitude more aggressive extrapolations than the rest. Despite the fact that the 4th order polynomial has the highest R^2 value, it should probably not be chosen, because the extrapolation *violates all common sense*. The annual growth rate would constantly be in the double-digits, with revenue in 2029 being greater than 3.1 bn €, which does not at all fit Olvi's profile of a stable and established consumer goods business. Thus, it is judged here on qualitative grounds that an intervention is required. The 4th order polynomial function and the exponential function are disqualified from further consideration. Figure 5 excludes them, and shows the other functions, using a closer scale.

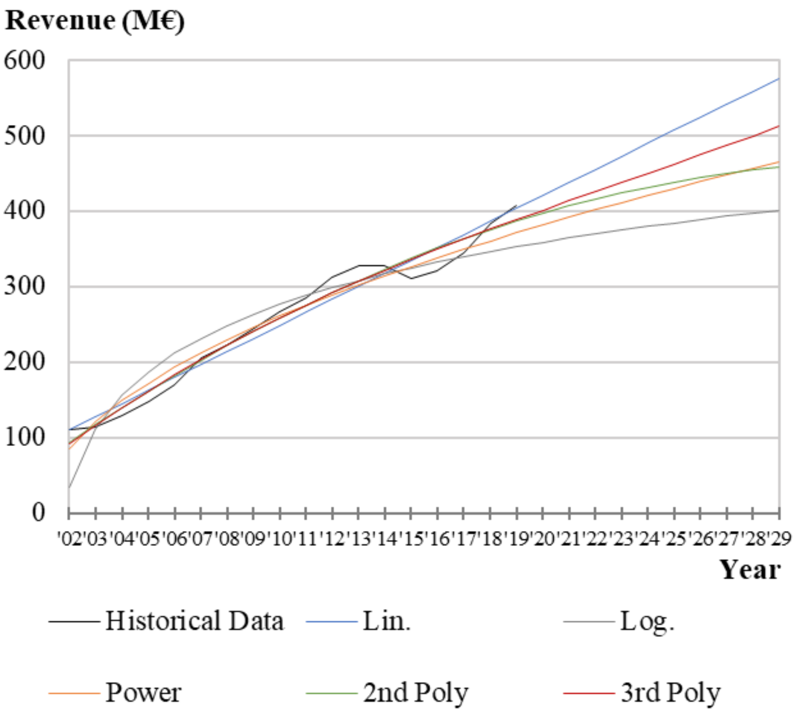


Figure 5. Extrapolation of selected functions from Table 3.

All the remaining extrapolations in Figure 5 represent much more plausible growth projections than the two that were excluded. The 3rd degree polynomial has the best fit of these options. Even still, the choice could be debated. The 2nd order polynomial has a virtually identical R^2, yet would lead to a much lower final result than the 3rd order polynomial. The linear function also seems to have a good fit but would lead to the highest growth. However, because there are no more functions that literally go “off the chart” among these options, by following the logic of Gordon (2009a), it seems the default choice should probably be the 3rd order polynomial, simply due to its highest fit. Therefore, it is chosen. The 2019 net margin of 10.3% is applied on that extrapolated revenue to arrive at a base scenario of net profit, shown in Figure 6.

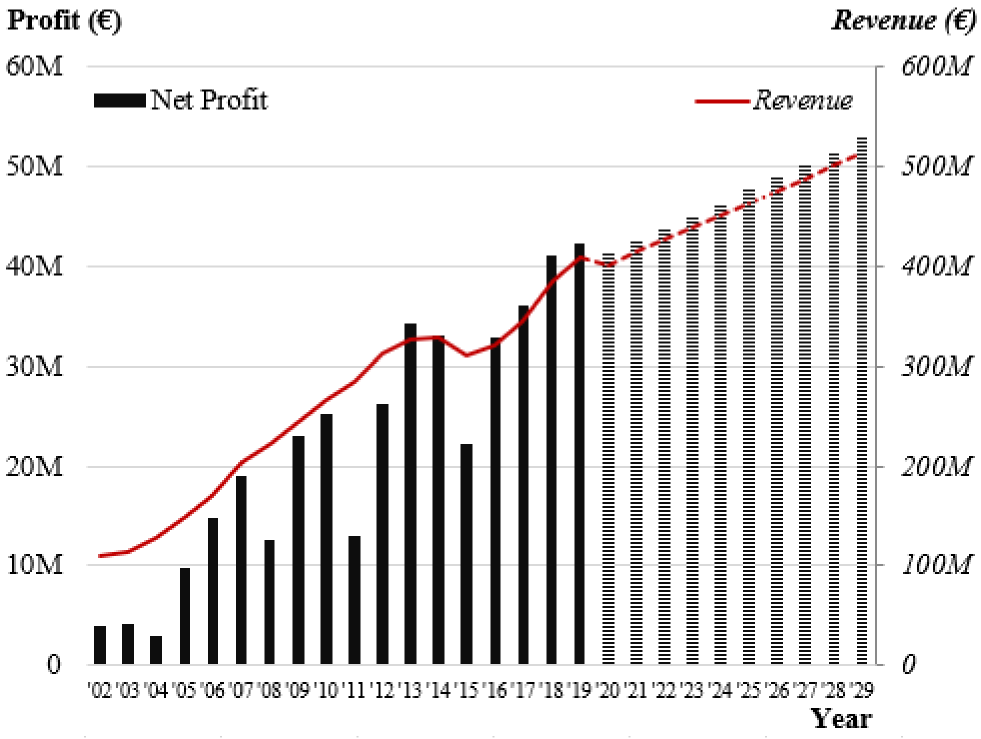


Figure 6. Base scenario.
Revenue (right vertical axis) is visually scaled down by 10x in relation to net profit (left vertical axis).

The base scenario in Figure 6 is not necessarily accurate. Most strikingly, the simple extrapolation cannot incorporate annual fluctuation to its result; occasionally there are weaker years for business, where revenue or net profit do decrease from the previous year. The clear exception is the small drop-off from 2019 to 2020, which is caused by the fact that this is the point where the 3rd degree polynomial takes over from historical data. Another observation is that overall growth would meaningfully slow down from the early 2000's: the CAGR of net profit during the '20-'29 period would be just 2.49%, using equation (6). It needs to be also noted that the net profit margin has only been greater than 10% since 2016, and could very well revert back to single digits in the future.

Despite a high likelihood of the base scenario being inaccurate, it is *not unbelievable* either. The implied slowing down of growth makes assumptions conservative, which is not necessarily bad in an investing context, fitting a value investing framework. Furthermore, the purpose must be repeated here: the base scenario in TIA is a simple extrapolation, nothing more.

5.3 Survey responses overview

Both surveys 1 and 2 were published in May 2020 on the Olvi page of the Shareville social media network. Each survey was made available for a week: survey 1 was live from 6 May to 13 May, and survey 2 from 15 May to 22 May. In survey 1, 19 out of 21 participants (90%) passed the screening questions. Later, in survey 2, 15 out of 31 attempting participants (48%) passed the screening questions. The lower passing rate may be due to the higher relative difficulty of the question about the fluctuation of Olvi's net profit, compared to the rest of the questions. The responses of those participants who did not pass the screening questions are not analyzed any further, nor are they included in the relevant Appendices 6 & 7 which include only accepted responses.

Before discussing the responses in detail, there are two important general remarks to be made about them. First, the response rates are so low that the results definitely do *not* represent the whole population of Finnish retail investors following the Olvi business, by any statistical measure. Therefore, any results are taken to only describe the opinions of these unidentifiable participants. However, the purpose of the TIA method is to express the subjective probabilities of a small group of experts. As such, the low survey sample size does not invalidate the use of TIA, but it must be recognized that there is no way to conclude anything about the broader retail investor community that follows Olvi. Second, as the emphasis is on maintaining the full anonymity of participants, there is no control that participants to each survey would be the same. It is plausible that there is a high degree of overlap, as the relevant Shareville website may be frequented by the same people. But the subjective expected rates of return in survey 1 are not actually what the specific participants to *survey 2* expect.

5.4 Return expectation

The participants' average return expectation is here compared against the two "benchmark" comparison discount rates: a cost of equity computed using the CAPM, and a historical total return of Finnish equities. The full responses to survey 1 are in Appendix 6. Figure 7 visualizes the participants' return expectation against the comparison rates.

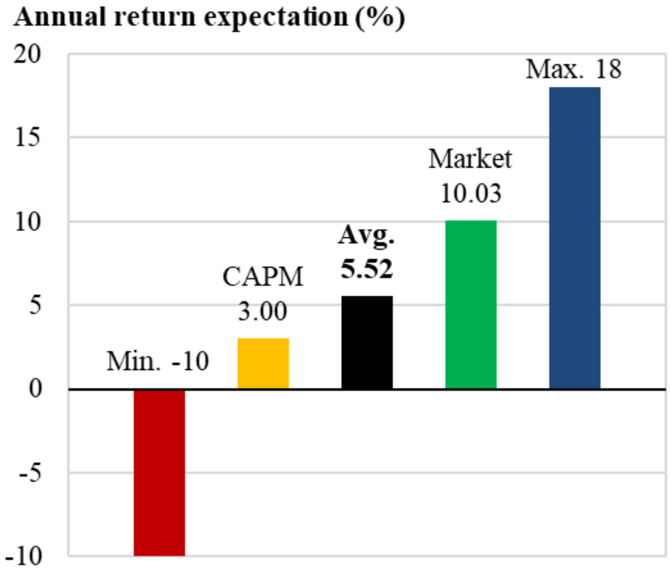


Figure 7. Participants' return expectation for Olvi and comparison rates.

Just one participant has a negative return expectation of -10%. To use stock market jargon, this is a very "bearish" view on the stock. In a decade, an investment with a -10% annual return would retain about a third of its original value. It implies that something catastrophic should happen to Olvi. On the other end, the highest expectation is +18%, implying that an investment would grow by more than fourfold. The general lack of negative expectations could be explained by a selection bias: because the participants are followers of the stock, they may be already predisposed towards taking a "long" position in it, and at least some if not most participants are likely to be shareholders.

However, the average response of 5.52% (practically identical to the median, 5.50%) is not very high. It is actually below historical equity market returns. The first comparison discount rate, the historical total return of Finnish equities, is as high as 10.03% from 1870-2015 (Jordà et al. 2019, 22). The participants' average expectation is modest in comparison to this. The second comparison, CAPM, is calculated using equation (5). Inputs for Olvi are found and applied in equation (7).

$$E[R_i] = 0\% + 0.30\big(10.03\% - (0\%)\big) = 3.00\%, \qquad (7)$$

Currently, in the whole Euro area, including Finland, government bond yields are negative (European Central Bank 2020). This means that investors will "lock in" a loss by buying bonds, paying governments to hold their money for ten years. However, in practice it is not unreasonable to assume that investors, including institutional investors, can store their cash somewhere for a risk-free 0% interest rate, which is used equation (7). For the historical market return, the 10.03% figure from Jordà et al. (2019) is used. For the beta input, Olvi's 5-year beta measure (0.30) is retrieved from Morningstar (2020a) on 30 July 2020. Because the beta is less than 1, the stock price statistically moves much less than the market, and consequently makes any investment in Olvi less "risky" in CAPM and related risk-reward models. The resulting cost of equity of 3.00% is a remarkably low discount rate for a stock and is bound to lead in relatively optimistic valuations. The result would be even lower if a negative bond yield was utilized in the CAPM, instead of the 0% substitution.

5.5 Three TIA statements

This section describes the types of future phenomena from responses to question 4 in survey 1, and three TIA statements that are created from them. The full responses are available in Appendix 6, which also shows their coding to various categories. Evaluated qualitatively, most of the ideas given by participants might fall in the realm of the "plausible" futures. They may be unlikely and counterintuitive but could conceivably become true, because they seem more dependent on large-scale social trends rather than physical boundaries. Perhaps the single most imaginative response suggests some unknown radically new product category that "achieves global popularity", also saying that it would be an unlikely but possible event.

Despite the fact that question 4 in survey 1 is worded neutrally, the overall tone and connotation of the responses appears negative – only one response mentions a phenomenon that is presented in very clear positive terms for Olvi's business (a specific type of product becoming an "international hit"). It appears that highly impactful future phenomena are perceived by participants more as threats and risks, rather than opportunities. It is not clear if this is a coincidence, or if there is an explanation. Reasons might be perhaps related either to the presentation (wording) of the original question in the context of the full survey 1, or some shared characteristic in the participant group.

Most responses are extremely specific and have no common thematic ground with the others. However, three categories barely emerge and are turned to TIA statements, which is enough for a basic simulation. Three is also the lowest applied number of TIA statements that has been observed in another real application of TIA, by Hennen & Benninga (2009, 19). The summary of the TIA statements is presented in Table 4.

Table 4. TIA statements created by coding of mentioned phenomena.

#	Category of phenomena	Count of mentions	Full TIA statement created
1	Healthy Lifestyles	4	*”Consumers focus more on healthy lifestyles, and as a consequence, total consumption of alcohol lowers by 2 litres per capita in each of Olvi’s markets.”*
2	Online Sales	2	*”New legal changes are introduced in Olvi’s markets concerning the online sales of alcohol. Because of this, online sales and home delivery are as easy as with any other consumer product. "*
3	Excise Tax	2	*”Taxation of alcohol in each of Olvi’s markets rises to levels comparable to Finland (taking into account general economic differences between countries)."*
-	Others	5	-
-	No Answer	5	-

TIA statement 1 is based on the “Healthy Lifestyles” category of responses, which is the most frequent. There is an attempt to quantify the statement, to include an element of verifiability to it. A 2-litre decline in alcohol consumption would be historically significant. For example, in Finland, this would be approximately a 20% decline from present levels (Terveyden ja hyvinvoinnin laitos 2020), though it would be relatively lower in countries with higher consumption like Belarus. Such a large decline resulting from healthier consumer lifestyle choices appears unlikely but still plausible.

TIA statement 2, “Online Sales”, is a combination of two answers that mentioned an increase in the online sales of alcohol products. Currently, legal frameworks for this are not necessarily clearly defined or uniform on national levels and between countries, and that element is incorporated within the full text of the statement. The Internet could be an entirely new future sales channel for Olvi, but it is not obvious how this would affect the business.

TIA statement 3 “Excise Tax” is made from those two responses that mention alcohol excise taxation as the most potentially significant future phenomenon. In particular, a response specifies tax increases in Belarus and Estonia. This angle is carried over to the full TIA statement, using Finland as a point of comparison, which might help the Finnish participants when they evaluate the statement. Excise taxes on alcohol are relatively low in Eastern European countries (including a few of Olvi’s main markets) and higher in Finland (Angus et al. 2019).

Overall, responses are mostly related to Olvi’s end markets, the products, and factors impacting demand. The responses do not mention factors that are “invisible” to consumers, such as production operations, research & development activities, supply chains etc. Notably, the participants' focus is more on alcohol, rather than the other product categories that Olvi manufactures – however, this may be also entirely justified, considering that mild alcohol products seem to be the core of the product lineup. It is interesting to compare the responses received to the perceptions of the management of Olvi itself. At least an indication of what the company itself considers as future risks can be found in the (legally required) "Operational Risks" section in the latest annual report:

"The Group's most substantial identified operational risks relate to the procurement and quality of raw materials and packaging supplies, the production process, markets and customers, personnel, information security and systems, as well as changes in foreign exchange rates, the environment as well as actions in violation of ethical values." (Olvi Group 2020a, 15).

The participants' responses mainly relate to the "markets and customers" category in the above quote, and do not have overlap with the rest of the risks disclosed by the company. There do not appear to be any public comments from the company with regard to the Healthy Lifestyles statement or the Online Sales statement, but for the Excise Tax statement, it is clear that Olvi does consider excise taxation one very significant factor that has recently had meaningful impacts in Estonia and Latvia, affecting the real demand of their products and net profit (Olvi Group 2020a, 1, 16).

Also, only one participant response directly mentions the global COVID-19 pandemic ongoing at the time. On some level this may be surprising, as it could be logical to classify the pandemic as an impactful phenomenon: at the time of survey 1, Olvi had already withdrawn its 2020 profit guidance as a direct consequence (Olvi Group 2020d). However, a reasonable explanation for why more participants do not mention it is that the pandemic might be perceived to be only a short-term issue – after all, question 4 is about the entire next decade.

No categories can be assigned for a total of five responses, three of them indicating that participants are unable to respond at all, even though the question is mandatory to answer. In that light, a "I don't know" option would have been useful to include here.

5.5.1 Probability judgments

This section summarizes the responses to the probability questions posed about each TIA statement. The full results are in Appendix 7. A summary of the responses is shown in Figure 8.

Figure 8. Summary of probability judgments.

The Healthy Lifestyles and Online Sales statements are judged to be quite likely on average. Still, averages for both are below 50%, suggesting that the independent statements would not come true “most of the time”. By contrast, the Excise Tax statement is seen as much less likely as the other two. It is the only statement where two participants go as far as judging it entirely impossible (0%). For each statement, and for any individual year before 2030, probabilities are found applying equation (2), and calculation results are summarized in Table 5.

Table 5. Subjective probability of TIA statements in any one year.

		Aggregate probability judgment (%)	
#	TIA statement	Before 2030	In any one year
1	Healthy Lifestyles	48.5%	6.4%
2	Online Sales	45.7%	5.9%
3	Excise Tax	15.2%	1.6%

It seems that while the occurrence of one or more TIA statements may be expected over the whole forecast period, at the level of individual years, the occurrence of any statement may be unlikely, due to their single-digit probabilities.

5.5.2 Impact curves

The aggregate results to the “maximum impact” and “time until maximum impact” questions in survey 2 are combined together, in order to define impact curves. To repeat, the impact curves can “begin” at any time period in a simulated scenario, but only at the point when the relevant TIA statement occurs for the first time, as its probability comes true. Original responses are in Appendix 7. Figure 9 shows the resulting curves compared with each other.

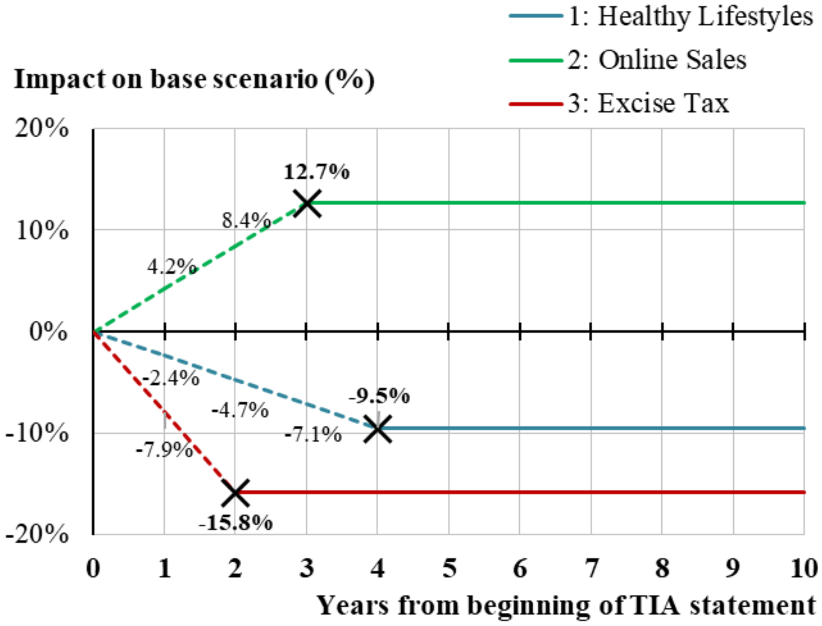


Figure 9. Impact curves of TIA statements.

The Healthy Lifestyles statement is judged as moderately negative, with the impact realizing itself slowly over four years. It implies Olvi would still manage as a beverage company in a world with lower alcohol consumption. However, several individual responses evaluate this as a positive trend for the company. That would perhaps imply growth in other product categories than alcoholic beverages, with these products being either more profitable than alcohol, or selling at a much higher volume than before.

The Online Sales statement is the only one that is judged in positive terms on average. This statement is also clearly perceived to be very difficult to evaluate, as six participants chose the "I don't know option". Two participants estimate the impact would be negative, which also seems very plausible; for example, the online sales channel would be new to Olvi and could "cannibalize" sales from Olvi's currently existing grocery stores channel.

The Excise Tax statement is assigned the role of a very damaging threat, with the highest negative impact and the fastest time until the maximum impact level is reached. There is a quite clear consensus about the negative direction of the impact. A bizarre exception is that one participant assumes a positive annual impact of +48%. It would be interesting to understand the rationale for that answer – it may be a mistake.

As an overall remark about the impact responses, the range of responses received is very large. There is no clear consensus about them, as there exists disagreement about the *direction* of impacts. This may be beneficial, not detrimental, as diversity between individual judgments may increase the accuracy of their aggregate (Tetlock & Gardner, 134). Still, even though it is not possible in the scope of this thesis, it would be valuable to get further inputs from participants to understand reasons behind the very heterogenous judgments.

5.5.3 Rationale for judgments

Only a single response is received to the optional question where participants could freely explain the rationale for their judgments. This response is related to the Healthy Lifestyles statement. The comment explains that answering the question is not possible due to perceived uncertainties related to the demand and nature of possible substitute products for alcoholic drinks. Nothing can be concluded from this one response.

5.6 10,000 PMT scenarios

This section explains the result of the TIA simulation. The simulation synthesizes the base scenario with the three TIA statements and the aggregated expert judgments of probability and impact. The 10,000 PMT scenarios are summarized as the minimum, first quartile ("Q1"), mean, median, third quartile ("Q3") and maximum. The numeric values of these are in Appendix 8. The scenarios are visualized in Figure 10. It should be noted that the base scenario and median are fully identical, which is why those two are shown as one line.

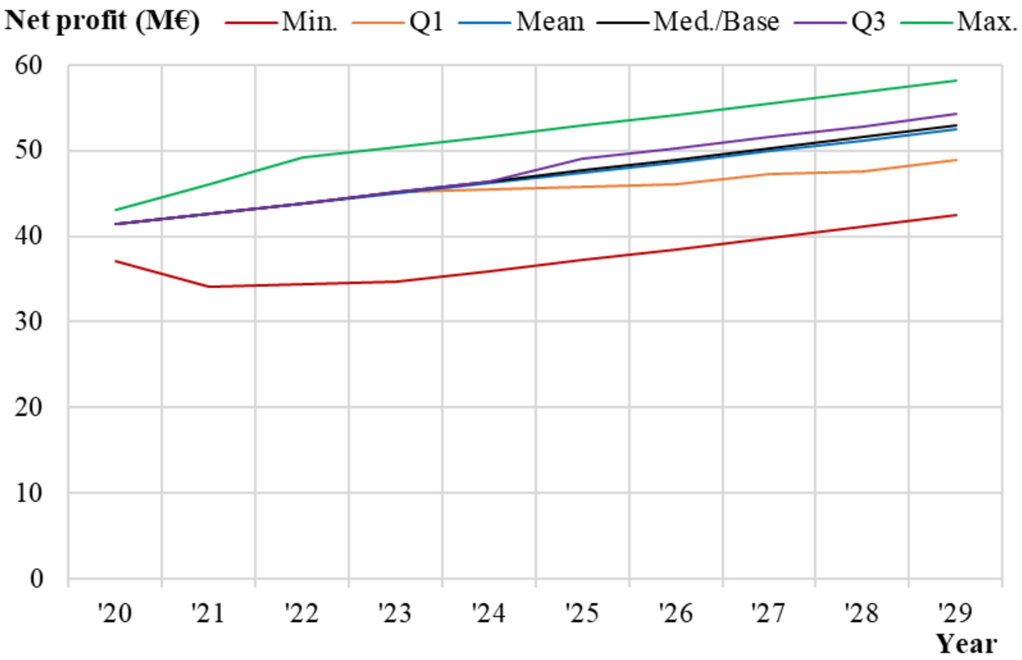


Figure 10. 10,000 PMT scenarios of net profit.

The overall message that Figure 10 seems to deliver is that while the TIA statements do illustrate a wide range of possible outcomes, their expected impact on Olvi's net profit is not very significant – they would probably lead to an almost identical result to the base scenario by itself. Across the whole forecast period, the mean scenario is only marginally lower than the median/base scenario, which is seen in the extremely narrow visual gap between the two in Figure 10. At the same time, there is still a real possibility of some impact. The range of outcomes appears slightly asymmetric, with higher potential effects to the downside than the upside. Another main observation is that any impacts of the TIA statements would probably only begin to be notable in 2024, not sooner, as the year 2024 is when the first quartile ("Q1") and third quartile ("Q3") start to diverge from the median.

As for the median scenario, it is 100% identical to the base scenario, meaning that the median is completely unaffected by TIA statements. This is perhaps counterintuitive. A total of 2374 complete scenarios have values identical to the median result, representing 23.7% of all scenarios. Though not visualized in Figure 10, the mode (most common value) would also be identical to the median. Logically there must be a ~76.3% total probability (1 - 0.237) that at least one of the TIA statements does occur *at some point* in the simulation. In fact, the same result can also be inferred just from the summary of probabilities in Table 5. However, when observing individual years, the probabilities of all three TIA statements are quite low, in the single digits. Because these main scenarios are constructed on the level of individual years, consequently, the median scenario shows no impact at all.

The Q1 and Q3 scenarios convey useful information when observed in relation to the median. Half of all scenarios fall in the interquartile range, between the first and third quartiles. It appears that if there is any divergence from the base scenario, this would only happen beginning in 2024. This may be a result of the expert judgments of time until maximum impact: the full impacts of TIA statements are reached gradually, only after a few years have passed from the beginning of a TIA statement. By only looking at the ending value in 2029, and comparing where the Q1 and Q3 scenarios end relative to the median, it is worth noting that Q3 is only 2.5% above the median, while Q1 is 7.4% lower. The net effect of the TIA statements tends to be unfavorable. The negative impacts of the Healthy Lifestyles and Excise Tax statements are overall judged to have higher probabilities of being realized than the positive Online Sales statement.

The maximum scenario represents the positive extreme of outcomes. The observed frequency of the maximum scenario is 264, which represents just 2.6% of all simulations – it represents an unlikely sequence of events. Here, the “bad” TIA statements do not happen at all and the only “good” TIA statement (Online Sales) is triggered immediately in 2020. This sequence of events would lead to substantially higher net profits compared to most scenarios, and it is visible in how the maximum is visually much higher than the Q3 scenario in Figure 11. The Q3 scenario being notably below the maximum reflects that in 75% of simulations, the maximum scenario is far from reach.

Conversely, the minimum scenario is characterized by the “bad” TIA statements (Healthy Lifestyles and Excise Tax) being triggered immediately. Of course, the positive effect of the Online Sales statement never occurs. In the minimum scenario, Olvi’s net profit first declines, and then slowly reaches the 2020 level again only in 2025. Because the minimum scenario is entirely conditional on two specific low-probability events happening at once during the first time period, there were only 5 simulated instances of it, 0.05% of all 10,000. Meanwhile, the less extreme scenarios around the Q1 tend to be affected by just one of the negative statements, and/or one of them beginning after the other has already begun. While the minimum scenario itself is extremely rare, Figure 10 shows that there is a large visual distance between the minimum and Q1, an area of negative events happening, where many scenarios are practically almost as “bad” as the minimum.

In an investing context, it can be preferable that the three TIA statements do not have a dramatic impact on the mean scenario. All else being equal, less uncertainty can be better. The relative unimportance of the statements on the median and mean scenarios seems to be fully in line with the supposition that Olvi is a stable, simple and slowly changing business. Still, it must be remembered that only three statements are included: if the same experts were to make judgments about more TIA statements, there almost certainly would exist some that would lead to larger impacts, and a shifting in the central tendency. Due to the low number of statements, perhaps the full benefits of the TIA method are not realized here, though it is a deeper analysis than the base scenario by itself.

5.7 DDM valuation of scenarios

Here, the main PMT scenarios are processed through the DDM in equation (3), to find a present value in each. Dividends per share *DPS* come from simulated net profit using equation (4). Discount rate *k* is the participants' average return expectation 5.52%. Terminal growth rate *g* is found for each scenario using equation (6). Valuation results are also compared against the closing price of the "class A" share on 30 July 2020, from Morningstar (2020a). The valuation range is displayed in Figure 11.

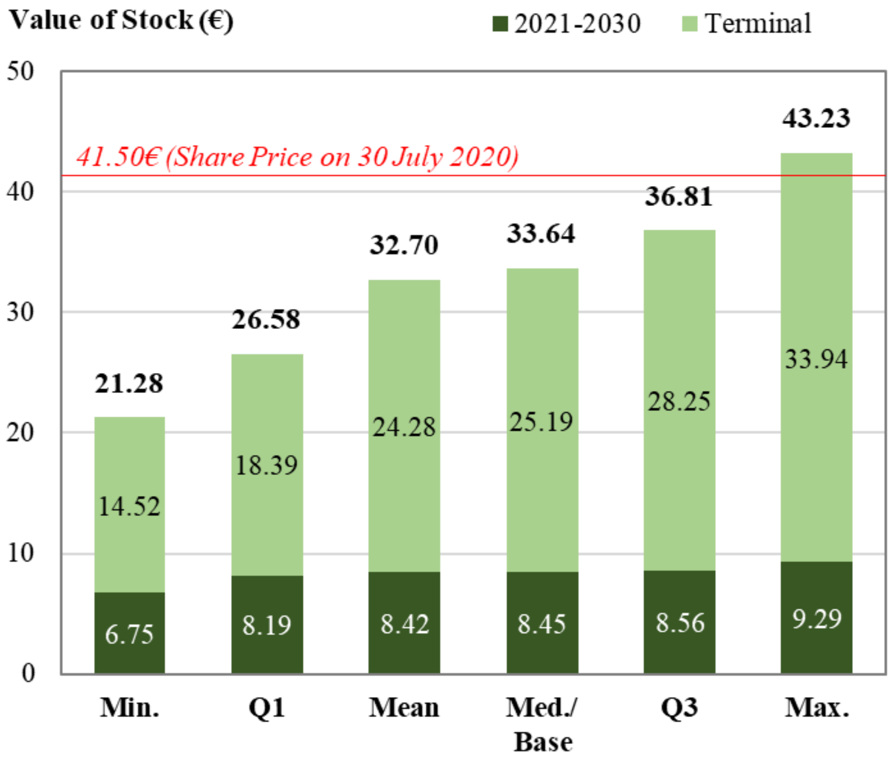


Figure 11. DDM valuation of main scenarios.

A logical way to interpret the results is to consider in which scenarios is the Olvi share undervalued, and what sequences of events would need to happen for them to become true. The stock might represent an attractive buying opportunity especially if the share price was significantly below the mean scenario, which has the role of an expected value. But that is far from the case here, as the current share price 41.50€ happens to be 26.9% above the mean scenario at 32.70€.

No trading action would be recommendable. However, that does not mean that the valuation has "failed". Generally, the expected final outcome of analyzing alternative investment options probably should be that most are *not* "buys". In a broad sense, futures studies aims to provide guidance for present action (Bell 1997, 89) but here it appears that the best action could be inaction. That in itself is a valid finding.

The exception is the maximum scenario at 43.23€. It exceeds the current share price, though only by 4.1%, so the upside would be very limited. Furthermore, the maximum scenario itself has a very low likelihood of happening, mainly because it requires the Online Sales statement to become true already in 2020. In practice, there are roughly six months left in the year, and so it seems entirely implausible that before 2021, the related legal frameworks would be implemented in the countries where Olvi operates in. However, this might be different if the TIA probability judgments were not simplified to a constant value in this project. Observations like this would ideally lead to a critical reexamination of the probability judgments of specific TIA statements in later rounds of analysis.

On the opposite end, value investors are especially concerned with the margin of safety. The minimum scenario itself has a very low simulated frequency (0.05% of all), and similarly to the maximum, may be considered implausible because of what should take place still within the year 2020. However, it can more important to think about the Q1 at 26.58€ - its valuation is 20.9% below the base/median scenario. Although there are no TIA statements included in this analysis that have a chance of completely ruining the Olvi business, it is the Healthy Lifestyles & Excise Tax statements that ultimately skew the overall expected value down. This can be perhaps be traced back all the way to the overall negative connotation of the phenomena originally mentioned by the participants. More than anything, the result highlights that a different initial list of phenomena would have of course led to different TIA statements, and consequently a different range of valuation. The PMT scenarios here are not in any way neutral or balanced. They create a range of valuation that is somewhat tilted towards the downside.

As also visualized in Figure 11, the importance of the long-term future after the forecast period is pronounced in every scenario, because terminal value forms more than half of present value in them all – a common occurrence with this approach (Hitchner 2017, 146). In the maximum scenario, the terminal period forms up to 78.5% of total present value. As the terminal growth rate *g* is calculated using a CAGR for each of the main scenarios individually, it must be highlighted that valuation range between scenarios would be reduced if the assumption for *g* was instead a constant figure.

Comparing this to the long-term GDP growth rate, the historical average growth rate of Finnish GDP is 2.82%, from 1961 to 2019, taken as a measure from data by the World Bank and OECD (World Bank 2020). While most scenarios seem to pass this quick test of plausibility by having a lower growth rate, the maximum scenario is ringing a warning bell with a growth rate of 3.03%. Recalculating the maximum scenario in equation (3) but with *g* lowered back to 2.82% would lower the resulting valuation from 43.23€ to 40.50€. Although it could be argued that Finnish GDP is not the best possible comparison, as Olvi's income does come from several countries, and Finland's historical GDP growth rate is below the global average rate of 3.48% over the same period, calculated from the same source (ibid). Still, the terminal growth rate in the maximum scenario may border on the upper limits of what is plausible.

According to the TIA results, the TIA statements themselves most likely do *not* actually have an effect on the median/base scenario. But the underlying assessments of probability and impact of the three TIA statements have been accounted for, and Figure 11 does show their perceived effects, in a way that a single valuation figure does not. Different statements about the futures lead to different estimations of present value. There could be benefits in thinking about valuation as an explicit range, and the result shows that TIA could act as one tool to achieve that outcome – even if the application is not necessarily perfect here.

5.7.1 Comparison rates

The participants' annual return expectation of 5.52% is based on subjective opinions, and the thought process behind their judgment remains obscured, but this rate is still arguably more suitable for the valuation here than either of the two comparison rates are. The calculated CAPM of 3.00% in equation (7) requires too little from the investment, while the historical Finnish total return on equities of 10.03% (Jordà et al. 2019, 22) requires too much from it.

Applying the 3.00% CAPM rate here would utterly break the DDM, leading to a completely absurd, overinflated terminal value: the mean scenario would have a per share valuation of 199.03€. In other words, Olvi should be worth 4.1 bn €, which would place it among the highest valued decile of publicly listed companies in Finland – and that is just the value of the dividends! This implausibility is caused by the assumed terminal growth rate 2.49% being too close to the 3.00% figure. As discussed, the low CAPM is mostly a consequence of the exceptionally low 5-year beta measure of the stock. This seems to be an example of how the CAPM does not necessarily always lead to useful results in practice with all valuation models.

Conversely, using the historical Finnish stock market total return is not at all "fair" when valuing Olvi only on the basis of its dividends. The mean scenario would be valued at just 13.49€. It is reasonable to state that between these three discount rates, the participants' return expectation 5.52% is actually the most realistic and applicable.

5.7.2 Difference to share price

Judging by the current share price of 41.50€ as of 30 July 2020, the market is valuing Olvi with different criteria than the ones used here. The share price is about 26.9% above the mean scenario, which expresses a major difference of "opinion" for what Olvi is worth. There are at least three obvious explanations for this.

The first, most obvious explanation, is that DDMs may be inherently too conservative, even outdated. While the DDM seems theoretically sound, investors are often willing to pay for more than only extrapolated dividends, and at some point, valuation models should account for that. A FCFE model would lead to a substantially higher valuation. The mean valuation of 32.70€ might be a fair price for future dividends, but maybe does not capture the full value of the company.

The second explanation is that Gordon's (2009a) logic of extrapolating past data to create the base scenario may not necessarily be the best possible practice to define the base scenario. In this case, it might be too conservative. As it is the base scenario that the 10,000 PMT scenarios are built on, if the base scenario is too low, it imposes a constraining effect on the whole simulation. The weight of this fact is especially emphasized in this case, because experts do not judge the TIA statements as probable and impactful enough to affect the median scenario. The market is potentially assigning much more aggressive growth rates for Olvi than what is implied by the extrapolation. Actors in the stock market, even if they are doing some similar type of trend extrapolation of financial data, might be looking at a different (shorter, more recent) historical time period than the 18 years used as the basis of extrapolation here. A higher share price implies higher assumptions about future growth (Hitchner 2017, 294). In line with Graham & Dodd (1951, 69), Olvi may be like one of those common situations where the future prospects of the business look obviously "rosy" to all market participants, which is consequently reflected in the stock price.

On the other hand, low growth in the base scenario could be justified. By observing the historical revenue growth data in Appendix 3, it is not necessarily irrational to think that Olvi's rate of growth may be slowing down. For example, a simple arithmetic average of annual revenue growth over the full period is an impressive 8.2%. But in the past ten measurement periods ('09-'19), that same average rate has declined to 5.4%, and only at three occasions reached the heights of its longer-term average. With the available data, it seems possible that the greatest growth years of Olvi could be well behind; the business could be maturing. Yet if one only looks at a shorter piece of historical revenue, the narrative changes. Over the three past years, the same average figure is 8.4%, but that is greatly elevated by a single exceptional period ('17-'18) with 11.3% growth. It could be misleading to use only the recent past as a basis of extrapolation, and theoretically a longer sample period might be better. However, this example is not to state that higher growth assumptions are necessarily irresponsible, either. The point is merely that other actors on the stock market are likely to be assuming more than the quite cautious extrapolation in the TIA base scenario.

A third explanation for the difference to the share price has to do with the discount rate used, the most sensitive variable in any DCF. Different market participants are using different rates and valuation models. There is no "silver bullet" to find what discount rate the market as an aggregate is using (Pratt & Grabowski 2014, 90). A rough way to "reverse-engineer" this is to perform simple algebraic manipulation on the DDM equation (3) used. By assuming that the market price 41.50€ is correct and inputs for the mean scenario are correct, and solving for discount rate k in equation (3), the result is 4.86%, which is 0.66 percentage points lower than the participants' expectation of 5.52%. In this case, that 0.66 p.p. would be enough to cause a swing of 26.9% in the present value. This simple sensitivity analysis highlights how critical the discount rate truly is. Had the participants' responded with just a slightly lower average return expectation, the valuation of all scenarios would be instantly elevated closer to the share price.

Finally, it should be noted that the market is *not* necessarily always “right” – the stock price can actually be slightly inflated. Another way to approach valuation is to consider multiples, like the mentioned price-to-book ratio, an integral part of some definitions of “value investing”. A price-to-book ratio of 1 would mean that the market price of the shares matches the value of equity on the balance sheet. According to Morningstar (2020c), Olvi’s price-to-book ratio is 3.45, which is a 18.5% premium to its five-year average value of 2.91. Also, looking at just the 52-week history of the share price by itself, Olvi has traded at a low of 30.25€ in that time (Morningstar 2020a), lower than the mean or median scenarios. In other words, 222.7 M € has flown in and out of the market capitalization between that recent low and the current price. Yet it seems completely implausible that *the true intrinsic value* of the company has really fluctuated by 37.1% in less than a year, especially keeping in mind that Olvi operates in a stable, secular industry, characterized by a slow rate of change. If the theory of intrinsic value is accepted, then either the current price 41.50€ or that recent price of 30.25€ must be closer to the intrinsic value than the other, by definition. At a price of 30.25€, the stock could have been considered slightly undervalued in the mean and median scenarios in Figure 11, and might even have potentially represented an attractive buying opportunity. It is also well possible that the price may revert back to that level in the future.

In light of the three major explanations discussed above, it is believable that the mean scenario valuation of 32.70€ can be too low. This is especially due to the conservative nature of DDM, and the fact that the TIA base scenario also happens to lead to a low growth assumption towards 2030. But it is also possible that the share price may be slightly too expensive at the moment. The two things could be true at the same time.

6 CONCLUSION

6.1 Overview

This concluding section answers the research questions. Also, some limitations are reflected upon and the potential value of the results to the participants is discussed. It is suggested what kinds of parties might be potential users of TIA with DCFs. Finally, some obvious further areas of research are discussed.

The major repeating theme throughout this thesis has been that of *subjectivity*, in relation to both TIA and all types of DCFs. These models create internally consistent outputs that have a surface-level appearance of being very "precise" about the futures, but the real challenge remains in defining high quality inputs. Continuous self-reflection and questioning of assumptions about the futures is necessary for the successful application of TIA and DCFs, and this journey can be more important than the destination, the final model output. It can be argued that stock valuation, like futures studies, is more art than science.

Although the empirical application of methods was imperfect and suffers from real limitations, the main objective of the thesis has been achieved; it has been demonstrated that TIA could be combined with a simple DDM. This may extend to DCFs, though more research is needed.

6.2 Answers to research questions

Research question 1 was written as: "In futures studies literature, has trend impact analysis ever been used in any applications with discounted cash flow methods or similar valuation methods?" Based on the literature review, the answer is no. Therefore, the use of TIA with a DDM in this project is novel.

Research question 2 was: "In finance literature, what are the main scenario methods that are used in combination with discounted cash flow analyses, and how are those methods different from trend impact analysis?" Different categories of scenario approaches to DCFs were identified from Damodaran (2018). The scenario methods range from very simple to complex. Of those, TIA is most similar to simulation approaches, by sharing the use of Monte Carlo simulations with them. However, TIA is distinctive especially because its source of uncertainty comes from a list of statements about specific future phenomena, where probabilities and impacts are defined subjectively.

Research question 3: “What kinds of possible future phenomena does a small group of Finnish retail investors consider most impactful for Olvi Oyj’s net profit towards 2030?” To summarize the subjective feedback of the participants to survey 1, they had an overall consumer-focused perspective, thinking almost exclusively about the end products that Olvi sells, and factors that might affect their demand. Notably, the excise taxation of alcohol is a key uncertainty that is considered highly significant by not only the participants, but the company itself as well. The participants also discussed the upcoming decade more in terms of threats or risks than opportunities.

Research question 4: “What range of valuation is found for Olvi Oyj through a trend impact analysis combined with a dividend discount model?” Following the TIA process, and discounting with the participants’ hurdle rate of 5.52%, the mean scenario at 32.70€ per share may be understood as the expected value. It is very close to the unmodified base scenario and median scenario at 33.64€, reflecting that the TIA statements do not change the valuation by much. The interquartile range is from 26.58€ to 36.81€, which illustrates how experts judged future phenomena as more harmful than beneficial, on aggregate. The extremely unlikely farthest ends of the valuation range are the minimum at 21.28€ and the maximum at 43.23€. It is acknowledged that the overall valuation may be too low, especially for two reasons: the previously known conservative nature of the DDM, and the fact that the base scenario extrapolation assumes a slowing down of growth for Olvi.

6.3 Limitations

Here, some main limitations are identified after the analysis of results. It should be noted that specific limitations inherent to the methods were already discussed in section 3, and practical limitations that were obvious at the stages of research design and the analysis of results were discussed throughout sections 4 and 5.

Due to the case nature of the project, there is little external validity to the results. Every piece of empirical data collected (and simulated) is only particular to the valuation of Olvi in these specific circumstances, and at a specific point in time. However, what is applicable to other contexts is the overall principle of how the TIA and DDM methods may be combined, even though clearly some modifications could be beneficial.

There was no hypothesis testing in this thesis, but internal validity here might ultimately mean whether the simulated valuations measure the intrinsic value of Olvi under the subjective inputs sourced from the experts. Theoretically, intrinsic value cannot be measured with certainty. It is also one of the main limitations of futures studies that the accuracy of research projects can really only be evaluated after years have passed (Masini 1993, 53). However, it was recognized that aspects of the valuation were quite likely too conservative. It can be stated that the median scenario valuation is not too high.

Specifically, it needs to be acknowledged that the forecast period of ten years may have an overall negative effect on internal validity. Selecting a shorter period might be preferable. The TIA base scenario, entirely based on extrapolating historical data, could be more valid if the forecast period was less than ten years, simply due to the general doubtfulness of extrapolating that far ahead using historical data. For example, a horizon in the range of five, or four years, as implied by Little (1962), may have more empirical backing. Shortening the forecast period would definitely also have had an influence on the TIA expert judgments, perhaps for the better. It can be that ten years is already well beyond the limits of the capabilities of even the most knowledgeable experts, when it comes to making judgments about complex systems (Tetlock & Gardner 2015, 156), which is something that Gordon's (2009a) writings on TIA do not necessarily acknowledge. On the other hand, if a shorter period was used, it would further increase the already relatively large portion of terminal value in the DDM.

If this project would be redone, the question of the depth vs. width of expert judgments should be seriously reconsidered. Surveys 1 and 2 were consciously designed to maximize the response rate. Yet as it is, the sample size of all responses is too small to have confidence in any statistical significance, or to seriously entertain a "wisdom of crowds" or "vox populi" argument (Mauboussin 2007, 201) about the predictive power of these judgments. Therefore, if it had been recognized from the beginning that there was not going to be a significant number of responses, and that this project would be a compromise in that regard, it might have been preferable to focus on greater depth instead. Gordon's (2009a) writing on TIA does not explicitly address how many persons are optimal to constitute the experts, but given that the method is an expression of the subjective probabilities of a particular group, only five or even fewer persons may be suitable.

Notably, a workshop or panel approach would also have enabled interaction between experts, but this project did not intentionally include that – again due to the focus on width over depth. Dialogue and communication between stakeholders may be one of the key benefits of TIA (Gordon 2009a, 7), and it is not observed here.

The project did not attempt to study *how* participants psychologically manage the task of making their judgments about the future. As it is, their judgment processes remain a "black box". The range of answers to each question was very wide, underlining the personal and subjective nature of the judgment process. For example, some answers may have involved more calculative reasoning, or others may have been based on pure intuition, but this cannot be deduced from the results. It is also impossible to do more work with the same participants, for the simple reason that they are anonymous. Any follow-up activity was purposefully excluded from this project, but TIA might be best utilized as an ongoing process where expert judgments could be revised on an ongoing basis.

6.4 Value of results to participants

Since the survey participants are the main stakeholders of the thesis, it is worth discussing if they can gain anything from it. It needs to be re-emphasized here that this project is not any kind of recommendation for the participants or readers to take any investment actions, either based on their participation experience, or on their reading of this document.

The main message that participants may take away from the 10,000 PMT scenarios in Figure 10 and the final valuation result in Figure 11 is that the three TIA statements (Healthy Lifestyles, Online Sales and Excise Tax) were ultimately not perceived to be critically important for Olvi's business or the value of the stock. Also, it was judged unlikely to observe any impacts of these statements before 2024. Therefore, participants may want to focus on thinking about other future phenomena instead. Those might have less to do with the end products and customers of Olvi, and more with its less visible aspects: raw materials, supply chains, production operations etc.

A secondary benefit to some interested participants can be the opportunity to compare their own return expectation, and judgments of probability and impact, against the aggregate judgments. If participants disagree, they might be able to rethink their own initial assessment. This can be particularly interesting to those participants who gave outlier answers that are far from the average.

6.5 Potential users of TIA with DCFs

Parties who might benefit from further experimentation combining TIA with DDMs, and by extension, DCFs, are investors who comprehend the inherent experimentality of combining these methods. It must be highlighted that it is not a foregone conclusion that TIA is even applicable with all DCFs. Due to the characteristics of TIA, its users should be those who do analysis with a fundamental approach. A key condition is that a large amount of effort must be spent studying specific phenomena, on a micro-level. Especially the expert judgments can be time consuming to perform. Where the subject is stocks, such users could include asset managers, funds, etc., who work with a relatively concentrated portfolio (e.g. less than 30 holdings), where every potential investment is analyzed at a great level of detail. Outside of the capital markets, TIA with DCFs could be used in corporate finance and strategy departments for valuing major investments in long-term projects.

Potential users need to recognize that TIA is not necessarily suitable for all subjects. TIA may be best applied on trends that are historically relatively stable and consistent, when one wants to evaluate how specified independent future phenomena might swing that trend. Since TIA does not truly account for second-order effects, its applicability may be limited, perhaps to only investments that do normally generate positive cash flows or other economic benefit streams.

To touch on the ethics of experimenting with probabilistic models in the real world, authors like Taleb (2012, 45-46; 336-337) have made calls to restrict such activity out of some domains. This idea is well argued by Ben-Haim & Demertzis (2015, 2-3), who state that models that deal with Knightian uncertainty (which would include TIA and DCFs) should not be relied upon lightly in decision-making, but especially in public policy-making, where collective harm can result from the results of poor modeling. To extend that argument, for-profit investing might be one of the most ethical areas of life to apply and develop experimental scenario methods, because the negative outcomes of any decisions made will only affect the individual or organization that made such decisions, and not society at large. In smaller-scale private risk-taking, there is less collective harm caused.

6.6 Further areas of research

In any further research of TIA with DCFs or other financial contexts, it is advisable to take lessons learned from this thesis, especially the limitations, as points to be improved upon. The next priority area of research should be those DCF variants that offer a more holistic understanding of cash flows, like FCFE and FCFF, to understand if TIA can work with them and what adjustments may be necessary. Using free cash flow as the trend would potentially lead to much more realistic outcomes than the simplified assumptions in this thesis, but the granularity of analytical work will definitely also be higher. Access to experts who are intimately familiar with financial analysis is a clear prerequisite to trying to combine TIA with FCFE and FCFF methods, for the impact judgments in particular. The common definition of free cash flow to invested capital is a result of five major accounting items (Hitchner 2017, 128-129), and it may be that impact judgments need to be given separately for each of those, adding them up to arrive at free cash flow. In impact judgments, absolute figures might be preferable to the relative percentages that are typically used in TIA.

Special areas that require attention in a TIA of free cash flow may arise especially in the treatment of scenarios that would lead to negative cash flow or even the failure of the business. The traditional form of TIA does not have any built-in "decision-tree" like logic, but because the method is malleable, automated guidelines in specific simulation outcomes could be added. As a simple example, there can be scenarios where a specified threshold of free cash flow is not met, which might lead to financial distress or a need to raise more capital. Such scenarios could be just automatically stopped at that point in time and flagged as "failures". When making changes to the TIA method, one should note that there may be a point where modifications will become impractical or defeat the purpose. In all further research, it needs to be remembered that TIAs advantages are that it is a simple, easy simulation method. More complex simulation approaches do already exist.

For additional sources to create the list of TIA statements in an investing context, it might be logical to study publicly communicated company management perceptions of the future, considering that those persons might be "experts" in the topic. Some possible critical management decisions themselves could be the basis for TIA statements. To the investor, management behavior can be a source of uncertainty.

Terminal value on its own is a significant futures related topic. It is naturally relevant for futures studies, because it deals with time horizons beyond ten years. A deeper epistemological discussion of terminal value, including not only the perpetual growth rate approach, but others as well, could be further conducted from a futures studies standpoint. As is the case in this thesis, terminal value is easily more important for total valuation than what happens in the forecast period, but ironically it is the forecast period may receive the majority of attention and dedicated analysis. It also should be specifically examined what assumptions about terminal value would work best in TIA or other scenario applications: for example, when using the constant growth rate assumption, it is not clear to what degree different scenarios should assume different rates.

Other than TIAs and DCFs, there is plenty of other methodological and philosophical common ground between futures studies and finance that can be researched. For practical combinations of methods across disciplines, an actionable idea was mentioned in the literature review: when futurists create intuitive logics scenarios, like in corporate strategy projects, it can be very appropriate to include even rough valuation estimations under each distinct scenario to communicate possible financial outcomes to stakeholders. This requires that the focal issue of the intuitive logics scenarios is directly connected to some project or asset that could be valued, and as valuation is not commonly an element in intuitive logics scenarios, some care is required to find the right balance in how much valuation is emphasized.

More broadly, every investor engages in consciously thinking about and planning for the future. The model of the dimensions of futures consciousness by Ahvenharju et al. (2018) could be a suitable starting point to a deeper examination of how investors differ in their futures thinking. Differences in underlying philosophical stances and views towards the futures between investors can be so drastic that they have led to the existence of well recognized styles or strategies, like “value” and “growth” investing. As has been highlighted, traditional value investors base their decisions on a clearly articulated cautiousness where “the future is essentially something to be guarded against rather than to be profited from” (Graham & Dodd 1951, 42), yet many investors disagree and would say the opposite. This thesis has only scratched the surface of possible intersections between futures studies and finance, and there is much more to be explored.

REFERENCES

Agami, N.M.E. – Omran, A.M.A. – Saleh, M.M. – El-Shishiny, H.E.E. (2008) An enhanced approach for Trend Impact Analysis. *Technological Forecasting & Social Change*, 75 (9), 1439-1450.

Ahvenharju, S. – Minkkinen, M. – Lalot, F. (2018) The five dimensions of Futures Consciousness. *Futures*, 104, 1-13.

Amara, R. (1991) Views on futures research methodology. *Futures*, 23 (6), 645-648.

Amer, M. – Daim, T.U. – Jetter, A. (2013) A review of scenario planning. *Futures,* 43, 23-40.

Anderson, M.W. (2013) Intergenerational bargains: Negotiating our debts to the past and our obligations to the future. *Futures*. 54, 43-52.

Angus, C. – Holmes, J. – Meier, P.S. (2019) Comparing alcohol taxation throughout the European Union. *Addiction*, 114 (8), 1489-1494.

Armstrong, J.S. (1980) The Seer-Sucker Theory: The Value of Experts in Forecasting. *Technology Review*, 82 (7), 16-24.

Barnes, A. (2016) Making Intelligence Analysis More Intelligent: Using Numeric Probabilities. *Intelligence and National Security*, 31 (3), 327-344.

Bell, W. (1997) *Foundations of futures studies, Volume 1: Human Science for a New Era*. Transaction Publishers, United States.

Ben-Haim, Y. – Demertzis, M. (2015) Decision Making in Times of Knightian Uncertainty: An Info-Gap Perspective. Kiel Institute for the World Economy. *Economics Discussion Papers*, 42, 2-17.

Bishop, P. – Hines, A. – Collins, T. (2007) The current state of scenario development: an overview of techniques. *Foresight*, 9 (1), 5-25.

Blackman Jr, A.W. (1973) A cross-impact model applicable to forecasts for long-range planning. *Technological Forecasting and Social Change*, 5 (3), 233-242.

Börjeson, L. – Höjer, M. – Dreborg, K. – Ekvall, T. – Finnveden, G. (2006) Scenario types and techniques: Towards a user's guide. *Futures*, 38 (7), 723-739.

Bradfield, R. – Burt, G. – Wright, G. – Cairns, G. – Van Der Heijden, K. (2005) The origins and evolution of scenario techniques in long range business planning. *Futures*, 37 (8), 795-812.

Brodowicz, D.P. (2013) *Futures Methodology as an Analysis and Planning Tool within the Commercial Real Estate Industry, an Interpretative Study.* Technological

University Dublin. Accessed 30 July 2020. Available: https://doi.org/10.21427/D78G75

Carlisle, T.E. (2014) *Deep Value : Why Activist Investors and Other Contrarians Battle for Control of Losing Corporations*. Wiley, United States.

Damodaran, A. (2006) *Damodaran on Valuation: Security Analysis for Investment and Corporate Finance. Second Edition*. Wiley, United States.

Damodaran, A. (2018) *Facing Up to Uncertainty: Using Probabilistic Approaches in Valuation*. SSRN. Accessed 30 July 2020. Available: https://dx.doi.org/10.2139/ssrn.3237778

Dichev, I.D. – Wei Tang, V. (2009) Earnings volatility and earnings predictability. *Journal of Accounting and Economics*, 47 (1-2), 160-181.

Doganova, L. (2013) *Necessarily untrue: on the use of the discounted cash flow formula in valuation of exploratory projects*. 7th Critical Management Studies Conference (CMS7 2011), Naples, Italy. Accessed 30 July 2020. Available: https://hal-mines-paristech.archives-ouvertes.fr/hal-00652887/document

European Central Bank. (2020) *Euro area yield curves*. European Central Bank. Accessed 30 July 2020. Available: https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_area_yield_curves/html/index.en.html

Evans, D.A. – Moussavi, F. – Langford, B.E. (1992) Integrating social and financial goals toward more balanced new technology decisions. *Technological Forecasting and Social Change,* 41 (1), 29-40.

Fama, E.F. – French, K.R. (1993) Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33 (1), 3-56.

Fama, E.F. – French, K.R. (2004) The Capital Asset Pricing Model: Theory and Evidence. *Journal of Economic Perspectives*, 18 (3), 25-46.

Fisher, C.M. (2010*) Researching and Writing a Dissertation: An Essential Guide for Business Students, Third Edition*. Pearson Education, United Kingdom.

Fontela, E. (2000) Bridging the gap between scenarios and models. *Foresight*, 2 (1), 10-14.

Fortune Magazine. (2005) *A database of 50 years of FORTUNE's list of America's largest corporations*. Archive.org. Accessed 30 July 2020. Available: https://archive.fortune.com/magazines/fortune/fortune500_archive/full/1984/

French, S. (2011) Aggregating expert judgement. *Revista de la Real Academia de Ciencias Exactas, Fisicas y Naturales: Matematicas, Serie A*, 105 (1), 181-206.

Fuller, R. – Russell, J. – Huberts, L.C. – Levinson, M. (1992) It's Not Higgledy-Piggledy Growth! *Journal of Portfolio Management*, 18 (2), 38-45.

Glenn, J.C. (2009) *Scenarios*. Futures Research Methodology - V3.0. The Millenium Project. CD-ROM.

Goetzmann, W. N. (2004) *Fibonacci and the Financial Revolution*. The National Bureau of Economic Research, NBER Working Paper No. 10352. Accessed 30 July 2020. Available: https://www.nber.org/papers/w10352

Gordon, T.J. – Stover, J. (1976) Using Perceptions and Data about the Future to Improve the Simulation of Complex Systems. *Technological Forecasting and Social Change*. 9 (1-2), 191-211.

Gordon, T.J. (1992) The Methods of Futures Research. *The Annals of the American Academy of Political and Social Science*, 522 (1), 25-35.

Gordon, T.J. (2009a) *Trend-Impact Analysis*. Futures Research Methodology - V3.0. The Millenium Project. CD-ROM.

Gordon, T.J. (2009b) *Cross Impact*. Futures Research Methodology - V3.0. The Millenium Project. CD-ROM.

Graham, B. – Dodd, D.L. (1951) *Security Analysis – Principles and Technique. Third Edition*. McGraw-Hill Book Company, United States.

Graham, B. (1939) Reviewed Work: The Theory of Investment Value by John Burr Williams. *Journal of Political Economy*, 47 (2), 276-278.

Greene, D.L. – Park, S. – Changzheng, L. (2014) Analyzing the transition to electric drive vehicles in the U.S. *Futures*, 58, 34-52.

Hancock, T. – Bezold, C. (1994) Possible futures, preferable futures. *Healthcare Forum Journal*, 37 (2), 23-9.

Hanea, A.M. – McBride, M.F. – Burgman, M.A. – Wintle, B.C. (2018) The Value of Performance Weights and Discussion in Aggregated Expert Judgments. *Risk Analysis*, 38 (9), 1781-1794.

Henchey, N. (1978) Making Sense of Future Studies. *Alternatives: Perspectives on Society, Technology and Environment*, 7 (2), 24-27.

Hennen, W.H.G.J – Benninga, J. (2009) Application of Trend Impact Analysis for predicting future fruit consumption. *Journal of Horticultural Science and Biotechnology*, 84 (6), 18-21.

Hirsch, S. – Burggraf, P. – Daheim, C. (2013) Scenario planning with integrated quantification – managing uncertainty in corporate strategy building. *Foresight*, 15 (5), 363-374.

Hitchner, J.R. (2017) *Financial Valuation: Applications and Models. Fourth Edition with Website*. Wiley, United States.

Hundal, S. – Eskola, A. – Tuan, D. (2019) Risk–return relationship in the Finnish stock market in the light of Capital Asset Pricing Model (CAPM). *Journal of Transnational Management,* 24 (4), 305-322.

Huss, W.R. – Honton, E.J. (1987) Scenario Planning: What Style Should You Use? *Long Range Planning*, 20 (4), 21-29.

Jain, S.C. (1984) Environmental scanning in U.S. corporations. *Long Range Planning*, 17 (2), 117-128.

Jaynes, E.T. (2003) *Probability Theory: The Logic of Science*. Cambridge University Press, United States.

Jensen, M.C. (1986) Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. *The American Economic Review*, 76 (2), 323-329.

Jensen, R.E. (1979) Fantasyland Accounting Research: Let's Pretend... . *The Accounting Review*, 54 (1), 189-196.

Joos, P. – Piotroski, J. – D. Srinivasan, S. (2016) Can analysts assess fundamental risk and valuation uncertainty? An empirical analysis of scenario-based value estimates. *Journal of Financial Economics*, 121 (3), 645-663.

Jordà, Ò. – Knoll, K. – Kuvshinov, D. – Schularick, M. – Taylor, A. (2019) The Rate of Return on Everything, 1870–2015. *The Quarterly Journal of Economics*, 134 (3), 1225-1298.

Kadous, K. – Krische, S.D. – Sedor, L.M. (2006) Using Counter-Explanation to Limit Analysts' Forecast Optimism. *The Accounting Review*, 81 (2), 377-397.

Karhapää, J. (2019) Beyond Simple Extrapolation: Trend-Impact Analysis and Cross-Impact Analysis. Finland Futures Research Centre. *Coolest Student Papers at Finland Futures Research Centre 2017-2018,* 115-123. Accessed 30 July 2020. Available: https://www.utupub.fi/handle/10024/148180

Klarman, S.A. (1991) *Margin of Safety: Risk-Averse Value Investing Strategies for the Thoughtful Investor*. Harper Business, United States.

Koehler, D.J. – Tversky, A. (1994) Support Theory: A Nonextensional Representation of Subjective Probability. *Psychological Review*, 101 (4), 547-567.

Kula, E. (2015) Future generations and nuclear power – A pluralistic economic appraisal. *Futures*, 73, 37-47.

Lavrakas, P.J. (2011) *Encyclopedia of Survey Research Methods*. Sage Publications, United States.

Lee, S. – Kim, Y. – Moon, K. (2015) Justifiable Trend Impact Analysis Based on Adaptive Neuro-Fuzzy System. *Information*, 18 (10), 4219-4227.

Little, I. M. (1962) Higgledy Piggledy Growth. *Bulletin of the Oxford University Institute of Economics & Statistics*, 24 (4), 387-412.

Makridakis, S. – Taleb, N. (2009) Decision making and planning under low levels of predictability. *International Journal of Forecasting*, 25 (4), 716–733.

Markowitz, H. (1952) Portfolio Selection. *The Journal of Finance*, 7 (1), 77-91.

Masini, E. B. (1993) *Why futures studies?* Grey Seal, United Kingdom.

Mauboussin, M. (2007) *More Than You Know. Finding Financial Wisdom in Unconventional Places (Updated and Expanded).* Columbia University Press, United States.

Meadows, D.H. – Meadows, D.L. – Randers, J. – Behrens, W.W (1972) *The Limits to Growth: A Report For The Club Of Rome's Project On The Predicament Of Mankind*. Potomac Associates, United States.

Meadows, D.H. (2009) *Thinking In Systems: A Primer*. Earthscan, United Kingdom.

Merriam-Webster. (2020) *Definition of Payout Ratio*. Merriam-Webster. Accessed 6 June 2020. Available: https://www.merriam-webster.com/dictionary/payout%20ratio

Microsoft. (2020) *Trendline options in Office*. Microsoft Corporation. Accessed 30 July 2020. Available: https://support.microsoft.com/en-us/office/trendline-options-in-office-92157920-fee4-4905-bc89-6a0f48152c52

Millett, S.M. (2009) Should Probabilities Be Used With Scenarios? *Journal of Futures Studies*, 13 (4), 61-68.

Mills, R.W. – Weinstein, B. (1996) Calculating Shareholder Value in a Turbulent Environment. *Long Range Planning*, 29 (1), 76-83.

Morningstar. (2020a) *Olvi Oyj Class A (OLVAS) Quote*. Morningstar Inc. Accessed 30 July 2020. Available: https://www.morningstar.com/stocks/xhel/olvas/quote

Morningstar. (2020b) *Olvi Oyj Class A (OLVAS) Operating Performance*. Morningstar Inc. Accessed 30 July 2020. Available: https://www.morningstar.com/stocks/xhel/olvas/performance

Morningstar. (2020c) *Olvi Oyj Class A (OLVAS) Valuation*. Morningstar Inc. Accessed 30 July 2020. Available: https://www.morningstar.com/stocks/xhel/olvas/valuation

MSCI, Inc. (2018) *Factor Focus: Value*. MSCI Inc. Accessed 30 July 2020. Available: https://www.msci.com/documents/1296102/8473352/Value-brochure.pdf

MSCI, Inc. (2020) *ESG Investing*. MSCI Inc. Accessed 30 July 2020. Available: https://www.msci.com/what-is-esg

Olsen, R.A. (2002) Professional Investors as Naturalistic Decision Makers: Evidence and Market Implications. *The Journal of Psychology and Financial Markets*, 3 (3), 161-167.

Olvi Group. (2020a) *Olvi Group's Financial Statements January to December 2019*. Olvi Group. Accessed 29 February 2020. Available: https://www.olvigroup.fi/app/uploads/sites/2/2020/02/Financial-statements-bulletin-Q4_2019.pdf

Olvi Group. (2020b) *Annual Reports*. Olvi Group. Accessed 30 July 2020. Available: https://www.olvigroup.fi/en/releases-and-publications/annual-reports/

Olvi Group. (2020c) *Olvi in Brief*. Olvi Group. Accessed 30 July 2020. Available: https://www.olvigroup.fi/en/company/olvi-in-brief/

Olvi Group. (2020d) *Olvi Group's Interim Report, 1 January to 31 March 2020 (3 Months)*. Olvi Group. Accessed 30 July 2020. Available: https://www.olvigroup.fi/app/uploads/sites/2/2020/04/Olve072020.pdf

Pabrai, M. (2007) *The Dhandho Investor: The Low-Risk Value Method to High Returns*. Wiley, United States.

Pearson, G. (1986) The Strategic Discount Protecting New Business Projects Against DCF. *Long Range Planning*, 19 (1), 18-24.

Plecher, H. (2020) *Unemployment rate in Finland 2019*. Statista. Accessed 30 July 2020. Available: https://www.statista.com/statistics/328297/unemployment-rate-in-finland/

Pratt, S.P. – Grabowski, R.J. (2014) *Cost of Capital.* Wiley, United States.

Ramirez, R. – Selin, C. (2014) Plausibility and probability in scenario planning. *Foresight*, 16 (4), 54-74.

Ruback, R. (2011) Downsides and DCF: Valuing Biased Cash Flow Forecasts. *Journal of Applied Corporate Finance*, 23 (2), 8-17.

Rutherford, D. (2013) *Routledge Dictionary of Economics, 3rd Edition*. Taylor & Francis Group, United States.

Scimago. (2020) *Journal Ranking on Finance*. Scimago Lab. Accessed 6 January 2020. Available: https://www.scimagojr.com/journalrank.php?area=2000&category=2003

Shareville AB. (2020) *Shareville*. Shareville AB. Accessed 21 June 2020. Available: https://www.shareville.fi/

Stålnacke, O. (2019) Individual investors' information use, subjective expectations, and portfolio risk and return. *The European Journal of Finance*, 25 (15), 1351-1376.

Steiger, F. (2010) *The Validity of Company Valuation Using Discounted Cash Flow Methods*. arXiv.org, Quantitative Finance Papers. Accessed 30 July 2020. Available: http://arxiv.org/abs/1003.4881

Taleb, N. (2012) *Antifragile: Things that Gain from Disorder.* Penguin Group, United Kingdom.

Taylor, B. (1984) Strategic Planning – Which Style do you Need? *Long Range Planning*, 17 (3), 51-62.

Taylor, C. (1990) *Creating strategic visions*. Strategic Studies Institute, US Army War College, Carlisle Barracks, Pennsylvania, United States.

Terveyden ja hyvinvoinnin laitos. (2020) *Alkoholijuomien kulutus 2019*. Terveyden ja hyvinvoinnin laitos. Accessed 30 July 2020. Available: https://thl.fi/fi/tilastot-ja-data/tilastot-aiheittain/paihteet-ja-riippuvuudet/alkoholi/alkoholijuomien-kulutus

Tetlock, P.E. – Gardner, D. (2015) *Superforecasting: The Art and Science of Prediction*. Crown Publishers, United States.

Vogt, W.P. (2005) *Dictionary of Statistics & Methodology: A Nontechnical Guide for the Social Sciences*. Sage Publications, United States.

Voros, J. (2003) A generic foresight process framework. *Foresight*, 5 (3), 10-21.

Voros, J. (2015) *On examining Preposterous! futures*. The Voroscope. Accessed 30 July 2020. Available: https://thevoroscope.com/2015/12/28/on-examining-preposterous-futures/

Webropol. (2020) *Webropol – konserni*. Webropol Oy. Accessed 30 July 2020. Available: https://webropol.fi/tietoa-yrityksesta/webropol-konserni/

Whipple III, W. (1989) Evaluating Alternative Strategies Using Scenarios. *Long Range Planning*, 22 (3), 82-86.

Williams, J.B. (1938) *The Theory of Investment Value*. North Holland Publishing Company, Netherlands.

World Bank. (2020) *GDP growth (annual %).* The World Bank. Accessed 31 July 2020. Available: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2019&start=1961&view=chart

APPENDICES

Appendix 1. Literature review details

Field	Journal title	Database used in search
Accounting & finance	Journal of Finance	Journal's website
	Journal of Financial Economics	Elsevier
	Review of Financial Studies	Oxford University Press
	Journal of Accounting Research	Wiley
	Journal of Management	Wiley
	Journal of Monetary Economics	Elsevier
	Journal of Accounting and Economics	Elsevier
	Accounting Review	JSTOR
	Annual Review of Financial Economics	Journal's website
	Journal of International Economics	Journal's website
	Journal of Financial and Quantitative Analysis	Springer
	Journal of Risk and Uncertainty	Springer
Futures studies	Journal of Futures Studies	Journal's website
	Futures	Elsevier
	Long Range Planning	Elsevier
	European Journal of Futures Research	Journal's website
	Foresight	Journal's website
	Technological Forecasting and Social Change	Journal's website

Keywords used
"DCF" + "scenario"
"discounted cash flow" + "scenario"
"discounted cash flow scenario"
"DCF scenario"
"cash flow scenario"
"net present value" + "scenario"
"npv" + "scenario"
"trend impact analysis"
"cross impact analysis"
"trend-impact analysis"
"cross-impact analysis"

Appendix 2. Disclaimer text in surveys

YLEISTÄ TIETOA KYSELYSTÄ

Tässä kyselyssä kerätään materiaalia pro gradu -tutkimukseen Turun kauppakorkeakoulussa. Gradu julkaistaan syksyllä 2020.

Shareville, Nordnet tai Olvi eivät ole millään tavalla osallisia kyselyyn.
Osallistuminen on vapaaehtoista. Osallistujat säilyttävät täydellisen yksityisyytensä koko tutkimuksen ajan.
Vastauksia ei voi yhdistää osallistujen henkilöllisyyteen tai Shareville-profiiliin.

Osallistujiin ei oteta yhteyttä missään tarkoituksessa kyselyn jälkeen.

Kysely ei ole minkäänlainen suositus käydä kauppaa pörssituotteilla.

Kyselyn tekijä ei omista sijoituksia, jotka liittyvät Olviin, eikä tee sellaisia seuraavan kuukauden aikana.

Tämä on voittoa tavoittelematon kokeellinen projekti.

Kyselyn tekijän yhteystiedot:
Jyri Karhapää
Turun yliopisto
[sähköposti-osoite]

Jatkamalla kyselyyn hyväksyt ylläolevan tekstin.

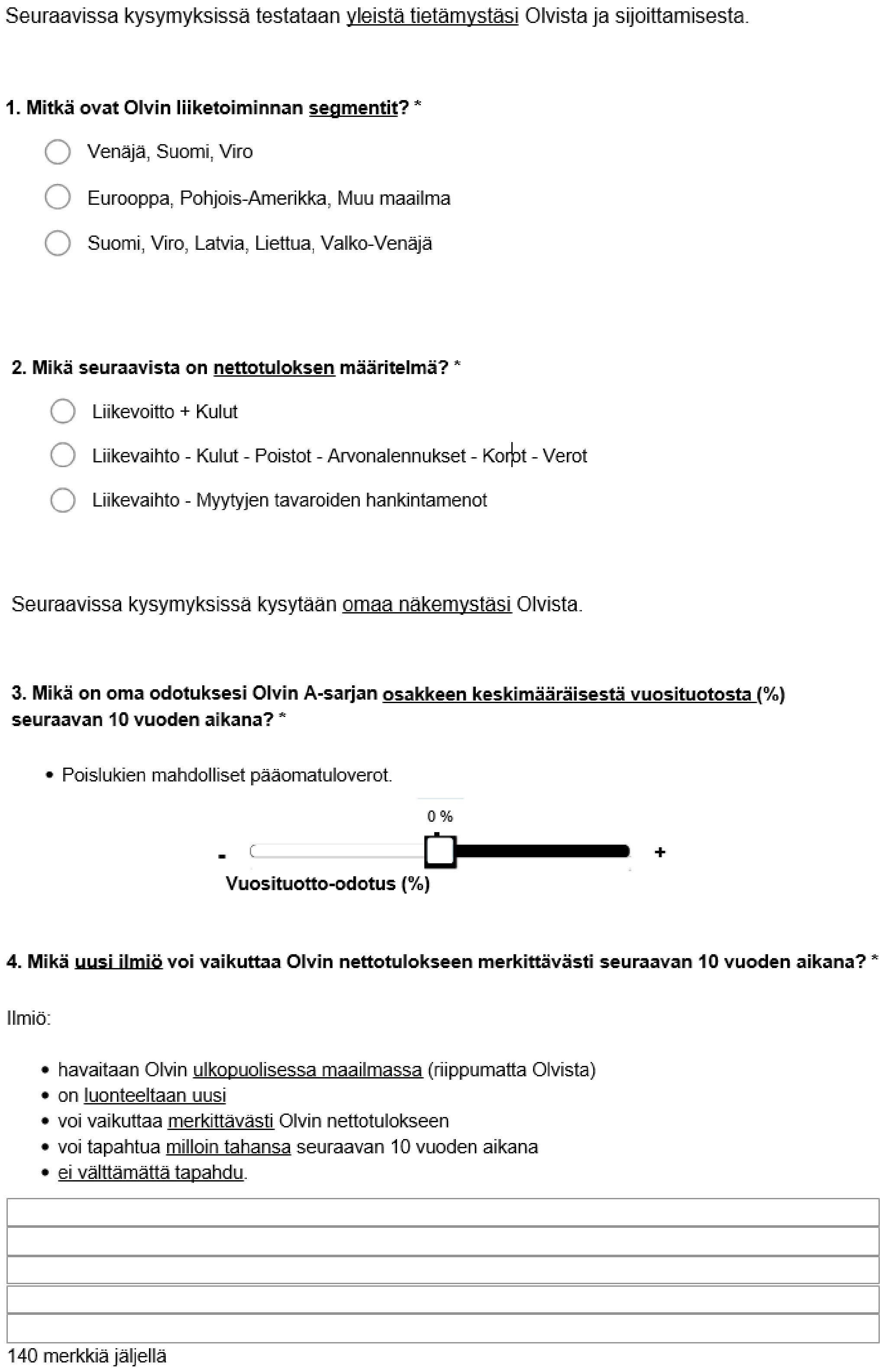
Appendix 3. Historical financial data (2002-2019)

Note: This data is compiled from the 18 annual reports available in Olvi Group (2020b) and provided here for convenience.
The 2002 annual report is not available, but its main financial figures are available in the 2003 report.
Revenue growth for any year is defined as Revenue in the current year / Revenue of the previous year.
Net margin for any year is defined as Net profit / Revenue.
Payout ratio for any year is defined as Dividend paid in the current year / Net profit of the previous year.

Historical data. Compiled from Annual Reports (Olvi Group 2020b)

Year	**Revenue**	***Revenue growth***	**Net profit**	***Net margin***	**Dividend paid**	***Payout ratio***
'02	110,184	*N/A*	3,957	*3.6%*	2,175	*N/A*
'03	114,554	*4.0%*	4,159	*3.6%*	3,021	*76.4%*
'04	128,894	*12.5%*	2,912	*2.3%*	1,585	*38.1%*
'05	147,519	*14.4%*	9,808	*6.7%*	3,259	*111.9%*
'06	170,319	*15.5%*	14,824	*8.7%*	4,411	*45.0%*
'07	205,188	*20.5%*	18,979	*9.3%*	6,725	*45.4%*
'08	222,124	*8.3%*	12,674	*5.7%*	8,288	*43.7%*
'09	244,165	*9.9%*	23,009	*9.4%*	5,411	*42.7%*
'10	267,509	*9.6%*	25,259	*9.4%*	8,321	*36.2%*
'11	285,174	*6.6%*	12,954	*4.5%*	10,377	*41.1%*
'12	312,230	*9.5%*	26,164	*8.4%*	10,377	*80.1%*
'13	327,256	*4.8%*	34,186	*10.5%*	10,541	*40.3%*
'14	328,239	*0.3%*	33,079	*10.0%*	13,531	*39.6%*
'15	310,494	*-5.4%*	22,220	*7.2%*	13,514	*40.9%*
'16	321,478	*3.5%*	32,794	*10.2%*	14,529	*65.4%*
'17	345,185	*7.4%*	36,124	*10.5%*	15,574	*47.5%*
'18	384,302	*11.3%*	41,137	*10.7%*	16,587	*45.9%*
'19	408,706	*6.4%*	42,230	*10.3%*	18,787	*45.7%*
Mean		*8.2%*		*7.8%*		*52.1%*
Median		*8.3%*		*9.0%*		*44.9%*

Appendix 4. Form in survey 1



Seuraavissa kysymyksissä testataan yleistä tietämystäsi Olvista ja sijoittamisesta.

1. Mitkä ovat Olvin liiketoiminnan segmentit? *

○ Venäjä, Suomi, Viro

○ Eurooppa, Pohjois-Amerikka, Muu maailma

○ Suomi, Viro, Latvia, Liettua, Valko-Venäjä

2. Mikä seuraavista on nettotuloksen määritelmä? *

○ Liikevoitto + Kulut

○ Liikevaihto - Kulut - Poistot - Arvonalennukset - Korot - Verot

○ Liikevaihto - Myytyjen tavaroiden hankintamenot

Seuraavissa kysymyksissä kysytään omaa näkemystäsi Olvista.

3. Mikä on oma odotuksesi Olvin A-sarjan osakkeen keskimääräisestä vuosituotosta (%) seuraavan 10 vuoden aikana? *

- Poislukien mahdolliset pääomatuloverot.

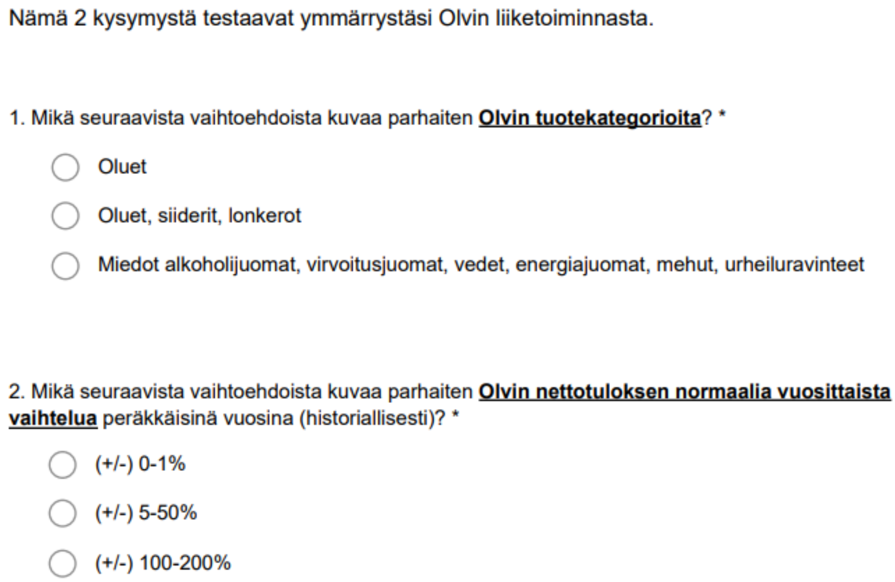
4. Mikä uusi ilmiö voi vaikuttaa Olvin nettotulokseen merkittävästi seuraavan 10 vuoden aikana? *

Ilmiö:

- havaitaan Olvin ulkopuolisessa maailmassa (riippumatta Olvista)
- on luonteeltaan uusi
- voi vaikuttaa merkittävästi Olvin nettotulokseen
- voi tapahtua milloin tahansa seuraavan 10 vuoden aikana
- ei välttämättä tapahdu.

140 merkkiä jäljellä

Appendix 5. Form in survey 2



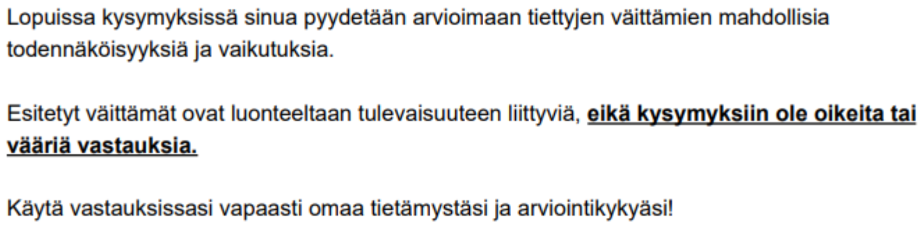
Nämä 2 kysymystä testaavat ymmärrystäsi Olvin liiketoiminnasta.

1. Mikä seuraavista vaihtoehdoista kuvaa parhaiten **Olvin tuotekategorioita**? *

○ Oluet
○ Oluet, siiderit, lonkerot
○ Miedot alkoholijuomat, virvoitusjuomat, vedet, energiajuomat, mehut, urheiluravinteet

2. Mikä seuraavista vaihtoehdoista kuvaa parhaiten **Olvin nettotuloksen normaalia vuosittaista vaihtelua** peräkkäisinä vuosina (historiallisesti)? *

○ (+/-) 0-1%
○ (+/-) 5-50%
○ (+/-) 100-200%



Lopuissa kysymyksissä sinua pyydetään arvioimaan tiettyjen väittämien mahdollisia todennäköisyyksiä ja vaikutuksia.

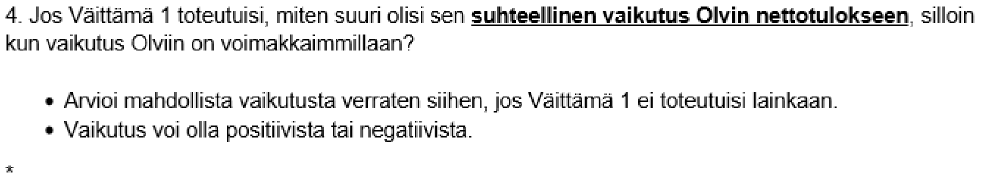
Esitetyt väittämät ovat luonteeltaan tulevaisuuteen liittyviä, **eikä kysymyksiin ole oikeita tai vääriä vastauksia.**

Käytä vastauksissasi vapaasti omaa tietämystäsi ja arviointikykyäsi!

Note: The last set of questions was repeated for each TIA Statement.
To conserve space, those questions are shown here only once.
Each TIA Statement was displayed at the top of the page that asked questions about it.
The full TIA Statements are written in English in Table 4.

3. Miten **todennäköiseksi** arvioit sen, että yllä kuvattu Väittämä 1 toteutuu **ennen vuotta 2030**? *

☐ En pysty vastaamaan

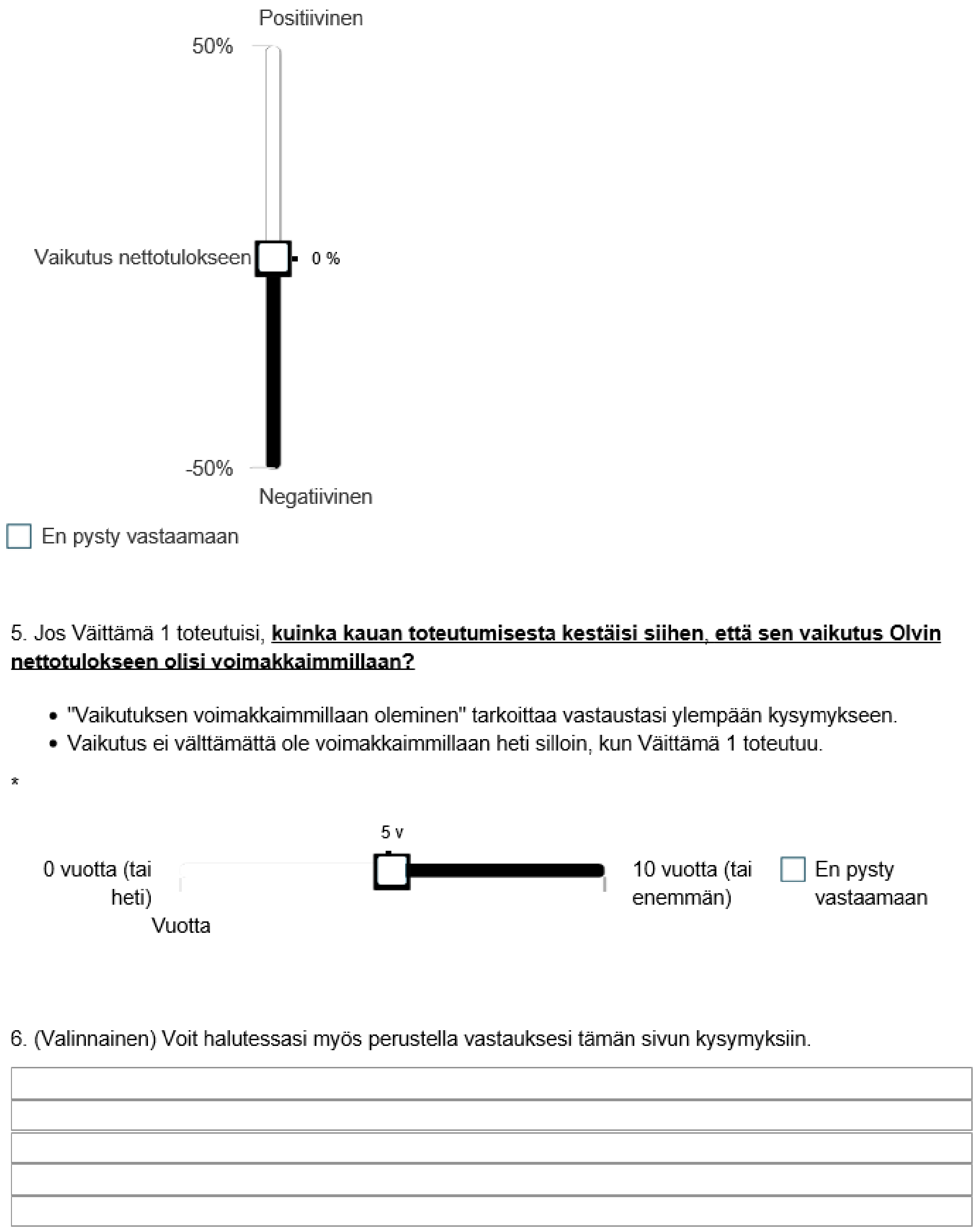


4. Jos Väittämä 1 toteutuisi, miten suuri olisi sen **suhteellinen vaikutus Olvin nettotulokseen**, silloin kun vaikutus Olviin on voimakkaimmillaan?

- Arvioi mahdollista vaikutusta verraten siihen, jos Väittämä 1 ei toteutuisi lainkaan.
- Vaikutus voi olla positiivista tai negatiivista.

*

(Form continues on next page)



Positiivinen

50%

Vaikutus nettotulokseen 0 %

-50%

Negatiivinen

☐ En pysty vastaamaan

5. Jos Väittämä 1 toteutuisi, **kuinka kauan toteutumisesta kestäisi siihen, että sen vaikutus Olvin nettotulokseen olisi voimakkaimmillaan?**

- "Vaikutuksen voimakkaimmillaan oleminen" tarkoittaa vastaustasi ylempään kysymykseen.
- Vaikutus ei välttämättä ole voimakkaimmillaan heti silloin, kun Väittämä 1 toteutuu.

*

5 v

0 vuotta (tai heti)

Vuotta

10 vuotta (tai enemmän)

☐ En pysty vastaamaan

6. (Valinnainen) Voit halutessasi myös perustella vastauksesi tämän sivun kysymyksiin.

Appendix 6. Answers to survey 1

Return Expectation (%)		
-10	4.9	7
2.5	5.1	7
3	5.5	7.7
3.8	6	9
4.3	6.1	9.1
4.3	6.7	18
4.8	-	-

Note: Answers below are presented in their original form, including spelling.
The “Tone” is categorized either as Negative (Neg.), Positive (Pos.) or unclear (N/A)
The distinct coding categories are highlighted with different colors.

Most impactful phenomenon	Tone	Category (Coding)
Terveysbuumi, ettei olutta tai virvoitusjuomia enää juoda.	Neg.	Healthy lifestyles
Vähittäiskaupan muuttuminen verkkoon ja sitä kautta alkoholin myynnin lasku	Neg.	Online sales of alcohol
Vesi on paras janojuoma hype.	Neg.	Healthy lifestyles
Suomalaisen kivennäisveden breikkaaminen maailmalla.	Pos.	Specific product
Virvoikejuomien käytön vähentyminen esim trendien takia tai taloustilanteesta johtuen.	Neg.	Macroeconomy
Kaljanjuonti menee pois muodista, leimautuu vanhanaikaiseksi/ epämuodikkaaksi/ juopoksi	Neg.	Healthy lifestyles
voi vaikuttaa merkittävästi Olvin nettotulokseen	N/A	N/A
Kansalaisille myönnetty helikopteriraha, joka suuntautuu suoraan kulutukseen. Muuten vaikea keksiä.	N/A	Monetary policy
Kulutustottumukset	N/A	Consumption habits (Vague)
joku täysin uusi erilainen tuotekategoria joka saavuttaa suuren (maailmanlaajuisen) suosion. Aika epätodennäköistä kylläkin. Muuta en keksi.	N/A	Radically new product category
Alkoholituotteiden verkkomyynti	N/A	Online sales of alcohol
-	N/A	N/A
En usko että pyörää keksitään uudestaan 😁	N/A	N/A
Alkoholin kulutuksen nykyistä merkittävämpi väheneminen. Muutokset verotuksessa.	Neg.	Healthy lifestyles Taxation of alcohol
Ei uusi mutta merkittävin riski on terveellisten ja ekologisten elämäntapojen merkittävä lisääntyminen.	Neg.	Healthy lifestyles
Alkoholiveronkorotukset baltiassa ja Valko-Venäjällä. Matkustamisen vähentyminen covid-19 jälkeen, mikä vaikuttaa matkustajatuontiin.	Neg.	Taxation of alcohol Tourism COVID-19
En osaa sanoa.	N/A	N/A
Kieltolaki	Neg.	Prohibition law
En osaa sanoa	N/A	N/A

Appendix 7. Answers to survey 2

	TIA statement		
Question	**1: Healthy Lifestyles**	**2: Online Sales**	**3: Excise Tax**
Probability (%)	10	18	0
	10	20	0
	30	25	5
	31	25	9
	32	25	10
	40	35	12
	44	39	15
	50	42	16
	50	48	18
	60	51	20
	61	60	20
	62	70	23
	75	72	29
	85	75	36
	87	80	”don’t know”
Maximum impact (%)	-42	-35	-43
	-38	-3	-38
	-25	10	-30
	-25	13	-30
	-20	17	-28
	-20	20	-25
	-5	25	-20
	-5	30	-13
	-3	37	0
	8	”don’t know”	5
	10	”don’t know”	48
	10	”don’t know”	”don’t know”
	32	”don’t know”	”don’t know”
	”don’t know”	”don’t know”	”don’t know”
	”don’t know”	”don’t know”	”don’t know”
Time-to-max. impact (y)	0	1	0
	0	1	0
	1	1	0
	1	1	1
	2	1	1
	2	2	1
	3	2	2
	4	2	3
	4	3	3
	4	3	3
	7	4	4
	7	4	4
	10	5	6
	10	5	”don’t know”
	”don’t know”	6	”don’t know”
Rationale for judgments	En pysty vastaamaan,asia riippuu mielestäni kehityksen vaikutuksesta muiden tuotteiden menekkiin ja korvaavien tuotteiden löytymisestä.	N/A	N/A

Appendix 8. Main scenarios summary

Net Profit (M€) & CAGR

Year	Base	Min.	Q1	Mean	Med.	Q3	Max.
’20	41.37	37.12	41.37	41.36	41.37	41.37	43.12
’21	42.64	34.14	42.64	42.61	42.64	42.64	46.14
’22	43.90	34.42	43.90	43.88	43.90	43.90	49.14
’23	45.15	34.69	45.15	45.07	45.15	45.15	50.39
’24	46.40	35.94	45.42	46.25	46.40	46.40	51.64
’25	47.66	37.20	45.70	47.44	47.66	48.99	52.90
’26	48.93	38.47	46.00	48.66	48.93	50.26	54.17
’27	50.22	39.77	47.29	49.89	50.22	51.55	55.47
’28	51.54	41.08	47.63	51.15	51.54	52.87	56.78
’29	52.89	42.43	48.98	52.44	52.89	54.22	58.13
CAGR	2.49%	1.35%	1.70%	2.40%	2.49%	2.74%	3.03%

Note: Simulated dividends are based on the previous years’ net profit.
Therefore, while the TIA forecast period is 2020-2029, the dividends would practically be paid out in 2021-2030.
Dividend per share (DPS) is calculated using equation (4).
CAGR is calculated using equation (6).

Dividend Per Share (DPS) (€) & CAGR

Year	Base	Min.	Q1	Mean	Med.	Q3	Max.
’21	1.00	0.90	1.00	1.00	1.00	1.00	1.04
’22	1.03	0.82	1.03	1.03	1.03	1.03	1.11
’23	1.06	0.83	1.06	1.06	1.06	1.06	1.19
’24	1.09	0.84	1.09	1.09	1.09	1.09	1.22
’25	1.12	0.87	1.10	1.12	1.12	1.12	1.25
’26	1.15	0.90	1.10	1.14	1.15	1.18	1.28
’27	1.18	0.93	1.11	1.17	1.18	1.21	1.31
’28	1.21	0.96	1.14	1.20	1.21	1.24	1.34
’29	1.24	0.99	1.15	1.23	1.24	1.28	1.37
’30	1.28	1.02	1.18	1.27	1.28	1.31	1.40
CAGR	2.49%	1.35%	1.70%	2.40%	2.49%	2.74%	3.03%