# International Harmonization of Reporting for Financial Securities


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# Preface

Dear readers,

This publication is devoted to problems of financial reporting for financial instruments. This branch is among academicians and practitioners widely discussed topic. It is mainly caused due to current developments in financial engineering, while accounting standard setters still lag. Moreover measurement based on fair value approach – popular phenomenon of last decades – brings to accounting entities considerable problems.

The text is clearly divided into four chapters. The introductory part is devoted to the theoretical background for the measurement and reporting of financial securities and derivative contracts.

The second chapter focuses on reporting of equity and debt securities. There are outlined the theoretical bases for the measurement, and accounting treatment for selected portfolios of financial securities.

Third part of text is devoted to derivative contracts. These contracts became popular during last two decades as a tool for hedging of currency and interest rate risks. The text focuses firstly on the accounting treatment of fixed-term operations and subsequently there is devoted a considerable space to the option contracts. There are specified selected option pricing models and there is also documented the sensitivity analysis of the option premium on selected parameters. Finally, there is also stressed an attention on selected option strategies as a tool for corporate risk management.

Final passage summarizes current practice. In addition, there is outlined the expected development in the harmonization of accounting rules and the procedures for reporting of financial instruments in SMEs.

We hope that this book will be a valuable guide for anyone seeking constructive engagement with regard to international harmonization of financial securities reporting.

Authors would like to thanks World Scientific and Engineering Academy and Society (WSEAS) for the kind support of this book.

March, 2011

Jiří Strouhal
Carmen Bonaci

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# International Convergence and Harmonization towards a Global Capital Market

Introducing reporting for financial securities requires us to first dimension the approached research area and further integrated it within the larger picture of financial reporting. Therefore we have chosen to begin our chapter by emphasizing the difficulties imposed by reporting for financial instruments. This is done on one hand by underlying the importance of having accounting regulations and practice closely follow the economic fundament of transactions being recorded, and on the other by discussing why accounting for financial instruments is necessary. Once we have our research area introduced, we continue by integrating it within the large picture of the worldwide globalization project in financial reporting. As we will further see, accounting for financial instruments was proven to be difficult even from the perspective of the accounting harmonization and convergence process. Developments being imposed by the recent financial crisis are also discussed. In the final part of the chapter we discuss accounting measurements and the shift in accounting paradigms that lead us from the historical cost model towards the fair value model. Recent crisis circumstances were also documented to have had significant impact in terms of fair value accounting.

## 1 Accounting for Financial Securities: One of the Most Controversial Areas in Financial Reporting

Aspects related to identifying the most appropriate manner to account for assets and liabilities within the balance sheet, but also for changes appearing in relation to the valuation being used, have been one of the main preoccupations in financial reporting starting with the development of balance sheet oriented financial statements in the 19th century and the emergence of the income or profit and loss statement in the 20th century [48]. Although a series of measurement basis were considered over time in terms of measurement for financial reporting, we can for sure say that the historical cost based approach represented the dominant paradigm for a significant period of time and for most of the accounting systems.

The 20th century brought the development of a significant number of researches dealing with identifying the most appropriate manner of measuring assets. In terms of papers that might be considered as benchmark in this area we must mention that of [14, 22]. Similar preoccupations were related to identifying the most appropriate manner in which financial performance should be measured, starting with studies such as [28, 38, 94]. In parallel with these developments, but in some ways separate, an older tradition of economic literature, being focused on aspects related to valuation and results, and having started with Ricardo's and some other classic economists writings also continued to develop. On the other hand, economists such as [45, 52, 74] already had preoccupations directly linked with establishing ways for periodically determining the result through a calculation framework of current values of future cash flows that were associated to assets and liabilities.

We consider that accounting researches dealing with financial instruments' measurement must be anchored in the reality of economic fundaments that further requires the consideration of economic literature. The therefore developed accounting studies determined what is now considered by research literature to represent a change in paradigms, with orientation towards fair value accounting.

### 1.1 Some perspectives on economic analysis of financial reporting concepts

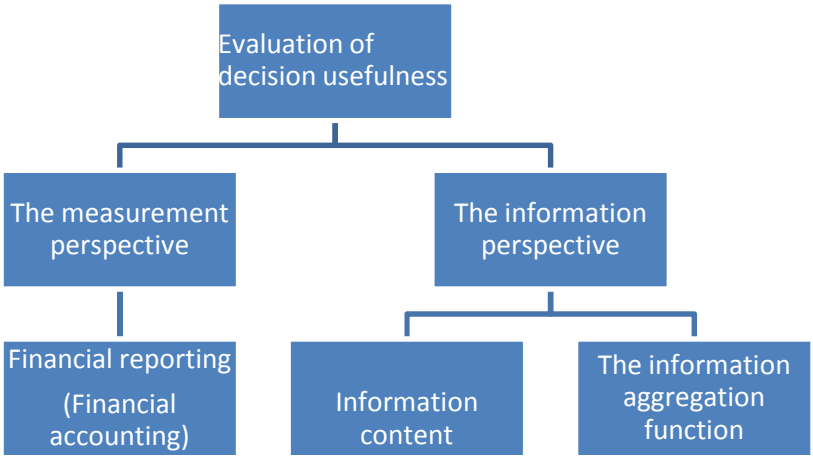
Following [81], from a methodological point of view the approach being pursued in this chapter represents a priori economic analysis, supplemented by standard setting inferences. Economic analysis aims at identifying the contribution of financial reporting alternatives to societal welfare or economic efficiency. One property of economic analysis is that it constitutes a priori research and therefore produces results on hypothetical reporting

alternatives prior to implementation. Empirical research, on the contrary, characteristically represents a posteriori research. Its applicability to questions of accounting regulations thus limited, especially with respect to predicting capital market reactions to new accounting standards.

As long as the Financial Accounting Standards Board's (FASB) and the International Accounting Standards Board's (IASB) frameworks identify decision usefulness as the primary objective of financial reporting, the findings of our analysis lend themselves to inferences for accounting regulation and therefore also contribute to the standard setting literature and the related debate on fair value accounting.

We therefore consider that the measurement and information perspective provide the framework for evaluation of decision usefulness as documented by [54]. What [54] argues is that from an information perspective, financial reporting represents but one information system competing with others. Since information is only relevant in its capability to induce revisions of expectations, the presentation format does not matter. Thus, in contrast to the measurement perspective, specific accounting representations such as balance sheets, captions and categories such as assets, liabilities, etc. are irrelevant. The following figure reflects the context being considered in assessing information's decision usefulness:

***Figure 1***. Evaluation of decision usefulness




Source: authors' projection based on [54]

We will further discuss the evaluation of decision usefulness by using [81] analysis of [54]. The so-called measurement perspective represents the traditional view on the information objective of financial reporting, especially of financial accounting. It is rooted in the neoclassical theory of value and income developed by economists such as Hicks, Fisher and Lindahl. The fundamental notion underlying the measurement perspective is that accounting should directly measure and report the basic information required by investors, which is the value of the firm, or at least a fraction of it.

Therefore the firm valuation is delegated to the reporting entity. Under the measurement perspective, stocks measures like assets, liabilities and equity and flows measures like income are well defined and exhibit an economic character. In an ideal world of complete and perfect markets, disclosure of the market values for all firm's assets and liabilities directly reports firm value and thud the desired investor information. Earnings equal economic income. Obviously, the measurement perspective is embedded into such a scenario, decision useful information being information on the contribution of assets and liabilities to enterprise value. When considering such an approach the benchmark measurement attribute is value in use.

Furthermore, the usefulness of reported cash flow information depends on its descriptiveness, that is, its "quality" and cost-benefit considerations, both being dependent on the decision situation assumed for the typical investor. We might therefore conclude that the conceptual case for value measurement from a rigid

measurement perspective can only be made for an idealized scenario of complete and perfect markets, which of course would have no further demand for financial reporting.

As emphasized through literature [54], the measurement perspective represents one foundation of the earlier a priori research. While the measurement perspective regards financial accounting numbers as numerical inputs to security valuation models, the information perspective takes a broader view. In information economics, useful information is defined in an abstract manner as signals capable of transforming a priori expectations (beliefs) into a posteriori expectations, which induces revisions and therefore improvements of decisions.

The rise of the information perspective is conventionally associated with the increasing focus on empirical accounting research [15]. Yet, information perspective criteria can also be extracted and used for the purpose of conceptual evaluation [54]. Moreover, two concepts of decision usefulness from an information perspective can be distinguished:

- Information content refers to the "newness" of accounting information, and
- Capital-markets-based research also recognizes a less rigid form of decision usefulness: the function of financial statements to aggregate in efficient manner valuation-relevant information regardless of its timeliness, thus providing cost-efficient capital markets information [11]. The information aggregation function will therefore be considered as the second as the second variant of decision useful information production under the information perspective.

## 1.2 The necessity of accounting for financial securities

The purpose of managing risks within financial markets which become more sophisticated every day has lead to the development of a series of accounting standards that approach complex financial instruments that are currently used in all fields of activity [1, 69]. Accounting practices, especially those related to derivative financial instruments have encouraged the development of a series of debates and arguments within professionals being preoccupied by measurement basis being used in cases such as hedging and corresponding disclosure and gains or losses [16]. The necessity of this reorientation from the historical cost principle to that of the fair value actually represented the centre of attention for accounting standards being developed at international level [78] referring to financial instruments.

Although the reality of this necessity for a change in paradigms being imposed in order to account for some elements that have a significantly different profile when considering their economic grounding was acknowledged for some time now by both theoreticians and practitioners, the therefore generated problematic issues continue to face us nowadays. [16] actually very well points the evolutions being recorded in the field of accounting for financial instruments, starting with an initial situation when accounting for derivatives developed by finding solutions for individual cases that appeared in practice, and therefore we might say kind of started on the wrong foot. This we argue due to the lack of comparability in the therefore generated financial reporting practices, similar transactions being treated in different manners.

The first manifestations in the field of regulating accounting practices related to financial instruments appeared within the American accounting referential at the beginning of the '80s. In 1994 the FASB was already issuing a standard with regard to information disclosure, SFAS 119 requiring for the presentation of derivatives' fair value within the notes to the financial statements [129]. The IASB on the other hand often started off by using FASB's previous developments.

We could say that the main part of accounting research literature in the field of financial instruments underlines the difficulties being met when it comes to their measurement, recognizing the gains or losses they generate, as well as presenting the risks being involved [37]. Even though real financial catastrophes such as the recent financial crisis can not only be considered as a result of accounting failures or of trading complex financial instruments, we agree upon the fact that their use creates real difficulties for both accountants and auditors

when it comes to applying the extremely complex accounting standards that were developed in this field at international level.

When speaking about complexity we must first be aware of the possibilities the term offers in relation to potential dissimulation and misleading [18]. Such an example is offered through the extremely complex credit derivatives that we recently had to deal with, their complexity making it possible for the real commissions being gained by the involved financial institutions to be hidden. Simple products such as shares and bonds involve low commissions that are easily verifiable within banks. This is the reason why they cannot be compared when considering the attractiveness they generated.

On the other hand, structured products are also more difficult to compare among each other due to their high level of personalization, investors never knowing the value of the commissions being paid in favor of banks, while banks not being forced to disclose such information. [26] was making an inspired comparison between financial institutions' practices and those of hotel companies which charge huge prices for phone calls being made by clients from their room or for using the mini bar, prices that are almost never publicized. The client therefore finds this information only when he/she leaves the room and is no longer able to take attitude, therefore being faced with the facts. The situation is to some extant similar with banks trading complex derivatives for significantly higher prices, while investors sometimes only find out in a couple of years the value of the commissions they have been paying.

Under such circumstances, accounting professionals should have the ability to segregate such products and to record the commissions being paid as expenses that immediately affect the income statement when filling in the investor's financial statements. Unfortunately the reality is that only a few of the accounting professionals have such abilities and meanwhile banks are not at all willing to offer their support in identifying the commissions being involved in such transactions. Actually, revealing these commissions might be the last thing they would want to do. These make quite difficult situations that increase the probability of wrongly accounting for structured derivatives.

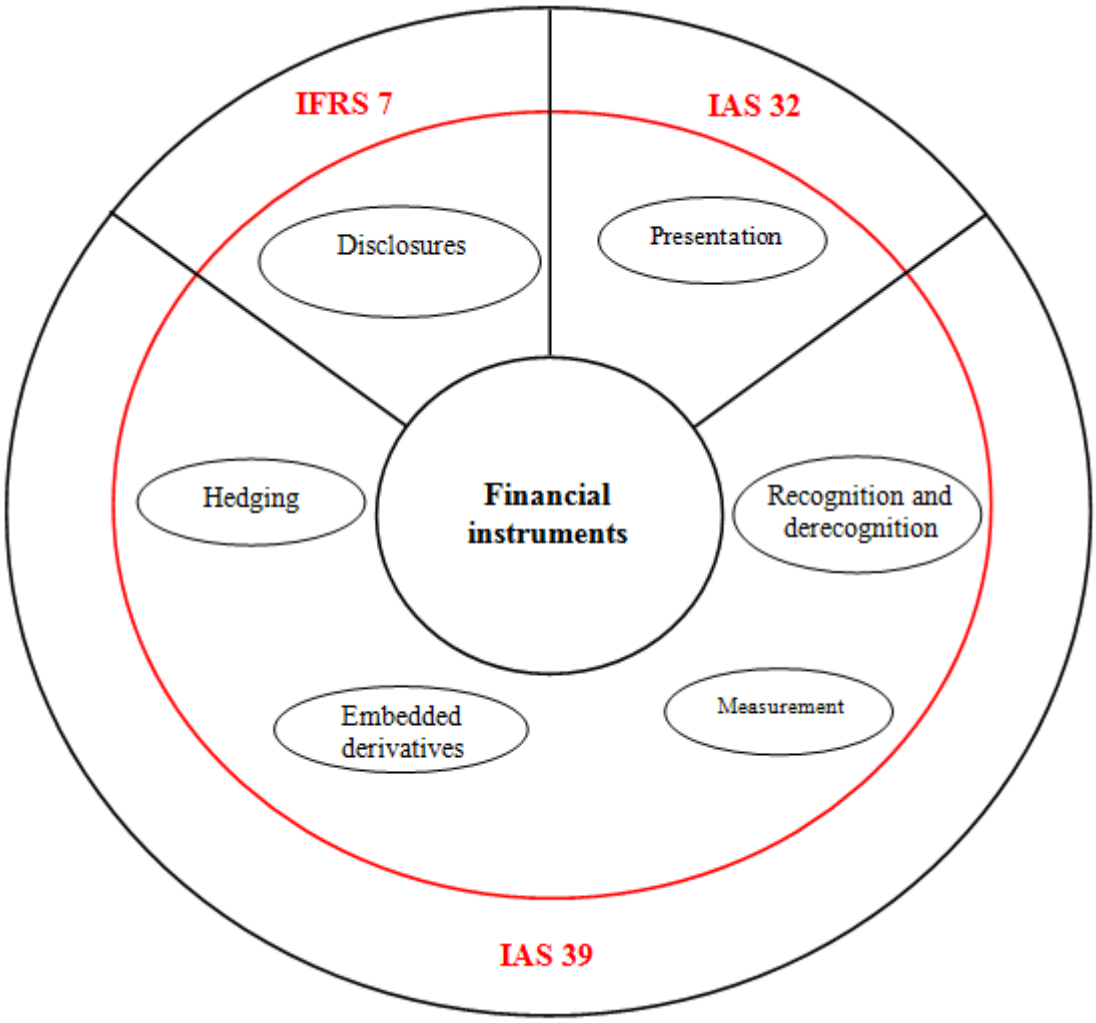
Another fundamental issue of nowadays regulations in the field of accounting is precisely the mixed attribute being used for measurement purposes, not all assets and liabilities being reflected within the balance sheet at their market value [26]. The result of such a mix leads to ignoring changes in the market value of certain categories of assets and liabilities such as those reflected at their cost, any increase or decrease in their value being ignored from both the balance sheet's and the income statement's perspective.

Inevitably, this state of facts creates the potential for generating some new problems. Extremely complicated accounting rules often determine entities to recognize losses or gains within their financial statements that are rather artificial. Accounting creativity can therefore interfere with the purpose of manipulating such regulations. Accounting standard setting bodies have most often took action through instituting a number of dogmatic rules that were aimed to prevent such situations, but ended creating an extremely complex set of accounting rules that are not always efficient due to the fact that they have not yet proven to be able to "close all the doors" for manipulation.

Starting with the well-known collapse of Enron in 2001, accounting standard setting bodies all over the world have brought a series of amendments to the regulations they issued, precisely with the purpose of avoiding opportunities for abuses such as those which have occurred in the case of the renown previous collapses from the beginning of the 21st century. On one hand we may say that a series of improvements were naturally brought to accounting regulations. But on the other it has come to the situation where in some fields too many rules have been created and these rules were proven to be difficult to follow and apply in practice, finally getting back to the premises of accounting creativity due to creating some superposition that allows for option.

An extremely complex context in the landscape of the international accounting referential is that relating to financial instruments, nowadays being governed by three standards whose role is reflected through the following figure:

***Figure 2.*** The content of IASB's regulations in the field of financial instruments




Source: authors' projection

We must also mention that, as usually, accounting for financial instruments is once again on the IASB's working agenda. More precisely, the IASB is currently working on issuing IFRS 9 Financial Instruments, covering classification and measurement of financial assets, as the first part of its project to replace IAS 39. The effective date of IFRS 9 is January 1st, 2013, with early adoption permitted starting in 2009 [127].

As it can also be seen from the above presented figure, the objective of the three standards (IAS 32 Financial Instruments: Presentation, IAS 39 Financial Instruments: Recognition and measurement and IFRS 7 Financial Instruments: Disclosures) is to offer necessary guidance for presenting, recognizing, measuring, derecognizing and disclosing information on financial instruments, as well as for hedge accounting [98]. As it can be seen from the existence of a particular standard on disclosure, special attention is paid to disclosing information, IFRS 7 having the role to enhance presentation on the significance financial instruments have within the entity as well as on the associated risks. As a consequence, information being provided must be linked to the accounting policies being used by the reporting entity when filling in its financial statements [42].

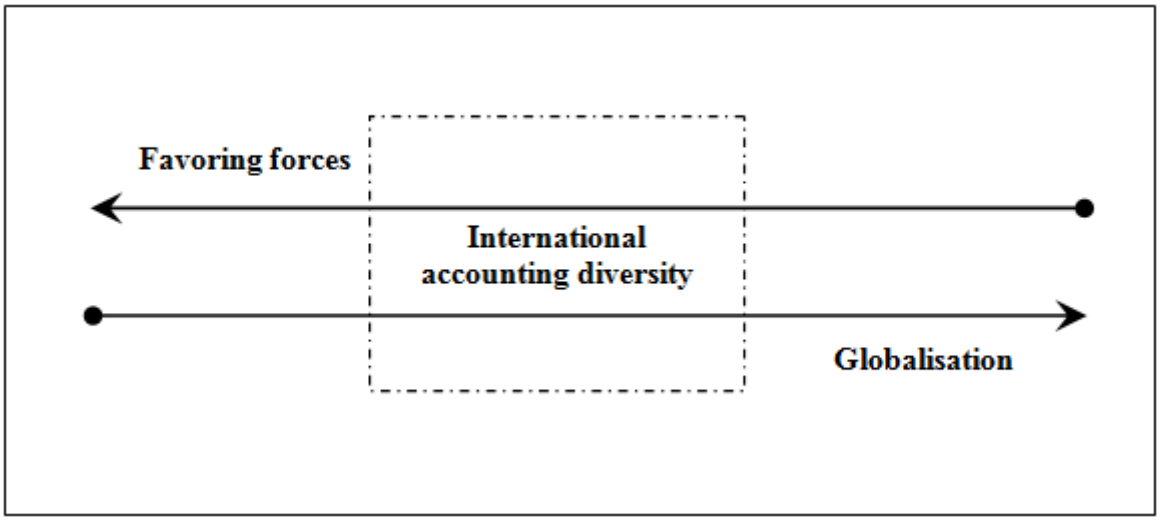
# 2 A Broader Approach by Reference to the Worldwide Globalization Project

In order to integrate our research demarche within the large picture of the worldwide globalization project in financial reporting we will further discuss international accounting harmonization. This is done through three main parts as follows: the first part discusses international accounting diversity and its relationship with the process of harmonization, main developments in the international arena being discussed with focus on accounting regulations; the second part continues the discussion on accounting regulations with particular focus on reporting for financial securities which is documented to be difficult even from the perspective of the accounting harmonization and convergence process; and the last part completes the approach by also considering the other forms of accounting harmonization besides formal harmonization and by synthesizing international accounting harmonization research.

## 2.1 From international accounting diversity to harmonization and convergence: historical developments

In accordance to [30] there are many forces that generate and enhance international accounting diversity, such as the fiscal system, economic stability, social responsibility, national culture, credit market etc. [91] positions economic globalization as being opposite to the above mentioned elements and having the ability to diminish the degree of diversity at international level. Furthermore he represents the relation between the degree of diversity, its favoring factors and the globalization phenomenon through the following figure:

***Figure 3.*** Positioning international accounting diversity




Source: [91]

[100] identify three main categories of differences when discussing the diversity of national accounting systems:

- differences related to national accounting regulations;
- differences related to the manner of interpreting and implemented accounting regulations;
- differences related to the option for certain accounting practices[1].

The main argument being used for the fact that companies in different countries use different accounting methods and treatments is related to differences being recorded between national accounting regulations [100]. Therefore we might extend the reasoning to the point where differences in national accounting regulations represent the main cause for differences in accounting practices[2]. Still, it might happen that when considering

[1] These differences include those due to voluntary reporting practices.
[2] This actually represents the causality relation between *de jure accounting* and *de facto accounting*.

two countries which have the same legal foresights in terms of a certain accounting treatment, companies in the two countries will apply and interpret regulations in a different manner [91].

Even though international accounting regulations' importance and role has been increasing during the last decades, differences continue to exist at national level and to influence the manner in which international accounting regulations are being interpreted and applied within the corresponding accounting system [39]. [100] also argue that accounting practices can significantly differ from one country to another even when the considered countries present a relatively small number of differences in terms of their national accounting regulations.

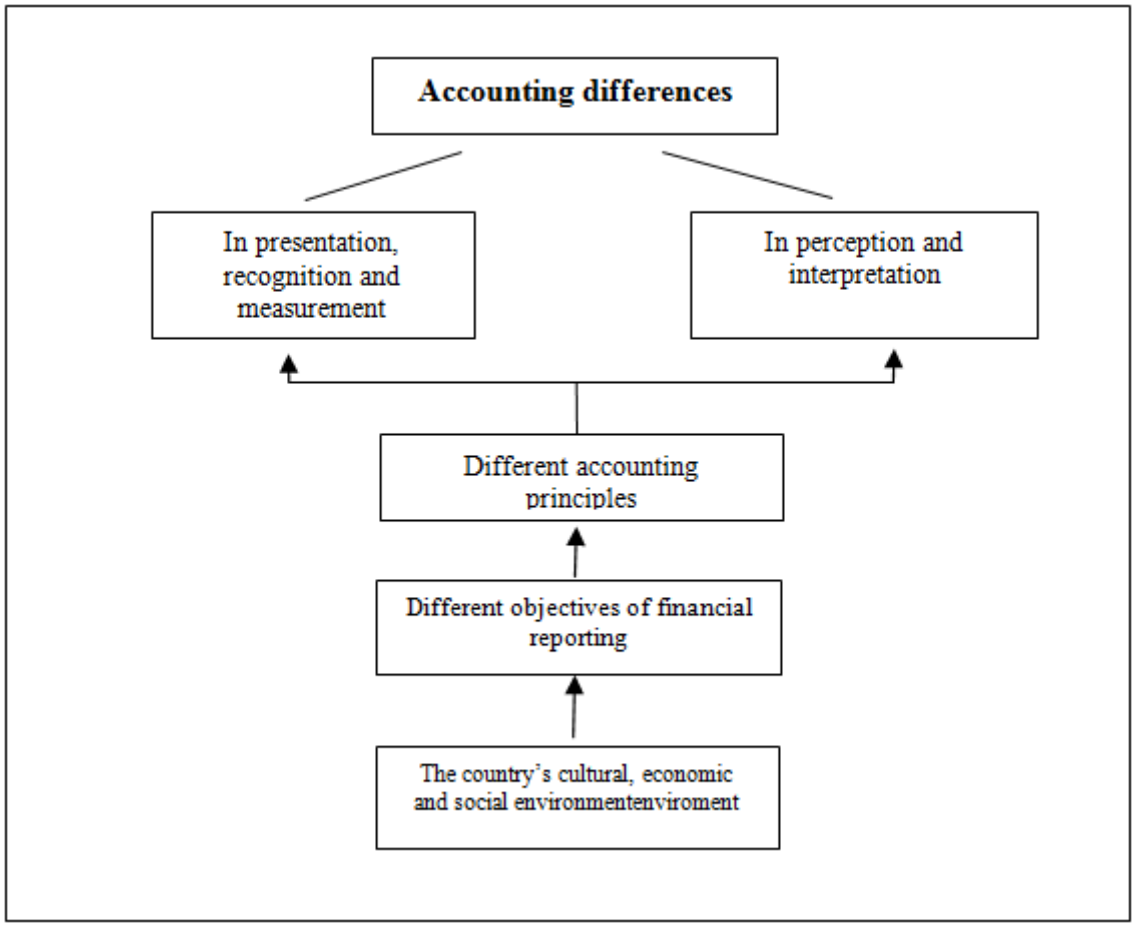
It therefore becomes obvious that when referring to accounting options they create the premises for differences to appear in term of actual accounting practices, companies and professionals being left with the choice. This can also be interpreted as a distinct source of accounting diversity. Standardization therefore takes action towards the reduction of the number of alternative treatments for a particular item within a specific regulation. Therefore we consider that standardization can also be considered as representing a factor helping diminish the premises of accounting diversity.

Research literature also underlines the fact that when discussing differences in accounting systems we must consider two main categories, as follows:

- differences regarding presentation, recognition and measurement of accounting elements;
- differences regarding accounting information's perception and interpretation.

These categories are also based on a series of determinant factors. [120] summarize the relation between the above mentioned two categories and their determinant factors:

***Figure 4.*** Nature of accounting differences




Source: [120]

As reflected through the above presented figure, due to the cultural, economic and social environment in each country, to the existence of different objectives of financial reporting and different accounting principles, national accounting systems are only natural to evolve in different manners. Accounting must therefore be placed within a variety of political, economic and social contexts, all involving both national and international perspectives that must be considered in order to get the big picture.

We have started our introduction to the arena of international accounting by considering the perspective of international accounting diversity. We must therefore continue our presentation by considering the important process of economic globalization that has naturally also reached to the level of accounting regulations and practices. Actually, starting with the '90s the effect of this process has become more obvious in the field of accounting, the idea of international accounting harmonization gaining filed and supporters. On the other hand it seemed like a national vision on financial reporting and accounting systems was starting to lose its sustainability [92]. Due to the development of certain fields of activity it has come to the existence of a global accounting environment where unity in terms of financial reporting is being emphasized, while we are all aware of national accounting differences still being recorder at a certain level [91].

The world of accounting and financial reporting has found itself within the middle of an important process, trying to deal with the variety of the accounting phenomenon at national, regional and international level. The increasing number of studies analyzing and classifying accounting systems also documents the importance of this process and its consequences. On the other hand the process itself is a consequence of nowadays' realities. Factors such as the development of international trade and international transactions, the increasing number of

multinationals, liberalization of the capital market, the increase in the volume of direct foreign investments, developments in communication techniques and access facilities offered through internet etc., all lead towards the need of satisfying the necessities of our times. All stakeholders argue for transparency, accuracy, relevance, feasibility, comparability and intelligibility of information being provided through companies' financial statements.

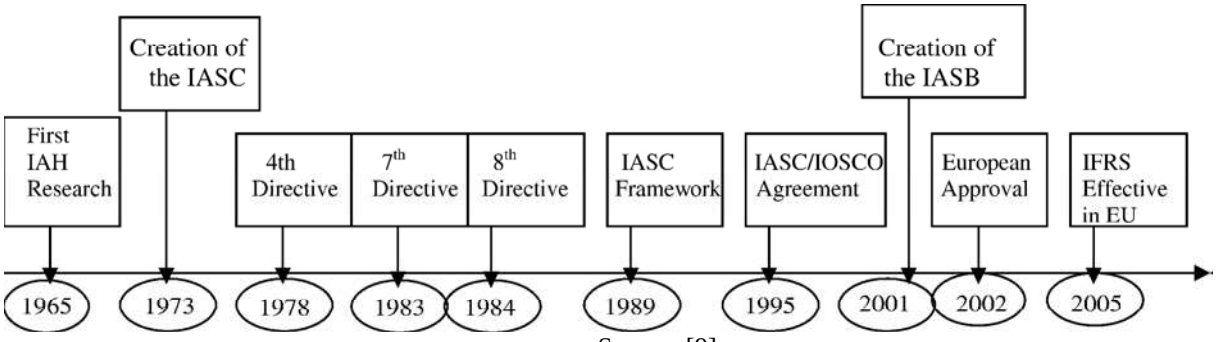
The great wave of globalizing economies and financial markets imposes the necessity of being able to compare financial statements belonging to companies all over the world. Both creditors and large investors need to understand and be able to compare companies' financial position and performance regardless of the elements that differentiate them. The intensity of these needs imposed the manifestation of a process taking place at international level and having the purpose of reaching certain equilibrium between stakeholders. The process has been called harmonization in research literature, recently shifting towards the term convergence. Still, some consider there are significant differences between the two concepts, harmonization referring to efforts being mainly made by one of the involved parties (therefore speaking about national accounting systems' harmonization with some international referential), while convergence requires efforts being made by both involved parties (therefore speaking about big players of the international arena such as the IASB and the FASB and their convergence project).

Summing up, we can say that nowadays, at international level, accounting is being confronted with an extremely complex and intense process of harmonization that was actually determined by the current context of economic and financial international connections being comprised within the globalization process. Accounting is nowadays expected to respond to the changes taking place in business models of a global economy and to ensure the proper information for investors, creditors and other shareholders. In this regard, rules and regulations are desired to be issued so that they could be applied at international level. The normalization process and the institutions being involved in it therefore also represent significant factors in the process of international accounting harmonization.

Research literature presents international harmonization of financial accounting standards as being the goal of many professional and academic accountants for many years, while progress being slow in achieving this goal [9]. All the above discussed elements of accounting diversity have proven to represent impediments to the creation of a uniform set of accounting standards for financial reporting purposes on a worldwide basis. A significant phase in the process of international accounting harmonization is considered to have started from January 1, 2005, due to all companies domiciled in the European Union (EU) with shares listed on securities exchanges having to prepare their consolidated accounts in accordance with International Financial Reporting Standards (IFRS) issued by the IASB [9].

[117] analyzes the spread of IFRS adoption, underlining the fact that the IASB has been put in a central position of responsibility vis-à-vis companies and market participants all around the world, while also considering the adoption's economic impact and significance as a frontier experiment in private-sector led global governance of a key policy area. [117] further calls the spread of IFRS adoption as a Global Accounting Experiment and warns that its success or failure will for sure have implications that go beyond the sole area of accounting. Besides the expected reduction of the cost of capital that should result from the harmonization of standards, [117] also addresses the nature of rules-setting institutions and the relationship between the US and the EU. Important events in international harmonization previous to the Global Accounting Experiment are well summarized within [9] figure as follows:

***Figure 5.*** Timeline of important events in international accounting harmonization




Source: [9]

[117] presents the ascent of the IASB as a non-governmental standard-setting institution, whose decisions directly impact the way business is conducted throughout the world as representing a true revolution in the governance of the world economy (Jean Pisani-Ferry in [117]). This when looked at the nature of rules-setting institutions and old times exclusively granting the power of setting rules to national governments and financial institutions. The fact is that significant changes are taking place in terms of global economic governance. Furthermore, EU's decision to endorse an outside standard instead of attempting to create one of its own also significantly impacted upon the international arena by stimulating similar responses by other governments and the spread of IFRSs.

[105] addresses the introduction of IFRS changing the roles of domestic standard setters, underlining that change did not involve lessening. He considers the case of the domestic standard setters in countries that have adopted IFRS, or are intending to do so, naturally wondering about what their role will be in the future. His conclusion is that after a grieving period, they are now coming to realize that they have fundamental roles supporting international standard setters and ongoing roles in the public and not-for-profit sectors. While the IASB focuses on for-profit reporting and the International Public Sector Standards Board (IPSASB) is a developing standard setter in the public sector, [105] considers that domestic standard setters can help fill the gaps, support the development of the international standard setters and assist at the coalface when standards are applied.

An interesting study in research literature is that of [123] who developed an analysis concerning the factors that could explain the adoption of international accounting standards by developing countries. They documents that developing countries with the highest literacy rates, that have capital markets, and that have an Anglo-American culture are the most likely to adopt international accounting standards. Besides adopting IFRSs there is also the major issue of constituents' participation in the IASB's due process. [66] address this issue in terms of representation (constituents' diversity and characteristics) and drivers to participate. Their analysis of comment letters sent directly to the IASB over the period 2002–2006 documents that preparers sent most letters followed by the accounting profession and standard setters. With reference to European constituents, [66] find that they infrequently use formal indirect participation in the IASB's due process by submitting comment letters to the European Financial Reporting Advisory Group (EFRAG), comment letters that are also being used in the exact same form in case constituents exert influence to both IASB and EFRAG. In terms of incentives to participate, results differ depending on the category of constituents being analyzed. [66] document that preparers, accountants and standard setters react significantly more when proposals have a major impact on the accounting numbers of a company, while users, stock exchanges and their supervisory authorities write significantly more comment letters when disclosure issues are at stake.

While still remaining in the area of accounting regulations, besides international accounting harmonization issues we previously also mentioned the idea of accounting convergence. This leads us to discussing the particular relation between the two big players in the international accounting arena, namely the IASB and the

FASB. As previously mentioned, historical developments have lead to extending the use of IFRSs, even the US Securities and Exchange Commission (SEC) considering to mandate that publicly listed U.S. companies prepare and file financial reports in accordance with IFRSs. [49, 50] develop an extensive analysis of the economic and policy factors related to such a potential decision. Therefore [49] develop the conceptual framework for their analysis of potential costs and benefits from IFRS adoption in the US. Their conclusion is that the decision to adopt IFRS mainly involves a cost-benefit trade-off between

- recurring, albeit modest, comparability benefits for investors;
- recurring future cost savings that will largely accrue to multinational companies; and
- one-time transition costs borne by all firms and the U.S. economy as a whole, including those from adjustments to US institutions [49].

Meanwhile [50] develop their previous analysis to related policy and political issues, present several scenarios for the future evolution of US accounting standards, and outline opportunities for future research on US and global accounting standards and regulation. Based on the developed economic framework of [49] and on the insights of their analysis, [50] outline several possible ways of how U.S. accounting standards could evolve, their scenarios including the following: maintaining U.S. GAAP, letting firms decide whether and when to adopt IFRS, mandating full compliance with IFRS within a pre-specified schedule, or creating a competing U.S. GAAP-based set of accounting standards that could serve as a global alternative to IFRS.

## 2.2 Accounting standards for financial securities: from the first carve out to recent crisis circumstances

We were previously discussing how EU's adoption of IFRSs significantly impacted international accounting. On one hand the decision could have been interpreted as a sign of weakness since the EU chose not to set its own rules, while on the other the decision actually put EU in a leadership position. It was this leadership position that allowed the EU to interfere with the standard setting process, as it will be further discussed in the context of reporting for financial instruments and fair value accounting. This emphasizes the relationship between the US and the EU since in order to become global, rules – whoever has drafted them – need to benefit from a degree of US and EU consent so they have a high probability of being accepted by others (Jean Pisani-Ferry in [117]). An interesting aspect is also that being observed by the previous Irish EU Internal Market Commissioner, Charlie McCreevy, considering that accounting and auditing are the precursors of the deepened EU-US cooperation [84, 117].

The EU adopting IFRSs for consolidated financial statements of listed companies, through the so-called EU IAS Regulation (1606/2002) represented a significant step forward in IASB's fight for supremacy in the international accounting arena [110]. What we must not forget is that it did not come without any costs but with the IAS 39 carve out, which resulted as an answer to French banks' well-known opposition to carrying financial instruments at fair value. Furthermore the danger in making such a compromise for IASB was translated through threats of carves outs elsewhere. Another significant decision was that of the US SEC in September 2007, recognizing IFRS as equivalent to US GAAP for the purposes of foreign companies listed in the US. Once again the important detail making any compromise or carve outs being accepted by IASB dangerous was that the US SEC specified the recognition only applied to IFRS as issued by the IASB.

Bottom line, all these fights for supremacy actually deal with the power to enforce the use of certain accounting regulations. It is the lack of power to enforce the use of its accounting standards that also prevented the IASB from promoting international accounting harmonization to the desired level. And if this wasn't enough, the recent credit crunch has undermined confidence in the competence of accounting standard setters worldwide [118] due to the inability of financial reports to reflect major risk exposures. Clearly, the turbulent times of 2007-2009 impacted upon the developments in the field of international accounting harmonization. The entire process is being rethought even by its proponents who are nowadays reflecting at the most appropriate pace that should be considered for such a process and also at ways of improving the necessary corresponding global governance structures [118]. Meanwhile, the new SEC chairperson, Mary Schapiro declared she thought a

single set of global standards would be a very beneficial thing; she meanwhile expressed doubts about the independence of IASB and declared she would not necessarily be bound by the proposed roadmap (World Accounting Report, February 2009 quoted by [6]). The regulatory competition and the worldwide globalization project were therefore for sure influenced by the circumstances and outcomes of the credit crunch [19].

As Jean Pisani-Ferry (in [117]), director at Bruegel Brussels, was noting, accounting was for long regarded as a mere technicality by everybody but accountants. Furthermore, he considers that even after the corporate scandals of the early 2000s, and since the controversies about financial reporting standards have been drawing attention to its intricacies, it remains an improbable topic for economic analysis. It was the recent financial crisis that brought financial reporting into the spotlight even though if with the purpose of finding a scapegoat as we will further discuss within the next part of this chapter when approaching fair value accounting.

As previously mentioned, it was financial instruments and their measurement at fair value that brought the first and until nowadays unique IFRS carve out, namely the IAS 39 carves out. The carving out actually represented the compromise of a long dispute over a debate starting as an EU initiative. Among other consequences of the recent financial crisis, we must also mention fair value for financial instruments related issues once again creating the premises for standard setting bodies' credibility, more precisely IASB's credibility to be affected. [110] analyze the underpinnings of the October 2009 amendment to IAS 39 that nearly brought another carve out for IASB. The banking industry was once again leading the European initiative relying on the EU IAS Regulation including a requirement that IFRS endorsed by EU must not disadvantage European companies when compared with those in other major markets. While IAS 39 included a key anti-abuse requirement based on which entities had to determine at inception into which category the asset fell, and were not subsequently able to re-classify it, an old US standard was found not to require property mortgages to be held at fair value and SFAS 133 to allow available for sale financial instruments to be re-classified under rare circumstance. This offered French banks the argument for a level playing field so that they wouldn't be disadvantaged in comparison with American banks and for another potential carve out. A compromise was once again found, this time in the shape of an amendment to IAS 39 allowing certain re-classifications.

The IASB considered it essential to avoid a second European carve out which was considered to have had the ability to lead to the demise of the worldwide globalization project [6]. Finally the IASB had to choose between two evils trying to go for the smaller one. But as [110] underline, while the chosen compromise helped control for the risk of taking away all safeguards on manipulating the categories of financial instruments, IASB's image and credibility were affected and furthermore, based on its role within the accounting harmonization process, so was the worldwide globalization process.

Of course that the accounting standard setting process is not a simple one even when considering a general approach that does not involve extremely challenging areas such as financial securities. The manner of approaching accounting regulation can be framed within a large range of attitudes starting with the vision of the free market and ending with the other extreme of excessive regulations that could to some extant be linked to rule based regulations. The fundamental assumption underlying the free market perspective when it comes to accounting regulations assumes that accounting information must be treated as any other goods, and that the forces of demand and offer should be left to act so that they generate the optimal offer of information regarding the entity [34]. In other words, those arguing for reducing the role of regulations consider that when someone wants a certain information regarding the entity it should be prepared and willing to pay for that information, therefore the demand and offer being able to produce the informational optimal point.

Still, where we consider the optic changes is when accounting information is included in the category of public goods. Accounting information can be included in this category, once it became available people being able to use it and even transmit it further without having to bear the costs that are associated to its obtaining. Approaching the particular case of accounting information, [36] assessed the following:

> Unlike pretzels and motor vehicles, information must not be necessarily destroyed or not even altered through one individual's particular consumption. This characteristic can create failures

> of the market. More precisely, if those who do not pay in order to benefit from this information cannot be excluded from using it, and still the information is valuable for them, the consequence consists in the fact that the information represents a public good. In other words, under such circumstances, producing information by some individuals or entities will make it that the produced information will become accessible to everybody without any cost. Therefore, the necessity of a more collective approach of the information generating process is implied.

Further arguments of those considering that public goods offer should not be regulated are developed based on the idea that since users must not bear the costs they might exaggerate when it comes to their real needs. An example in this regard is financial analysts who almost always argue for more disclosure, therefore creating the premises for situations when benefits of certain information are no longer correlated with the costs being involved when obtaining that information, costs only affecting the reporting entities. Therefore, besides being prudent, there is also the risk of having different lobby activities lead to an overload of accounting standards that implicitly creates unnecessary costs for the reporting entities when it comes to implementation.

On the other hand, not having accounting regulations will most probably lead to presenting insufficient information for the public, reporting entities being tented to reduce costs related to producing accounting information and disclosure. This makes an extremely difficult job for accounting standard setting bodies to find the equilibrium when it comes to the market of accounting information. The concept of level playing field is being used in order to justify the implementation of regulations, from an accounting perspective meaning that everybody should have access to the same information based on the principle of correctness. Implementing regulations that require for detailed disclosure would generate an increase of the users' trust regarding to their belonging to this level playing field [34], therefore stimulating trust within capital markets and corresponding to the definition of representing the public interest.

[97] considered that the theory of public interest makes it that any regulation to be issued as a response to the public's demand in order to correct some inefficient or unfair practices in the market. This would mean that regulations are being implemented for the benefit of the society as a whole rather than for particular interests, and that regulatory bodies should also represent the interests of their society and not their own[3] [34]. Moreover, the regulation process is considered to have the role of balancing regulations' social costs and benefits. By transposing this principle in the field of financial reporting and within the context of the capitalist economy, the society needs to be assured that capital markets efficiently direct resources towards productive assets, while accounting regulations represent a tool for building this trust. This trust was for sure significantly altered through the recent financial crisis; people asking themselves how could it happened that such risks were accumulated without any signals being sent through accounting disclosure? Standard setting bodies' activity is nowadays even more difficult due to the fact that besides confronting the usual difficulties in financial reporting they also need to work on rebuilding the trust they lost from the public.

There is also the approach being based on the economic theory of self-interest which consider that regulatory bodies will implement those regulations that better suit their own interest (taking different forms such as ensuring their reelection) and that people will pled for law implementation only when this brings them personal benefits. This actually represents the vision belonging to the theory of private groups' interest and takes us back to the cases of lobby which we have previously documented as interfering with the accounting regulation process.

We conclude our discussion of the accounting standards setting process by underlining the fact that the greater is the stake, the greater are the interests of all involved parties. Therefore, beyond optimistic views upon well grounded objectives such as offering information that is useful for the decision making process, history

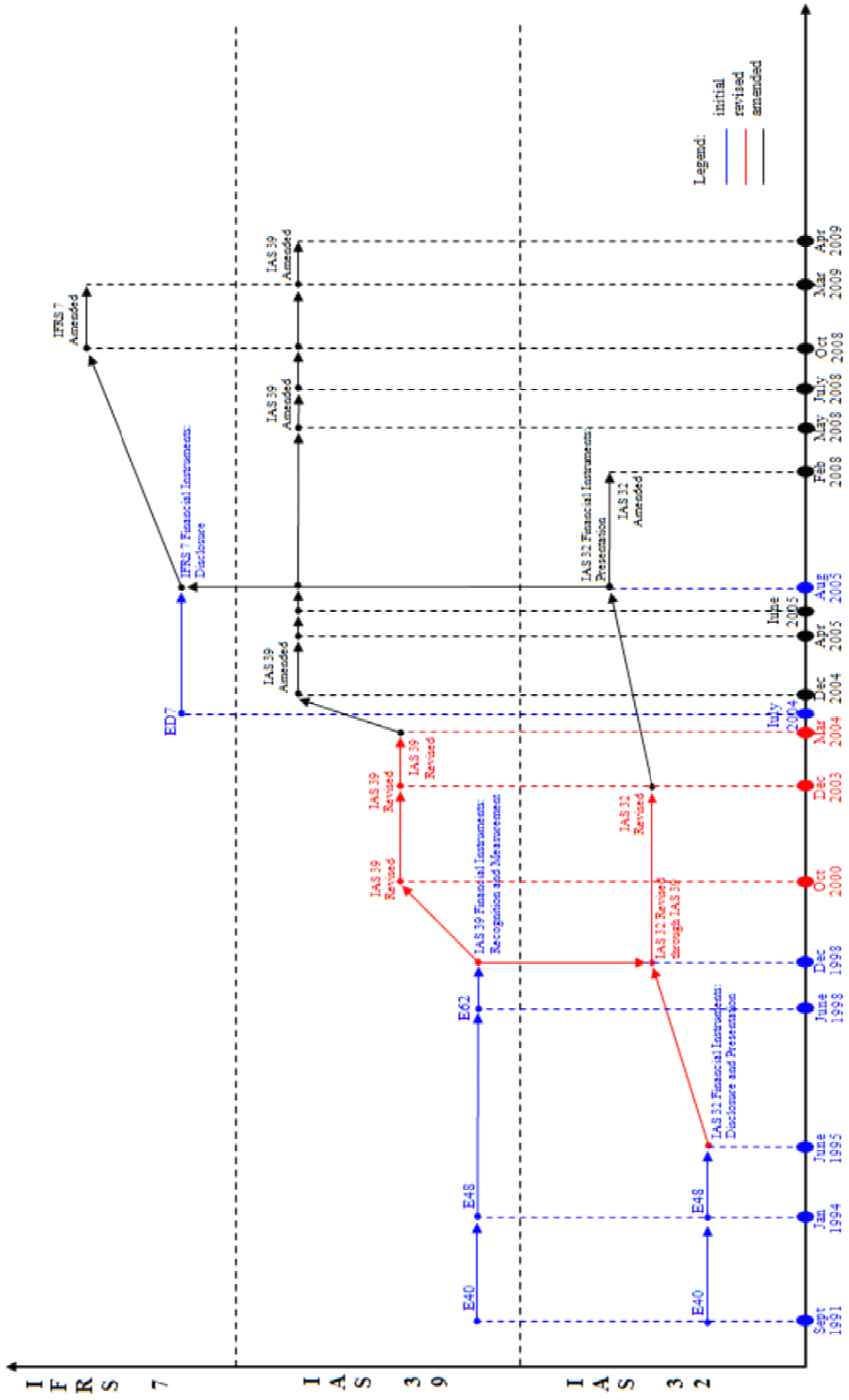
[3] This vision is of course not accepted by the proponents of the *economic rational human being* who argue that all activities, including those of regulatory bodies and politicians, are firstly motivated by the desire to maximize their personal wealth beyond any notion of public interest.

documents a continuous and incontrollable tendency of manipulating the accounting information in order to serve certain interests. This only makes the regulatory process even more difficult in an area that is complex already due to the very economic grounding of transactions taking place within capital markets. [82] develop an analysis on the accounting regulation process by considering the field of financial instruments, documenting difficulties constantly being raised from practice and often determining the international accounting referential to move away from the declared principle based approach towards rules that made the standards extremely complex, difficult to apply and also controversial.

In order to catch the dynamic of the approached field and the complexity of the corresponding accounting regulations, [82] graphically represent those moments that imposed significant amendments of the international accounting referential therefore mirroring the difficult task of establishing financial reporting standards for financial instruments[4] as follows:

[4] Their figure only included developments taking place until April 2009.

***Figure 6.*** Evolutions of the international accounting referential in the field of financial instruments




Source: [82]

## 2.3 Back to international accounting harmonization research

We have up until this point focused on accounting regulations which we approached through the perspective of the worldwide globalization project. Our approach also enhanced the importance financial securities play in

terms of financial reporting and accounting regulations. Besides representing a difficult field to be issuing standards for, it was documented to also be offering the necessary tools for political lobby. Still, coming back to our incursion to the field of international accounting harmonization we must mention that besides the previously approached aspect of accounting regulations leading to formal harmonization there are also other forms of accounting harmonization. Therefore formal accounting harmonization or de jure accounting harmonization can be defined as aiming the reduction of dissimilar treatments for a particular item between two different regulations (such as national accounting regulations and international accounting regulations).

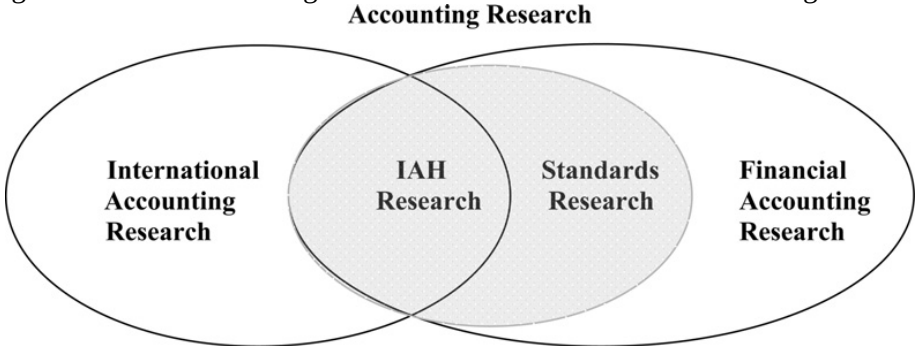
The purpose of accounting regulations is to guide accounting practices and the final objective of the international accounting harmonization process is to reach harmonized accounting practices. This actually represents material accounting harmonization or de facto accounting harmonization aiming to increase the compatibility degree between accounting regulations and accounting practices. Considering the definitions of formal and material accounting harmonization we might say that it would be normal for formal accounting harmonization to generate material harmonization. Still, this is not always the case due to the fact that when accounting regulations allow many options, even though harmonized between themselves, they might lead to companies applying those regulations presenting differentiated accounting practices. On the other hand, material harmonization can appear even without an increase in formal harmonization, in this case taking the shape of the so-called spontaneous accounting harmonization [27].

The complexity of the process of international accounting harmonization was also captured within accounting research literature. [9] offer a fair reflection of international accounting harmonization research by reviewing articles published in major English language accounting journals during the period from 1965 through 2004. In doing so, they also address the definition of international accounting research within research literature in order to further position international accounting harmonization research. An interesting definition is that formulated by [9, 119], considering that international accounting research is concerned with…

> … accounting phenomena in one country with lessons or repercussions extending to other countries…accounting phenomena related to multinational enterprises… global movements to shape the direction of accounting…and comparative accounting requirements and practices.

[9] further assess that international accounting harmonization research as a part of international accounting research that actually contributed to its increase in volume and rigor. Besides being a subset of international accounting research, international accounting harmonization is also a subset of financial accounting research within the overall discipline of accounting as reflected through the following figure:

***Figure 7.*** Situating international accounting harmonization research within accounting research




Source: [9]

An important aspect being documented by [9] is that the various themes in international accounting harmonization research have been influenced by increasing levels of globalization, leading to demands for greater harmonization of financial accounting standards on an international basis, and by a growing interest in accounting practices in countries outside the United States, particularly on the part of capital markets researchers. Furthermore it was found that key historical developments such as the creation of the IASB (more

precisely of its predecessor, the International Accounting Standards Committee) and the Accounting Directives of the European Union also tend to affect researchers' interests and the themes that attract their interest.

In terms of international accounting harmonization studies focusing on financial instruments we must mention [77] studying the determinants of the disclosure level in the accounting for financial instruments of Portuguese listed companies by using an index of disclosure based on IAS 32 and IAS 39 requirements. Their study was not able to document any significant influence of corporate governance structure or of financing structure, concluding that the disclosure degree is significantly related to size, type of auditor, listing status and economic sector. As many of the international accounting harmonization studies, [77] offer useful insights for regulatory bodies, suggesting areas for intervention of the Portuguese capital markets regulator based on analyzing Portuguese companies' reporting practices.

[90] analyze the level of harmonization between IAS 39 and the financial reporting practice of a broad-based sample of European-listed companies in 2005. Another aspect being followed is the association between different levels of harmonization and company-specific factors. Their findings documented that the level of compliance was not affected by institutional factors or company factors as predicted, but did show a high level of compliance of financial instrument measurement practices with IAS 39, for the first year of mandatory adoption.

[21] develop a parallel analysis on the Romanian and Czech accounting regulations by focusing on accounting for financial instruments. Formal harmonization measurement is also performed both between the two considered national accounting regulations and with reference with IFRS. The obtained results documents a high level of similarities between the two national set of GAAPs and IFRS, and also among the two of them, still both of them being closer to the international referential than to each other.

Based on our review of international accounting harmonization research it becomes obvious for us that reporting for financial securities was impacted by all the above discussed historical developments and by increasing levels of globalization as much as any other area in financial reporting. Perhaps it would be even fair to say that being a controversial area of financial reporting makes the international harmonization of reporting for financial securities an even more complex process to develop, analyze, assess and research. The following chapters of the book will focus on analyzing aspects related to reporting for financial securities at international level, as they have come to be developed until nowadays, therefore bringing our analysis to current times.

We cannot conclude this section approaching international accounting research without mentioning the fact that financial instruments mainly attracted researchers’ interest in relation to measurement issues that are going to be further discussed.

# 3 Perspectives on Accounting Measurements

Grounding the necessary perspectives on accounting measurements requires a general introduction to accounting measurement, followed by pointing main conceptual debates in terms of accounting models, and finally completed by a detailed analysis of fair value developments.

## 3.1 Introductory thoughts on accounting measurements

Despite the fact that in order to reach the true and fair view in financial reporting both quantitative and qualitative information is required, we consider the importance of the concept of value to be incontestable. The more obvious the meaning of the concept tends to let the impression it is, the more complex it usually proves to be. On the other hand we could actually even discuss the value being attributed through qualitative information disclosure. While we all agree that *beauty lies in the eyes of the beholder*, we wonder if this is not also the case when discussing accounting measurements, value receiving shades depending on the one assessing it? [46]. Furthermore we consider that any type of value has no meaning until it is being defined. Trade literature

considers the different definitions together with any corresponding supplementary information (such as application terms, measurement guidance etc.) to be forming the standards of value.

From an extremely pragmatic point of view, the measurement process can be looked at as being nothing more than finding the answer to the question: *What is the value?* [46]. Before starting the quest for this answer we must first define value and that should start with identifying the standard of value, or in other words the type of value that proves itself to be necessary under the considered circumstances. Each standard of value comprises a series of assumptions that actually represent the essence of the type of value being used under certain circumstances. Furthermore, once chosen the standard of value, there is no guarantee that it will also benefit of unanimous approval upon its assumptions.

The most often used standards of value are fair market value and the fair value. A linguistic analysis of the two concepts indicate the fact that fair value can be seen as a larger concept, making reference to a *value* that is *fair – correct*. The term *fair – correct* leaves for considerable freedom in terms of professional judgment being used in the decision making process. For example an asset's fair value can be represented through its market value, its replacement value or even a liquidation value. The concept of fair market value is narrower due to the use of the word market. Moving forward to the concept's linguistic construction, we must ask ourselves if the word market is directly linked to the adjective fair (as in fair market) or in fact with the noun value (as in market value). We are actually forced into determining the value which we would receive on the market for a certain asset in the context of a real or hypothetical sale. We must conclude by mentioning the fact that fair market value represents the fundament for all judicial concepts of value, while fair value is defined in terms of financial reporting.

References to the standards of value appear even since the beginning of the 19th century, without yet having their definition developed. During the second part of the 20th century the development of railways permitted the expansion of trade, favoring corporations and therefore generating the necessity of finding a solution in order to evaluate properties for tax purposes, but also to fairly settle disagreements that naturally appeared between shareholders. At the beginning of the 20th century, courts, states and other regulatory bodies have started to be more and more confronted with litigations that involved business valuations. Terms such as *willing buyer* and *willing seller* or *knowable* have already been established as representing elements that had to be considered in determining fair market values even back in 1920. Things changed even more during the last half of the 20th century, the most valuable assets of an entity often being intangibles and not intangibles. Implicitly, the evaluation process also had to evolve in order to keep pace with the new type of assets that required a more complex measurement approach. The need for judicial evaluations also increased due to the large number of disputes that arose with reference to intangibles.

After this brief pleading for *value* we will further analyze the shift in accounting paradigms that lead us from the historical cost model towards the fair value model.

## 3.2 Balance sheet based measurements versus income statement based measurements[5] or the fair value principle versus the historical cost principle

The shift towards fair value measurements in financial reporting took place due to the paradigm of fair value being embraced by the big players in the arena of standard setting bodies (the IASB and the FASB). At the origins of this change in paradigms we find the shortcomings of the financial reporting model being used, the income-expense approach or the income statement approach proving to fail in several aspects. This approach is largely debated by [95]. The shortcomings of this approach started to be identified by the IASB since the beginning of the 80's and led to a general revising of the accounting model. As a consequence, the orientation towards fair value accounting must be integrated within a much more general evolution that is the adoption of the asset-liability approach or the balance sheet based approach.

[5] In accordance to recent foresights of the international referential, statement of financial position and statement of comprehensive income.

The main quality of the balance sheet based approach relies on defining the result based on changes being recorded in assets and debts and not based on the vague concept of nondistortion [17], which was being seen more as a pretext for arbitrary definitions that were given to balance sheet positions. Furthermore, researchers and regulatory bodies were feeling uncomfortable due to a balance sheet having no informative purpose of its own [54], the perception thus was that under a revenue–expense approach, the balance sheet merely served as *mausoleum for the unwanted costs that the double-entry system throws up as regrettable by-products* [13]. As a consequence, the FASB adopted Statement of Financial Accounting Concepts (SFAC) No.3 in 1980 and five years later SFAC No.6. It was these documents that implemented economic based definitions for assets and liabilities, referring to future economic benefits and outflows of those benefits, respectively, and links income strictly to changes in net assets.

Over the years there have been significant debates over the necessity of using measurements that are based on current values rather than on the historical cost, all within the asset-liability approach, even leading to serious controversies within the American accounting standard setter [89]. There is no doubt that this approach enhanced the balance sheet's role as source of useful information for the decision making process, therefore building the conceptual grounding required for the initiation of the fair value paradigm, the latter being stimulated by specific issues arising in the area of accounting for financial instruments.

[101] analyzes fair value in the context of the two fundamental objectives of financial statements as proposed through the joint IASB-FASB conceptual framework project. More precisely he refers to the informational purpose of assisting investors (in their quality of owners of available capital) in forecasting, measuring and comparing values, synchronizing and uncertainty of future cash-flows, but also to the stewardship function by facilitating the assessment of managers' efficiency and efficacy in creating value for the shareholders. The shift towards fair value measurements reflects the belief that one of the main objectives of financial statements, deriving from the two objectives being discussed above, is that of measuring assets and liabilities within the balance sheet. The income statement would therefore have to reflect chances in the value of assets and liabilities for the reporting period.

Reformulating the accounting model of value involves a reconsideration of the fundamental principles of re-evaluation. Accounting is evolving from the financial reporting system being based on the principle of the historical cost towards that of fair value. The first places the income statement in a central position by having it accumulating the history of transactions between the entity and its acquisition and selling markets on one hand, and the added value resulting based on these transactions (the obtained result) on the other. In this case, recording transactions and accumulating/increasing future input and output flows leads to increases of assets and liabilities within the balance sheet. Furthermore, measuring these assets and liabilities represents a secondary outcome of the realization principle[6] and the principle of linking expenses with incomes.

On the other hand, fair value measurements see the result as the secondary outcome, considering that value is being reflected through the balance sheet. Since gains are only reflected as changes in the assets' value, they do not foresee future changes in value supposing that the value will have a random evolution. Meanwhile, recording changes in value over time can provide information regarding future business risk due to the fact that it allows for the calculation of the volatility of profits being generated.

While in the case of the principle for recognizing incomes value is usually obtained by multiplying gains with a multiple[7], when referring to the concept of fair value, value is given by the net assets' fair value. Critics of the

[6] An income or profit only being recognized when the entity develops an operation with a third party, offers a service or sells a good.

[7] The price to earnings ratio being the most used method for assessing how valuable the shares of an entity are. It shows the premium capital markets place on the shares of entities recording fast developments in comparison with entities recording low growth rates.

historical cost argue that this represents an ex-post approach. But when expenses and incomes are correspondingly connected the system is characterized as being ex-ante.

Historical cost accounting has the purpose to reflect the value being added as a result of purchasing resources, transforming them and selling the resulting elements at a price that is higher than the value being spent for their obtaining. As a consequence, even though it does not report the value of the business, it facilitates its estimation due to the fact that, usually, current profit rates offer an image on future profit rates.

[101] states that between the two considered approaches (the one based on the balance sheet and the one based on the income statement), the one that best satisfies the objectives of financial statements should be chosen. Due to the fact that the two approaches have significantly different characteristics we might even ask ourselves if it wouldn't be possible for them to coexist. This would mean having fair value balance sheets and income statements that are filled based on the realization principle. The main issue therefore being raised would be that we would have to eliminate the connection between the income statement and the balance sheet and this might be too much of a change considering the connection's place within our accounting culture. That is why accounting research literature presents the two approaches as excluding each other. Comparing the two approaches is also difficult due to the fact that we can only imagine them as perfectly implemented. Imagining such a situation would bring us the balance sheet approach offering the *precise value* of the entity and the income statement approach offering a result which multiplied with the price to earnings ratio would lead towards the same precise value. The choice would therefore not be important anymore since we would benefit from the same information. But, coming back to reality the idea is to compare two imperfect systems in order to determine the information they provide and further decide what maximizes the informational volume required in order to satisfy the objectives of informativeness and stewardship.

We conclude by saying that fair value accounting for financial instruments mainly involves accounting issues arising within capital markets that are exposed to volatility of securities' prices and interest rates [63]. What accounting measurement should always follow, even though it is often quite difficult, is the pattern of prices' changes and the economic fundament. As discussed above, the most controversial aspects are related to the manner of determining net assets' value (equity) and the result's value.

## 3.3 Fair value developments and the recent financial crisis

In terms of regulatory actions concerning fair value measurement, the FASB was the first to make the step of issuing SFAS 157 - Fair Value Measurement in the autumn of 2006 [131]. [20] describe two essential motivations that determined the FASB to draw up a standard that would represent a procedural guide, which would be used for estimating fair value, and which could be applied to a wide range of financial and non-financial assets [24]. On one hand, the set of accounting standards available around 2004 did not include a unique source of general guidance, valid in the attempt of defining and estimating fair value. The guidance that concerned fair value could be found mainly in a series of intersected and "patched" accounting standards, which referred to financial instruments. On the other hand, the exiting accounting standards showed an increasing level of the acceptance of fair value as measurement attribute. Assuming that there is a high probability that future standards will include at fair value measurements, the definition of this concept (fair value) as measurement attribute – accompanied by procedural guidance at the highest level, and concerning a consistent estimation of the concept – back then became a priority in the goal of the efficient application of already existing or new standards.

SFAS 157 provides a consistent definition of fair value, outlines several types of valuation techniques that can be used to measure fair value, and requires firms to disclose their valuation inputs (the *fair value hierarchy*), in order to increase consistency and comparability in fair value measurements [93]. In terms of defining fair value, SFAS 157 stipulates that *it represents the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date* (paragraph 5). The focus is therefore placed on the exit price (price that would be received to sell the asset or paid to transfer the liability) and not on the entry price (price that would be paid to acquire the asset or received to assume the

liability). Among other significant contributions of SFAS 157 we must mention that it states three valuation techniques which can be used for estimating fair values and establishes a fair value hierarchy that prioritizes the inputs to valuation techniques that are used to measure fair value.

Meanwhile, the IASB has issued an exposure draft on fair value measurement in June 2010 and is in the process of issuing the corresponding IFRS. Until the issuance of the intended standard we can find the definition of fair value within IAS 39 as *representing the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction* (paragraph 9). Regarding the measurement issues relating to fair value estimation, IAS 39 provides three classifications: active markets for which quoted prices are available, inactive markets for non-equity instruments, and inactive markets for equity instruments.

Fair value measurement was often on the standard setting bodies agenda considering the recent financial crisis' circumstances that brought significant questions in discussion. Most of the issues were related to reviewing best practices in the area of valuation techniques, and to formulating any necessary additional guidance on valuation methods for financial instruments and related disclosures when markets are no longer active, as mentioned on IASB's website.

As documented throughout accounting research literature, recent initiatives by both the IASB and the FASB have increased the use of fair value accounting for financial reporting across many jurisdictions around the world [93]. Still, we may say that the recent financial crisis might have slowed down the pace of implementing the new paradigm due to a series of issues being raised and requiring clarification. Such a significant issue that is also emphasized through accounting research literature and whose importance was enhanced due to current turbulent times relates to having directly linked prudential requirements for equity capital to accounting rules [19]. The most argued implication being underlined by the banking sector was fair value's pro-cyclical effect under crisis circumstances. This only raised other significant questions related to what would be more appropriate to be changed when analyzing the accounting model and the way regulators establish the required level of equity capital. In this regard, research literature signals the necessity of addressing the fundamental inconsistency between accounting measurement and prudential valuation [6].

# Non-Derivatives: First Stage in the Development of Financial Securities

The purpose of this chapter is to synthesize main developments in the field of financial securities while offering a detailed presentation of primary securities, derivatives representing the distinct object of the following chapter. Starting with an approach that focuses on the finance perspective of securities in order to document how they developed as part of the financial innovation process, we further focus on financial reporting related aspects. In order to do so, before discussing how financial reporting captures the reality of securities trading, we start by analyzing the changes that were imposed in the world of accounting through the developments taking place within the financial market. Once the shift in accounting principles discussed, we proceed by analyzing the accounting classification of securities, which by being necessary at the point of recognition is considered to be one of the most problematic issues in accounting for financial instruments. Finally, other details related to reporting for financial instruments in accordance to the International Financial Reporting Standards (IFRS) are presented, once again by focusing on primary securities. Comparisons with the US Generally Accepted Accounting Principles (US GAAP) are made for key elements.

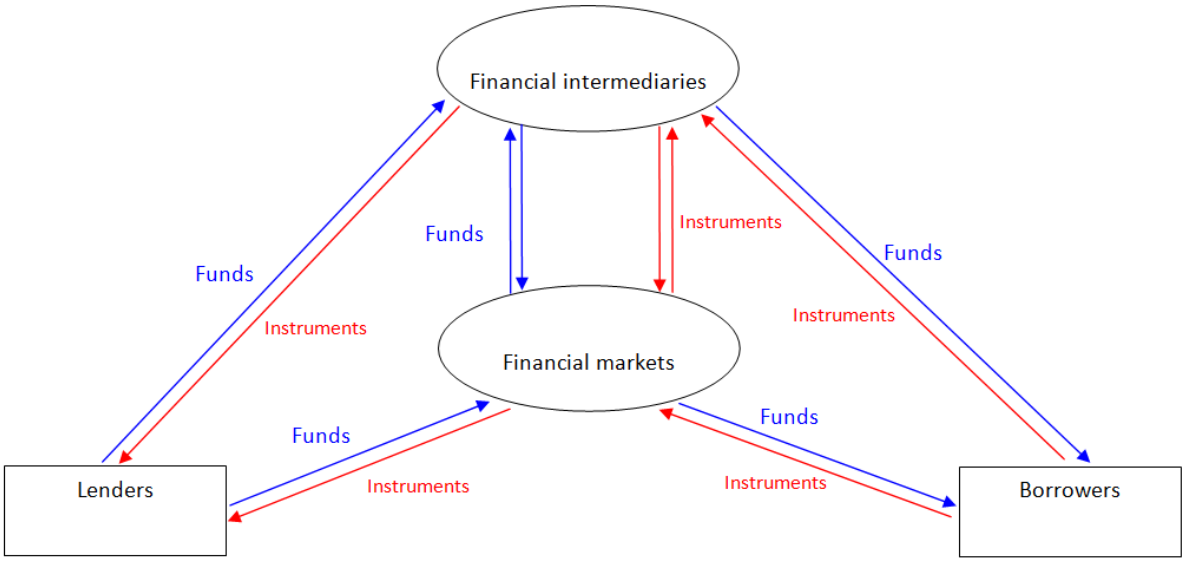
## 1 Financial Innovation Development

As [40] discuss, we can think of a security as a legal contract representing the right to receive future benefits under a stated set of conditions. A financial security can also be defined as a financial instrument that is negotiable and has a recognized financial worth, having the potential to generate some additional return above face value for either the holder of the issuer of the security. We might also say that securities are actually documents, which historically speaking used to have the physical form of a certificate, but are increasingly becoming electronic. Showing that one owns a portion of a publicly-traded company or is owed a portion of a debt issue, securities are tradable. Another way of putting the definition of securities would be that they represent an evidence of an interest in corporate stock or stock rights or an interest in any note, bond, debenture or other evidence of indebtedness issued by a government or corporation. We should also mention the fact that for certain tax purposes national regulatory bodies might offer more limited definitions for securities.

From the issuer's point of view, financial instruments offer the means to attract resources that are temporarily available in the market, while from the investor's point of view they represent a financial investment that assumes rights on future income [8]. One of the first classifications of financial instruments divides securities into non-derivative (or primary) financial instruments, derivative financial instruments and synthetic financial instruments. Therefore, non-derivative financial instruments are those being issued by the ones using the funds, both in order to develop equity and in order to attract borrowed capital. Derivatives are contracts between issuers and beneficiaries, giving the latter certain rights at a future time under terms being established through the contract. Derivatives are one of the results of the financial innovation process, reaching unimaginable dimensions starting with the lat fifteen years of the 20th century [29].Synthetic products are those resulting from the combination of different financial assets in order to therefore create new instruments of financial investment.

We could therefore say that financial securities play a significant role within financial markets. The latter's role within the financial system is to channel funds from those who save and do not have the capacity to ensure a productive use of the therefore saved funds towards those who have own productive investment but do not possess the necessary funds in order to finalize those projects [122]. Simplifying the above presented situation we may say that financial markets transfer funds from those who save towards those who spend on productive capital. This transfer can be done directly or indirectly as seen from the following figure also reflecting the role being played by financial securities:

***Figure 8.*** Funds' circulation within the financial system

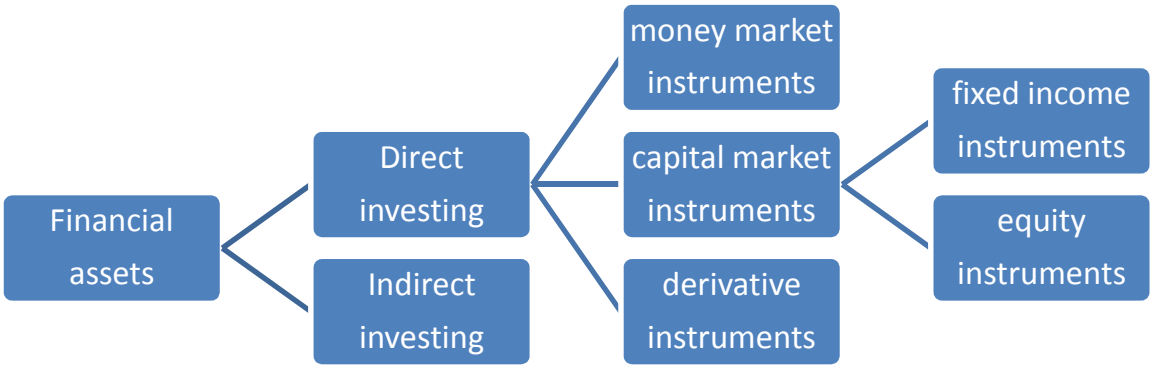



Source: adapted from [122]

We should also emphasize the fact that most of the entities issue non-derivatives financial instruments in the category of shares and bonds, the latter usually in their simpler shape, all known in the world of finance as plain vanilla. Meanwhile, specialized firms further transform these non-derivatives into sophisticated financial instruments through the process of financial engineering that does nothing else but builds and issues new financial instruments based on already existing securities [87]. Despite all the cases being offered throughout history, documenting the negative consequences derivatives' trading can have, including the recent financial crisis, we must not cease in front of the negative connotation instantly and inseparably being associated to financial engineering. Beyond large disasters shocking the audience, those developing complex financial instruments are financial specialists who see financial assets as packages of financial flows that can be divided and rearranged in accordance to the needs and expectations of those acting on the market [87], offering the latter opportunities and corresponding risks. What is also interesting to notice (as seen through trade literature - [87] is that despite derivatives being associated with huge losses (such as the Barings case and the Long Term Capital Management fund), these did not lead to a decrease of the market, but rather to enhancing the development of new products.

It therefore becomes clear that while at their most basic referring to stocks and bonds, securities also sometimes cover the area of derivatives. Even though often being referred as simply securities, they can take on several forms. We should also make the difference between direct and indirect investments, the first referring to investors being able to directly purchase different types of securities, and the latter to them using an intermediary (such as a mutual fund) which bundles together a set of direct investments in order to further sell shares in the portfolio of financial instruments it holds. We will further use [40] classification of marketable financial securities that is also graphically captured within the following figure 9.

***Figure 9.*** Financial instruments: the investors' perspective




Source: [40]

Direct investments are further classified based on the investment's time horizon. Therefore, investments in debt that have a life of less than one year are usually called money market instruments [40] and are further classified in accordance to their issuer which can be a government entity or a private entity. Investments having maturities that exceed one year are generally called capital market instruments and are further divided into debt and equity instruments. Debt instruments can also be issued by either a government entity or a private entity. Another category of investments is that of derivative financial instruments whose name is due to the fact that the reward they bring depends (derives from) the price of one of the above discussed primary financial assets. When considering financial instruments' structure, they can also be grouped into two main categories of securities [8], namely variable income securities (such as shares) and fixed income securities (such as bonds).

Another manner of classifying financial instruments is by looking at the way they are being traded. Trading therefore can be done within organized markets or within Over the Counter (OTC) markets, both offering different advantages and disadvantages as it can be seen from the following table [114]:

- organized markets – standardized contracts
  - advantages
    - liquidity
    - quotations availability
    - increased level of the possibility to clear the position
  - disadvantages
    - impossibility to perfect hedge the risks associated with the owned instruments due to standardization
- over-the-counter (OTC) markets
  - advantages
    - the possibility to develop personalized structures in accordance to personal needs
  - disadvantages
    - difficult to liquidate
    - lack of quotations imposes the use of valuation techniques

Primary financial instruments are less debated within accounting research literature due to the fact that their structure is less complicated than that of derivatives. Therefore, shares, generally called variable-income securities, exist in order to allow companies in need of long term financing to sell parts of the company – equity shares in exchange for money [8]. Common stock (equity) represents an ownership claim on the earnings and assets of a corporation. Once the holders of debt claims are paid, the company's management can either pay out the remaining earnings to stockholders in the form of dividends or reinvest part of all the earnings in the business [40]. Among the features of common stock we must mention the involved limited liability, in case of a company going bankrupt the holder of common stocks only being exposed to losing the original investment in

the stock. Theoretically speaking, due to the residual nature of its claims to earnings and assets, common stock as a class is considered to represent risky securities, but as [40] also emphasize, in certain circumstances common stock can be less risky than some high-risk debt issues.

Bonds represent financial securities that have a determined life and generate cash flow that is influenced by the coupon and the reimbursement value. Coupons can be paid at equal intervals of time, at a certain fixed interval or all at once. The bond can be issued with issue premium (that is granted at the beginning and equals the difference between the nominal value and the issue price) or with reimbursement premium (that is granted one paying parts of the loan), taking several shapes [8]. In the case of classic bonds the coupon and the reimbursement price are fixed, known with certainty at the issuance date, while for indexed bonds the issuing entity's commitments vary in accordance to an indicator being chosen as reference. Participative bonds offer the right to a fixed installment and are reimbursed at a minimum determined price, together with a premium that is granted in accordance to the importance of the issuing entity's evolution of financial results. An innovative form of bonds is that offering the holder the possibility to transform the receivable right of the loan into a property right through convertible bonds which can be transformed in shares of the issuing company. Warrant bonds can also be placed in this area since they carry a permanent right to subscribe for a number of bonds or shares by using a determined price over a determined period. In other words we could say that fixed income securities differ from each other in promised return because of differences which include the maturity of bonds, the issuer's creditworthiness and taxable status of the bond [40].

Coming back to [40], the categories of securities being presented in their classification are further detailed. Money market securities, being short-term debt instruments sold by governments, financial institutions and corporations, have maturities when issued of one year or less. [40] comprise the following within the category of major money market instruments:

- treasury bills,
- repurchase agreements (repos or RPs),
- LIBOR,
- negotiable certificate of deposit (CDs),
- bankers acceptances,
- commercial paper,
- Eurodollars.

[40] also present some details concerning capital market securities which we will further use. Including instruments with maturities greater than one year and those with no designated maturity at all, capital market securities are usually divided according to weather the instruments contain a promised set of cash flows over time, or offer participation in the future profitability of a company, the first sector being referred as the Fixed Income Market and the latter the Equity Market. This actually corresponds to our previous classification of fixed-income securities and variable-income securities. Fixed income securities have a specified payment schedule and mainly comprise traditional bonds promising to pay specific amounts at specific times and some other particular types such as the following:

- treasury notes and bonds,
- Federal Agency securities,
- municipal securities,
- corporate bonds.

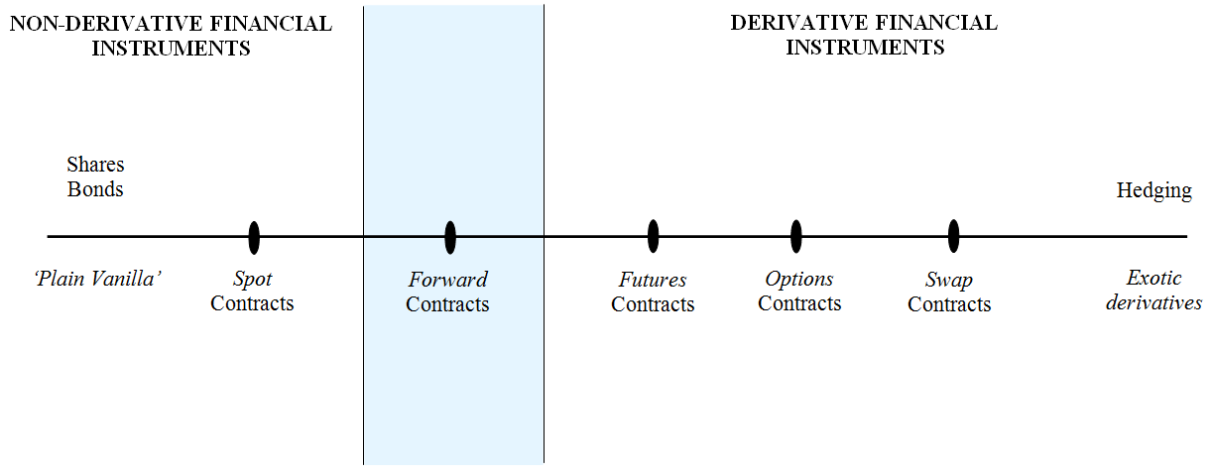
We have so far discussed common stock as representative of variable income securities and bonds as representatives of fixed income securities. On the other hand, preferred stock combines the characteristics of the fixed income market instruments and that of the equity markets. This is also explained by [40] who note that fixed income securities do not always pay the security holder the promised payment because of calls or default, therefore generating variability in cash flows being received by the investor. The term sometimes being used for this category is not-so-fixed income securities, preferred stock and mortgage-backed securities having

great variability in cash flows. This variability in cash flows is expected and variability does not result in the holder's right to force bankruptcy [40].

Preferred stock promise to pay to the holder periodic payments, like coupons, which are rather called dividends than interest, while there is no return of principal because they usually have infinite life. What differentiates them from fixed payments instruments is that failure to pay the promised dividend does not result in bankruptcy, but usually unpaid dividends are cumulated and should be paid off before any common stock dividends. That is why in terms of payment priority preferred stock can be placed somewhere between bonds and common stock. [40] also underline the fact that the infinite life of preferred stock is affected by frequently being callable and the possibility of them being converted into common stock at the discretion of the holder, a combination of callability and convertibility allowing the issuer to force conversion. Mortgage-backed securities also represent securities often being classified as fixed income securities, while not being quite so fixed. By being a share in a pool of mortgages, they offer the holder the right to receive a very uncertain stream of future payments, being dependent on how fast mortgage holders pay off their mortgages. After all, combining the discussed features of securities determine the involved risks and rewards for the holder.

What we must also emphasize with regard to primary financial instruments is that they offer rewards that are based on the issuer's status. An unsatisfied demand with regard to the possibility of obtaining incomes that would not keep the fingerprint of this constraint further developed in the market. It was this demand that led to the development of derivative financial instruments which will be discussed in detail within the following chapter. The following figure captures the gradual sophistication of contracts in the area of financial instruments:

***Figure 10.*** Financial instruments' sophistication



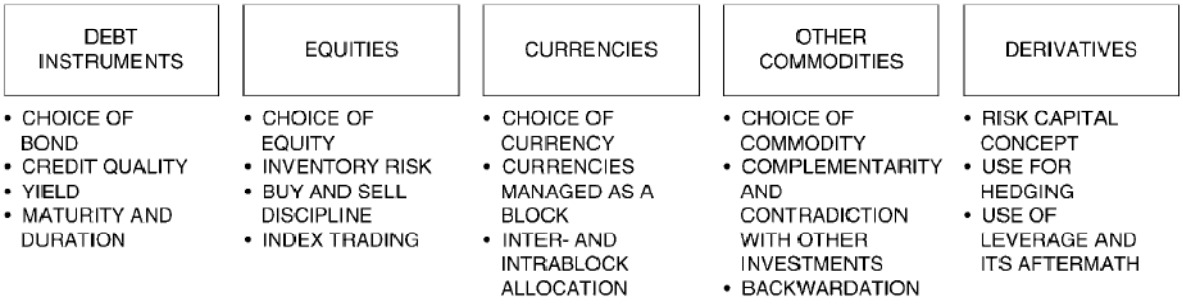

Source: authors' projection

A widely used category of contracts is that of cash contracts belonging to primary financial instruments which can easily be further derived. Cash contracts assume the mandatory delivery of the underlying asset at due time, the involved commitments not being able to be liquidated before this term [87]. Depending on the moment when the delivery is done, these contracts can be spot (with immediate delivery) or forward (with postponed delivery). Forward contracts actually benefit from two approaches within trade literature, some authors including them in the category of derivatives based on their feature to record a price that is closely linked to the price of the underlying asset, while others, more traditional treat it like a cash contract. Spot contracts are classic selling – buying contracts that theoretically happen right after the moment of the signing (this explaining the name), but practically take a very short period of time (from until 00 hours pm to maximum 20 working days, a longer period transforming the contract into a forward one by being close to one month). Forward contracts are also selling – buying contracts but with the parties rights and obligations being suspended until or being valid until a future date from that of signing the contract, date that is agreed by the involved parties or

standardized, in both cases included in the contract. The outcome of such a contract will therefore depend on the value of the underlying asset at due time and on the open long or short position.

[29] also approaches the currently predominant families of financial products and captures the broadening domain of financial instruments for which investors must calculate risk and return, as seen from the following figure:

***Figure 11.*** The broadening domain of financial instruments for which investors must calculate risk and return




Source: [29]

The following part of the chapter will shift toward an accounting perspective of securities as also discussed at the beginning of this chapter.

# 2 An Accounting Approach of Financial Securities' Classification

Starting with a brief overview on accounting changes being imposed through the developments driven by financial innovation, we will further analyze the accounting distinction of financial securities. While the investors accounts for financial assets, the issuer might account for financial liabilities or equity instruments. We also look at how the distinction is currently being made based on international accounting regulations, what are the difficulties nowadays being encountered and also what would be the perspective for this classification.

## 2.1 Accounting Developments Following the Financial Innovation Process

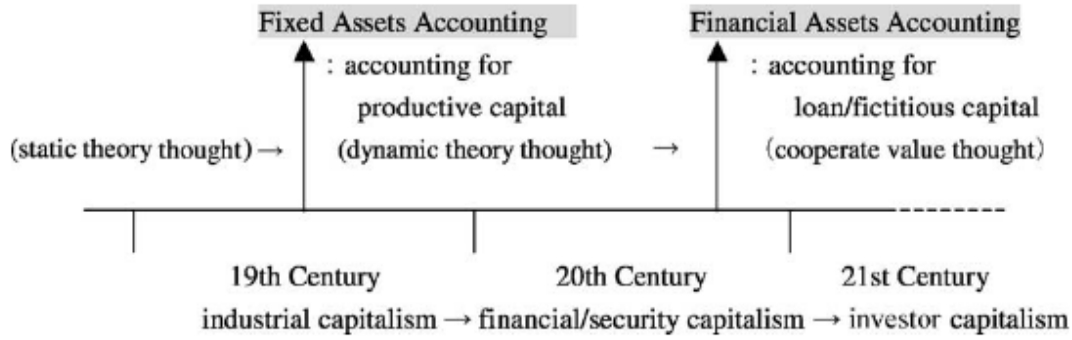
Before continuing our classification and discussion of primary securities from an accounting perspective, we will complete the introduction on accounting for financial instruments being developed in the first chapter in order to document how developments of the financial innovation process also imposed and required accounting developments. Therefore, at the end of the 80's the FASB and the SEC were identifying 14 distinct categories of derivatives which they considered to be available at that time [29]. Since then the world of derivatives has undergone significant changes, not only when considering the increase in their availability and trading, but also in terms of products that were once considered to be exotic and gradually became common, while the novelty in the new created products' structure has become a major competitive advantage. A beneficial development of the 90's and of later periods is the increasing importance being attributed to risk by bankers and investors, regulatory bodies and entities with sound corporate governance systems concentrating on means to control for current and potential exposure to risk, therefore stimulating the development of new directions within regulations. Despite the optimistic trend of developments in the 20th century, what the recent financial crisis had proven to all of us was that developments in risk oversight and risk management were far overcome by developments in financial innovation.

Looking back in time we see how the explosion of derivatives lead to having them presented as off-balance sheet assets and liabilities with little significance being completely unfitted and far from the truth. Derivatives nowadays represent distinct parts related to entities' main activity which is captured through the balance sheet, not only for banks and some financial institutions, but also for a growing number of other entities, including hedge funds, pension funds, insurance companies and manufacturing or service providing companies.

As innovation impacted derivatives' development, the FASB was making changes to their definition back in 1998 due to the fact that their changing nature and the fast increase in their use was making the distinctive lines between the various types of contracts seem more and more unclear. Accounting regulatory bodies and authorities admitted the necessity to modernize accounting and the information being required through the standards of those times so that they would be able to respond to the development of new financial products and new techniques in risk management. A series of shortcomings were also brought to their attention especially in relation to the disclosed information not reflecting the exposure to market risk in n adequate manner. This also leads us towards the jurisdiction of the Basel Committee on Banking Supervision (BCBS).

Another well-known fact is that what developed during the 19th century into the shape of the so-called accounting for fixed assets or depreciation accounting started off as an issue being raised within railroad companies and other forms of industrial capital. A parallel approach can be achieved when thinking about the development of fair value accounting at the end of the 20th century, this time explained through the development of fictitious capital. This recent development creates the premises for a new area of accounting which we might call financial assets' (and financial liabilities') accounting [63]. As [63] puts it, accounting for fixed assets focused on issues related to the productive capital. Meanwhile, accounting for financial assets deals with issues related to the fictitious capital in the financial economy instead of industrial capital in the real economy. If the manner in which the two areas of accounting act is very different, we must notice the fact that they are both the result of dynamic structural changes of the basic socio-economic environment, as it can also be seen from the following figure:

***Figure 12.*** Dynamic and structural changes in economy and the emergence of new accounting




Source: [63]

The necessity of a shift from historical cost accounting to fair value accounting has been the main objective of accounting standard setters at international level in the context of accounting for financial instruments [78]. The objective of controlling risk within sophisticated financial markets has lead to the development of several accounting standards addressing financial securities that are nowadays used within all industries [1, 69]. Accounting for derivatives has always created a series of debates among practitioners, especially with regard to their measurement basis when it comes to hedging, and to the manner of disclosing information, as well as recognizing corresponding gains and losses [16].

With reference to the IASB's approach to reporting for financial instruments, the Basel Committee on Banking Supervision also addressed two aspects of prudential regulations that are closely linked to IAS 39 Financial Instruments: Recognition and Measurement, focusing on the manner of developing hedge operations through the use of derivatives. One is related to what should be sound risk management policies and the processes being connected to the principle of fair value measurement, and the other to the manner in which banks' using fair value could affect the assessments of supervisory bodies in relation to capital adequacy and risk management [12]. This once again leads us toward that area involving financial securities that is placed at the junction between responsibilities belonging to the FASB, the IASB and the BCBS.

## 2.2 Distinguishing between Non-Equity and Equity Instruments: Current Approach

A first issue related to financial instruments from an accounting perspective is their classification into financial assets, financial liabilities and equity instruments, the principles guiding this distinction from the issuer's perspective being comprised within IAS 32 Financial Instruments: Presentation. The first step in this direction is the definition of a financial instrument assuming the existence of a contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity [124]. It is therefore understood that those elements that do not derive from a contract (such as tax profit) cannot be considered financial assets or financial liabilities. When looking at the definition being provided through the US GAAP we must make reference to SFAS 107 Disclosures about Fair Value of Financial Instruments and notice great similarities [128]. Therefore a financial instrument is

- Cash
- Evidence of an ownership interest in an entity, or
- A contract that meets both of the following criteria:
    - Imposes on one entity a contractual obligation
        - to deliver cash or another financial instrument to a second entity or
        - to exchange other financial instruments on potentially unfavorable terms with the second entity, and
    - Conveys to that second entity a contractual right
        - to receive cash or another financial instrument from the first entity or
        - to exchange other financial instruments on potentially favorable terms with the first entity [41].

It therefore becomes necessary for us to make the distinction between the so-called real assets (non-financial) and financial assets, the first referring to those assets that have intrinsic value due to their using (tangibles and intangibles), while the latter represent rights on real assets. Extending the definition of financial instruments, we can also include in this category those contracts for selling or buying a non-financial element that can be settled in cash or in another financial instrument, through exchange of financial instruments, with the exemption of contracts that are initiated and continued with the purpose of receiving or delivering a non-financial element in accordance to the entity's acquisition, selling or using stipulated terms. Many commodities contracts are standardized and being traded within organized markets almost the same as derivatives, easily being sold or bought against money, therefore changing the holder many times. Still, the parties buying or selling the contract actually trade the underlying commodity. The possibility of selling or buying a commodities contract against money, the facility of trading and the possibility to negotiate a cash settlement of the obligation to deliver or of the right to receive, does not modify the fundamental character of the contract in a manner that would create a financial instrument. There is the possibility for contracts of buying or selling non-financial elements to generate financial instruments in case they can be settled net or thorough the exchange of financial instruments, or when the non-financial instrument is easily convertible into cash. There is also the possibility that some contracts make reference to commodities without involving settlement through the physical delivery or receiving of the commodities, specifying cash settlements which are determined based on a contract formula and not a fixed amount.

> For example, the principal amount of a bond may be calculated by applying the market price of oil prevailing at the maturity of the bond to a fixed quantity of oil. The principal is indexed by reference to a commodity price, but is settled only in cash. Such a contract constitutes a financial instrument [124].

The essence of the definition given to the financial instrument through SFAS 107 is the same as that of IAS 32, the necessity of the contract meeting both of the two criteria being mentioned above actually dimensioning a financial liability for the first entity and meanwhile a financial asset for the second entity. By trying to comprise both financial assets and financial liabilities, SFAS 107' definition was proven to be difficult to understand, the only use of the financial instrument concept also generating some confusions in terms of practical application.

As a response to this shortcoming, SFAS 157 Fair Value Measurements offers separate definitions for the financial asset and financial liability.

Full understanding of the definitions being comprised within IAS 32 and IAS 39 Financial Instruments: Recognition and Measurement is not only necessary in order to develop an adequate conceptual approach of financial securities, but also for their practical application, professionals often relating to definitions when in need to develop and apply certain professional judgment. As seen from the above presented definitions, a special emphasize is put on contracts, the being used with reference to parties' rights and obligations, the commitments between them generating clear economic consequences, with low or even inexistent possibility to avoid them.

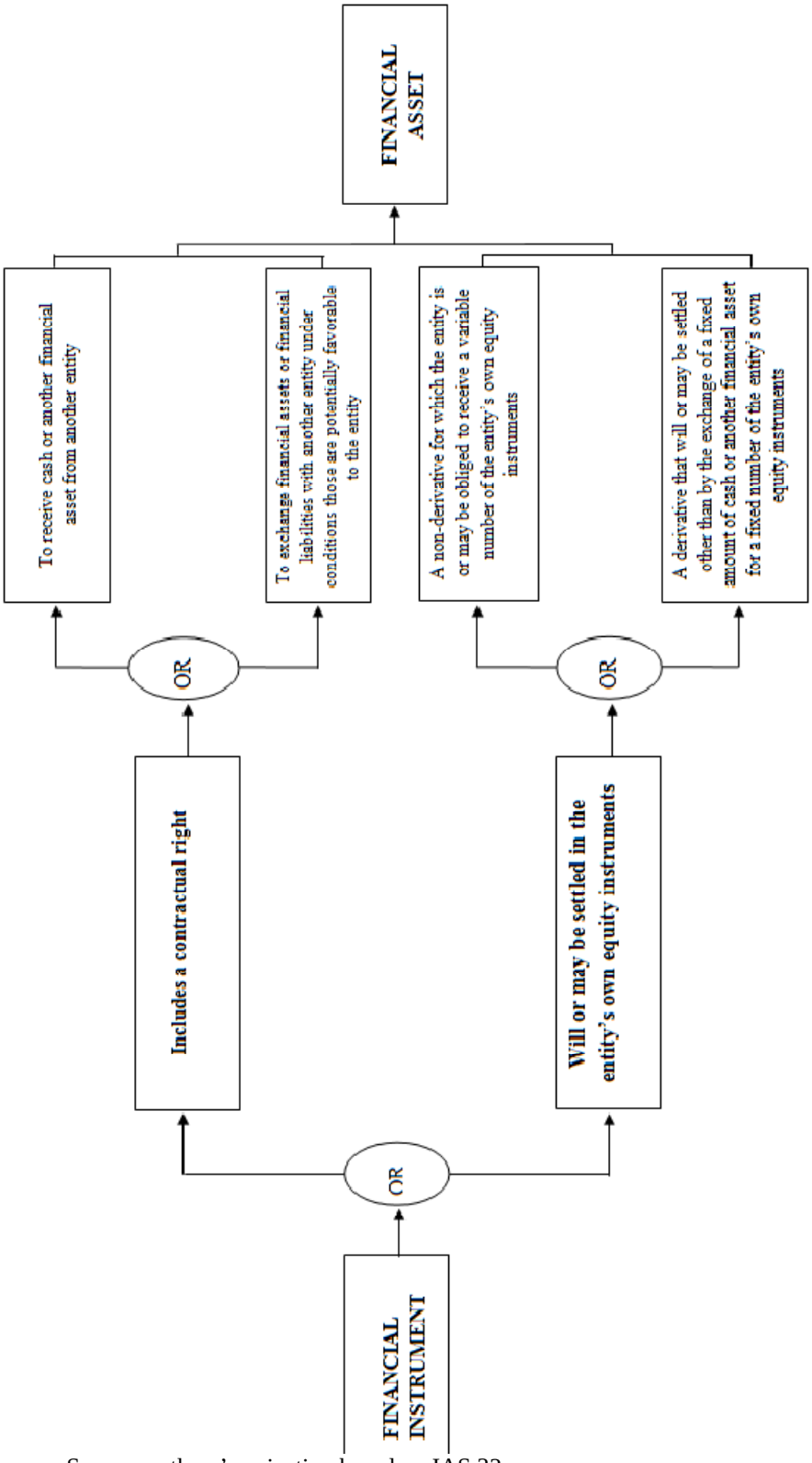
The reasons why making the distinction between financial liabilities and equity instruments is extremely important are many and include impact on the entity's solvability, diluting the ownership interest in an entity, obligations that might require cash settlement or other assets, the priority of rights upon the entity's assets or identifying those instruments that actually generate an ownership interest in an entity. It therefore becomes clear that accounting regulatory bodies' task of establishing a model that allows making the distinction between financial liabilities and equity instruments which should be simple and clear while applicable for even the most complex financial instruments is not an easy one to do especially on a fast track. As mentioned on the IASB's website, IAS 32 provides the relevant guidance for distinguishing between asset and liability instruments (non-equity instruments) and equity instruments, while the IASB is still reviewing this guidance to address some practice issues, including eliminating current rules-based approaches, and to achieve convergence with US GAAP. This is one of three long-term projects on the IASB's agenda to address issues related to financial instruments.

Based on the IASB's definition, a financial asset is any asset that is:

- cash;
- an equity instrument of another entity;
- a contractual right:
    - to receive cash or another financial asset from another entity; or
    - to exchange financial assets or financial liabilities with another entity under conditions that are potentially favorable to the entity; or
- a contract that will or may be settled in the entity's own equity instruments and is:
    - a non-derivative for which the entity is or may be obliged to receive a variable number of the entity's own equity instruments; or
    - a derivative that will or may be settled other than by the exchange of a fixed amount of cash or another financial asset for a fixed number of the entity's own equity instruments. For this purpose the entity's own equity instruments do not include puttable financial instruments classified as equity instruments, instruments that impose on the entity an obligation to deliver to another party a pro rata share of the net assets of the entity only on liquidation and are classified as equity instruments, or instruments that are contracts for the future receipt or delivery of the entity's own equity instruments.

A graphical representation of IASB's vision on financial instrument being classifies as financial assets is presented below:

***Figure 13.*** Financial assets' conceptual approach – the IASB's vision



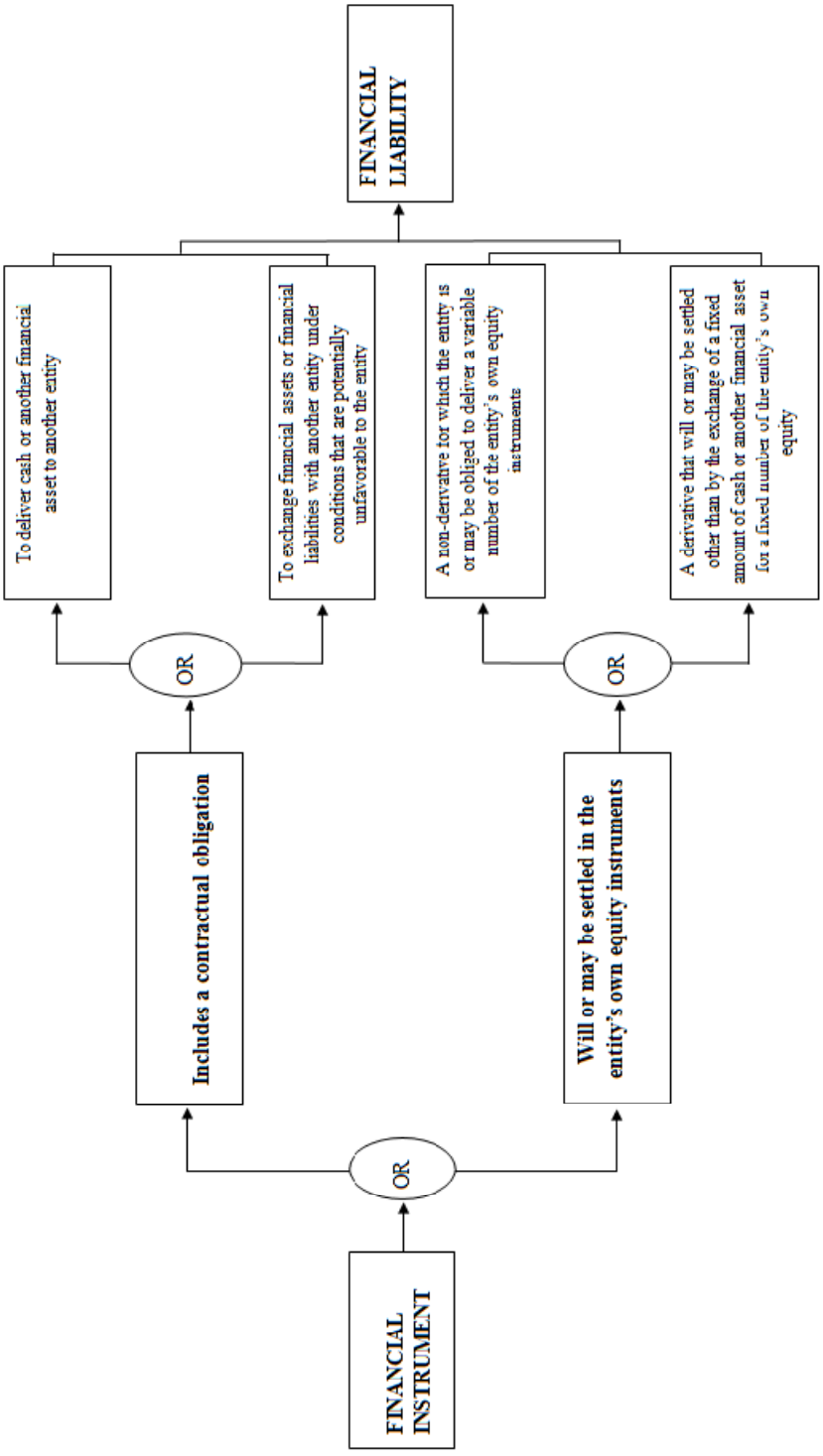

Source: authors' projection based on IAS 32

IAS 32 further defines a financial liability as any liability that is:

- a contractual obligation :
    - to deliver cash or another financial asset to another entity; or
    - to exchange financial assets or financial liabilities with another entity under conditions that are potentially unfavorable to the entity; or
- a contract that will or may be settled in the entity's own equity instruments and is:
    - a non-derivative for which the entity is or may be obliged to deliver a variable number of the entity's own equity instruments; or
    - a derivative that will or may be settled other than by the exchange of a fixed amount of cash or another financial asset for a fixed number of the entity's own equity instruments. For this purpose, rights, options or warrants to acquire a fixed number of the entity's own equity instruments for a fixed amount of any currency are equity instruments if the entity offers the rights, options or warrants pro rata to all of its existing owners of the same class of its own non-derivative equity instruments. Also, for these purposes the entity's own equity instruments do not include puttable financial instruments that are classified as equity instruments, instruments that impose on the entity an obligation to deliver to another party a pro rata share of the net assets of the entity only on liquidation and are classified as equity instruments, or instruments that are contracts for the future receipt or delivery of the entity's own equity instruments.

We will further present a graphical representation of financial instruments being considered as financial liabilities in accordance to the IASB's approach:

***Figure 14.*** Financial liabilities' conceptual approach – the IASB's vision




Source: authors' projection based on IAS 32

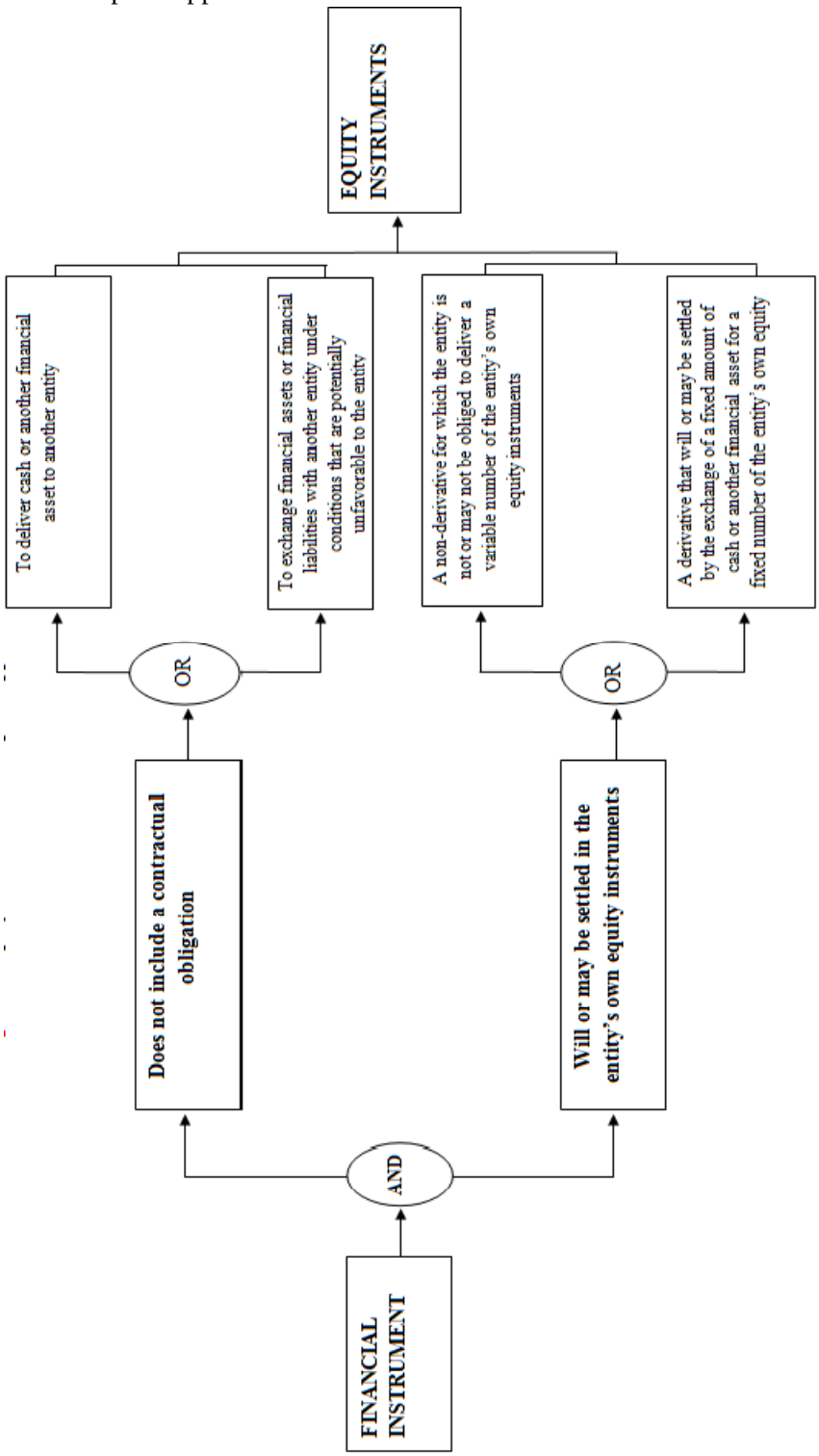
The international accounting referential also defines the equity instrument as any contract that evidences a residual interest in the assets of an entity after deducting all of its liabilities [124]. Most of the existent approaches tend to define assets and liabilities, while treating equity as the residual interest in the entity's assets, after all liabilities are paid. Implicitly, an equity instrument is that which is not a financial asset or a

financial liability. An extremely difficult issue is to distinguish between financial liabilities and equity instruments, financial analysts and accountants arguing for some time now that many forms of equity instruments are at their essence insignificantly different from liabilities. This led the IASB into formulating some principles that are meant to help the issuer distinguish between financial instruments representing financial liabilities and those representing equity instruments by focusing on the nature of the commitment rather than on its shape.

Therefore, a financial instrument is considered to be an equity instrument only if it simultaneously fulfils two clearly established criteria. The first criterion asks for the instrument not to include a contractual obligation to deliver cash or another financial asset to another entity, or to exchange financial assets or financial liabilities with another entity under conditions that are potentially unfavorable to the entity. The second criterion refers to the situation when the instrument will or may be settled in the entity's own equity instruments. In this case, in order for it to be classified as an equity instrument, the non-derivative version must not include a contractual obligation for the issuer to deliver a variable number of the entity's own equity instruments; while the derivative version refers to the possibility to be settled by the exchange of a fixed amount of cash or another financial asset for a fixed number of the entity's own equity instruments.

A graphical representation of the criteria being imposed through the principles that were adopted by the IASB in order to identify equity instruments from the issuer's perspective is presented below through figure 15.
In accordance to US GAAP, any security that evidences an ownership interest in an entity or the right to acquire or dispose of such an ownership interest in an entity for a fixed or determinable price represents an own equity security [41].

***Figure 15.*** Equity instruments' conceptual approach – the IASB's vision




Source: authors' projection based on IAS 32

IAS 32 follows a substance approach to the classification of instruments as liabilities or equity, an instrument having terms such as that there is an obligation on the enterprise to transfer financial assets to redeem the obligation than it is a liability regardless of its legal nature [39]. Referring to the situation when the entity has an obligation that can be settled with the entity's own equity shares, if the number of equity shares to be issued

varies with changes in their value so that the entity always has an obligation to give shares equal to the fair value of the obligation, they are treated as a financial liability. It is preference shares for example that create the conditions for an instrument that in substance could be a liability and legally would be equity. Therefore the common conditions on the preference shares that would indicate it is to be treated as a liability instruments are as follows: annual dividends are compulsory and are not at the discretion of directors; or the share provides for mandatory redemption by the issuer at a fixed or determinable amount at a future fixed or determinable date; or the share gives the holder the option to redeem upon the occurrence of a future event that is highly likely to occur (such as after the passing of a future date).

Including financial instruments in the category of financial liabilities does not alter the cash flows or risks that the instrument give, but it generates a presentational change. For example when including a preference share in the category of financial liabilities reduces net assets and increases gearing. This of course has further impact since the company might be perceived as more risky and having a higher credit risk. Besides this, a series of other aspects of the IASB approach to classifying financial instruments within the three categories which we have discussed have proven to be problematic in terms of their practical implementation. We will further discuss some of these difficulties within the following part of this chapter. Another aspect which we must mention and will also be further discussed is that the issue of classification is still part of one of the projects the IASB is working on. Also, in February 2008 the IASB amended IAS 32 by requiring some puttable financial instruments and some financial instruments that impose on the entity an obligation to deliver to another party a pro rata share of the net assets of the entity only on liquidation to be classified as equity.

## 2.3 Some Difficulties in Applying the Recent Classification Guidance

There are a series of critiques that can be brought to the manner in which the principles within IAS 32 make the distinction between equity instruments and financial liabilities or financial assets. These critiques can mainly be comprised within two main categories. One of them refers to the manner in which the principles should be applied and the other questions their capacity to lead to a correct delimitation of equity instruments.

Difficulties related to identifying the manner in which principles should be put in practice refer to certain specific situations [59, 60], mostly questioning the documentation of a contractual obligation, the application of the fixed for fixed principle and the documentation of contingent settlement provisions. A contractual obligation exists when an entity does not have an unconditioned right to avoid delivering cash (or other financial assets) to another party. This was in some times proven to be difficult to apply due to the fact that the holder of the instrument can also have other relations with the entity: he/she can also be a shareholder, a manager or an investor, and implicitly make decisions in the quality of all these roles. Therefore it can be difficult to assess whether the entity has an unconditioned right to avoid delivering a financial asset to another party.

A contract which assumes the exchange of a financial asset for the entity's own equity instruments is classified as an equity instruments only and only if the amount in cash or of another financial asset as well as the number of the entity's own equity instruments are fixed (this being known as the fixed for fixed principle). In case the amount of cash or of other financial asset or the number of the entity's own equity instruments are not fixed we are dealing with a financial liability. This opens the question what does actually fixed mean? For example if the cash amount is fixed but in another currency than the one being used by the entity then the amount is not considered to be fixed in accordance to the understanding of the classification principle. Another example would be warrants that are issued by the entity in another currency than one being used by the entity, being classified as financial liabilities in accordance to the fixed for fixed principle. We must therefore further consider the implications on the entity's financial performance. In case the entity had a successful year when considering the developed activity, its own shares' fair value as well as the warrants on these shares will increase. Meanwhile, from an accounting point of view this increase would generate the recognition of an expense when measuring its financial liabilities at fair value, therefore generating quite a bizarre situation.

A financial instrument may require the entity to pay through delivering cash or another financial asset (or to settle it in a manner that makes it to be a financial liability) under the contingency of the appearance or absence of some uncertain future events (or as a result of some uncertain circumstances) that are not controlled by neither the issuer or the holder [59], such as changes of stock exchange indexes or of the interest rate. This is actually the definition of contingent settlements provisions which are ignored when applied only in the contingency of the issuer's liquidation or when are not authentic. These terms impose the instrument's classification as a financial liability. Applying a criterion for authenticity assumes certain professional judgment in order to determine the probability (or improbability) of a future event's occurrence, once again raising problems.

In accordance to the current principles being applied in classifying financial instruments, the existence of a contractual obligation to deliver cash of another financial asset prevails to any other characteristic of the financial instruments being classified. This can in some circumstances lead to an inadequate classification of certain financial instruments, in cases such as the existence of the certainty to redeem an instrument without the existence of a contractual obligation in this regard, the total lack of equity instruments for some entities due to the fact that all instruments being issued by the entity are classified as financial liabilities, and the case of derivative financial instruments that are settled through the entity's own equity instruments.

A financial instrument that does not include the contractual obligation to deliver a financial asset is classified as an equity instrument. An example that should be considered here is a perpetual instrument that assumes periodical discretionary payments that must be made by the owner. The amount being paid by the owner of such an instrument as dividends could increase significantly in time so that it would determine the entity through economic circumstances to redeem the instrument. As a consequence it is almost certain that the issuer will redeem the instrument, while there is no contractual obligation for him to do so. Another similar example is that of an instrument which includes a non-financial obligation that must be honored if and only if the entity does not redeem the considered instrument. We could consider the example of an instrument imposing the entity to deliver a certain fixed quantity of wheat in case the entity does not redeem the instrument until a predetermined date. The value of the non-financial obligation (in this case the obligation to deliver a fixed quantity of wheat) might substantially exceed the amount that would be necessary for the entity to redeem the instrument. Similar to our previous example, it is almost certain that the entity will redeem the instrument (in order to avoid the non-financial obligation). In this case the instrument is considered to include an indirect contractual obligation to deliver cash or another financial asset and is classified as a financial liability in accordance to IAS 32. Considering the similarities between the two examples and the economic content of the two financial instruments, it may be more appropriate to develop a consistent classification.

Another aspect which should be considered is that a significant number of entities only issue instruments that include a contractual obligation, such as instruments that are redeemable at the buyer's option. In case these instruments do not contain certain specific features, they are classified as financial liabilities in accordance to IAS 32, therefore reaching situations when the entity has no instruments being classified as equity instruments. This could sometimes lead to situations that generate irrelevant or difficult to understand information concerning the entity's status.

Derivative financial instruments that are settled in the entity's own equity instruments generate a series of situations that lead to classifications in accordance to IAS 32 that are not consistent with the classifications in the former Conceptual Framework and even with some foresights within IAS 39, also generating a series of critiques to current classification principles in IAS 32.

Things are also complicated when considering the US accounting regulations, a series of standards approaching the manner to account for instruments that have both characteristics of financial liabilities and equity instruments, generating an extremely complex and difficult to implement assembly [62]. The Accounting

Standards Executive Committee (AcSEC)[8] underlines the importance and necessity to simplify the current labyrinth in trade literature that must be considered in order to include a financial instrument in one of the three previously discussed categories, invoking the significant number of supplementary justifications being required by the SEC as documenting how inappropriate the current American model of classification is [2].

As previously discussed, we do not find specific guidance for financial instruments' classification being analyzed in this part of the chapter within the European Directives. Still we must mention the fact that there is a real preoccupation in sorting these problematic aspects at the European level as well. This preoccupation is documented when analyzing the activity being developed by authorized national bodies in this field. Furthermore, comment letters being formulated by the European Financial Reporting Advisory Group (EFRAG) and other national regulatory bodies being reunited under the Proactive Accounting Activities in Europe (or PAAinE) initiative[9] argue that certain possible approaches would not be feasible to implement when considering a short to medium horizon of time, while problems being encountered when applying the current classification principle do require a solution as soon as possible [99].

## 2.4 Perspective Approach

Accounting for financial instruments that have characteristics of both financial liabilities and equity instruments is one of the most complex and demanding topic for producers of accounting information, auditors and also users. The danger for the accounting approach would be to focus on the manner of structuring a transaction rather than on the transaction's economic characteristics and risks [35]. As a consequence, developing a set of consistent principles that would be able to generate relevant information while also reducing the complexity of this area of financial reporting represents a priority for different parties being involved at international level [80].

We have also dedicated a considerable part of this chapter to discussing the delimitation between financial liabilities and equity instruments considering the importance of the subject which also represents the object of a common IASB – FASB project that is being debated since 2005 and is still under discussion nowadays. In a period when international accounting convergence is gaining both attention and controversies, the manner of establishing those financial instruments that should be classified by the issuer as either financial liabilities or equity instruments must be given proper attention. The applied principles should in essence lead to the same solution regardless of the jurisdiction, financial instruments that are similar from an economic point of view requiring similar classification. This fundamental issue of accounting theory has been considered by the FASB for some decades now, being also further considered by the IASB.

In February 28, 2008 the IASB published for commentary the Discussion Paper entitled Financial Instruments with Characteristics of Equity, representing the first step of a possible project to improve the classification requirements in IAS 32, which as discussed above receive quite a lot of critiques. Besides the invitation to comment upon the discussion paper, the document also incorporates the Preliminary Views Financial Instruments with Characteristics of Equity being previously issued by the FASB in November 2007. Indeed, a project dealing with the delimitation of financial liabilities and equity instruments is extremely important when considering the fact that financial instruments keep developing shapes that are more and more complex and

[8] Accounting Standards Executive Committee (AcSEC) of the American Institute of Certified Public Accountants (AICPA).

[9] EFRAG and the European national accounting regulatory bodies have agreed to allocate a part of their resources for the purpose of collaborating in their mission to increase Europe's capacity, as a whole, to participate in a more efficient manner to the global accounting debates. The particular objective of this initiative is to stimulate debates on some important topics on the IASB's agenda starting from an incipient phase of the accounting standard's due process and before the IASB officially issues its proposals. The ambitious of the initiative is to represent a common European point of view and to therefore be more involved in the accounting standards' due process. PAAinE's activity started by approaching five main proactive common projects, among which we also find the project on Classification of financial instruments between liabilities and equity instruments being coordinated by Germany.

reveal a series of shortcomings in the existent classification principles. This led to the objective of developing principles that aim a classification focusing on the economic characteristics of the financial instruments.

Another important aspect is that the project must assure strong links with another essential project being developed by the IASB, namely the one dealing with the Conceptual Framework, especially with reference to the elements of the financial statements in order to avoid potential contradictory results. The IASB and the FASB are working on a joint project on financial statements, while financial liabilities and equity instruments offer them the opportunity to undertake a common project with a precise scope, completing the first one. The project on financial instruments with characteristics of equity is part of the Memorandum of Understanding[10], aiming a joint approach once it reaches the exposure draft phase. Meanwhile the IASB is also trying to offer an adequate interaction between its projects being seen by its members as a priority.

With regard to the approach being chosen when dealing with this particular project, we might say it is a modified joint approach. More precisely, the FASB took the initiative by issuing its Preliminary Views[11], while the IASB further issued its Discussion Paper[12] without previous discussions, despite the fact that IFRSs have a different starting point in classifying financial instruments when compared with the FASB. In the context of the current regulations, the distinction between equity and liabilities plays a decisive role in determining the perspective from which activities taking place within the entity and its financial position are being looked at. One of the roles of this separation is to help accounting professionals distinguish between those amounts that are extracted in order to reach the net profit and those that are distributed from the net profit therefore being determined.

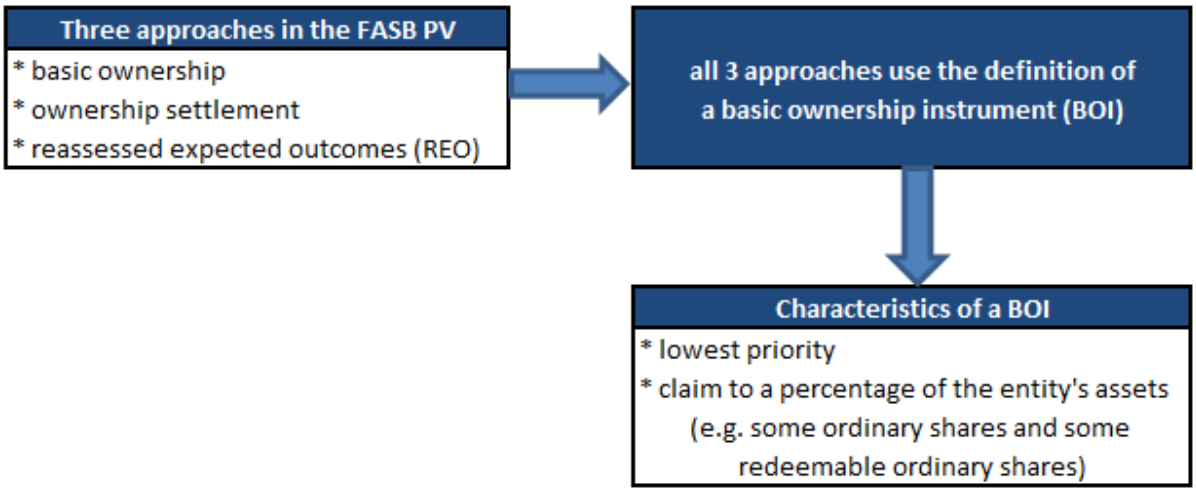
Another extremely important issue is that of measurement, instruments being classified as financial liabilities further impacting the income statement while equity instruments don't. IASB's Discussion Paper Financial Instruments with Characteristics of Equity comprises three possible approaches in delimiting equity instruments from financial liabilities being taken from the FASB's Preliminary Views Financial Instruments with Characteristics of Equity. Differences between the current approach and the ones being comprised in the project are significant. In contrast to IAS 39 which defines equity instruments as being that instrument that is not a financial asset nor a financial liability, all three new approaches come with a definition for equity instruments themselves. It is therefore considered that equity instruments should have certain characteristics of their own. In other words, while the current approach defines equity instruments in an indirect manner, the project defines them in a direct manner.

We consider it useful to briefly present the three approaches being proposed in order to distinguish between equity instruments and financial liabilities, approaches being brought into discussion by the FASB and further taken for debate by the IASB. The three approaches are: the basic ownership, the ownership-settlement and the reassessed expected outcomes – REO. All three approaches use the definition of an instrument reflecting a basic ownership that must meet the following characteristics: (a) the holder has a claim to a share of the assets of the entity that is subordinate to all other claims if the issuer were to liquidate on the date the classification decision is being made, and (b) the holder is entitled to a percentage of the assets of the entity that remain after all higher priority claims have been satisfied [60]. Some instruments that are redeemable (mandatorily or at the option of the holder) meet the definition of a basic ownership instrument. A basic ownership instrument would be classified as equity under all three approaches, while under the basic ownership approach, only basic

[10] Memorandum of Understanding ("The Norwalk Agreement" –September 18, 2002, Conneticut, SUA), London, Great Britain, October 29, 2002; signed between the Financial Accounting Standards Board and the International Accounting Standards Board with the purpose of defining a work plan regarding the convergence between US GAAPs and IFRSs.
[11] Preliminary Views *Financial Instruments with Characteristics of Equity,* issued by the FASB in November 2007, with commentary being received until May 30, 2008.
[12] Discussion Paper *Financial Instruments with Characteristics of Equity* issued by IASB in February 2008, with commentary being received until September 5, 2008.

ownership instruments would be classified as equity. The following figure captures the three proposed approaches:

***Figure 16.*** Possible approaches in delimiting equity instruments and financial liabilities




*PV - Financial Instruments with Characteristics of Equity*

Source: [11]

The manner in which the above presented three approaches to delimiting equity instruments and financial liabilities should be applied is also presented through the following graphical representation:

***Figure 17.*** Equity instruments in FASB's vision,

| |
|---|
| **Basic ownership approach** |
| Basic ownership instruments |
| **Ownership settlement approach** |
| Basic ownership instruments |
| Other perpetual instruments |
| Indirect ownership instruments settled by issuing basic ownership instruments |
| *e.g.: a physically settled written call option* |
| **REO approach** |
| Basic ownership instruments |
| Instruments (or components) that have a payoff directly or inversely related to the price of the basic ownership instrument |
| *e.g.: a written or purchased call or put option* |

Source: [11]

As presented previously when discussing the manner in which the project on financial instruments with characteristics of equity is being handled by the IASB and the FASB, the period for commenting upon both the IASB's discussion paper and upon the FASB's preliminary views already ended. Before synthesizing the latest developments in this area we will use FASB's comment letter summary in order to get a grasp on the respondent's profile. Therefore, as it can be seen from the following table 1, the Board received comment letters from 65 respondents. Professional organizations and preparers were the type of respondents sending most of the received comment letters. This once again documents that most of the questions being raised occur when it comes to the regulations' practical implementation.

***Table 1.*** Respondents to the FASB's

| **Number and Type of Respondents (by Occupation / Role)** | |
|---|---|
| Type of Respondent | Number |
| Public Accounting | 6 |
| • *Big 4 companies* | 4 |
| • *other companies* | 2 |
| Preparer | 24 |
| • *cooperative* | 13 |
| • *financial institution* | 7 |
| • *technology* | 2 |
| • *other* | 2 |
| User | 1 |
| • *rating agency* | 1 |
| Academic | 3 |
| • *American Accounting Association (AAA)* | 2 |
| • *other* | 1 |
| Professional Organization | 25 |
| • *cooperative* | 10 |
| • *CPA society* | 8 |
| • *private company / venture* | 2 |
| • *standard setter* | 2 |
| • *other* | 3 |
| ***Subtotal*** | ***59*** |
| Other | 6 |
| **Total respondents** | **65** |

Source: [44]

Based on the information being provided by the IASB on its official website, it seems like in October 2008 the IASB discussed the comment letters received, and which approach provided the best starting point. The IASB and FASB decided to begin future deliberations using the principles underlying the perpetual and basic ownership approaches. After exploring many different approaches, the boards have developed a model where classification is based on the form of an instrument's settlement, assets (e.g. cash) or its own equity instruments (e.g. shares).

For instruments that the issuer settles with assets:

- classify as equity if asset-settlement occurs because of the following reasons:
  - on distribution of all of its assets (such as bankruptcy);
  - the issuer chooses to pay a dividend or repurchase shares;
  - redemption allows existing instrument holders to maintain control of the entity;
  - the holder ceases to participate in the activities of the entity, while
- all other asset-settled instruments are classified as liabilities.

For instruments that the issuer settles with its own equity instruments:

- a contract for a specified number of its own equity instruments in exchange for a specified price are classified as equity if the
  - specified number must be fixed or vary as an anti-dilution measure and the
  - specified price must be in the functional currency of the reporting entity or shareholder, while
- all other equity-settled instruments are classified as liabilities.

Instruments with both liability and equity features will be separated into liability and equity components. Examples being offered include ordinary shares with required dividend payments, debt convertible at the option of holder into a specified number of ordinary shares.

Nowadays, we can say that the project did not progress much lately in its development, but we consider it might be due to the work being done on the Conceptual Framework whose foresights will also have to be considered and correlated with. Furthermore the boards acknowledged in October 2010 that they do not have the capacity to devote the time necessary to deliberate the project issues and decided not to issue an exposure draft in the near term as originally planned. It was said that the boards will return to this project when they have the requisite capacity which is expected to be after June 2011.

# 3 Financial Reporting Particularities

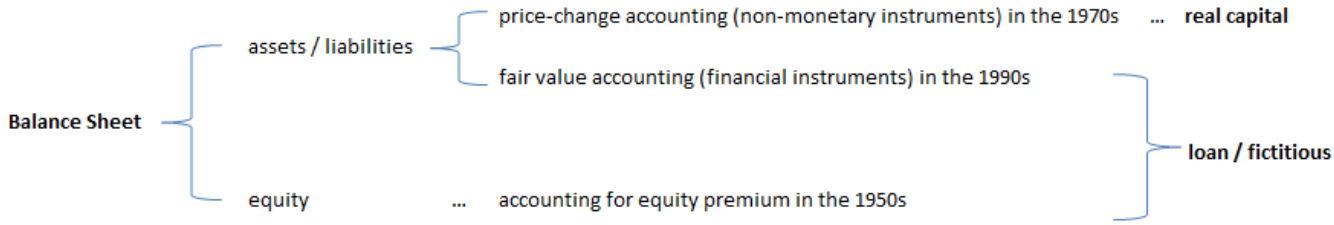
Nowadays, bankers, investors, regulatory bodies and financial analysts are being confronted with the growing complexity of interrelations and correlations that are deeply incorporated in all modern financial instruments. Besides all these aspects we must also offer proper attention to the accounting perspective, not less problematic. Information on financial securities is spread within the notes to the financial statements and is only fully understood by a relative low number of persons. Many investors and even professionals in the field of finance are still raped in the mystery of derivatives and often become frustrated by their impact on the company's exposure and also by the implications they have on the balance sheet. It is therefore understood why reporting for financial instruments is a constant presence on the agenda of accounting regulatory bodies.

A series of critiques have been debated within accounting research literature regarding the current accounting approaches of financial instruments, some even suggesting that the existing conceptual framework and its foresights on recognizing and measuring financial instruments cannot be considered as appropriate in determining the performance connected to fictitious capital representing the essence of any given financial instrument [63]. This is argued because the existing conceptual framework was at its inception grounded on the characteristics of real capital. We should in this context mention that nowadays both the IASB's conceptual framework and accounting standards on financial instruments (namely IAS 39) represent the object of currently developed projects and are considered to be replaced.

Measuring the obtained results when dealing with fictitious capital is nowadays treated similarly with capital gains and losses (based on the concept of realization), representing a manner of determining the result when it should rather be a simple issue of presenting information, beyond measuring results related to real capital, the corresponding results of the two types of capital being fundamentally different when considering their economic substance. When dealing with fictitious capital, gains do not involve increases in the prices of real commodities but rather gains from changes in the market value of the fictitious capital, namely securities which make a special category of commodities. Furthermore, at macroeconomic level these gains being connected to the fictitious capital are annulled.

The object and realities at the basis of the so-called value based accounting still taking much of the ink nowadays have their correspondent, at a theoretical or conceptual level, in fictitious capital replacing the real capital. These aspects are disused in detail by [63]. Understanding and accepting these realities is required in order to move along with the developments that should follow nowadays' value based accounting being totally different from price-change accounting in the 70s dealing with differing concepts of capital maintenance. Nowadays the debate continues to be related to issue of fictitious capital as an aspect of accounting for financial assets. The following figure illustrates this issue together with the issue of accounting for real capital, as presented by [63]:

***Figure 18***. Accounting problems of fictitious capital




Source: [63]

While IAS 32 makes the distinction between the three categories of financial instruments which we previously discussed in detail (financial assets, financial liabilities and equity instruments), IAS 39 is the one to be stipulating further classifications which are this time required for measurement purposes. More precisely these categories will be the ones dictating the measurement attribute to be used for subsequent measurement. The first distinction that needs to be done is between financial instruments that are used for hedge purposes and those that are not. Financial instruments not falling under accounting for hedge operations, which will be explained within the next chapter, therefore follow accounting for financial assets or accounting for financial liabilities. Financial assets are further divided into four categories[13], while financial liabilities into two categories.

Including financial instruments within the above mentioned categories belonging to financial assets and financial liabilities is done based on management's intention. What is extremely important and must be emphasized is that this classification significantly affects the accounting treatment of financial instruments [51]. The foresights of the international accounting referential are in its significant points similar to those of the American referential. The following table n synthesizes the reasoning (judgment) guiding these classifications.

We must also present some definitions being offered through IAS 39 before moving forward to the above mentioned classification. Among the required terms there is also the amortized cost and the effective interest method. The amortized cost of a financial asset or financial liability is the amount at which the financial asset or financial liability is measured at initial recognition minus principal repayments, plus or minus the cumulative amortization using the effective interest method of any difference between that initial amount and the maturity amount, and minus any reduction (directly or through the use of an allowance account) for impairment or uncollectibility [125]. In accordance to the same standard, the effective interest method is a method of calculating the amortized cost of a financial asset or a financial liability (or group of financial assets or financial liabilities) and of allocating the interest income or interest expense over the relevant period. Meanwhile, the effective interest rate is the rate that exactly discounts estimated future cash payments or receipts through the expected life of the financial instrument or, when appropriate, a shorter period to the net carrying amount of the financial asset or financial liability.

[13] These provisions change when looking at IFRS 9, issued in 2009 with January 2013 as effective date.

***Table 2:*** Financial assets and financial liabilities' classification

| Category - definition | IASB Reasoning | FASB Reasoning |
|---|---|---|
| Financial assets | | |
| A. Financial assets at fair value through profit or loss | | |
| Upon initial recognition it is designated by the entity as at fair value through profit or loss. | The decision to classify the financial asset at fair value through profit or loss assuming that when doing so results in more relevant information, because either:<br>it eliminates or significantly reduces a measurement or recognition inconsistency (sometimes referred to as 'an accounting mismatch');<br>a group of financial assets, financial liabilities or both is managed and its performance is evaluated on a fair value basis; | The decision to classify the financial asset at fair value through profit or loss. |
| classified as held for trading –acquired or incurred principally for the purpose of selling or repurchasing it in the near term; a derivative (except for a designated and effective hedging instrument). | The intention must be to own the financial asset for a relatively short period of time, or as part of a portfolio with the purpose of short term profit obtaining. | Similar to IFRSs. Frequent buying and selling usually indicates an instrument being held for trading. |
| Management's trading intention. | Measured at fair value with changes being recognized through profit or loss. | Similar to IFRSs. |
| | Allow for reclassification under certain circumstances[14]. | Similar to IFRSs. |

Source: authors' projection based on IASB and FASB's regulations

[14] In accordance to the amendment *Reclassification of Financial Asset* being brought to IAS 39 in October 2008.

***Table 3:*** Financial assets and financial liabilities' classification

| Category - definition | IASB Reasoning | FASB Reasoning |
|---|---|---|
| Financial assets | | |
| B. Held-to-maturity investments | | |
| Non-derivative financial assets with fixed or determinable payments and fixed maturity that an entity has the positive intention and ability to hold to maturity.<br><br>Management's intention to hold to maturity | The entity must have the positive intention and ability to hold the financial asset to maturity and not just a momentary intention.<br><br>When the entity sells more that an insignificant value from its held-to-maturity investments (other than those belonging to limited circumstances), during the current reporting period or during the last consecutive years, it will be forbidden to use this category. The entity must reclassify the held-to-maturity investments into the category of available-for-sale financial assets.<br><br>Measured at amortized cost using the effective interest method. | Similar to IFRSs, US GAAPs not mentioning the two years period.<br><br>For listed entities the SEC brings the two years foresight. |
| C. Loans and receivables | | |
| Non-derivative financial assets with fixed or determinable payments that are not quoted in an active market<br><br>Management's intention not to trade or being initiated by the entity. | Measured at amortized cost. | Do not define this category. |

Source: authors' projection based on IASB and FASB's regulations

***Table 4:*** Financial assets and financial liabilities' classification

| Category - definition | IASB Reasoning | FASB Reasoning |
|---|---|---|
| Financial assets | | |
| D. Available-for-sale financial assets | | |
| Non-derivative financial assets that are designated as available for sale or are not classified as (a) loans and receivables, (b) held-to-maturity investments or (c) financial assets at fair value through profit or loss.<br><br>Residual category. | Measured at fair value.<br><br>Changes in fair values are recognized in other comprehensive income and transferred to the result once they are sold, impaired or settled. | Similar to IFRSs. |
| Financial liabilities | | |
| Financial liabilities at fair value through profit or loss | | |
| Held for trading; derivatives are always included in this category if they do not qualify for hedge accounting; | Measured at fair value with changes being recognized through profit or loss.<br><br>Separate presentation of those designated upon initial recognition and those classified as held for trading – management's intention to trade. | Similar to IFRSs * |
| B. Other financial liabilities | | |
| Residual category. | Measured at amortized cost. | Similar to IFRSs * |

Source: authors' projection based on IASB and FASB's regulations

Once we clarified the issue of financial instruments' classification we must also consider the issue of their recognition. Recognition can be defined as the process that allows for an element that meets the recognition criteria to be included within the balance sheet or the income statement, while the recognition criteria refer to the probability of future economic benefits that can be attributed to the considered elements and to the existence of a reliable measurement attribute, be it cost or value [1]. [25] considers that the first of the two

* Although the two considered sets of accounting regulations define financial liabilities in a similar manner, a series of differences appear in terms of their classification through accounting practices due to different models. Furthermore the SEC had issued a distinct category that is not presented by the international accounting referential (only through the project on financial assets, financial liabilities and equity instruments which we previously discussed) for certain redeemable instruments that did not apply SFAS 150, named mezzanine equity (or in other words outside permanent equity).

criteria, that referring to future economic benefits, is quite achievable, while the second is just an assumption in the case of financial instruments.

We could consider that this type of recognition criteria represented a transition from traditionalism towards contract based accounting. [57] was even making the distinction between two preceding basis when referring to the concentration of recognition criteria, the measurement model and the involved risk. Conventional grounding that was focused on exchange was being characterized as associating the contract's performance with the critical event of the recognition, using the contract's price at the date of the exchange (historical cost model) as a measurement base for the contract, further ignoring changes in its value. Those arguing for this approach considered that it offered the chance to eliminate uncertainty being associated to the contract in terms of measurement and settlement [1].

On the other hand, contract based grounding considers the signing of the contract as being the critical event of recognition. Measurement is further presented as linked with the market for the whole life of the contract, market value representing the adequate measurement attribute for the assets in the contract [57]. This approach reaches towards identifying uncertainty before the contract's settlement date by in advance use of reasonable measurements of value.

Coming back to the foresights of IAS 39, we must mention that it requires recognition of a financial asset or a financial liability when, and only when, the entity becomes a party to the contractual provisions of the instrument. When referring to regular way purchases or sales of a financial asset, it is recognized and derecognized using either trade date or settlement date accounting. Therefore trade date represents the moment when the entity becomes a party to the contractual provisions of the instrument, the entity promising to buy or sell an asset, while settlement date is the moment when actual delivery of the asset takes place, the asset being deliver toward or by an entity. This actually generates two different accounting practices called trade date accounting and settlement date accounting.

IAS 39 allows for both of the above mentioned practices with the request that the method being used is to be applied consistently for all purchases and sales of financial assets that belong to the same category of financial asset as defined by the same standard. While the choice of method is considered to represent an accounting policy, practitioners seem to believe that using trade date accounting for regular way purchases or sales might be a problem since information on the entity's financial position would include securities that involve risk, settlement failing in some cases. If we are to analyze the effect of the two accounting practices on entities' financial statements, we notice that the financial position could be temporarily influenced in a significant manner by each practice, while the income statement and the equity statement are not affected in a different manner by the two practices.

Another aspect which must be emphasized is the IAS 39 requiring all financial assets and all financial liabilities to be recognized on the balance sheet. Initial measurement must be done for all financial assets and financial liabilities at fair value, including transaction costs for assets and liabilities not measured at fair value through profit or loss. In accordance to the standard [125], transaction costs are incremental costs that are directly attributable to the acquisition, issue or disposal of a financial asset or financial liability, while an incremental cost is one that would not have been incurred if the entity had not acquired, issued or disposed of the financial instrument.

As it can also be seen from the above presented table, IAS 39 requires financial assets and financial liabilities to be subsequently measured at fair value with some exceptions. These exceptions include: loans and receivables, held-to-maturity investments, and non-derivative financial liabilities which should be measured at amortized cost using the effective interest method; and investments in equity instruments with no reliable fair value measurement which should be measured at cost.

With reference to impairment, IAS 39 requires entities to assess at the end of each reporting period whether there is any objective evidence of impairment. Therefore, a financial asset or group of assets is considered to be impaired, and impairment losses are recognized, only if there is objective evidence as a result of one or more events that occurred after the initial recognition of the asset. Based on the presentation of a detailed impairment calculation, the entity will further document whether an impairment loss should be recognized in those cases when such evidence exists. The amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated cash flows discounted at the financial asset's original effective interest rate [125]. Considering a subsequent period, in case the amount of the impairment loss relating to a financial asset carried at amortized cost or a debt instrument carried as available-for-sale decreases due to an event occurring after the impairment was originally recognized, the previously recognized impairment loss is reversed through profit or loss. Impairments relating to investments in available-for-sale equity instruments are not reversed through profit or loss.

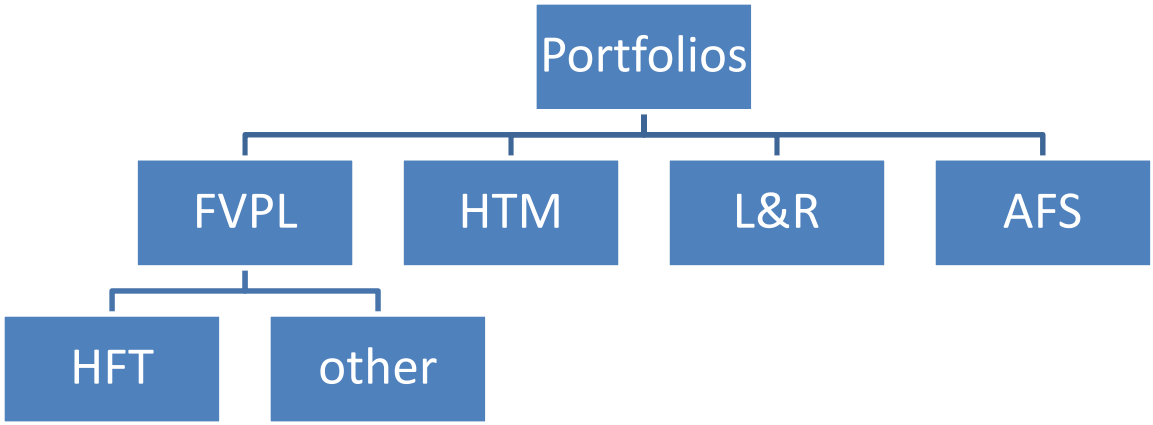
In order to approach the issue of financial instruments' derecognition we must make reference to trade literature on assets' transfer which appeals to different reasoning in order to ground the existent practices. A useful overview in this regard is offered by [25] who summarizes different approaches in accounting literature that ground the derecognition criteria as follows:

- The risk and reward approach grounds assets' derecognition in accordance to the exposure to the risks and benefits being associated with the considered asset. This approach is used in Great Britain by the Accounting Standards Board.
- The condition based approach presents a different focus by establishing certain criteria that generate the loss of control when transferring a financial asset that might be considered for derecognition. This approach was adopted by the FASB within SFAS 140.
- The financial components approach being introduced by the Joint Working Group on financial instruments (of IASB) in 2000, in accordance to which not the entire transaction is considered for recognition or derecognition, but rather its dividing on components. Based on this dividing, those components that are kept by the entity will be recognized, while derecognition applies for those components being transferred.

Therefore the derecognition model being presented by IAS 39 starts with determining whether the asset under consideration for derecognition is: an asset in its entirety; specifically identified cash flows from an asset; a fully proportionate share of the cash flows from an asset; or a fully proportionate share of specifically identified cash flows from a financial asset. After determining the asset under consideration for derecognition, an assessment is made as to whether the asset has been transferred, and if so, whether the transfer of that asset is subsequently eligible for derecognition. Furthermore, an asset is considered to be transferred if either the entity has transferred the contractual rights to receive the cash flows, or the entity has retained the contractual rights to receive the cash flows from the asset, but has assumed a contractual obligation to pass those cash flows on under an arrangement that meets the certain conditions. These conditions require the entity (a) not to have any obligation to pay amounts to the eventual recipient unless it collects equivalent amounts on the original asset; (b) to be prohibited from selling or pledging the original asset; and (c) to acknowledge an obligation to remit those cash flows without material delay.

After the entity has determined that the asset has been transferred, it then determines whether or not it has transferred substantially all of the risks and rewards of ownership of the asset. In case of a positive answer the asset is derecognized, while in case substantially all the risks and rewards have been retained, derecognition of the asset is precluded. In case the entity has neither retained nor transferred substantially all of the risks and rewards of the asset, then the entity must assess whether it has relinquished control of the asset or not. When not controlling the asset derecognition is allowed, but in case the entity has retained control of the asset, then the entity continues to recognize the asset to the extent to which it has a continuing involvement in the asset [125]. We could therefore say that the derecognition model in IAS 39 combines the risk and reward approach with the financial components approach based on our previous discussion.

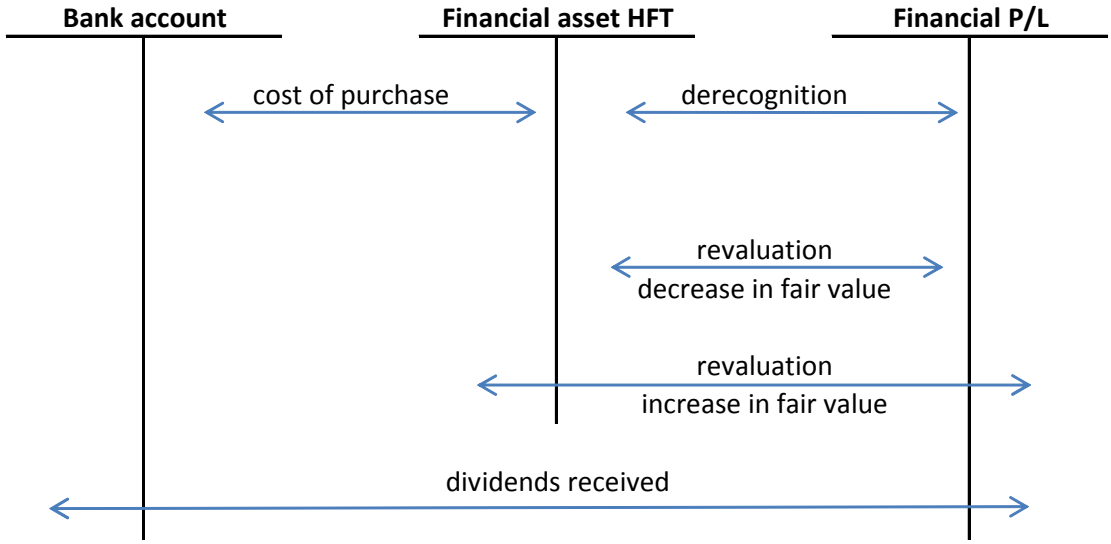
Before we will proceed towards practical examples on reporting of selected portfolios, we have to summarize the classification of financial assets under IFRSs:




| Portfolio | | Revaluation | Impact |
|---|---|---|---|
| FVPL | Fair Value Through Profit and Loss | fair value | P/L |
| HFT | Held For Trading | fair value | P/L |
| HTM | Held To Maturity | amortized costs | P/L |
| L&R | Loans and Receivables | amortized costs | P/L |
| AFS | Available For Sale | fair value | OCI |

### 3.1 Financial Securities within HFT portfolio

Firstly we have to start with portfolio FVPL, concretely with financial assets held for trading. Following scheme shows the accounting treatment for this portfolio:



***EXAMPLE***
Company A purchased in 2011 100 shares of company B for the trading purposes (HFT). The commission was 0.1 % from the volume of trade. Upon balance sheet date the shares were traded for 5,200 CU/share. In 2012 company sold all shares for their current market price 515,500 CU.

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of shares | 500,000<br>500,000 | Dr | <br>Cr | Shares HFT<br>Bank account |
| 2 | Commission paid | 500<br>500 | Dr | <br>Cr | E – Financial P/L<br>Bank account |
| 3 | Revaluation at fair value upon balance sheet date | 20,000<br>20,000 | Dr | <br>Cr | Shares HFT<br>R – Financial P/L |
| 4 | Revaluation at fair value upon date of sale | 4,500<br>4,500 | Dr | <br>Cr | E – Financial P/L<br>Shares HFT |
| 5 | Sale of shares | 515,500<br>515,500 | Dr | <br>Cr | Bank account<br>R – Financial P/L |
| 6 | Disposal of shares | 515,500<br>515,500 | Dr | <br>Cr | E – Financial P/L<br>Shares HFT |

**Balance Sheet (changes 2011)**

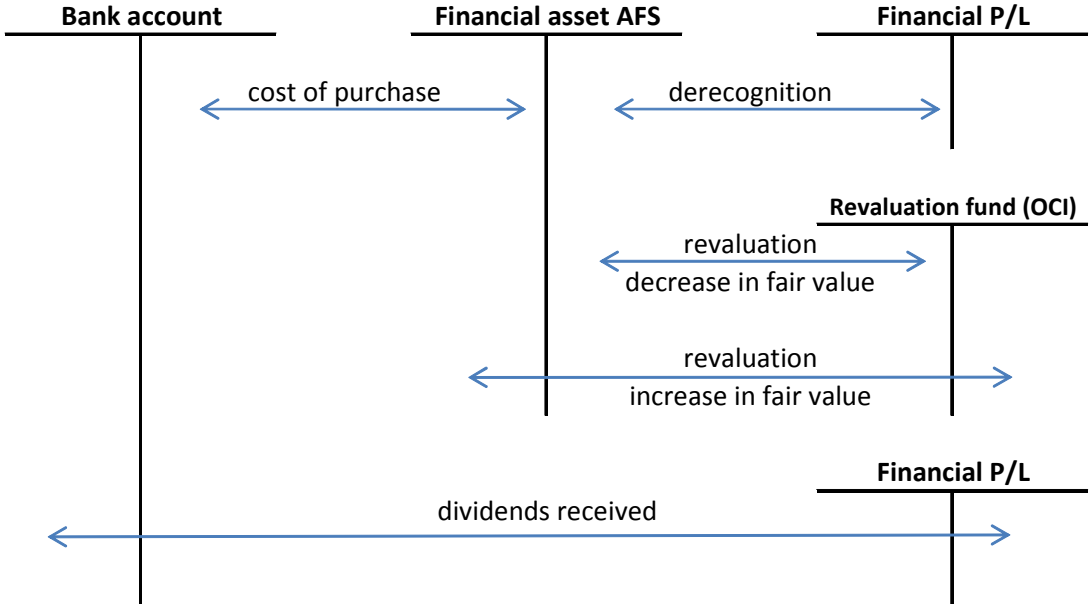
| | | | |
|---|---|---|---|
| Shares HFT | 520,000 | Profit | 19,500 |
| Bank account | -500,500 | | |
| **Σ** | **19,500** | **Σ** | **19,500** |

**Balance Sheet (changes 2012)**

| | | | |
|---|---|---|---|
| Bank account | 15,000 | Retained earnings | 19,500 |
| | | Profit | -4,500 |
| **Σ** | **15,000** | **Σ** | **15,000** |

## 3.2 Shares and AFS portfolio

In case that entity will not recognize shares as held for trading, company has to treat them as available-for-sale financial asset. Following scheme shows accounting treatment for this portfolio:



***EXAMPLE***

Company A has purchased 100,000 shares of company B for 800,000 CU and classified these shares as AFS. In May 2011 company A received dividend 20 CU/share. As at 31st December 2011 market price of one share is 75 CU. As at 31st December 2012 market price of one share is 84 CU. Company A sold all shares in 2013 for the current market price 90 CU/share.

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of shares | 800,000 | Dr | | Shares AFS |
| | | 800,000 | | Cr | Bank account |
| 2 | Dividends received | 200,000 | Dr | | Bank account |
| | | 200,000 | | Cr | R – Financial P/L |
| 3 | Revaluation at fair value as at 31.12.2011 | 50,000 | Dr | | Revaluation fund |
| | | 50,000 | | Cr | Shares AFS |
| 4 | Revaluation at fair value as at 31.12.2012 | 90,000 | Dr | | Shares AFS |
| | | 90,000 | | Cr | Revaluation fund |
| 5 | Revaluation at fair value upon date of sale | 60,000 | Dr | | Shares AFS |
| | | 60,000 | | Cr | Revaluation fund |
| 6 | Sale of shares | 900,000 | Dr | | Bank account |
| | | 900,000 | | Cr | R – Financial P/L |
| 7 | Disposal of shares | 900,000 | Dr | | E – Financial P/L |
| | | 900,000 | | Cr | Shares AFS |
| 8 | Transfer of revaluation fund to net profit | 100,000 | Dr | | Revaluation fund |
| | | 100,000 | | Cr | R – Financial P/L |

**Balance Sheet (changes 2011)**

| | | | |
|---|---|---|---|
| Shares AFS | 750,000 | Revaluation fund | -50,000 |
| Bank account | -600,000 | Profit | 200,000 |
| **Σ** | **150,000** | **Σ** | **150,000** |

**Balance Sheet (changes 2012)**

| | | | |
|---|---|---|---|
| Shares AFS | 840,000 | Revaluation fund | 40,000 |
| Bank account | -600,000 | Retained earnings | 200,000 |
| **Σ** | **240,000** | **Σ** | **240,000** |

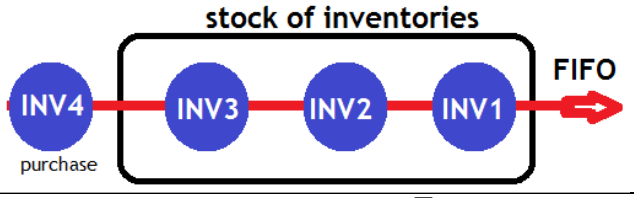
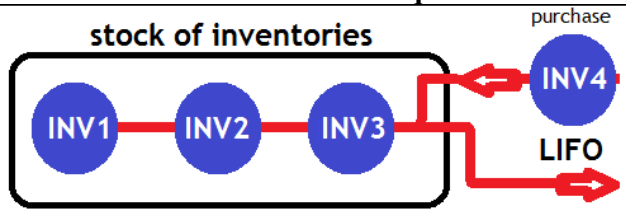
**Balance Sheet (changes 2013)**

| | | | |
|---|---|---|---|
| Bank account | 300,000 | Retained earnings | 200,000 |
| | | Profit | 100,000 |
| **Σ** | **300,000** | **Σ** | **300,000** |

In case we do not apply individual costs for disposal of shares, we can use to measure the costs following formulas:

- **FIFO (First-In, First-Out);** or
- **weighted average.**

LIFO (Last-In, Last-Out) method is not permitted.

| Allowed techniques | Not-allowed techniques |
|---|---|
|  |  |
| $weighted\ average = \frac{\sum p_i q_i}{\sum q_i}$ | |
| individual costs | |

***EXAMPLE***

Company A did purchased 300 shares of company B for 270,000 CU + commission 10 %. During current accounting period made another purchase of 200 shares of the same company for 200,000 CU. These shares are part of portfolio AFS.

Before the end of an accounting period company sold 400 shares for 400,000 CU. Upon balance sheet date the market price of one share is 800 CU.

For the disposal of shares use FIFO, or weighted average method.

*Solution:*

*1 – Fair value calculation*

| Market value | Number of shares | Total |
|---|---|---|
| 800 | 100 | 80,000 |

*2 - Posting of transactions (variant FIFO)*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of 300 shares | 270,000 | Dr | | Shares AFS |
| | | 270,000 | | Cr | Bank account |
| 2 | Commission paid | 27,000 | Dr | | Shares AFS |
| | | 27,000 | | Cr | Bank account |
| 3 | Purchase of 200 shares | 200,000 | Dr | | Shares AFS |
| | | 200,000 | | Cr | Bank account |
| 4 | Sale of 400 shares | 400,000 | Dr | | Bank account |
| | | 400,000 | | Cr | R – Financial P/L |
| 5 | Disposal of shares | 397,000 | Dr | | E – Financial P/L |
| | | 397,000 | | Cr | Shares AFS |
| 6 | Revaluation at fair value | 20,000 | Dr | | Revaluation fund |
| | | 20,000 | | Cr | Shares AFS |

*Value of shares to be disposed*

$$disposal = delivery\ 1 + \frac{100}{200} delivery\ 2$$

$$disposal = 297{,}000 + \frac{100}{200} \cdot 200{,}000$$

$$\boldsymbol{disposal = 397{,}000\ CU}$$

*Calculation of revaluation*

| | |
|---|---|
| Fair value | 80,000 |
| Book value | 100,000 |
| **Revaluation** | **- 20,000** |

**Balance Sheet (changes)**

| | | | |
|---|---|---|---|
| Shares AFS | 80,000 | Revaluation fund | -20,000 |
| Bank account | -97,000 | Profit | 3,000 |
| **Σ** | **-17,000** | **Σ** | **-17,000** |

*2 - Posting of transactions (variant weighted average)*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of 300 shares | 270,000 | Dr | | Shares AFS |
| | | 270,000 | | Cr | Bank account |
| 2 | Commission paid | 27,000 | Dr | | Shares AFS |
| | | 27,000 | | Cr | Bank account |
| 3 | Purchase of 200 shares | 200,000 | Dr | | Shares AFS |
| | | 200,000 | | Cr | Bank account |
| 4 | Sale of 400 shares | 400,000 | Dr | | Bank account |
| | | 400,000 | | Cr | R – Financial P/L |
| 5 | Disposal of shares | 397,600 | Dr | | E – Financial P/L |
| | | 397,600 | | Cr | Shares AFS |
| 6 | Revaluation at fair value | 19,400 | Dr | | Revaluation fund |
| | | 19,400 | | Cr | Shares AFS |

*Value of shares to be disposed*

$$disposal = book\ value \frac{number\ of\ shares\ to\ be\ disposed}{number\ of\ shares\ owned}$$

$$disposal = 497{,}000 \cdot \frac{400}{500}$$

$$\boldsymbol{disposal = 397{,}600\ CU}$$

*Calculation of revaluation*

| | |
|---|---|
| Fair value | 80,000 |
| Book value | 99,400 |
| **Revaluation** | **- 19,400** |

**Balance Sheet (changes)**

| | | | |
|---|---|---|---|
| Shares AFS | 80,000 | Revaluation fund | -19,400 |
| Bank account | -97,000 | Profit | 2,400 |
| **Σ** | **-17,000** | **Σ** | **-17,000** |

## 3.3 Financial Securities within HTM portfolio

According to IAS 39 discounts and premiums of bonds shall be amortized and this amortization has to be based on effective interest rate. It is such discount rate where the issuing price of bond corresponds to discounted cash flows from the bond.

$$issuing\ price = \frac{C_1}{\left(1+i_{ef}\right)^1} + \frac{C_2}{\left(1+i_{ef}\right)^2} + \frac{C_3}{\left(1+i_{ef}\right)^3} + \cdots + \frac{C_n}{\left(1+i_{ef}\right)^n} + \frac{NV}{\left(1+i_{ef}\right)^n} \quad (1)$$

where:

$i_{ef}$ effective interest rate
$C_i$ coupon payment in i-period
$NV$ nominal value

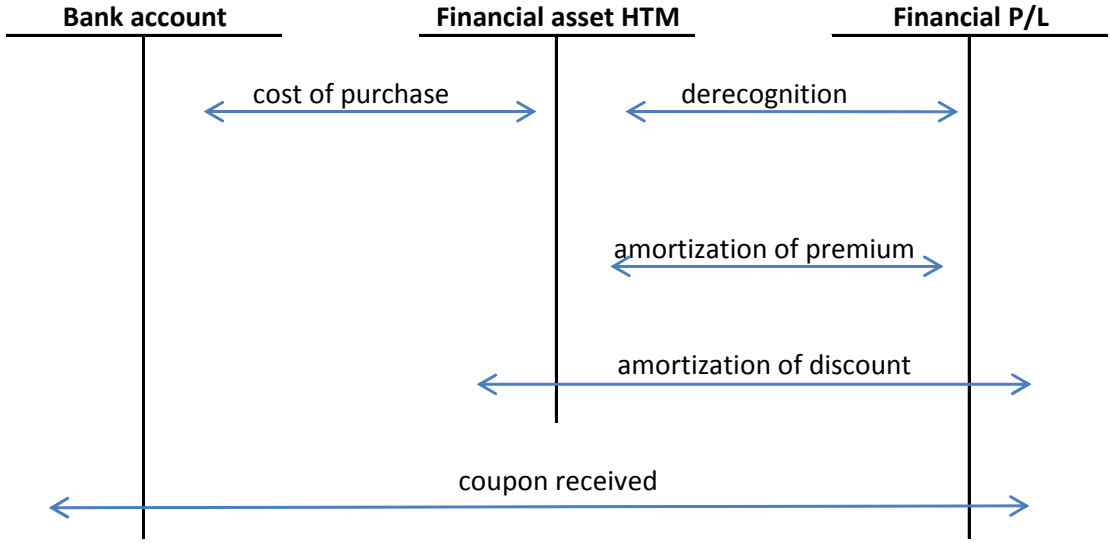
For calculation of effective interest rate, there are valid following relations:

| | | |
|---|---|---|
| $i_{ef} > c$ | IP < NV | amortization of discount |
| $i_{ef} = k$ | IP = NV | --- |
| $i_{ef} < c$ | IP > NV | amortization of premium |

where:

$c$ coupon rate

Accounting treatment for bonds held to maturity is presented within following scheme:




**EXAMPLE**

On 1st January 2011 entity purchased 5Y bond for its issue price 1,050,000 CU. Nominal value of this bond is 1,000,000 CU and the annual coupon (payable on 31st December) is 10 % p.a. Entity classifies this security as financial asset held to maturity (HTM portfolio).

*Calculation of the coupon*

$$coupon = coupon\ rate \cdot nominal\ value$$
$$coupon = 0.1 \cdot 1000000$$
$$\boldsymbol{coupon = 100{,}000\ CU}$$

*Calculation of the effective interest rate*

F1 | fx | 8,72373882758363%

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Year** | **Payments** | **Present value** | | **effective IR** | **8,7237%** |
| 2 | 1 | 100 000 | 91 976 | | nominal value | 1000000 |
| 3 | 2 | 100 000 | 84 596 | | coupon rate | 10% |
| 4 | 3 | 100 000 | 77 808 | | | |
| 5 | 4 | 100 000 | 71 565 | | | |
| 6 | 5 | 100 000 | 65 823 | | | |
| 7 | 5 | 1 000 000 | 658 231 | | | |
| 8 | | **TOTAL** | **1 050 000** | | | |

As you can see from the Excel calculation the effective interest rate of this bond is 8.724 %. This rate will be used for amortization of the premium.

*Amortization of premium*

| Date | Coupon | Profit based on effective interest rate | Amortization of premium | Book value of bond |
|---|---|---|---|---|
| 01.01.2011 | | | | 1,050,000 |
| 31.12.2011 | 100,000 | 91,599 | -8,401 | 1,041,599 |
| 31.12.2012 | 100,000 | 90,866 | -9,134 | 1,032,465 |
| 31.12.2013 | 100,000 | 90,070 | -9,930 | 1,022,535 |
| 31.12.2014 | 100,000 | 89,203 | -10,797 | 1,011,738 |
| 31.12.2015 | 100,000 | 88,262 | -11,738 | 1,000,000 |
| Methodology | coupon | $i_{ef} \times BVA_{t-1}$ | $profit - coupon$ | $BVA_{t-1} + amortization$ |

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of bond | 1,050,000 | Dr | | Bonds HTM (long-term) |
| | | 1,050,000 | | Cr | Bank Account |
| 2 | Coupon received (2011) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 3 | Amortization of premium (2011) | 8,401 | Dr | | E – Financial P/L |
| | | 8,401 | | Cr | Bonds HTM (long-term) |
| 4 | Coupon received (2012) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 5 | Amortization of premium (2012) | 9,134 | Dr | | E – Financial P/L |
| | | 9,134 | | Cr | Bonds HTM (long-term) |
| 6 | Coupon received (2013) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 7 | Amortization of premium (2013) | 9,930 | Dr | | E – Financial P/L |
| | | 9,930 | | Cr | Bonds HTM (long-term) |
| 8 | Coupon received (2014) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 9 | Amortization of premium (2014) | 10,797 | Dr | | E – Financial P/L |
| | | 10,797 | | Cr | Bonds HTM (long-term) |
| 10 | Reclassification | 1,011,738 | Dr | | Bond HTM (short-term) |
| | | 1,011,738 | | Cr | Bond HTM (long-term) |
| 11 | Coupon received (2015) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 12 | Amortization of premium (2015) | 11,738 | Dr | | E – Financial P/L |
| | | 11,738 | | Cr | Bonds HTM (short-term) |
| 13 | Settlement | 1,000,000 | Dr | | Bank Account |
| | | 1,000,000 | | Cr | Bond HTM (short-term) |

**Balance Sheet (changes 2011)**

| | | | |
|---|---|---|---|
| Bonds HTM (long-term) | 1,041,599 | Profit/loss | 91,599 |
| Bank Account | -950,000 | | |
| **Σ** | **91,599** | **Σ** | **91,599** |

**Balance Sheet (changes 2012)**

| | | | |
|---|---|---|---|
| Bonds HTM (long-term) | 1,032,465 | Retained Earnings | 91,599 |
| Bank Account | -850,000 | Profit/loss | 90,866 |
| **Σ** | **182,465** | **Σ** | **182,465** |

**Balance Sheet (changes 2013)**

| | | | |
|---|---|---|---|
| Bonds HTM (long-term) | 1,022,535 | Retained Earnings | 182,465 |
| Bank Account | -750,000 | Profit/loss | 90,070 |
| **Σ** | **272,535** | **Σ** | **272,535** |

**Balance Sheet (changes 2014)**

| | | | |
|---|---|---|---|
| Bonds HTM (short-term) | 1,011,738 | Retained Earnings | 272,535 |
| Bank Account | -650,000 | Profit/loss | 89,203 |
| **Σ** | **361,738** | **Σ** | **361,738** |

**Balance Sheet (changes 2015)**

| | | | |
|---|---|---|---|
| Bank Account | 450,000 | Retained Earnings | 361,738 |
| | | Profit/loss | 88,262 |
| **Σ** | **450,000** | **Σ** | **450,000** |

**EXAMPLE**

On 1st January 2011 entity purchased 5Y bond for its issue price 950,000 CU. Nominal value of this bond is 1,000,000 CU and the annual coupon (payable on 31st December) is 10 % p.a. Entity classifies this security as financial asset held to maturity (HTM portfolio).

*Calculation of the coupon*

$$coupon = coupon\ rate \cdot nominal\ value$$
$$coupon = 0.1 \cdot 1000000$$
$$\boldsymbol{coupon = 100,000\ CU}$$

*Calculation of the effective interest rate*

F1 | 11,3653056629422%

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Year** | **Payments** | **Present value** | | **effective IR** | **11,3653%** |
| 2 | 1 | 100 000 | 89 795 | | nominal value | 1000000 |
| 3 | 2 | 100 000 | 80 631 | | coupon rate | 10% |
| 4 | 3 | 100 000 | 72 402 | | | |
| 5 | 4 | 100 000 | 65 013 | | | |
| 6 | 5 | 100 000 | 58 378 | | | |
| 7 | 5 | 1 000 000 | 583 782 | | | |
| 8 | | **TOTAL** | **950 000** | | | |

As you can see from the Excel calculation the effective interest rate of this bond is 11.365 %. This rate will be used for amortization of the discount.

*Amortization of discount*

| **Date** | **Coupon** | **Profit based on effective interest rate** | **Amortization of discount** | **Book value of bond** |
|---|---|---|---|---|
| 01.01.2011 | | | | 950,000 |
| 31.12.2011 | 100,000 | 107,970 | 7,970 | 957,970 |
| 31.12.2012 | 100,000 | 108,876 | 8,876 | 966,846 |
| 31.12.2013 | 100,000 | 109,885 | 9,885 | 976,731 |
| 31.12.2014 | 100,000 | 111,009 | 11,009 | 987,740 |
| 31.12.2015 | 100,000 | 112,260 | 12,260 | 1,000,000 |
| Methodology | coupon | $i_{ef} \times BVA_{t-1}$ | $profit - coupon$ | $BVA_{t-1} + amortization$ |

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of bond | 950,000 | Dr | | Bonds HTM (long-term) |
| | | 950,000 | | Cr | Bank Account |
| 2 | Coupon received (2011) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 3 | Amortization of discount (2011) | 7,970 | Dr | | Bond HTM (long-term) |
| | | 7,970 | | Cr | R – Financial P/L |
| 4 | Coupon received (2012) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 5 | Amortization of discount (2012) | 8,876 | Dr | | Bond HTM (long-term) |
| | | 8,876 | | Cr | R – Financial P/L |
| 6 | Coupon received (2013) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 7 | Amortization of discount (2013) | 9,885 | Dr | | Bond HTM (long-term) |
| | | 9,885 | | Cr | R – Financial P/L |
| 8 | Coupon received (2014) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 9 | Amortization of discount (2014) | 11,009 | Dr | | Bond HTM (long-term) |
| | | 11,009 | | Cr | R – Financial P/L |
| 10 | Reclassification | 987,740 | Dr | | Bond HTM (short-term) |
| | | 987,740 | | Cr | Bond HTM (long-term) |
| 11 | Coupon received (2015) | 100,000 | Dr | | Bank Account |
| | | 100,000 | | Cr | R – Financial P/L |
| 12 | Amortization of discount (2015) | 12,260 | Dr | | Bond HTM (short-term) |
| | | 12,260 | | Cr | R – Financial P/L |
| 13 | Settlement | 1,000,000 | Dr | | Bank Account |
| | | 1,000,000 | | Cr | Bond HTM (short-term) |

**Balance Sheet (changes 2011)**

| | | | |
|---|---|---|---|
| Bonds HTM (long-term) | 957,970 | Profit/loss | 107,970 |
| Bank Account | -850,000 | | |
| **Σ** | **107,970** | **Σ** | **107,970** |

**Balance Sheet (changes 2012)**

| | | | |
|---|---|---|---|
| Bonds HTM (long-term) | 966,846 | Retained Earnings | 107,970 |
| Bank Account | -750,000 | Profit/loss | 108,876 |
| **Σ** | **216,846** | **Σ** | **216,846** |

**Balance Sheet (changes 2013)**

| | | | |
|---|---|---|---|
| Bonds HTM (long-term) | 976,731 | Retained Earnings | 216,846 |
| Bank Account | -650,000 | Profit/loss | 109,885 |
| **Σ** | **326,731** | **Σ** | **326,731** |

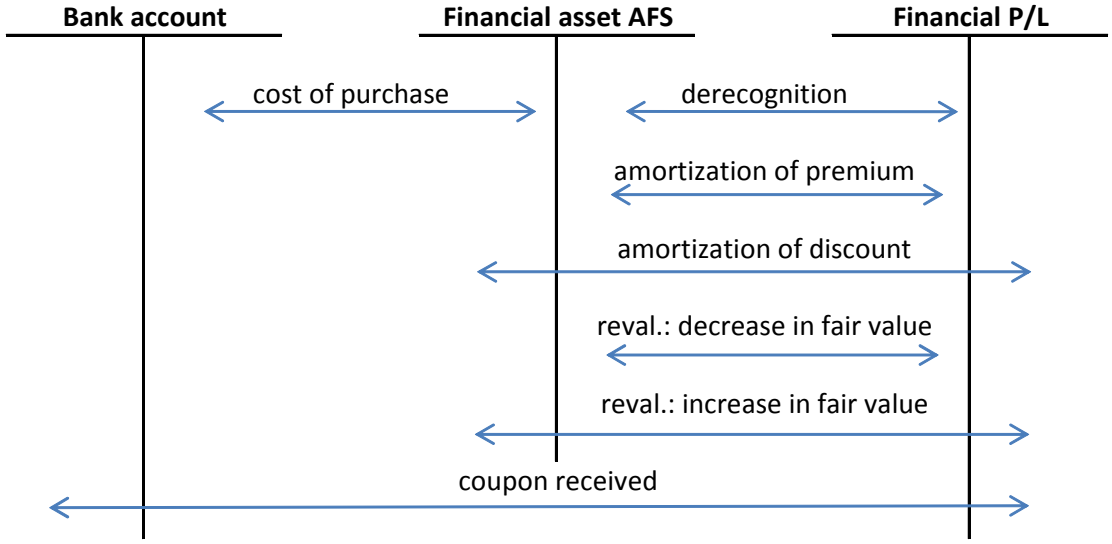
**Balance Sheet (changes 2014)**

| | | | |
|---|---|---|---|
| Bonds HTM (short-term) | 987,740 | Retained Earnings | 326,731 |
| Bank Account | -550,000 | Profit/loss | 111,009 |
| **Σ** | **437,740** | **Σ** | **437,740** |

**Balance Sheet (changes 2015)**

| | | | |
|---|---|---|---|
| Bank Account | 550,000 | Retained Earnings | 437,740 |
| | | Profit/loss | 112,260 |
| **Σ** | **550,000** | **Σ** | **550,000** |

Bonds might be also classified as a part of portfolio available-for sale. In such case their treatment is following:




There shall be also pointed out an attention on validity of tainting rule: "Where an entity sells or transfers more than an 'insignificant amount' of its held-to-maturity investments it must reclassify all of them as available-for-sale. It is then prohibited from classifying any assets as held-to-maturity for the next two full annual financial periods, until confidence in its intentions is restored."

# 4 Fair Value Measurement and Illiquid Markets

As we know from previous paragraphs selected portfolios of shares shall be revaluated at fair value. Fair value can be determined as a market price of shares or could be based on valuation models. Especially at less transparent markets shall be used these models. As common methods shall be stated:

- net asset value model,
- Price/Earnings ratio model,
- dividend discount model.

***Net asset value model***

This method is based on book values and the fair value is determined from the net asset value of the issuer. Fair value is calculated as follows:

$$fair\ value = \frac{Total\ assets - Liabilities}{number\ of\ shares} \qquad (2)$$

As a major limitation of this model shall be considered the absolute inconsistency of measurement bases where is applied both cost model as well as fair value approach. From the mathematical point of view it is the ratio of equity to number of issued shares.

**EXAMPLE**

Company A owns 500 shares of company B where has an influence of 5 %. From the Balance Sheet of company B you know that the net asset value is 25,000,000 CU. Calculate fair value of one share using net asset value model.

*Solution:*
*1 – quantification of issued shares:*

$$issued\ shares = \frac{shares\ owned}{percentage} \cdot 100$$
$$issued\ shares = \frac{500}{5} \cdot 100$$
$$\boldsymbol{issued\ shares = 10{,}000}$$

*2 – fair value calculation*

$$fair\ value = \frac{total\ assets - liabilities}{issued\ shares}$$
$$fair\ value = \frac{25{,}000{,}000}{10{,}000}$$
$$\boldsymbol{fair\ value = 2{,}500\ CU}$$

Fair value of one share is 2,500 CU.

***Price/Earnings ratio model***
This is a very popular method how to determine the fair value of shares. It is a product of earnings per share ratio and price/earnings ratio.

$$fair\ value = EPS \cdot P/E = \frac{Price}{Shares} \quad (3)$$

According to IFRSs it is required to present EPS ratio within the statement of comprehensive income. However there shall be stated following limitation of this model: (i) in certain markets it is not easy to find out P/E ratio value, and (ii) this model is not applicable in case that the valuated company reaches loss.

**EXAMPLE**
Company A owns shares of company B. Issuer realized net profit per share 275 CU. Average P/E in sector where company B operates, is 6. Calculate fair value of one share using P/E ratio model.

*Solution:*

$$fair\ value = EPS \cdot P/E$$
$$fair\ value = 275 \cdot 6$$
$$\boldsymbol{fair\ value = 1{,}650\ CU}$$

Fair value of one share is 1,650 CU.

***Dividend discount model***
Finally we have to mention Gordon's dividend discount model. In this case the fair value is calculated as a ratio between the estimated amount of dividends to required rate of return less growth rate of dividends. The calculation formula is following:

$$fair\ value = \frac{D_0(1+g)}{i-g} = \frac{D_1^e}{i-g} \quad (4)$$

where:

| | |
|---|---|
| $D_0$ | dividend per share for the previous accounting period |
| $D_1^e$ | estimated dividend per share for the current accounting period |
| $i$ | required rate of return |
| $g$ | growth rate of dividends |

As a major disadvantage of this model shall be stated the fact it cannot be applicable for those share issuers reaching loss and those who do not pay dividends.

**EXAMPLE**
Company expects dividend per share 30 CU. In last year dividend per share was 28.30 CU and your company operates with the rate of return 10 %. Calculate fair value of one share using dividend discount model.

*Solution:*
*1 – calculation of the growth rate of dividends:*

$$D_1 = D_0(1+g)$$
$$g = \frac{D_1}{D_0} - 1$$
$$g = \frac{30}{28.3} - 1$$
$$\boldsymbol{g = 0.06}$$

*2 – fair value calculation:*

$$fair\ value = \frac{D_1^e}{i-g}$$
$$fair\ value = \frac{30}{0.1 - 0.06}$$
$$\boldsymbol{fair\ value = 750\ CU}$$

Fair value of one share is 750 CU.

Within the next example we will summarize knowledge from all measurement models.

**EXAMPLE**
You have following information about the issuer of shares:

**Balance Sheet as at 31.12.2011**

| | | | |
|---|---|---|---|
| ***Non-current assets*** | ***120,000,000*** | ***Equity*** | ***105,000,000*** |
| Intangibles | 15,000,000 | Registered capital | 50,000,000 |
| Tangibles | 88,000,000 | Funds | 35,000,000 |
| Financial assets | 17,000,000 | Retained earnings | 8,000,000 |
| | | Profit/loss | 12,000,000 |
| ***Current assets*** | ***180,000,000*** | ***Liabilities*** | ***195,000,000*** |
| Inventories | 40,000,000 | Provisions | 9,800,000 |
| Receivables | 118,500,000 | Payables | 156,000,000 |
| Deferred assets | 1,500,000 | Deferred liabilities | 3,200,000 |
| Financial assets | 20,000,000 | Loans | 26,000,000 |
| **Σ** | **300,000,000** | **Σ** | **300,000,000** |

Furthermore you also know that:

| | |
|---|---|
| number of issued shares | 300,000 |
| P/E ratio for listed companies | 10 |
| requested rate of return | 12 % |
| total dividends (last period) | 8,653,850 CU |
| total dividends (current period – estimation) | 9,000,000 CU |

As this company is not listed you'll modify the P/E on 9 (less liquidity).
Calculate fair value of one share using all models.

*Solution:*
*1 – net asset value model*

$$fair\ value = \frac{total\ assets - liabilities}{issued\ shares}$$

$$fair\ value = \frac{300{,}000{,}000 - 195{,}000{,}000}{300{,}000}$$
$$\boldsymbol{fair\ value = 350\ CU}$$

Fair value of one share is 350 CU.

*2 – P/E ratio model*

$$fair\ value = EPS \cdot P/E$$
$$fair\ value = \frac{12{,}000{,}000}{300{,}000} \cdot 9$$
$$\boldsymbol{fair\ value = 360\ CU}$$

Fair value of one share is 360 CU.

*3 – dividend discount model*

*a – calculation of growth rate of dividends:*

$$DIV_1 = DIV_0(1 + g)$$
$$g = \frac{DIV_1}{DIV_0} - 1$$
$$g = \frac{9{,}000{,}000}{8{,}653{,}850} - 1$$
$$\boldsymbol{g = 0.04}$$

*b – fair value calculation*

$$fair\ value = \frac{D_1^e}{i - g}$$
$$fair\ value = \frac{\frac{9{,}000{,}000}{300{,}000}}{0.12 - 0.04}$$
$$\boldsymbol{fair\ value = 375\ CU}$$

Fair value of one share is 375 CU.

From the following calculations you can see that we have different results of fair value using different models. Therefore it is necessary to apply the consistency when measure fair value.

# Derivatives: Friends or Enemies?

## 1 Introduction

The world of derivatives uses to be considered as a mysterious, sometimes a little bit fantastic, world with many myths and legends. The reader of books or newspapers could find out some incredible derivative speculators with a few dollars in their pockets who are nowadays incredibly rich. However there shall be also mentioned big companies, funds or Nobel laureates who, despite their theoretical knowledge and famous reputation, loss incredible amounts. Derivative world is sometimes considered as a big market casino where all players risk much more than in extreme sports and believe that due to their economic (or just) knowledge and intuition survive against market and without great efforts reach unlimited profits.

The history of derivatives has been always associated with hedging of the corporate risks. The first derivatives were negotiated to hedge the agriculture production. As typical example may be stated a farmer selling the future contract on wheat and the miller who is willing to purchase this contract. Due to the negotiation of this contract both farmer and miller they have a certainty. Farmer has granted income, so he needn't to care about potential big harvest and logical decrease in price of wheat. Miller is protected against weak harvest, a lack of wheat and its increasing price. Of course historically these operations started to be standardized and traded at regulated markets.

Options used to be use even in ancient Greece, during the Middle Age has been used commodity options in Holland (options on tulips), England or in Florence. The fist information about the options has been mentioned in Hammurabi Code, a period over 3,800 years ago. According to § 48 of this Code, all people having losses due to the limited harvest needn't to pay interest for a period of one year.

First fixed term operations have been realized in 50s of 20$^{th}$ century. In the 70s became popular financial futures, i.e. purchases or sales of financial assets under currently negotiated conditions in the future. The volume of financial derivatives trades became much higher than the volume of commodity derivative trades.

Current evolution of derivative market as well as new derivative products was considered by companies as an opportunity how to minimise their risks. Typical example is the hedge of exchange rate risks. Exporting company is taking risk that the exchange rate will change to the disadvantageous direction. Therefore it will negotiate forward contract when the received amount of foreign currency will be transferred to domestic currency using negotiated exchange rate.

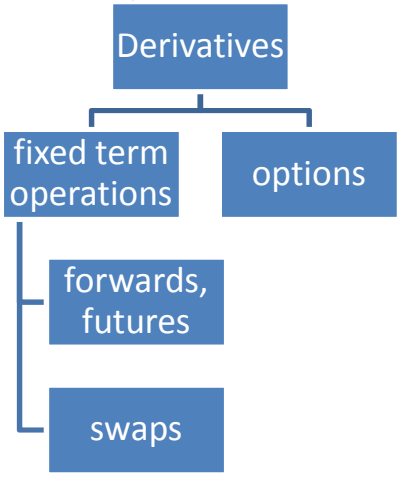
In 80s of 20$^{th}$ century there were also standardized interest rate derivatives. At that time companies started to hedge disadvantageous changes of interest rates.

From the accounting point of view, **derivative** is considered as a financial instrument or other contract with all three of the following characteristics:

- its value changes in response to the change in a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index, or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract ("underlying");
- it requires no initial net investment or an initial net investment that is smaller than would be required for other types of contracts that would be expected to have a similar response to changes in market factors; and
- it is settled at a future date.

Derivatives could be divided onto two major groups:

- fixed term operations (MUST – MUST)
  - forwards, futures, swaps
- option contracts (MAY – MUST)




When company negotiates a derivative contract it has take in mind following rule (which is obviously forgotten and the risk for company is incredibly high):

PROFIT OF ONE PARTY = LOSS OF OTHER PARTY

The company with which the accounting entity negotiates the derivative contract would like also to gain some profit (i.e. entity has to have loss).

**Derivatives and underlying instruments**

From this point of view, there could be stated following types of derivatives:

- interest rate derivative
- currency derivative
- equity derivative
- commodity derivative
- credit derivative

*Interest rate derivative* is a financial instrument consisting from two or more underlying interest rate instruments denominated in one currency and which fair value is not affected by the interest rate risk of some subject. As a most popular interest rate derivative is considered interest rate swap.

*Currency derivative* is a financial instrument consisting from two or more underlying interest rate instruments denominated at least in two currencies and which fair value is not affected by the interest rate risk of some subject. As a most popular interest rate derivatives are considered FX forward, cross-currency swap and FX option.

*Equity derivative* is a financial instrument consisting from at least one underlying equity instrument, eventually also from one or more underlying interest rate instruments (but not commodity instrument) and which fair value is not affected by the interest rate risk of some subject.

*Commodity derivative* is a financial instrument consisting from at least one underlying commodity instrument, eventually also from one or more underlying interest rate or equity instruments and which fair value is not affected by the interest rate risk of some subject.

*Credit derivative* is a financial instrument consisting from two or more underlying interest rate instruments, eventually also from one or more equity or commodity instruments and which fair value is affected by the interest rate risk of some subject.

| Type of contract | Underlying variable |
|---|---|
| interest rate swap | interest rates |
| currency swap (FX swap) | currency rates |
| commodity swap | commodity prices |
| equity swap | equity prices (equity of another entity) |
| credit swap | credit rating, credit index or credit price |
| total return swap | total fair value of the reference asset and interest rates |
| purchased or written treasury bond option (call or put) | interest rates |
| purchased or written currency option (call or put) | currency rates |
| purchased or written commodity option (call or put) | commodity prices |
| purchased or written stock option (call or put) | equity prices (equity of another entity) |
| interest rate futures linked to government debt (treasury futures) | interest rates |
| currency futures | currency rates |
| commodity futures | commodity prices |
| interest rate forward linked to government debt (treasury forward) | interest rates |
| currency forward | currency rates |
| commodity forward | commodity prices |
| equity forward | equity prices (equity of another entity) |

Entities can take following two positions: (i) long, or (ii) short.
*Long position* means a situation where accounting entity purchased some financial instruments throughout a derivative contract and the settlement will be made in the future.
*Short position* means a situation where accounting entity sold some financial instrument throughout a derivative contract and the settlement will be made in the future.

According to the reason of derivative negotiation we can distinguish following types:

- derivatives of market makers,
- derivatives for the hedging purposes,
- speculative derivatives,
- derivatives as a form of remuneration,
- fraud derivatives.

From the accounting point of view it is interesting the difference between hedging and speculative derivatives. According to international rules as hedging derivative is considered only derivative where is applied hedge accounting rules. All other derivatives are understood as derivatives held for trading.

The use of derivative contracts is related to the elimination of following types of risks:

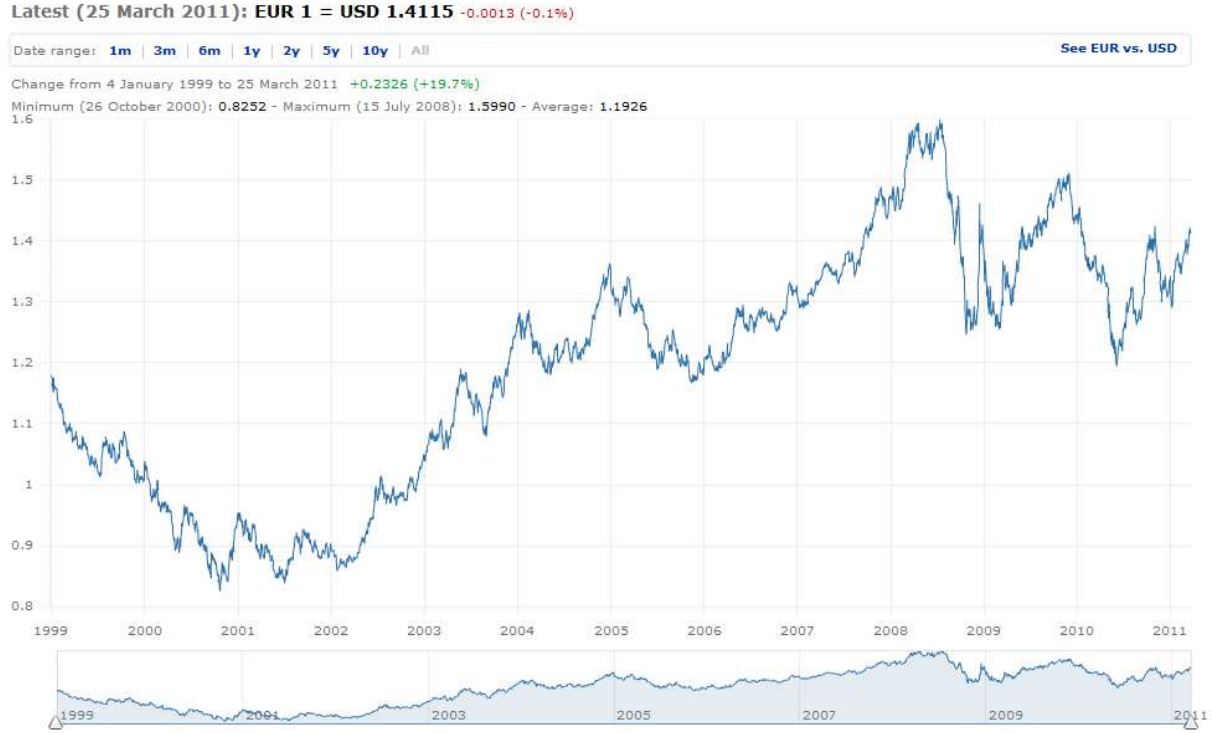
- market risk,
- credit risk, and
- liquidity risk

As a *market risk* is considered as a risk that the change in fair value of future cash flows from financial instruments will change due to the changes in market price. The market risk could be divided onto exchange rate risk, interest rate risk and other price risk.
As *liquidity risk* is considered as a risk that the company could have some problems in payments of its financial liabilities.
*Credit risk* is considered as a risk that one party of financial instrument will cause a financial loss to another

party by non-fulfilment of its liability.
According to IFRS 7 Financial instruments: Disclosures, accounting units shall present in the Notes sensitivity analysis for the area of market risks [126].

***Exchange rate risk***
Exchange rate risk is a risk that the fair value of future cash flows from financial instruments will change due to the volatility of exchange rate. Figure 19 shows the evolution of exchange rate between EUR and USD.

***Figure 19.*** Evolution of EUR/USD exchange rate (1999 - 2011)




Source: [43]

Among popular exchange rate derivatives shall be stated FX forward and FX option.

**EXAMPLE**
Your company has a liability of 100,000 FCU payable at the end of third month. You are considered as an important customer and therefore you are offered a discount of 3 % in case that you'll pay this liability within one month.
Your CFO is aware of the appreciation of FCU against DCU and therefore is wondering about the hedge against the possible movement of exchange rate throughout the negotiation of forward contract. Bank offers him following alternatives:

| **Purchase of FCU at the end of** | **Forward rate** |
|---|---|
| first month | 25.20 DCU/FCU |
| third month | 25.50 DCU/FCU |

For the calculation consider the rate of return 12 %.

Prepare for your CFO documents for his final decision and consider following variants:

- variant A
  - immediate purchase of FCU for a spot rate 25 DCU/FCU. The amount will be saved in bank at the account with interest 2 % p.a. You will pay your liability at the end of the third month.
- variant B
  - negotiation of the forward contract with the purchase of FCU at the end of the first month. At the very same time your company will settle the liability, so the discount of 3 % will be applied.
- variant C
  - negotiation of the forward contract with the purchase of FCU at the end of the first month. The amount will be saved in bank at the account with interest 2 % p.a. You will pay your liability at the end of third month.
- variant D
  - negotiation of the forward contract with the purchase of FCU at the end of the third month. At the very same time your company will settle the liability.

Which alternative would you recommend to your CFO as a most advantageous, i.e. associated with the lowest costs?

*Solution:*
*1 – variant A*
*A1 – calculation of the amount of FCU to be purchased and saved in bank*

$$x\left(1+\frac{i}{12}\cdot m\right)=liability$$
$$x\left(1+\frac{0.02}{12}\cdot 3\right)=100000$$
$$\boldsymbol{x=99\,502\ FCU}$$
$$\boldsymbol{99502\cdot 25=2\,487\,550\ DCU}$$

*A2 – cost of variant A*

$$cost=purchased\ FCU_{in\ DCU}\left(1+\frac{i_c}{12}\cdot m\right)$$
$$cost=2{,}487{,}550\left(1+\frac{0.12}{12}\cdot 3\right)$$
$$\boldsymbol{cost=2{,}562{,}177\ DCU}$$

Costs associated with realization of variant A at the end of the third month will be 2,562,177 DCU.

*2 – variant B*
*B1 – accounts payable after discount*

$$AP\ less\ discount=liability(1-discount)$$
$$AP\ less\ discount=100{,}000(1-0.03)$$
$$\boldsymbol{AP\ less\ discount=97{,}000\ FCU}$$
$$\boldsymbol{97{,}000\cdot 25.2=2{,}444{,}400\ DCU}$$

*B2 – cost of variant B*

$$cost=purchased\ FCU_{in\ DCU}\left(1+\frac{i_c}{12}\cdot m\right)$$
$$cost=2{,}444{,}400\left(1+\frac{0.12}{12}\cdot 2\right)$$
$$\boldsymbol{cost=2{,}493{,}288\ DCU}$$

Costs associated with realization of variant B at the end of third month will be 2,493,288 DCU.

*3 – variant C*
*C1 – calculation of the amount of FCU to be purchased and saved in bank*

$$x\left(1+\frac{i}{12}\cdot m\right)=liability$$
$$x\left(1+\frac{0.02}{12}\cdot 2\right)=100{,}000$$
$$\boldsymbol{x=99{,}668\ FCU}$$
$$\boldsymbol{99{,}668\cdot 25.20=2{,}511{,}634\ DCU}$$

*C2 – cost of variant C*

$$cost=purchased\ FCU_{in\ DCU}\left(1+\frac{i_c}{12}\cdot m\right)$$
$$cost=2{,}511{,}634\left(1+\frac{0.12}{12}\cdot 2\right)$$
$$\boldsymbol{cost=2{,}561{,}867\ DCU}$$

Costs associated with realization of variant C at the end of third month will be 2,561,867 DCU.

*4 – cost of variant D*

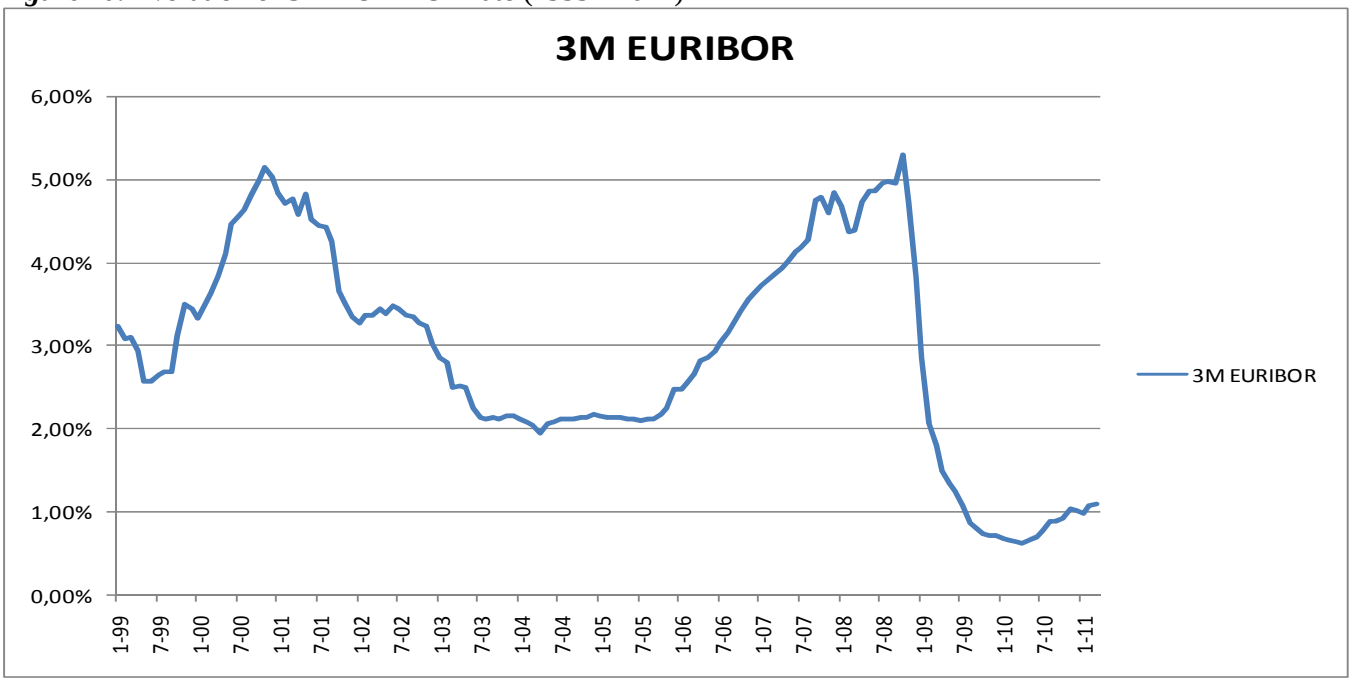
$$cost=liability\cdot forward\ rate$$
$$cost=100{,}000\cdot 25.5$$
$$\boldsymbol{cost=2{,}550{,}000\ DCU}$$

Costs associated with realization of variant D at the end of third month will be 2,550,000 DCU.

*Final decision*
From the above mentioned calculation seems to be most advantageous variant B.

***Interest rate risk***
Interest rate risk is considered as a risk that the fair value of future cash flows from the financial instrument will fluctuate due to changes in market interest rates. Following figure shows the evolution of 3M EURIBOR rate:

***Figure 20.*** Evolution of 3M EURIBOR rate (1999 - 2011)




Source: [133]; own analysis

Among popular interest rate derivatives shall be stated interest rate swap and cross-currency swap.

***Other price risk***
It is considered as a risk that the fair value of future cash flows from financial instrument will fluctuate due to the changes of market prices (not caused by change in interest rates or exchange rates).

## 1.1 Some Brief Review on Derivatives Trading and Reporting

Financial sector liberalization is considered to be the aim for all industrialized countries, the exact moment of it happening still depending actually on the legacy of controls from the 1930s and from World War II which were active for a long time (France ended capital control by the late '80, while even United Kingdom reached this goal in the early '80).

All these current realities lead both to a higher efficiency of the financial sector and higher vulnerability and therefore concerns towards potential risks within the international financial system. Massive numbers expressing the nominal value of derivative financial instruments raise fears concerning financial crisis which could occur, but it is still the derivatives that made it possible for the risks to be separated from their original context by shifting them the ones most willing to assume them. The main concern regarding derivatives is that the risks that are passed on through derivative contracts may be inappropriately placed and not adequately recognized. One possibility would be in the case when the risks move from people who understand them to those who don't. It is not to neglect that risks may be moving from places which are forced to mark to market to places which are not forced to mark to market, because many participants in financial markets prefer to retain the capacity to smooth their revenues and profits, these leading to information asymmetry issues. Statistics released by the Bank for International Settlements show that approximately 93% of total derivatives outstanding as of 31 December 2006 are OTC derivatives. As an old adage has it, whenever competitive conditions are altered, new windows of opportunity open up, market niches grow in dimensions and the more agile companies refocus their plans to take advantage of the innovation.

Data published within a study of the World Federation of Exchanges show a new historic record of 11.6 billion derivative contracts being transacted in 2006 on exchanges worldwide, with 5.0 billion futures and 6.6 billion options traded, this increase in derivatives markets activity confirming their continuing growth over recent years. Considering the period between 2002 and 2006, the average annual growth rate of the number of traded contracts reached 14% for options and 22% for futures.

[76] found that the average trading turnover is related to a firm's characteristics, such as expected stock return and market capitalization while examining the implication of portfolio theory for the cross-sectional behaviour of equity trading volume. Moreover [75] have focused on the implication of trading volume in an Intertemporal Capital Asset Pricing Model (ICAPM) framework showing that a hedging portfolio constructed on individual stock trading volumes consistently outperforms other predictors of future returns on a market portfolio, this hinting that trading volume contains valuable information that can be used to predict future market returns. [47] have examined daily data for stocks traded on the New York Stock Exchange over a period of 34 years (1963-1996) finding that extreme trading activity contains significant information about the future evolution of stock prices, more precisely that stocks experiencing unusually high (low) trading volumes over a day or a week tend to appreciate (depreciate) over the course of the following month. Their explanation attributing the high-volume return premium to the stock's publicity caused by extreme trading activity in a given stock is supported by earlier studies, such as [7, 31, 32, 70, 83, 86, 88].

[73] performed a survey on emerging derivatives markets concluding that both commodity and financial derivatives markets have grown in emerging market economies over the past few years, though the sizes of the markets are relatively small compared to those of matured economies. Both theoretical and empirical researches which have addressed the role of derivatives markets in emerging market economies showed that commodity derivatives markets offer a more effective and welfare-improving method to deal with price

volatility and that derivatives markets had their contribution in supporting capital inflows into these economies. These doesn't mean that using financial derivatives does not have its negative effects, such as leading to exacerbated volatility and accelerated capital outflow, seldom causing financial crisis but having the potential to amplify their negative effects and to accelerate contagion. [73] also stress that the underlying reasons for the negative effects are associated with the leverage nature of derivatives transactions, nontransparent reporting of transaction risks, and unsophisticated or insufficient risk management controls in financial institutions, as well as weak prudential supervision. Their conclusion concerning the constructive development of derivatives markets in emerging market economies is that it needs to be supported by sound macroeconomic fundamentals and updated financial policies and regulations and that there is no uniform optimal development strategy that countries can adopt to sequence or structure their markets; gradual development schemes accounting for dynamics in different markets being encouraged.

[33] model and exploit the bursty nature of interest-rate volatility in trying to understand the effect of uncertain and changing volatility on rate-sensitive derivative instruments. [72] examine whether bonds and interest rate derivatives are driven by the same set of risk factors, their results strongly suggesting the existence of systematic unspanned factors related to stochastic volatility in interest rate derivatives markets. [113] provide an accessible description and several examples of how to use Monte-Carlo simulation to value interest rate derivatives when the short rate follows an arbitrary time series process.

[23] provide evidence on the relation between the board of directors and the firm's decision to use interest rate derivatives. Since the capital structure decision and hedging decision are considered to be endogenous they have modelled the firm's capital structure and its interest rate derivative decisions simultaneously. After the losses suffered by several prominent entities in the early '90 greater risk-management oversight was required by firms. If different incentives to managing risk exist between management and shareholders, then conflict situations might appear and moreover the outside members of the board of directors are expected to work in the best interests of the shareholders. [29] prove that the decision of using interest rate derivates is being influenced by boards of directors and that the decision varies with the composition of the board. A significant and positive relation was found to exist between the quantity of interest rate derivative use and the relative influence of outside directors. On average, corporate interest rate derivative use was proven to benefit shareholders, while there was no evidence for the managers' benefits.

Another interesting issue concerns the way investors evaluate managers in accordance to their option towards using or not derivatives, as soon as the outcomes of their decision is available, different theories offering different predictions. [68] find that investors are more satisfied with firm managers and assign a higher value to firms when managers use derivatives (that address firm risks) than when they do not. Their study also stresses the idea that investors believe that managers who use derivatives in these situations exhibit a higher level of decision-making care than those who do not use derivatives. Moreover they have documented that these inferences about greater decision-making care do not apply to the speculative use of derivatives.

[103] analysis the holdings of derivatives contracts in the UK general insurance industry by using data for a period of 9 years (1994-2002). The study focuses on the relationship between the usage and insurer organizational characteristics, finding that a general insurer's size, liquidity, interest rate risk exposure, line of business concentration and organizational form are important factors associated with the decision to employ derivatives. The use of derivatives in the general insurance industry was found to be limited and with a downward trend.

## 1.2 Synthetic, Structured and Other Complex Financial Instruments

Delimitating synthetic and structured instruments is difficult to do, because they are both very similar, as some experts consider. However, this is not the general opinion within trade literature [29]. According to the international accounting referential (IFRS) a synthetic instrument is a financial product that is purchased and owed so as to rival another instrument, especially by imitating it.

A good example for this matter is granting a long-term loan with a variable interest rate, combined with a swap

contract on the interest rate, this implying cashing in variable payments and realizing fixed payments, thus synthesizing a long term loan with a fixed interest rate.

Alternatively, a synthetic instrument can be created through the means of a certificate, which grants a right on the basis of a number of underlying assets or on the diversification of a range of risk factors. The main types of this kind are: index certificates, regional certificates and certificates based on a securities basket/portfolio. Relying on an official index, index certificates have the quality of reflecting the behavior of a specific market. Regional certificates are derived on the base of indexes or companies from a specific region, usually from emerging economies. Basket/portfolio certificates are created based on a selection of active companies from a specific industrial sector.

Within the financial market, there are other kinds of financial instruments, such as hybrid financial instruments, which are most common known as loan products with an embedded conversion option.

Examples of compound financial instruments are bonds convertible into ordinary shares of the issuer.

As one can deduce from their name, compound derivatives are financial instruments that, according to their contract, contain components that can be separately classified as financial debts, financial assets or equity instruments, at the same time respecting the afferent definitions [59].

Embedded derivatives represent also an interesting case, because they allow the possibility that some contracts may not be themselves financial instruments, but may still have financial instruments embedded in them.

An example would be an acquisition contract of goods at a fixed price with the purpose of their future delivery. These types of contracts have embedded in them a derivative that is indexed in the price of the goods, representing in essence, a type of derivative in a contract that is not itself a derivative financial instrument.

The embedded derivative is, in fact, a component of a hybrid derivative that includes a non- derivative host - contract, its effect being that the variations of certain cash flows generated by the hybrid instrument is similar to the one of a stand-alone derivative. An embedded derivative generates some or all cash-flows for which, on other occasions, the modifications of their value in relation to a certain variable (such as the interest rate, the price of the financial instrument, the price of the goods, exchange rate, price index or rate index) would be stipulated in contract, under the condition that, in the case of a non-financial variable, it (that variable) would not be specific to neither of the contractual parties [59]. The American accounting referential defines embedded derivatives as being contractual terms - explicit or implicit - that affect cash-flows or values of other changes imposed by contract in a similar manner to a derivative (one or many underlying assets can affect cash-flows or changes) [41].

Under certain conditions, it is necessary for an embedded derivative to be separated by the host contract, and separately accounted for as a derivative by both contracting parties. The intended purpose is that the entities should not have the opportunity to avoid certain legal provisions that aim recognition and measurement by incorporating a derivative in other contracts. Likewise, there also are compound instruments that have already been used for some time, in their case the derivative component having a strong connection to the host contract, a separation being therefore unnecessary.

As it is expected, in the case of synthetic instruments, both the US GAAP and the IFRS, include clauses whose purpose is to standardize the accounting practices of this category. The international accounting referential specifies the fact that each individually derived instrument - derivative which together with others make up a synthetic product - represents a contractual right or obligation, having its own terms and conditions. Under these circumstances, each individually derived financial instrument can be transferred or settled separately and is also the subject of risks that can differ from the risks of others comprised in the synthetic instrument. What matters in this case is the fact that when a financial product belonging to a synthetic instrument is a financial asset, and other is a financial debt, there is no compensation between them.

Structured financial products, like synthetic ones, belong to the category of derivatives, many of them being personalized bonds, some of them generating throughout time a series of problematic aspects for their buyers and owners [29], especially in the case of investors that are not skillful enough to use modern and complex instruments or are not aware of their future impact.

> For example, in the case of owning a structured note, instead of benefitting from a fixed coupon, the investor in cause will receive a sum calculated according to a pretty sophisticated formula.

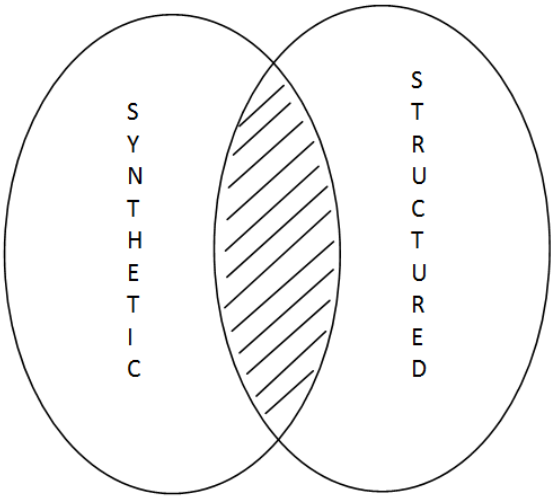
Despite the fact that structured instruments lack in transparency, the market seems to demonstrate an acute appetite for this type of products. This reality is proven by the sums that were invested in structured notes - which in 2008 totalized a trillion dollars, and were on an ascending trend [29] - and by the market of swap credit contracts - which reached 54,6 trillions of dollars - given that the global GDP in 2007 was 54,3 trillion dollars according to World Bank data. Not to mention the Collateralized Debt Obligations (or more precisely Mortgage Backed Collateralized Debt Obligations) that were highly demanded for, right before the effects of the recent financial crisis became visible.

The irony associated to these types of products is that, when they are acquired, an investor with a medium know-how does not have yet a clear image regarding the fact that he practically bets against the future evolution of yield curves that tend to rise, but which can also drop or remain flat. It is a well-known fact that the yield curves behaviour cannot be controlled by investors.

On the other hand, the great advantages of structured products rely in the fact that they can be used by sophisticated investors in their attempt to optimize certain portfolios or transaction risks. Although, should we quantify the degree of exposure to the associated risks of using structured products, there is the tendency to conclude that trading instruments with a flexible structure is not something to be done by investors that do not have the capacity to comprehend the behavior of their intrinsic values, or by investors that are not financially capable to handle the risks imposed by the worst case scenario.

Having observed the characteristics of synthetic and structured derivatives, it is our opinion that a synthetic derivative can be a structured one and vice-versa - without mutually conditioning - while the reality of the financial markets generating many occasions on which the two concepts meet in the same derivative, as the following figure suggests:

***Figure 21***. Synthetic and structured derivatives




Source: authors' projection

# 2 Fixed-Term Operations

## 2.1 Forwards and Futures

**Futures contract** could be simply defined as an agreement of two parties to buy/sell some standardized amount of commodity at a predefined quality in the future. Futures contract can be traded on the exchanges only. It is a fixed-term operation when at the defined time has one party the obligation to buy and another party the obligation to sell. During the settlement of this contract there is used a clearing centre who guaranties the settlement (what's done on a daily basis).

Forward contracts are very similar to futures contract. Again, it is an agreement between two parties to buy/sell some standardized amount of underlying asset in the futures at an agreed price. Unlike futures contracts, forward contracts are not traded on the exchanges and therefore they are not standardized. Forward is an over-the-counter (OTC) agreement between financial institutions or financial institution and client.

The comparison of futures and forward contracts is provided within following table:

| Forwards | Futures |
|---|---|
| negotiated individually | traded on regulated markets |
| non-standardized contracts | standardized contracts |
| parties know each other | parties do not know each other |
| settlement upon date of expiration | daily settlement and revaluation |

In case that the object of the contract is the exchange of fixed amount of cash in one currency for as yet unknown amount of cash or debt security, loan or investment loan in the same currency, it is a interest rate forward. We could also exchange the fixed amount of cash in one currency for fixed amount of case in another currency (currency forward), for equity instrument (equity forward) or for commodity instrument (commodity forward).

Forwards are obviously negotiated to hedge the fixed purchase or sale price for such asset (e.g. share, commodity, exchange rate, interest rates), to avoid unexpected changes in market conditions.

**FX forward**

FX forward is an agreement between two parties to exchange fixed amount of cash in one currency (DCU – domestic currency unit) for a fixed amount of cash in another currency (FCU – foreign currency unit) at a fixed exchange rate and the predetermined future date. The agreed fixed exchange rate is called the forward exchange rate. It could be calculated as follows:

$$FX = SR\frac{1 + i_D \frac{t}{360}}{1 + i_F \frac{t}{360}} \tag{5}$$

where:

- $i_D$ domestic interest rate
- $i_F$ foreign interest rate
- $t$ time to expiration (in days)
- $FX$ negotiated forward exchange rate
- $SR$ spot exchange rate

**EXAMPLE**
Calculate the forward rate if you know following details:

- current spot rate 25.15 DCU/FCU
- domestic interest rate 1.6 % p.a.
- foreign interest rate 1.8 % p.a.
- time to maturity 6 months

You would like to purchase 100,000 FCU. Calculate your profit in case that the spot rate at the settlement date will be:

- 25.10 DCU/FCU
- 25.15 DCU/FCU
- 25.20 DCU/FCU

*Solution:*
*1 – calculation of the forward rate*

$$FX = SR\frac{1 + i_D\frac{t}{360}}{1 + i_F\frac{t}{360}}$$

$$FX = 25.15 \cdot \frac{1 + 0.016 \cdot \frac{180}{360}}{1 + 0.018 \cdot \frac{180}{360}}$$

$$\boldsymbol{FX = 25.125\ DCU/FCU}$$

You will be offered a forward rate 25.125 DCU/FCU.

*2 – calculation of the profit*
*a – exchange rate at the settlement day will be 25.10 DCU/FCU*

$$loss = (SR - FX) \cdot volume$$

$$loss = (25.10 - 25.125) \cdot 100{,}000$$

$$\boldsymbol{loss = -2.500\ DCU}$$

Company will realize a loss of 2,500 DCU.

*b – exchange rate at the settlement day will be 25.15 DCU/FCU*

$$profit = (SR - FX) \cdot volume$$

$$profit = (25.15 - 25.125) \cdot 100{,}000$$

$$\boldsymbol{profit = 2{,}500\ DCU}$$

Company will realize a profit of 2,500 DCU.

*c – exchange rate at the settlement day will be 25.20 DCU/FCU*

$$profit = (SR - FX) \cdot volume$$

$$profit = (25.2 - 25.125) \cdot 100{,}000$$

$$\boldsymbol{profit = 7{,}500\ DCU}$$

Company will realize a profit of 7,500 DCU.

**Interest rate forward / Forward Rate Agreement**
First forward rate agreement (FRA) was negotiated in 1984 in Switzerland. FRA contract is an agreement between two parties to exchange fixed amount of cash in one currency for as yet unknown amount of cash derived from referential interest rate at the predetermined future date. Unlike other types of forward contracts, FRAs are characterized by the fact that there is expected net cash settlement, i.e. net difference between agreed and referential interest rate on the revaluation date.

For the determination of FRA value play an important role following data:

- date of FRA contract negotiation,
- date of fixing of a float interest rate,
- settlement date.

**Equity forward**

If the company worries about the market price of shares which would like to purchase, it can negotiate equity forward. It is an agreement about the exchange of the fixed amount of cash for share at the predetermined future date for a negotiated price. The negotiated price is called the forward price.

**Commodity forward**

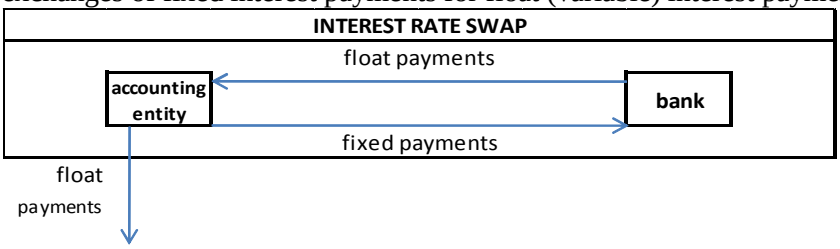
Commodity forwards are popular not only among farmers. It is an agreement about the exchange of the fixed amount of cash for the forward delivery of commodity at the predetermined future date for a negotiated price. The negotiated price is called the forward price.

## 2.2 Swaps

Swap is considered as an OTC contract of exchange underlying assets at the predefined dates in the future, i.e. it is a series of several forwards with gradual exchange of underlying assets. There could be exchanged fixed amounts of cash in one currency for currently unknown amount of cash in very same currency (interest rate swap, credit swap); exchange of cash in one currency for cash in another currency (currency swap), for equity instruments (equity swap), or for commodity instruments (commodity swap).

**Interest rate swap**

The most important type of swap is a "plain vanilla" interest rate swap (IRS). Company B agrees with company A that will pay a cash flow linked to fixed rate for a certain period of time. Simultaneously company A will pay a cash flow linked to float rate for a certain period of time to company B at the very same frequencies. The contract is based on exchanges of fixed interest payments for float (variable) interest payments.




Fair value of interest rate swap might be determined as follows:

$$fair\ value = receivable - liability \tag{6}$$

$$receivable = \frac{\frac{i_{FLOAT}}{m}NV}{\left(1+i_{0,1}\right)^{\frac{t_1}{360}}} + \frac{\frac{i_{1,2}}{m}NV}{\left(1+i_{0,2}\right)^{\frac{t_2}{360}}} + \cdots + \frac{\left(1+\frac{i_{n-1,n}}{m}\right)NV}{\left(1+i_{0,n}\right)^{\frac{t_n}{360}}}$$

$$liability = \frac{\frac{i_{FIX}}{m}NV}{\left(1+i_{0,1}\right)^{\frac{t_1}{360}}} + \frac{\frac{i_{FIX}}{m}NV}{\left(1+i_{0,2}\right)^{\frac{t_2}{360}}} + \cdots + \frac{\left(1+\frac{i_{FIX}}{m}\right)NV}{\left(1+i_{0,n}\right)^{\frac{t_n}{360}}}$$

where:

| | |
|---|---|
| $NV$ | nominal value of the contract |
| $m$ | frequency of coupon payments |
| $t_0$ | due date of previous coupon payment (in days) |
| $t_1$ | due date of first coupon payment (in days) |
| $t_2$ | due date of second coupon payment (in days) |
| $t_n$ | due date of the last coupon payment (in days) |

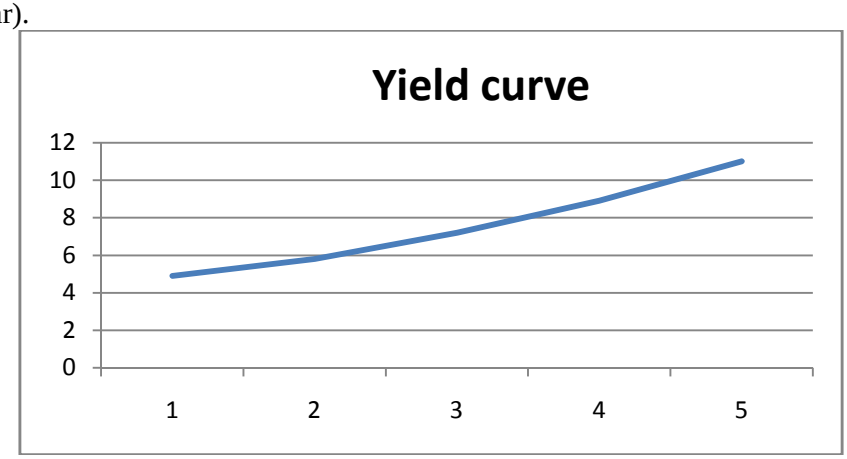
| | |
|---|---|
| $i_{FLOAT}$ | fixed float interest rate for the first period |
| $i_{FIX}$ | fixed interest rate |
| $i_{0,1}$ | actual spot interest rate for maturity $t_1$ |
| $i_{0,2}$ | actual spot interest rate for maturity $t_2$ |
| $i_{0,n}$ | actual spot interest rate for maturity $t_n$ |
| $i_{1,2}$ | forward interest rate for maturity $t_2$ |
| $i_{n-1,n}$ | forward interest rate for maturity $t_n$ |

Forward interest rates could be calculated as follows (based on interpolation method):

$$\left(1+i_{0,1}\right)^{\frac{t_1}{360}}\left(1+i_{1,2}\right)=\left(1+i_{0,2}\right)^{\frac{t_2}{360}} \quad (7)$$

$$\left(1+i_{0,2}\right)^{\frac{t_2}{360}}\left(1+i_{2,3}\right)=\left(1+i_{0,3}\right)^{\frac{t_3}{360}} \quad (8)$$

As you can see, for the calculation are used **yield curves**. Yield curve is a graphically expressed time structure of bond rates based on their maturity. It is a dependence of the yield to maturity on the time to maturity of bond. The most frequent yield curves in common practice are based on treasury bonds. Typically there are constructed yield curves for cash market (maturities up to one year) as well as for bond market (maturities longer than one year).




The shape of yield curve is described in three theoretical concepts:

- ***net expectations theory***
  - spot yield curve fully reflects the market expectation about the future evolution of interest rates on full length of the yield curve. Rising curves predict the increase of interest rates in the future; declining curves predict the decrease in rates. It is a very popular theory because of a simplicity of calculation:

$$\left(1+i_{0,2}\right)^2=\left(1+i_{0,1}\right)\left(1+i_{1,2}\right) \quad (9)$$

- ***theory of preferred market segments***
  - this theory explains a positive shape of yield curve by the fact that various investors prefer various maturity, however obviously shorter times to maturity. Higher demand for short-term bonds means their higher price, but lower yield.
- ***theory of liquidity preference***
  - based on this theory the long-term bonds are linked to higher risk for investors and therefore the investor has to benefit from higher yield linked to such bonds

Financial managers have to examine the current shape of the yield curve when they decide about the terms of loans or deposits, as from the shape of the yield curve could be seen the market expectations about future movements of interest rates. Sharply rising yield curve means the increase of interest rates in the future. Manager would like to avoid variable interest rates of long-term loans as the interest rates could be

substantially higher. Therefore the short-term loan with variable interest rate or long-term loan with fixed interest rate could be considered as much better solution.

**EXAMPLE**

Company has negotiated 4-year interest rate swap with annual settlement – company pays fixed payments and receive float payments. Nominal value of swap is 1,000,000 CU. Swap has been negotiated on 1.7.2011 and settlement dates are following: 30.6.2012, 30.6.2013, 30.6.2014 and 30.6.2015. Fixed coupon is 3.6 % p.a., for the first payment the float coupon rate is fixed on 3.25 %. The information about spot interest rates could be seen from following table:

| **Interest rate** | |
|---|---|
| $i_{0,1}$ | 3.40 % |
| $i_{0,2}$ | 3.50 % |
| $i_{0,3}$ | 3.60 % |
| $i_{0,4}$ | 3.70 % |

Calculate the fair value of interest rate swap as at 31st December 2011.

*Solution:*

*1 – Calculation of days*

| | **Due date** | **Days** | **30/360** |
|---|---|---|---|
| $t_1$ | 30.6.2012 | 180 | 0.5 |
| $t_2$ | 30.6.2013 | 540 | 1.5 |
| $t_3$ | 30.6.2014 | 900 | 2.5 |
| $t_4$ | 30.6.2015 | 1,260 | 3.5 |

*2 – Determination of forward interest rates:*

$$\left(1+i_{0,1}\right)^{\frac{t_1}{360}}\left(1+i_{1,2}\right)=\left(1+i_{0,2}\right)^{\frac{t_2}{360}}$$

$$i_{1,2}=\frac{\left(1+i_{0,2}\right)^{\frac{t_2}{360}}}{\left(1+i_{0,1}\right)^{\frac{t_1}{360}}}-1$$

$$i_{1,2}=\frac{(1+0.035)^{\frac{540}{360}}}{(1+0.034)^{\frac{180}{360}}}-1$$

$$\boldsymbol{i_{1,2}=3.55\ \%}$$

$$i_{2,3}=\frac{\left(1+i_{0,3}\right)^{\frac{t_3}{360}}}{\left(1+i_{0,2}\right)^{\frac{t_2}{360}}}-1$$

$$i_{2,3}=\frac{(1+0.036)^{\frac{900}{360}}}{(1+0.035)^{\frac{540}{360}}}-1$$

$$\boldsymbol{i_{2,3}=3.75\ \%}$$

$$i_{3,4} = \frac{\left(1 + i_{0,4}\right)^{\frac{t_4}{360}}}{\left(1 + i_{0,3}\right)^{\frac{t_3}{360}}} - 1$$

$$i_{3,4} = \frac{(1 + 0.037)^{\frac{1260}{360}}}{(1 + 0.036)^{\frac{900}{360}}} - 1$$

$$\boldsymbol{i_{3,4} = 3.95\ \%}$$

*3 – Fair value calculation*

$$receivable = \frac{\frac{i_{FLOAT}}{m} NV}{\left(1 + i_{0,1}\right)^{\frac{t_1}{360}}} + \frac{\frac{i_{1,2}}{m} NV}{\left(1 + i_{0,2}\right)^{\frac{t_2}{360}}} + \frac{\frac{i_{2,3}}{m} NV}{\left(1 + i_{0,3}\right)^{\frac{t_3}{360}}} + \frac{\left(1 + \frac{i_{3,4}}{m}\right) NV}{\left(1 + i_{0,4}\right)^{\frac{t_4}{360}}}$$

$$receivable = \frac{0.0325 \cdot 1{,}000{,}000}{(1 + 0.034)^{\frac{180}{360}}} + \frac{0.0355 \cdot 1{,}000{,}000}{(1 + 0.035)^{\frac{540}{360}}} + \frac{0.0375 \cdot 1{,}000{,}000}{(1 + 0.036)^{\frac{900}{360}}} + \frac{1.0395 \cdot 1{,}000{,}000}{(1 + 0.037)^{\frac{1260}{360}}}$$

$$\boldsymbol{receivable = 1{,}015{,}377\ CU}$$

$$liability = \frac{\frac{i_{FIX}}{m} NV}{\left(1 + i_{0,1}\right)^{\frac{t_1}{360}}} + \frac{\frac{i_{FIX}}{m} NV}{\left(1 + i_{0,2}\right)^{\frac{t_2}{360}}} + \frac{\frac{i_{FIX}}{m} NV}{\left(1 + i_{0,3}\right)^{\frac{t_3}{360}}} + \frac{\left(1 + \frac{i_{FIX}}{m}\right) NV}{\left(1 + i_{0,4}\right)^{\frac{t_4}{360}}}$$

$$liability = \frac{0.036 \cdot 1{,}000{,}000}{(1 + 0.034)^{\frac{180}{360}}} + \frac{0.036 \cdot 1{,}000{,}000}{(1 + 0.035)^{\frac{540}{360}}} + \frac{0.036 \cdot 1{,}000{,}000}{(1 + 0.036)^{\frac{900}{360}}} + \frac{1.036 \cdot 1{,}000{,}000}{(1 + 0.037)^{\frac{1260}{360}}}$$

$$\boldsymbol{liability = 1{,}014{,}839\ CU}$$

$$fair\ value = receivable - liability$$

$$fair\ value = 1{,}015{,}377 - 1{,}014{,}839$$

$$\boldsymbol{fair\ value = 538\ CU}$$

Fair value of this interest rate swap is 538 CU. Following table offers you an insight on this calculation:

| Date | Receivable (float) | Liability (fixed) | Profit/loss |
|---|---|---|---|
| 30.6.2012 | 31,961 | 35,403 | -3,442 |
| 30.6.2013 | 33,714 | 34,189 | -475 |
| 30.6.2014 | 34,327 | 32,954 | 1,373 |
| 30.6.2015 | 915,375 | 912,293 | 3,082 |
| **Total** | **1,015,377** | **1,014,839** | **538** |

**Currency swaps**

Very popular type of swap is currency swap. It is an agreement about the exchange of:

- fixed amounts of cash, or
- unknown amounts of cash based on referential rate

in one currency for:

- unknown amounts of cash based on referential rate, or
- fixed amount of cash

in another currency at the predetermined future date. We can differ FX swaps and cross-currency swaps.

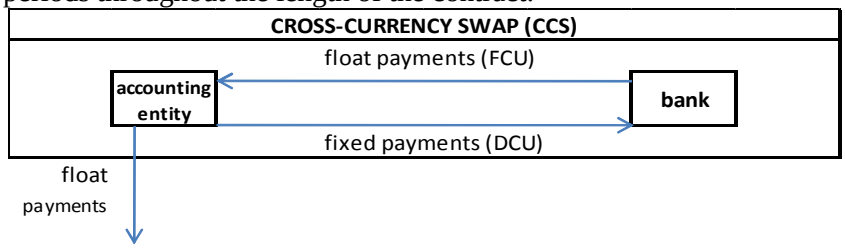
***FX swap***

General currency swap (FX swap) is an agreement about the exchange of one currency for another currency under spot rate with the agreement of the redemption of such currencies in predefined exchange rate at the

predetermined future date. In fact it is a combination of the spot contract and forward contract.

***Cross-currency swap***

Cross-currency swap (CCS) is a combination of interest rate swaps and FX contracts. Cross-currency swap is considered as a FX contract as the interest payments are not settled in one currency. Moreover this settlement is not done on net, but on gross basis. It is an agreement to exchange fixed interest payments in one currency for a float (variable) interest payments (derived from referential interest rate) in another currency at the predetermined time periods throughout the length of the contract.




Fair value of cross-currency swap might be determined as follows:

$$fair\ value = receivable - liability \tag{10}$$

$$receivable = \left[ \frac{\frac{i^F_{FLOAT}}{m} NV_F}{\left(1 + i^F_{0,1}\right)^{\frac{t_1}{360}}} + \frac{\frac{i^F_{1,2}}{m} NV_F}{\left(1 + i^F_{0,2}\right)^{\frac{t_2}{360}}} + \cdots + \frac{\left(1 + \frac{i^F_{n-1,n}}{m}\right) NV_F}{\left(1 + i^F_{0,n}\right)^{\frac{t_n}{360}}} \right] \cdot SR$$

$$liability = \frac{\frac{i^D_{FIX}}{m} NV_D}{\left(1 + i^D_{0,1}\right)^{\frac{t_1}{360}}} + \frac{\frac{i^D_{FIX}}{m} NV_D}{\left(1 + i^D_{0,2}\right)^{\frac{t_2}{360}}} + \cdots + \frac{\left(1 + \frac{i^D_{FIX}}{m}\right) NV_D}{\left(1 + i^D_{0,n}\right)^{\frac{t_n}{360}}}$$

where:

| | |
|---|---|
| $NV_D$ | nominal value of swap (in DCU) |
| $NV_F$ | nominal value of swap (in FCU) |
| $i^F_{FLOAT}$ | fixed first foreign float interest rate |
| $i^D_{FIX}$ | fixed domestic interest rate |
| $SR$ | spot exchange rate |

**EXAMPLE**

Company has negotiated 4-year cross currency swap with annual settlement – company pays fixed DCU payments and receive float FCU payments. Nominal value of swap is 1,000,000 DCU, respectively 40,000 FCU. Swap has been negotiated on 1.7.2011 and settlement dates are following: 30.6.2012, 30.6.2013, 30.6.2014 and 30.6.2015. Fixed coupon is 3.6 % p.a., for the first payment the float coupon rate is fixed on 3.25 %. The information about spot interest rates could be seen from following table:

| Rate | Domestic interest rate | Foreign interest rate |
|---|---|---|
| $i_{0,1}$ | 3.50 % | 3.40 % |
| $i_{0,2}$ | 3.60 % | 3.50 % |
| $i_{0,3}$ | 3.70 % | 3.60 % |
| $i_{0,4}$ | 3.80 % | 3.70 % |

Spot rate as at 31.12.2011 will be 24.80 DCU/FCU. Calculate fair value of this swap as at 31.12.2011.

*Solution:*

*1 – Calculation of days*

| | **Due date** | **Days** | **30/360** |
|---|---|---|---|
| $t_1$ | 30.6.2012 | 180 | 0.5 |
| $t_2$ | 30.6.2013 | 540 | 1.5 |
| $t_3$ | 30.6.2014 | 900 | 2.5 |
| $t_4$ | 30.6.2015 | 1,260 | 3.5 |

*2 – Determination of forward interest rates:*

$$\left(1+i_{0,1}^{F}\right)^{\frac{t_1}{360}}\left(1+i_{1,2}^{F}\right)=\left(1+i_{0,2}^{F}\right)^{\frac{t_2}{360}}$$

$$i_{1,2}^{F}=\frac{\left(1+i_{0,2}^{F}\right)^{\frac{t_2}{360}}}{\left(1+i_{0,1}^{F}\right)^{\frac{t_1}{360}}}-1$$

$$i_{1,2}^{F}=\frac{(1+0.035)^{\frac{540}{360}}}{(1+0.034)^{\frac{180}{360}}}-1$$

$$\boldsymbol{i_{1,2}^{F}=3.55\ \%}$$

$$i_{2,3}^{F}=\frac{\left(1+i_{0,3}^{F}\right)^{\frac{t_3}{360}}}{\left(1+i_{0,2}^{F}\right)^{\frac{t_2}{360}}}-1$$

$$i_{2,3}^{F}=\frac{(1+0.036)^{\frac{900}{360}}}{(1+0.035)^{\frac{540}{360}}}-1$$

$$\boldsymbol{i_{2,3}^{F}=3.75\ \%}$$

$$i_{3,4}^{F}=\frac{\left(1+i_{0,4}^{F}\right)^{\frac{t_4}{360}}}{\left(1+i_{0,3}^{F}\right)^{\frac{t_3}{360}}}-1$$

$$i_{3,4}^{F}=\frac{(1+0.037)^{\frac{1260}{360}}}{(1+0.036)^{\frac{900}{360}}}-1$$

$$\boldsymbol{i_{3,4}^{F}=3.95\ \%}$$

*3 – Fair value calculation*

$$receivable=\left[\frac{\frac{i_{FLOAT}^{F}}{m}NV_F}{\left(1+i_{0,1}^{F}\right)^{\frac{t_1}{360}}}+\frac{\frac{i_{1,2}^{F}}{m}NV_F}{\left(1+i_{0,2}^{F}\right)^{\frac{t_2}{360}}}+\frac{\frac{i_{2,3}^{F}}{m}NV_F}{\left(1+i_{0,3}^{F}\right)^{\frac{t_3}{360}}}+\frac{\left(1+\frac{i_{3,4}^{F}}{m}\right)NV_F}{\left(1+i_{0,4}^{F}\right)^{\frac{t_4}{360}}}\right]\cdot SR$$

$$receivable=\left[\frac{0.0325\cdot 40{,}000}{(1+0.034)^{\frac{180}{360}}}+\frac{0.0355\cdot 40{,}000}{(1+0.035)^{\frac{540}{360}}}+\frac{0.0375\cdot 40{,}000}{(1+0.036)^{\frac{900}{360}}}+\frac{(1+0.0395)\cdot 40{,}000}{(1+0.037)^{\frac{1260}{360}}}\right]\cdot 24.80$$

$$\boldsymbol{receivable=1{,}007{,}254\ DCU}$$

$$liability = \frac{\frac{i_{FIX}^{D}}{m} NV_D}{\left(1 + i_{0,1}^{D}\right)^{\frac{t_1}{360}}} + \frac{\frac{i_{FIX}^{D}}{m} NV_D}{\left(1 + i_{0,2}^{D}\right)^{\frac{t_2}{360}}} + \frac{\frac{i_{FIX}^{D}}{m} NV_D}{\left(1 + i_{0,3}^{D}\right)^{\frac{t_3}{360}}} + \frac{\left(1 + \frac{i_{FIX}^{D}}{m}\right) NV_D}{\left(1 + i_{0,4}^{D}\right)^{\frac{t_4}{360}}}$$

$$liability = \frac{0.036 \cdot 1{,}000{,}000}{(1 + 0.035)^{\frac{180}{360}}} + \frac{0.036 \cdot 1{,}000{,}000}{(1 + 0.036)^{\frac{540}{360}}} + \frac{0.036 \cdot 1{,}000{,}000}{(1 + 0.037)^{\frac{900}{360}}} + \frac{(1 + 0.036) \cdot 1{,}000{,}000}{(1 + 0.038)^{\frac{1260}{360}}}$$

$$\boldsymbol{liability = 1{,}011{,}620\ DCU}$$

$$fair\ value = receivable - liability$$
$$fair\ value = 1{,}007{,}254 - 1{,}011{,}620$$
$$\boldsymbol{fair\ value = -4{,}366\ DCU}$$

Fair value of this cross currency swap is -4,366 DCU. Following table offers you an insight on this calculation:

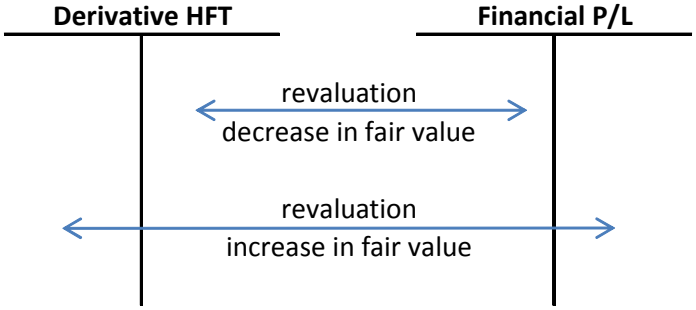
| **Date** | **Receivable (float) (rate 24.80 DCU/FCU)** | | | **Liability (fixed)** | **Profit/loss** |
|---|---|---|---|---|---|
| 30.6.2012 | 1,278.45 EUR | 24.8 | 31,705 | 35,386 | -3,681 |
| 30.6.2013 | 1,348.58 EUR | 24.8 | 33,445 | 34,140 | -695 |
| 30.6.2014 | 1,373.07 EUR | 24.8 | 34,052 | 32,874 | 1,178 |
| 30.6.2015 | 36,614.98 EUR | 24.8 | 908,052 | 909,220 | -1,168 |
| **Total** | | | **1,007,254** | **1,011,620** | **-4,366** |

**Equity swap**
Equity swap is an agreement to exchange fixed (or still unknown) amounts of cash for shares (dividends inclusive) at the predetermined periods in the future.

**Commodity swap**
Commodity swap is an agreement to exchange fixed (or still unknown) amounts of cash for commodity at the predetermined periods in the future.

## 2.3 Accounting Issues: Focused on FX Forwards

All fixed-term operations have to be posted in off-balance sheet evidence since the time of negotiation. At the balance sheet day the accounting unit has the obligation to revaluate such contract at fair value. Generally all derivatives are revaluated at fair value through profit/loss.



Methodology of posting of forward contracts provides following table [107]:

| | |
|---|---|
| 1 | Posting of off-balance sheet receivable upon the date of contract negotiation |
| 2 | Posting of off-balance sheet liability upon the date of contract negotiation |
| 3 | Revaluation of forward contract at fair value upon balance sheet date |
| 4 | Revaluation of off-balance sheet receivable upon balance sheet date |
| 5 | Revaluation of off-balance sheet liability upon balance sheet date |
| 6 | … |
| 7 | Revaluation of forward contract at fair value upon the date of settlement |
| 8 | Settlement of contract |
| 9 | Derecognition of off-balance sheet receivable |
| 10 | Derecognition of off-balance sheet liability |

Fair value, off-balance sheet receivable, and off-balance sheet liability can be calculated as follows:

$$receivable = contract\frac{SR}{1 + i_F\frac{t}{360}} \tag{11}$$

$$liability = contract\frac{FX}{1 + i_D\frac{t}{360}} \tag{12}$$

$$fair\ value = \frac{(FR - FX)\cdot contract\ volume}{1 + i_D\frac{t}{360}} \tag{13}$$

where:

$FR$ forward exchange rate
$FX$ negotiated forward exchange rate

Next example provides evidence how to report currency forwards.

**EXAMPLE**

Company has negotiated 3M FX forward on purchase of 750,000 FCU. Contract has been negotiated on 1.11.2011 and will be settled on 31.1.2012. Current spot exchange rate is 25 DCU/FCU, domestic interest rate 2 % p.a. and foreign interest rate is 3 % p.a.

Interest rates, spot and forward exchange rates evolved as follows:

| **Variable** | **1.11.2011** | **31.12.2011** | **31.1.2012** |
|---|---|---|---|
| **Spot rate** | 25.000 DCU/FCU | 25.200 DCU/FCU | 24.900 DCU/FCU |
| **Forward rate** | 24.937965 DCU/FCU | 25.185339 DCU/FCU | 24.900 DCU/FCU |
| **Domestic interest rate** | 2.0 % | 2.5 % | 2.3 % |
| **Foreign interest rate** | 3.0 % | 3.2 % | 2.8 % |
| **Time to expiration** | 90 | 30 | 0 |

For the simplicity of calculations there will be used method 30/360.

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Off-balance sheet receivable as at 1.11.2011<br>$receivable = 750000 \cdot \frac{25}{1 + 0.03 \cdot \frac{90}{360}} = 18{,}610{,}422$ | 18,610,422 | Dr | | OBS receivable |
| 2 | Off-balance sheet payable as at 1.11.2011<br>$payable = 750000 \cdot \frac{24.937965}{1 + 0.02 \cdot \frac{90}{360}} = 18{,}610{,}422$ | 18,610,422 | | Cr | OBS payable |
| 3 | Revaluation of off-balance sheet receivable on 31.12.2011<br>$receivable = 750000 \cdot \frac{25.2}{1 + 0.032 \cdot \frac{30}{360}} = 18{,}849{,}734$ | 239,312 | Dr | | OBS receivable |
| 4 | Revaluation of off-balance sheet payable on 31.12.2011<br>$payable = 750000 \cdot \frac{24.937965}{1 + 0.025 \cdot \frac{30}{360}} = 18{,}664{,}589$ | 54,167 | | Cr | OBS payable |
| 5 | Fair value of the FX forward as at 31.12.2011<br>$FV_{FW} = \frac{(25.185339 - 24.937965) \cdot 750000}{1 + 0.025 \cdot \frac{30}{360}} = 185{,}145$ | 185,145<br>185,145 | Dr<br> | <br>Cr | FX forward<br>R – Financial P/L |
| 6 | Revaluation of off-balance sheet receivable on 31.1.2012<br>$receivable = 750000 \cdot \frac{24.9}{1 + 0.028 \cdot \frac{0}{360}} = 18{,}675{,}000$ | 174,734 | | Cr | OBS receivable |
| 7 | Revaluation of off-balance sheet payable on 31.1.2012<br>$Payable = 750000 \cdot \frac{24.937965}{1 + 0.023 \cdot \frac{0}{360}} = 18{,}703{,}474$ | 38,885 | | Cr | OBS payable |
| 8 | Revaluation of forward at fair value on 31.1.2012<br>$FV_{FW} = \frac{(24.9 - 24.937965) \cdot 750000}{1 + 0.023 \cdot \frac{0}{360}} = -28{,}474$ | 267,786<br>267,786 | Dr<br> | <br>Cr | E – Financial P/L<br>FX forward |
| 9 | Settlement<br>750,000 EUR @ 24.900<br><br>750,000 EUR @ 24.937965 | <br>18,675,000<br>28,474<br>18,703,474 | <br>Dr<br>Dr<br> | <br><br><br>Cr | <br>Bank account (FCU)<br>FX forward<br>Bank account (DCU) |
| 10 | Derecognition of off-balance sheet receivable | 18,675,000 | | Cr | OBS receivable |
| 11 | Derecognition of off-balance sheet payable | 18,703,474 | Dr | | OBS payable |

**Balance Sheet (changes 2011)**

| | | | |
|---|---|---|---|
| FX forward | 239,312 | Profit/loss | 239,312 |
| **Σ** | **239,312** | **Σ** | **239,312** |

| Balance Sheet (changes 2012) | | | |
|---|---|---|---|
| Bank account (DCU) | -18,703,474 | Retained earnings | 239,312 |
| Bank account (FCU) | 18,675,000 | Profit/loss | -267,786 |
| **Σ** | **-28,474** | **Σ** | **-28,474** |

# 3 Options

## 3.1 Introduction

Unlike fixed-term operation, option contracts offer a right (option), but not an obligation to buy or sell an underlying asset for a fixed price (strike price) until the date of expiration.

We may divide the option on **call options** and **put options**. If we purchase a call option we have a right (not an obligation) to purchase certain asset until the date of expiration for the currently negotiated strike price. If we purchase a put option we have a right (not an obligation) to sell certain asset until the date of expiration for the currently negotiated strike price.

**Illustration of the option contracts**


Source: [132]

Another possibility how to divide the option contracts is the criterion of settlement date. From this point of view, we may differ European and American options. European options can be settled only at the date of expiration; however American options whenever until the date of expiration. From this point of view it is logical that American options have to be more expensive than European options.

In terms of option premium values we can differ:

- ***in-the-money options***
  - call option is ITM in case that the strike price is lower than current market price. Owner of such call option has a right to purchase an underlying asset for the lower price than is the current market price of underlying asset

- put option is ITM in case that the strike price is higher than current market price. Owner of such put option has a right to sell an underlying asset for the higher price than is the current market price of underlying asset

- ***at-the-money options***
  - call option is ATM in case that the strike price is (approximately) equal to current market price of underlying asset
  - put option is ATM in case that the strike price is (approximately) equal to current market price of underlying asset
- ***out-of-the-money options***
  - call option is OTM in case that the strike price is higher than current market price. Owner of such option purchase the underlying asset cheaper directly on the market
  - put option is OTM in case that the strike price is lower than current market price. Owner of such option sell the underlying asset for higher price directly on the market

**EXAMPLE**
Market price of underlying asset is 60 CU. Determine types of options:

| Strike | CALL OPTION | | | PUT OPTION | | |
|---|---|---|---|---|---|---|
| | ITM | ATM | OTM | ITM | ATM | OTM |
| JUN 40 | ☒ | ☐ | ☐ | ☐ | ☐ | ☒ |
| JUN 45 | ☒ | ☐ | ☐ | ☐ | ☐ | ☒ |
| JUN 50 | ☒ | ☐ | ☐ | ☐ | ☐ | ☒ |
| JUN 55 | ☒ | ☐ | ☐ | ☐ | ☐ | ☒ |
| JUN 60 | ☐ | ☒ | ☐ | ☐ | ☒ | ☐ |
| JUN 65 | ☐ | ☐ | ☒ | ☒ | ☐ | ☐ |
| JUN 70 | ☐ | ☐ | ☒ | ☒ | ☐ | ☐ |
| JUN 75 | ☐ | ☐ | ☒ | ☒ | ☐ | ☐ |
| JUN 80 | ☐ | ☐ | ☒ | ☒ | ☐ | ☐ |

According to the time to expiration of the option contracts, we may divide them onto European, American or Bermuda options. European options could be settled just in the expiration date, thus American option whenever before the date of expiration. As some combination between these type is considered Bermuda option. This option may be settled in defined possible dates before the date of expiration or at the date of expiration.
From this description could be seen, that the most expensive options are American ones, thus European options are considered as the cheapest.

**OPTION EXCHANGES**
Within the option exchanges are traded following types of options:

- equity options,
- interest rate options,
- FX options,
- options on stock index,
- options on futures contracts.

*Equity options*
The standardized amount is obviously based on 100 shares and the strike price is determined as a multiple of some basic amount based on standard price of this shares. All options have standardized date of expiration – e.g. in USA it is as third Friday in selected months. Of course these options are most popular and the trade volume is the highest one.

*Interest rate options*
They are realized directly via determined interest rate or via interest rate on state bonds. In case that the interest rate will increase, the price of the bond will have declining trend and vice versa. Therefore if we are expecting

an increase in long-term interest rates, we can speculate purchasing a put option on state bonds.

*FX options*
These contracts started to be standardized in 1982. The strike price is obviously determined as an exchange rate (e.g. 0.72 EUR/USD) and upon the settlement of this contract is paid just a difference in exchange rates.

*Options on stock index*
Owner of call option on stock index has a right on financial settlement based on the value of the index. Therefore the purchasing party purchase the fragment of shares in index with the right on financial settlement. The value of the index is obviously multiplied by negotiated constant.

*Options on futures*
This kind of option represents a right on the purchase of futures contract. As a strike price is considered the price of futures contract.

**OTC MARKETS**
Within OTC (over-the-counter) markets are traded options which are tailored on the needs of both parties in terms of volume and dates of expiration. These options are not traded on regulated markets. As a major advantage for investor could be considered any requirement of deposit payments. Of course on the other hand the limitation is in lower liquidity and higher risks, also the transaction costs might be higher.

There are traded all options traded at options exchanges and commodity options. As traditional underlying assets shall be stated rice, grain, oil, gold, tulips, etc.

**Exotic options**
In common practice we can see trades with so called exotic options. Sometimes these contracts are not considered as options but as securities with certain option characteristics.
Among exotic options we might state:

- options on options
- barrier options
- as you like it options

*Options on options*
There are four basic types of these contracts:

- call option on call option,
- call option on put option,
- put option on call option,
- put option on put option.

Of course the most difficult problem associated with this time of options is their measurement.

*Barrier options*
These options have a characteristic that in case there is reached the determined barrier in price of underlying asset, this option is automatically settled.

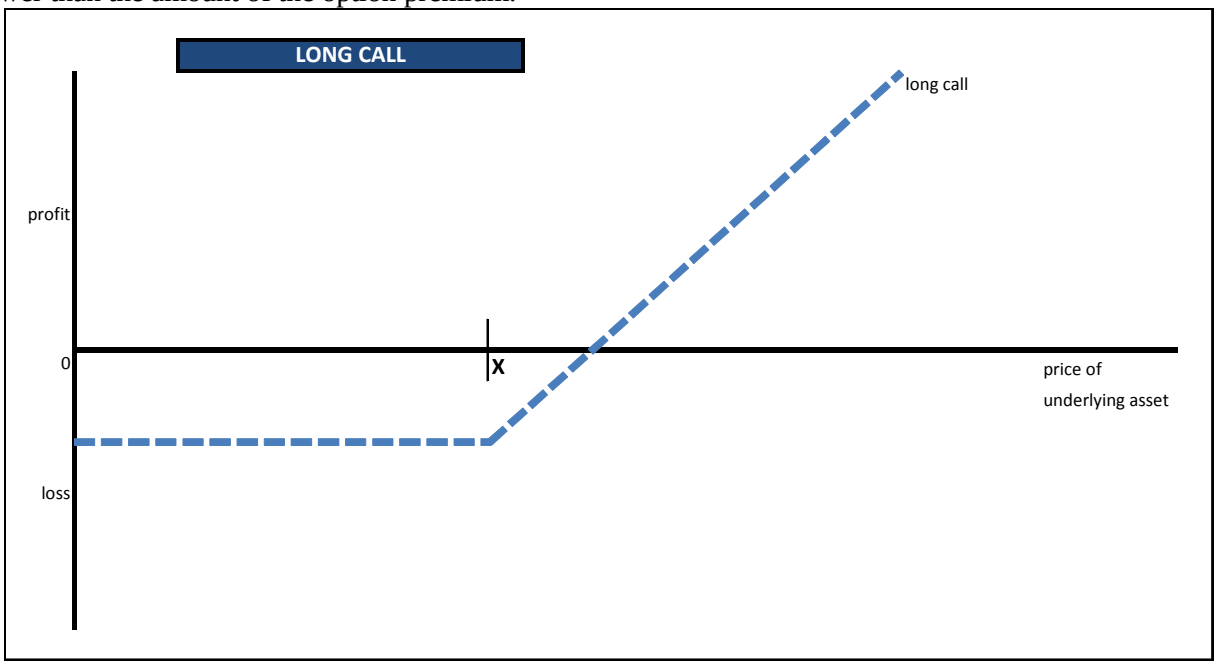
*As you like it options*
This is a very special type of the option contract where an owner may decide after some time whether this option will be considered as call option or as put option. For this reason is this type of option one of the most expensive.

## 3.2 Basic Positions

There exist four basic positions:

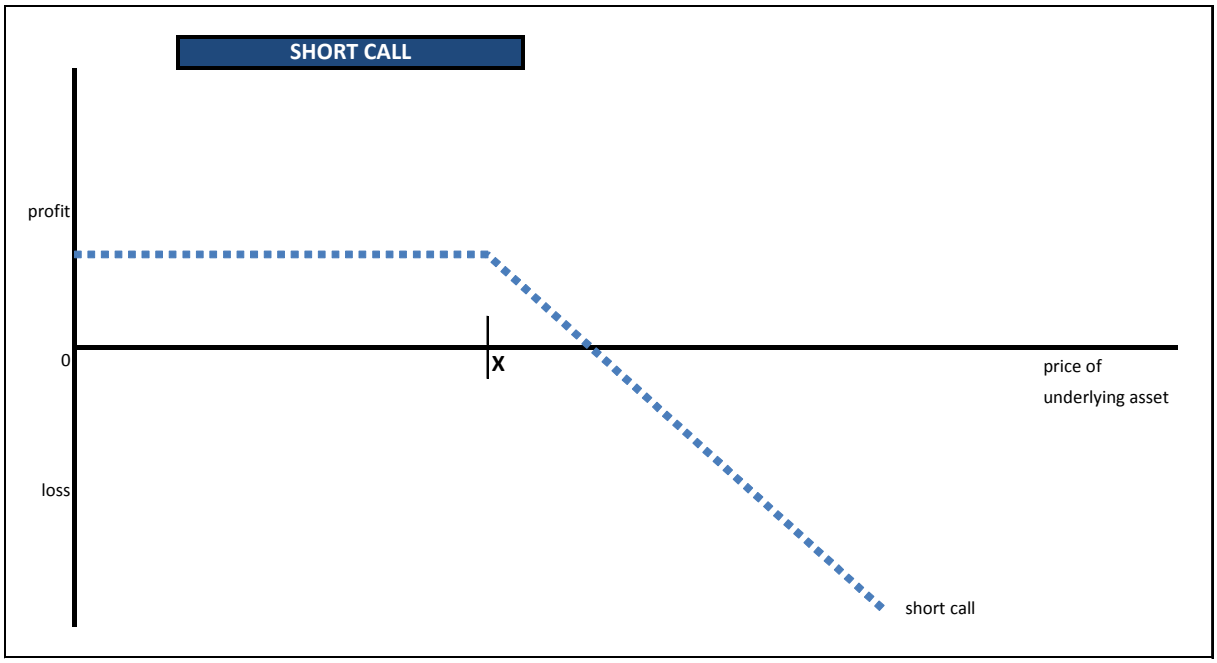
- long call option
- short call option
- long put option
- short put option

If an investor purchases call option (long call), for a certain option premium, he has a right to purchase an underlying asset for a negotiated strike price in the future. To gain a profit investor hopes that the market price will be considerably higher than negotiated strike price. Higher the market price (than strike price), higher the profit. In case that the market price of underlying asset will be lower than strike price it does not make any sense to realize such option. Investor will realize loss in the amount of the option premium. There could be realized loss also in case that the market price is higher than strike price, but the difference between these prices is lower than the amount of the option premium.



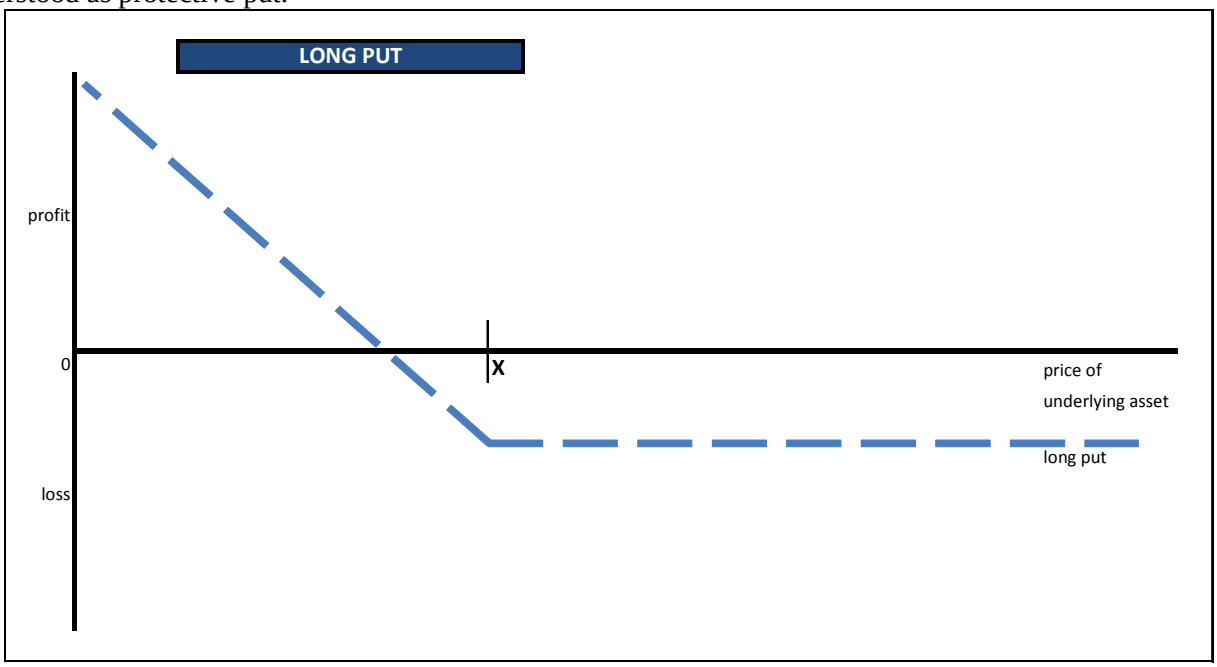

As a break-even point is considered strike price higher for option premium paid.

If company sells call option (short call), for a certain option premium, it has an obligation to sell an underlying asset for a negotiated strike price in the future in case that the owner of this option applies for settlement of the contract. In case that the market price of underlying asset will be lower than strike price, company will realize profit, as this option contract will not be settled. In case that the market price of underlying asset will be higher than strike price, company will realize a loss. Higher the market price (than strike price), higher the loss.
In case that the company will not possess the underlying asset at the settlement (expiration) date, this call option is called naked call. In case that the company owns an underlying asset upon the time of negotiation of this contract, such position is understood as covered call.



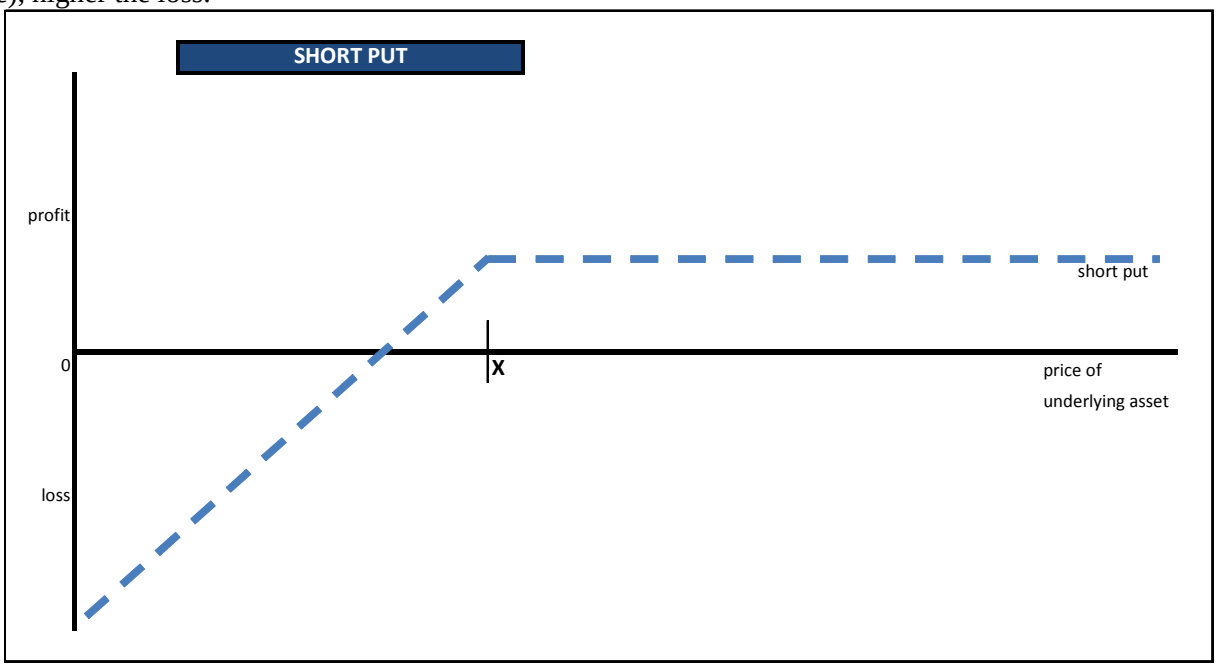

As a break-even point is considered strike price higher for option premium received.

If an investor purchases put option (long put), for a certain option premium, he has a right to sell an underlying asset for a negotiated strike price in the future. To gain a profit investor hopes that the market price will be considerably lower than negotiated strike price. Lower the market price (than strike price), higher the profit. In case that the market price of underlying asset will be higher than strike price it does not make any sense to realize such option. Investor will realize loss in the amount of the option premium. There could be realized loss also in case that the market price will be lower than strike prices, but the difference between prices is lower than the amount of the option premium.
In case that investor purchases a put option and he is an owner of an underlying asset, this position is understood as protective put.




As a break-even point is considered strike price less option premium paid.

If company sells put option (short put), for a certain option premium, it has an obligation to purchase an underlying asset for a negotiated strike price in the future in case that the owner of this option applies for settlement of the contract. In case that the market price of underlying asset will be higher than strike price, company will realize profit, as this option contract will not be settled. In case that the market price of underlying asset will be lower than strike price, company will realize a loss. Lower the market price (than strike price), higher the loss.




As a break-even point is considered strike price less option premium received.

## 3.3 Measurement of Option Contracts

### 3.3.1 Factors Affecting Option Premium Values

The option premium values could not be understood as some fixed characteristics defined by individual exchanges where these options are traded. These values are determined by various quantifiable and non-quantifiable factors.

**Non-quantifiable factors**

Option premium values are affected by many predicable or unpredictable, often psychological, factors. Psychology of people could be a very powerful market force and therefore may have a strong influence on the price of underlying asset. As a good example might be mentioned the expectation about the crop failure what will raise the price of such commodity.

In addition to these factors there have a significant impact various market factors, such as:

- market players change their expectation about future volatility of the underlying asset,
- individual investors change their expectation about the evolution of the price of the underlying asset based on fundamental, technical or other analysis,
- effects of supply and demand on the options market as well as on the underlying assets market,
- transparency and liquidity of the market where is such option traded. This is affected by the number and volume of transactions.

The ability to estimate the future volatility of the underlying asset is an essential key to proper valuation of the option premium. Unfortunately the pricing models are unable to clearly predict how the market price of underlying asset will behave in the future.

Another aspect is the investors' perception. Strong company is very interesting for potential investors; however weak company might be an acquisition target. This psychological aspect may affect the market price of the underlying share as well as the option premium.

Psychology of the market may lead to unpredictable situations in any market. Upon the period of uncertainty, investors can enter options markets due to the hedge of their risks, but also because of their speculations. The factor of this imbalance is a liquidity of market. In case of lower liquidity (few buyers, few sellers) this imbalance in supply and demand can strongly affect the option premium values.

**Quantifiable factors**

Among quantifiable factors affecting the option premium values can be stated:

- current (spot) market price of underlying asset $S$
- strike price $X$
- time to expiration (in years) $T$
- risk-free interest rate $i_{RF}$
- price volatility of underlying asset $\sigma$

*Strike price*

Option contract's strike price is considered as a price for which can be purchased or sold the underlying asset.

*Time to expiration*

At the time of expiration option "ends its life". It is an only possible moment when it is possible to settle European option, for the American option it is a last moment when it is possible to settle it. As the time approaches the expiration, the time value of option is decreasing.

*Risk-free interest rate*

Consider a situation of the purchase of call option. Strike price for the underlying asset will be paid at the time of settlement of this contract and therefore we can save money necessary for this settlement in bank where we could gain some interest.

*Volatility*

If the company invests onto call option purchase, it tries to hedge the price of an underlying asset. However still hopes that the market price at the settlement date will be as highest as possible to gain the highest possible profit, i.e. investor hopes in high price volatility of underlying asset. Higher the price volatility of underlying asset, higher the option premium value.

The impact of these factors on option premium values could be summarized as follows:

| | Call option | Put option |
|---|---|---|
| Price of underlying asset<br>• ▼<br>• ▲ | <br>↓<br>↑ | <br>↑<br>↓ |
| Strike price<br>• ▼<br>• ▲ | <br>↑<br>↓ | <br>↓<br>↑ |
| Time to expiration<br>• ▼<br>• ▲ | <br>↓<br>↑ | <br>↓<br>↑ |
| Risk-free interest rate<br>• ▼<br>• ▲ | <br>↓<br>↑ | <br>↑<br>↓ |
| Volatility<br>• ▼<br>• ▲ | <br>↓<br>↑ | <br>↓<br>↑ |

Source: [5]

**INTRINSIC AND TIME VALUE OF THE OPTION**

The option premium value could be split onto intrinsic value and time value. Intrinsic value is considered as an option value in case that the option contract expires today. For call options it means, that the market price shall be higher than strike price; and for put option it means that the market price shall be lower than the strike price:

$$call\ option: \quad intrinsic\ value = \max(S - X; 0) \tag{14}$$

$$put\ option: \quad intrinsic\ value = \max(X - S; 0) \tag{15}$$

Time value represents the probability that the option at the time of expiration will provide a profit, i.e. at the time of expiration will have some intrinsic value. Time value is understood as a difference between option premium and intrinsic value. As the time passes, the time value is decreasing. The chances that the price of underlying asset will dramatically change in investor's favour for one week is considerably lower than in case that the time to expiration will be whole month.

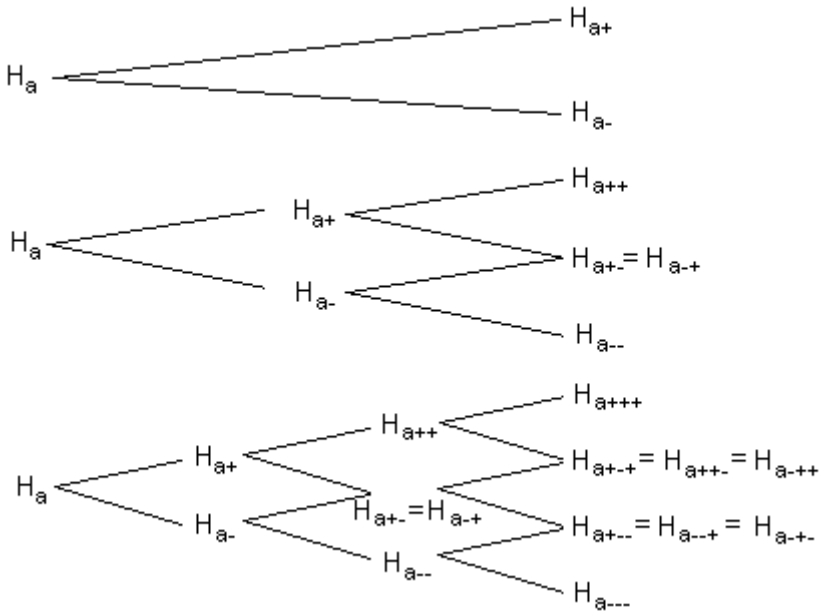
### 3.3.2 Option Pricing Models

There shall be stated several models, how to determine the option value. We would like to stress our attention to following ones:

- binomial model,
- Black-Scholes model, and
- Garman-Kohlhagen model.

**BINOMIAL MODEL**

Binomial model is relatively simple tool, how to measure various types of call and put options. The asset value (as well as possible options) could be changed in shorter and shorter time interval. Following figure shows the evolution of the asset value for a period with continuously decreasing time intervals, what is a base for the binomial model for options' valuation.




where:

$a^+$ alternative of increase in price of underlying asset

$a^-$ alternative of decrease in price of underlying asset

The option premium values based on binomial model could be calculated as follows:

$$CALL = S \cdot B[n, a, b] - X \cdot V^{-n} \cdot B[n, a, p] \quad (16)$$

$$PUT = X \cdot V^{-n} \cdot \bar{B}[n, a, p] - S \cdot \bar{B}[n, a, b] \quad (17)$$

where: (18)

$$B[n, a, b] = \sum_{j=a}^{n} \frac{n!}{(n-j)!\, j!} b^j (1-b)^{n-j}$$

$$B[n, a, p] = \sum_{j=a}^{n} \frac{n!}{(n-j)!\, j!} p^j (1-p)^{n-j}$$

$$\bar{B}[n, a, b] = \sum_{j=0}^{a-1} \frac{n!}{(n-j)!\, j!} b^j (1-b)^{n-j}$$

$$\bar{B}[n, a, p] = \sum_{j=0}^{a-1} \frac{n!}{(n-j)!\, j!} p^j (1-p)^{n-j}$$

where:

$CALL$ call option premium value

$PUT$ put option premium value

$S$ spot price of underlying asset

$X$ strike price

$V$ constant rate of return

$b; p$ probability rates

Binomial model is obviously used for the measurement of American options. Upon certain phases the results of this model converge to results based on Black-Scholes model.

**BLACK-SCHOLES MODEL**

In 1973 was presented famous Black-Scholes formula for the calculation of option premium values. Within this model the price of call options de facto equals to the difference between the market price of the share and present value of the strike price. For the simplicity of calculation Black and Scholes predefined that the price of assets will change continuously and all those changes have a normal distribution (application of Wiener process).

Black and Scholes predicted that the evolution of the price of underlying share consists from the constant change and from the random variable.

***Constant change***

The model predicts that the shares have the tendency for the constant increase or constant decrease. We will sign the constant component as $\mu$. The value of share at the time t $S_t$ for the certain instant of time *t* will change for $S_t \mu \Delta t$.

***Random variable***

Black and Scholes also predicted that the value of share will randomly deviate from its constant tendencies. Model operates with following deviation:

$S_t \varepsilon \sigma \sqrt{\Delta t}$, where ε represents a random variable with normal distribution.

***Probabilistic model of the share behaviour*** has the following form:

$$\Delta S / S_t = \mu \Delta t + \varepsilon \sigma \sqrt{\Delta t} \tag{19}$$

We will try to construct the ***portfolio P***, consisting from one share with its market price S and $1/(\partial CALL/\partial S)$ sold call options. The value of such portfolio is following:

$$V_P = S - 1/(\partial CALL/\partial S)\, CALL \tag{20}$$

We will focus on the change in value of portfolio P for the minimum instant of time *t*:

$\delta V_P = \delta S - 1/(\partial CALL/\partial S)\, \delta CALL$, and the share behaves as expected ($\Delta S/S_t = \mu \Delta t + \varepsilon \sigma \sqrt{\Delta t}$).

We could use at this time Ito's lemma:

$$\begin{aligned} \delta CALL &= CALL(S + \delta S, X, t + \delta t, i_{RF}, \sigma) - CALL(S, X, t, i_{RF}, \sigma) \\ &= \frac{\partial CALL}{\partial S}\delta S + \frac{1}{2} \cdot \frac{\partial^2 CALL}{\partial S^2}\sigma^2 S^2 \delta t + \frac{\partial CALL}{\partial t}\delta t \end{aligned} \tag{21}$$

We will make now a substitution in an equation for the change in value of portfolio P:

$$\delta V_P = \delta S - 1/(\partial CALL/\partial S)\delta CALL = -\left(\frac{1}{2} \cdot \frac{\partial^2 CALL}{\partial S^2}\sigma^2 S^2 + \frac{\partial CALL}{\partial t}\right)\delta t/(\partial CALL/\partial S) \tag{22}$$

For the change in the portfolio value for certain period of time, this change has to be very same like for risk-free asset:

$$\begin{aligned} &\delta V_P \\ &= -\left(\frac{1}{2} \cdot \frac{\partial^2 CALL}{\partial S^2}\sigma^2 S^2 + \frac{\partial CALL}{\partial t}\right)\delta t/(\partial CALL/\partial S) = V_P i_{RF}\delta t = (S - 1/(\partial CALL/\partial S)CALL) i_{RF}\delta t \end{aligned} \tag{23}$$

Reducing $\delta t$, after the adjustment we will receive following differential equation:

$$-\frac{1}{2} \cdot \frac{\partial^2 CALL}{\partial S^2}\sigma^2 S^2 - \frac{\partial CALL}{\partial S} S i_{RF} - \frac{\partial CALL}{\partial t} + CALL\, i_{RF} = 0 \tag{24}$$

At the time of expiration $t = T$ has to be valid for European call option:

$$CALL(S, X, t = T) = max[S - X; 0] \tag{25}$$

Solution of the differential equation with above mentioned boundary condition is famous Black-Scholes formula for calculation of the call option premium:

$$CALL = S \cdot N(d_1) - X \cdot e^{-i_{RF}T} \cdot N(d_2) \quad (26)$$

where: (27)

$$d_1 = \frac{ln\frac{S}{X} + \left(i_{RF} + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$$N(d) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{d} e^{-\frac{x^2}{2}} dx$$

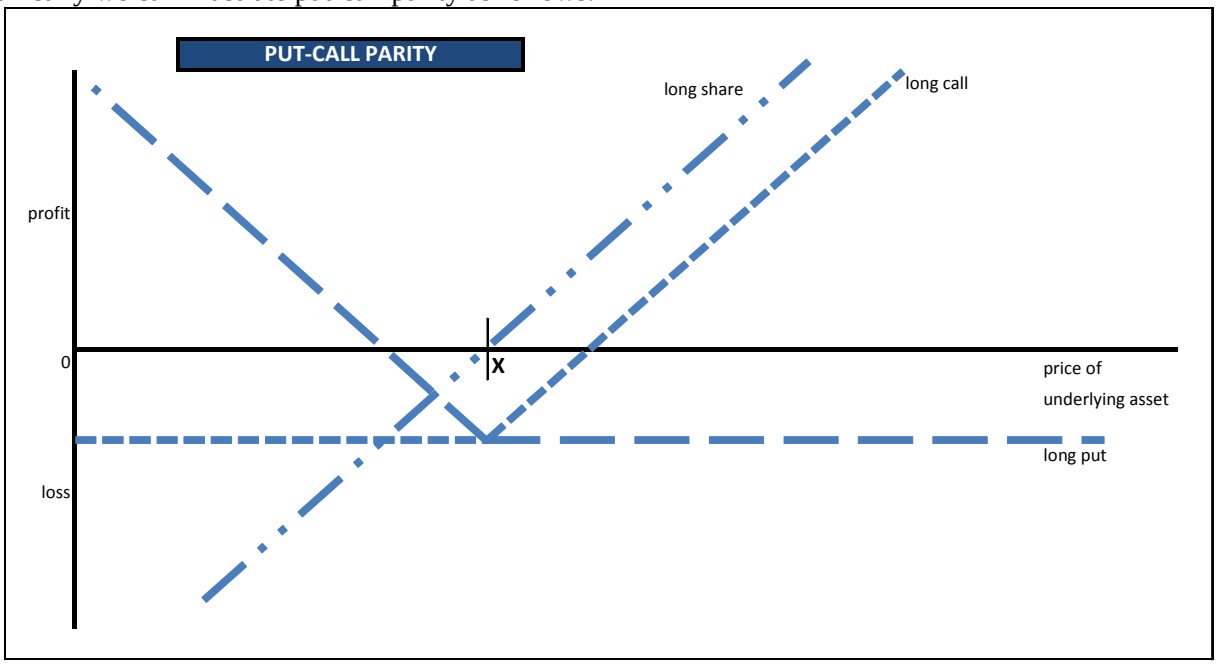
where:

| | |
|---|---|
| $CALL$ | call option premium value |
| $PUT$ | put option premium value |
| $S$ | market (spot) price of underlying share |
| $X$ | strike price |
| $T$ | time to expiration (in years) |
| $i_{RF}$ | risk-free interest rate |
| $\sigma$ | volatility of underlying share |
| $N(d)$ | distribution function of normal distribution |

The equation might be also interpreted for the calculation of the put option premium, when using put-call parity. The formula is as follows:

$$PUT = CALL + X \cdot e^{-i_{RF}T} - S \quad (28)$$

Graphically we can illustrate put-call parity as follows:




The original Black-Scholes formula was reformulated by Merton. He assumed that the share will pay a continuous dividend.

**GARMAN-KOHLHAGEN MODEL**

Garman-Kohlhagen model is the modification of Black-Scholes formula for the calculation of FX option premiums. It has been introduced in 1983.

Option premiums for call options and put options are calculated as follows:

$$CALL = SR \cdot e^{-i_{RF}^{F}T} \cdot N(d_1) - FX \cdot e^{-i_{RF}^{D}T} \cdot N(d_2) \quad (29)$$

where: (30)

$$d_1 = \frac{ln\frac{SR}{FX} + \left(i_{RF}^{D} - i_{RF}^{F} + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$$N(d) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{d} e^{-\frac{x^2}{2}} dx$$

$$PUT = FX \cdot e^{-i_{RF}^{D}T} \cdot N(-d_2) - SR \cdot e^{-i_{RF}^{F}T} \cdot N(-d_1) \quad (31)$$

$$PUT = CALL + FX \cdot e^{-i_{RF}^{D}T} - SR \cdot e^{-i_{RF}^{F}T} \quad (32)$$

where:

| | |
|---|---|
| $CALL$ | FX call option premium value |
| $PUT$ | FX put option premium value |
| $SR$ | spot exchange rate |
| $FX$ | strike exchange rate |
| $T$ | time to expiration (in years) |
| $i_{RF}^{D}$ | domestic risk-free interest rate |
| $i_{RF}^{F}$ | foreign risk-free interest rate |
| $\sigma$ | volatility of exchange rate |
| $N(d)$ | distribution function of normal distribution |

**EXAMPLE**

Company would like to purchase FX call option or FX put option. The current conditions are following:

- spot exchange rate 25.00 DCU/FCU
- strike exchange rate 24.80 DCU/FCU
- time to expiration 180 days
- domestic risk-free interest rate 3 % p.a.
- foreign risk-free interest rate 4 % p.a.
- volatility of exchange rate 10 %

Calculate the call option premium and put option premium.

*Solution:*

*1 – calculation of parameters $d_1$ and $d_2$ and the distribution function values $N(d_1)$ and $N(d_2)$*

$$d_1 = \frac{ln\frac{SR}{FX} + \left(i_{RF}^{D} - i_{RF}^{F} + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_1 = \frac{ln\frac{25}{24.8} + \left(0.03 - 0.04 + \frac{0.1^2}{2}\right)0.5}{0.1\sqrt{0.5}}$$

$$\boldsymbol{d_1 = 0.078237}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$$d_2 = 0.78237 - 0.1\sqrt{0.5}$$

$$\boldsymbol{d_2 = 0.007526}$$

$$N(d) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{d} e^{-\frac{x^2}{2}} dx$$

$$N(d_1) = N(0.078237)$$

$$\boldsymbol{N(d_1) = 0.531180}$$

$$N(d_2) = N(0.007526)$$

$$\boldsymbol{N(d_2) = 0.503002}$$

*2 – calculation of call option premium and put option premium*

$$CALL = SR \cdot e^{-i_{RF}^{F} T} \cdot N(d_1) - FX \cdot e^{-i_{RF}^{D} T} \cdot N(d_2)$$

$$CALL = 25 \cdot e^{-0.04 \cdot 0.5} \cdot 0.53118 - 24.8 \cdot e^{-0.03 \cdot 0.5} \cdot 0.503002$$

$$\boldsymbol{CALL = 0.727812\ DCU}$$

Call option premium will be 0.728 DCU. If company would like to purchase 100,000 FCU (see part 3), the total call option premium will be 72,781.20 DCU.

$$PUT = CALL + FX \cdot e^{-i_{RF}^{D} T} - SR \cdot e^{-i_{RF}^{F} T}$$

$$PUT = 0.727812 + 24.8 \cdot e^{-0.03 \cdot 0.5} - 25 \cdot e^{-0.04 \cdot 0.5}$$

$$\boldsymbol{PUT = 0.653621\ DCU}$$

Put option premium will be 0.654 DCU. If company would like to sell 100,000 FCU (see part 3), the total put option premium will be 65,362.10 DCU.

*3 – graphical solution*

Now consider the situation of the purchase (or sell) of 100,000 FCU. At that time the call option premium will be 72,781.20 DCU and put option premium will be 65,362.10 DCU.

CALL OPTION: The exchange rate from which the company will realize profit could be calculated as follows:

$$volume \cdot (x - strike\ exchange\ rate) - call\ option\ premium = 0$$

$$100{,}000(x - 24.80) - 72{,}781.20 = 0$$

$$\boldsymbol{x = 25.528\ DCU/FCU}$$

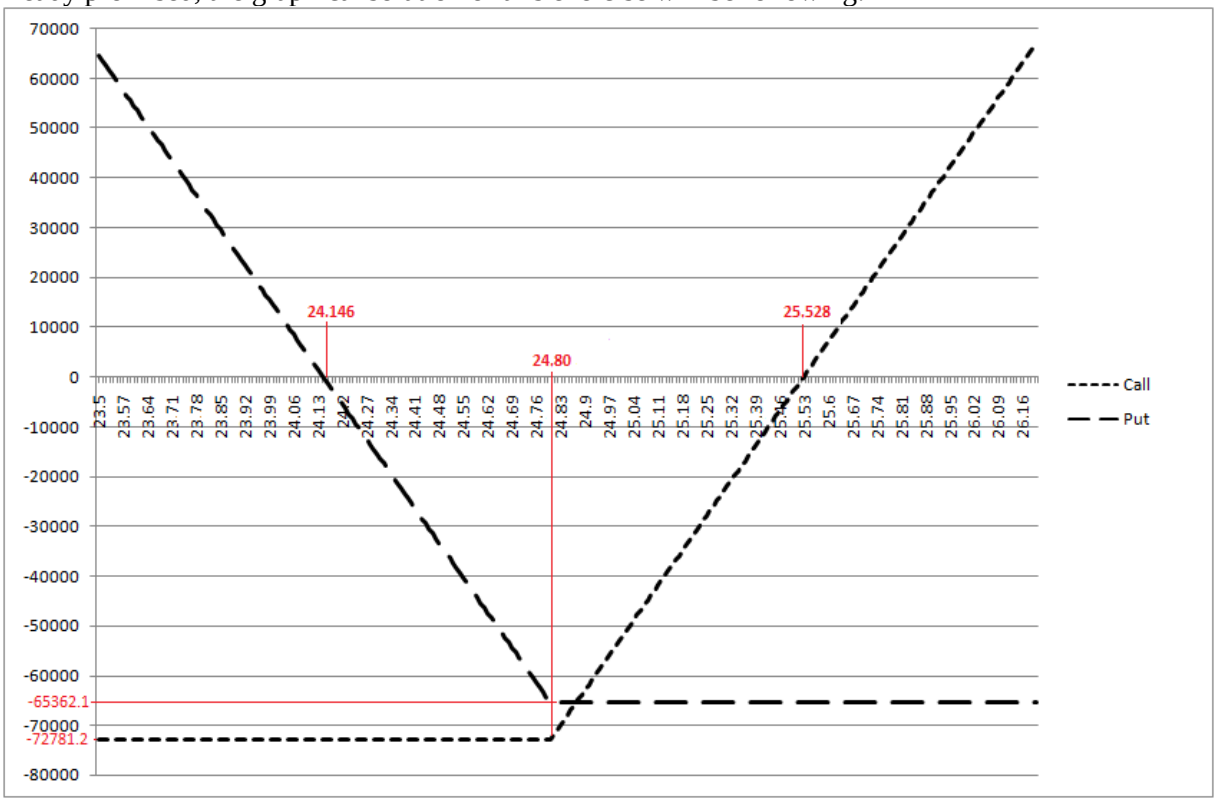
PUT OPTION: The exchange rate until which the company will realize profit could be calculated as follows:

$$volume \cdot (strike\ exchange\ rate - x) - put\ option\ premium = 0$$

$$100{,}000(24.80 - x) - 65{,}362.10 = 0$$

$$\boldsymbol{x = 24.146\ DCU/FCU}$$

As already promised, the graphical solution of this exercise will be following:




### 3.3.3 Characteristics of Option Premiums

Furthermore there it is necessary to discuss some basic characteristics of option premiums.

*Characteristic No. 1*

The price of call and put option has to be non-negative. Option' owner has any obligation to pay in the future; in case that the right could be considered as a dead asset, the value is zero:

$$CALL \geq 0; PUT \geq 0 \tag{33}$$

*Characteristic No. 2*

American call (or put) option could be realized at any time before the expiration. Therefore the price of American options has to be same or higher than the price of European options:

$$CALL_{US} \geq CALL_{EU}; PUT_{US} \geq PUT_{EU} \tag{34}$$

*Characteristic No. 3*

The value of American option has to be equal at least to the intrinsic value:

$$CALL_{US} \geq max[0; S - X]; PUT_{US} \geq max[0; X - S] \tag{35}$$

*Characteristic No. 4*

Last characteristic is invalid for European put option as its value need not to be higher than its intrinsic value. According to characteristic No. 12 is NOT valid:

$$PUT_{EU} \geq max[0; X - S] \tag{36}$$

*Characteristic No. 5*

Entity is the owner of two options (call or put) with different realization prices.

In such a case the value of the call option with lower strike price is same or higher than the price of the second call option.

$$CALL(X_1) \geq CALL(X_2) \quad for\ X_2 \geq X_1 \tag{37}$$

The value of the put option with higher strike price is same or higher than the price of the second put option.

$$PUT(X_1) \leq PUT(X_2) \quad for\ X_2 \geq X_1 \tag{38}$$

*Characteristic No. 6*

Entity is the owner of two American options (call or put) with same strike prices but different time to the expiration.

The value of the option with longer time to expiration has to be same or higher than the price of the second option.

$$CALL_{US}(T_2) \geq CALL_{US}(T_1) \quad for\ T_2 \geq T_1 \tag{39}$$

$$PUT_{US}(T_2) \geq PUT_{US}(T_1) \quad for\ T_2 \geq T_1 \tag{40}$$

*Characteristic No. 7*

The characteristic No. 6 is valid only for European call options and not for European put options:

$$CALL_{EU}(T_2) \geq CALL_{EU}(T_1) \quad for\ T_2 \geq T_1 \tag{41}$$

$$PUT_{EU}(T_2) \geq PUT_{EU}(T_1) \quad for\ T_2 \geq T_1 \quad IS\ NOT\ VALID! \tag{42}$$

*Characteristic No. 8*

The value of call options could be maximally equal to the current market price of underlying share:

$$S \geq CALL_{US}(S) \geq CALL_{EU}(S) \tag{43}$$

*Characteristic No. 9*

The value of put options could be maximally equal to the strike price:

$$X \geq PUT_{US}(X) \geq PUT_{EU}(X) \tag{44}$$

*Characteristic No. 10*

As the call option value is higher than its fair value, option will be never realized before the expiration and its value has to be therefore higher than the intrinsic value:

$$CALL_{US}(S,X,T,i_{RF}) \geq CALL_{EU}(S,X,T,i_{RF}) \geq S - Xe^{-i_{RF}T} > S - X; \quad if\ CALL_{US} = CALL_{EU} \tag{45}$$

*Characteristic No. 11*

The call options values are the convex functions of the strike price. From mathematical point of view is therefore valid for $X_3 = \lambda X_1 + (1-\lambda)X_2; 0 \leq \lambda \leq 1$:

$$CALL(X_3) = CALL(\lambda X_1 + (1-\lambda)X_2) \leq \lambda CALL(X_1) + (1-\lambda)CALL(X_2) \tag{46}$$

We will create following two portfolios:

*Portfolio 1:* call option with strike price $X_3$

*Portfolio 2:* $\lambda$ call options with strike price $X_1$ and (1-$\lambda$) call options with strike price $X_2$.

The portfolios values at the time of expiration is following:

portfolio 1: $max[S - \lambda X_1 - (1-\lambda)X_2; 0]$ (47)

portfolio 2: $\lambda max[S - X_1; 0] + (1-\lambda)max[S - X_2; 0]$ (48)

The maximum is the convex function and it is valid:

$$max[S - \lambda X_1 - (1-\lambda)X_2; 0] \leq \lambda max[S - X_1; 0] + (1-\lambda)max[S - X_2; 0] \tag{49}$$

There could be stated that portfolio 2 dominates to portfolio 1 and therefore this relation it is also valid for CALL($X_3$).

In case that this relation would be invalid, investor could sell call option with strike price $X_3$ and purchase $\lambda$ options with strike price $X_1$ and (1-$\lambda$) options with strike price $X_2$. The difference represents realized minimal profit.

*Characteristic No. 12*
There is valid for European put option following relation:

$$PUT_{EU}(X,T,i_{RF}) \leq Xe^{-i_{RF}T} \quad (50)$$

European put option with longer time to expiration has to have lower value than European put option with shorter time to expiration.

*Characteristic No. 13*
For put options is also valid:

$$PUT_{US}(S,X,T,i_{RF}) \geq PUT_{EU}(S,X,T,i_{RF}) \geq Xe^{-i_{RF}T} - S \quad (51)$$

From this point of view the minimum value of the American put option has to be its intrinsic value.

*Characteristic No. 14*
American put option could be realized before the expiration. Therefore it is invalid the following relation:

$$PUT_{US}(S,X,T) > max[0; X - S] \quad (52)$$

*Characteristic No. 15*
Entity has two options just with different strike prices. The difference in option values will be always lower than the difference in strike prices:

$$|CALL(X_1) - CALL(X_2)| \leq |X_1 - X_2| \quad (53)$$

$$|PUT(X_1) - PUT(X_2)| \leq |X_1 - X_2| \quad (54)$$

*Characteristic No. 16*
For the European options the characteristic No. 15 has to be modified as follows: difference in option values will be always same or lower than the difference in present values or strike prices:

$$CALL(X_1,T,i_{RF}) - CALL(X_2,T,i_{RF}) \leq (X_2 - X_1)e^{-i_{RF}T} \quad (55)$$

$$PUT(X_2,T,i_{RF}) - PUT(X_1,T,i_{RF}) \leq (X_2 - X_1)e^{-i_{RF}T} \quad (56)$$

*Characteristic No. 17*
This characteristic deals with the impact of risk-free interest rate on the option value.
In case that the risk-free interest rate is rising, the value of call option is also rising (and vice versa).
In case that the risk-free interest rate is rising, the value of put option is decreasing (and vice versa).

*Characteristic No. 18*
Volatility of the price of underlying asset obviously means the increase in option value.
In case that the volatility is rising, the value of call (and put) option is also rising (and vice versa).

*Characteristic No. 19*
The European call option value has to be higher than:

$$CALL_{EU}(S,X,T,i_{RF},div) \geq S - Xe^{-i_{RF}T} - div \quad (57)$$

The European put option value has to be higher than:

$$PUT_{EU}(S,X,T,i_{RF},div) \geq Xe^{-i_{RF}T} - S + div \quad (58)$$

*Characteristic No. 20*
Knowing that the value of American options is same or higher than value of European options, it is also valid this last characteristic:

$$PUT_{US}(S,X,T,i_{RF},div) \geq PUT_{EU}(S,X,T,i_{RF},div) \geq Xe^{-i_{RF}T} - S + div \quad (59)$$

### 3.3.4 Sensitivity Analysis: Greeks Matters!

Economists and analysts are mostly interested in the change in price of option in case that will be changed one

of the quantifiable parameters – there is tested the sensitivity on the change in spot (market) price, time to expiration, risk-free interest rate and volatility.

**Delta option**

Delta parameter measures the change in option premium value in case that the price of underlying asset will change for a unit. The value of delta reaches interval <-1; +1>; delta call always reaches positive values, thus delta put always reaches negative values.

*Delta call option*

This parameter could be calculated as follows:

$$\Delta_{CALL} = \frac{\partial CALL}{\partial S} \tag{60}$$

$$\boldsymbol{\Delta_{CALL} = N(d_1)} \tag{61}$$

*Delta put option*

This parameter could be calculated as follows:

$$\Delta_{PUT} = \frac{\partial PUT}{\partial S} \tag{62}$$

$$\boldsymbol{\Delta_{PUT} = -N(-d_1)} \tag{63}$$

The difference between delta call and delta put is always equal to 1.

**Gamma option**

Gamma option defines the volume of future reaction of the option premium on change of the price of underlying asset. Therefore it states how will change delta parameter in case that the price of underlying asset will change for a unit. Investor therefore seeks for options with the highest gamma, i.e. not very expensive option with a change that the delta will change significantly and the purchase of this option would be advantageous for the investor. There is purchased an option with such intrinsic value where the change in price of underlying asset affects the value of delta parameter as much as possible.
Gamma parameter always reaches positive values.

*Gamma call option*

This parameter could be calculated as follows:

$$\Gamma_{CALL} = \frac{\partial \Delta_{CALL}}{\partial S} \tag{64}$$

$$\boldsymbol{\Gamma_{CALL} = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}d_1^2} \frac{1}{S\sigma\sqrt{T}}} \tag{65}$$

*Gamma put option*

This parameter could be calculated as follows:

$$\Gamma_{PUT} = \frac{\partial \Delta_{PUT}}{\partial S} \tag{66}$$

$$\boldsymbol{\Gamma_{PUT} = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}d_1^2} \frac{1}{S\sigma\sqrt{T}}} \tag{67}$$

Gamma put option is always identical with gamma call option.

**Rho option**

Rho parameter defines the change in option premium value in case of the change in risk-free interest rate. In case that the interest rate will be higher for 5 %, we can expect the increase of call option value for rho multiplied by 5 %.

*Rho call option*
This parameter could be calculated as follows:

$$\rho_{CALL} = \frac{\partial CALL}{\partial i_{RF}} \tag{68}$$

$$\boldsymbol{\rho_{CALL} = XTe^{-i_{RF}T}N(d_2)} \tag{69}$$

Rho call option always reaches positive values.

*Rho put option*
This parameter could be calculated as follows:

$$\rho_{PUT} = \frac{\partial PUT}{\partial i_{RF}} \tag{70}$$

$$\boldsymbol{\rho_{PUT} = -XTe^{-i_{RF}T}N(-d_2)} \tag{71}$$

Rho put option always reaches negative values.

**Vega (kappa, lambda or sigma) option**
Vega option interprets a change in option premium value as a result of 1 % change in volatility of underlying asset. Options with high vega parameter are very sensitive on small changes in volatility; the price of options with small vega are affected by the change in volatility minimally.
Vega parameter always reaches positive values.

*Vega call option*
This parameter could be calculated as follows:

$$\upsilon_{CALL} = \frac{\partial CALL}{\partial \sigma} \tag{72}$$

$$\boldsymbol{\upsilon_{CALL} = S\sqrt{T}\frac{e^{-\frac{1}{2}d_1^2}}{\sqrt{2\pi}}} \tag{73}$$

*Vega put option*
This parameter could be calculated as follows:

$$\upsilon_{PUT} = \frac{\partial PUT}{\partial \sigma} \tag{74}$$

$$\boldsymbol{\upsilon_{PUT} = S\sqrt{T}\frac{e^{-\frac{1}{2}d_1^2}}{\sqrt{2\pi}}} \tag{75}$$

Vega put option is always identical with vega call option.

**Theta option**
Theta option interprets a change in option premium value in case that the time to expiration will decrease for a unit. As the time to expiration has to have declining trend (it simply cannot increase), theta parameter always has to reach negative values.

*Theta call option*
This parameter could be calculated as follows:

$$\Theta_{CALL} = \frac{\partial CALL}{\partial T} \tag{76}$$

$$\boldsymbol{\Theta_{CALL} = -Xe^{-i_{RF}T}\left(i_{RF}N(d_2) + \frac{\sigma e^{-\frac{1}{2}d_2^2}}{2\sqrt{2\pi T}}\right)} \tag{77}$$

*Theta put option*
This parameter could be calculated as follows:

$$\Theta_{PUT} = \frac{\partial PUT}{\partial T} \tag{78}$$

$$\boldsymbol{\Theta_{PUT} = -Xe^{-i_{RF}T}\left(-i_{RF}N(-d_2) + \frac{\sigma e^{-\frac{1}{2}d_2^2}}{2\sqrt{2\pi T}}\right)} \tag{79}$$

**EXAMPLE**
Company would like to purchase equity call option or equity put option. The current conditions are following:

- market price 2 000 CU
- strike price 1 995 CU
- time to expiration 1 year
- risk-free interest rate 4 % p.a.
- volatility of the price 11 %

Calculate the call option premium and put option premium and provide the sensitivity analysis (coefficients delta, gamma, rho, vega and theta).

*Solution:*
*1 – calculation of parameters $d_1$ and $d_2$ and the distribution function values $N(d_1)$ and $N(d_2)$*

$$d_1 = \frac{ln\frac{S}{X} + \left(i_{RF} + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_1 = \frac{ln\frac{2{,}000}{1{,}995} + \left(0.04 + \frac{0.11^2}{2}\right)1}{0.11\sqrt{1}}$$

$$\boldsymbol{d_1 = 0.441392}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$$d_2 = 0.441392 - 0.11\sqrt{1}$$

$$d_2 = 0.331392$$

$$N(d) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{d} e^{-\frac{x^2}{2}}\,dx$$

$$N(d_1) = N(0.441392)$$

$$\boldsymbol{N(d_1) = 0.670535}$$

$$N(d_2) = N(0.331392)$$

$$\boldsymbol{N(d_2) = 0.629826}$$

*2 – calculation of call option premium and put option premium*[15]

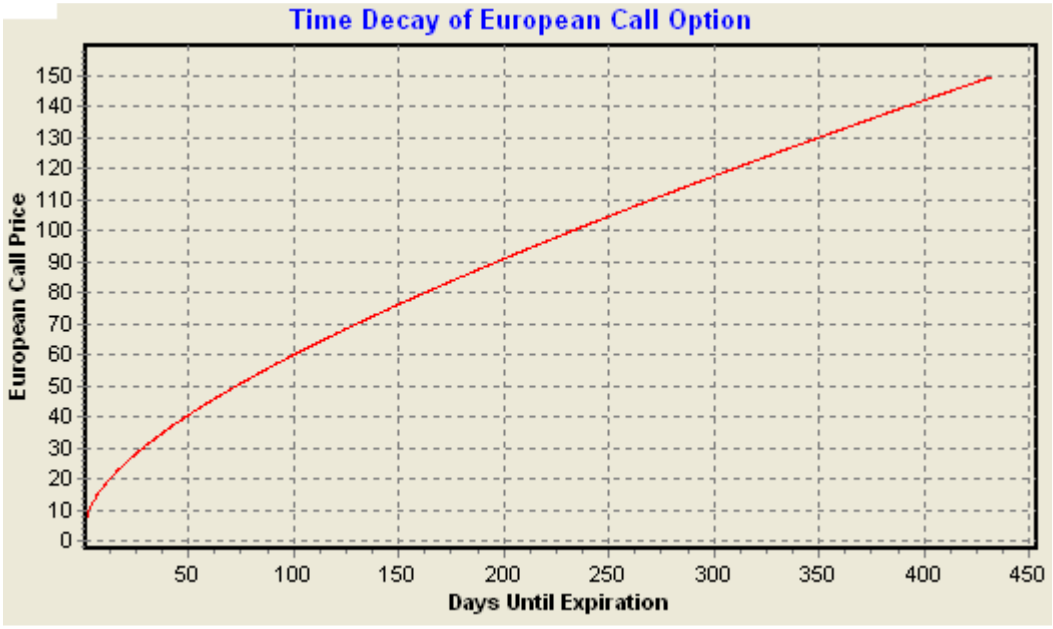
$$CALL = S \cdot N(d_1) - X \cdot e^{-i_{RF}T} \cdot N(d_2)$$

$$CALL = 2{,}000 \cdot 0.670535 - 1{,}995 \cdot e^{-0.04 \cdot 1} \cdot 0.629826$$

$$\boldsymbol{CALL = 133.84\ CU}$$

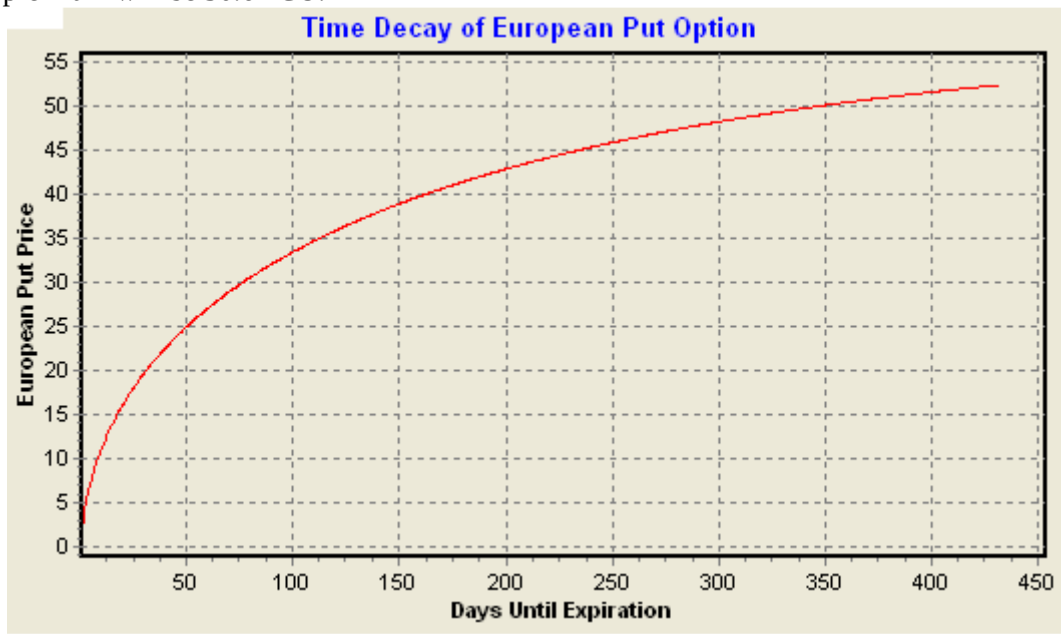
Call option premium will be 133.84 CU.

[15] Graphical solution based on software [58].




$$PUT = CALL + X \cdot e^{-i_{RF}T} - S$$
$$PUT = 133.84 + 1995 \cdot e^{-0.04 \cdot 1} - 2000$$
$$\boldsymbol{PUT = 50.61\ CU}$$

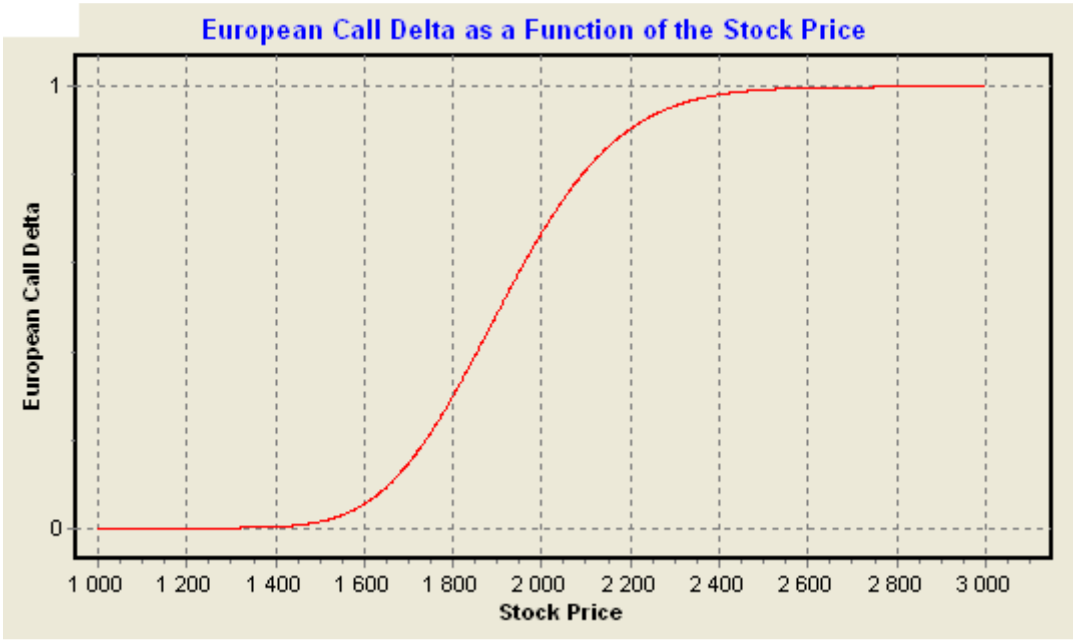
Put option premium will be 50.61 CU.

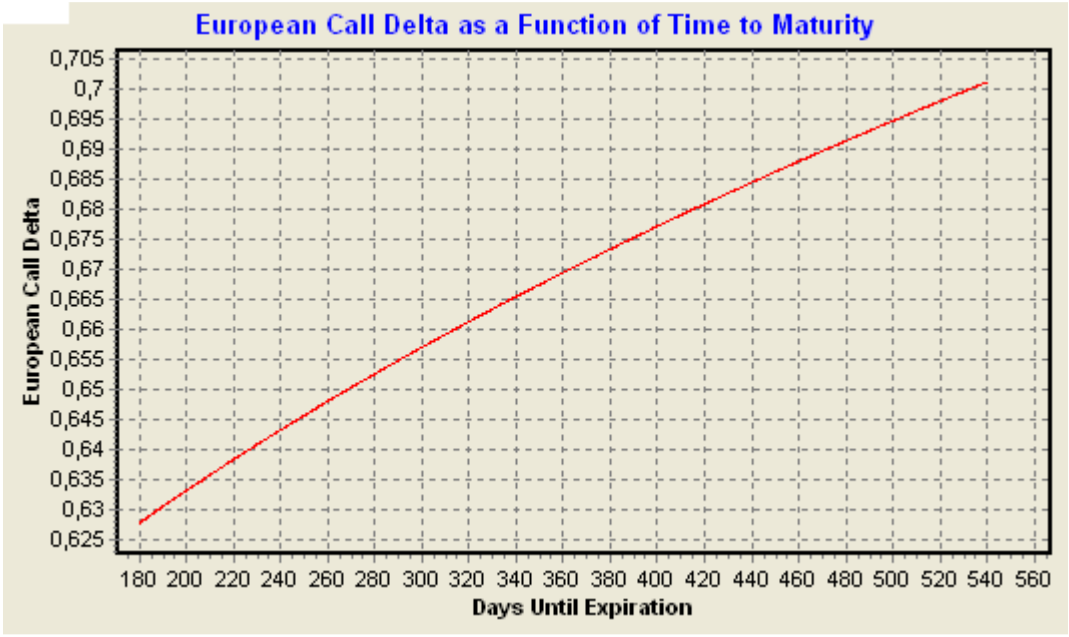



*3 – sensitivity analysis*
*a – delta*

$$\Delta_{CALL} = N(d_1)$$
$$\boldsymbol{\Delta_{CALL} = 0.670535}$$

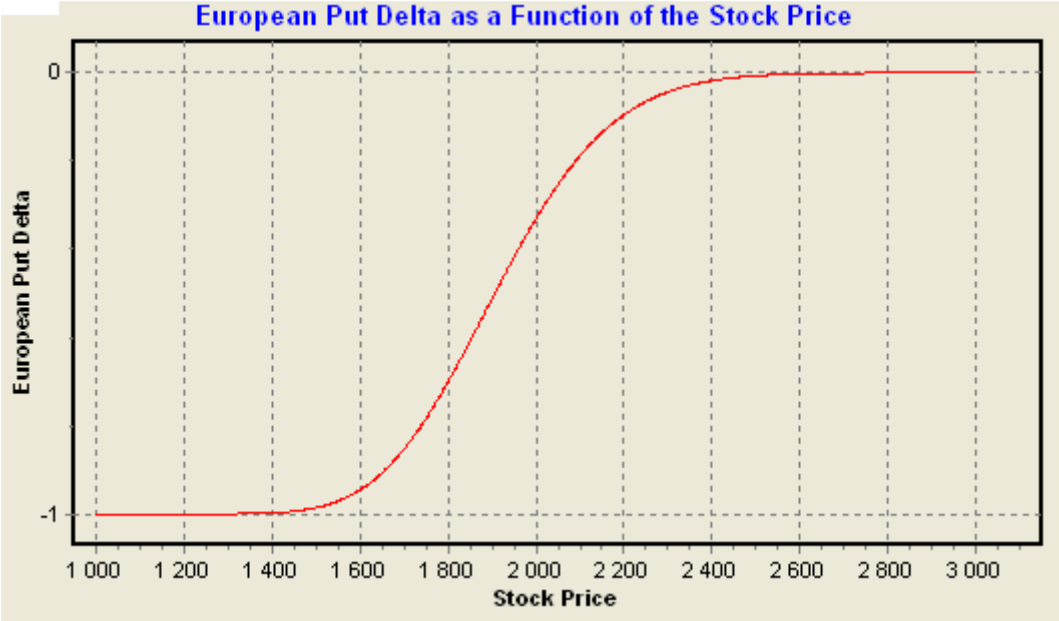
Delta call option will be 0.67.

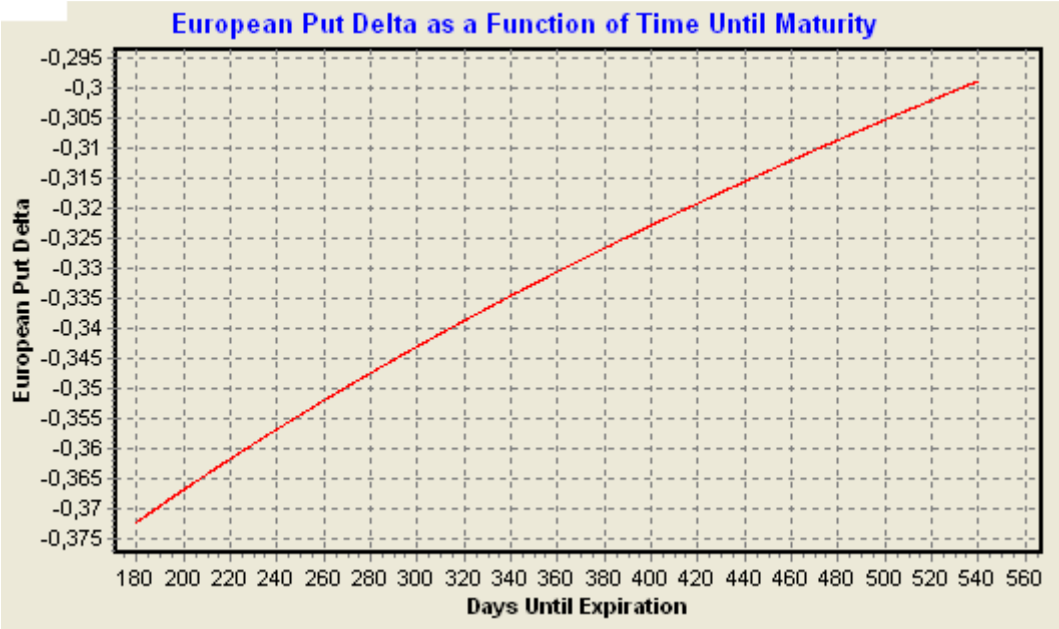



$$\Delta_{PUT} = -N(-d_1)$$
$$\Delta_{PUT} = -N(-0.441392)$$
$$\boldsymbol{\Delta_{PUT} = -0.329465}$$

Delta put option will be -0.33.



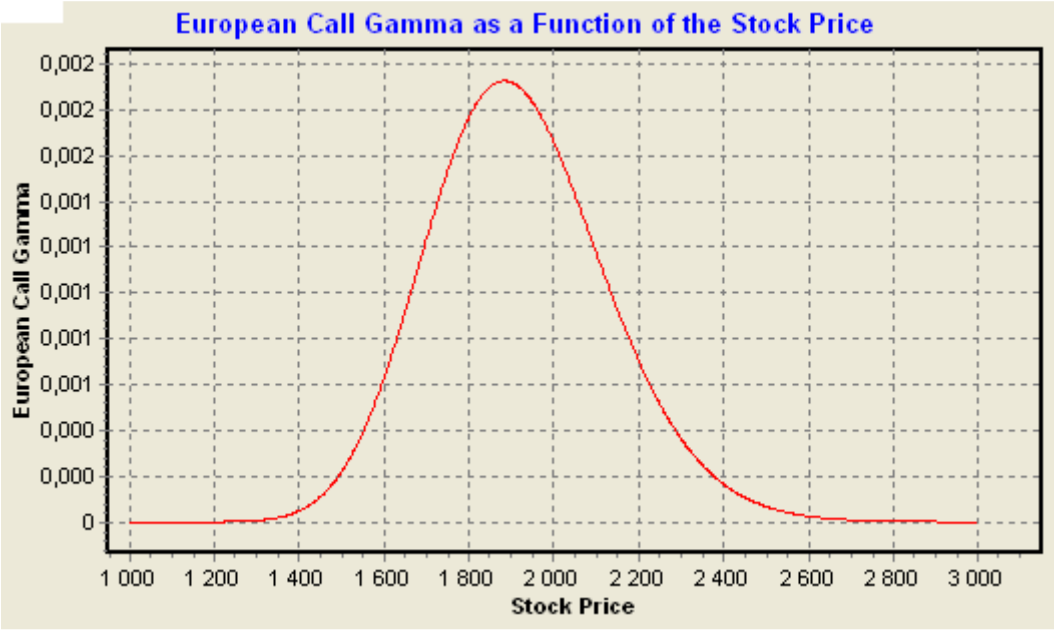

*b – gamma*

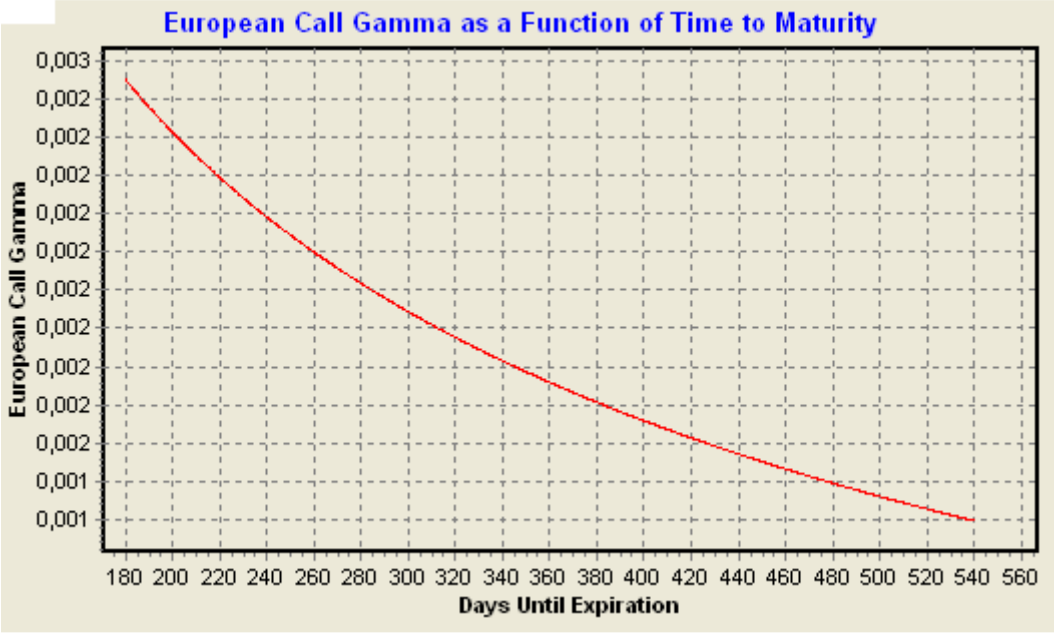
$$\Gamma_{CALL} = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}d_1^2} \frac{1}{S\sigma\sqrt{T}}$$

$$\Gamma_{CALL} = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}0.41392^2} \frac{1}{2{,}000 \cdot 0.11 \cdot \sqrt{1}}$$

$$\boldsymbol{\Gamma_{CALL} = 0.001645}$$

Gamma call option will be 0.0002.




$$\Gamma_{PUT} = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}d_1^2} \frac{1}{S\sigma\sqrt{T}}$$

$$\Gamma_{PUT} = \Gamma_{CALL}$$

$$\boldsymbol{\Gamma_{PUT} = 0.001645}$$

Gamma put option will be very same like gamma call option, i.e. 0.0002.

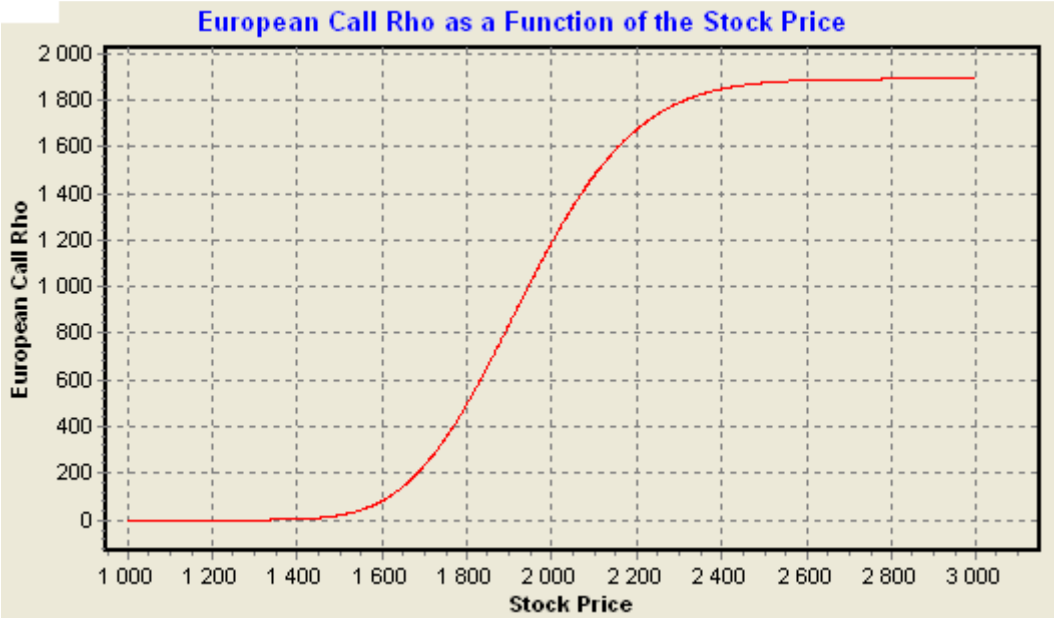
*c – rho*

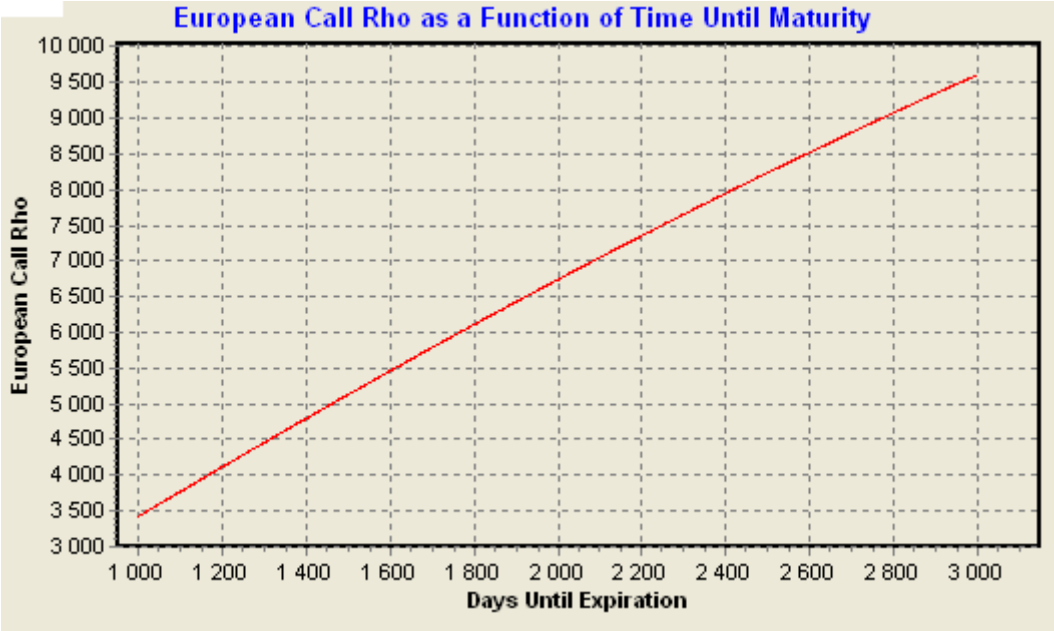
$$\rho_{CALL} = XTe^{-i_{RF}T}N(d_2)$$

$$\rho_{CALL} = 1{,}995 \cdot 1 \cdot e^{-0.04 \cdot 1} \cdot 0.629826$$

$$\boldsymbol{\rho_{CALL} = 1{,}207.23}$$

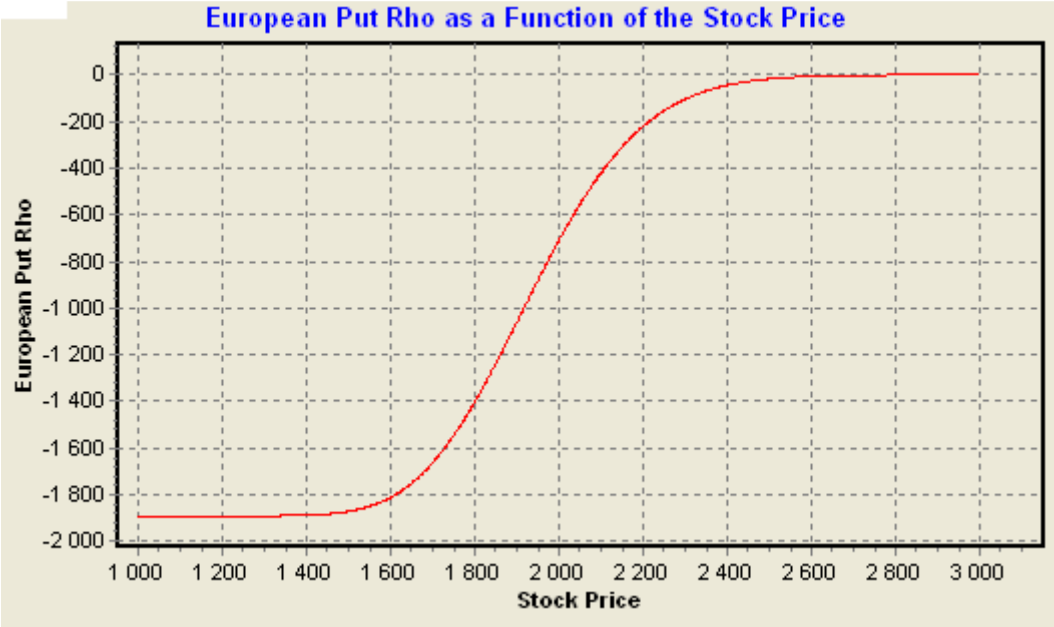
Rho call option will be 1,207.23.

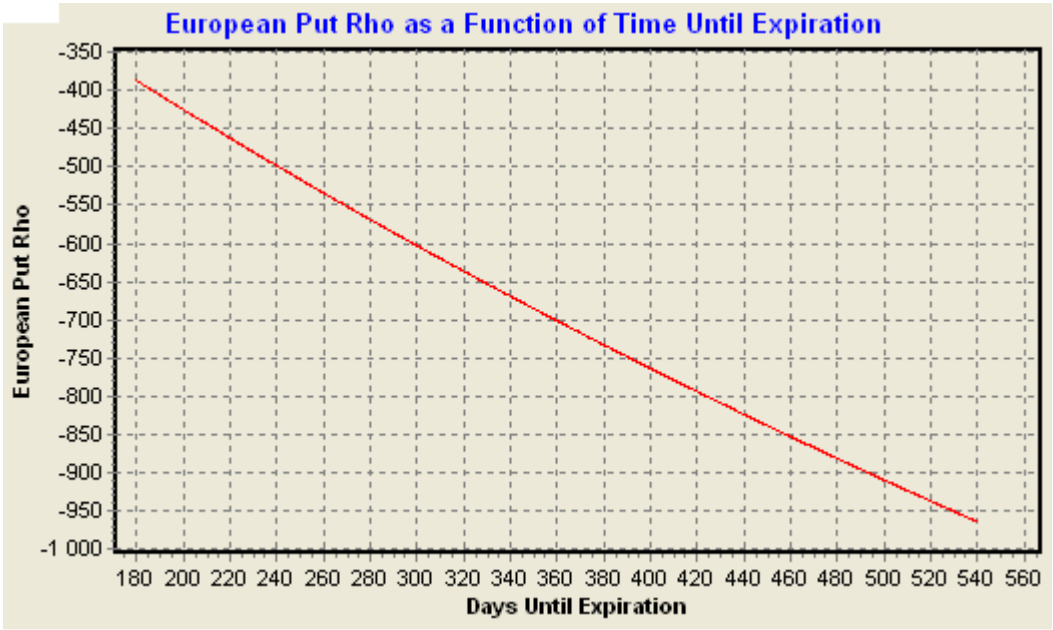



$$\rho_{PUT} = -XTe^{-i_{RF}T}N(-d_2)$$
$$\rho_{PUT} = -1{,}995 \cdot 1 \cdot e^{-0.04 \cdot 1}N(-0.331392)$$
$$\boldsymbol{\rho_{PUT} = -709.54}$$

Rho put option will be -709.54.



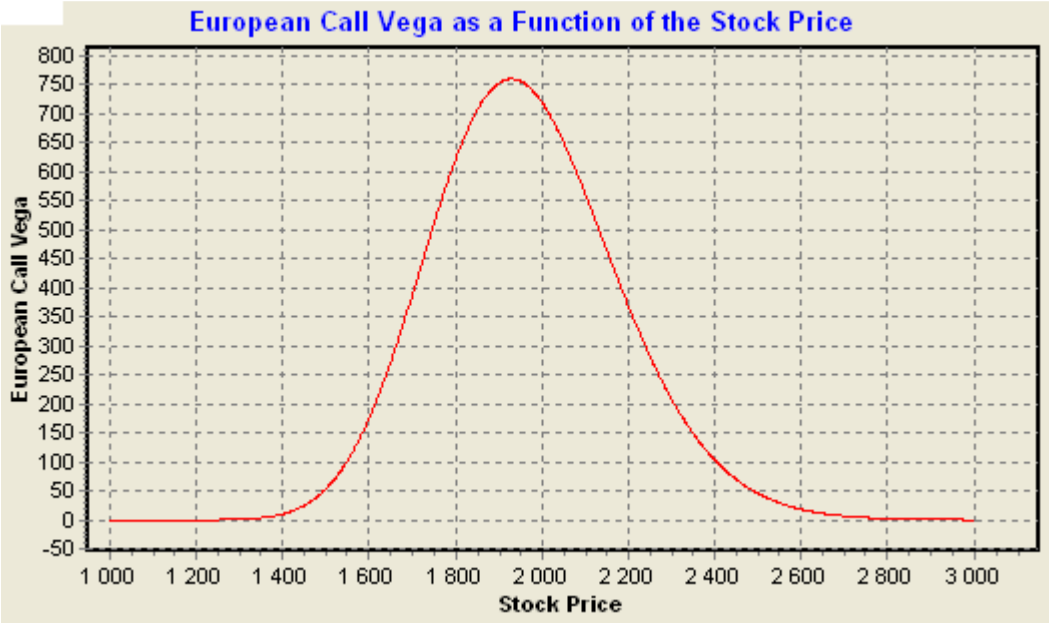

*d – vega*

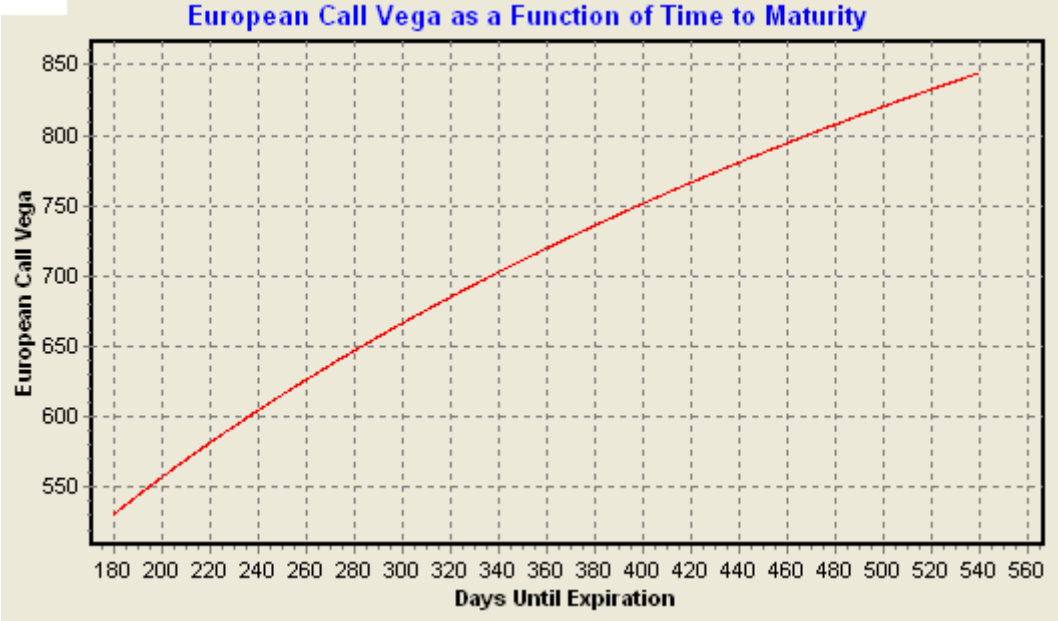
$$v_{CALL} = S\sqrt{T}\frac{e^{-\frac{1}{2}d_1^2}}{\sqrt{2\pi}}$$

$$v_{CALL} = 2{,}000\sqrt{1}\frac{e^{-\frac{1}{2}\cdot 0.441392^2}}{\sqrt{2\pi}}$$

$$\boldsymbol{v_{CALL} = 723.83}$$

Vega call option will be 723.83.




$$\nu_{PUT} = S\sqrt{T}\frac{e^{-\frac{1}{2}d_1^2}}{\sqrt{2\pi}}$$

$$\nu_{PUT} = \nu_{CALL}$$

$$\boldsymbol{\nu_{PUT} = 723.83}$$

Vega put option will be very same like vega call option, i.e. 723.83.

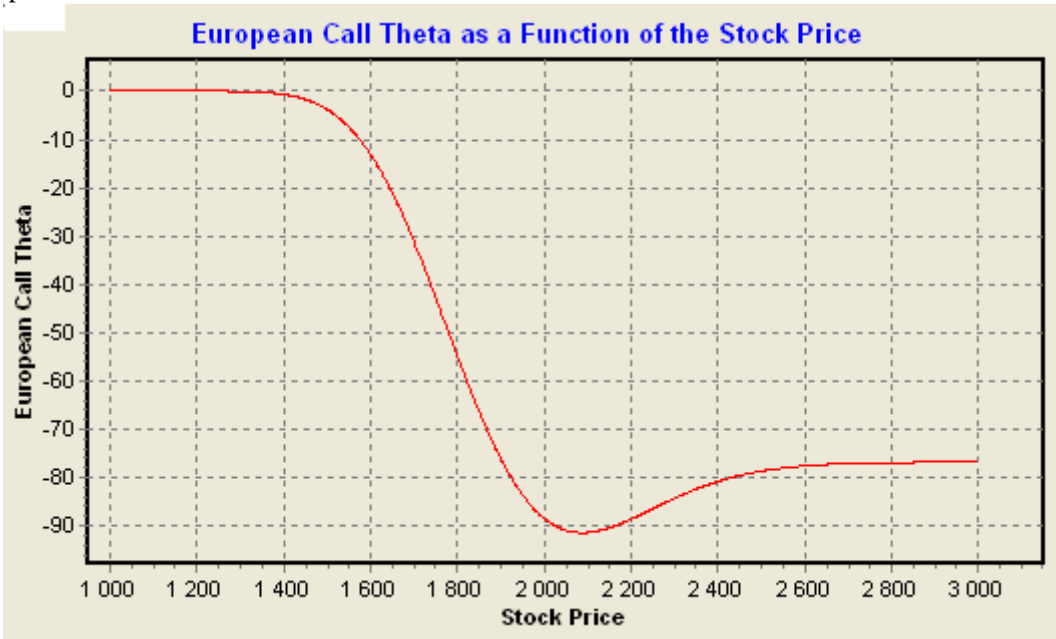
*e – theta*

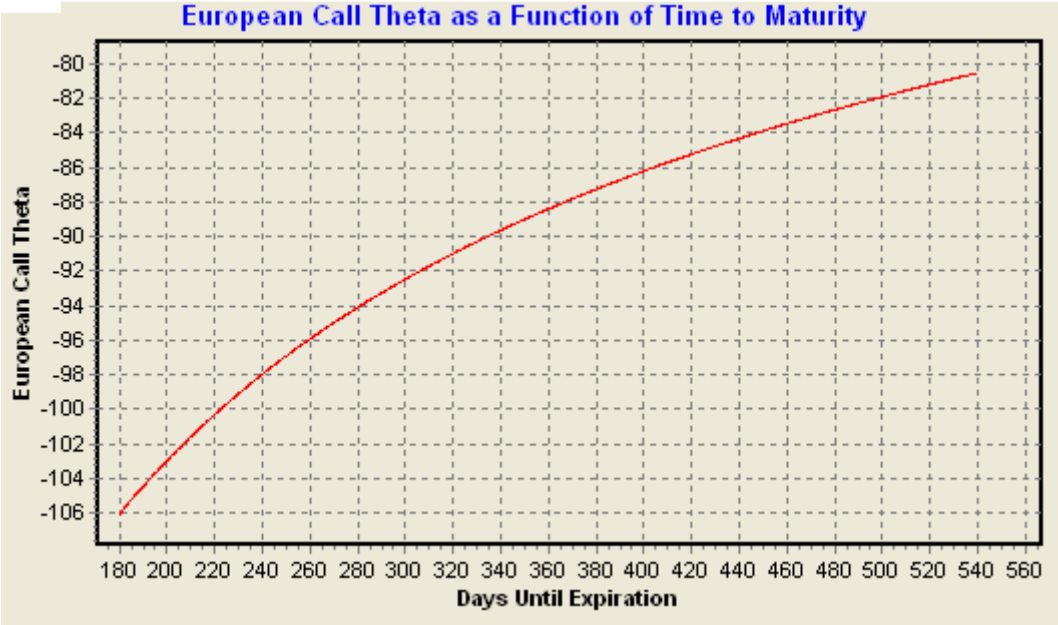
$$\Theta_{CALL} = -Xe^{-i_{RF}T}\left(i_{RF}N(d_2) + \frac{\sigma e^{-\frac{1}{2}d_2^2}}{2\sqrt{2\pi T}}\right)$$

$$\Theta_{CALL} = -1{,}995 \cdot e^{-0.04 \cdot 1}\left(0.04 \cdot 0.629826 + \frac{0.11 \cdot e^{-\frac{1}{2}0.331392^2}}{2\sqrt{2\pi \cdot 1}}\right)$$

$$\boldsymbol{\Theta_{CALL} = -88.10}$$

Theta call option will be -88.10.



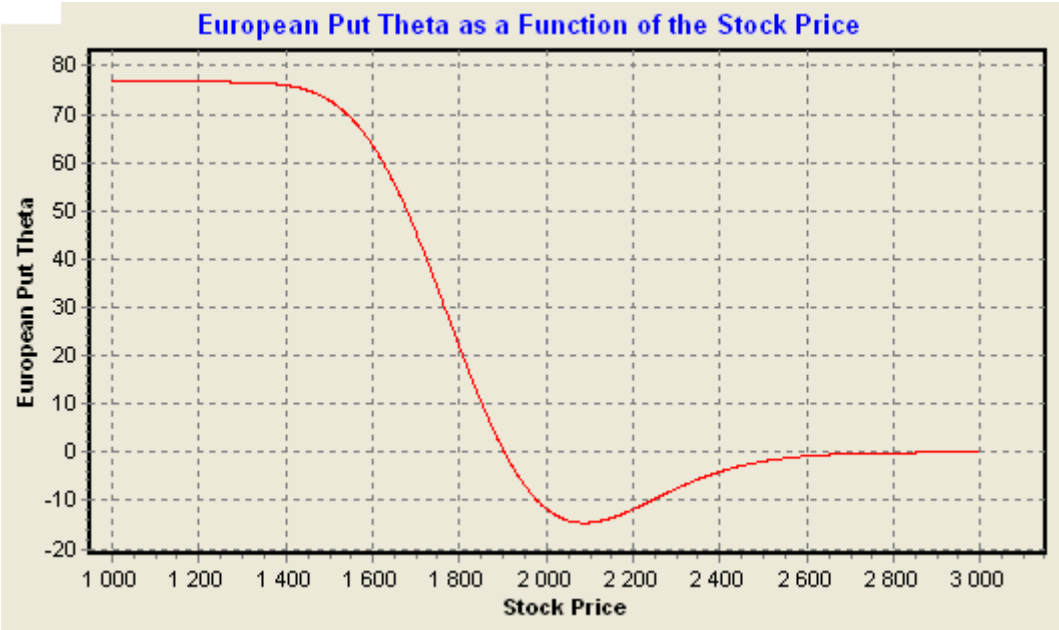



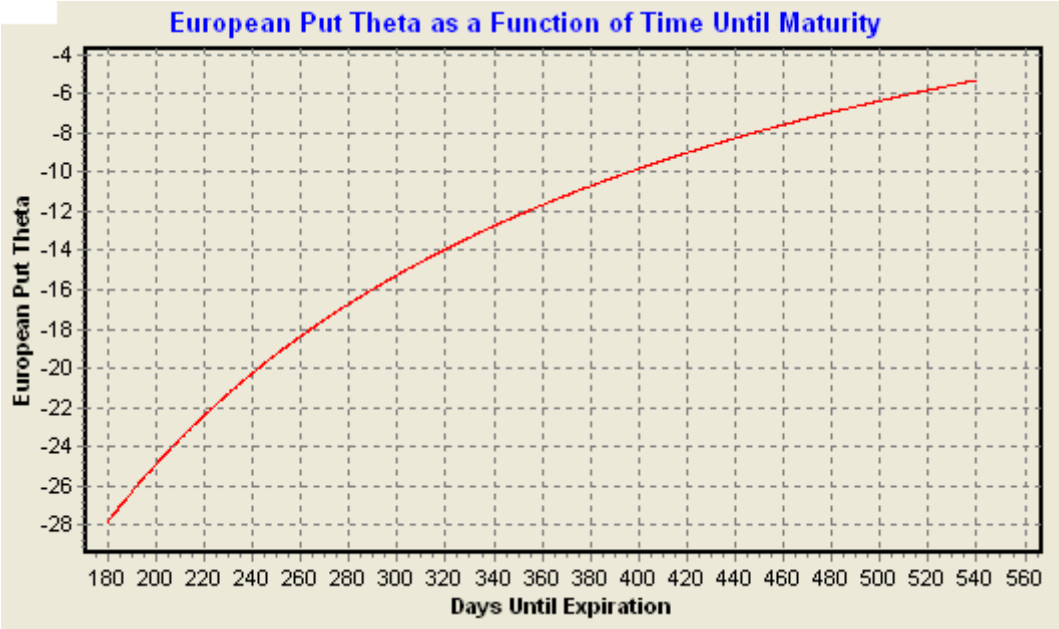

$$\Theta_{PUT} = -Xe^{-i_{RF}T}\left(-i_{RF}N(-d_2) + \frac{\sigma e^{-\frac{1}{2}d_2^2}}{2\sqrt{2\pi T}}\right)$$

$$\Theta_{PUT} = -1{,}995 \cdot e^{-0.04 \cdot 1}\left(-0.04 \cdot N(-0.331392) + \frac{0.11 \cdot e^{-\frac{1}{2}0.331392^2}}{2\sqrt{2\pi \cdot 1}}\right)$$

$$\boldsymbol{\Theta_{PUT} = -11.43}$$

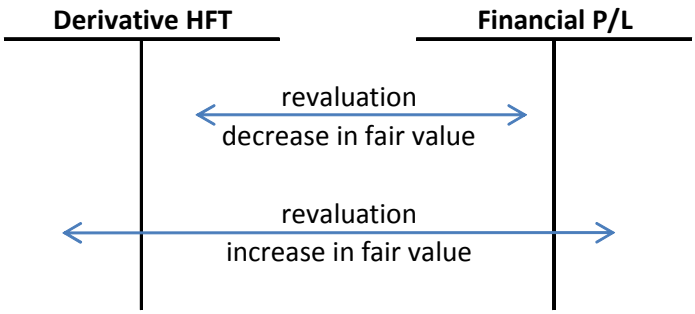
Theta put option will be -11.43.




## 3.4 Accounting Issues: Focused on FX Options

Options have to be posted in off-balance sheet evidence since the time of negotiation. Within the balance sheet there is treated the option premium received or paid. Upon the balance sheet day the accounting unit has the obligation to revaluate such contract at fair value. Generally all derivatives are revaluated at fair value through profit/loss.




Methodology of posting of options provides following table [107]:

| | |
|---|---|
| 1 | Posting of option premium paid |
| 2 | Posting of off-balance sheet receivable upon the date of contract negotiation |
| 3 | Posting of off-balance sheet liability upon the date of contract negotiation |
| 4 | Revaluation of option contract at fair value upon balance sheet date |
| 5 | Revaluation of off-balance sheet receivable upon balance sheet date |
| 6 | Revaluation of off-balance sheet liability upon balance sheet date |
| 7 | … |
| 8 | Revaluation of option contract at fair value upon the date of settlement |
| 9 | Settlement of contract |
| 10 | Derecognition of off-balance sheet receivable |
| 11 | Derecognition of off-balance sheet liability |

Fair value of option, the off-balance sheet receivable and off-balance sheet liability is calculated as follows:

$$fair\ value = receivable - liability \tag{80}$$

$$receivable = SR \cdot e^{-i_{RF}^{F} T} \cdot N(d_1) \cdot contract\ volume \tag{81}$$

$$liability = FX \cdot e^{-i_{RF}^{D} T} \cdot N(d_2) \cdot contract\ volume \tag{82}$$

Next example provides evidence how to report currency options.

**EXAMPLE**

Company has negotiated 6M FX European option on purchase of 200,000 FCU. Contract has been negotiated on 1.10.2011 and will be settled on 31.3.2012. Current spot exchange rate is 25.70 DCU/FCU, domestic interest rate 2 % p.a. and foreign interest rate is 1.5 % p.a.

Interest rates, spot and strike exchange rates evolved as follows:

| **Variable** | **1.10.2011** | **31.12.2011** | **31.3.2012** |
|---|---|---|---|
| **Spot exchange rate** | 25.70 DCU/FCU | 25.55 DCU/FCU | 25.60 DCU/FCU |
| **Strike exchange rate** | 25.50 DCU/FCU | 25.50 DCU/FCU | 25.50 DCU/FCU |
| **Domestic risk-free interest rate** | 2.0 % | 2.2 % | 2.3 % |
| **Foreign risk-free interest rate** | 1.5 % | 1.8 % | 1.8 % |
| **Time to expiration** | 180 | 90 | 0 |
| **Volatility** | 7.0 % | 6.0 % | 6.0 % |

For the simplicity of calculations there will be used method 30/360.

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Purchase of FX long-call option<br>$CALL = [25.7 \cdot e^{-0.015 \cdot 0.5} \cdot N(0.233094) - 25.5 \cdot e^{-0.02 \cdot 0.5} \cdot N(0.183596)] \cdot 200000 = 128{,}549$ | 128,549<br>128,549 | Dr | <br>Cr | Long call option<br>Bank account (DCU) |
| 2 | Off-balance sheet receivable as at 1.10.2011<br>$receivable = [25.7 \cdot e^{-0.015 \cdot 0.5} \cdot N(0.233094)] \cdot 200000 = 3{,}020{,}938$ | 3,020,938 | Dr | | OBS receivable |
| 3 | Off-balance sheet payable as at 1.10.2011<br>$payable = [25.5 \cdot e^{-0.02 \cdot 0.5} \cdot N(0.183596)] \cdot 200000 = 2{,}892{,}389$ | 2,892,389 | | Cr | OBS payable |
| 4 | Revaluation of off-balance sheet receivable on 31.12.2011<br>$receivable = [25.55 \cdot e^{-0.018 \cdot 0.25} \cdot N(0.113629)] \cdot 200000 = 2{,}773{,}636$ | 247,302 | | Cr | OBS receivable |
| 5 | Revaluation of off-balance sheet payable on 31.12.2011<br>$payable = [25.5 \cdot e^{-0.022 \cdot 0.25} \cdot N(0.083629)] \cdot 200000 = 2{,}705{,}035$ | 187,354 | Dr | | OBS payable |
| 6 | Revaluation of the option at fair value on 31.12.2011<br>$CALL = [25.55 \cdot e^{-0.018 \cdot 0.25} \cdot N(0.113629) - 25.5 \cdot e^{-0.022 \cdot 0.25} \cdot N(0.083629)] \cdot 200000 = 68{,}601$ | 59,948<br>59,948 | Dr | <br>Cr | E – Financial P/L<br>Long call option |
| 7 | Revaluation of off-balance sheet receivable on 31.3.2012<br>$receivable = 25.6 \cdot 200000 = 5{,}120{,}000$ | 2,346,364 | Dr | | OBS receivable |
| 8 | Revaluation of off-balance sheet payable on 31.3.2012<br>$payable = 25.5 \cdot 200000 = 5{,}100{,}000$ | 2,394,965 | | Cr | OBS payable |
| 9 | Revaluation of the option at fair value on 31.3.2012<br>$CALL = (25.6 - 25.5) \cdot 200000 = 20{,}000$ | 48,601<br>48,601 | Dr | <br>Cr | E – Financial P/L<br>Long call option |
| 10 | Settlement<br>200,000 EUR @ 25.60<br>200,000 EUR @ 25.50 | 5,120,000<br>5,100,000<br>20,000 | Dr | <br>Cr<br>Cr | Bank account (FCU)<br>Bank account (DCU)<br>Long call option |
| 11 | Derecognition of off-balance sheet receivable | 5,120,000 | | Cr | OBS receivable |
| 12 | Derecognition of off-balance sheet payable | 5,100,000 | Dr | | OBS payable |

**Balance Sheet (changes 2011)**

| | | | |
|---|---|---|---|
| Long call option | 68,601 | Profit/loss | -59,948 |
| Bank account (DCU) | -128,549 | | |
| **Σ** | **-59,948** | **Σ** | **-59,948** |

**Balance Sheet (changes 2012)**

| | | | |
|---|---|---|---|
| Bank account (DCU) | -5,228,549 | Retained earnings | -59,948 |
| Bank account (FCU) | 5,120,000 | Profit/loss | -48,601 |
| **Σ** | **-108,549** | **Σ** | **-108,549** |

## 3.5 Option Strategies

By this moment there were defined two basic types of options, call options and put options and there were discussed two major positions, i.e. purchase of the option (long position) and sell of the option (short position).

**Spread** is considered as an option strategy consisting at least from two parts which can separately realize profit from the negative trend of the price of underlying asset. Due to the combination of options and shares to these

spreads investor could reach much better flexibility within his investment planning. Complex option strategies consist obviously from more spreads. Generally, investor purchase one option, but at the very same time sell another one. Spreads could be divided onto time spreads and vertical spreads.

**Time spread** (calendar or horizontal spread) consist from the purchase of call (or put) option with certain time of expiration and concurrent sell of call (or put) option with the same strike price, but shorter time to expiration. This spread is very sensitive on the price of underlying asset and the volatility. It is used in case upon the expiration the value of the option premium and the price of underlying asset will be approximately equal to strike price.

Time spreads are very sensitive on the changes in expected volatilities of options. Increase in volatility is vital for the time spread.

**Vertical spread** (bullish or bearish) is based on purchase of call (or put) option and simultaneous sell of other call (or put) option with the very same time to expiration, but different strike price:

- *bullish spread:*
  - strike price of purchased call option is lower than strike price of sold call option
  - strike price of purchased put option is lower than strike price of sold put option
- *bearish spread:*
  - strike price of purchased call option is higher than strike price of sold call option
  - strike price of purchased put option is higher than strike price of sold put option

***Bullish spread*** is used by investors who do not tend just to long call position or short put position. It is a popular type of trade as the investor is able to determine his position even in case of uncertain conditions.

***Bearish spread*** is used by investors who believe in decrease of the price of underlying asset.
Impact of the volatility change on vertical spreads is dependent on the fact whether the option strategy is profitable and also on the time to expiration.

Within following text we will focus on bullish, bearish and neutral option strategies. We would like to kindly note, that the illustration of the option strategies is only indicative.

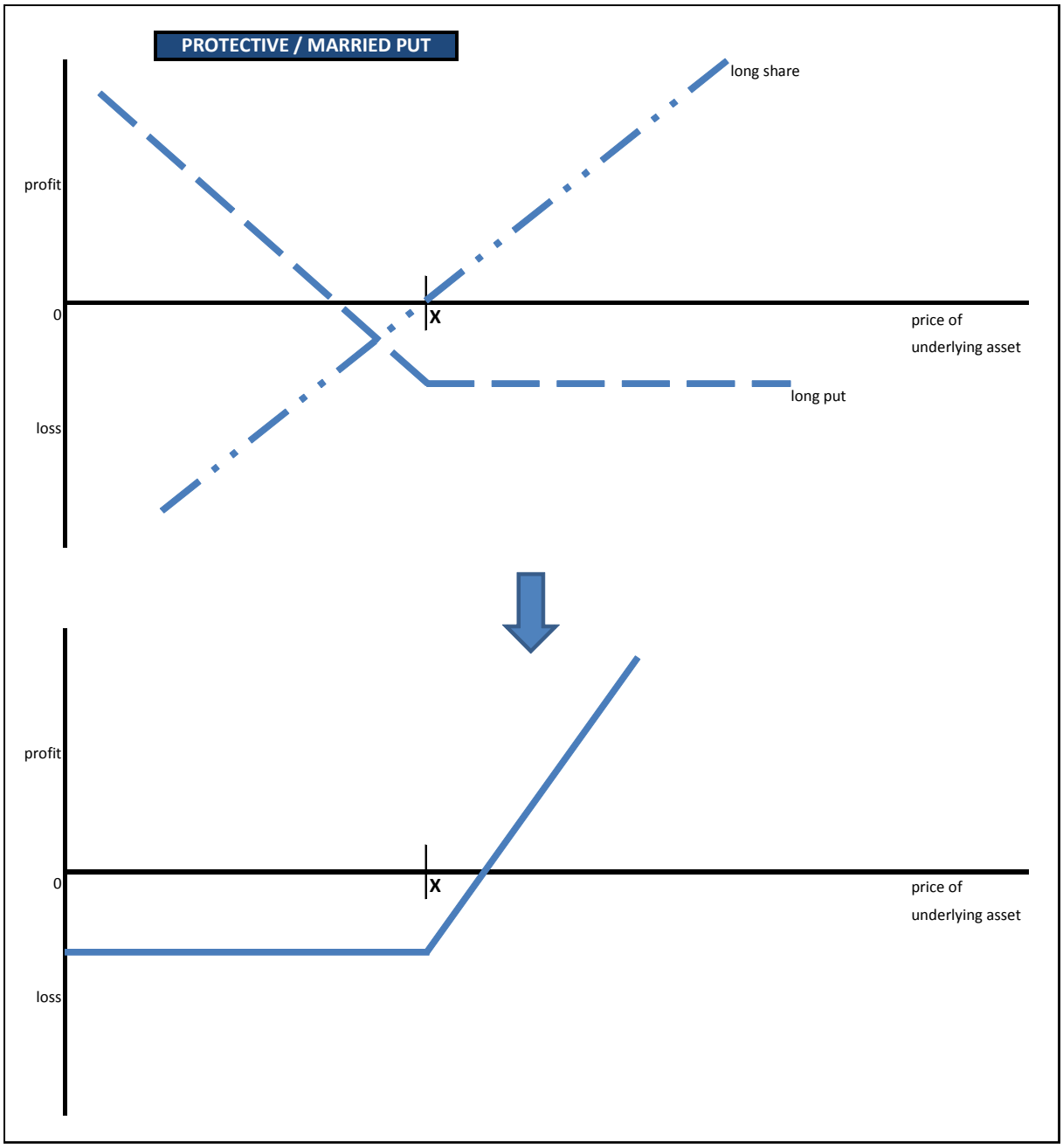
### 3.5.1 Bullish Strategies

Among **bullish strategies** could be for example stated:

- protective/married put,
- covered call / buy write,
- bull split-strike combo,
- bull call spread,
- call backspread,
- cash-secured short put.

*PROTECTIVE / MARRIED PUT*

When company applies the strategy **"protective/married put"**, entity is the owner of underlying asset (e.g. share) what is hedged by the purchase of the put option. This strategy leads to elimination of risks with de facto unlimited profits.
As a break-even point could be considered the cost of underlying asset (e.g. share) increased for the paid premium of purchased put option.

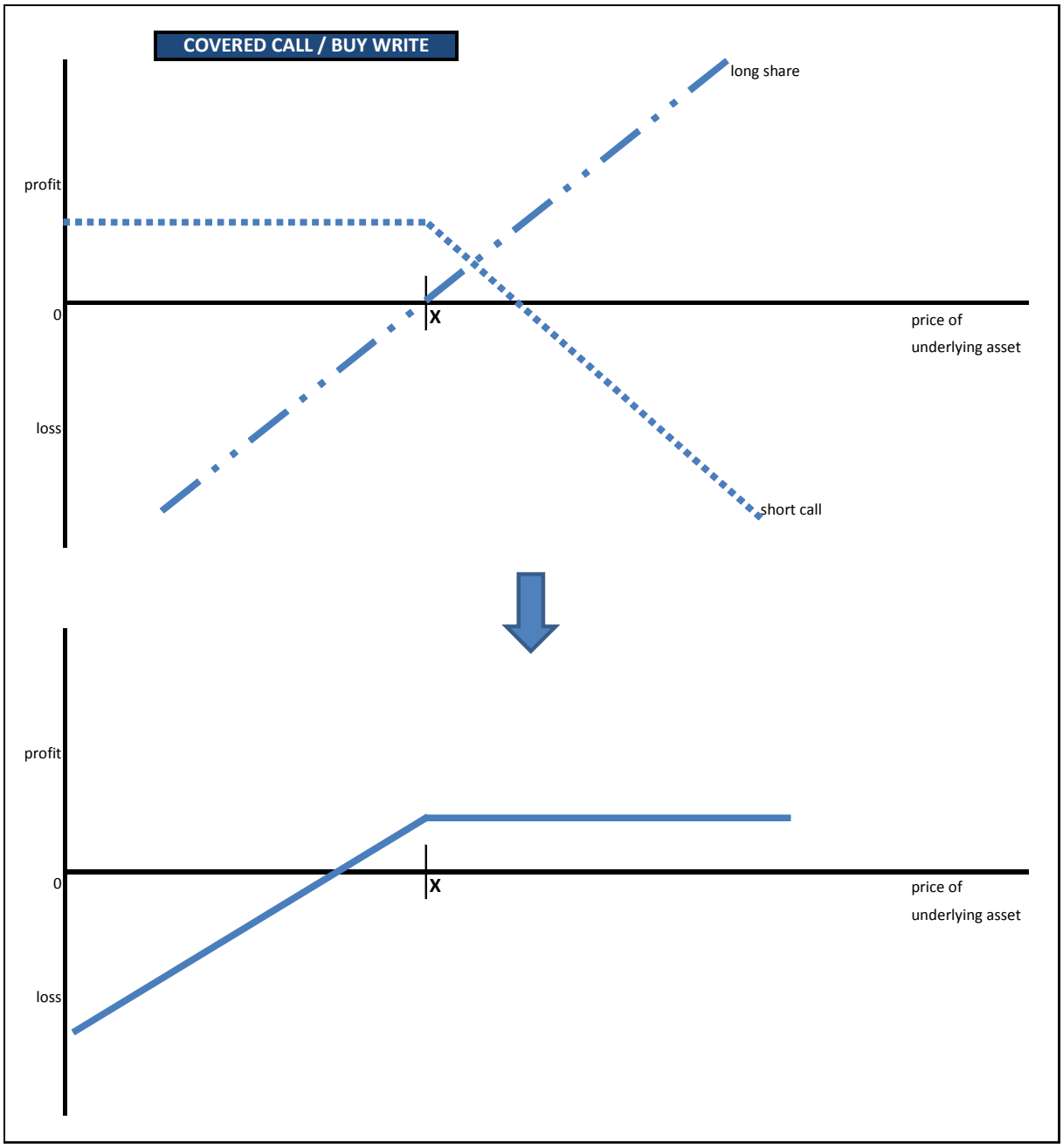



Source: authors' projection based on [132]

*COVERED CALL / BUY WRITE*

When company applies the strategy **"covered call / buy write"**, entity will purchase an underlying asset (e.g. share) and this purchase is hedged by the proportional sell of call options. This strategy tries to eliminate the potential risks, however as a major risk could be considered the decrease in market price of the underlying asset. Profits brought by this strategy are also limited.

As a break-even point could be considered the cost of underlying asset (e.g. cost of shares) less option premium received.



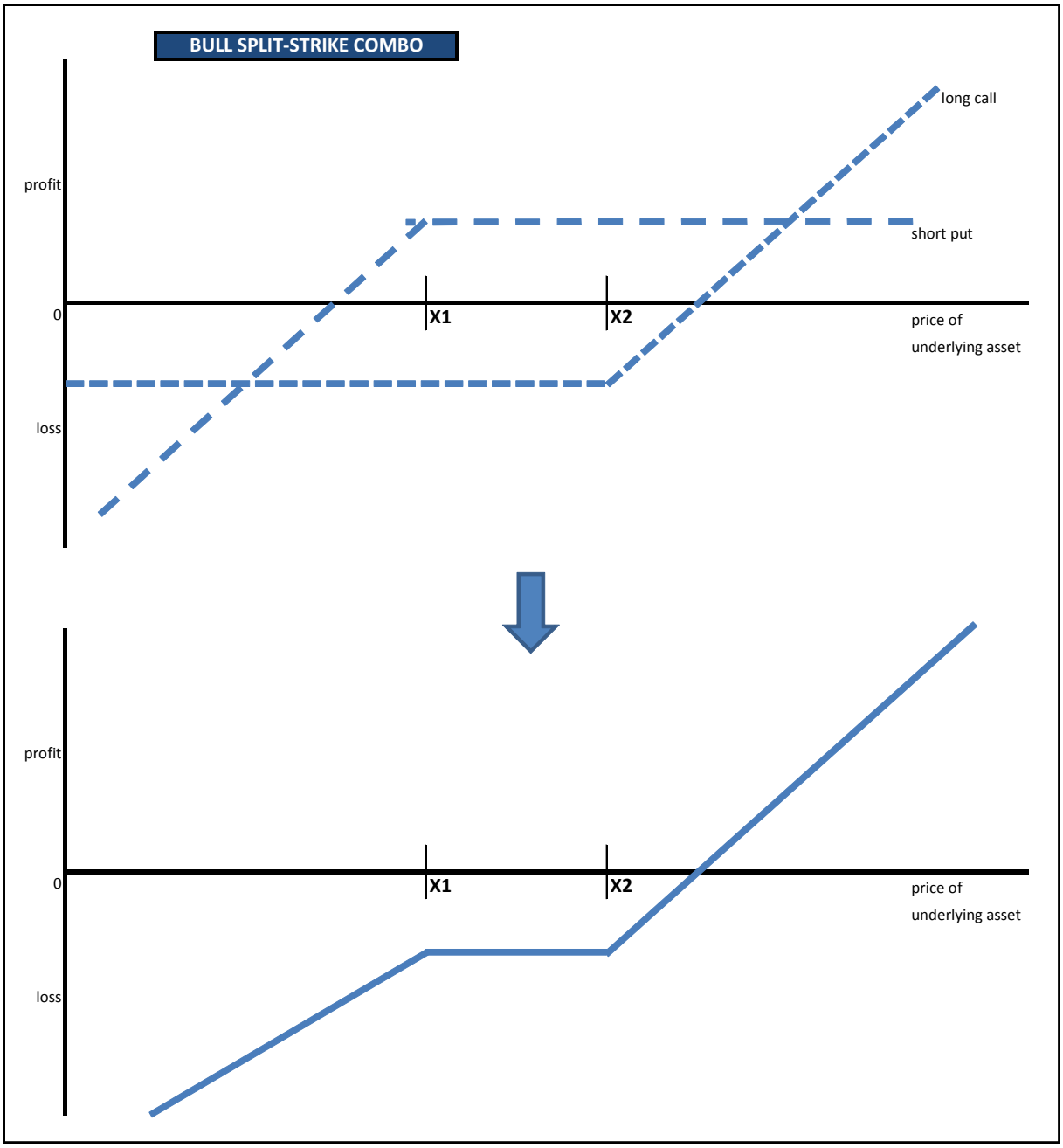

Source: authors' projection based on [132]

*BULL SPLIT-STRIKE COMBO*

When company applies the strategy **"bull split-strike combo"**, entity will purchase call option and simultaneously will sell the put option. Strike price of call option has to be higher than strike price of the put option. This strategy brings unlimited profit, however the risk is limited.

As a break-even point could be considered the strike price of the call option increased for the option premium paid.

In case that strike price of call option will be same as the strike price of put option, investor will apply the strategy "**synthetic long stock**".

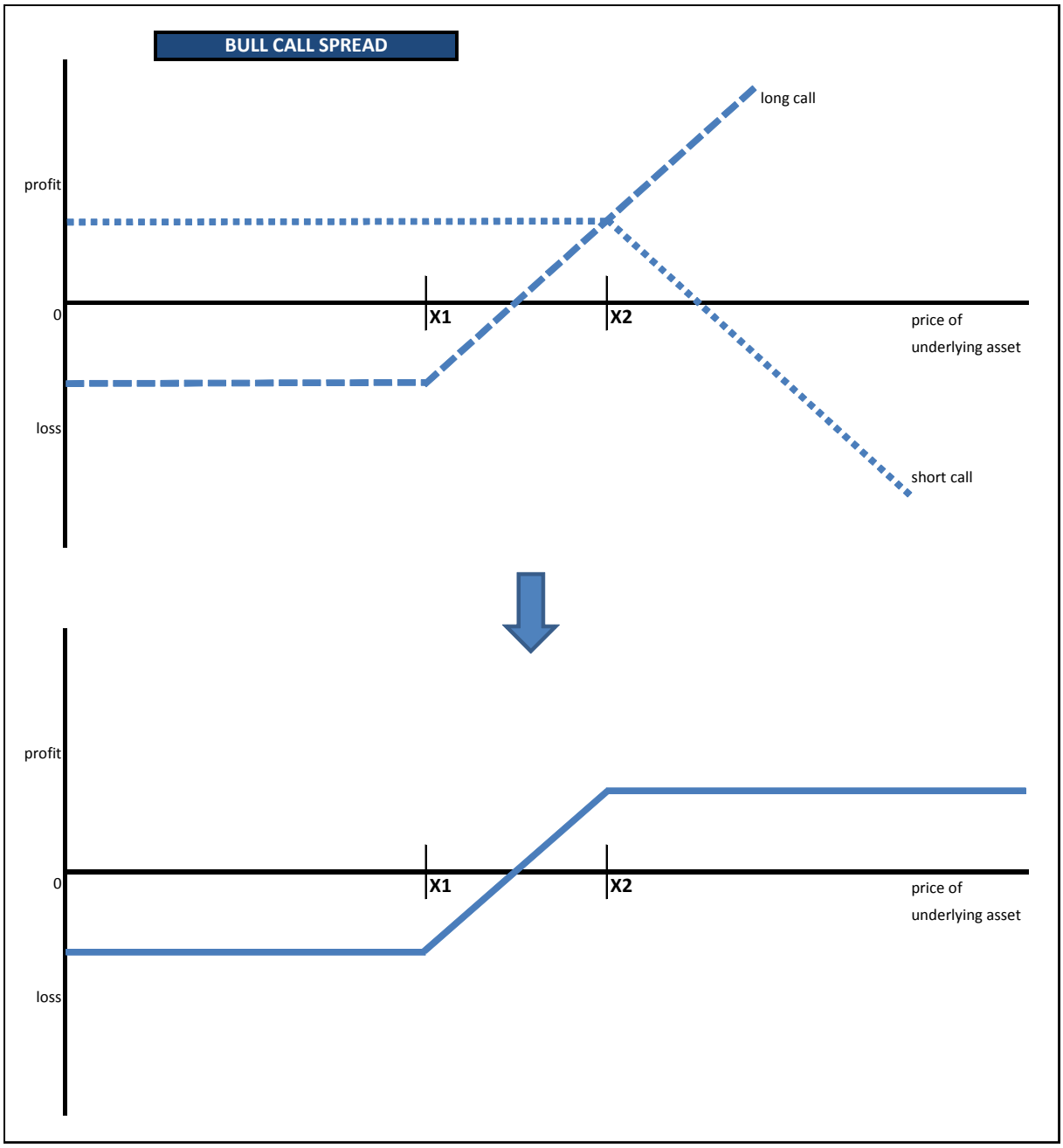



Source: authors' projection based on [132]

*BULL CALL SPREAD*

When company applies the strategy **"bull call spread"**, entity will purchase one call option and simultaneously will sell another call option. The strike price of long call option is lower than the strike price of short call option. This strategy leads to limited profit and elimination of potential risks.

As a break-even point could be considered the strike price of the purchased option increased for the net option premium paid.

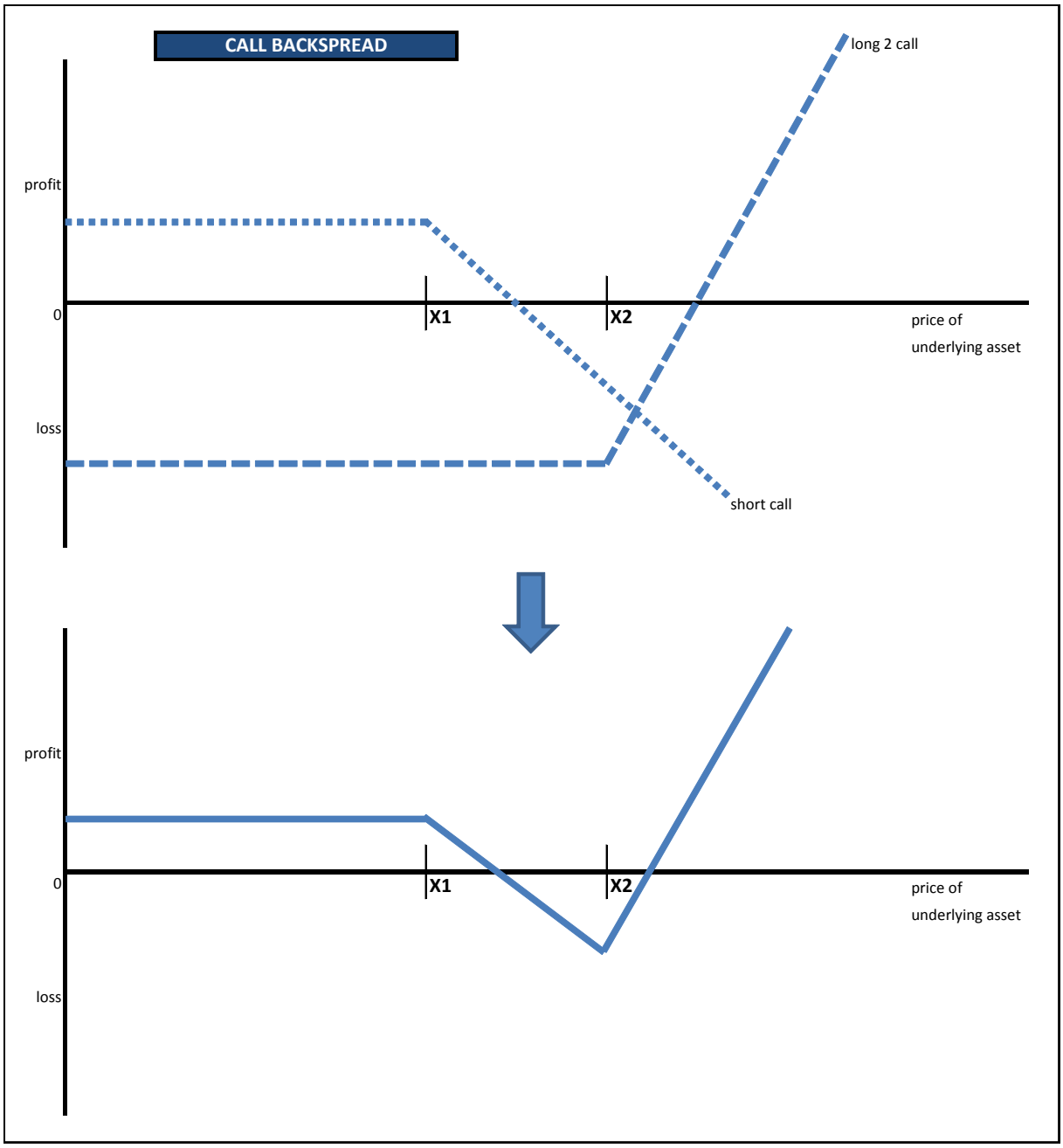



Source: authors' projection based on [132]

*CALL BACKSPREAD*

When company applies the strategy **"call backspread"**, entity sells one call option and simultaneously purchases two call options. Strike price of short call option is lower than strike price of long call options. The profit is considered as unlimited and the company successfully eliminates its potential risks.

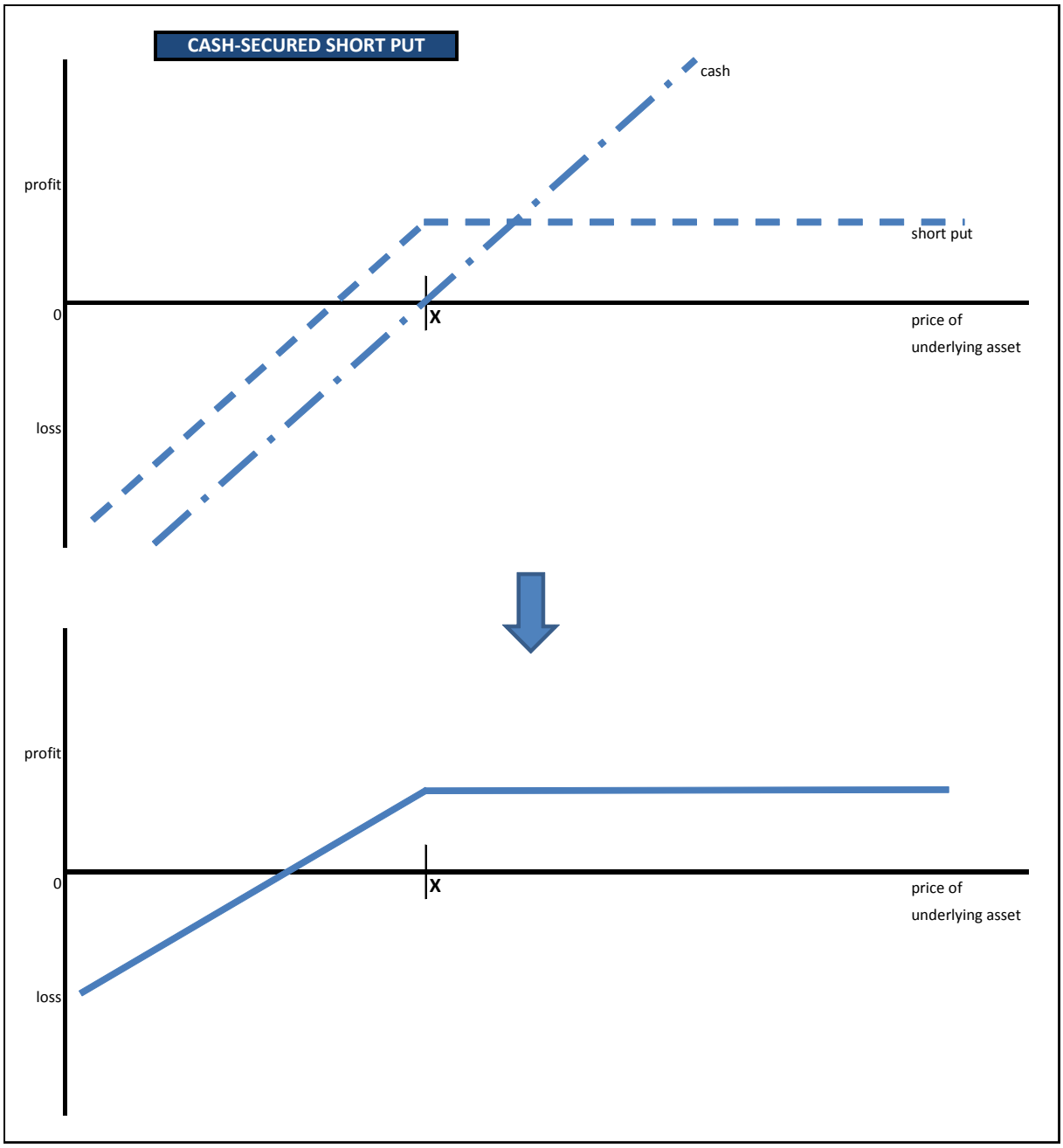
As break-even points could be considered: (i) strike price of short call option increased for option premium received; and (ii) strike price of long call options increased for the difference in strike prices.




Source: authors' projection based on [132]

*CASH-SECURED SHORT PUT*

When company applies the strategy **"cash-secured short put"**, entity owns cash equal to 100-multiple of the strike price of sold put option. This strategy eliminates potential risks; however the profit is also limited.
As a break-even point could be considered strike price of the option less for option premium received.




Source: authors' projection based on [132]

### 3.5.2 Bearish Strategies

Among **bearish strategies** could be for example mentioned:

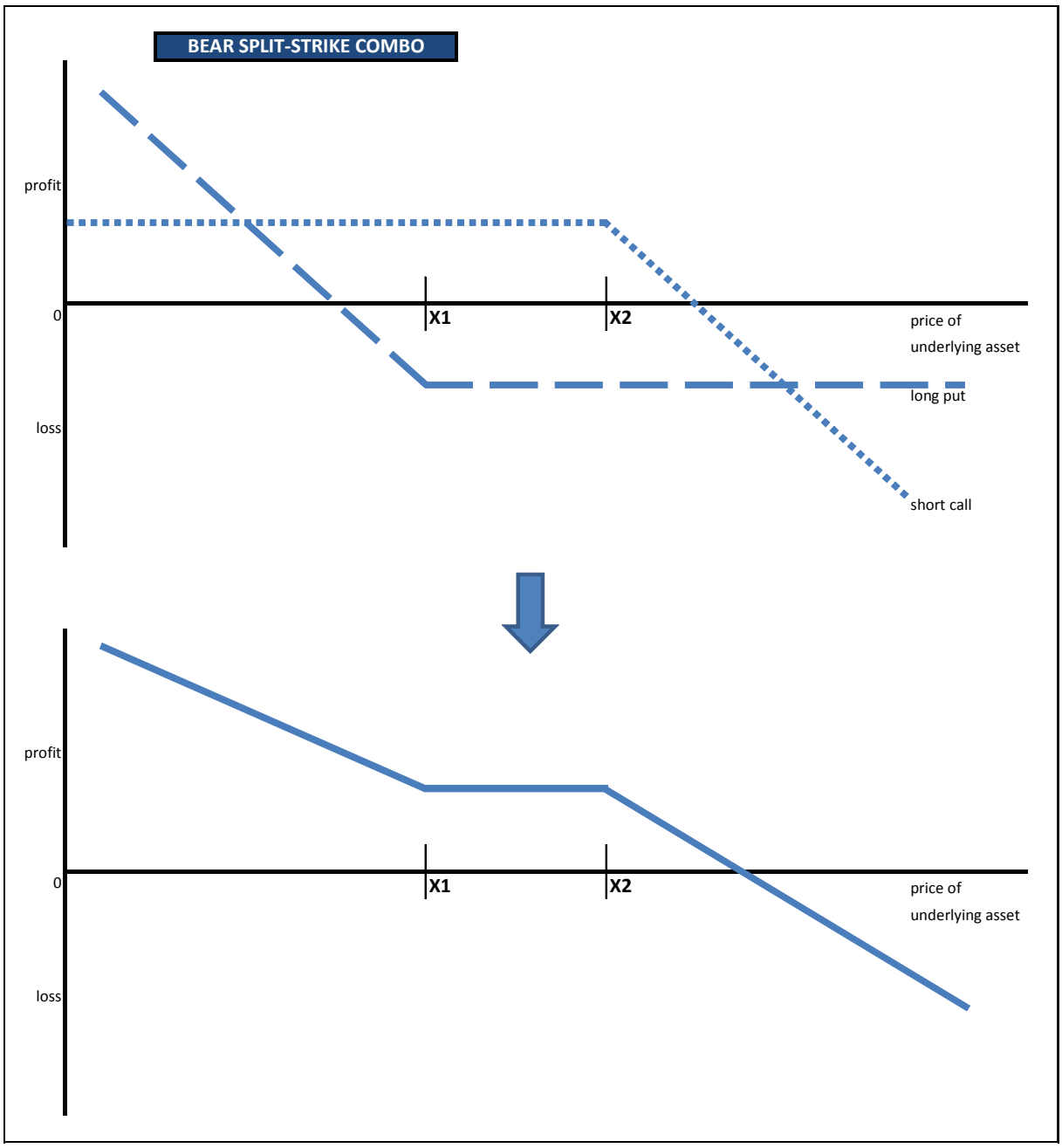
- bear split-strike combo,
- bear put spread,
- put backspread.

*BEAR SPLIT-STRIKE COMBO*

When company applies the strategy **"bear split-strike combo"**, entity will purchase put option and simultaneously will sell call option. The strike price of long put option is lower than strike price of short call option. This strategy brings a considerable profit, however the potential risk is high.

As a break-even point could be considered strike price of short call option increased for option premium

received.

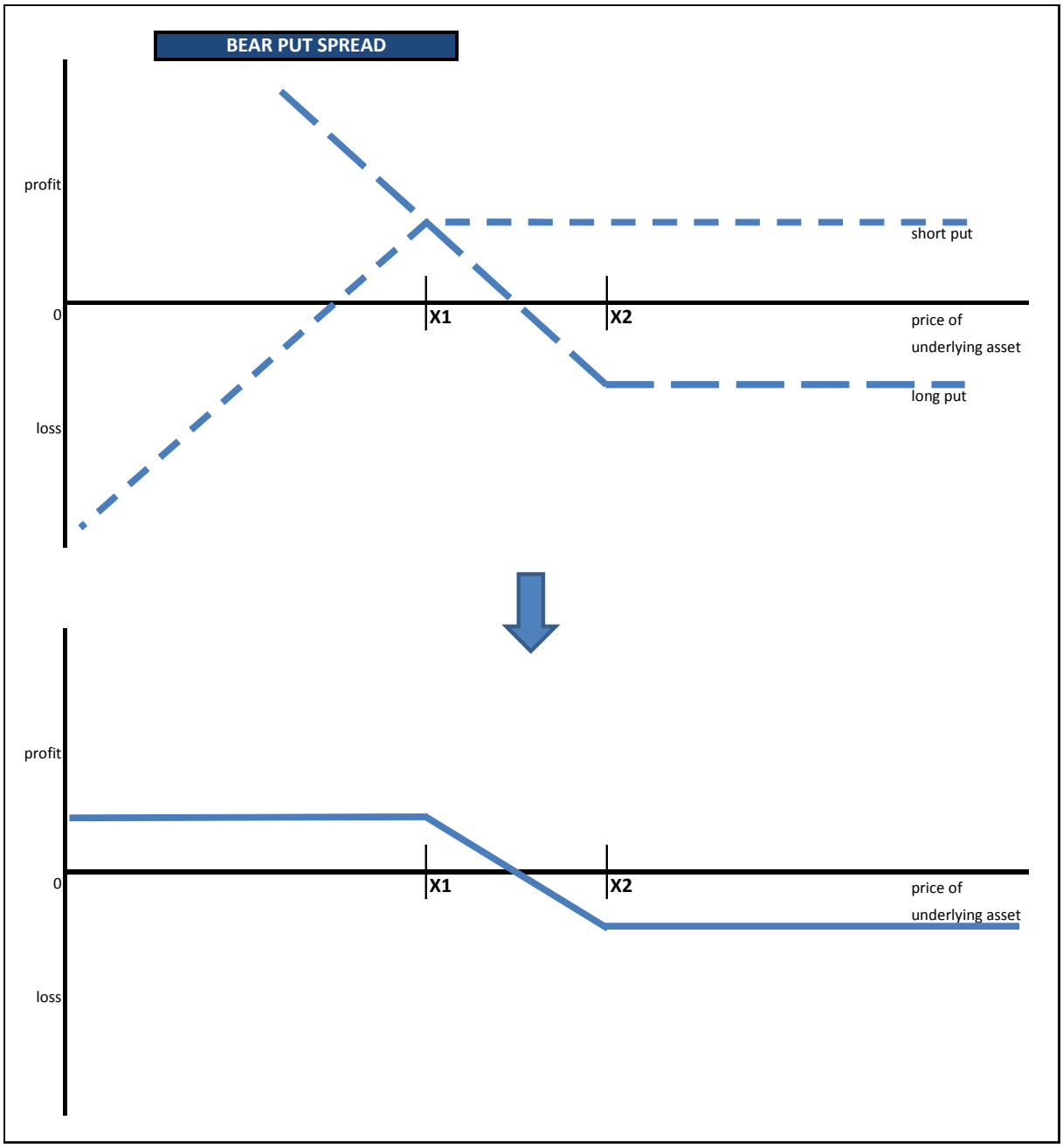



Source: authors' projection based on [132]

*BEAR PUT SPREAD*

When company applies the strategy **"bear put spread"**, entity will purchase one put option and simultaneously will sell another put option. The strike price of short put option is lower than strike price of long put option. This strategy eliminates potential risks; however the profit is also limited.

As a break-even point could be considered strike price of long option less net option premium paid.

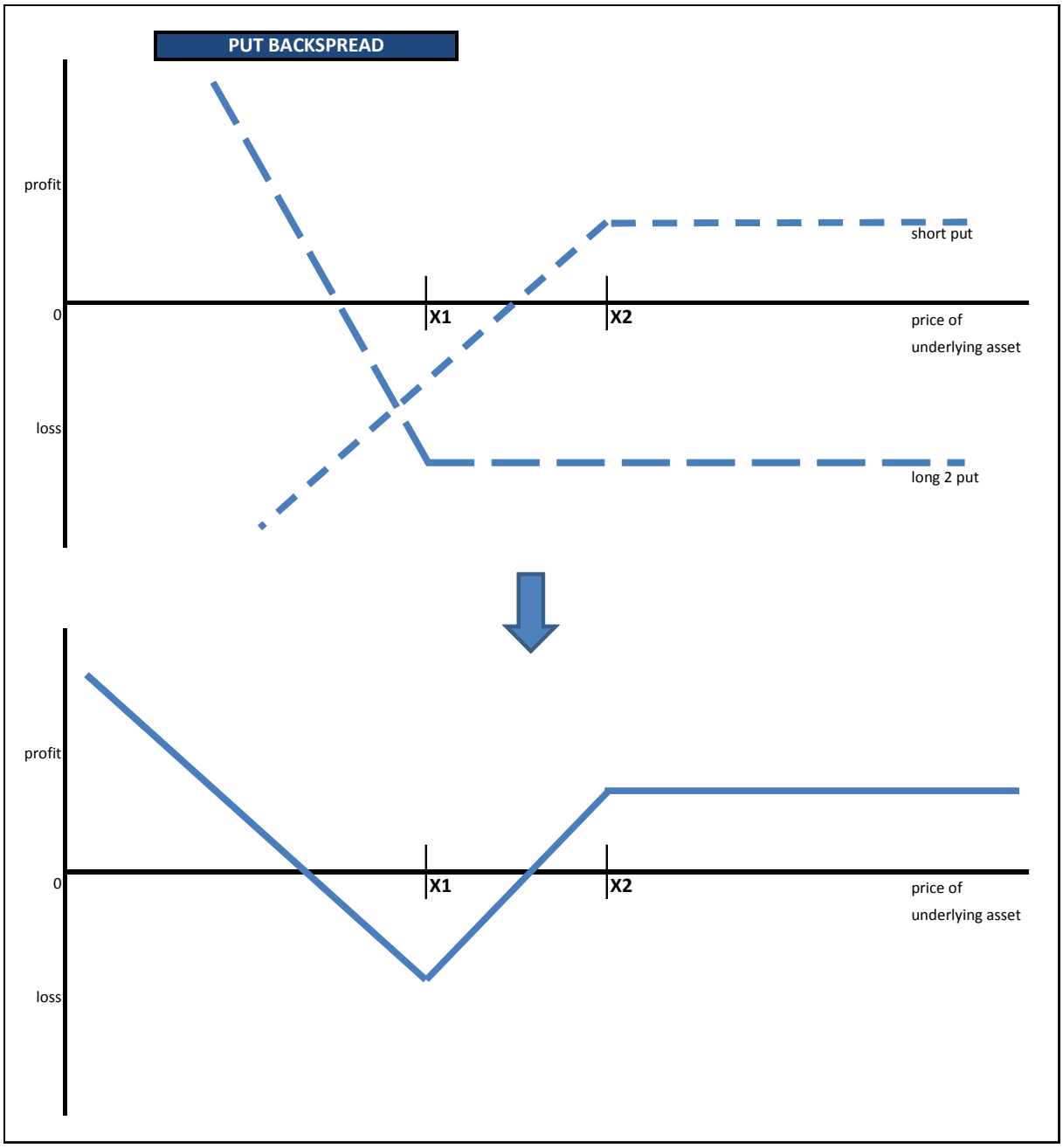



Source: authors' projection based on [132]

*PUT BACKSPREAD*

When company applies the strategy **"put backspread"**, entity will sell one put option and simultaneously will purchase two put options. The strike price of short put option is higher than strike price of long put options. The potential risk is limited, but company could earn theoretically unlimited profit.

As break-even points could be considered: (i) strike price of short put option less option premium received; and (ii) strike price of long put options less the difference in strike prices.




Source: authors' projection based on [132]

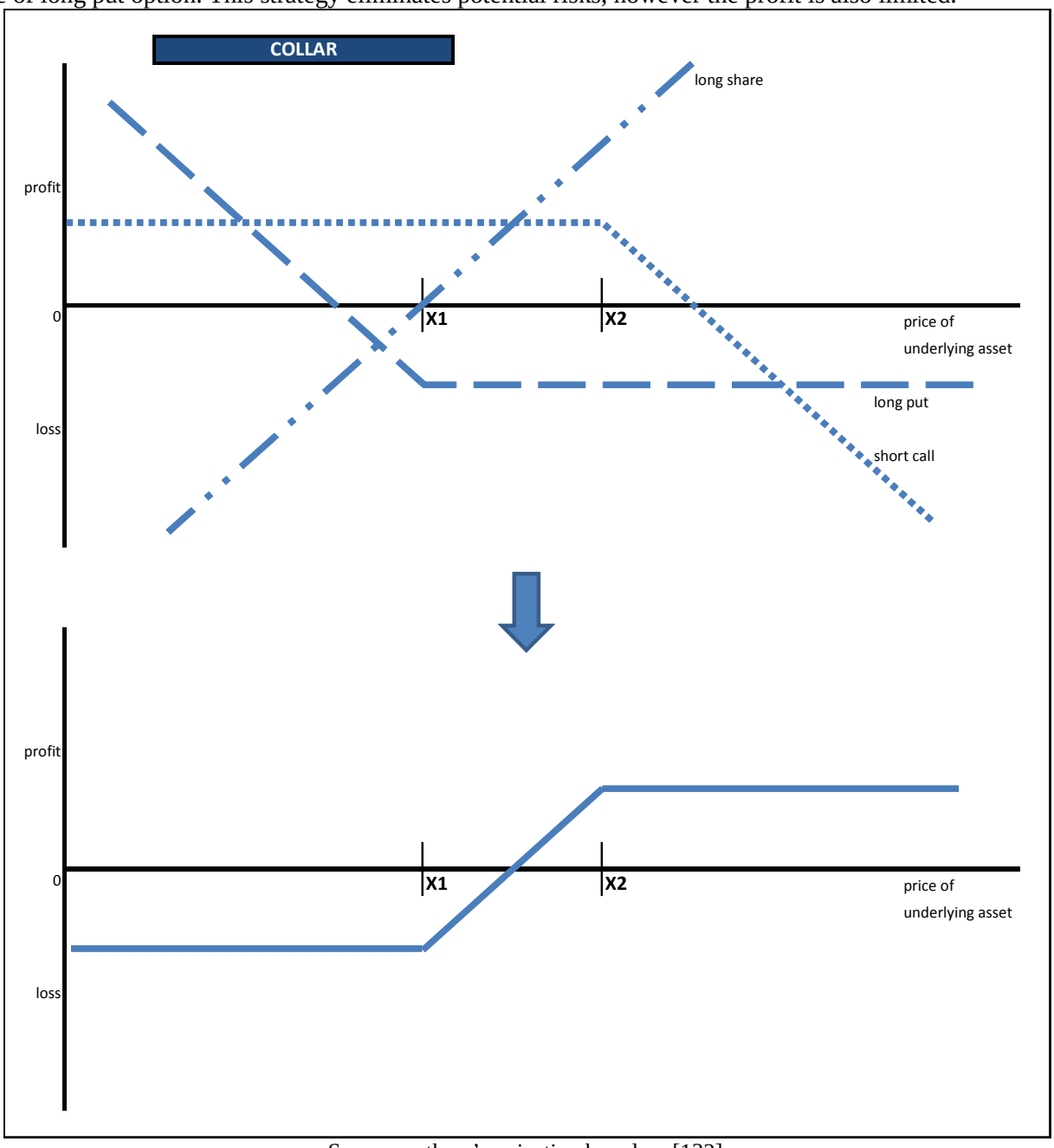
### 3.5.3 Neutral Strategies

Among **neutral strategies** could be for example stated:

- collar,
- long straddle,
- short straddle,
- long strangle,
- short strangle,
- long call butterfly,
- ratio spread with calls.

*COLLAR*

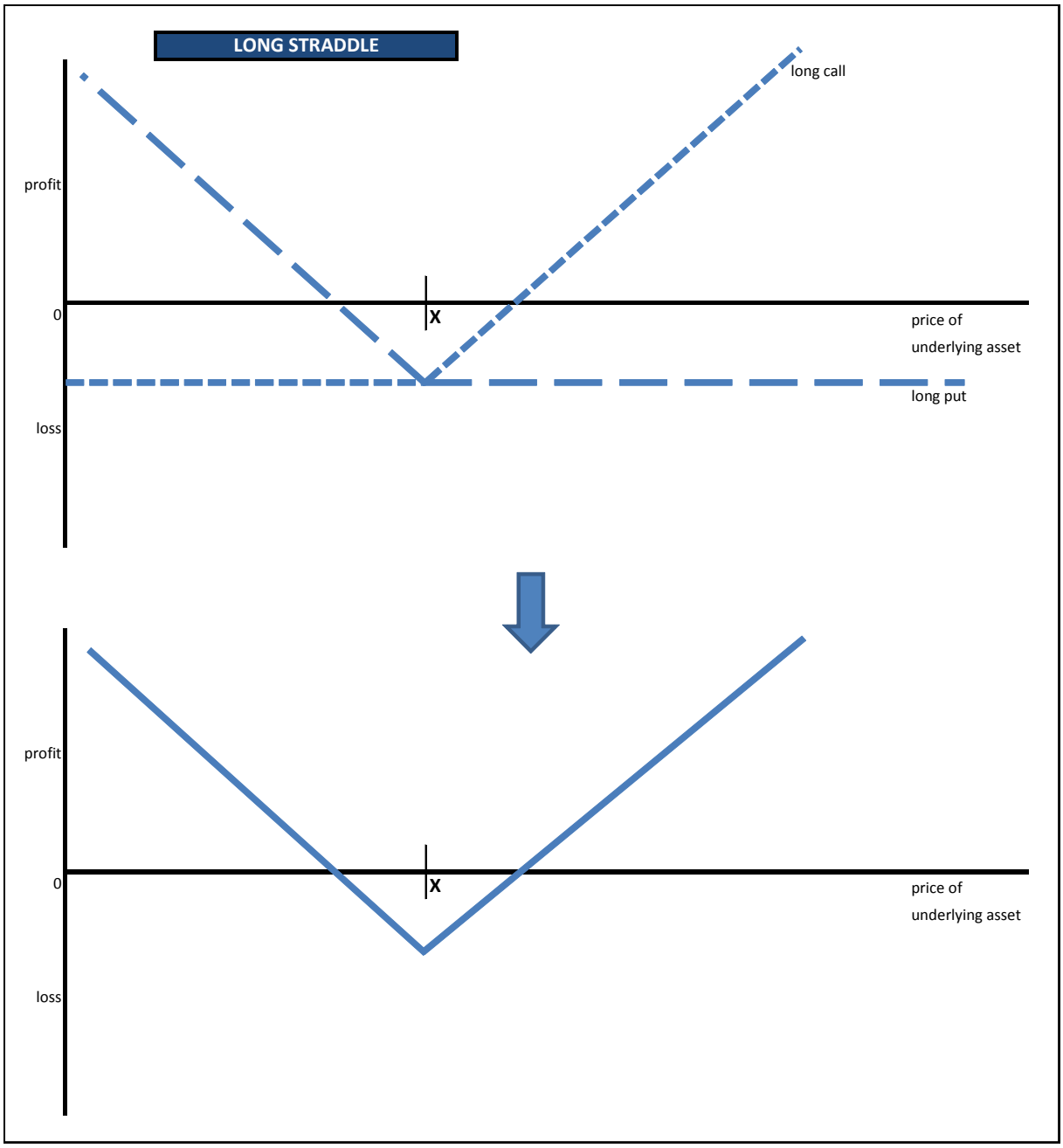
When company applies the strategy **"collar"**, entity owns an underlying asset (e.g. share) and hedges its position by purchase of put option and sell of call option. Strike price of short call option is higher than strike price of long put option. This strategy eliminates potential risks, however the profit is also limited.




Source: authors' projection based on [132]

*LONG STRADDLE*

When company applies the strategy **"long straddle"**, entity will purchase simultaneously both call and put options at similar strike prices. This strategy eliminates potential risks, but the profit is theoretically unlimited. As break-even points could be considered: (i) strike price of call option increased for option premium paid; and (ii) strike price of put option less option premium paid.

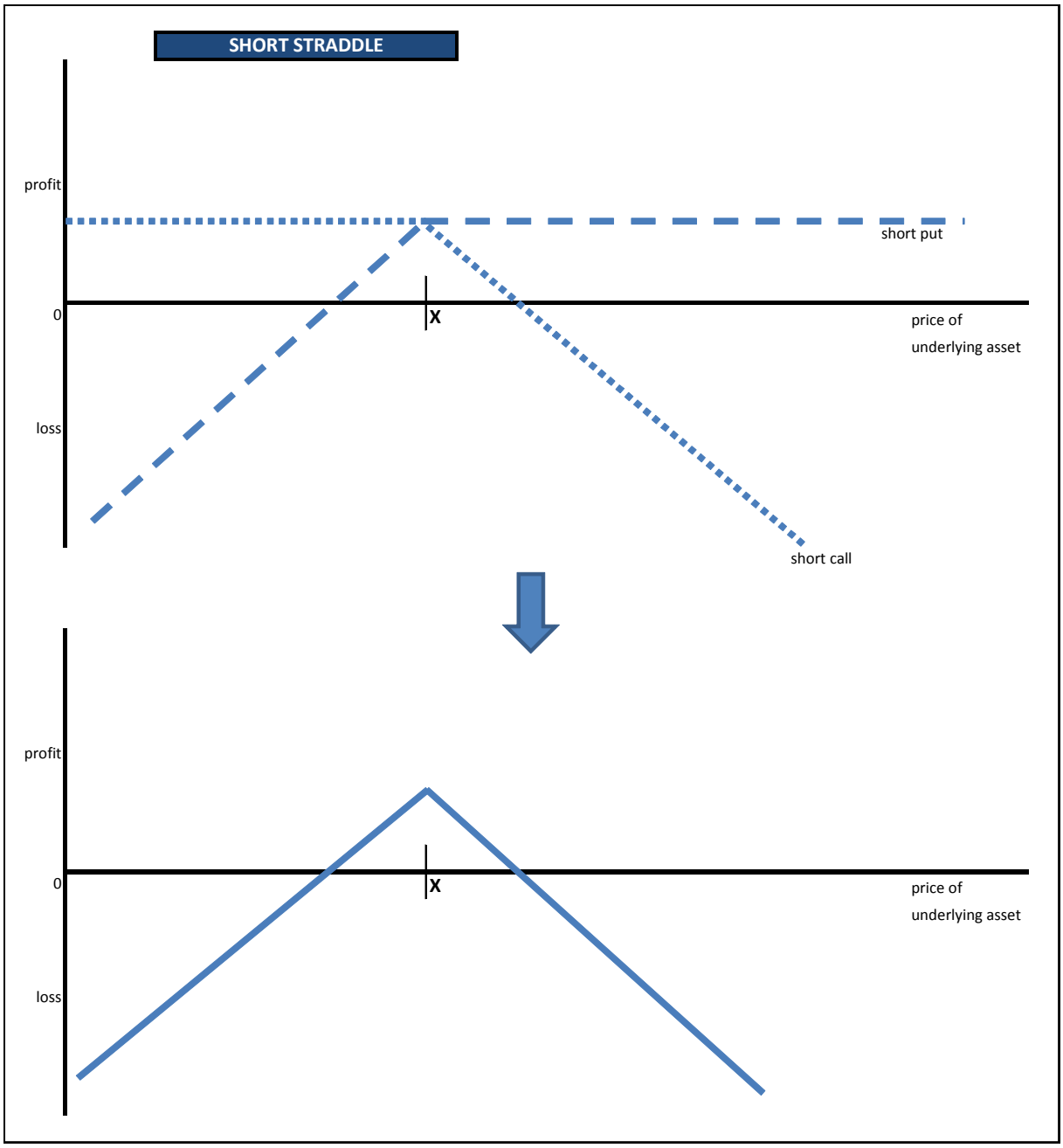



Source: authors' projection based on [132]

*SHORT STRADDLE*

When company applies the strategy **"short straddle"**, entity will sell simultaneously both call and put options at similar strike prices. This strategy brings unlimited potential risks with very limited profit.

As break-even points could be considered: (i) strike price of call option increased for option premium received; and (ii) strike price of put option less option premium received.

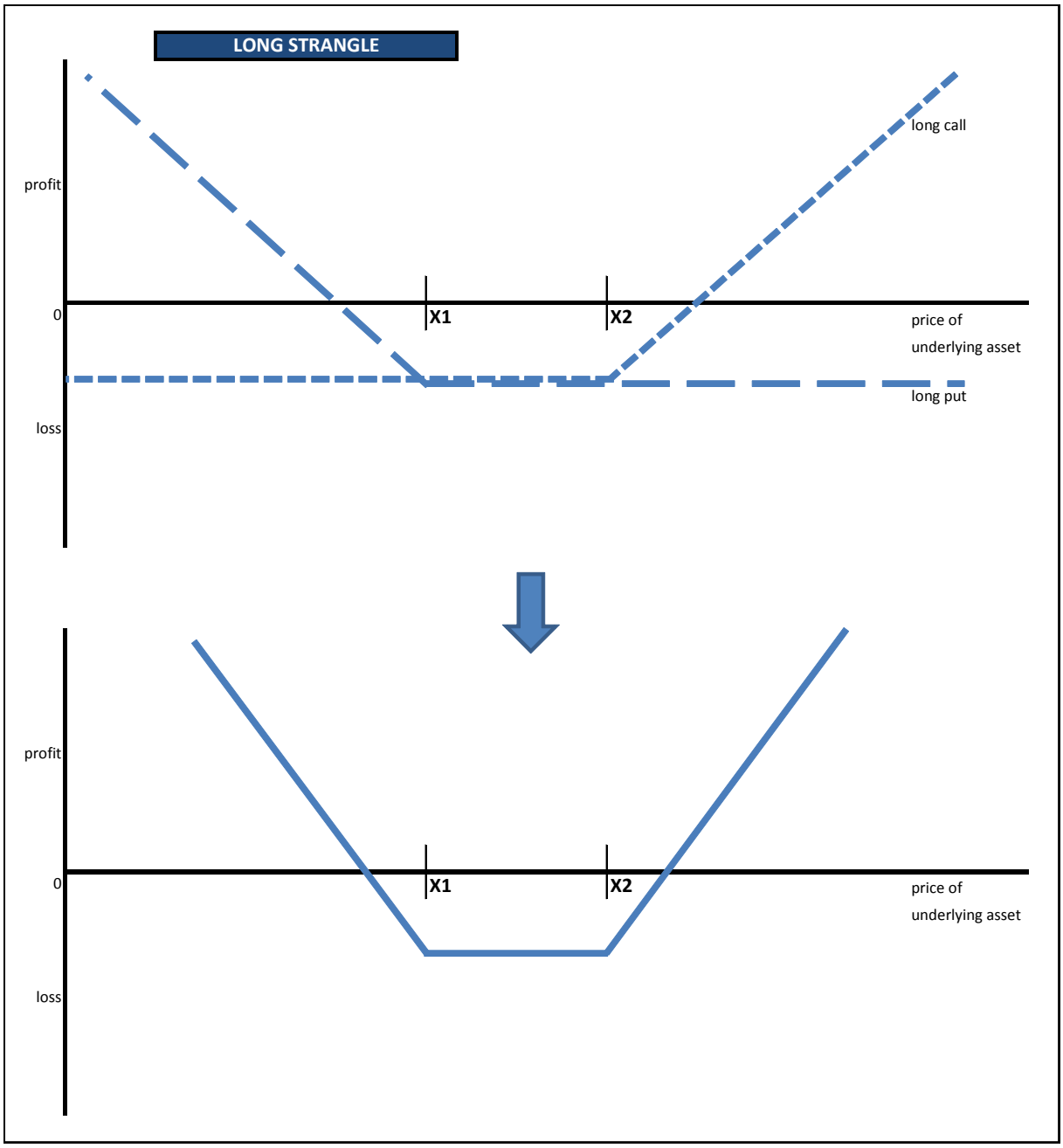



Source: authors' projection based on [132]

*LONG STRANGLE*

When company applies the strategy **"long strangle"**, entity will purchase both call and put options. Strike price of call option is higher than strike price of put option. This strategy eliminates potential risks and the profit is theoretically unlimited.

As break-even points could be considered: (i) strike price of call option increased for option premium paid; and (ii) strike price of put option less option premium paid.

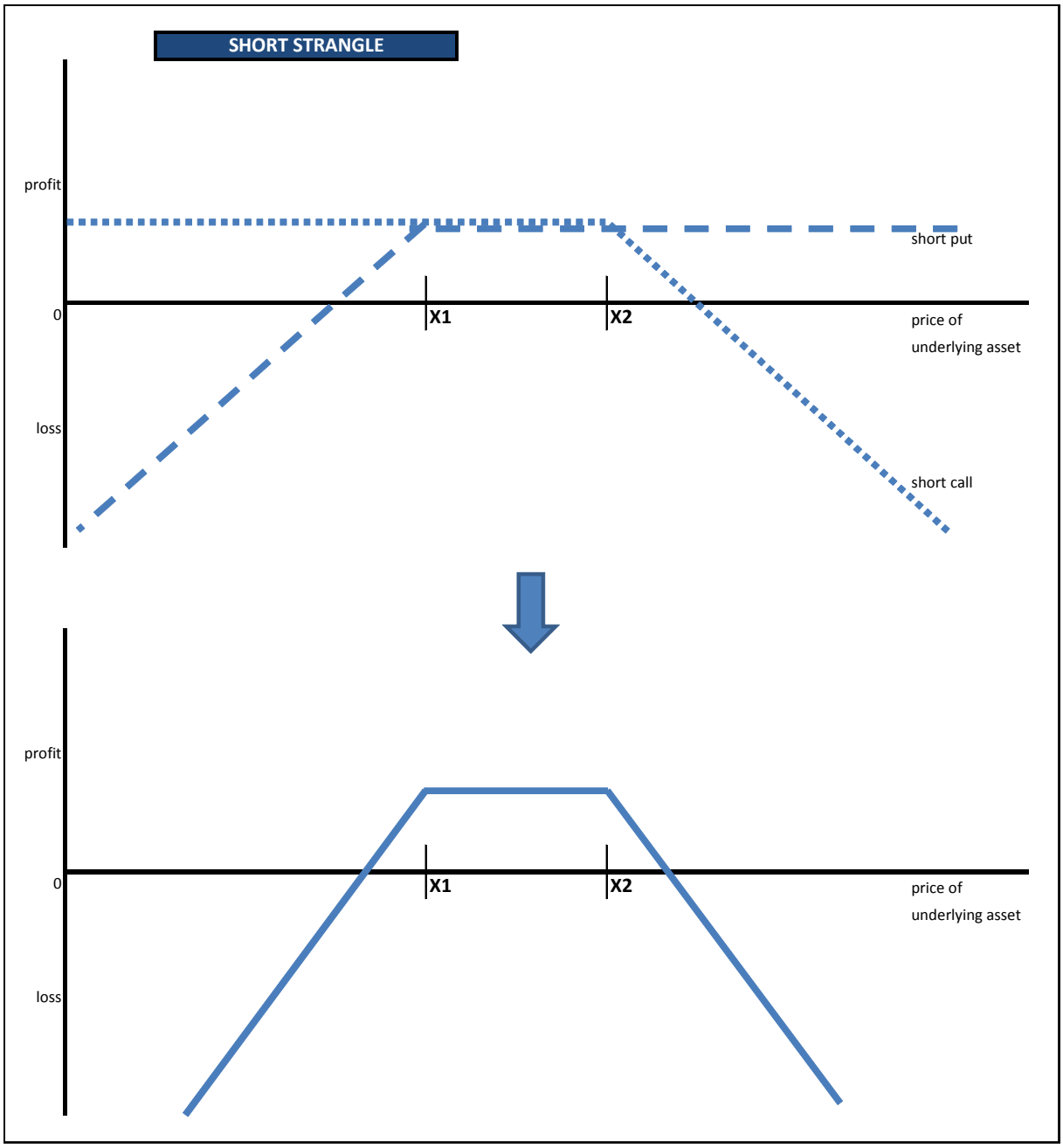



Source: authors' projection based on [132]

*SHORT STRANGLE*

When company applies the strategy **"short strangle"**, entity sells both call and put options. Strike price of put option is lower than strike price of call option. This strategy brings theoretically unlimited potential risks, however the profit is limited.

As break-even points could be considered: (i) strike price of call option increased for option premium received; and (ii) strike price of put option less option premium received.

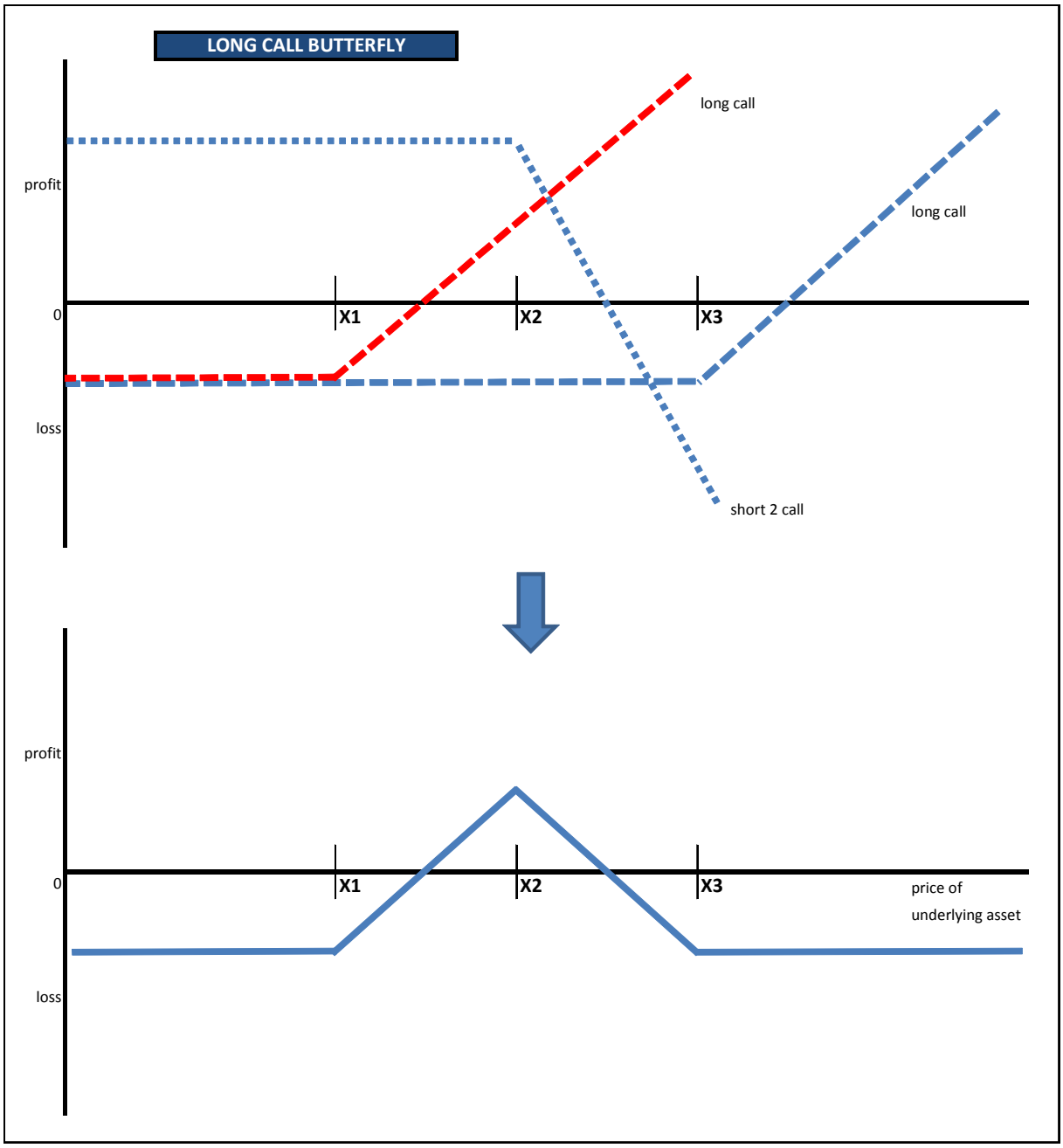



Source: authors' projection based on [132]

*LONG CALL BUTTERFLY*

When company applies the strategy **"long call butterfly"**, entity will purchase two call options and simultaneously will sell another two call options. Company will purchase one call option at the strike price lower than strike price of two short call options, and also purchases one call option at the strike price higher than strike price of two short call options. The potential risk is limited as well as the profit.

As break-even points could be considered: (i) lower strike price of call option increased for net option premium paid; and (ii) higher strike price of call option less net option premium paid.

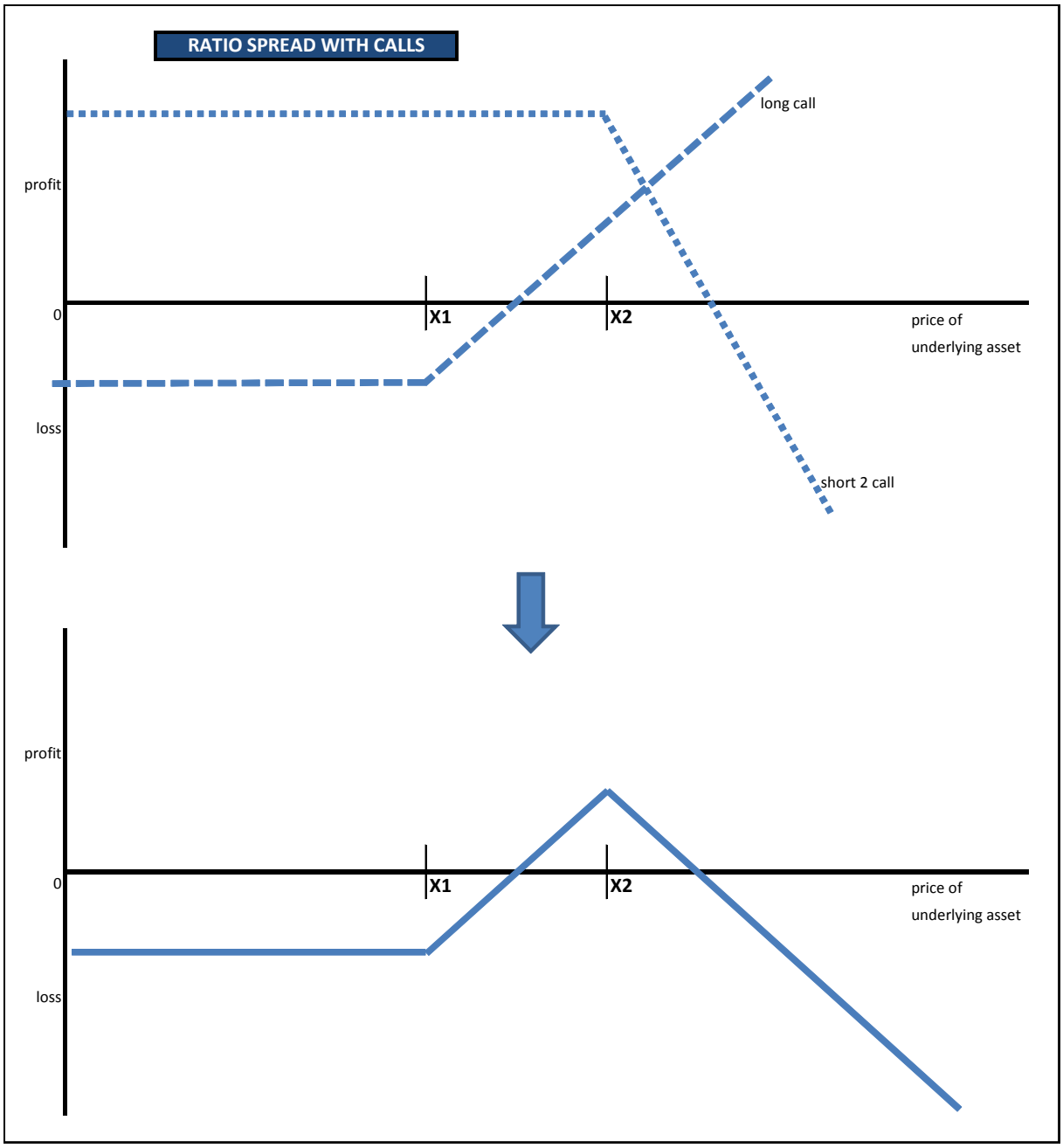



Source: authors' projection based on [132]

*RATIO SPREAD WITH CALLS*

When company applies the strategy **"ratio spread with calls"**, entity will purchase one call option and simultaneously will sell two call options. Strike price of long call option is lower than strike price of short call options. The potential risk is theoretically unlimited, however the profit is limited.

As break-even points could be considered: (i) strike price of long call option increased for option premium paid; and (ii) strike price of short call options less option premium paid (from long call option) and increased for the difference in strike prices.




Source: authors' projection based on [132]

# 4 Hedge Accounting

Generally, accounting entity may voluntary decide whether to treat all derivatives as held for trading or will adopt the hedge accounting rules. In such case there shall be fully met following conditions of hedge accounting:

- at the inception of the hedge there is formal designation and documentation of the hedging relationship and the entity's risk management objective and strategy for undertaking the hedge. That documentation shall include identification of the hedging instrument, the hedged item or transaction, the nature of the risk being hedged and how the entity will assess the hedging instrument's effectiveness in offsetting the exposure to changes in the hedged item's fair value or cash flow attributable to the hedged risk;
- the hedge is expected to be highly effective in achieving offsetting changes in fair value or cash flows

attributable to the hedged risk, consistently with the originally documented risk management strategy for that particular hedging relationship
    - a hedge is regarded as highly effective only if both of the following conditions are met:
        - at the inception of the hedge and in subsequent periods, the hedge is expected to be highly effective in achieving offsetting changes in fair value or cash flows attributable to the hedged risk during the period for which the hedge is designated. Such an expectation can be demonstrated in various was, including a comparison of past changes in the fair value or cash flows of the hedged item that are attributable to the hedged risk with past changes in the fair value or cash flows of the hedging instrument, or by demonstrating a high statistical correlation between the fair value or cash flows of the hedged item and those of the hedging instrument;
        - the actual results of the hedge are within a range of 80 – 125 %
- for cash flow hedges, a forecast transaction that is the subject of the hedge must be highly probable and must present an exposure to variations in cash flows that could ultimately affect profit or loss;
- the effectiveness of the hedge can be reliably measured, i.e. the fair value or cash flows of the hedged item that are attributable to the hedged risk and the fair value of the hedging instrument can be reliably measured;
- the hedge is assessed on an ongoing basis and determined actually to have been highly effective throughout the financial reporting periods for which the hedge was designated.

**Hedging instrument** is a designated derivative or (for a hedge of the risk of changes in foreign currency exchange rates only) a designated non-derivative financial asset or non-derivative financial liability whose fair value or cash flows are expected to offset changes in the fair value or cash flows of a designated hedged item.
Following table summarizes which instruments might be used as hedging instruments:

| **YES** | **NO** |
|---|---|
| Derivatives and embedded derivatives | Short options |
| Non-derivatives for exchange rate risks | Non-derivatives for other types of risks |
| Intrinsic value of derivative | Time value of derivative |

**Hedge effectiveness** is the degree to which changes in the fair value or cash flows of the hedged item that are attributable to a hedged risk are offset by changes in the fair value or cash flows of the hedging instrument. Hedge effectiveness is tested at least upon balance sheet day. There exist two tests: prospective and retrospective one.

The main aim of prospective testing of the hedge effectiveness is to provide an evidence of highly effective relationship between hedging instrument and hedged item when compensating the defined hedged risk. Prospective tests are realized upon the dates of interim financial statements as well as annual financial statements. The main aim of retrospective testing is to provide evidence that the hedge relationship was effective in compensation of the defined hedge risk during tested accounting period.

Among most popular methods how to calculate the effectiveness of hedge relationship can be stated “dollar-offset” method and regression analysis.

***“Dollar-offset” method*** is considered as a more practically oriented one for the computation of the effectiveness, however it may cause, that a substantial volume of hedge relationships could be considered as ineffective. This method could be used upon following conditions:

- the basic characteristics of hedging instrument and hedged item are covered (and are compensated), or
- these characteristics are not covered, however the expected extent of change is very slight and will not generate significant changes in fair values between hedging instrument and hedged item what otherwise might cause an inefficiency of hedge relationship.

Calculation of hedge effectiveness is as follows:

$$effectiveness = \frac{\Delta\ fair\ value\ of\ hedging\ instrument}{\Delta\ fair\ value\ of\ hedged\ item} \tag{83}$$

**EXAMPLE**

Company has issued bond with fixed coupons. Therefore has negotiated interest rate swap where pays float payments and receive fixed payments from bank.

According to hedge documentation for the calculation of effectiveness is used "dollar offset" method.

During the period there have been detected following changes in fair value of swap and issued bond:

| **swap (hedging instrument)** | **issued bond (hedged item)** |
|---|---|
| +5 | -7 |

$$effectiveness = \frac{\Delta\ fair\ value\ of\ hedging\ instrument}{\Delta\ fair\ value\ of\ hedged\ item}$$

$$effectiveness = \frac{5}{-7}$$

$$\boldsymbol{effectiveness = -71.4\ \%}$$

According to the results company is unable to apply the hedge accounting rules anymore. Derivative has to be reclassified as held for trading and issued bond cannot be revaluated at fair value through profit/loss.

**EXAMPLE**

We have the very same information like in previous example. During the period there have been detected following changes in fair value of swap and issued bond:

| **swap (hedging instrument)** | **issued bond (hedged item)** |
|---|---|
| +98 | -100 |

$$effectiveness = \frac{\Delta\ fair\ value\ of\ hedging\ instrument}{\Delta\ fair\ value\ of\ hedged\ item}$$

$$effectiveness = \frac{98}{-100}$$

$$\boldsymbol{effectiveness = -98\ \%}$$

According to the results company can still apply the hedge accounting rules.

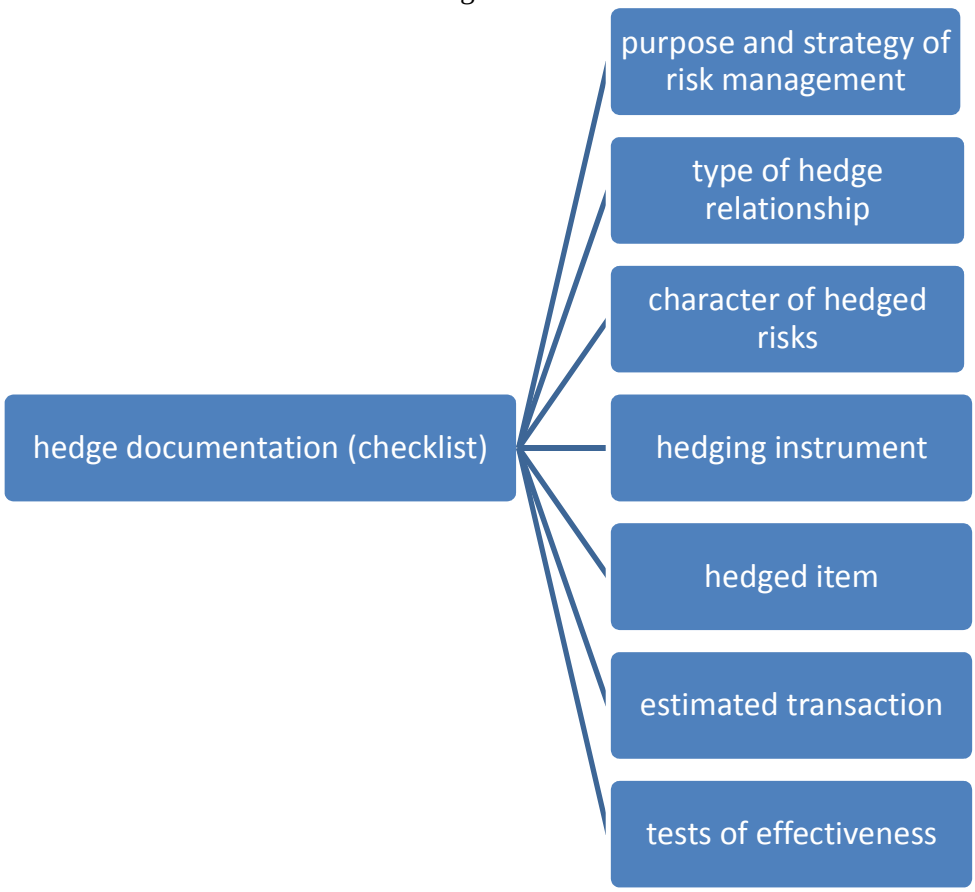
***Regression analysis*** tests the statistical relation between the hedged item and hedging instrument. It provides the best tool for determination of the level of dependence. Entities typically use regression analysis to measure the effectiveness (prospective as well as retrospective) in areas where they did implemented various strategies to hedge the portfolio risks.

Following table provides a summary for which area shall be these tests used:

| Hedged risk | Hedging item | Tests of effectiveness (FVH) | Test of effectiveness (CFH) |
|---|---|---|---|
| Interest rate risk | interest rate swap | *"Dollar offset" method: fair value versus fair value* or *Regression analysis* | *"Dollar offset" method: risk of variability equal to referential rate* or *Regression analysis* |
| Exchange rate risk | FX forwards | not used | |
| Exchange rate risk and interest rate risk | cross currency swap | *"Dollar offset" method: fair value versus fair value* or *Regression analysis* | |

Source: [67]

As mentioned above, one of the required conditions for the hedge accounting application is the preparation of hedge documentation.
The **hedge documentation** has to cover following areas:




- ***purpose and strategy of risk management***
  - the entity has to clearly explain the reason for the negotiation of the hedge relationship. There has to be provided the statement of compliance of this relationship with company's risk management policy, eventually also some cross-reference which is valid to a specific type of hedge relationship

- ***type of hedge relationship***
  - the entity has to identify the type of hedging relationship (see below), i.e. fair value hedge, cash flow hedge or hedge of net foreign investment
- ***character of hedged risks***
  - the entity has to clearly identify all risks being hedged, e.g. currency risks, interest rate risks, etc.
- ***identification of hedging instrument***
  - the entity has to provide a detailed description of the hedging instrument to be clearly be identified
  - hedging instrument is a designated derivative or (for a hedge of the risk of changes in foreign currency exchange rates only) a designated non-derivative financial asset or non-derivative financial liability whose fair value or cash flows are expected to offset changes in the fair value or cash flows of a designated hedged item
- ***identification of hedged item***
  - the entity has to provide a detailed description of the hedged item to be clearly be identified
  - hedged item is an asset, liability, firm commitment, highly probable forecast transaction or net investment in a foreign operation that (i) exposes the entity to risk of changes in fair value or future cash flows and (ii) is designated as being hedged.
- ***estimated transaction***
  - the entity has to declare the high probability of the estimated transaction realization:
    - the transaction is highly probable in case, that there is a certainty of almost 100 %,
    - information, whether the transaction represents a threat to the volatility of cash flow due to the hedged risk which may affect company's profit,
  - documentation has to contain the information about the time determination, nature and volume of estimated transaction, i.e. hedged quantity or amount,
- ***identification of the mechanism for the effectiveness testing***
  - the entity has to clearly describe at the very beginning of the hedge relationship the method, throughout which will test the prospective as well as retrospective effectiveness of this relationship and have to disclose following information:
    - whether the entity use the whole amount of change in fair value of hedging instrument or eliminates its concrete part (e.g. time value of option which could not be used as a hedging instrument),
    - methodology for the calculation of the changes in fair value of the hedging instrument for the effectiveness tests,
    - methodology for the calculation of the changes in fair value of hedged item for the effectiveness tests,
  - the entity is required to expect the high level of effectiveness throughout the duration of the hedge relationship.

We can differ following three types of hedge relationships:

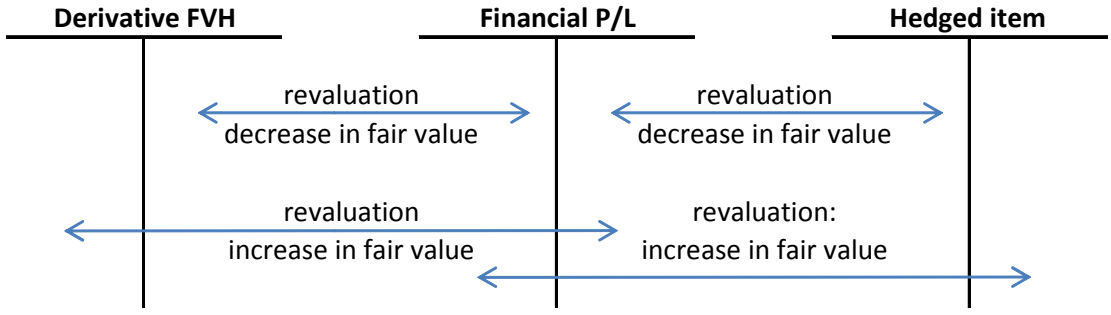
| | |
|---|---|
| fair value hedge | • hedging instrument - FVTPL<br>• hedged item - FVTPL |
| cash flow hedge | • hedging instrument - FVOCI |
| hedge of net investment in a foreign operation | • hedging instrument - FVOCI |

**Fair value hedge**

- hedge of the exposure to changes in fair value of a recognised asset or liability or an unrecognised firm commitment, or an identified portion of such an asset, liability or firm commitment, that is attributable to a particular risk and could affect profit or loss

If a fair value hedge meets the condition during the period, it shall be accounted as follows:

- the gain or loss from remeasuring the hedging instrument at fair value shall be recognised in profit or loss; and
- the gain or loss on the hedged item attributable to the hedged risk shall adjust the carrying amount of the hedged item and be recognised in profit or loss. This applies if the hedged item is otherwise measured at cost. Recognition of the gain or loss attributable to the hedged risk in profit or loss applies if the hedged item is an AFS financial asset.




***EXAMPLE***

On 30th June 2011 company issued 3Y bonds in nominal value 10,000,000 CU with fixed coupon 7.5 %; coupon is paid bi-yearly. Company negotiated interest rate swap where the company will pay float interest rate and will receive fixed interest rate from bank. Nominal value of this 3Y swap is also 10,000,000 CU and the settlement will be bi-yearly. The float interest rate for the first period is 6 %.

We are assuming that the hedge relationship is fully effective. This relationship is recognized as a fair value hedge.

Fair value of the swap is following:

| Date | Before settlement | Settlement | After settlement |
|---|---|---|---|
| 30.06.2011 | 0 | 0 | 0 |
| 31.12.2011 | 200,000 | - 75,000 | 125,000 |

The net payment will be as follows:

| | | |
|---|---|---|
| Liability in fixed interest rate | $10{,}000{,}000\frac{0.075}{2}$ | 375,000 |
| Income from swap | $10{,}000{,}000\frac{0.06}{2} - 10{,}000{,}000\frac{0.075}{2}$ | - 75,000 |
| **Net payment** | | **300,000** |

*Posting of transactions*

| Op. | Text | Amount | | | Account |
|---|---|---|---|---|---|
| 1 | Issue of bond | 10,000,000 | Dr | | Bank account |
| | | 10,000,000 | | Cr | Issued bonds |
| 2 | Revaluation of swap at fair value | 200,000 | Dr | | Swap |
| | | 200,000 | | Cr | R – Financial P/L |
| 3 | Payment of bi-yearly coupon | 375,000 | Dr | | E – Financial P/L |
| | | 375,000 | | Cr | Bank account |
| 4 | Income from swap | 75,000 | Dr | | Bank account |
| | | 75,000 | | Cr | Swap |
| 5 | Revaluation of bond at fair value | 125,000 | Dr | | E – Financial P/L |
| | | 125,000 | | Cr | Issued bonds |

**Balance Sheet (changes)**

| | | | |
|---|---|---|---|
| Swap | 125,000 | Profit/loss | -300,000 |
| Bank account | 9,700,000 | Issued bonds | 10,125,000 |
| **Σ** | **9,825,000** | **Σ** | **9,825,000** |

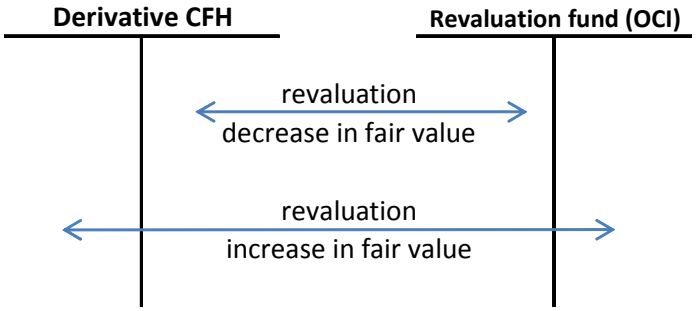
**Cash flow hedge**

- hedge of the exposure to variability in cash flows that
  - is attributable to particular risk associated with a recognised asset or liability or a highly probable forecast transaction, and
  - could affect profit or loss
- gains or losses from the hedging instrument revaluation are posted against the revaluation fund (part of other comprehensive income)

If a cash flow hedge meets the condition during the period, it shall be accounted as follows:

- the portion of the gain or loss on the hedging instrument that is determined to be an effective hedge shall be recognised in other comprehensive income; and
- the ineffective portion of the gain or loss on the hedging instrument shall be recognised in profit or loss.

Hedges of a net investment in a foreign operation shall be accounted for similarly to cash flow hedges.




***EXAMPLE***

On 30th June 2011 company issued 3Y bonds in nominal value 10,000,000 CU with float coupon; coupon is paid bi-yearly. Company negotiated interest rate swap where the company will pay fixed interest rate 7.5 % and will receive float interest rate from bank. Nominal value of this 3Y swap is also 10,000,000 CU and the settlement will be bi-yearly. The float interest rate for the first period is 6 %.

We are assuming that the hedge relationship is fully effective. This relationship is recognized as a cash value hedge.

Fair value of the swap is following:

| **Date** | **Before settlement** | **Settlement** | **After settlement** |
|---|---|---|---|
| 30.06.20X1 | 0 | 0 | 0 |
| 31.12.20X1 | - 200,000 | 75,000 | - 125,000 |

The net payment will be as follows:

| | | |
|---|---|---|
| Liability in float interest rate | $10{,}000{,}000\frac{0.06}{2}$ | 300,000 |
| Payment of swap | $10{,}000{,}000\frac{0.075}{2} - 10{,}000{,}000\frac{0.06}{2}$ | 75,000 |
| **Net payment** | | **375,000** |

*Posting of transactions*

| **Op.** | **Text** | **Amount** | | | **Account** |
|---|---|---|---|---|---|
| 1 | Issue of bond | 10,000,000 | Dr | | Bank account |
| | | 10,000,000 | | Cr | Issued bonds |
| 2 | Revaluation of swap at fair value | 200,000 | Dr | | Revaluation fund |
| | | 200,000 | | Cr | Swap |
| 3 | Payment of bi-yearly coupon | 300,000 | Dr | | E – Financial P/L |
| | | 300,000 | | Cr | Bank account |
| 4 | Payment of bi-yearly swap settlement | 75,000 | Dr | | Swap |
| | | 75,000 | | Cr | Bank account |
| 5 | Transfer of fair value to costs | 75,000 | Dr | | E – Financial P/L |
| | | 75,000 | | Cr | Revaluation fund |

**Balance Sheet (changes)**

| | | | |
|---|---|---|---|
| Bank account | 9,625,000 | Revaluation fund | -125,000 |
| | | Profit/loss | -375,000 |
| | | Issued bonds | 10,000,000 |
| | | Swap | 125,000 |
| **Σ** | **9,625,000** | **Σ** | **9,625,000** |

**EXAMPLE**
For the hedge of exchange rate risks might be also use non-derivative contracts. Among developers became popular the hedge of loans against received rentals in foreign currency.
The procedure of this hedge relation will be following:

| | |
|---|---|
| hedging instrument | loans to be paid in foreign currency |
| hedged item | rental payments to be received in foreign currency |
| hedged risk | exchange rate risk (DCU/FCU) |
| hedging relationship | cash flow hedge |

***Prospective test of hedge effectiveness***
At the very beginning there is estimated similar evolution of hedging instrument and hedged item. There are valid following details:

- all transactions are negotiated in very same currency,
- value of loans is less than present value of future cash flows from rental contracts,
- there are not estimated significant changes in hedge items (e.g. dramatic increase/decrease of rental payments).

From this point of view there it is estimated the effectiveness of the hedge relation throughout it whole duration. Changes in rental payments in foreign currency will be compensated by changes in values of loan funding in foreign currency.

***Retrospective test of hedge effectiveness***
Entity will compare the cumulative change in fair value of received rentals in foreign currency and cumulative change in fair value from loan funding in foreign currency. In case that present value of the rental payments received will be higher than present value of the loan funding, for the test of effectiveness will be used only present value up to the value of loan funding.

**Discontinuation of hedge accounting**
An entity shall discontinue prospectively the hedge accounting if:

- the hedging instrument expires or is sold, terminated or exercised;
- the hedge no longer meets the criteria for hedge accounting; or
- the entity revokes the designation.

In any of the following circumstances an entity shall discontinue prospectively the hedge accounting:

- the hedging instrument expires or is sold, terminated or exercised. In this case, the cumulative gain or loss on the hedging instrument that has been recognised in other comprehensive income from the period when the hedge was effective shall remain separately in equity until the forecast transaction occurs;
- the hedge no longer meets the criteria for hedge accounting. In this case, the cumulative gain or loss on the hedging instrument that has been recognised in other comprehensive income from the period when the hedge was effective shall remain separately in equity until the forecast transaction occurs;
- the forecast transaction is no longer expected to occur, in which case any related cumulative gain or loss on the hedging instrument that has been recognised in other comprehensive income from the period when the hedge was effective shall be reclassified from equity to profit or loss as a reclassification adjustment. A forecast transaction that is no longer highly probable may still be expected to occur;
- the entity revokes the designation. For hedges of a forecast transaction, the cumulative gain or loss on the hedging instrument that has been recognised in other comprehensive income from the period when the hedge was effective shall remain separately in equity until the forecast transaction occurs or is no longer expected to occur. If the transaction is no longer expected to occur, the cumulative gain or loss that had been recognised in other comprehensive income shall be reclassified from equity to profit or loss as a reclassification adjustment.

*Discontinuation of fair value hedge*

| | **Hedging instrument (derivative)** | | **Hedged item (e.g. issued bond)** | |
|---|---|---|---|---|
| | Revaluation at fair value through P/L | Derecognition from balance sheet | Derecognition from balance sheet | Cancellation of all future fair value revaluations |
| Hedging is ineffective | **X** | | | **X** |
| Hedging instrument is sold, terminated or settled | | **X** | | **X** |
| Hedged item is settled | **X** | | **X** | |
| Management voluntary terminates hedge relationship | **X** | | | **X** |

*Discontinuation of cash flow hedge*

| | **Hedging instrument (derivative)** | | **Amount in OCI** | |
|---|---|---|---|---|
| | Revaluation at fair value through P/L | Derecognition from balance sheet | Posting of the amount to net profit | "Freezing" of the amount in OCI |
| Hedging is ineffective | **X** | | | **X** |
| Hedging instrument is sold, terminated or settled | | **X** | | **X** |
| The estimated transaction is not considered as highly probable | **X** | | | **X** |
| The estimated transaction will not be realized | **X** | | **X** | |
| Management voluntary terminates hedge relationship | **X** | | | **X** |

[96] is concerned with the fact that accounting units tend to note primarily the high level of disclosure obligations in relation to hedge accounting and the costs related thereto. On the other hand, the primary goal of the standard-issuing authority is the incontestable effort to provide investors with highly relevant information. The fact that the information on hedge accounting should form an indivisible part of the financial statements is motivated by the effort to assure investors that the criteria applicable to the field of hedge accounting were applied correctly rather than by the fact that the information on hedge accounting causes considerable additional costs to accounting units.

Numerous studies in our professional practice have dealt with the bond between the economic and

the accounting concept of hedging. [85], for instance, indicates that the application of hedge accounting in compliance with the US standard SFAS 133 leads to deviations from optimum hedging in the economic sense [130]. However, [10] draws attention to the fact that these deviations from economic hedging are the very consequence of the set hedge accounting model, pointing out that hedge accounting may motivate poorly performing companies to speculate and influence their economic results on a short-term basis.
Several studies have also dealt with the information and control effects of hedge accounting [56, 65]. The most interesting finding lies in the fact that the voluntary application of hedge accounting leads to a deviation from the optimum hedging strategy (as opposed to the exclusive application of economic hedging without the application of the principles of hedge accounting).

# 5 Disclosures

Requirements on disclosed information are given by standard IFRS 7 Financial Instruments: Disclosures. Within following text we will deal with the requirement on fair value disclosures and disclosures concerning hedge accounting.

### DISCLOSURE – FAIR VALUE

Entity has to disclose following information concerning fair value issues [126]:

- methods and the assumptions applied in determining fair values of each class of financial assets or financial liabilities,
- whether fair values are determined directly by reference to published price quotations in an active market or are estimated using a valuation technique,
- whether the fair values recognised or disclosed in the financial statements are determined in whole or in part using a valuation technique based on assumptions that are not supported by prices from observable current market transactions in the same instrument and not based on available observable market data,
- total amount of the change in fair value estimated using such a valuation technique that was recognised in profit or loss during the period.

Fair value disclosure ***is not required***:

- when the carrying amount is a reasonable approximation of fair value, e.g. for financial instruments such as short-term trade receivables and payables,
- for an investment in equity instruments that do not have a quoted market price in an active market, or derivatives linked to such equity instruments, that is measured at cost in accordance with IAS 39 because its fair value cannot be measured reliably, or
- for a contract containing a discretionary participation feature (see IFRS 4) if the fair value of that feature cannot be measured reliably.

In case that there is impossible to reliably measure fair value of financial instruments, entity has to also disclose:

- fact that fair value information has not been disclosed for these instruments because their fair value cannot be measured reliably,
- description of the financial instruments, their carrying amount, and an explanation of why fair value cannot be measured reliably,
- information about the market for the instruments,
- information about whether and how the entity intends to dispose of the financial instruments, and
- if financial instruments whose fair value previously couldn't be reliably measured are derecognised, that fact, their carrying amount at the time of derecognition, and the amount of gain or loss recognised.

### DISCLOSURE – FINANCIAL RISKS

Entity has to disclose following information about the risks associated with financial instruments [126]:

- objectives, policies and processes for managing the risk and the methods used to measure the risks,

- area of ***credit risks***:
  - amount that best represents its maximum exposure to credit risk at the end of the reporting period without taking account of any collateral held or other credit enhancements,
  - a description of collateral held as security and other credit enhancements,
  - information about the credit quality of financial assets that are neither past due nor impaired, and
  - carrying amount of financial assets that would otherwise be past due or impaired whose terms have been renegotiated,
- area of ***liquidity risks***:
  - maturity analysis for financial liabilities that shows the remaining contractual maturities, and
  - description of how it manages the liquidity risks.
- area of ***market risks***:
  - sensitivity analysis for each type of market risk to which the entity is exposed at the end of the reporting period.

**DISCLOSURE – HEDGE ACCOUNTING**

Due to the application of hedge accounting based on IAS 39, companies shall disclose for all types of hedge activities following information [126]:

- description of each type of hedge,
- description of the financial instruments designated as hedging instruments and their fair values at the end of the reporting period,
- nature of the risks being hedged,
- in fair value hedges, gains or losses on the hedging instrument and on the hedged item attributable to the hedged risk,
- ineffectiveness recognized in profit or loss that arises from cash flow hedges and hedges of net investments in foreign operations,
- for ***cash flow hedges*** also:
  - periods when the cash flows are expected to occur and when they are expected to affect profit or loss,
  - description of any forecast transaction for which hedge accounting had previously been used, but which is no longer expected to occur,
  - amount that was recognized in other comprehensive income during the period,
  - amount that was reclassified from equity to profit or loss for the period, showing the amount included in each line item in the statement of comprehensive income, and
  - amount that was removed from equity during the period and included in the initial cost or other carrying amount of a non-financial asset or non-financial liability whose acquisition or incurrence was a hedged highly probable forecast transaction.

***ILLUSTRATION – INFORMATION ABOUT FINANCIAL DERIVATIVES***

| | 20X2 | | 20X1 | |
|---|---|---|---|---|
| | Book value | Fair value | Book value | Fair value |
| FX forwards (+) | | | | |
| FRA contracts (+) | | | | |
| Futures contracts (+) | | | | |
| Interest rate swaps (+) | | | | |
| Cross currency swaps (+) | | | | |
| FX options (+) | | | | |
| Interest rate options (+) | | | | |
| Other derivatives (+) | | | | |
| **Positive values total** | | | | |

| | | | | |
|---|---|---|---|---|
| FX forwards (-) | | | | |
| FRA contracts (-) | | | | |
| Futures contracts (-) | | | | |
| Interest rate swaps (-) | | | | |
| Cross currency swaps (-) | | | | |
| FX options (-) | | | | |
| Interest rate options (-) | | | | |
| Other derivatives (-) | | | | |
| **Negative values total** | | | | |

***ILLUSTRATION – HEDGE ACCOUNTING***

| Positive values (+) / Negative values (-) | 20X2 | | 20X1 | |
|---|---|---|---|---|
| | Book value | Fair value | Book value | Fair value |
| Forward contracts (fair value hedge) | | | | |
| Futures contracts (fair value hedge) | | | | |
| Swap contracts (fair value hedge) | | | | |
| Option contracts (fair value hedge) | | | | |
| ***Derivatives (fair value hedge)*** | | | | |
| Forward contracts (cash flow hedge) | | | | |
| Futures contracts (cash flow hedge) | | | | |
| Swap contracts (cash flow hedge) | | | | |
| Option contracts (cash flow hedge) | | | | |
| ***Derivatives (cash flow hedge)*** | | | | |
| **Hedging derivatives (total)** | | | | |
| Trading derivatives (total) | | | | |
| **Derivatives (total)** | | | | |

## 5.1 Sensitivity Analysis

IFRS 7 brought a new requirement for companies to prepare sensitivity analysis for each type of market risk. According to [126] company shall disclose:

- how profit or loss and equity would have been affected by changes in the relevant risk variable that were reasonably possible upon balance sheet date,
- methods and assumptions used in preparing the sensitivity analysis, and
- changes from the previous period in the methods and assumptions used, and the reasons for such changes.

In case that company uses value-at-risk, according to IFRS 7.41 it shall also disclose:

- explanation of the method used in preparing such a sensitivity analysis, and of the main parameters and assumptions underlying the data provided, and
- explanation of the objective of the method used and of limitations that may result in the information not fully reflecting the fair value of the assets and liabilities involved.

Sensitivity analysis represents for majority of companies difficult part of notes' preparation. We will show how to disclose the sensitivity analysis on following illustration:

***ILLUSTRATION: SENSITIVITY ANALYSIS***

The following sensitivity analyses as prescribed in IFRS 7 show how net profit and equity would change if the price risk variables had been different from the perspective of the balance sheet date.

| **in mil. EUR** | **Effects on net profit*** | **Effects on equity*** |
|---|---|---|
| **Fuel price** | | |
| + 10% | –114 | +344 |
| – 10% | –25 | –179 |
| **Currency – USD** | | |
| + 10% | –182 | +516 |
| – 10% | +169 | –646 |
| **Currency – JPY** | | |
| + 10% | –10 | –46 |
| – 10% | +8 | +56 |
| **Currency – GBP** | | |
| + 10% | +19 | –36 |
| – 10% | –15 | +44 |
| **Interest** | | |
| – 100 basis points | +30 | +23 |
| + 100 basis points | –30 | –22 |

* All amounts after deferred tax effects; +/- sings relate to net profit and/or equity

The figures shown above for the interest risk component do not reflect sensitivity for a borrower's note loan included in the value-at-risk analysis. The performance of this borrower's note loan is linked to a special portfolio of investments.

The historical value-at-risk analysis carried out shows that in 99 per cent of all cases losses did not exceed 2.0 per cent (2 mil. EUR) in the following ten days.

Source: [79]

# Concluding Remarks and Future Developments

## 1 Concluding Thoughts

We are currently witnessing the second largest era of financial globalization, the first being over in 1914. Regardless of the method chosen to evaluate the globalization level of the financial sector, proofs concerning an extraordinary aperture of markets, which manifested in 1914 and has not been reached after the 70's. Stanley Fischer (2006) connects the beginning of the first big era of financial globalization to the invention of the telegraph (May 24, 1844), as he states in his speech at OECD, from 2006.

> If we analyzed the moment in which return rates of various markets began to synchronize, we will observe that these coincided with the invention of the telegraph. Therefore, in just a few minutes, interest rates and prices from different financial centers could be correlated in a significant way.
>
> Stanley Fischer, Governor of Israeli Central Bank

In order to acknowledge the critical changes underlying the present state of the financial sector, one must go back in time, half a century. Those minutes that were necessary then for the use of the telegraph are now reduced to microseconds, due to technological developments, which give us free access to information, fast data transfers and rapid ways to communicate and transport. All of these have contributed to the present sophistication of the financial field, sustained especially through the boom of derivatives [109].

The liberalization of the financial sector is considered to be the goal of all industrialized countries, the precise moment of the fulfillment of this purpose depending on the legacy of the old control systems inherited from the Second World War, which have been felt for a significant period of time. All these realities lead both to a growth in the efficiency of the financial system and to an increased vulnerability, thus generating justified concerns regarding potential risks associated to the international dimension of the financial system. Impressive sums expressing values of derivatives that are transacted around the world raise fears in relation to possible financial crisis that manifested in the past, manifest in the present, and will still pose a significant danger in the future. However, their important role must not be overlooked. Derivatives are the ones which make possible separating risks from their initial context, in order to transfer them to parties willing to take that risk. Therefore, while some see derivatives as sources of stability and robustness for the financial system, others regard them as financial weapons of mass destruction (Warren Buffett, 2003)

> At the same time, derivatives create a dangerous incentive for false accounting. Profits and losses generated by derivatives are immediately recognized in accounting, even though money does not effectively pass from one hand to another. In many cases, the costs of these practices do not affect companies until years later.
>
> Warren Buffet, investor

The legendary investor expressed his disapproval regarding the use of derivatives during his well-known annual speech, addressed to his stockholders (the so called annual letter to shareholders), emphasizing the possibility that derivatives can generate significant accounting errors, some of them being caused by pure optimism, while other by wide scale frauds. The main concern regarding derivatives is linked to their capacity to transfer risks through contracts, thus being placed in wrong places and not being recognized correctly [109]. Such an unwanted situation is generated when risks are transferred from persons who comprehend them to others who don't, the informational advantage being in the favor of the first category, thus creating the premise that the first category (the ones who understand the risks of derivatives) can exploit the second category (the ones who are less informed), with dangerous consequences for the whole financial system. Analyzing this situation from an accounting perspective, we must not forget about the possibility of the transfer of these risks from entities that evaluate them using market to market information to entities that do not have this obligation, thus having the opportunity to round their own revenues and profits [108]. Evidently, for the parties involved in such an

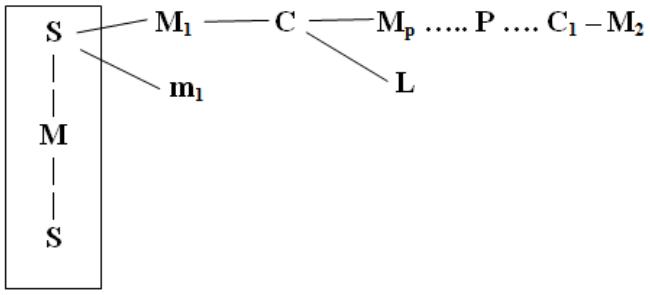
operation - the two parties involved in the contract and the third parties from the markets in which the first two protagonists act - a classic case of information asymmetry appears. A well known aspect of any market is that when the competitive conditions are affected, new opportunities appear, market niches become more obvious and companies become more agile in reorienting their plans so as to benefit as much as they can by the emerging innovations. As a consequence, derivatives can become the best friend or the worst enemy for any company, depending on the way in which they are conceived, evaluated, used, and on the control of the risk exposure [29].

Financial innovation is the art and science of developing new products and services that promote the science of services by promoting credit, stimulating investments, facilitating market transactions and bringing new perspectives on inexistent or less popular market activities and practices [29]. While clothes and automobile models change every year, currency remains - in appearance - unchanged - although its value fluctuates - thus creating the impression that the finances field does not suffer important changes [121]. In fact, the means of financing change quite often, therefore generating the need for new financing models, so as to stay on top. An employee of Lehman Brother formulated this necessity by stating that the ones involved in the creation of new financing models are inventive architects of the money business [121].

A pillar of the science of financial service - together with trust and technology - is the process of learning. Learning is in fact correlated with the abilities of adaptation and management of new changes, although changes are most of the times not abrupt, being caused by multiple small events and little steps based on what is to be learned. As a consequence, we should follow Buddha's advice and live as this would be the last day of our lives, and learn as if we would live forever. Unfortunately, people accept change only of necessity, as the French banker Jean Monnet observed, and necessity is seen only through the light of crisis. Next, we will focus on making a short incursion in the world of financial instruments, unfortunately being ourselves amidst a real financial crisis.

It is necessary, in our opinion, to accentuate the fact that the current problems linked to the use of fair value accounting for financial instruments - especially in the case of instruments such as derivatives - are closely tied to the type of capital that these imply, i.e. the fictitious capital which has a fundamentally different motion than the real one. In other words, the nature of the fictitious capital resides in its' evaluation through capitalization, being completely different in comparison to the goods movement [63]. Fictitious capital has a dynamic of its own, due to the fact that the capital itself is converted into goods, which is different to the motion of the real capital - a metamorphose of goods [63]. [53] describes the specific manner of the fictitious capital's motion as it can be seen from the following figure. Therefore, when shares are issued (S), these are sold for money (M), part of this money (m1) representing the circulation of the promoter in this cycle. The other part (M1) is transformed in productive capital, becoming part of the cycle of industrial capital, which is better known comparative to the fictitious one. Considering that these shares were sold, in order for theme to circulate again, a new sum of money will be necessary (M2) - this sum being a mean for this movement - this process (S-M2-S) taking place on the stock market. Once a share has been issued, it has nothing to do with the industrial capital which it represents. Furthermore, none of the events (positive or negative) that take place after it was transacted on the market will have an effect on the cycle of the productive capital [53]. Also, accounting aspects regarding the promoters' capital have already been debated within trade literature since the 50's, taking the form of the so-called equity premium controversy, thus becoming an early preoccupation of the debate that fictitious capital generates an accounting problem. The defining trait of the current accounting problems regarding fictitious capital is its' reinstatement as an important aspect of financial asset counting and not of capital within the balance sheet [63].

***Figure 22***. The circulation of real capital and fictitious capital




Source: [63]

It is important to keep in mind the fact that - as we can also see in the previous figure - the circulation of the fictitious capital (M – S – M') represents a completely separated and different circuit, in comparison with the one that the real capital has (M – C – M'), being external to the circulation of real capital. This is why the author [63] deduces the idea of an inadequacy of the traditional accounting conceptual framework based on the historical cost concept, which was designed to have the ability to surprise the circulation of real capital (production and sale of goods by the entity). Considering the significant differences regarding the circulation of the two types of capital, the need to create a new conceptual framework able to capture the specific case of fictitious capital movement, becomes urgent. However, a series of economic and financial aspects of fictitious capital indicate the fact that addressing the problems posed by accounting its' circulation is not possible through a simple extension of a conceptual framework that has been customized only after the necessities of the real capital.

One of the strategic advantages of derivatives consist in the possibility of personalizing them, experts suggesting the fact that the future will bring an increase in personalizing derivatives, keeping in mind the fact that the investor population will increase and that their preoccupations will shift from acquiring securities towards maintaining their financial well-being [29]. In spite of the risks involved in the transaction of derivatives, we place ourselves on the optimist side, in the sense that we can still appreciate the positive aspects and the reason for which these types of instruments were developed. [115] appreciated at the time that one of the cornerstones of our financial system is represented by financial innovation, the blood necessary for receptive and efficient capital markets. One of the most common opinions in the specialty literature is that this tendency towards personalizing financial instruments - due to its' opposition to repetitive, off-the shelf products - was not fully appreciated by bankers [29]. Therefore, we expect s series of surprises, not only for the financial community, but for the governments also, wide scale industries and general public. A correct strategy to personalize derivatives is to identify and address the necessities and end-users from an accounting point of view, but without replacing the need of creativity in this process.

Governments have the tendency to try and resolve the dilemma of personalized financial instruments by using regulations. However, this practice does not always work properly. Creating an efficient supervision imposes a series of rigorous technical elements to regulatory bodies and this, in turn, generates the necessity of a certain degree of knowledge regarding the sophistication of these instruments. We also must not forget about the danger of implementing rules and regulations that are not fully adequate for the environment for which they are meant to function, having a negative effect on the market by slowing innovation and affecting market competition.

Before considering the respective technical details, the first thing that draws our attention is the development of a conceptual framework regarding an adequate approach to increasingly complex instruments. The importance of these products can be compared in a philosophical manner to the introduction of paper money, in France, 1701, the importance of the event being diminished and annihilated by one of the first manifestations of the speculative bubble effect - the Mississippi bubble, which in the end lead to the bankruptcy of the Royal

Bank.16 What we wish to emphasize here is the inadequate use of financial innovation, because it can unjustly reduce the benefits that it can provide, if used correctly. On the other hand, we can perceive this reality of personalizing derivatives as a natural evolution in the financial field, an evolution that will continue to manifest no matter the conditions imposed by the specific of the environment. Also, we can often notice the existence of operational restrictions, which have an effect on the tailoring process of derivatives, process that is meant to serve the diverse interests of the users. The manner in which the management of a company makes use of these derivatives must always be correlated to the rules provided by the regulatory bodies.

An example regarding this matter is the fact that both the US GAAP and IFRSs consider management's intention as a key element for the classification of financial instruments into categories that further lead to fair value measurement or historical cost approach, as previously documented within the second chapter.

## 2 IFRS 9: New "Child" of IFRS Family

In April 2009, the IASB undertook a three-stage overhaul of IAS 39 to be completed within the ambitious timeframe of one year. In November 2009, following the consultative due process that closed in September 2009, the IASB issued the first phase of IAS 39's replacement, IFRS 9 "Financial Instruments: Classification and Measurement" for voluntary adoption by IFRS filers. Mandatory adoption will be required starting in 2013. The IFRS 9 classification and measurement debate was dominated primarily by the issue of whether to apply fair value or amortized cost measurement to specific financial instruments. The IFRS 9 amendments were guided by a raft of technical considerations, including the establishment of criteria to determine whether to apply fair value or amortized cost measurement to specific financial instruments.

The criteria for applying amortized cost treatment include

- that the business model applied by the entity holding the financial instrument manages the instrument on a contractual yield basis, and
- the underlying contractual cash flows of the financial instrument possess stable characteristics.

The criteria apply to an instrument held to maturity by the firm such that it can realize full par value. Financial instruments not eligible for amortized cost are measured at fair value, with gains and losses recorded in net income. An exception is allowed, however, for equity instruments that can be accounted for at fair value through other comprehensive income. The scope of these changes is limited to financial assets.

For the classification in amortized costs there shall be met following two conditions:

[16] The first European experience with printed currency at a national scale is owned to Scot John Law and resulted in a catastrophe for France. In 1715 France was on the brink of bankruptcy after the war in Spain. Seeing its economy in such a disastrous way, the French authorities asked Scottish financier John Law for help. In 1705 he published a monetary theory in which he explained the benefits of paper currency, insisting on its ability to stabilize the economy. Law created the Central Bank, which retrieved large quantities of gold and silver and issued in exchange metal and paper currency. The results were good and Law gained influence among the French authorities. In 1717 he created the Mississippi company (Companies des Indie) which owned the monopoly over the trading rights with the French colonies in the U.S. (Louisiana). By 1719, Law created a financial scheme which allowed the company to take over the entire national debt of France, parts of the debt being gradually changed with shares in the company mentioned above, promising returns of 120% to the shareholders. With the growing demand for such shares, the French government was practically controlled by Law and continued to issue banknotes, thus causing high inflation. The euphoria did not last long because the speculative bubble burst in 1720 when the Central Bank asked the government to recognize that the value of the banknotes was double in comparison to their correspondent in precious metals. The government issued an order that would gradually weaken the value of the shares, and by the end of the year they were at half of their nominal value. This order was canceled under the public pressure only a week later, but the Royal Bank (Central Bank) went bankrupt and was then reopened in June. In November 1720, the Mississippi Company's shares were already worthless, and Law was forced to leave France. I submitted this short story as a first example in the history of "speculative bubble" and of the effects that may annihilate the effects of positive evolutions in the financial domain.

- business model
    - the purpose of corporate business model is to held this instrument for the purpose of collection or payment of cash-flows
- terms and conditions of the financial instrument
    - financial instrument has to have the credit character

Revaluation at fair value through other comprehensive income is not possible to apply onto shares held for trading. In case that financial asset was classified at fair value through OCI, all future gains/losses from sale will be classified in OCI, however dividends will be classified in profit/loss.

There have been also changed the recognition of embedded derivatives. Embedded derivative is a component of hybrid security in a non-derivative instrument. An embedded derivative can modify the cash flows of the host contract because the derivative contract can be related to an exchange rate, commodity price or some other variable which frequently changes.

In case that the host contract is non-financial asset, there are applied the very same rules like under IAS 39, i.e. to separate the embedded derivative. If the host contract is financial asset, there is cancelled the separation of embedded derivatives and this hybrid security is classified as a whole.

***Figure 23***. Comparative analysis of IFRS 9 and FASB standards

| | **IFRS 9** | **FASB** |
|---|---|---|
| categories | • fair value<br>• amortized costs | • fair value<br>• (amortized costs) |
| classification and measurement approaches | • FVTPL<br>• FVOCI (shares)<br>• amortized costs | • FVTPL<br>• FVOCI (debt instruments)<br>• amortized costs |
| classification criteria | For amortized costs portfolio:<br>• business model<br>• terms and conditions | For FVOCI portfolio:<br>• terms and conditions<br>• business model |
| embedded derivatives | if a host contract is financial asset, hybrid security is classified as derivative | obviously classified at FVTPL |
| reclassification | required for the change of business model | not permitted |

Source: [44, 127]

# 3 Financial Securities and IFRS for SMEs

One of the pillars of the EU business environment is the single European market. The reasons of low integration of SMEs in business activities on the single market (cross-border activities), compared to big companies are mainly the following:

- differences in legal regulations of individual member countries,
- non-existence of unified accounting standards for these enterprises (until July 2009),
- non-existence of unified taxation of these enterprises,
- limited offer of capital and financial sources,
- insufficient support of SMEs business activities on the single market,
- cultural and language differences,
- lack of information.

IASB finalized in 2009 its effort on the wider spread of international accounting standardization issuing brand-new standard **IFRS for Small and Medium-Sized Entities (IFRS for SMEs)** [61]. This standard in fact brought a lot of positive and reasonable simplification of rules from “full IFRS” for the necessities of SME

businesses. However it is necessary to state that certain "full IFRS" requirements were not simplified or superseded, but only shortened. This leads to the worse understandability of this standard among SMEs. Due to this reason can be stated that IFRS for SMEs is still not required as a reporting framework within lots of countries or within European Union.

IFRS for SMEs defines ***"small and medium-sized enterprises" as entities that do not have public accountability, and publish general purpose financial statements for external users***. Every entity has some form of accountability, if only to its owners and the local tax authorities. Note that size is not the determining factor as to which entitles can use the IFRS for SMEs – the applicability is based entirely on whether the entity has public accountability or not. Therefore, entities that wish to apply the standard may vary in size from very small to substantial private entities. Hence, the standard potentially could have a large audience. The IASB estimates that 95 % of all companies meet these criteria.

There is some evidence that suggests the difficulties or the failure of the adoption process:

- the lack of political will, rooted in local culture and a strong national outlook prevented a truly harmonized framework, a magnitude of the differences that exist between countries and the high costs to eliminate them [64];
- local traditions exercise a strong influence over the implementations of new concepts (as previously noted on true and fair view) [111];
- tax and legally-based orientation hinder the harmonization process [71, 116];
- diversity will not disappear as it comes from different accounting cultures and their interpretation will be partly influenced by their history and previous practice [3, 4, 55, 102, 104, 112].

Several questions arise in this context [106]:

- are transition countries, while their accounting models have understandably less tradition, more at ease to implement full IFRSs and the IFRS for SMEs?
- are the differences between local practices and IFRSs more easily to be reduced?

Some could argue that the change of the accounting model is more easily achieved in transition countries just because of the reduced impact of the tradition. However, impediments to convergence are seen as more of a problem in the new EU member states. Drawing on this experience in applying full IFRSs, we assert that the implementation of the IFRS for SMEs will be even more challenging, given the characteristics of these entities.

IFRS for SMEs divide financial instruments onto two groups: (i) basic financial instruments, and (ii) other financial instruments.

Among **basic financial instruments** may be stated:

- cash;
- demand and fixed-term deposits when the entity is the depositor, e.g. bank accounts;
- commercial paper and commercial bills held;
- accounts, notes and loans receivable and payable;
- bonds and similar debt instruments;
- investments in non-convertible preference shares and non-puttable ordinary and preference shares;
- commitments to receive a loan if the commitment cannot be net settled in cash.

These basic financial instruments shall be measured upon initial recognition at the **transaction price**.

Upon balance sheet date subsequent measurement varies according to type of the financial instrument:

- ***debt instruments***
  - at amortized cost using the effective interest rate
- ***commitments to receive a loan***
  - at cost less impairment

- ***investments in non-convertible preference shares and non-puttable ordinary or preference share***
    - if these instruments are publicly traded or their fair value can be measured reliably, at fair value through profit or loss,
    - otherwise at cost less impairment.

**Other financial instruments** have to be measured upon initial recognition at **fair value** (obviously the transaction price).
Upon balance sheet date the subsequent measurement is following:

- ***general approach***
    - at fair value through profit/loss
- ***exemptions***
    - equity instruments which are not publicly traded or their fair value is not reliably measured and contracts linked to such instruments
        - at cost less impairment

According to [61] company shall **disclose** for the area of financial instruments:

- financial assets measured at fair value through profit or loss;
- financial assets that are debt instruments measured at amortized cost;
- financial assets that are equity instruments measured at cost less impairment;
- financial liabilities measured at fair value through profit or loss;
- financial liabilities measured at amortized cost;
- loan commitments measured at cost less impairment;
- income, expense, gains or losses, including changes in fair value, recognized on:
    - financial assets measured at fair value through profit or loss;
    - financial liabilities measured at fair value through profit or loss;
    - financial assets measured at amortized cost;
    - financial liabilities measured at amortized cost;
- total interest income and total interest expense for financial assets or financial liabilities that are not measured at fair value through profit or loss;
- the amount of any impairment loss for each class of financial asset.

# 4 Comparative Analysis of Revaluation Models: Case Study

You have the following information about the balance sheet items of the company before the revaluation of financial securities:

**Balance Sheet as at 31.12.2011 (before revaluation)**

| | | | |
|---|---|---|---|
| Financial securities | 1,000,000 | Registered capital | 2,000,000 |
| Other assets | 9,000,000 | Revaluation fund | 0 |
| | | Other parts of equity | 2,000,000 |
| | | Profit/loss | 1,000,000 |
| | | Tax liabilities | 250,000 |
| | | Other liabilities | 4,750,000 |
| Σ | 10,000,000 | Σ | 10,000,000 |

Registered capital is constituted from 2,000 shares. All liabilities are not remunerating. For the simplicity calculate the income tax of 20 %.

Before the revaluation the initial ROA, ROE and EPS were following:

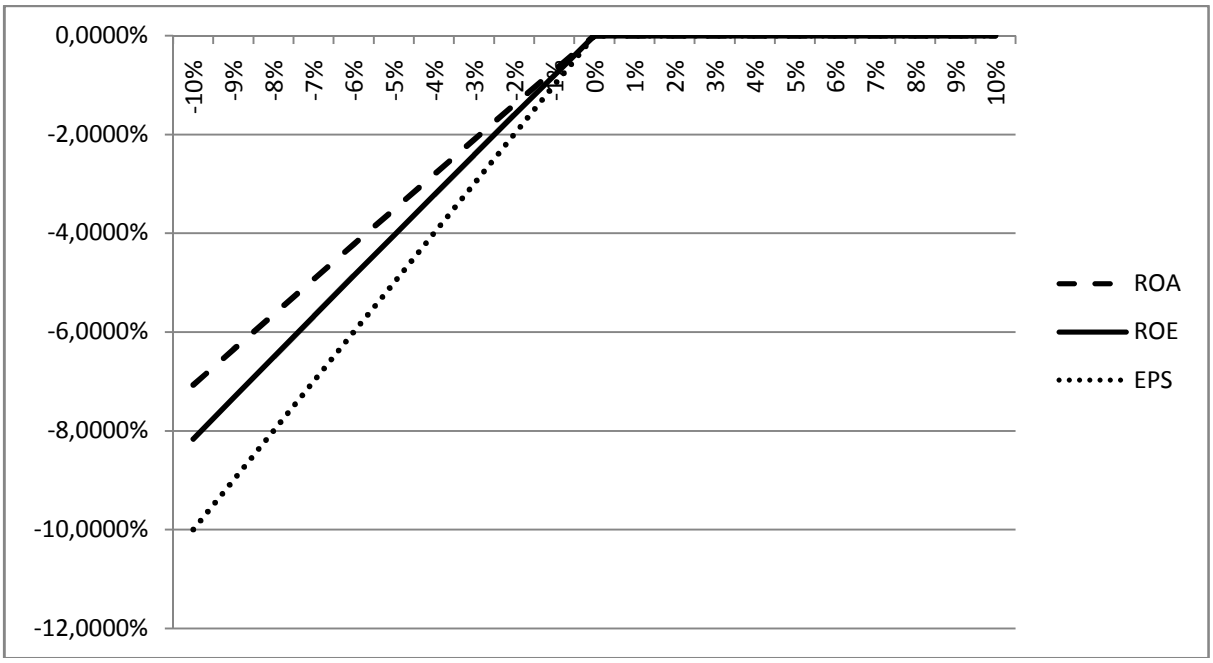
| Ratio | Calculation | Result |
|---|---|---|
| $ROA = \frac{EBIT}{Total\ assets}$ | $\frac{1{,}250{,}000}{1{,}000{,}000}$ | 0.125 |
| $ROE = \frac{EAT}{Equity}$ | $\frac{1{,}000{,}000}{5{,}000{,}000}$ | 0.2 |
| $EPS = \frac{EAT}{shares}$ | $\frac{1{,}000{,}000}{2{,}000}$ | 500 CU/share |

Consider the revaluation of securities within the interval $\langle -10\%;\ +10\% \rangle$ of initial book value. (Input data are part of Appendix 2).

There will be tested following models:

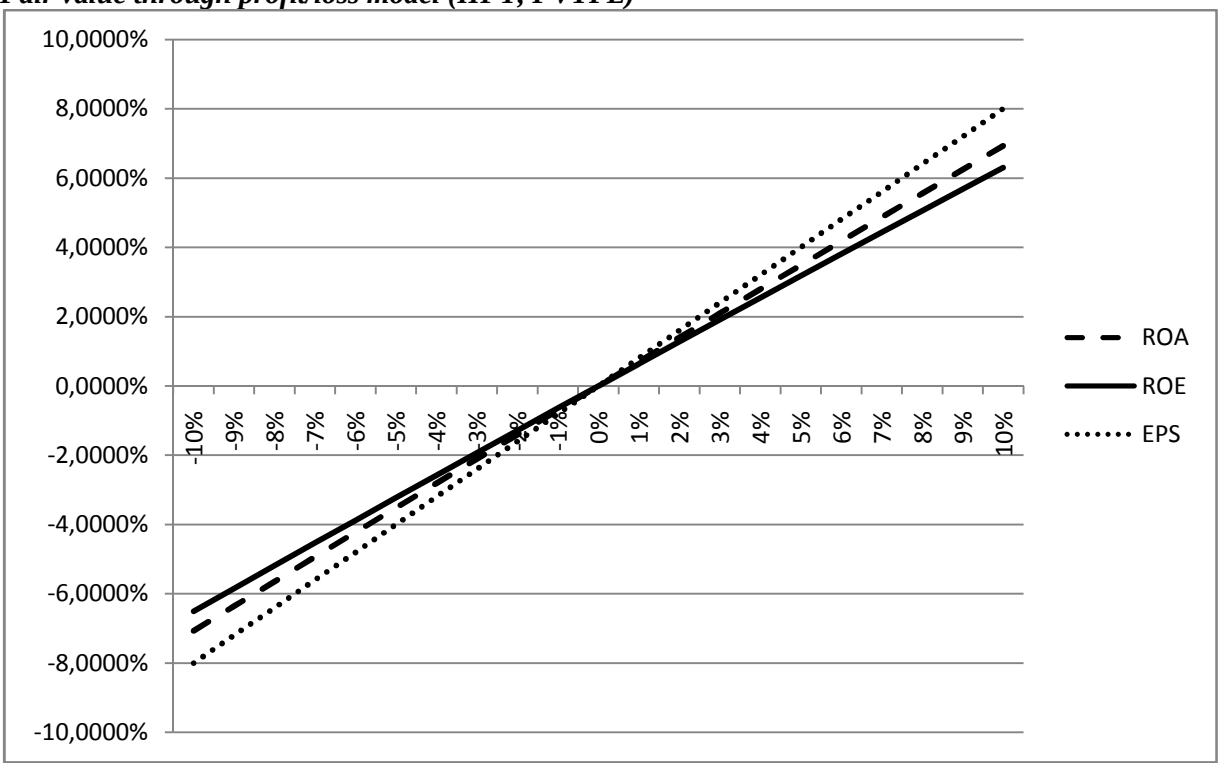
- cost model
- fair value through profit/loss model
- fair value through other comprehensive income model

***Cost model***



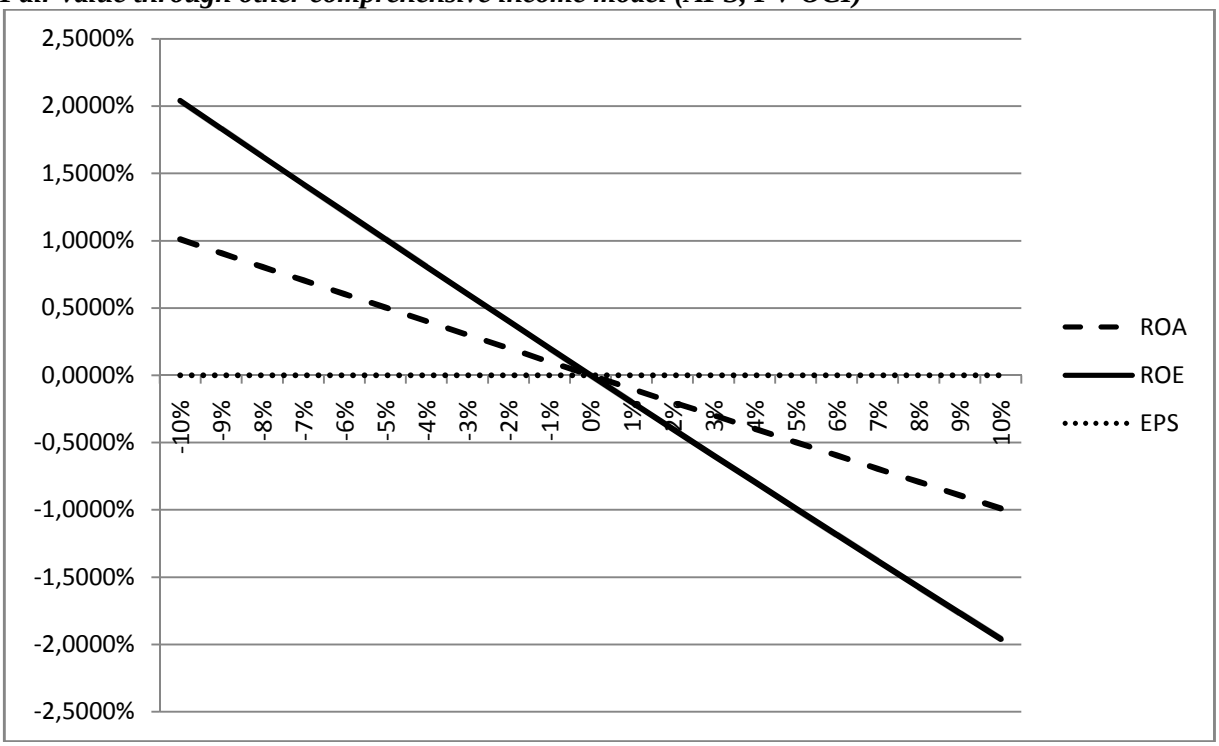

The most sensitive ratio on cost model seems to be EPS (the effect is proportional). Cost model does not allow the revaluation on higher values, therefore it is clearly seen, that there is any effect on revaluation higher than 0 % from the initial costs.

***Fair value through profit/loss model (HFT, FVTPL)***




The most sensitive ratio on Fair Value through Profit/Loss is EPS, however this sensitivity is under-proportional. The less sensitive seems to be ROE.

***Fair value through other comprehensive income model (AFS, FV OCI)***




The most sensitive ratio on this revaluation model is ROE (higher values than initial costs have negative under-proportional effect on profitability ratios given by the higher value of revaluation fund). However this

revaluation model has any effect on EPS. These revaluation methods do not have any effect on Earnings per Share.

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# Appendix 1. Fundamentals of Financial Mathematics

Obviously we are differing following types of interest rates:

| | Abbreviation | Latin |
|---|---|---|
| yearly | p.a. | per annum |
| half-yearly | p.s. | per semestre |
| quarterly | p.q. | per quartale |
| monthly | p.m. | per mensum |
| daily | p.d. | per diem |

It is valid:

$$p.a. = 2 \times p.s. = 4 \times p.q = 12 \times p.m. = 360 \times p.d. \tag{84}$$

It is discussable whether to use 360 or 365 (366) days per year. For this reason there exist several conventions how to calculate number of days:

- ***30E/360 (European method)***
  - for the simplicity it is estimated that each month has 30 days, i.e. whole year has 360 days
- ***30A/360 (US method)***
  - it is a modification of European method. It might differ for one day in case that the end of the period will be 31st day of the month. In such a case all months "have" 30 days, but the last one will have 31 days
- ***ACT/360 (French method)***
  - in numerator there is used real number of days, however in denominator there is still used 360 days per year
- ***ACT/365 (UK method)***
  - there is used real number of days and therefore this method is considered as a most precise one

Throughout the book we did used European method for the simplicity of calculation. However French method is the one commonly used in practice.

**EXAMPLE**
You have save your money in bank for a period 24.6.2011 – 31.10.2011. Calculate number of days for which money has been saved in bank?

*Solution:*
*1 – ACT method*

| 6/2010 | 7/2010 | 8/2010 | 9/2010 | 10/2010 | Total |
|---|---|---|---|---|---|
| 6 | 31 | 31 | 30 | 31 | 129 days |

*French method:*

$$\frac{ACT}{360} = \frac{129}{360} = 0.3583$$

*UK method:*

$$\frac{ACT}{365} = \frac{129}{365} = 0.3534$$

*2 – 30E method*

| 6/2010 | 7/2010 | 8/2010 | 9/2010 | 10/2010 | Total |
|---|---|---|---|---|---|
| 6 | 30 | 30 | 30 | 30 | 126 days |

*European method:*

$$\frac{30E}{360} = \frac{126}{360} = 0.35$$

*3 – 30A method*

| 6/2010 | 7/2010 | 8/2010 | 9/2010 | 10/2010 | Total |
|---|---|---|---|---|---|
| 6 | 30 | 30 | 30 | 31 | 127 days |

*US method:*

$$\frac{30A}{360} = \frac{127}{360} = 0.3528$$

The real length of the period 24.6.-31.10.2011 is 129 days. When using European method, number of days will be just 126, using US method will differ just for one day – i.e. 127 days.

## FUTURE VALUE AND PRESENT VALUE OF SINGLE DEPOSIT

### FUTURE VALUE OF SINGLE DEPOSIT

The calculation provides us information how much money we will have after some period of deposit under generally known interest rate in case that today we are saving some amount. In case that the period of the deposit will be shorter than one year, the formula for the calculation of future value of single deposit will be following:

$$FV = PV \cdot \left(1 + i\frac{t}{360}\right) \tag{85}$$

where:

| | |
|---|---|
| $FV$ | future value of single deposit |
| $PV$ | present value of single deposit |
| $i$ | interest rate |
| $t$ | period of the deposit (in days) |

In case that the period of the deposit will be longer than one year, the formula for the calculation of future value of single deposit will be following:

$$FV = PV(1 + i)^n \tag{86}$$

where:

| | |
|---|---|
| $n$ | period of the deposit (in years) |

In case that the frequency of interest will be other than yearly based, the formula for the calculation of future value of single deposit will be following:

$$FV = PV\left(1 + \frac{i}{m}\right)^{mn} \tag{87}$$

where:

| | |
|---|---|
| $m$ | frequency of interest |

### EXAMPLE

Today you did saved 100,000 CU on your bank account with interest rate 2 % p.a. What amount you may expect after ten years in case of yearly/monthly frequency of interest payments?

*Solution:*

*1 - Yearly frequency*

$$FV = PV(1 + i)^n$$
$$FV = 100{,}000(1 + 0.02)^{10}$$
$$\boldsymbol{FV = 121{,}900\ CU}$$

After ten years we could reach 121,900 CU.

*2 - Monthly frequency*

$$FV = PV\left(1 + \frac{i}{m}\right)^{mn}$$

$$FV = 100{,}000\left(1 + \frac{0.02}{12}\right)^{12 \cdot 10}$$

$$\boldsymbol{FV = 122{,}120\ CU}$$

After ten years we could reach 122,120 CU.

**PRESENT VALUE OF SINGLE DEPOSIT**

The calculation provides us information about the value of future cash flow to date. In case that the period of the deposit will be shorter than one year, the formula for the calculation of present value of single deposit will be following:

$$PV = \frac{FV}{1 + i\frac{t}{360}} \tag{88}$$

In case that the period of the deposit will be longer than one year, the formula for the calculation of present value of single deposit will be following:

$$PV = \frac{FV}{(1 + i)^n} \tag{89}$$

In case that the frequency of interest will be other than yearly based, the formula for the calculation of present value of single deposit will be following:

$$PV = \frac{FV}{\left(1 + \frac{i}{m}\right)^{mn}} \tag{90}$$

**EXAMPLE**

You will be retired in five years. For this reason you would like to start travelling round the world. For these purposes you need 300,000 CU. What amount you have to deposit today to your bank account with interest rate 2 % p.a. to have after 5 years your expected 300,000 CU in case of yearly/monthly frequency of interest payments?

*Solution:*

*1 - Yearly frequency*

$$PV = \frac{FV}{(1 + i)^n}$$

$$PV = \frac{300{,}000}{(1 + 0.02)^5}$$

$$\boldsymbol{PV = 271{,}720\ CU}$$

You have to deposit today the amount of 271,720 CU.

*2 - Monthly frequency*

$$PV = \frac{FV}{\left(1 + \frac{i}{m}\right)^{mn}}$$

$$PV = \frac{300{,}000}{\left(1 + \frac{0.02}{4}\right)^{12 \cdot 5}}$$

$$\boldsymbol{PV = 271{,}470\ CU}$$

You have to deposit today the amount of 271,470 CU.

**EXAMPLE**

You did found at street 100,000 CU. Of course as a honest citizen you did give this amount to the police office. As no one applied for this money, you did received reward 10 %, i.e. 10,000 CU. This amount you have deposited onto your bank account with the interest rate 2 % p.a. and yearly frequency of interest payments. How long does it take to have at your bank account 100,000 CU, i.e. money you did found?

$$FV = PV(1 + i)^n$$

$$100{,}000 = 10{,}000(1 + 0.02)^n$$

$$10 = 1.02^n$$

$$\ln 10 = n \cdot \ln 1.02$$

$$n = \frac{\ln 10}{\ln 1.02}$$

$$\boldsymbol{n = 116.3\ years}$$

You will earn that money after 116.3 years. *Honesty is the best policy – fact of fiction??* ☺

**FUTURE AND PRESENT VALUE OF THE ANNUITY**

**Annuity** is considered as a very same repetitive payment.

**FUTURE VALUE OF THE ANNUITY**

Future value of the annuity provides information how much money will investor earn after regular repetitive payments. The calculation formula is following:

$$FV = A\frac{(1 + i)^n - 1}{i} \tag{91}$$

where:

| | |
|---|---|
| $FV$ | future value of the annuity |
| $A$ | annuity |
| $i$ | interest rate |
| $n$ | length of deposit (in years) |

**EXAMPLE**

You have decided to negotiate with bank "Wonderful savings". You will deposit annually 24,000 CU and this account has an interest rate of 4 % p.a. How much money will you earn after 20 years of saving?

$$FV = A\frac{(1 + i)^n - 1}{i}$$

$$FV = 24{,}000\frac{(1 + 0.04)^{20} - 1}{0.04}$$

$$\boldsymbol{FV = 714{,}670\ CU}$$

After twenty years you will earn 714,670 CU.

**ANNUITY FROM FUTURE VALUE**

This method is used in case that company needs information what has to deposit (e.g. from profit) to have in the future some required amount of money. The calculation formula is following:

$$A = FV\frac{i}{(1+i)^n - 1} \tag{92}$$

**PRESENT VALUE OF THE ANNUITY**

Present value of the annuity provides information what amount it is necessary to deposit today to be able to pay in the future the regular repetitive payments. The calculation formula is following:

$$PV = A\frac{1-(1+i)^{-n}}{i} \tag{93}$$

where:

*PV* present value of the annuity

**ANNUITY FROM PRESENT VALUE**

This method is used in case that company needs information about the volume of annual payments from the current loans, which shall be settled (interest inclusive). The calculation formula is following:

$$A = PV\frac{i}{1-(1+i)^{-n}} \tag{94}$$

**EXAMPLE**

You did negotiate a loan contract for a volume of 800,000 CU. It is a 10 years loan where bank requires interest 12 % p.a. and the instalments are negotiated as a yearly based.

$$A = PV\frac{i}{1-(1+i)^{-n}}$$

$$A = 800{,}000\frac{0.12}{1-(1+0.12)^{-10}}$$

$$\boldsymbol{A = 141{,}587.33\ CU}$$

Annual loan instalments will be 141,587.33 CU.

The repayment calendar will be following:

| Date | Instalment | Interest | Repayment | Loan |
|---|---|---|---|---|
| 1.1.2011 | | | | 800,000 |
| 31.12.2011 | 141,587 | 96,000 | 45,587 | 754,413 |
| 31.12.2012 | 141,587 | 90,530 | 51,058 | 703,355 |
| 31.12.2013 | 141,587 | 84,403 | 57,185 | 646,170 |
| 31.12.2014 | 141,587 | 77,540 | 64,047 | 582,123 |
| 31.12.2015 | 141,587 | 69,855 | 71,733 | 510,391 |
| 31.12.2016 | 141,587 | 61,247 | 80,340 | 430,050 |
| 31.12.2017 | 141,587 | 51,606 | 89,981 | 340,069 |
| 31.12.2018 | 141,587 | 40,808 | 100,779 | 239,290 |
| 31.12.2019 | 141,587 | 28,715 | 112,873 | 126,417 |
| 31.12.2020 | 141,587 | 15,170 | 126,417 | 0 |
| **Total** | **1,415,873** | **615,873** | **800,000** | **x** |

**TABLE VALUES**

$$(1+i)^n \qquad (95)$$

| n | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.0100 | 1.0200 | 1.0300 | 1.0400 | 1.0500 | 1.0600 | 1.0700 | 1.0800 | 1.0900 | 1.1000 |
| **2** | 1.0201 | 1.0404 | 1.0609 | 1.0816 | 1.1025 | 1.1236 | 1.1449 | 1.1664 | 1.1881 | 1.2100 |
| **3** | 1.0303 | 1.0612 | 1.0927 | 1.1249 | 1.1576 | 1.1910 | 1.2250 | 1.2597 | 1.2950 | 1.3310 |
| **4** | 1.0406 | 1.0824 | 1.1255 | 1.1699 | 1.2155 | 1.2625 | 1.3108 | 1.3605 | 1.4116 | 1.4641 |
| **5** | 1.0510 | 1.1041 | 1.1593 | 1.2167 | 1.2763 | 1.3382 | 1.4026 | 1.4693 | 1.5386 | 1.6105 |
| **6** | 1.0615 | 1.1262 | 1.1941 | 1.2653 | 1.3401 | 1.4185 | 1.5007 | 1.5869 | 1.6771 | 1.7716 |
| **7** | 1.0721 | 1.1487 | 1.2299 | 1.3159 | 1.4071 | 1.5036 | 1.6058 | 1.7138 | 1.8280 | 1.9487 |
| **8** | 1.0829 | 1.1717 | 1.2668 | 1.3686 | 1.4775 | 1.5938 | 1.7182 | 1.8509 | 1.9926 | 2.1436 |
| **9** | 1.0937 | 1.1951 | 1.3048 | 1.4233 | 1.5513 | 1.6895 | 1.8385 | 1.9990 | 2.1719 | 2.3579 |
| **10** | 1.1046 | 1.2190 | 1.3439 | 1.4802 | 1.6289 | 1.7908 | 1.9672 | 2.1589 | 2.3674 | 2.5937 |
| **11** | 1.1157 | 1.2434 | 1.3842 | 1.5395 | 1.7103 | 1.8983 | 2.1049 | 2.3316 | 2.5804 | 2.8531 |
| **12** | 1.1268 | 1.2682 | 1.4258 | 1.6010 | 1.7959 | 2.0122 | 2.2522 | 2.5182 | 2.8127 | 3.1384 |
| **13** | 1.1381 | 1.2936 | 1.4685 | 1.6651 | 1.8856 | 2.1329 | 2.4098 | 2.7196 | 3.0658 | 3.4523 |
| **14** | 1.1495 | 1.3195 | 1.5126 | 1.7317 | 1.9799 | 2.2609 | 2.5785 | 2.9372 | 3.3417 | 3.7975 |
| **15** | 1.1610 | 1.3459 | 1.5580 | 1.8009 | 2.0789 | 2.3966 | 2.7590 | 3.1722 | 3.6425 | 4.1772 |
| **16** | 1.1726 | 1.3728 | 1.6047 | 1.8730 | 2.1829 | 2.5404 | 2.9522 | 3.4259 | 3.9703 | 4.5950 |
| **17** | 1.1843 | 1.4002 | 1.6528 | 1.9479 | 2.2920 | 2.6928 | 3.1588 | 3.7000 | 4.3276 | 5.0545 |
| **18** | 1.1961 | 1.4282 | 1.7024 | 2.0258 | 2.4066 | 2.8543 | 3.3799 | 3.9960 | 4.7171 | 5.5599 |
| **19** | 1.2081 | 1.4568 | 1.7535 | 2.1068 | 2.5270 | 3.0256 | 3.6165 | 4.3157 | 5.1417 | 6.1159 |
| **20** | 1.2202 | 1.4859 | 1.8061 | 2.1911 | 2.6533 | 3.2071 | 3.8697 | 4.6610 | 5.6044 | 6.7275 |
| **21** | 1.2324 | 1.5157 | 1.8603 | 2.2788 | 2.7860 | 3.3996 | 4.1406 | 5.0338 | 6.1088 | 7.4002 |
| **22** | 1.2447 | 1.5460 | 1.9161 | 2.3699 | 2.9253 | 3.6035 | 4.4304 | 5.4365 | 6.6586 | 8.1403 |
| **23** | 1.2572 | 1.5769 | 1.9736 | 2.4647 | 3.0715 | 3.8197 | 4.7405 | 5.8715 | 7.2579 | 8.9543 |
| **24** | 1.2697 | 1.6084 | 2.0328 | 2.5633 | 3.2251 | 4.0489 | 5.0724 | 6.3412 | 7.9111 | 9.8497 |
| **25** | 1.2824 | 1.6406 | 2.0938 | 2.6658 | 3.3864 | 4.2919 | 5.4274 | 6.8485 | 8.6231 | 10.8347 |
| **26** | 1.2953 | 1.6734 | 2.1566 | 2.7725 | 3.5557 | 4.5494 | 5.8074 | 7.3964 | 9.3992 | 11.9182 |
| **27** | 1.3082 | 1.7069 | 2.2213 | 2.8834 | 3.7335 | 4.8223 | 6.2139 | 7.9881 | 10.2451 | 13.1100 |
| **28** | 1.3213 | 1.7410 | 2.2879 | 2.9987 | 3.9201 | 5.1117 | 6.6488 | 8.6271 | 11.1671 | 14.4210 |
| **29** | 1.3345 | 1.7758 | 2.3566 | 3.1187 | 4.1161 | 5.4184 | 7.1143 | 9.3173 | 12.1722 | 15.8631 |
| **30** | 1.3478 | 1.8114 | 2.4273 | 3.2434 | 4.3219 | 5.7435 | 7.6123 | 10.0627 | 13.2677 | 17.4494 |

| n | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.1100 | 1.1200 | 1.1300 | 1.1400 | 1.1500 | 1.1600 | 1.1700 | 1.1800 | 1.1900 | 1.2000 |
| **2** | 1.2321 | 1.2544 | 1.2769 | 1.2996 | 1.3225 | 1.3456 | 1.3689 | 1.3924 | 1.4161 | 1.4400 |
| **3** | 1.3676 | 1.4049 | 1.4429 | 1.4815 | 1.5209 | 1.5609 | 1.6016 | 1.6430 | 1.6852 | 1.7280 |
| **4** | 1.5181 | 1.5735 | 1.6305 | 1.6890 | 1.7490 | 1.8106 | 1.8739 | 1.9388 | 2.0053 | 2.0736 |
| **5** | 1.6851 | 1.7623 | 1.8424 | 1.9254 | 2.0114 | 2.1003 | 2.1924 | 2.2878 | 2.3864 | 2.4883 |
| **6** | 1.8704 | 1.9738 | 2.0820 | 2.1950 | 2.3131 | 2.4364 | 2.5652 | 2.6996 | 2.8398 | 2.9860 |
| **7** | 2.0762 | 2.2107 | 2.3526 | 2.5023 | 2.6600 | 2.8262 | 3.0012 | 3.1855 | 3.3793 | 3.5832 |
| **8** | 2.3045 | 2.4760 | 2.6584 | 2.8526 | 3.0590 | 3.2784 | 3.5115 | 3.7589 | 4.0214 | 4.2998 |
| **9** | 2.5580 | 2.7731 | 3.0040 | 3.2519 | 3.5179 | 3.8030 | 4.1084 | 4.4355 | 4.7854 | 5.1598 |
| **10** | 2.8394 | 3.1058 | 3.3946 | 3.7072 | 4.0456 | 4.4114 | 4.8068 | 5.2338 | 5.6947 | 6.1917 |
| **11** | 3.1518 | 3.4785 | 3.8359 | 4.2262 | 4.6524 | 5.1173 | 5.6240 | 6.1759 | 6.7767 | 7.4301 |
| **12** | 3.4985 | 3.8960 | 4.3345 | 4.8179 | 5.3503 | 5.9360 | 6.5801 | 7.2876 | 8.0642 | 8.9161 |
| **13** | 3.8833 | 4.3635 | 4.8980 | 5.4924 | 6.1528 | 6.8858 | 7.6987 | 8.5994 | 9.5964 | 10.6993 |
| **14** | 4.3104 | 4.8871 | 5.5348 | 6.2613 | 7.0757 | 7.9875 | 9.0075 | 10.1472 | 11.4198 | 12.8392 |
| **15** | 4.7846 | 5.4736 | 6.2543 | 7.1379 | 8.1371 | 9.2655 | 10.5387 | 11.9737 | 13.5895 | 15.4070 |
| **16** | 5.3109 | 6.1304 | 7.0673 | 8.1372 | 9.3576 | 10.7480 | 12.3303 | 14.1290 | 16.1715 | 18.4884 |
| **17** | 5.8951 | 6.8660 | 7.9861 | 9.2765 | 10.7613 | 12.4677 | 14.4265 | 16.6722 | 19.2441 | 22.1861 |
| **18** | 6.5436 | 7.6900 | 9.0243 | 10.5752 | 12.3755 | 14.4625 | 16.8790 | 19.6733 | 22.9005 | 26.6233 |
| **19** | 7.2633 | 8.6128 | 10.1974 | 12.0557 | 14.2318 | 16.7765 | 19.7484 | 23.2144 | 27.2516 | 31.9480 |
| **20** | 8.0623 | 9.6463 | 11.5231 | 13.7435 | 16.3665 | 19.4608 | 23.1056 | 27.3930 | 32.4294 | 38.3376 |
| **21** | 8.9492 | 10.8038 | 13.0211 | 15.6676 | 18.8215 | 22.5745 | 27.0336 | 32.3238 | 38.5910 | 46.0051 |
| **22** | 9.9336 | 12.1003 | 14.7138 | 17.8610 | 21.6447 | 26.1864 | 31.6293 | 38.1421 | 45.9233 | 55.2061 |
| **23** | 11.0263 | 13.5523 | 16.6266 | 20.3616 | 24.8915 | 30.3762 | 37.0062 | 45.0076 | 54.6487 | 66.2474 |
| **24** | 12.2392 | 15.1786 | 18.7881 | 23.2122 | 28.6252 | 35.2364 | 43.2973 | 53.1090 | 65.0320 | 79.4968 |
| **25** | 13.5855 | 17.0001 | 21.2305 | 26.4619 | 32.9190 | 40.8742 | 50.6578 | 62.6686 | 77.3881 | 95.3962 |
| **26** | 15.0799 | 19.0401 | 23.9905 | 30.1666 | 37.8568 | 47.4141 | 59.2697 | 73.9490 | 92.0918 | 114.4755 |
| **27** | 16.7386 | 21.3249 | 27.1093 | 34.3899 | 43.5353 | 55.0004 | 69.3455 | 87.2598 | 109.5893 | 137.3706 |
| **28** | 18.5799 | 23.8839 | 30.6335 | 39.2045 | 50.0656 | 63.8004 | 81.1342 | 102.9666 | 130.4112 | 164.8447 |
| **29** | 20.6237 | 26.7499 | 34.6158 | 44.6931 | 57.5755 | 74.0085 | 94.9271 | 121.5005 | 155.1893 | 197.8136 |
| **30** | 22.8923 | 29.9599 | 39.1159 | 50.9502 | 66.2118 | 85.8499 | 111.0647 | 143.3706 | 184.6753 | 237.3763 |

$$\frac{1}{(1+i)^n} \tag{96}$$

| n | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 0.9901 | 0.9804 | 0.9709 | 0.9615 | 0.9524 | 0.9434 | 0.9346 | 0.9259 | 0.9174 | 0.9091 |
| **2** | 0.9803 | 0.9612 | 0.9426 | 0.9246 | 0.9070 | 0.8900 | 0.8734 | 0.8573 | 0.8417 | 0.8264 |
| **3** | 0.9706 | 0.9423 | 0.9151 | 0.8890 | 0.8638 | 0.8396 | 0.8163 | 0.7938 | 0.7722 | 0.7513 |
| **4** | 0.9610 | 0.9238 | 0.8885 | 0.8548 | 0.8227 | 0.7921 | 0.7629 | 0.7350 | 0.7084 | 0.6830 |
| **5** | 0.9515 | 0.9057 | 0.8626 | 0.8219 | 0.7835 | 0.7473 | 0.7130 | 0.6806 | 0.6499 | 0.6209 |
| **6** | 0.9420 | 0.8880 | 0.8375 | 0.7903 | 0.7462 | 0.7050 | 0.6663 | 0.6302 | 0.5963 | 0.5645 |
| **7** | 0.9327 | 0.8706 | 0.8131 | 0.7599 | 0.7107 | 0.6651 | 0.6227 | 0.5835 | 0.5470 | 0.5132 |
| **8** | 0.9235 | 0.8535 | 0.7894 | 0.7307 | 0.6768 | 0.6274 | 0.5820 | 0.5403 | 0.5019 | 0.4665 |
| **9** | 0.9143 | 0.8368 | 0.7664 | 0.7026 | 0.6446 | 0.5919 | 0.5439 | 0.5002 | 0.4604 | 0.4241 |
| **10** | 0.9053 | 0.8203 | 0.7441 | 0.6756 | 0.6139 | 0.5584 | 0.5083 | 0.4632 | 0.4224 | 0.3855 |
| **11** | 0.8963 | 0.8043 | 0.7224 | 0.6496 | 0.5847 | 0.5268 | 0.4751 | 0.4289 | 0.3875 | 0.3505 |
| **12** | 0.8874 | 0.7885 | 0.7014 | 0.6246 | 0.5568 | 0.4970 | 0.4440 | 0.3971 | 0.3555 | 0.3186 |
| **13** | 0.8787 | 0.7730 | 0.6810 | 0.6006 | 0.5303 | 0.4688 | 0.4150 | 0.3677 | 0.3262 | 0.2897 |
| **14** | 0.8700 | 0.7579 | 0.6611 | 0.5775 | 0.5051 | 0.4423 | 0.3878 | 0.3405 | 0.2992 | 0.2633 |
| **15** | 0.8613 | 0.7430 | 0.6419 | 0.5553 | 0.4810 | 0.4173 | 0.3624 | 0.3152 | 0.2745 | 0.2394 |
| **16** | 0.8528 | 0.7284 | 0.6232 | 0.5339 | 0.4581 | 0.3936 | 0.3387 | 0.2919 | 0.2519 | 0.2176 |
| **17** | 0.8444 | 0.7142 | 0.6050 | 0.5134 | 0.4363 | 0.3714 | 0.3166 | 0.2703 | 0.2311 | 0.1978 |
| **18** | 0.8360 | 0.7002 | 0.5874 | 0.4936 | 0.4155 | 0.3503 | 0.2959 | 0.2502 | 0.2120 | 0.1799 |
| **19** | 0.8277 | 0.6864 | 0.5703 | 0.4746 | 0.3957 | 0.3305 | 0.2765 | 0.2317 | 0.1945 | 0.1635 |
| **20** | 0.8195 | 0.6730 | 0.5537 | 0.4564 | 0.3769 | 0.3118 | 0.2584 | 0.2145 | 0.1784 | 0.1486 |
| **21** | 0.8114 | 0.6598 | 0.5375 | 0.4388 | 0.3589 | 0.2942 | 0.2415 | 0.1987 | 0.1637 | 0.1351 |
| **22** | 0.8034 | 0.6468 | 0.5219 | 0.4220 | 0.3418 | 0.2775 | 0.2257 | 0.1839 | 0.1502 | 0.1228 |
| **23** | 0.7954 | 0.6342 | 0.5067 | 0.4057 | 0.3256 | 0.2618 | 0.2109 | 0.1703 | 0.1378 | 0.1117 |
| **24** | 0.7876 | 0.6217 | 0.4919 | 0.3901 | 0.3101 | 0.2470 | 0.1971 | 0.1577 | 0.1264 | 0.1015 |
| **25** | 0.7798 | 0.6095 | 0.4776 | 0.3751 | 0.2953 | 0.2330 | 0.1842 | 0.1460 | 0.1160 | 0.0923 |
| **26** | 0.7720 | 0.5976 | 0.4637 | 0.3607 | 0.2812 | 0.2198 | 0.1722 | 0.1352 | 0.1064 | 0.0839 |
| **27** | 0.7644 | 0.5859 | 0.4502 | 0.3468 | 0.2678 | 0.2074 | 0.1609 | 0.1252 | 0.0976 | 0.0763 |
| **28** | 0.7568 | 0.5744 | 0.4371 | 0.3335 | 0.2551 | 0.1956 | 0.1504 | 0.1159 | 0.0895 | 0.0693 |
| **29** | 0.7493 | 0.5631 | 0.4243 | 0.3207 | 0.2429 | 0.1846 | 0.1406 | 0.1073 | 0.0822 | 0.0630 |
| **30** | 0.7419 | 0.5521 | 0.4120 | 0.3083 | 0.2314 | 0.1741 | 0.1314 | 0.0994 | 0.0754 | 0.0573 |

| n | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 0.9009 | 0.8929 | 0.8850 | 0.8772 | 0.8696 | 0.8621 | 0.8547 | 0.8475 | 0.8403 | 0.8333 |
| **2** | 0.8116 | 0.7972 | 0.7831 | 0.7695 | 0.7561 | 0.7432 | 0.7305 | 0.7182 | 0.7062 | 0.6944 |
| **3** | 0.7312 | 0.7118 | 0.6931 | 0.6750 | 0.6575 | 0.6407 | 0.6244 | 0.6086 | 0.5934 | 0.5787 |
| **4** | 0.6587 | 0.6355 | 0.6133 | 0.5921 | 0.5718 | 0.5523 | 0.5337 | 0.5158 | 0.4987 | 0.4823 |
| **5** | 0.5935 | 0.5674 | 0.5428 | 0.5194 | 0.4972 | 0.4761 | 0.4561 | 0.4371 | 0.4190 | 0.4019 |
| **6** | 0.5346 | 0.5066 | 0.4803 | 0.4556 | 0.4323 | 0.4104 | 0.3898 | 0.3704 | 0.3521 | 0.3349 |
| **7** | 0.4817 | 0.4523 | 0.4251 | 0.3996 | 0.3759 | 0.3538 | 0.3332 | 0.3139 | 0.2959 | 0.2791 |
| **8** | 0.4339 | 0.4039 | 0.3762 | 0.3506 | 0.3269 | 0.3050 | 0.2848 | 0.2660 | 0.2487 | 0.2326 |
| **9** | 0.3909 | 0.3606 | 0.3329 | 0.3075 | 0.2843 | 0.2630 | 0.2434 | 0.2255 | 0.2090 | 0.1938 |
| **10** | 0.3522 | 0.3220 | 0.2946 | 0.2697 | 0.2472 | 0.2267 | 0.2080 | 0.1911 | 0.1756 | 0.1615 |
| **11** | 0.3173 | 0.2875 | 0.2607 | 0.2366 | 0.2149 | 0.1954 | 0.1778 | 0.1619 | 0.1476 | 0.1346 |
| **12** | 0.2858 | 0.2567 | 0.2307 | 0.2076 | 0.1869 | 0.1685 | 0.1520 | 0.1372 | 0.1240 | 0.1122 |
| **13** | 0.2575 | 0.2292 | 0.2042 | 0.1821 | 0.1625 | 0.1452 | 0.1299 | 0.1163 | 0.1042 | 0.0935 |
| **14** | 0.2320 | 0.2046 | 0.1807 | 0.1597 | 0.1413 | 0.1252 | 0.1110 | 0.0985 | 0.0876 | 0.0779 |
| **15** | 0.2090 | 0.1827 | 0.1599 | 0.1401 | 0.1229 | 0.1079 | 0.0949 | 0.0835 | 0.0736 | 0.0649 |
| **16** | 0.1883 | 0.1631 | 0.1415 | 0.1229 | 0.1069 | 0.0930 | 0.0811 | 0.0708 | 0.0618 | 0.0541 |
| **17** | 0.1696 | 0.1456 | 0.1252 | 0.1078 | 0.0929 | 0.0802 | 0.0693 | 0.0600 | 0.0520 | 0.0451 |
| **18** | 0.1528 | 0.1300 | 0.1108 | 0.0946 | 0.0808 | 0.0691 | 0.0592 | 0.0508 | 0.0437 | 0.0376 |
| **19** | 0.1377 | 0.1161 | 0.0981 | 0.0829 | 0.0703 | 0.0596 | 0.0506 | 0.0431 | 0.0367 | 0.0313 |
| **20** | 0.1240 | 0.1037 | 0.0868 | 0.0728 | 0.0611 | 0.0514 | 0.0433 | 0.0365 | 0.0308 | 0.0261 |
| **21** | 0.1117 | 0.0926 | 0.0768 | 0.0638 | 0.0531 | 0.0443 | 0.0370 | 0.0309 | 0.0259 | 0.0217 |
| **22** | 0.1007 | 0.0826 | 0.0680 | 0.0560 | 0.0462 | 0.0382 | 0.0316 | 0.0262 | 0.0218 | 0.0181 |
| **23** | 0.0907 | 0.0738 | 0.0601 | 0.0491 | 0.0402 | 0.0329 | 0.0270 | 0.0222 | 0.0183 | 0.0151 |
| **24** | 0.0817 | 0.0659 | 0.0532 | 0.0431 | 0.0349 | 0.0284 | 0.0231 | 0.0188 | 0.0154 | 0.0126 |
| **25** | 0.0736 | 0.0588 | 0.0471 | 0.0378 | 0.0304 | 0.0245 | 0.0197 | 0.0160 | 0.0129 | 0.0105 |
| **26** | 0.0663 | 0.0525 | 0.0417 | 0.0331 | 0.0264 | 0.0211 | 0.0169 | 0.0135 | 0.0109 | 0.0087 |
| **27** | 0.0597 | 0.0469 | 0.0369 | 0.0291 | 0.0230 | 0.0182 | 0.0144 | 0.0115 | 0.0091 | 0.0073 |
| **28** | 0.0538 | 0.0419 | 0.0326 | 0.0255 | 0.0200 | 0.0157 | 0.0123 | 0.0097 | 0.0077 | 0.0061 |
| **29** | 0.0485 | 0.0374 | 0.0289 | 0.0224 | 0.0174 | 0.0135 | 0.0105 | 0.0082 | 0.0064 | 0.0051 |
| **30** | 0.0437 | 0.0334 | 0.0256 | 0.0196 | 0.0151 | 0.0116 | 0.0090 | 0.0070 | 0.0054 | 0.0042 |

$$\frac{(1+i)^n - 1}{i} \qquad (97)$$

| n | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| **2** | 2.0100 | 2.0200 | 2.0300 | 2.0400 | 2.0500 | 2.0600 | 2.0700 | 2.0800 | 2.0900 | 2.1000 |
| **3** | 3.0301 | 3.0604 | 3.0909 | 3.1216 | 3.1525 | 3.1836 | 3.2149 | 3.2464 | 3.2781 | 3.3100 |
| **4** | 4.0604 | 4.1216 | 4.1836 | 4.2465 | 4.3101 | 4.3746 | 4.4399 | 4.5061 | 4.5731 | 4.6410 |
| **5** | 5.1010 | 5.2040 | 5.3091 | 5.4163 | 5.5256 | 5.6371 | 5.7507 | 5.8666 | 5.9847 | 6.1051 |
| **6** | 6.1520 | 6.3081 | 6.4684 | 6.6330 | 6.8019 | 6.9753 | 7.1533 | 7.3359 | 7.5233 | 7.7156 |
| **7** | 7.2135 | 7.4343 | 7.6625 | 7.8983 | 8.1420 | 8.3938 | 8.6540 | 8.9228 | 9.2004 | 9.4872 |
| **8** | 8.2857 | 8.5830 | 8.8923 | 9.2142 | 9.5491 | 9.8975 | 10.2598 | 10.6366 | 11.0285 | 11.4359 |
| **9** | 9.3685 | 9.7546 | 10.1591 | 10.5828 | 11.0266 | 11.4913 | 11.9780 | 12.4876 | 13.0210 | 13.5795 |
| **10** | 10.4622 | 10.9497 | 11.4639 | 12.0061 | 12.5779 | 13.1808 | 13.8164 | 14.4866 | 15.1929 | 15.9374 |
| **11** | 11.5668 | 12.1687 | 12.8078 | 13.4864 | 14.2068 | 14.9716 | 15.7836 | 16.6455 | 17.5603 | 18.5312 |
| **12** | 12.6825 | 13.4121 | 14.1920 | 15.0258 | 15.9171 | 16.8699 | 17.8885 | 18.9771 | 20.1407 | 21.3843 |
| **13** | 13.8093 | 14.6803 | 15.6178 | 16.6268 | 17.7130 | 18.8821 | 20.1406 | 21.4953 | 22.9534 | 24.5227 |
| **14** | 14.9474 | 15.9739 | 17.0863 | 18.2919 | 19.5986 | 21.0151 | 22.5505 | 24.2149 | 26.0192 | 27.9750 |
| **15** | 16.0969 | 17.2934 | 18.5989 | 20.0236 | 21.5786 | 23.2760 | 25.1290 | 27.1521 | 29.3609 | 31.7725 |
| **16** | 17.2579 | 18.6393 | 20.1569 | 21.8245 | 23.6575 | 25.6725 | 27.8881 | 30.3243 | 33.0034 | 35.9497 |
| **17** | 18.4304 | 20.0121 | 21.7616 | 23.6975 | 25.8404 | 28.2129 | 30.8402 | 33.7502 | 36.9737 | 40.5447 |
| **18** | 19.6147 | 21.4123 | 23.4144 | 25.6454 | 28.1324 | 30.9057 | 33.9990 | 37.4502 | 41.3013 | 45.5992 |
| **19** | 20.8109 | 22.8406 | 25.1169 | 27.6712 | 30.5390 | 33.7600 | 37.3790 | 41.4463 | 46.0185 | 51.1591 |
| **20** | 22.0190 | 24.2974 | 26.8704 | 29.7781 | 33.0660 | 36.7856 | 40.9955 | 45.7620 | 51.1601 | 57.2750 |
| **21** | 23.2392 | 25.7833 | 28.6765 | 31.9692 | 35.7193 | 39.9927 | 44.8652 | 50.4229 | 56.7645 | 64.0025 |
| **22** | 24.4716 | 27.2990 | 30.5368 | 34.2480 | 38.5052 | 43.3923 | 49.0057 | 55.4568 | 62.8733 | 71.4027 |
| **23** | 25.7163 | 28.8450 | 32.4529 | 36.6179 | 41.4305 | 46.9958 | 53.4361 | 60.8933 | 69.5319 | 79.5430 |
| **24** | 26.9735 | 30.4219 | 34.4265 | 39.0826 | 44.5020 | 50.8156 | 58.1767 | 66.7648 | 76.7898 | 88.4973 |
| **25** | 28.2432 | 32.0303 | 36.4593 | 41.6459 | 47.7271 | 54.8645 | 63.2490 | 73.1059 | 84.7009 | 98.3471 |
| **26** | 29.5256 | 33.6709 | 38.5530 | 44.3117 | 51.1135 | 59.1564 | 68.6765 | 79.9544 | 93.3240 | 109.1818 |
| **27** | 30.8209 | 35.3443 | 40.7096 | 47.0842 | 54.6691 | 63.7058 | 74.4838 | 87.3508 | 102.7231 | 121.0999 |
| **28** | 32.1291 | 37.0512 | 42.9309 | 49.9676 | 58.4026 | 68.5281 | 80.6977 | 95.3388 | 112.9682 | 134.2099 |
| **29** | 33.4504 | 38.7922 | 45.2189 | 52.9663 | 62.3227 | 73.6398 | 87.3465 | 103.9659 | 124.1354 | 148.6309 |
| **30** | 34.7849 | 40.5681 | 47.5754 | 56.0849 | 66.4388 | 79.0582 | 94.4608 | 113.2832 | 136.3075 | 164.4940 |

| n | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| **2** | 2.1100 | 2.1200 | 2.1300 | 2.1400 | 2.1500 | 2.1600 | 2.1700 | 2.1800 | 2.1900 | 2.2000 |
| **3** | 3.3421 | 3.3744 | 3.4069 | 3.4396 | 3.4725 | 3.5056 | 3.5389 | 3.5724 | 3.6061 | 3.6400 |
| **4** | 4.7097 | 4.7793 | 4.8498 | 4.9211 | 4.9934 | 5.0665 | 5.1405 | 5.2154 | 5.2913 | 5.3680 |
| **5** | 6.2278 | 6.3528 | 6.4803 | 6.6101 | 6.7424 | 6.8771 | 7.0144 | 7.1542 | 7.2966 | 7.4416 |
| **6** | 7.9129 | 8.1152 | 8.3227 | 8.5355 | 8.7537 | 8.9775 | 9.2068 | 9.4420 | 9.6830 | 9.9299 |
| **7** | 9.7833 | 10.0890 | 10.4047 | 10.7305 | 11.0668 | 11.4139 | 11.7720 | 12.1415 | 12.5227 | 12.9159 |
| **8** | 11.8594 | 12.2997 | 12.7573 | 13.2328 | 13.7268 | 14.2401 | 14.7733 | 15.3270 | 15.9020 | 16.4991 |
| **9** | 14.1640 | 14.7757 | 15.4157 | 16.0853 | 16.7858 | 17.5185 | 18.2847 | 19.0859 | 19.9234 | 20.7989 |
| **10** | 16.7220 | 17.5487 | 18.4197 | 19.3373 | 20.3037 | 21.3215 | 22.3931 | 23.5213 | 24.7089 | 25.9587 |
| **11** | 19.5614 | 20.6546 | 21.8143 | 23.0445 | 24.3493 | 25.7329 | 27.1999 | 28.7551 | 30.4035 | 32.1504 |
| **12** | 22.7132 | 24.1331 | 25.6502 | 27.2707 | 29.0017 | 30.8502 | 32.8239 | 34.9311 | 37.1802 | 39.5805 |
| **13** | 26.2116 | 28.0291 | 29.9847 | 32.0887 | 34.3519 | 36.7862 | 39.4040 | 42.2187 | 45.2445 | 48.4966 |
| **14** | 30.0949 | 32.3926 | 34.8827 | 37.5811 | 40.5047 | 43.6720 | 47.1027 | 50.8180 | 54.8409 | 59.1959 |
| **15** | 34.4054 | 37.2797 | 40.4175 | 43.8424 | 47.5804 | 51.6595 | 56.1101 | 60.9653 | 66.2607 | 72.0351 |
| **16** | 39.1899 | 42.7533 | 46.6717 | 50.9804 | 55.7175 | 60.9250 | 66.6488 | 72.9390 | 79.8502 | 87.4421 |
| **17** | 44.5008 | 48.8837 | 53.7391 | 59.1176 | 65.0751 | 71.6730 | 78.9792 | 87.0680 | 96.0218 | 105.9306 |
| **18** | 50.3959 | 55.7497 | 61.7251 | 68.3941 | 75.8364 | 84.1407 | 93.4056 | 103.7403 | 115.2659 | 128.1167 |
| **19** | 56.9395 | 63.4397 | 70.7494 | 78.9692 | 88.2118 | 98.6032 | 110.2846 | 123.4135 | 138.1664 | 154.7400 |
| **20** | 64.2028 | 72.0524 | 80.9468 | 91.0249 | 102.4436 | 115.3797 | 130.0329 | 146.6280 | 165.4180 | 186.6880 |
| **21** | 72.2651 | 81.6987 | 92.4699 | 104.7684 | 118.8101 | 134.8405 | 153.1385 | 174.0210 | 197.8474 | 225.0256 |
| **22** | 81.2143 | 92.5026 | 105.4910 | 120.4360 | 137.6316 | 157.4150 | 180.1721 | 206.3448 | 236.4385 | 271.0307 |
| **23** | 91.1479 | 104.6029 | 120.2048 | 138.2970 | 159.2764 | 183.6014 | 211.8013 | 244.4868 | 282.3618 | 326.2369 |
| **24** | 102.1742 | 118.1552 | 136.8315 | 158.6586 | 184.1678 | 213.9776 | 248.8076 | 289.4945 | 337.0105 | 392.4842 |
| **25** | 114.4133 | 133.3339 | 155.6196 | 181.8708 | 212.7930 | 249.2140 | 292.1049 | 342.6035 | 402.0425 | 471.9811 |
| **26** | 127.9988 | 150.3339 | 176.8501 | 208.3327 | 245.7120 | 290.0883 | 342.7627 | 405.2721 | 479.4306 | 567.3773 |
| **27** | 143.0786 | 169.3740 | 200.8406 | 238.4993 | 283.5688 | 337.5024 | 402.0323 | 479.2211 | 571.5224 | 681.8528 |
| **28** | 159.8173 | 190.6989 | 227.9499 | 272.8892 | 327.1041 | 392.5028 | 471.3778 | 566.4809 | 681.1116 | 819.2233 |
| **29** | 178.3972 | 214.5828 | 258.5834 | 312.0937 | 377.1697 | 456.3032 | 552.5121 | 669.4475 | 811.5228 | 984.0680 |
| **30** | 199.0209 | 241.3327 | 293.1992 | 356.7868 | 434.7451 | 530.3117 | 647.4391 | 790.9480 | 966.7122 | 1181.8816 |

$$\frac{i}{(1+i)^n - 1} \tag{98}$$

| n | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| **2** | 0.4975 | 0.4950 | 0.4926 | 0.4902 | 0.4878 | 0.4854 | 0.4831 | 0.4808 | 0.4785 | 0.4762 |
| **3** | 0.3300 | 0.3268 | 0.3235 | 0.3203 | 0.3172 | 0.3141 | 0.3111 | 0.3080 | 0.3051 | 0.3021 |
| **4** | 0.2463 | 0.2426 | 0.2390 | 0.2355 | 0.2320 | 0.2286 | 0.2252 | 0.2219 | 0.2187 | 0.2155 |
| **5** | 0.1960 | 0.1922 | 0.1884 | 0.1846 | 0.1810 | 0.1774 | 0.1739 | 0.1705 | 0.1671 | 0.1638 |
| **6** | 0.1625 | 0.1585 | 0.1546 | 0.1508 | 0.1470 | 0.1434 | 0.1398 | 0.1363 | 0.1329 | 0.1296 |
| **7** | 0.1386 | 0.1345 | 0.1305 | 0.1266 | 0.1228 | 0.1191 | 0.1156 | 0.1121 | 0.1087 | 0.1054 |
| **8** | 0.1207 | 0.1165 | 0.1125 | 0.1085 | 0.1047 | 0.1010 | 0.0975 | 0.0940 | 0.0907 | 0.0874 |
| **9** | 0.1067 | 0.1025 | 0.0984 | 0.0945 | 0.0907 | 0.0870 | 0.0835 | 0.0801 | 0.0768 | 0.0736 |
| **10** | 0.0956 | 0.0913 | 0.0872 | 0.0833 | 0.0795 | 0.0759 | 0.0724 | 0.0690 | 0.0658 | 0.0627 |
| **11** | 0.0865 | 0.0822 | 0.0781 | 0.0741 | 0.0704 | 0.0668 | 0.0634 | 0.0601 | 0.0569 | 0.0540 |
| **12** | 0.0788 | 0.0746 | 0.0705 | 0.0666 | 0.0628 | 0.0593 | 0.0559 | 0.0527 | 0.0497 | 0.0468 |
| **13** | 0.0724 | 0.0681 | 0.0640 | 0.0601 | 0.0565 | 0.0530 | 0.0497 | 0.0465 | 0.0436 | 0.0408 |
| **14** | 0.0669 | 0.0626 | 0.0585 | 0.0547 | 0.0510 | 0.0476 | 0.0443 | 0.0413 | 0.0384 | 0.0357 |
| **15** | 0.0621 | 0.0578 | 0.0538 | 0.0499 | 0.0463 | 0.0430 | 0.0398 | 0.0368 | 0.0341 | 0.0315 |
| **16** | 0.0579 | 0.0537 | 0.0496 | 0.0458 | 0.0423 | 0.0390 | 0.0359 | 0.0330 | 0.0303 | 0.0278 |
| **17** | 0.0543 | 0.0500 | 0.0460 | 0.0422 | 0.0387 | 0.0354 | 0.0324 | 0.0296 | 0.0270 | 0.0247 |
| **18** | 0.0510 | 0.0467 | 0.0427 | 0.0390 | 0.0355 | 0.0324 | 0.0294 | 0.0267 | 0.0242 | 0.0219 |
| **19** | 0.0481 | 0.0438 | 0.0398 | 0.0361 | 0.0327 | 0.0296 | 0.0268 | 0.0241 | 0.0217 | 0.0195 |
| **20** | 0.0454 | 0.0412 | 0.0372 | 0.0336 | 0.0302 | 0.0272 | 0.0244 | 0.0219 | 0.0195 | 0.0175 |
| **21** | 0.0430 | 0.0388 | 0.0349 | 0.0313 | 0.0280 | 0.0250 | 0.0223 | 0.0198 | 0.0176 | 0.0156 |
| **22** | 0.0409 | 0.0366 | 0.0327 | 0.0292 | 0.0260 | 0.0230 | 0.0204 | 0.0180 | 0.0159 | 0.0140 |
| **23** | 0.0389 | 0.0347 | 0.0308 | 0.0273 | 0.0241 | 0.0213 | 0.0187 | 0.0164 | 0.0144 | 0.0126 |
| **24** | 0.0371 | 0.0329 | 0.0290 | 0.0256 | 0.0225 | 0.0197 | 0.0172 | 0.0150 | 0.0130 | 0.0113 |
| **25** | 0.0354 | 0.0312 | 0.0274 | 0.0240 | 0.0210 | 0.0182 | 0.0158 | 0.0137 | 0.0118 | 0.0102 |
| **26** | 0.0339 | 0.0297 | 0.0259 | 0.0226 | 0.0196 | 0.0169 | 0.0146 | 0.0125 | 0.0107 | 0.0092 |
| **27** | 0.0324 | 0.0283 | 0.0246 | 0.0212 | 0.0183 | 0.0157 | 0.0134 | 0.0114 | 0.0097 | 0.0083 |
| **28** | 0.0311 | 0.0270 | 0.0233 | 0.0200 | 0.0171 | 0.0146 | 0.0124 | 0.0105 | 0.0089 | 0.0075 |
| **29** | 0.0299 | 0.0258 | 0.0221 | 0.0189 | 0.0160 | 0.0136 | 0.0114 | 0.0096 | 0.0081 | 0.0067 |
| **30** | 0.0287 | 0.0246 | 0.0210 | 0.0178 | 0.0151 | 0.0126 | 0.0106 | 0.0088 | 0.0073 | 0.0061 |

| n | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| **2** | 0.4739 | 0.4717 | 0.4695 | 0.4673 | 0.4651 | 0.4630 | 0.4608 | 0.4587 | 0.4566 | 0.4545 |
| **3** | 0.2992 | 0.2963 | 0.2935 | 0.2907 | 0.2880 | 0.2853 | 0.2826 | 0.2799 | 0.2773 | 0.2747 |
| **4** | 0.2123 | 0.2092 | 0.2062 | 0.2032 | 0.2003 | 0.1974 | 0.1945 | 0.1917 | 0.1890 | 0.1863 |
| **5** | 0.1606 | 0.1574 | 0.1543 | 0.1513 | 0.1483 | 0.1454 | 0.1426 | 0.1398 | 0.1371 | 0.1344 |
| **6** | 0.1264 | 0.1232 | 0.1202 | 0.1172 | 0.1142 | 0.1114 | 0.1086 | 0.1059 | 0.1033 | 0.1007 |
| **7** | 0.1022 | 0.0991 | 0.0961 | 0.0932 | 0.0904 | 0.0876 | 0.0849 | 0.0824 | 0.0799 | 0.0774 |
| **8** | 0.0843 | 0.0813 | 0.0784 | 0.0756 | 0.0729 | 0.0702 | 0.0677 | 0.0652 | 0.0629 | 0.0606 |
| **9** | 0.0706 | 0.0677 | 0.0649 | 0.0622 | 0.0596 | 0.0571 | 0.0547 | 0.0524 | 0.0502 | 0.0481 |
| **10** | 0.0598 | 0.0570 | 0.0543 | 0.0517 | 0.0493 | 0.0469 | 0.0447 | 0.0425 | 0.0405 | 0.0385 |
| **11** | 0.0511 | 0.0484 | 0.0458 | 0.0434 | 0.0411 | 0.0389 | 0.0368 | 0.0348 | 0.0329 | 0.0311 |
| **12** | 0.0440 | 0.0414 | 0.0390 | 0.0367 | 0.0345 | 0.0324 | 0.0305 | 0.0286 | 0.0269 | 0.0253 |
| **13** | 0.0382 | 0.0357 | 0.0334 | 0.0312 | 0.0291 | 0.0272 | 0.0254 | 0.0237 | 0.0221 | 0.0206 |
| **14** | 0.0332 | 0.0309 | 0.0287 | 0.0266 | 0.0247 | 0.0229 | 0.0212 | 0.0197 | 0.0182 | 0.0169 |
| **15** | 0.0291 | 0.0268 | 0.0247 | 0.0228 | 0.0210 | 0.0194 | 0.0178 | 0.0164 | 0.0151 | 0.0139 |
| **16** | 0.0255 | 0.0234 | 0.0214 | 0.0196 | 0.0179 | 0.0164 | 0.0150 | 0.0137 | 0.0125 | 0.0114 |
| **17** | 0.0225 | 0.0205 | 0.0186 | 0.0169 | 0.0154 | 0.0140 | 0.0127 | 0.0115 | 0.0104 | 0.0094 |
| **18** | 0.0198 | 0.0179 | 0.0162 | 0.0146 | 0.0132 | 0.0119 | 0.0107 | 0.0096 | 0.0087 | 0.0078 |
| **19** | 0.0176 | 0.0158 | 0.0141 | 0.0127 | 0.0113 | 0.0101 | 0.0091 | 0.0081 | 0.0072 | 0.0065 |
| **20** | 0.0156 | 0.0139 | 0.0124 | 0.0110 | 0.0098 | 0.0087 | 0.0077 | 0.0068 | 0.0060 | 0.0054 |
| **21** | 0.0138 | 0.0122 | 0.0108 | 0.0095 | 0.0084 | 0.0074 | 0.0065 | 0.0057 | 0.0051 | 0.0044 |
| **22** | 0.0123 | 0.0108 | 0.0095 | 0.0083 | 0.0073 | 0.0064 | 0.0056 | 0.0048 | 0.0042 | 0.0037 |
| **23** | 0.0110 | 0.0096 | 0.0083 | 0.0072 | 0.0063 | 0.0054 | 0.0047 | 0.0041 | 0.0035 | 0.0031 |
| **24** | 0.0098 | 0.0085 | 0.0073 | 0.0063 | 0.0054 | 0.0047 | 0.0040 | 0.0035 | 0.0030 | 0.0025 |
| **25** | 0.0087 | 0.0075 | 0.0064 | 0.0055 | 0.0047 | 0.0040 | 0.0034 | 0.0029 | 0.0025 | 0.0021 |
| **26** | 0.0078 | 0.0067 | 0.0057 | 0.0048 | 0.0041 | 0.0034 | 0.0029 | 0.0025 | 0.0021 | 0.0018 |
| **27** | 0.0070 | 0.0059 | 0.0050 | 0.0042 | 0.0035 | 0.0030 | 0.0025 | 0.0021 | 0.0017 | 0.0015 |
| **28** | 0.0063 | 0.0052 | 0.0044 | 0.0037 | 0.0031 | 0.0025 | 0.0021 | 0.0018 | 0.0015 | 0.0012 |
| **29** | 0.0056 | 0.0047 | 0.0039 | 0.0032 | 0.0027 | 0.0022 | 0.0018 | 0.0015 | 0.0012 | 0.0010 |
| **30** | 0.0050 | 0.0041 | 0.0034 | 0.0028 | 0.0023 | 0.0019 | 0.0015 | 0.0013 | 0.0010 | 0.0008 |

$$\frac{1-(1+i)^{-n}}{i} \tag{99}$$

| n | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 0.9901 | 0.9804 | 0.9709 | 0.9615 | 0.9524 | 0.9434 | 0.9346 | 0.9259 | 0.9174 | 0.9091 |
| **2** | 1.9704 | 1.9416 | 1.9135 | 1.8861 | 1.8594 | 1.8334 | 1.8080 | 1.7833 | 1.7591 | 1.7355 |
| **3** | 2.9410 | 2.8839 | 2.8286 | 2.7751 | 2.7232 | 2.6730 | 2.6243 | 2.5771 | 2.5313 | 2.4869 |
| **4** | 3.9020 | 3.8077 | 3.7171 | 3.6299 | 3.5460 | 3.4651 | 3.3872 | 3.3121 | 3.2397 | 3.1699 |
| **5** | 4.8534 | 4.7135 | 4.5797 | 4.4518 | 4.3295 | 4.2124 | 4.1002 | 3.9927 | 3.8897 | 3.7908 |
| **6** | 5.7955 | 5.6014 | 5.4172 | 5.2421 | 5.0757 | 4.9173 | 4.7665 | 4.6229 | 4.4859 | 4.3553 |
| **7** | 6.7282 | 6.4720 | 6.2303 | 6.0021 | 5.7864 | 5.5824 | 5.3893 | 5.2064 | 5.0330 | 4.8684 |
| **8** | 7.6517 | 7.3255 | 7.0197 | 6.7327 | 6.4632 | 6.2098 | 5.9713 | 5.7466 | 5.5348 | 5.3349 |
| **9** | 8.5660 | 8.1622 | 7.7861 | 7.4353 | 7.1078 | 6.8017 | 6.5152 | 6.2469 | 5.9952 | 5.7590 |
| **10** | 9.4713 | 8.9826 | 8.5302 | 8.1109 | 7.7217 | 7.3601 | 7.0236 | 6.7101 | 6.4177 | 6.1446 |
| **11** | 10.3676 | 9.7868 | 9.2526 | 8.7605 | 8.3064 | 7.8869 | 7.4987 | 7.1390 | 6.8052 | 6.4951 |
| **12** | 11.2551 | 10.5753 | 9.9540 | 9.3851 | 8.8633 | 8.3838 | 7.9427 | 7.5361 | 7.1607 | 6.8137 |
| **13** | 12.1337 | 11.3484 | 10.6350 | 9.9856 | 9.3936 | 8.8527 | 8.3577 | 7.9038 | 7.4869 | 7.1034 |
| **14** | 13.0037 | 12.1062 | 11.2961 | 10.5631 | 9.8986 | 9.2950 | 8.7455 | 8.2442 | 7.7862 | 7.3667 |
| **15** | 13.8651 | 12.8493 | 11.9379 | 11.1184 | 10.3797 | 9.7122 | 9.1079 | 8.5595 | 8.0607 | 7.6061 |
| **16** | 14.7179 | 13.5777 | 12.5611 | 11.6523 | 10.8378 | 10.1059 | 9.4466 | 8.8514 | 8.3126 | 7.8237 |
| **17** | 15.5623 | 14.2919 | 13.1661 | 12.1657 | 11.2741 | 10.4773 | 9.7632 | 9.1216 | 8.5436 | 8.0216 |
| **18** | 16.3983 | 14.9920 | 13.7535 | 12.6593 | 11.6896 | 10.8276 | 10.0591 | 9.3719 | 8.7556 | 8.2014 |
| **19** | 17.2260 | 15.6785 | 14.3238 | 13.1339 | 12.0853 | 11.1581 | 10.3356 | 9.6036 | 8.9501 | 8.3649 |
| **20** | 18.0456 | 16.3514 | 14.8775 | 13.5903 | 12.4622 | 11.4699 | 10.5940 | 9.8181 | 9.1285 | 8.5136 |
| **21** | 18.8570 | 17.0112 | 15.4150 | 14.0292 | 12.8212 | 11.7641 | 10.8355 | 10.0168 | 9.2922 | 8.6487 |
| **22** | 19.6604 | 17.6580 | 15.9369 | 14.4511 | 13.1630 | 12.0416 | 11.0612 | 10.2007 | 9.4424 | 8.7715 |
| **23** | 20.4558 | 18.2922 | 16.4436 | 14.8568 | 13.4886 | 12.3034 | 11.2722 | 10.3711 | 9.5802 | 8.8832 |
| **24** | 21.2434 | 18.9139 | 16.9355 | 15.2470 | 13.7986 | 12.5504 | 11.4693 | 10.5288 | 9.7066 | 8.9847 |
| **25** | 22.0232 | 19.5235 | 17.4131 | 15.6221 | 14.0939 | 12.7834 | 11.6536 | 10.6748 | 9.8226 | 9.0770 |
| **26** | 22.7952 | 20.1210 | 17.8768 | 15.9828 | 14.3752 | 13.0032 | 11.8258 | 10.8100 | 9.9290 | 9.1609 |
| **27** | 23.5596 | 20.7069 | 18.3270 | 16.3296 | 14.6430 | 13.2105 | 11.9867 | 10.9352 | 10.0266 | 9.2372 |
| **28** | 24.3164 | 21.2813 | 18.7641 | 16.6631 | 14.8981 | 13.4062 | 12.1371 | 11.0511 | 10.1161 | 9.3066 |
| **29** | 25.0658 | 21.8444 | 19.1885 | 16.9837 | 15.1411 | 13.5907 | 12.2777 | 11.1584 | 10.1983 | 9.3696 |
| **30** | 25.8077 | 22.3965 | 19.6004 | 17.2920 | 15.3725 | 13.7648 | 12.4090 | 11.2578 | 10.2737 | 9.4269 |

| n | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 0.9009 | 0.8929 | 0.8850 | 0.8772 | 0.8696 | 0.8621 | 0.8547 | 0.8475 | 0.8403 | 0.8333 |
| **2** | 1.7125 | 1.6901 | 1.6681 | 1.6467 | 1.6257 | 1.6052 | 1.5852 | 1.5656 | 1.5465 | 1.5278 |
| **3** | 2.4437 | 2.4018 | 2.3612 | 2.3216 | 2.2832 | 2.2459 | 2.2096 | 2.1743 | 2.1399 | 2.1065 |
| **4** | 3.1024 | 3.0373 | 2.9745 | 2.9137 | 2.8550 | 2.7982 | 2.7432 | 2.6901 | 2.6386 | 2.5887 |
| **5** | 3.6959 | 3.6048 | 3.5172 | 3.4331 | 3.3522 | 3.2743 | 3.1993 | 3.1272 | 3.0576 | 2.9906 |
| **6** | 4.2305 | 4.1114 | 3.9975 | 3.8887 | 3.7845 | 3.6847 | 3.5892 | 3.4976 | 3.4098 | 3.3255 |
| **7** | 4.7122 | 4.5638 | 4.4226 | 4.2883 | 4.1604 | 4.0386 | 3.9224 | 3.8115 | 3.7057 | 3.6046 |
| **8** | 5.1461 | 4.9676 | 4.7988 | 4.6389 | 4.4873 | 4.3436 | 4.2072 | 4.0776 | 3.9544 | 3.8372 |
| **9** | 5.5370 | 5.3282 | 5.1317 | 4.9464 | 4.7716 | 4.6065 | 4.4506 | 4.3030 | 4.1633 | 4.0310 |
| **10** | 5.8892 | 5.6502 | 5.4262 | 5.2161 | 5.0188 | 4.8332 | 4.6586 | 4.4941 | 4.3389 | 4.1925 |
| **11** | 6.2065 | 5.9377 | 5.6869 | 5.4527 | 5.2337 | 5.0286 | 4.8364 | 4.6560 | 4.4865 | 4.3271 |
| **12** | 6.4924 | 6.1944 | 5.9176 | 5.6603 | 5.4206 | 5.1971 | 4.9884 | 4.7932 | 4.6105 | 4.4392 |
| **13** | 6.7499 | 6.4235 | 6.1218 | 5.8424 | 5.5831 | 5.3423 | 5.1183 | 4.9095 | 4.7147 | 4.5327 |
| **14** | 6.9819 | 6.6282 | 6.3025 | 6.0021 | 5.7245 | 5.4675 | 5.2293 | 5.0081 | 4.8023 | 4.6106 |
| **15** | 7.1909 | 6.8109 | 6.4624 | 6.1422 | 5.8474 | 5.5755 | 5.3242 | 5.0916 | 4.8759 | 4.6755 |
| **16** | 7.3792 | 6.9740 | 6.6039 | 6.2651 | 5.9542 | 5.6685 | 5.4053 | 5.1624 | 4.9377 | 4.7296 |
| **17** | 7.5488 | 7.1196 | 6.7291 | 6.3729 | 6.0472 | 5.7487 | 5.4746 | 5.2223 | 4.9897 | 4.7746 |
| **18** | 7.7016 | 7.2497 | 6.8399 | 6.4674 | 6.1280 | 5.8178 | 5.5339 | 5.2732 | 5.0333 | 4.8122 |
| **19** | 7.8393 | 7.3658 | 6.9380 | 6.5504 | 6.1982 | 5.8775 | 5.5845 | 5.3162 | 5.0700 | 4.8435 |
| **20** | 7.9633 | 7.4694 | 7.0248 | 6.6231 | 6.2593 | 5.9288 | 5.6278 | 5.3527 | 5.1009 | 4.8696 |
| **21** | 8.0751 | 7.5620 | 7.1016 | 6.6870 | 6.3125 | 5.9731 | 5.6648 | 5.3837 | 5.1268 | 4.8913 |
| **22** | 8.1757 | 7.6446 | 7.1695 | 6.7429 | 6.3587 | 6.0113 | 5.6964 | 5.4099 | 5.1486 | 4.9094 |
| **23** | 8.2664 | 7.7184 | 7.2297 | 6.7921 | 6.3988 | 6.0442 | 5.7234 | 5.4321 | 5.1668 | 4.9245 |
| **24** | 8.3481 | 7.7843 | 7.2829 | 6.8351 | 6.4338 | 6.0726 | 5.7465 | 5.4509 | 5.1822 | 4.9371 |
| **25** | 8.4217 | 7.8431 | 7.3300 | 6.8729 | 6.4641 | 6.0971 | 5.7662 | 5.4669 | 5.1951 | 4.9476 |
| **26** | 8.4881 | 7.8957 | 7.3717 | 6.9061 | 6.4906 | 6.1182 | 5.7831 | 5.4804 | 5.2060 | 4.9563 |
| **27** | 8.5478 | 7.9426 | 7.4086 | 6.9352 | 6.5135 | 6.1364 | 5.7975 | 5.4919 | 5.2151 | 4.9636 |
| **28** | 8.6016 | 7.9844 | 7.4412 | 6.9607 | 6.5335 | 6.1520 | 5.8099 | 5.5016 | 5.2228 | 4.9697 |
| **29** | 8.6501 | 8.0218 | 7.4701 | 6.9830 | 6.5509 | 6.1656 | 5.8204 | 5.5098 | 5.2292 | 4.9747 |
| **30** | 8.6938 | 8.0552 | 7.4957 | 7.0027 | 6.5660 | 6.1772 | 5.8294 | 5.5168 | 5.2347 | 4.9789 |

$$\frac{i}{1-(1+i)^{-n}} \qquad (100)$$

| n | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.0100 | 1.0200 | 1.0300 | 1.0400 | 1.0500 | 1.0600 | 1.0700 | 1.0800 | 1.0900 | 1.1000 |
| **2** | 0.5075 | 0.5150 | 0.5226 | 0.5302 | 0.5378 | 0.5454 | 0.5531 | 0.5608 | 0.5685 | 0.5762 |
| **3** | 0.3400 | 0.3468 | 0.3535 | 0.3603 | 0.3672 | 0.3741 | 0.3811 | 0.3880 | 0.3951 | 0.4021 |
| **4** | 0.2563 | 0.2626 | 0.2690 | 0.2755 | 0.2820 | 0.2886 | 0.2952 | 0.3019 | 0.3087 | 0.3155 |
| **5** | 0.2060 | 0.2122 | 0.2184 | 0.2246 | 0.2310 | 0.2374 | 0.2439 | 0.2505 | 0.2571 | 0.2638 |
| **6** | 0.1725 | 0.1785 | 0.1846 | 0.1908 | 0.1970 | 0.2034 | 0.2098 | 0.2163 | 0.2229 | 0.2296 |
| **7** | 0.1486 | 0.1545 | 0.1605 | 0.1666 | 0.1728 | 0.1791 | 0.1856 | 0.1921 | 0.1987 | 0.2054 |
| **8** | 0.1307 | 0.1365 | 0.1425 | 0.1485 | 0.1547 | 0.1610 | 0.1675 | 0.1740 | 0.1807 | 0.1874 |
| **9** | 0.1167 | 0.1225 | 0.1284 | 0.1345 | 0.1407 | 0.1470 | 0.1535 | 0.1601 | 0.1668 | 0.1736 |
| **10** | 0.1056 | 0.1113 | 0.1172 | 0.1233 | 0.1295 | 0.1359 | 0.1424 | 0.1490 | 0.1558 | 0.1627 |
| **11** | 0.0965 | 0.1022 | 0.1081 | 0.1141 | 0.1204 | 0.1268 | 0.1334 | 0.1401 | 0.1469 | 0.1540 |
| **12** | 0.0888 | 0.0946 | 0.1005 | 0.1066 | 0.1128 | 0.1193 | 0.1259 | 0.1327 | 0.1397 | 0.1468 |
| **13** | 0.0824 | 0.0881 | 0.0940 | 0.1001 | 0.1065 | 0.1130 | 0.1197 | 0.1265 | 0.1336 | 0.1408 |
| **14** | 0.0769 | 0.0826 | 0.0885 | 0.0947 | 0.1010 | 0.1076 | 0.1143 | 0.1213 | 0.1284 | 0.1357 |
| **15** | 0.0721 | 0.0778 | 0.0838 | 0.0899 | 0.0963 | 0.1030 | 0.1098 | 0.1168 | 0.1241 | 0.1315 |
| **16** | 0.0679 | 0.0737 | 0.0796 | 0.0858 | 0.0923 | 0.0990 | 0.1059 | 0.1130 | 0.1203 | 0.1278 |
| **17** | 0.0643 | 0.0700 | 0.0760 | 0.0822 | 0.0887 | 0.0954 | 0.1024 | 0.1096 | 0.1170 | 0.1247 |
| **18** | 0.0610 | 0.0667 | 0.0727 | 0.0790 | 0.0855 | 0.0924 | 0.0994 | 0.1067 | 0.1142 | 0.1219 |
| **19** | 0.0581 | 0.0638 | 0.0698 | 0.0761 | 0.0827 | 0.0896 | 0.0968 | 0.1041 | 0.1117 | 0.1195 |
| **20** | 0.0554 | 0.0612 | 0.0672 | 0.0736 | 0.0802 | 0.0872 | 0.0944 | 0.1019 | 0.1095 | 0.1175 |
| **21** | 0.0530 | 0.0588 | 0.0649 | 0.0713 | 0.0780 | 0.0850 | 0.0923 | 0.0998 | 0.1076 | 0.1156 |
| **22** | 0.0509 | 0.0566 | 0.0627 | 0.0692 | 0.0760 | 0.0830 | 0.0904 | 0.0980 | 0.1059 | 0.1140 |
| **23** | 0.0489 | 0.0547 | 0.0608 | 0.0673 | 0.0741 | 0.0813 | 0.0887 | 0.0964 | 0.1044 | 0.1126 |
| **24** | 0.0471 | 0.0529 | 0.0590 | 0.0656 | 0.0725 | 0.0797 | 0.0872 | 0.0950 | 0.1030 | 0.1113 |
| **25** | 0.0454 | 0.0512 | 0.0574 | 0.0640 | 0.0710 | 0.0782 | 0.0858 | 0.0937 | 0.1018 | 0.1102 |
| **26** | 0.0439 | 0.0497 | 0.0559 | 0.0626 | 0.0696 | 0.0769 | 0.0846 | 0.0925 | 0.1007 | 0.1092 |
| **27** | 0.0424 | 0.0483 | 0.0546 | 0.0612 | 0.0683 | 0.0757 | 0.0834 | 0.0914 | 0.0997 | 0.1083 |
| **28** | 0.0411 | 0.0470 | 0.0533 | 0.0600 | 0.0671 | 0.0746 | 0.0824 | 0.0905 | 0.0989 | 0.1075 |
| **29** | 0.0399 | 0.0458 | 0.0521 | 0.0589 | 0.0660 | 0.0736 | 0.0814 | 0.0896 | 0.0981 | 0.1067 |
| **30** | 0.0387 | 0.0446 | 0.0510 | 0.0578 | 0.0651 | 0.0726 | 0.0806 | 0.0888 | 0.0973 | 0.1061 |

| n | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |
|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 1.1100 | 1.1200 | 1.1300 | 1.1400 | 1.1500 | 1.1600 | 1.1700 | 1.1800 | 1.1900 | 1.2000 |
| **2** | 0.5839 | 0.5917 | 0.5995 | 0.6073 | 0.6151 | 0.6230 | 0.6308 | 0.6387 | 0.6466 | 0.6545 |
| **3** | 0.4092 | 0.4163 | 0.4235 | 0.4307 | 0.4380 | 0.4453 | 0.4526 | 0.4599 | 0.4673 | 0.4747 |
| **4** | 0.3223 | 0.3292 | 0.3362 | 0.3432 | 0.3503 | 0.3574 | 0.3645 | 0.3717 | 0.3790 | 0.3863 |
| **5** | 0.2706 | 0.2774 | 0.2843 | 0.2913 | 0.2983 | 0.3054 | 0.3126 | 0.3198 | 0.3271 | 0.3344 |
| **6** | 0.2364 | 0.2432 | 0.2502 | 0.2572 | 0.2642 | 0.2714 | 0.2786 | 0.2859 | 0.2933 | 0.3007 |
| **7** | 0.2122 | 0.2191 | 0.2261 | 0.2332 | 0.2404 | 0.2476 | 0.2549 | 0.2624 | 0.2699 | 0.2774 |
| **8** | 0.1943 | 0.2013 | 0.2084 | 0.2156 | 0.2229 | 0.2302 | 0.2377 | 0.2452 | 0.2529 | 0.2606 |
| **9** | 0.1806 | 0.1877 | 0.1949 | 0.2022 | 0.2096 | 0.2171 | 0.2247 | 0.2324 | 0.2402 | 0.2481 |
| **10** | 0.1698 | 0.1770 | 0.1843 | 0.1917 | 0.1993 | 0.2069 | 0.2147 | 0.2225 | 0.2305 | 0.2385 |
| **11** | 0.1611 | 0.1684 | 0.1758 | 0.1834 | 0.1911 | 0.1989 | 0.2068 | 0.2148 | 0.2229 | 0.2311 |
| **12** | 0.1540 | 0.1614 | 0.1690 | 0.1767 | 0.1845 | 0.1924 | 0.2005 | 0.2086 | 0.2169 | 0.2253 |
| **13** | 0.1482 | 0.1557 | 0.1634 | 0.1712 | 0.1791 | 0.1872 | 0.1954 | 0.2037 | 0.2121 | 0.2206 |
| **14** | 0.1432 | 0.1509 | 0.1587 | 0.1666 | 0.1747 | 0.1829 | 0.1912 | 0.1997 | 0.2082 | 0.2169 |
| **15** | 0.1391 | 0.1468 | 0.1547 | 0.1628 | 0.1710 | 0.1794 | 0.1878 | 0.1964 | 0.2051 | 0.2139 |
| **16** | 0.1355 | 0.1434 | 0.1514 | 0.1596 | 0.1679 | 0.1764 | 0.1850 | 0.1937 | 0.2025 | 0.2114 |
| **17** | 0.1325 | 0.1405 | 0.1486 | 0.1569 | 0.1654 | 0.1740 | 0.1827 | 0.1915 | 0.2004 | 0.2094 |
| **18** | 0.1298 | 0.1379 | 0.1462 | 0.1546 | 0.1632 | 0.1719 | 0.1807 | 0.1896 | 0.1987 | 0.2078 |
| **19** | 0.1276 | 0.1358 | 0.1441 | 0.1527 | 0.1613 | 0.1701 | 0.1791 | 0.1881 | 0.1972 | 0.2065 |
| **20** | 0.1256 | 0.1339 | 0.1424 | 0.1510 | 0.1598 | 0.1687 | 0.1777 | 0.1868 | 0.1960 | 0.2054 |
| **21** | 0.1238 | 0.1322 | 0.1408 | 0.1495 | 0.1584 | 0.1674 | 0.1765 | 0.1857 | 0.1951 | 0.2044 |
| **22** | 0.1223 | 0.1308 | 0.1395 | 0.1483 | 0.1573 | 0.1664 | 0.1756 | 0.1848 | 0.1942 | 0.2037 |
| **23** | 0.1210 | 0.1296 | 0.1383 | 0.1472 | 0.1563 | 0.1654 | 0.1747 | 0.1841 | 0.1935 | 0.2031 |
| **24** | 0.1198 | 0.1285 | 0.1373 | 0.1463 | 0.1554 | 0.1647 | 0.1740 | 0.1835 | 0.1930 | 0.2025 |
| **25** | 0.1187 | 0.1275 | 0.1364 | 0.1455 | 0.1547 | 0.1640 | 0.1734 | 0.1829 | 0.1925 | 0.2021 |
| **26** | 0.1178 | 0.1267 | 0.1357 | 0.1448 | 0.1541 | 0.1634 | 0.1729 | 0.1825 | 0.1921 | 0.2018 |
| **27** | 0.1170 | 0.1259 | 0.1350 | 0.1442 | 0.1535 | 0.1630 | 0.1725 | 0.1821 | 0.1917 | 0.2015 |
| **28** | 0.1163 | 0.1252 | 0.1344 | 0.1437 | 0.1531 | 0.1625 | 0.1721 | 0.1818 | 0.1915 | 0.2012 |
| **29** | 0.1156 | 0.1247 | 0.1339 | 0.1432 | 0.1527 | 0.1622 | 0.1718 | 0.1815 | 0.1912 | 0.2010 |
| **30** | 0.1150 | 0.1241 | 0.1334 | 0.1428 | 0.1523 | 0.1619 | 0.1715 | 0.1813 | 0.1910 | 0.2008 |

# Appendix 2. Comparative Analysis of Revaluation Models for Financial Securities: Input Data

***Cost model***

| | Assets | | Equity and liabilities | | | | | Ratios | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Δ | Securities | Other | Reg.c. | Other | EAT | Liabilities | Tax l. | ROA | ROE | EPS |
| 10% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 9% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 8% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 7% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 6% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 5% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 4% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 3% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 2% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 1% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| 0% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| -1% | 990,000 | 9,000,000 | 2,000,000 | 2,000,000 | 990,000 | 4,750,000 | 250,000 | 0.1241 | 0.1984 | 495 |
| -2% | 980,000 | 9,000,000 | 2,000,000 | 2,000,000 | 980,000 | 4,750,000 | 250,000 | 0.1232 | 0.1968 | 490 |
| -3% | 970,000 | 9,000,000 | 2,000,000 | 2,000,000 | 970,000 | 4,750,000 | 250,000 | 0.1224 | 0.1952 | 485 |
| -4% | 960,000 | 9,000,000 | 2,000,000 | 2,000,000 | 960,000 | 4,750,000 | 250,000 | 0.1215 | 0.1935 | 480 |
| -5% | 950,000 | 9,000,000 | 2,000,000 | 2,000,000 | 950,000 | 4,750,000 | 250,000 | 0.1206 | 0.1919 | 475 |
| -6% | 940,000 | 9,000,000 | 2,000,000 | 2,000,000 | 940,000 | 4,750,000 | 250,000 | 0.1197 | 0.1903 | 470 |
| -7% | 930,000 | 9,000,000 | 2,000,000 | 2,000,000 | 930,000 | 4,750,000 | 250,000 | 0.1188 | 0.1886 | 465 |
| -8% | 920,000 | 9,000,000 | 2,000,000 | 2,000,000 | 920,000 | 4,750,000 | 250,000 | 0.1179 | 0.1870 | 460 |
| -9% | 910,000 | 9,000,000 | 2,000,000 | 2,000,000 | 910,000 | 4,750,000 | 250,000 | 0.1171 | 0.1853 | 455 |
| -10% | 900,000 | 9,000,000 | 2,000,000 | 2,000,000 | 900,000 | 4,750,000 | 250,000 | 0.1162 | 0.1837 | 450 |

| Change | ROA | ROE | EPS |
|---|---|---|---|
| -10% | -7.0707% | -8.1633% | -10.0000% |
| -9% | -6.3572% | -7.3320% | -9.0000% |
| -8% | -5.6452% | -6.5041% | -8.0000% |
| -7% | -4.9345% | -5.6795% | -7.0000% |
| -6% | -4.2254% | -4.8583% | -6.0000% |
| -5% | -3.5176% | -4.0404% | -5.0000% |
| -4% | -2.8112% | -3.2258% | -4.0000% |
| -3% | -2.1063% | -2.4145% | -3.0000% |
| -2% | -1.4028% | -1.6064% | -2.0000% |
| -1% | -0.7007% | -0.8016% | -1.0000% |
| 0% | 0.0000% | 0.0000% | 0.0000% |
| 1% | 0.0000% | 0.0000% | 0.0000% |
| 2% | 0.0000% | 0.0000% | 0.0000% |
| 3% | 0.0000% | 0.0000% | 0.0000% |
| 4% | 0.0000% | 0.0000% | 0.0000% |
| 5% | 0.0000% | 0.0000% | 0.0000% |
| 6% | 0.0000% | 0.0000% | 0.0000% |
| 7% | 0.0000% | 0.0000% | 0.0000% |
| 8% | 0.0000% | 0.0000% | 0.0000% |
| 9% | 0.0000% | 0.0000% | 0.0000% |
| 10% | 0.0000% | 0.0000% | 0.0000% |

***Fair value through profit/loss model***

| | Assets | | Equity and liabilities | | | | | Ratios | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Δ | **Securities** | **Other** | **Reg.c.** | **Other** | **EAT** | **Liabilities** | **Tax l.** | **ROA** | **ROE** | **EPS** |
| 10% | 1,100,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,080,000 | 4,750,000 | 270,000 | 0.1250 | 0.2000 | 540 |
| 9% | 1,090,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,072,000 | 4,750,000 | 268,000 | 0.1337 | 0.2126 | 536 |
| 8% | 1,080,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,064,000 | 4,750,000 | 266,000 | 0.1328 | 0.2114 | 532 |
| 7% | 1,070,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,056,000 | 4,750,000 | 264,000 | 0.1319 | 0.2101 | 528 |
| 6% | 1,060,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,048,000 | 4,750,000 | 262,000 | 0.1311 | 0.2089 | 524 |
| 5% | 1,050,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,040,000 | 4,750,000 | 260,000 | 0.1302 | 0.2076 | 520 |
| 4% | 1,040,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,032,000 | 4,750,000 | 258,000 | 0.1294 | 0.2063 | 516 |
| 3% | 1,030,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,024,000 | 4,750,000 | 256,000 | 0.1285 | 0.2051 | 512 |
| 2% | 1,020,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,016,000 | 4,750,000 | 254,000 | 0.1276 | 0.2038 | 508 |
| 1% | 1,010,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,008,000 | 4,750,000 | 252,000 | 0.1267 | 0.2026 | 504 |
| 0% | 1,000,000 | 9,000,000 | 2,000,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1259 | 0.2013 | 500 |
| -1% | 990,000 | 9,000,000 | 2,000,000 | 2,000,000 | 992,000 | 4,750,000 | 248,000 | 0.1250 | 0.2000 | 496 |
| -2% | 980,000 | 9,000,000 | 2,000,000 | 2,000,000 | 984,000 | 4,750,000 | 246,000 | 0.1241 | 0.1987 | 492 |
| -3% | 970,000 | 9,000,000 | 2,000,000 | 2,000,000 | 976,000 | 4,750,000 | 244,000 | 0.1232 | 0.1974 | 488 |
| -4% | 960,000 | 9,000,000 | 2,000,000 | 2,000,000 | 968,000 | 4,750,000 | 242,000 | 0.1224 | 0.1961 | 484 |
| -5% | 950,000 | 9,000,000 | 2,000,000 | 2,000,000 | 960,000 | 4,750,000 | 240,000 | 0.1215 | 0.1948 | 480 |
| -6% | 940,000 | 9,000,000 | 2,000,000 | 2,000,000 | 952,000 | 4,750,000 | 238,000 | 0.1206 | 0.1935 | 476 |
| -7% | 930,000 | 9,000,000 | 2,000,000 | 2,000,000 | 944,000 | 4,750,000 | 236,000 | 0.1197 | 0.1922 | 472 |
| -8% | 920,000 | 9,000,000 | 2,000,000 | 2,000,000 | 936,000 | 4,750,000 | 234,000 | 0.1188 | 0.1909 | 468 |
| -9% | 910,000 | 9,000,000 | 2,000,000 | 2,000,000 | 928,000 | 4,750,000 | 232,000 | 0.1179 | 0.1896 | 464 |
| -10% | 900,000 | 9,000,000 | 2,000,000 | 2,000,000 | 920,000 | 4,750,000 | 230,000 | 0.1171 | 0.1883 | 460 |

| **Change** | **ROA** | **ROE** | **EPS** |
|---|---|---|---|
| -10% | -7.0707% | -6.5041% | -8.0000% |
| -9% | -6.3572% | -5.8442% | -7.2000% |
| -8% | -5.6452% | -5.1864% | -6.4000% |
| -7% | -4.9345% | -4.5307% | -5.6000% |
| -6% | -4.2254% | -3.8772% | -4.8000% |
| -5% | -3.5176% | -3.2258% | -4.0000% |
| -4% | -2.8112% | -2.5765% | -3.2000% |
| -3% | -2.1063% | -1.9293% | -2.4000% |
| -2% | -1.4028% | -1.2841% | -1.6000% |
| -1% | -0.7007% | -0.6410% | -0.8000% |
| 0% | 0.0000% | 0.0000% | 0.0000% |
| 1% | 0.6993% | 0.6390% | 0.8000% |
| 2% | 1.3972% | 1.2759% | 1.6000% |
| 3% | 2.0937% | 1.9108% | 2.4000% |
| 4% | 2.7888% | 2.5437% | 3.2000% |
| 5% | 3.4826% | 3.1746% | 4.0000% |
| 6% | 4.1750% | 3.8035% | 4.8000% |
| 7% | 4.8659% | 4.4304% | 5.6000% |
| 8% | 5.5556% | 5.0553% | 6.4000% |
| 9% | 6.2438% | 5.6782% | 7.2000% |
| 10% | 6.9307% | 6.2992% | 8.0000% |

***Fair value through other comprehensive income model***

| | Assets | | Equity and liabilities | | | | | | Ratios | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ɜ | Securities | Other | Reg.c. | Reval.fund | Other | EAT | Liabilities | Tax l. | ROA | ROE | EPS |
| 10% | 1,100,000 | 9,000,000 | 2,000,000 | 100,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1237 | 0.1960 | 500 |
| 9% | 1,090,000 | 9,000,000 | 2,000,000 | 90,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1238 | 0.1964 | 500 |
| 8% | 1,080,000 | 9,000,000 | 2,000,000 | 80,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1240 | 0.1968 | 500 |
| 7% | 1,070,000 | 9,000,000 | 2,000,000 | 70,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1241 | 0.1972 | 500 |
| 6% | 1,060,000 | 9,000,000 | 2,000,000 | 60,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1242 | 0.1976 | 500 |
| 5% | 1,050,000 | 9,000,000 | 2,000,000 | 50,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1243 | 0.1980 | 500 |
| 4% | 1,040,000 | 9,000,000 | 2,000,000 | 40,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1245 | 0.1984 | 500 |
| 3% | 1,030,000 | 9,000,000 | 2,000,000 | 30,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1246 | 0.1988 | 500 |
| 2% | 1,020,000 | 9,000,000 | 2,000,000 | 20,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1247 | 0.1992 | 500 |
| 1% | 1,010,000 | 9,000,000 | 2,000,000 | 10,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1248 | 0.1996 | 500 |
| 0% | 1,000,000 | 9,000,000 | 2,000,000 | 0 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1250 | 0.2000 | 500 |
| -1% | 990,000 | 9,000,000 | 2,000,000 | -10,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1251 | 0.2004 | 500 |
| -2% | 980,000 | 9,000,000 | 2,000,000 | -20,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1252 | 0.2008 | 500 |
| -3% | 970,000 | 9,000,000 | 2,000,000 | -30,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1253 | 0.2012 | 500 |
| -4% | 960,000 | 9,000,000 | 2,000,000 | -40,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1255 | 0.2016 | 500 |
| -5% | 950,000 | 9,000,000 | 2,000,000 | -50,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1256 | 0.2020 | 500 |
| -6% | 940,000 | 9,000,000 | 2,000,000 | -60,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1257 | 0.2024 | 500 |
| -7% | 930,000 | 9,000,000 | 2,000,000 | -70,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1258 | 0.2028 | 500 |
| -8% | 920,000 | 9,000,000 | 2,000,000 | -80,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1260 | 0.2032 | 500 |
| -9% | 910,000 | 9,000,000 | 2,000,000 | -90,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1261 | 0.2036 | 500 |
| -10% | 900,000 | 9,000,000 | 2,000,000 | -100,000 | 2,000,000 | 1,000,000 | 4,750,000 | 250,000 | 0.1262 | 0.2040 | 500 |

| Change | ROA | ROE | EPS |
|---|---|---|---|
| -10% | 1.0101% | 2.0408% | 0.0000% |
| -9% | 0.9082% | 1.8330% | 0.0000% |
| -8% | 0.8065% | 1.6260% | 0.0000% |
| -7% | 0.7049% | 1.4199% | 0.0000% |
| -6% | 0.6036% | 1.2146% | 0.0000% |
| -5% | 0.5025% | 1.0101% | 0.0000% |
| -4% | 0.4016% | 0.8065% | 0.0000% |
| -3% | 0.3009% | 0.6036% | 0.0000% |
| -2% | 0.2004% | 0.4016% | 0.0000% |
| -1% | 0.1001% | 0.2004% | 0.0000% |
| 0% | 0.0000% | 0.0000% | 0.0000% |
| 1% | -0.0999% | -0.1996% | 0.0000% |
| 2% | -0.1996% | -0.3984% | 0.0000% |
| 3% | -0.2991% | -0.5964% | 0.0000% |
| 4% | -0.3984% | -0.7937% | 0.0000% |
| 5% | -0.4975% | -0.9901% | 0.0000% |
| 6% | -0.5964% | -1.1858% | 0.0000% |
| 7% | -0.6951% | -1.3807% | 0.0000% |
| 8% | -0.7937% | -1.5748% | 0.0000% |
| 9% | -0.8920% | -1.7682% | 0.0000% |
| 10% | -0.9901% | -1.9608% | 0.0000% |

# Appendix 3. Greeks

***Delta***
It is an interdependence of the option premium on market price.

*Delta call*
Mathematical solution is based on partial derivation of the call option premium as to market price of underlying asset:

$$\Delta_{CALL} = \frac{\partial CALL}{\partial S} \tag{101}$$

$$\Delta_{CALL} = N(d_1) + S\frac{\partial N(d_1)}{\partial S} - Xe^{-i_{RF}T}\frac{\partial N(d_2)}{\partial S} \tag{102}$$

Furthermore we have to solve partial derivations of distributional function of normal distribution as to market price:

$$\frac{\partial N(d_1)}{\partial S} = \frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}d_1^2}\frac{\partial d_1}{\partial S} \tag{103}$$

$$\frac{\partial N(d_2)}{\partial S} = \frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}d_2^2}\frac{\partial d_2}{\partial S} = \frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}d_2^2}\frac{\partial d_1}{\partial S} \tag{104}$$

After the adjustments it is valid:

$$\Delta_{CALL} = \frac{\partial CALL}{\partial S} = N(d_1) + \frac{1}{\sqrt{2\pi}}\frac{\partial d_1}{\partial S}\left(Se^{-\frac{1}{2}d_1^2} - Xe^{-i_{RF}T}e^{-\frac{1}{2}d_2^2}\right) \tag{105}$$

Based on put-call parity formula equals to zero:

$$Se^{-\frac{1}{2}d_1^2} - Xe^{-i_{RF}T}e^{-\frac{1}{2}d_2^2} = 0 \tag{106}$$

The calculation formula for delta call is following:

$$\boldsymbol{\Delta_{CALL} = N(d_1)} \tag{107}$$

*Delta put*
Mathematical solution is based on partial derivation of the put option premium as to market price of underlying asset:

$$\Delta_{PUT} = \frac{\partial PUT}{\partial S} \tag{108}$$

$$\Delta_{PUT} = N(-d_1) - S\frac{\partial N(-d_1)}{\partial S} + Xe^{-i_{RF}T}\frac{\partial N(-d_2)}{\partial S} \tag{109}$$

Furthermore we have to solve partial derivations of distributional function of normal distribution as to market price:

$$\frac{\partial N(-d_1)}{\partial S} = \frac{1}{\sqrt{2\pi}}e^{-\frac{1}{2}(-d_1)^2}\frac{\partial(-d_1)}{\partial S} = -\frac{\partial N(d_1)}{\partial S} \tag{110}$$

$$\frac{\partial N(-d_2)}{\partial S} = -\frac{\partial N(d_2)}{\partial S} \tag{111}$$

After the adjustments it is valid:

$$\Delta_{PUT} = -N(-d_1) + \left(S\frac{\partial N(d_1)}{\partial S} - Xe^{-i_{RF}T}\frac{\partial N(d_2)}{\partial S}\right) \tag{112}$$

Based on put-call parity formula equals to zero:

$$S\frac{\partial N(d_1)}{\partial S} - Xe^{-i_{RF}T}\frac{\partial N(d_2)}{\partial S} = 0 \quad (113)$$

The calculation formula for delta put is following:

$$\Delta_{\boldsymbol{PUT}} = -\boldsymbol{N}(-\boldsymbol{d_1}) \quad (114)$$

Finally, the relation between parameters delta call and delta put is following:

$$\Delta_{\boldsymbol{CALL}} - \Delta_{\boldsymbol{PUT}} = \boldsymbol{1} \quad (115)$$

***Gamma***

It is an interdependence of delta parameter on market price.

*Gamma call*

Mathematical solution is based on partial derivation of delta call parameter as to market price of underlying asset:

$$\Gamma_{CALL} = \frac{\partial \Delta_{CALL}}{\partial S} \quad (116)$$

$$\Gamma_{CALL} = \frac{\partial \Delta_{CALL}}{\partial S} = \frac{\partial N(d_1)}{\partial S} \quad (117)$$

$$\boldsymbol{\Gamma_{CALL}} = \frac{\boldsymbol{1}}{\sqrt{\boldsymbol{2\pi}}}\boldsymbol{e}^{-\frac{\boldsymbol{1}}{\boldsymbol{2}}\boldsymbol{d_1^2}}\frac{\boldsymbol{1}}{\boldsymbol{S\sigma\sqrt{T}}} \quad (118)$$

*Gamma put*

Mathematical solution is based on partial derivation of delta put parameter as to market price of underlying asset:

$$\Gamma_{PUT} = \frac{\partial \Delta_{PUT}}{\partial S} \quad (119)$$

$$\Gamma_{PUT} = \frac{\partial \Delta_{PUT}}{\partial S} = \frac{-\partial N(-d_1)}{\partial S} \quad (120)$$

$$\frac{-\partial N(-d_1)}{\partial S} = \frac{-\big(-\partial N(d_1)\big)}{\partial S} = \frac{\partial \Delta_{CALL}}{\partial S} \quad (121)$$

$$\boldsymbol{\Gamma_{PUT}} = \boldsymbol{\Gamma_{CALL}} = \frac{\boldsymbol{1}}{\sqrt{\boldsymbol{2\pi}}}\boldsymbol{e}^{-\frac{\boldsymbol{1}}{\boldsymbol{2}}\boldsymbol{d_1^2}}\frac{\boldsymbol{1}}{\boldsymbol{S\sigma\sqrt{T}}} \quad (122)$$

Gamma call is similar to gamma put.

***Rho***

It is an interdependence of the option premium on risk-free interest rate.

*Rho call*

Mathematical solution is based on partial derivation of call option premium as to risk-free interest rate:

$$\rho_{CALL} = \frac{\partial CALL}{\partial i_{RF}} \quad (123)$$

$$\rho_{CALL} = \frac{\partial CALL}{\partial i_{RF}} = \left[S\frac{\partial N(d_1)}{\partial d}\frac{\partial d_1}{\partial i_{RF}} - X\left(-Te^{-i_{RF}T}N(d_2) + e^{-i_{RF}T}\frac{\partial N(d_2)}{\partial d}\frac{\partial d_2}{\partial i_{RF}}\right)\right] \quad (124)$$

$$\rho_{CALL} = \left[S\frac{\partial N(d_1)}{\partial d} - Xe^{-i_{RF}T}\frac{\partial N(d_2)}{\partial d}\right]\frac{\partial d_1}{\partial i_{RF}} + XTe^{-i_{RF}T}N(d_2) \quad (125)$$

Based on put-call parity formula equals to zero:

$$S\frac{\partial N(d_1)}{\partial d} - Xe^{-i_{RF}T}\frac{\partial N(d_2)}{\partial d} = 0 \tag{126}$$

The calculation formula for rho call is following:

$$\boldsymbol{\rho_{CALL} = XTe^{-i_{RF}T}N(d_2)} \tag{127}$$

*Rho put*

Mathematical solution is based on partial derivation of put option premium as to risk-free interest rate:

$$\rho_{PUT} = \frac{\partial PUT}{\partial i_{RF}} \tag{128}$$

$$\rho_{PUT} = \frac{\partial PUT}{\partial i_{RF}} = \frac{\partial CALL}{\partial i_{RF}} - \frac{\partial S}{\partial i_{RF}} + \frac{\partial\left(Xe^{-i_{RF}T}\right)}{\partial i_{RF}} \tag{129}$$

$$\rho_{PUT} = \rho_{CALL} - 0 - XTe^{-i_{RF}T}(N(d_2) - 1) \tag{130}$$

The calculation formula for rho put is following:

$$\boldsymbol{\rho_{PUT} = -XTe^{-i_{RF}T}N(-d_2)} \tag{131}$$

***Vega***

It is an interdependence of the option premium on volatility of underlying asset.

*Vega call*

Mathematical solution is based on partial derivation of call option premium as to volatility:

$$\upsilon_{CALL} = \frac{\partial CALL}{\partial \sigma} \tag{132}$$

$$\upsilon_{CALL} = \frac{\partial CALL}{\partial \sigma} = S\frac{\partial N(d_1)}{\partial d}\frac{\partial d_1}{\partial \sigma} - Xe^{-i_{RF}T}\frac{\partial N(d_2)}{\partial d}\frac{\partial d_2}{\partial \sigma} \tag{133}$$

After the adjustments it is valid:

$$\upsilon_{CALL} = Xe^{-i_{RF}T}\sqrt{T}\frac{\partial N(d_2)}{\partial d} \tag{134}$$

where:

$$\frac{\partial N(d_2)}{\partial d} = \frac{e^{-\frac{1}{2}d_2^2}}{\sqrt{2\pi}} \tag{135}$$

The calculation formula for vega call is following:

$$\upsilon_{CALL} = Xe^{-i_{RF}T}\sqrt{T}\frac{e^{-\frac{1}{2}d_2^2}}{\sqrt{2\pi}} \tag{136}$$

$$\boldsymbol{\upsilon_{CALL} = S\sqrt{T}\frac{e^{-\frac{1}{2}d_1^2}}{\sqrt{2\pi}}} \tag{137}$$

*Vega put*

Mathematical solution is based on partial derivation of put option premium as to volatility:

$$\upsilon_{PUT} = \frac{\partial PUT}{\partial \sigma} \tag{138}$$

$$\upsilon_{PUT} = \frac{\partial PUT}{\partial \sigma} = \frac{\partial CALL}{\partial \sigma} - \frac{\partial S}{\partial \sigma} + \frac{\partial\left(i_{RF}Xe^{-i_{RF}T}\right)}{\partial \sigma} = \frac{\partial CALL}{\partial \sigma} \tag{139}$$

$$\boldsymbol{v_{PUT} = v_{CALL} = S\sqrt{T}\frac{e^{-\frac{1}{2}d_1^2}}{\sqrt{2\pi}}} \tag{140}$$

***Theta***

It is an interdependence of the option premium on time to expiration.

*Theta call*

Mathematical solution is based on partial derivation of the call option premium as to time to expiration:

$$\Theta_{CALL} = -\frac{\partial CALL}{\partial T} \tag{141}$$

$$\Theta_{CALL} = -\frac{\partial CALL}{\partial T} = -\left[S\frac{\partial N(d_1)}{\partial d}\frac{\partial d_1}{\partial T} - X\left(\frac{\partial\left(e^{-i_{RF}T}\right)}{\partial T} + e^{-i_{RF}T}\frac{\partial N(d_2)}{\partial d}\frac{\partial d_2}{\partial T}\right)\right] \tag{142}$$

After the adjustments it is valid:

$$\Theta_{CALL} = -Xe^{-i_{RF}T}\left(i_{RF}N(d_2) + \frac{\sigma}{2\sqrt{T}}\frac{\partial N(d_2)}{\partial d}\right) \tag{143}$$

where:

$$\frac{\partial N(d_2)}{\partial d} = \frac{e^{-\frac{1}{2}d_2^2}}{\sqrt{2\pi}} \tag{144}$$

The calculation formula for theta call is following:

$$\Theta_{CALL} = -Xe^{-i_{RF}T}\left(i_{RF}N(d_2) + \frac{\sigma}{2\sqrt{T}}\frac{e^{-\frac{1}{2}d_2^2}}{\sqrt{2\pi}}\right) \tag{145}$$

$$\boldsymbol{\Theta_{CALL} = -Xe^{-i_{RF}T}\left(i_{RF}N(d_2) + \frac{\sigma e^{-\frac{1}{2}d_2^2}}{2\sqrt{2\pi T}}\right)} \tag{146}$$

*Theta put*

Mathematical solution is based on partial derivation of put option premium as to time to expiration:

$$\Theta_{PUT} = -\frac{\partial PUT}{\partial T} \tag{147}$$

$$\Theta_{PUT} = -\frac{\partial PUT}{\partial T} = \Theta_{CALL} + i_{RF}Xe^{-i_{RF}T} \tag{148}$$

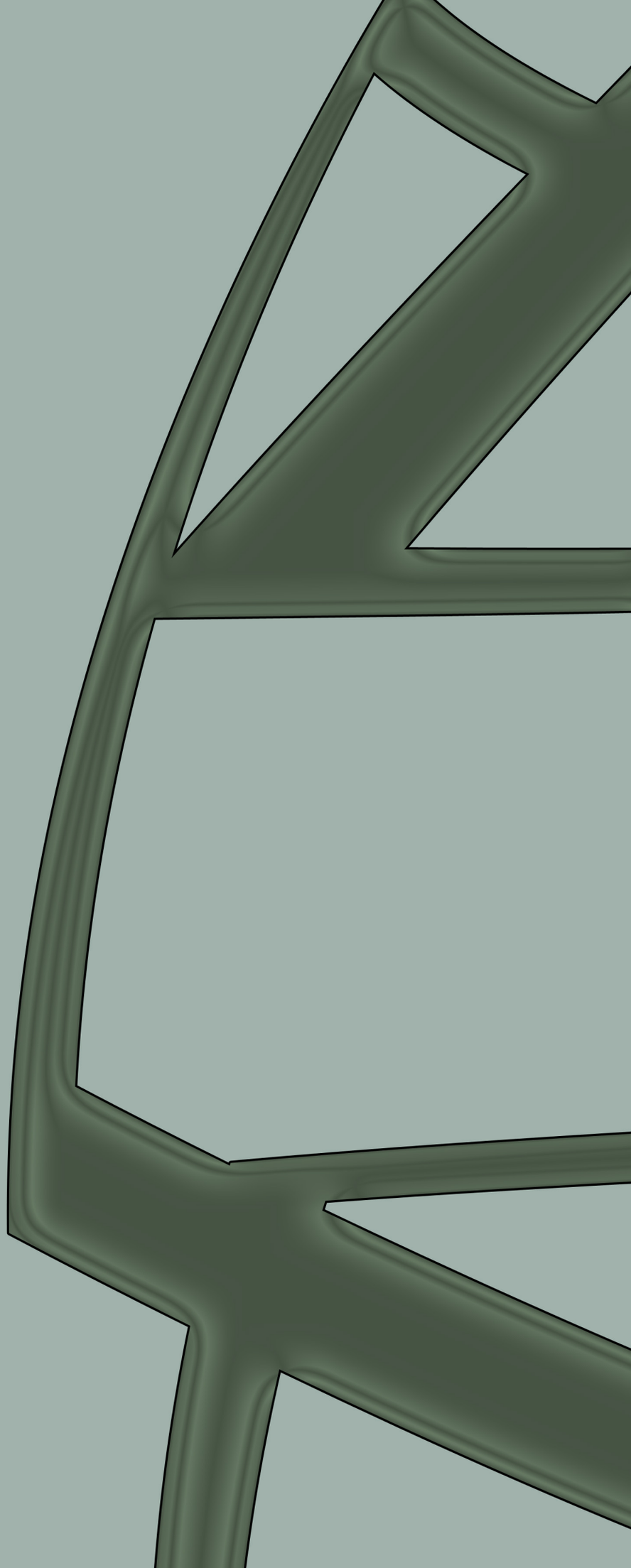
For normal distribution is valid the equation:

$$N(-d) = 1 - N(d) \tag{149}$$

Therefore the calculation formula for theta put is following:

$$\boldsymbol{\Theta_{PUT} = -Xe^{-i_{RF}T}\left(-i_{RF}N(-d_2) + \frac{\sigma e^{-\frac{1}{2}d_2^2}}{2\sqrt{2\pi T}}\right)} \tag{150}$$

# SUBJECT INDEX



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