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MASTER'S THESIS

ASSET – LIABILITY MANAGEMENT IN LIFE INSURANCE

Ljubljana, October 2022 SANJA MIHAJLOVSKA BALESKA

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LIST OF ABBREVIATIONS

ALM – Asset Liability Management

FX – Foreign Exchange Rate

ISA – Insurance Supervisory Agency

EU – European Union

GDP – Gross Domestic Product

CEE – Central and Eastern Europe

ORSA – Own Risk and Solvency assessment

EIOPA – European Insurance and Occupational Pensions Authority

NBRM- National Bank of the Republic of Macedonia

INTRODUCTION

This research will contain theoretical material and data collection from various sources. It will mostly examine how we deal with the consequences that influence the mismatch of assets and liabilities. It will use the techniques used by Asset Liability Management. The analysis will examine the investments and the portfolio structure of the policies. The benefit of this Master Thesis is to provide policy recommendations to the most important policymaker decisions, namely, the Supervisory Agency, Ministry of Finance and Insurance Companies which are the mainstays of Pillar 3 part of Solvency II regulation.

The first part of the thesis will describe the growth of the Life Insurance market in North Macedonia. It will use the Life Insurance Companies which exist in the Macedonian Market. This part will use statistical data from the Insurance Supervisory Agency of North Macedonia and the National Bank of North Macedonia and Annual Reports for the five Life Insurance companies that exist in the Macedonian Insurance Market. Annual report of Croatia Life Insurance (Grant Thorthon, 2019), Grawe Life Insurance company (Grawe, 2019), Triglav Life Insurance Company (Triglav,2019), Uniqa Life Insurance Company (Uniqa Life, 2019) and Winner Life Insurance Company (Winner Life, 2019). This thesis aims to make the insurance companies aware of the potential that the insurance market has and to promote innovation in developing new products that will increase the low penetration that still exists in this region.

In the second part, the focus will be on Solvency Regulation. First, it will describe Solvency I and will continue with the concepts of Solvency I and Solvency II. It is easier when most of the companies existing on the Macedonian Insurance Market are owned by foreign companies and represent part of the foreign corporation from which we can learn. Nowadays, when we have examples of how other countries operate, we should be able to avoid undesirable consequences and be able to develop the most efficient ways to solve the issues related to them.

The third part will describe what Asset-Liability Management is and why it represents an integral part of the insurance market and how it contributes to the whole economy's financial stability. Then, it will mention some of the risks that are part of every insurance company's framework, but the focus will be dealing with currency risk and duration risk, issues that occur, and how to solve them. The main goal is to avoid mismatch. The Solvency II regulation focuses on all the risks and the building of their funds with regard to the risk exposure of the insurance company. In order to be prepared for the Solvency II regulation, the focus should be on the risks and how to hedge them. ALM represents a crucial part of that segment. It is focused on these three parts because North Macedonia wants to become part of the European Union and follow their regulations, and it is time to start bringing its laws and requirements into alignment with Solvency II.

1 ANALYSIS OF LIFE INSURANCE MARKET IN NORTH MACEDONIA

1.1 Life Products which Exist in the Macedonian Market

In the Macedonian Insurance Market, there are two classes of Insurance: Life Insurance and Non-Life Insurance. To introduce the study of Life Insurance in this Master's Thesis, definitions for Life Insurance will be provided.

Life insurance is an agreement between the policyholder and an insurer. Under the terms of a life insurance policy, the insurer promises to pay a certain amount to a person you choose (your beneficiary) upon your death, in exchange for your premium payments. Proper life insurance coverage should provide peace of mind since you know that those you care about will be financially protected in case of your death (Forntinelle, 2022).

When someone dies, family income decreases, which is the reason that most people buy life insurance - to replace the loss of income. When someone dies and stops earning a salary, the family may not have enough money to live comfortably. The deceased can support the family with the proceeds from a life insurance policy. Proceeds from a life insurance policy make cash available to support the family. Life Insurance is also commonly used to pay any debts that one may leave behind.

There are several types of Life Insurance policies to choose from, but in this thesis, only a few of them will be explained.

First, the Term of Life Insurance will be described. This type of insurance provides Life Insurance protection for a specific period. This means that if you die during the coverage period, your beneficiary receives the policy death benefit, but if you live to the end of the term which is listed in the policy, the policy simply terminates, unless is automatically renewed for a new period. When the policy is concluded the policyholder can choose for how many years (duration) the insurance policy will be effective. The duration of the Life Insurance policy can be concluded between 1 and 30 years, and in some cases, it can be renewed until the age of 75.

The next type of Life Insurance is Permanent Life Insurance. Permanent Insurance policies provide protection for your entire life. In this case, for the policy to remain in force, a premium must be paid. Premium payments are greater than necessary to provide the Life Insurance benefit in the early years of the policy so that a reserve can be accumulated to make up the shortfall in premiums necessary to provide the insurance in the later years. If the policyholder should discontinue the policy, this reserve is returned to the holder, subject to applicable surrender or early withdrawal charges.

Permanent Life insurance can be further separated into some basic categories: Whole Life, Universal Life and Variable Life.

Whole Life means that one generally makes level (equal) premium payments for life. The death benefit and minimum cash value are predetermined and guaranteed. Any guarantees associated with payment of death benefits, income options, or rates of return are based on the claims-paying ability of the insurer.

Universal Life means that one pays premiums at any time, in any amount, as long as policy expenses and the cost of insurance coverage are met. The amount of insurance coverage can be changed, and the cash value will grow at a declared interest rate, which may vary over time.

The next type of Permanent Insurance is similar to Whole Life Insurance which means one pays a level premium for life. However, the death benefit and cash value fluctuate depending on the performance of investments in what are known as 'subaccounts'. The policyholder selects subaccounts in which the cash value is invested.

The final part which will be explained in this Master Thesis will be Variable Universal Life. This is a combination of Variable Life Insurance and Universal Life Insurance. One pays premiums at any time, in any amount, so long as policy expenses and the cost of insurance coverage are met. The amount of insurance coverage can be changed, and the cash value goes down or up based on the performance of investments in the subaccounts.

Before explaining the mathematical models, there will be a comparison of these five types of insurance from the perspective of premium, coverage, death benefit, cash value, cash value account growth, cash withdrawals allowed and policy loans allowed.

If we take the premium as a basis for comparison, the Whole Life insurance and Variable Life premiums are on a basic level. For Term Life the premiums increase at each renewal, while for Universal Life and Variable Universal Life it is a flexible amount. From a coverage point of view, only Term Life is renewable until the age of 70, for the other types of insurance the coverage is for life. From the death benefit point of view, for Term life, the benefits are agreed upon in advance and this amount is guaranteed. If we take the Whole Life Insurance, benefits can be guaranteed or may be increased with dividends. Universal Life is the same as other types of insurance and is related to death benefit, and in this situation that benefit will be guaranteed, depending on the policy, however, it can also be increased or decreased. Variable Life is also related to death benefit, and in this type of insurance death benefit is guaranteed and varies relative to cash value investment returns. This kind of insurance is the most common insurance that is related to currency risk which is one of the topics covered in this Master Thesis. On Variable Universal Life the death benefit may be guaranteed or depending on the policy, it can also be increased or decreased, and it varies according to

cash value investment returns. The type of insurance also relates to the cash value and the cash value may vary for certain types. For Term Insurance, there is no cash value, for Whole Life Insurance it is guaranteed and related to the dividends. Universal Life cash value varies according to interest rates and the guaranteed minimum interest rate. The Variable Life does not guarantee a cash value and fluctuates with the subaccount performance. The Variable Universal Life like Variable Life does not guarantee but varies with the fluctuation of subaccount performance. Next, a comparison of different forms of insurance can be made regardless of the policy loans allowed. Policy Loans are allowed everywhere except in Term Life Insurance. In Whole Life, the policyholder can borrow up to 100% of the total cash surrender value less the annual loan interest rate, while in Universal Life loans are usually available at a lower net interest rate. The same logic applies to the other types of insurance.

When we become familiar with the way insurance behaves from different perspectives, we can further explain the mathematical models that refer to these types of insurance, and later explain the statistical data relating to different types of the insurance market in the Republic of North Macedonia.

Under a Life Insurance contract, the benefit insured consists of a single payment, the sum insured. The time and amount of this payment are functions of the random variable which is denoted with *T*. The time and amount of payment may be random variables.

For the sake of this thesis, the present value of the payment is denoted by *Z* and the expected value of the present value of the payment *E(Z)*, which means the net single premium of the contract (Gerber & Cox,1997).

- Whole Life and Term Insurance

Whole Life insurance provides for the payment of one unit at the end of the year of death. In this case, we can consider that at the end the amount of the payment is fixed, but the time of the payment we can denote as *(K+1)*, and it is random. If we want to calculate the present value, we can do it in the following way:

$$Z = V^{k+1} \tag{1}$$

As earlier noted above, Z there is a random variable that ranges over the value of $v,v^2,v^3,\ v^4,\ldots,$, where with *V* we note the discount factor, and its distribution is represented by (1) formula, but the distribution of *K* will be represented below:

$$Pr(Z = v^{K+1}) = Pr(K = k) = {}_{k}p_x q_{x+k} \tag{2}$$

the net single premium is denoted with *Π* and let it be shown by the following formula:

$$\Pi = E[v^{k+1}] = \sum_{k=0}^{\infty} v^{k+1}{}_{k}p_x\, k_{x+k} \tag{3}$$

If we have an amount of A_x and an amount of Z we can easily calculate the variance of Z:

$$Var(Z) = E(Z^2) - A_x^2 \tag{4}$$

Term insurance is insurance which provides for payment only if death occurs within *n* years. If the policyholder survives the *n* year duration, nothing is paid to the policyholder. That net single premium is denoted differently $A^1_{x:n\rceil}$ and this is equal to

$$A^1_{x:n\rceil} = \sum_{k=0}^{n-1} v^{k+1}\, {}_kp_x q_{x+k} \tag{5}$$

- Pure Endowment

A pure Endowment of duration *n* provides for payment of the sum insured only if the insured is alive at the end of *n* years, and the net single premium is denoted as:

$$A_{x:n\rceil}^{\ 1} = v^n {}_pn_x \tag{6}$$

- Endowment Insurance

Endowment Insurance is a combination of Term Life Insurance and Pure Endowment Insurance, this means that the sum insured is payable at the end of the year of death, if this occurs within the first *n* years, or at the end of the n^{th} year. Pure Endowment provides payment of the sum insured only if the policyholder is alive at the end of *n* years.

The net single premium is denoted by:

$$A_{x:n\rceil} = \mathrm{A}_{x:n\rceil}^{\ 1} + A^1_{x:n\rceil} \tag{7}$$

- Unit Linked Insurance

Unit Linked Insurance is an insurance product which works on the principle of the monetary fund and the unit fund. If we take the premium of this type of insurance, we can notice that part of the premium is immediately discharged into the monetary fund for cost premium and other guarantees, while the rest is invested, and the insurance may include the guaranteed minimum sum insured payable on death. One of the negative consequences is that the customer, who is not instructed in the principles of security markets, does not understand these products, the possible high lapse ratios, and that the policyholder takes the investment risk partially or fully.

This thesis will focus on the Life Insurance products that exist in the Macedonian Insurance Market. Life Insurance products can be separated into seven classes and they are divided into subclasses within their portfolio. These are Total Basic Life Insurance, Marriage and Birth, and Life Insurance related to shares in investment funds, tontines,

capital redemption operations, and pension payouts from the second pillar, and the last one is pension payout from the third pillar. The Macedonian Insurance Market offers Whole Life, Term Life, Endowment, Pure Endowment, and Unit Link Insurance. The main premium growth appeared in 2015 when the Unit Link Insurance class was introduced in the Macedonian Market, there is also Accident and Health insurance as supplementary insurance. An analysis from the ISA (Insurance Supervisory Agency) explains how the insurance market developed through separate products. In 2019, the total gross written premium which was paid was 1.603.231 MKD in Total Life Insurance and for supplementary insurance, the gross written premium was 96.897.000 MKD. This part is about Life Insurance products, which exist in the Macedonian Insurance Market. From the data published by the ISA, we can make an analysis and examine the movement of insurance products by the individual insurance classes. As stated previously, Macedonian Life Insurance consists of several parts. The first part is Total Basic Life Insurance which consists of Endowment, Term, Pure Endowment, Endowment with CI (Critical Illness) and Whole Life classes of insurance. Accident (death), Accident (invalidity), Health (supplementary LVHI), Health (private LVHI) and Health (severe illness) are included in total supplementary insurance. The other part which is included in Life Insurance is Total Annuity Insurance, which consists of Personal Whole Life Annuity, Personal Term Life Annuity and other annuities.

The focus will be on the Total Basic Life Insurance product with profit participation and their gross written premiums. In addition, an analysis will be presented for these products for the period 2012- 2019. For this purpose, we will take the gross written premium at the end of each year. By presenting the data from 2012 to 2019 for each class of Life Insurance, we can identify different movements for each class.

Table 1: Gross Written Premium for last 12 months aggregate amount (000MKD)[1].

Life Insurance Products	2019	2018	2017	2016	2015	2014	2013	2012
Endowment	139.983	115.984	111.173	153.024	183.297	167.702	184.921	182.484
Term	0	205.964	90.086	29.113	188	55	16	0
Pure Endowment	43.070	39.925	42.285	34.281	32.419	30.276	17.282	18
Endowment with CI	37.944	33.096	39.805	37.427	36.577	41.919	0	0
Whole Life	597	613	901	674	344	0	0	0

Source : Own work

[1] This data is for total life insurance with profit participation only. In Macedonian Insurance Companies that is class 1901. See Appendix 3 for detailed analysis of each class.

From Table 1, we can see that there is fluctuating growth in the premiums in Endowment Insurance. From 2012 to 2019 there is a growth of 0.78%, but from 2013 to 2014 there is a decrease of -9.67%. In 2019, there are zero concluded contracts for Term Life with profit participation, however, there is a significant growth in gross written premium from 2012 to 2018. Pure Endowment shows growth from 2012 till 2017, however, after 2017 there was a significant decrease in gross written premium, followed by further growth after 2018. In 2014, Endowment with CI gross written premium is first apparent followed by a decrease in 2015 of 12.74 % in the gross written premium, however after 2016 the Endowment with CI's shows an increase in its gross written premium until 2017 whereafter it decreases by 16.85 %. The last type of Life Insurance product that exists on the Macedonian Insurance Market is Whole Life Insurance for which the first gross written premium was used in 2015, but with smaller gross written premiums compared to the other types of insurance products. In Appendix 3 where the gross written premium is represented, there is an analysis of each class and subclass in the Life Insurance for the 2012-2019 period. In Appendix 2 we can also observe the number of concluded contracts by each class for that period. In the sequel, the movements of these insurance products will be explained to better understand and compare with other countries.

1.2 Trends and Movements of Life Insurance Products

The insurance market in the Republic of North Macedonia consists of several stakeholders, one of which is the regulatory body, the Supervisory Agency of Insurance, which is responsible for the effective governance of the insurance market and its development. The second stakeholder is the National Bureau which represents the insurance companies in the Republic of North Macedonia within international organizations. The National Bureau is responsible for issuing international green cards for members' needs and collects statistical data processing of insurance companies, and does not exist in the Life Insurance market. It has one system on which the policies are recorded. The last ones are Life Insurance companies which are essential to the market's existence. The Insurance companies are predominantly owned by foreign legal entities or are part of insurance groups based in the EU member states. There are five Life Insurance companies: Croatia Life, Winner Life, Grawe, Uniqa, and Triglav Life.

The basic indicators that measure the degree of development of the insurance market are the degree of penetration representing the insurance premiums participation in the GDP of the country and the degree of density which is expressed as the ratio between the total direct gross premium collected and the population of the country. Table 2 shows the movement of these two indicators from 2011 to 2019.

Table 2: Penetration and Density per capita from 2011 to 2019 for Macedonian Insurance Market

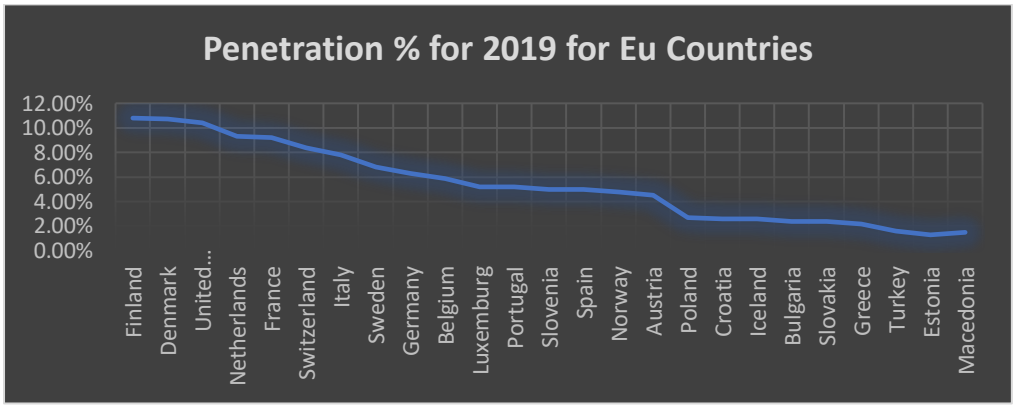
Year	Penetration	Density per capita	Exchange rate with EU 31.12
2011	1.50%	MKD 3.304	61.5050
2012	1.52%	MKD 3.401	61.5000
2013	1.52%	MKD 3.487	61.5113
2014	1.45%	MKD 3.694	61.4811
2015	1.48%	MKD 4.001	61.5947
2016	1.44%	MKD 4.411	61.4812
2017	1.45%	MKD 4.336	61.4907
2018	1.50%	MKD 4.784	61.4950
2019	1.52%	MKD 5.095	61.4856

Source: Own work

From Table 2 we can see that the average movement of penetration is 1.5% which represents how much the insurance gross written premium participates in the GDP of the country. The highest percentage of penetration recorded in 2012, 2013, and 2019 was 1.52% respectively, while the lowest percentage of penetration of 1.44% was recorded in 2016, in comparison to the developed European countries, where the penetration is 10.8%, the percentage in the Republic of North Macedonia, is very low. Figure 1 compares the Macedonian insurance sector development to those of countries in Europe and the EU according to insurance penetration indicators. In 2019, only one country has a lower penetration rate, Estonia, while other countries in the region have higher rates. For example, Slovenian insurance penetration is 5.00%, but the highest penetration rate appears in Finland where the percentage is 10.8%.

The low level of insurance culture, the low living standards and the poor corporate risk management practices are considered to be serious limiting factors for the development of the Macedonian insurance market. (Blazeski, 2015).

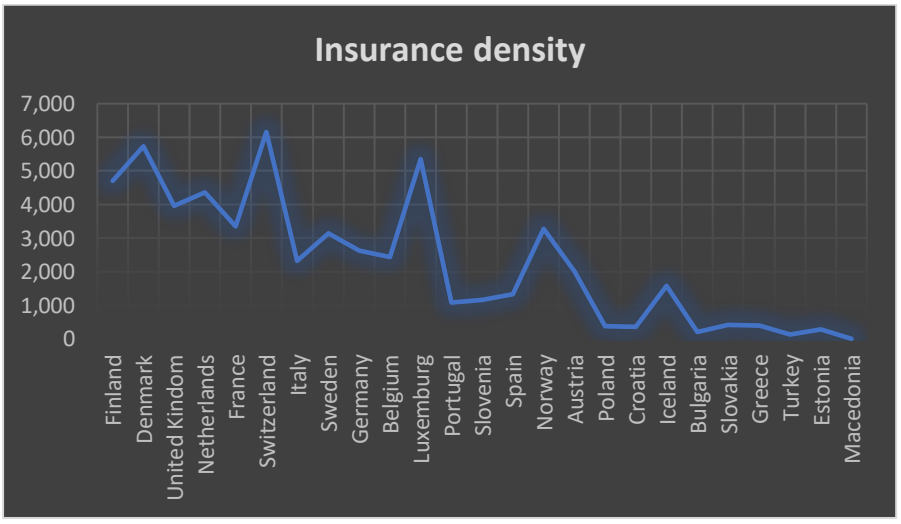
Figure 1: Penetration in European Countries for 2019



Source: Own work

The second important indicator which measures how an insurance market is developing is the degree of density, which is used as an indicator for the development of insurance within a country and is expressed as the ratio of the total direct gross premium collected and the total population of the country. According to the data on the degree of density for the Republic of North Macedonia obtained from the ISA, there is an increase in density from 2011 to 2019 up to 64.85%. The density in 2018 was MKD 4.784 which is an increase of 10.32% from 2017, while a 6.51% growth is noticed from 2018 to 2019. Figure 2 shows the movement of insurance density in European countries. Insurance density in the Republic of North Macedonia has grown from 2011 to 2019. The largest increase recorded in the period was recorded from 2015 to 2016 which was 470 MKD. The data obtained from ISA illustrates annual growth in insurance density, and there is a 56.1% increase from 2018 to 2019.

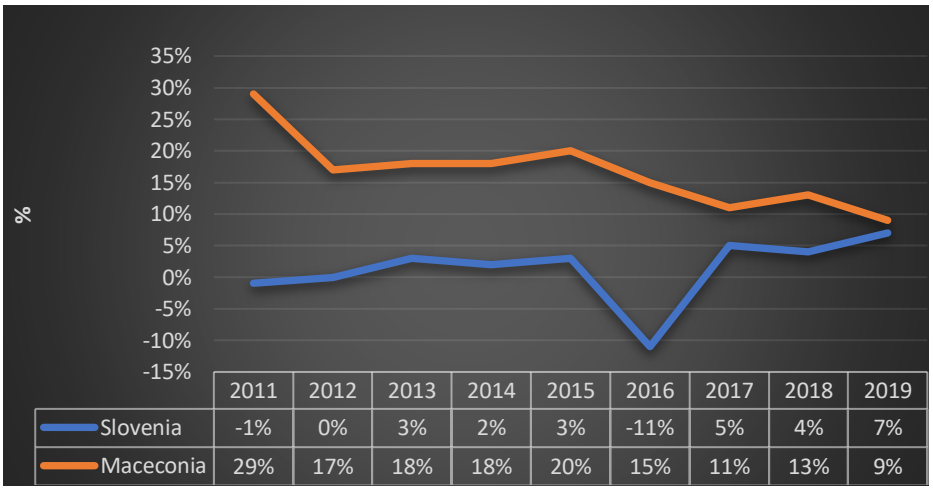
Figure 2: Insurance density for EU countries in 2019



Source: Own work

In addition, this thesis will analyze how developed the Macedonian market is in terms of gross written premium, as it is one of the most important indicators of how developed a market is. As stated previously, different classes of Life Insurance exist in the Macedonian Insurance Market. In this part of the thesis, only the gross written premium representing Total Life insurance and the by-product is used. The total gross written premium in 2019 was MKD 1.603.231, however, the gross written premium under contracts for 2019 is MKD 521.021 (ISA, 2019). The movement of the Macedonian Insurance gross written premium compared to the Slovenian Insurance Market (Insurance Supervisory Agency of Slovenia, 2019) will be analysed, and this can be viewed in Figure 3.

Figure 3: Percentage of growth in gross written premium for Macedonia and Slovenia from 2011-2019



	2011	2012	2013	2014	2015	2016	2017	2018	2019
Slovenia	-1%	0%	3%	2%	3%	-11%	5%	4%	7%
Maceconia	29%	17%	18%	18%	20%	15%	11%	13%	9%

Source: Own work

Notably, in comparison to the average growth of the EU, the average gross written life insurance premium in the period 2011-2019 for Macedonia has a better growth percentage. Moreover, compared to the CEE region, Slovenia, one of the most developed countries in the CEE region, also showed stronger growth for the year 2011, in contrast to some countries in the region, where there was a downward trend or stagnation in Life Insurance development, the number of gross written premiums in the Republic of North Macedonia records a dramatic increase. From data published by the ISA (Insurance Supervisory Agency), the growth in gross written premium is evident till 2019. The Life Insurance sector has the biggest potential for future development, especially because of new marketing strategies connecting Life Insurance with credit offers from the banks, and the appearance of new players (intermediaries) in the Life Insurance sector. It is important to note that the Life Insurance segment is at a developmental stage and is constituting only a small part of the financial sector. Data at the end of 2019 shows that the total assets of Life Insurance were 34.6% of the total activity of the domain sector and represented 1.2% of the gross domestic product.

Several factors are important in the development of Life Insurance in a country. The biggest problem Macedonia is facing is that there is not enough awareness of insurance and a low level of trust in insurance companies. To remedy these issues in the Macedonian Insurance Market, several measures should be taken. For example, measures should be put in place to improve the population's education on the importance of Life Insurance and raise awareness. The population should be familiar with how Life Insurance companies work. In addition, there should be a harmonization of regulations in the Republic of Macedonia with those of the EU. This thesis will explain one of the many regulations that should be aligned with those from the EU - the Solvency II Regulation.

2 REGULATION OF INSURANCE COMPANIES

2.1 Regulatory Framework in North Macedonia

What would the world be like without rules? Rules are vital. Even though Life Insurance companies know their business strategies, a framework of risk surveillance and regulation must be followed. Almost every country where the insurance sector exists has at least some degree of regulation. They are subject to specific rules and procedures over and above the standard framework of laws concerning contracts, bankruptcy and corporate governance.

The Macedonian Insurance Market has its regulations regarding insurance, but because the country wants to be part of the European Union, it must align its regulations with the European regulation.

In the Republic of North Macedonia, Life Insurance has gone through several stages of development since its inception. The first one was until World War II, following the period of the Former Yugoslavia, and the third period was from the Independence of the Republic of North Macedonia and this period persists.

Once the Property and Persons Insurance Law was passed in 1993 by the Parliament of the Republic of Macedonia, a new era began in the development of Life Insurance in this independent country with its national economy (Andreeski, Milosevic, Njegomir, 2012). A significant part of this law relates to a series of important issues with which insurance companies must deal. To further regulate this activity and develop the national economy, in the following years, the Parliament of the Republic of Macedonia passed other laws such as the Insurance Law in 2001 and the Insurance Supervision Law in 2002. In 2007 an amendment was passed to the Insurance Law 2001 and the Insurance Supervision Law 2002. In 2009, the Insurance Supervisory Agency was created which acts as the Regulatory Agency in the Insurance Industry in Macedonia. The Insurance Supervisory Agency was set up as an independent regulatory authority that promotes the fair and efficient functioning of the insurance market with the

objective of protecting the rights of the insurance policyholders and beneficiaries (ISA, 2021).

As mentioned before, the Insurance Supervision Agency was established in 2009. The Insurance Supervision Law sets the legal grounds for the establishment and performance of the authorization of the ISA.

The ISA is authorized to supervise insurance undertakings, insurance brokerage companies, insurance agencies, insurance brokers and agents, and all the related parties defined by the Insurance Supervision Law, as well as the activities of the National Insurance Bureau. The ISA is also authorized to issue and withdraw licenses and consents, issue measures and sanctions, adopt secondary insurance regulations, and propose amendments to the primary insurance regulation. The ISA initiates the procedure for full membership of the relevant European and International Insurance Supervision Associations and cooperation with counterparts from the region, with the objective of further development of sound and stable insurance markets. The managing body of the ISA comprises the President and four other members of the Council of Experts.

A particular challenge in the new transition period that has a huge impact on Life Insurance in the Macedonian Insurance Industry is the transition from Solvency I to Solvency II which is part of this Master thesis. It will describe the challenge in the ALM segment in the transition from Solvency I to Solvency II regulation. For this reason, it will identify the main challenges that Life Insurance Companies in Macedonia have to be aware of concerning ALM when they face the Solvency II Directive.

2.2 Solvency I

Solvency is the ability of a company to meet its long-term debts and financial obligations. Solvency is an important measure of financial health because it is one way of presenting a company’s ability to manage its operations into the future.

Why solvency must be regulated will be explained in the rest of this thesis. Insurance companies work with other people's money, therefore they start their work they must be authorized by the ISA and, they are subject to supervision.

Policyholders pay their premiums upfront before receiving any services from the insurance companies as a result of the inverted production cycle. In other words, guaranteeing the insurance company promises is an important part of insurance companies’ *modus operandi*. In practice, this is achieved by requiring the insurer to set up technical provisions for the expected risk or in the case of insurance companies’ potential liabilities that the insurer promised to pay, resulting from the contract between the insurer and policyholder. In addition, insurance companies must create their own capital funds as well as technical provisions to ensure the delivery of the insurance

promise in situations of stress. Stress might result from unexpected risks, such as fluctuations in the interest rate or foreign exchange rate, or other risks that contribute to any disruption of the possibility on behalf of the insurer to pay the obligation that he has towards the policyholder.

According to economic theory, regulation of the insurance sector is justified in order to resolve market imperfections as insurance can change their risk profile after the contract has been signed. The other issue is that customers are unable to analyze an insurer's financial soundness, and insurers may be incentivised to price their products too low because of market competition. With market imperfection being the rationale for insurance regulation, the objective of insurance regulation aims to mimic perfect market conditions as closely as possible (DOFF, 2016).

Since North Macedonia has been trying to join the European Union for years, the regulation of Life Insurance companies should be in accordance with Europe. The ISA is currently trying to give insurance companies in North Macedonia directions that are similar to those that apply to European Life Insurance Companies.

With Solvency II, the primary objectives are to increase the level of harmonization of solvency regulation across Europe, that is, to defend policyholders, and to introduce Europe -wide capital requirements that are more sensitive to levels of risk assumed if we make a comparison with the previous Solvency I regulative minimums and to provide incentives for good risk management.

North Macedonia is still using Solvency I Regulation, the insurance companies determine their own funds and capital adequacy in accordance with the prescribed regulations from the ISA. Insurance companies must always keep adequate capital on hand, according to workload and risk exposure. The calculation of the solvency margin is in accordance with Article 75, paragraph 1 of Supervision Law.

To continue, the Solvency I Regulation will be further explained.

Several studies have been written on the importance of insurance to the financial system and economy of each country. A common, generally accepted goal of insurance systems globally is to ensure efficient and stable functioning of the markets in which adequate protection of policyholders is achieved. It is generally accepted that adequate protection can be provided in the long term. If the country establishes financial stability for a long period of time, it implies solvent insurance companies. When an insurance company can service liabilities on each agreement, we know that it is solvent.

As a result of the contract between the insurance companies and policyholders, the technical reserves are liabilities for the insurance companies. Calculating the reserves should be enough to cover all liabilities incurred by insurance companies as a result of the concluded contracts and have to be calculated on a prudent basis.

We can say that insurance companies are not a significant source of systematic risk, even though they are financial institutions that play an important role in the financial system. Regulation and capital requirements are crucial factors in the ability of insurance companies to meet all of their obligations due to the public nature of the services they provide.

There are several mandatory requirements imposed by law that must be met for the activity to be in accordance with the law. One of the basic requirements that must be met for insurance companies to perform their operations is to have sufficient capital at the time of establishment. In North Macedonia, there is a prescribed law that contains the amounts of capital that a company requires to get a license to be formed. In Life Insurance the minimum capital required must be at least €3.000.000.

The sufficient capital that the insurance companies should have in their balance sheet, known as the solvency margin is calculated with a simple mathematical equation. The solvency margin is one of the indicators that explain the degree of risk that insurance companies have and whether it has operational problems.

The solvency margin is important for the protection of insurance companies in the event that some uncertain expenses occur. The technical reserve that insurance companies should keep in their portfolio should be enough to be able to fulfil their future obligations. If their own funds fell below the required amount, the supervisory authority would intervene and prescribe measures to restore the sound financial situation of the undertaking concerned.

The Solvency I requirements introduced in 1979 were largely based on the research conducted by Prof. Cornelis Campagne, the chairman of the supervisory authority in the Netherlands. The regulation was updated in 2002, but after the capital market crisis, a few structural weaknesses remain.

The first Directive 79/267/EEE3 from 5 March 1979 harmonized solvency for the countries on European territory for the first time. This Directive has been changed twice in 2002 and 2003. The European Parliament and the Council adopted the new Directive 2002/83/E3, which terminated the previous two directives and consolidated the provisions relating to the performance of the Life Insurance business into a single directive.

A primary legal framework for performing insurance activities equivalent to these regulations was established in North Macedonia when they adopted a National Program for aligning their law with the law of the European Union. The Directive 2002/83/EC on Life Insurance specifies the basic criteria for the different economic categories based on the solvency margin of insurance undertakings located for the EU Member States.

The available solvency margin, i.e. the capital of each insurance company is the difference between the assets of the company, on one hand, and all expected liabilities on the other. The expected liabilities of an insurance company are its technical reserves, which means the reserves that arise and are calculated on the insurance contracts.

To calculate the required solvency margin for Life Insurance, the company calculates the solvency margins for each of the classes in which it operates. The required margin of solvency is calculated as the sum of the following situations in Life Insurance namely, reaching a certain age or death, Combined Life Insurance, Life Insurance with a premium return, Marriage Insurance, Insurance in the case of childbirth and annuities.

The first step in calculating the capital requirement is 4 % of the gross mathematical reserve related to direct insurance operations and undertaken reinsurance risks, and this amount is multiplied by a coefficient for the last business year, calculated as the ratio between the net mathematical reserve and gross mathematical reserve. That calculation of the coefficient cannot be smaller than 85 %.

The second result is for the policies where the risk capital is not a negative number. Then 0.3 % of the risky capital is multiplied by the coefficient for the last fiscal year, calculated as the proportion between the total risky capital, which the insurance companies keep as an obligation after subtracting the part which is transferred to reinsurance and the gross risky capital taken from reinsurance, and that coefficient should be also smaller than 50%.

For policies related to Life Insurance, 0.1 % of the risk capital is taken for a predetermined period, and the maximum period is set at three years. A sum of 0.15 % of the risk capital is taken for these Life Insurance contracts lasting more than three, but not more than five years.

Some weaknesses of Solvency I remain, a few of these are described in the Impact Assessment Report that accompanied the EC's 2007 proposed Solvency II FD[2].

Under Solvency I, the capital buffer mainly looked at underwriting risk. At the beginning of the 21st century, the capital market crisis revealed the disadvantages of this limited approach to risk. There was no specific rule requiring insurers to hold sufficient capital for market risk, and there was no capital buffer for concentration risk. When the value of their investments declined due to the capital market crisis, insurers that had heavily invested in equity suffered major losses. Market risk and concentration risk were not adequately covered in the required solvency margin, and credit and operational risk were not properly considered. Additionally, there was a lack of sensitivity to risk mitigation tools, such as reinsurance, securitization, and derivatives.

[2] EC Commission Staff Working Document: Accompanying document to the Proposal for a Directive of the EP and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance. Solvency II: Impact Assessment Report, SEC (2007) 871, 10 July 2007, pp 9-14.

Moreover, Solvency I did not credit insurers for diversification across lines of business or among legal entities, even though diversification is one of the key characteristics of the insurance business model. In general, Solvency I did not contain an incentive for insurers to manage their risk properly. As a result, some insurers were operating with too much capital, while others were underwriting businesses for which they did not have a sufficient amount of capital.

Furthermore, the required solvency margin calculation under Solvency I was based on past data, meaning that the Member States had the option to value assets at their historic cost and to apply a discount rate to the liabilities of the Life Insurance companies, consistent with the conditions of the government bond market at the time the contract was concluded.

When evaluating underwriting risk, Solvency is focused primarily on the insurer's past performance. In Solvency I, attention was paid exclusively to quantitative aspects of Solvency, overlooking the importance of qualitative aspects, including the effectiveness of governance.

However, studies such as the Muller Report and the Sharma report have shown that when insurers failed, it was less likely due to an insufficient amount of capital, but more likely to lack of proper governance. This qualitative aspect of prudential supervision, already recognized in Basel II, was absent under the Solvency I regulatory regime.

The main deficiencies of Solvency I can be summarized as follows (Van Hulle, 2019):

- Under Solvency I, the capital buffer is mainly considered an insurance risk, rather than drawing attention to other risks an insurer might face, such as market risk, credit risk, or operational risk.

- Solvency I did not provide an incentive for good risk management, and risk was not directly related to capital. As a result, insurers could operate successfully under the solvency regime without adequate risk management. We can see examples in the Life Insurance companies which continued to offer fixed guarantees at rates which were higher than the market value. Under Solvency I, they could nevertheless show an attractive solvency margin.

- The Solvency I regime did not contain early-warning signals. The system did not highlight when an insurer was becoming insolvent. As insurance is a long-term business, problems only appear gradually, and when they become apparent, it is often too late to do something about them. Supervisors did not have sufficient information nor the tools to intervene when there was still sufficient time to deal with problems.

- As Solvency I is mainly focused on underwriting risk, it predominantly looked at the past situation of the insurer. In order to understand the solvency position of an insurance

undertaking, it is however important to look at its business model over a number of years. A forward-looking approach was therefore lacking.

- Solvency is not just about capital; it is also very much a question of good risk management and proper governance. If an insurance undertaking is properly managed, it will match the risks that it underwrites with the right amount of capital. Under Solvency I, too much attention was being paid to the volume of business (growth of written premium) rather than to the quality of the business. Actuarial or risk management expertise was not always present at the right level in the organizations. Insufficient attention was being paid to the qualitative aspect of solvency.

- Public disclosure and supervisory reporting were minimal under Solvency I. In addition, the comparison of the supervisory data produced a situation whereby data relating to insurance undertakings were not comparable. This made it impossible to compare the financial situation and the solvency situation of insurance undertakings belonging to the different Member States.

Once we reviewed Solvency I regulations, we will explain how Solvency II was developed and what differences have been made with regard to Solvency I.

2.3 Solvency II

Solvency II will change and already has changed the insurance industry world-wide (Solvency II Handbook).

After many years of development, preparation, consultation, and amendments to better calibrate the Solvency II regulative, the consultations continue today. Solvency II is a harmonized prudential regulatory framework for the supervision of insurance and reinsurance companies operating in the European Union.

It is risk-based regulation and goes beyond quantitative measures (capital requirements) to cover overall risk-management.

Solvency II applies to all EU insurers except for those with annual premium income below €5 million and technical provisions less than €25m million, however, these smaller companies can still choose to follow this regulation. (Institute and Faculty of Actuaies, 2016).

The new regulations came into effect on the 1st of January 2016 and replaced 14 directives, commonly known as Solvency I, where capital requirements were determined using a factor-based approach based on a matrix such as technical provisions and premium. It is important to know that Solvency II is not a zero-failure regulation which means that there is 0.5% probability of failure, because the insurers will need enough capital to have 99.5% confidence they could cope with the worst

expected losses over a year. Once the capital requirement reflects risks to the company, necessary steps are taken to manages those risks, and minimizes the impact of sovereign conditions. However, it is not possible to cover all unexpected future events.

Insurance is a long-term business, and it faces many risks which influence the solvency of the insurance companies. The aim of Solvency II is risk-based regulation, when the capital of one insurance company is sensitive to its risk profile, it provides an enhanced level of protection to policyholders. Risk-based capital means the higher the risk exposure, the higher the capital requirements.

A harmonized routine across the European market also means that companies will determine their capital requirements using a consistent approach. This can also reduce regulatory arbitrage. For example, being selective within the rules and structuring activity in a way that can reduce the capital requirements, leads to a reduction in risk.

The main goal of the Solvency II integration is that supervisory authorities, insurance companies and consumers have a comparable view of the market, protecting the market and providing more comfortable stability.

Solvency II does that with a three-pillar structure similar to Basel II.

The First Pillar deals with quantitative requirements, the principle of valuation assets, the principle of valuation liabilities, and the determination of capital requirements in the short term.

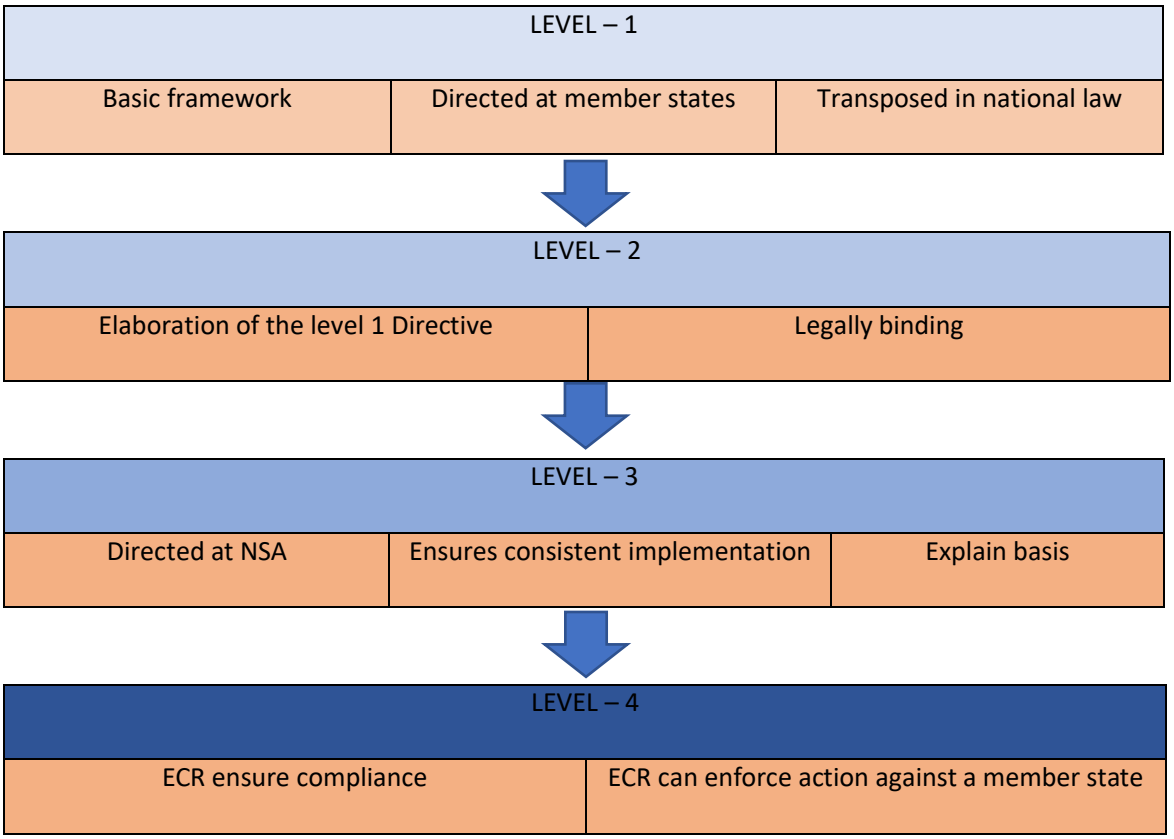
The Pillar II Structure is the governance and supervision containing systems of governance and risk management with an additional layer of risk assessment that considers quantifiable and non-quantifiable risks over the medium or long-term insurance companies' operations, and Own risk & Solvency assessment (ORSA). Also, this part is introducing supervisory powers to enforce the supervisory review process in order to indicate whether the company is sufficiently capitalized for the risks it faces.

Then we have Pillar III which considers whether the outcomes from the previous two Pillars should be communicated transparently and consistently.

Solvency II came into force on the 1st of January 2016, but the most important date is when the Solvency II directive was approved by the European Parliament on 22 April 2009. Here we should mention two more important dates which are related to Solvency II, the first date is 2001 when the process began to assess existing insurance regulations and 2014 when amendments to the Directives 2003/71/EC and 2009/138/EC and Regulations (EC) No. 1095/2010. In respect of the powers of the European Supervisory Authority, the directive was passed.

Solvency II has had a difficult path from its inception. Take into consideration the Lamfalussy Process, which was introduced by Alexander Lamfalussy, the chair of the advisory committee that created that process.

Figure 4: Levels of the Lamfalussy Process

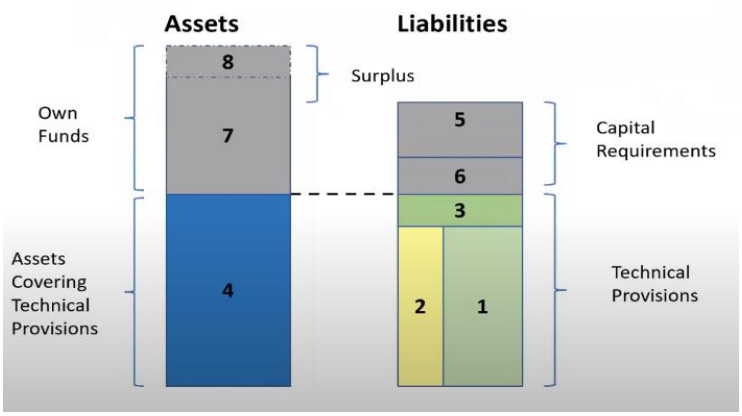


Source: Own work

There are four levels of the Lamfalussy Process. The framework has generic rules developed in the first level, directed at the member states and transposed into national law. The second level elaborates on the Level 1 Directive and legislation and is legally binding. Technically we can then move to Level 3 which is Guidance. It is directed at National Supervisory Authorities and ensures consistent implementation across member states, it is based on a comply or explain' basis. In this case, the directive gives the power of the regulatory body to EIOPA, which replaced CEOPS. Level four is the enforcement stage. From the Solvency II point of view, the first level started in 2009, when the Directive was approved and was completed on implementation.

For an explanation of Solvency II, we need to understand the Solvency II Balance sheet. For the needs of this thesis, the balance sheet is the most useful financial statement.

Figure 5: Balance sheet in Solvency II world



Source: Husain (2021)

Pillar I which quantifies the quantitative requirements of the regulation is based on a total balance sheet approach. So, the impact on the total balance sheet of a risk materializing in extreme conditions represents the capital needed to be held against that risk. It does not only cover insurance risks, but it covers quantifiable assets and liabilities risks and how they interact. It uses the market consistent valuation of assets and liabilities. This is important because compared to the previous regime, prudent valuations were used for liabilities, and the insurance companies used different ways to evaluate their assets.

Technical provisions are the sum of the Best Estimate of Liabilities and Risk Margin. The Best Estimate of Liabilities is the probability-weighted average of future cash-flows, taking account of the time value of money using the relevant risk-free interest rate term structure. The cash flow projection should take account of all the in and out flows required over the lifetime of the insurance or reinsurance obligations and the probabilities of these cash flows happening being considered. Then the cash flows are discounted using a common interest rates term structure that is specific to the EU member's stage. This is different from the Solvency I approach where the interest rate was determined by considering assets held against business, along with their future expected returns. They should take account financial guarantees, contractual options, policyholder behaviour, and future management action, which is particularly important for the profitability of the business.

To increase the technical provisions, the risk margin is supposed to represent the amount that would have to be paid to another insurance company to cover the best estimate liability. Accordingly, it is a theoretical compensation for the risk of future experience being worse than the best estimate assumptions, and the cost of holding regulatory capital against that risk.

An exception exists, where future cash flows associated with insurance or reinsurance obligations can be replicated reliably, using financial instruments for which a reliable market value is observable. In these cases, the value of technical provisions associated with those future cash flows shall be determined based on the market value of those financial instruments.

For better comprehension, take the balance sheet report and denote it with a number, where 1 means the best estimate of liabilities for non-hedgeable risks, 2 means market consistent valuation for hedgeable risks, 3 means the risk margin for non-hedgeable risks, and 4 represents assets covering Technical Provisions valued on a market consistent basis.

The Liabilities column is explained as Capital Requirements. Insurance companies need to calculate two capital requirements. The first requirement is Solvency Capital Requirement (SCR), and the second requirement is Minimum Capital Requirement (MCR).

The Solvency Capital Requirement is very important as it is Value at Risk (VAR) at 99.5% confidence interval over a one-year time period which means that if extreme market conditions are realized, the probability of one company going insolvent is less than 0.5%.

The Solvency Capital Requirement can be calculated using a prescribed approach or the standard formula, or a company-specific Internal Model approved by the relevant regulator. Alternatively, the insurance companies can use a combination of the Internal Model and the model which is required under Solvency II regulation. This Solvency Capital Requirement is the first point of supervisory intervention, leading to increased supervision. However, companies can continue to operate subject to recovery measures within a short period of time.

The Minimum Capital Requirement (MCR) is a simple factor-based linear formula. It is not on addition to the SCR, but a subset of the SCR. In the Solvency Capital Requirement, the VAR had a 99.5 % confidence interval, but in MCR there should be 85 % confidence.

MCR cannot have a floor lower than 25 % of SCR, and is capped at 45 % of SCR.

We can continue with an explanation of the calculation of MCR (McCulloch, 2008):

$$MCR_{life} = max\left\{\alpha_{wp_{guaranteed}} TR_{wp_{guaranteed}} + \alpha_{wp_{bonus}} TR_{wp_{bonus}};\ \gamma\, TR_{wp_{guaranteed}}\right\} + \sum_{i\{non-wp)} \alpha_i\, TR_i + 0.25 \times Exp^{*}_{ul} + \sum_j \beta_j\, CAR_j$$

The meaning of denotations is explained below:

$\alpha_{wp\_quaranteed}$, means the factor applying to guaranteed with profit benefits

α_{wp_bonus}, means the factor applying to non-guaranteed with profit benefits

$TP_{wp\_guaranteed}$, means technical provisions which represent the net best estimate for guaranteed benefits related to profits contracts

TP_{wp_bonus}, technical provisions which are the net best estimate for discretionary bonuses related to profit contracts

$Exp*_{ul}$, represents the amount of the previous year's net administrative expenses in respect of non-retail unit-linked business and management of group pensions funds where only the policyholder takes the investment risk

$\alpha_i TP_i$, represents technical provisions multiplied with a factor, but separated into different classes and risk drivers

$\beta_j CAR_j$, this note is used for capital at risk multiplied by another factor, appropriate to the outstanding claims of the contract. CAR is defined as the sum of amounts currently payable on death or should disability occur, less technical provisions.

Also, we can say that MCR is the ultimate point of supervisory intervention, below which the company loses its authorization.

The SCR must cover some of the risks such as non-life underwriting risk, health underwriting risk, operational risk, and importantly for this thesis, market risk, with which ALM deals the most. We can see the positions in the balance sheet of these capital requirements with numbers 5 and 6 on the Table 2.

In Solvency II regulation, the most important part is the Own Funds of the insurance companies. Own Funds are assets in excess of technical provisions. They cover the capital requirements and include any surplus above the SCR. The Own funds consist of the basic and ancillary Own Funds. The basic Own Fund is the capital which already exists with the insurer. They are tiered based on the quality of capital, where Tier 1 means the highest quality and Tier 3 means the lowest quality. At least 50% of SCR must be backed by Tier 1 own funds and less than 15 % Tier 3. At least 80% of MCR must be backed by Tier 1 own funds and zero Tier 3. Ancillary Own Funds are off-balance sheet items and capital that can be called upon in certain adverse circumstances, but which do not currently exist within the insurance company.

Corporate governance is the focus of Pillar 2 and requires an adequate system of corporate governance. As part of Solvency II, four governance blocks exist, namely, Own Risk and Solvency Assessment (ORSA), risk management system, policy processes and procedures, and key functions.

The ORSA can be defined as the entirety of the processes and procedures employed to identify, assess, monitor, manage, and report the short and long-term risks a (re)insurance undertaking faces or may face. It also determines the Own Funds necessary to ensure that the undertaking's overall solvency needs are met at all times. The EIOPA issue reports on ORSA. In addition, ORSA serves as an internal assessment of the overall solvency needs of an insurer. The ORSA process and its results must be reviewed by an independent body such as internal audit, external auditors or another independent reviewer, and reviewed, at a minimum, on an annual basis. It must be developed by the company and be part of the daily processes.

The main requirements of ORSA are the methods and assumptions used in the risk assessments, the results (including sensitivities in the results), appropriateness of the assessments and the model, data sources, system and controls that affect the ORSA and the method which represents parameters of uncertainties.

This is a unique feature of Solvency II since there are no comparable requirements in any other regulation and will make both the firm itself and the supervisory bodies gain a better understanding of a firm's risk profile. The regulator will have the power to impose higher capital on an insurer if it believes the ORSA system does not meet the standards or if a company does not follow its own internal model. Of the three pillars, Pilar II is probably the most challenging when it comes to implementation since it mandates what for many companies will be a major overhaul of the risk culture at all levels.

In addition to risk management strategies, policies, and processes, an effective risk management system must include internal reporting procedures. Managing risk is an essential component of insurance companies' operations. Companies must document the objectives, principles, responsibilities and internal risks of risk management, and demonstrate constant risk prevention measures or a program.

The Last Pillar of the Solvency II is Pillar 3.

"Now that Pillar 3 has finally become a priority, we are seeing that there are huge organizational and process implications with regard to how insurers produce, collate and manage their data." (Anne, 2015)

Pillar 3 requires market discipline and adherence to minimum reporting and disclosure requirements. Transparency in data reduces informational gaps between capital owners, investors, and also between insurance companies, policyholders and beneficiaries of insurance. Investors are therefore able to make investment decisions based on accurate, relevant, credible, and complete information. Capital market mobility, trading volume, market competition, and efficient allocation of capital are all enhanced when investments are made efficiently. The regulatory framework related to reporting for supervisory purposes includes a set of acts, standards and regulations that require

insurance companies to report to the supervisory authority in the country where the company has headquarters for the calculation of capital, solvency margin, the composition of the technical reserves by certain classes of insurance, also the total amount, as well as the calculation and monitoring of certain technical coefficients for the performance of the basic activity. Regulators should be able to detect potential risks of possible losses in particular classes of insurance that could threaten solvency over a time period using this set of regulations.

We can conclude that one of the principal challenges of Pillar 3 is that the complexity of the reporting and disclosure aspects of Solvency II was underestimated, which has adversely affected the number of resources that firms have devoted to this part of their Solvency II programs. As Pillar 3 is now a priority, we are observing that insurers' production and management of data have huge implications in terms of processes and organization. Also, Pillar 3 is the most difficult to assess of the other two Pillars because of transparency issues.

According to Solvency II, insurers are required to hold 141% more capital than they did under Solvency I. Solvency II requires over 60% of capital to cover market risk, making it the most important component of risk (Wang, 2006). Market risk consists of the sensitivity of the values of assets, liabilities and financial instruments to changes in the term structure of interest rates or in the volatility of interest rates as these represent interest rate risk. Market risk arises from potential changes in rates or prices in various markets such as those for bonds, foreign currency, equities and commodities. The next part of market risk represents the sensitivity of the values of assets, liabilities and financial instruments to changes in the level or the volatility of market prices of equities, known as equity risk. Property risk is also part of market risks and means the sensitivity of the values of assets, liabilities and financial instruments to changes in the level or the volatility of market prices of real estate. In the sequel is Spread Risk which means the sensitivity of the values of assets, liabilities and financial instruments to changes in the level or the volatility of credit spread over the risk-free interest rate term structure. It is worth mentioning the currency risk because it is also an important part of this master thesis and represents the sensitivity of the value of assets, liabilities and financial instruments to changes in the level or the volatility of currency exchange rates. And last but not least, is market risk concentrations, meaning additional risks to an insurance or reinsurance undertaking stemming either from lack of diversification in the asset portfolio or from large exposure to default risk by a single issuer of securities or a group of related issuers.

As we mentioned above in the SCR section on Pillar 1, the market risk module[3] is calculated with the formula below (3.1)

[3] Article 105(5)

$$\text{SCR}_{\text{market}} = \sqrt{\sum Corr_{i,j} \times SCR_i \times SCR_j}$$

[4]

To explain the SCR_i formula, $_i$ denotes the sub-module$_i$ and SCR $_j$ denotes the sub-module$_j$, where $_i$ and $_j$ means that the sum of the different terms should cover all possible combinations of *i* and *j*. If we want to calculate SCR for different risk we can replace the SCR formula by the risk that we want calculated. For example, $SCR_{\text{interest rate}}$ denotes the interest rate risk sub-module, SCR_{equity} denotes the equity risk sub-module, SCR_{property} denotes the property risk sub-module, SCR_{spread} denotes the spread risk sub-module, $SCR_{\text{concentration}}$ denotes the market risk concentrations sub-module, SCR_{currency} denotes the currency risk sub-module i and sub-module j.

Table 3: Currency risk sub-module

i \ j	Interest rate	Equity	Property	Spread	Concentration	Currency
Interest rate	1	A	A	A	0	0.25
Equity	A	1	0.75	0.75	0	0.25
Property	A	0.75	1	0.5	0	0.25
Spread	A	0.75	0.5	1	0	0.25
Concentration	0	0	0	0	1	0
Currency	0.25	0.25	0.25	0.25	0	1

Source: Delegated Regulation (EU) 2015/35

The parameter A is equal to 0 where the capital requirement for interest rate risk set out in Article 165 is the capital requirement referred to in point A. In all other cases, the parameter A shall equal 0.5.

Regulation of currency risk is in Level 1 Directive 2009/138/CE (Art 105.5, Art, 209a.c, Art 111.1.p) and Level 2 Commission Delegated Regulation 2015/35 and Commission implementing regulation 2015/2017 laying down the implementation of technical standards regarding the adjusted factors to calculate the capital requirement for currency risk for currencies pegged to the euro.

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0138&from=EN

The capital requirement for currency risk shall be equal to the larger of the following capital requirements:

- The capital requirement of the risk of an increase in the value of the foreign currency against the local currency.

- The capital requirement of the risk of a decrease in the value of the foreign currency against the local currency

- The capital requirement for currency risk shall be equal to the addition of the capital requirements of each foreign currency.

- For each foreign currency the capital requirement should be the larger loss in own funds due to an increase or decrease of 25 % in the foreign currency in comparison with the domestic one.

To understand this concept, we will use the euro with some other foreign currency such as Australian Dolar, Swiss Franc and Danish Krone. (Table 7)

Figure 6: Implementing Technical Standards with regard to the adjusted factors to calculate the capital requirement for currency risk for currencies pegged to the euro

Implementing Technical Standards with regard to the adjusted factors to calculate the capital requirement for currency risk for currencies pegged to the euro	
Adjusted factor:	***Adjusted factors where the local and the foreign currency are pegged to the euro:***
0.39% where the other currency is the Danish krone (DKK); 1.81% where the other currency is the Bulgarian lev (BGN); 2.18% where the other currency is the West African CFA franc (BCEAO) (XOF); 1.96% where the other currency is the Central African CFA franc (BEAC) (XAF); 2.00% where the other currency is the Comorian franc (KMF).	2.24% where the two currencies are the DKK and the BGN; 2.62% where the two currencies are the DKK and the XOF; 2.40% where the two currencies are the DKK and the XAF; 2.44% where the two currencies are the DKK and the KMF; 4.06% where the two currencies are the BGN and the XOF; 3.85% where the two currencies are the BGN and the XAF; 3.89% where the two currencies are BGN and the KMF; 4.23% where the two currencies are the XOF and the XAF; 4.27% where the two currencies are the XOF and the KMF; 4.04% where the two currencies are the XAF and the KMF.

Source: Commission implementing regulation (EU) 2015.2014 of 11 November 2015

In the sequel, some examples of the calculation of SCR currency will be explained:

Table 4: Calculation of SCR

	Assets	Liabilities
Australian Dollar	3,958,727.84	0.00
Swiss Franc	100,000.00	2,000,000.00
Danish Krone	3,000.00	100.00

Source: Luisa, 2016

If we want to obtain the net position, we should find the difference between assets and liabilities in this case. They are the following:

Table 5: Currencies of Australian dollar, Swiss Franc and Danish Krone

	Currencies
Australian Dollar	3,958,727.84
Swiss Franc	-1,900,000.00
Danish Krone	2,900.00
	2,058,727.84

Source: Luisa, 2016

We apply some shock upwards and shock downwards which is represented in the tables below:

Table 6: Shock on Currencies

	INITIAL VALUE	SHOCK UPWARDS	SHOCK DOWNWARDS
Australian Dollar	3,958,727.84	4,948,409.80	2,969,045.88
Swiss Franc	-1,900,000.00	-2,375,000.00	-1,425,000.00
Danish Krone	2,900.00	2,922.31	2,888.69
Total			

Source: Luisa, 2016

Table 7: Change in Currencies

	UPWARDS CHARGE	DOWNWARDS CHARGE
Australian Dollar	989,681.96	0.00
Swiss Franc	0.00	475,000.00
Danish Krone	11.31	0.00

Source: Luisa, 2016

$SCR_{currency\ risk}$ = 1,464,693.27

One popular quote says "Your greatest resource is your time", so Solvency II has transition provisions for 16 years for Life Insurance Companies, and companies still have issues that should be solved.

The following issues are taken from an EIOPA review on Solvency II:

The first issue is related to Pillar 3 which is the most complex Pillar due to lack of transparency. EIOPA is asked to grade the ongoing appropriateness of the requirements relating to supervisory reporting and public disclosure and volume, frequency and deadlines of reporting and appropriate disclosure. Time is your greatest resource, so that means all companies need time to make sure the data they are reporting are accurate.

The second issue is related to Pillar 1 on technical provisions, own funds, the standard formula for the calculation of the SCR, and also on risk-mitigating techniques and other techniques used to reduce the SCR (EIOPA is examining possible solutions for segments such as non-proportional reinsurance and adverse development covers), on the MCR. (EIOPA reports experiences with the methodology for calculation in three cases

- Based on a confidence level of 85 % over one-period, determining whether the rules governing the calculation of the MCR continue to be consistent with the VaR method.

- Some issues that appear related to the identification of eligible basic Own Funds for composite insurers.

Proportionality is one of the main issues, which is discussed in the Council at the moment and EIOPA is asked to examine a further enhancement of the proportionality principle, particularly in the following areas:

- The appropriateness of the thresholds for exclusion from the scope of the Solvency II Framework Directive

- The possibility to waive certain requirements relating to some of the three pillars.

- Rules for the simplified calculation of sub-modules that form an immaterial part of the SCR of an individual insurance undertaking

Under Solvency II, long-term investments are the most important issue related to this topic. EIOPA is asked to assess whether the assumptions and methods behind the calculation of the market risk module reflect the long-term nature of insurance and whether they are reasonable and appropriate. Description of the characteristics of the insurance business and liabilities that enable insurers to hold investments over the long term and the assumptions and standards for calculating the market risk module, which reflects the behaviour of insurers as long-term investors.

Regardless that these issues still exist in Solvency II, it is a more effective regulation than Solvency I. The first positive thing is that by using Solvency II as an example, the required solvency capital is calculated based on the risk profile of the insurers. Insurers are required to calculate their required solvency capital as a total of their basic required solvency capital, the required capital to cover their operational risk, and a reserve that provides for insufficiently calculated technical reserves and deferred taxes. They must apply the fair value principles to assets and liabilities at the time of valuation, and for a period of 12 months into the future, insurance companies should maintain the value of their own funds at least equal to the required solvency capital.

By allowing these insurance companies to independently calculate the required solvency based on data from their own operations, Solvency II significantly eases compliance requirements. Specifically, it allows these companies to choose which parameters to use in the risk modules that refer to insurance risks using the standard formula for calculating the capital requirements.

Solvency II assumes that insurance companies are managed by professionals, with professional integrity and experience in managing financial institutions. Solvency II requires that each insurance company establishes a functionally independent internal audit department that is responsible for conducting an internal audit of the organization’s risk management function, responsible for periodically informing the supervisory body of the results of their audit. However, insurance companies must have at least one certified actuary, who monitors premium rates and calculates technical reserves and informs the management bodies about the solvency of Life Insurance companies through regular reports and meetings. The actuarial work influences the proficiency of the Life Insurance companies as a result of their assessments of reserves.

The final positive factor mentioned in this thesis is that having sufficient Own Funds above the amount arising from the technical provisions allows insurance companies to meet all obligations arising from insurance contracts as well as other obligations.

2.4 Meaning of Solvency II for Life Insurance Companies in North Macedonia

In the Republic of North Macedonia, there are basic conditions for preparing a regulatory framework for the adoption of Solvency II. So far, no research has yet been carried out on the possible quantitative implications of the introduction of changes in the regulatory framework for determining the required capital and available capital of insurance companies established in the Republic of North Macedonia. However, according to the characteristics and degree of development of insurance companies, some important changes can be expected.

In this section, the focus will be on the necessary changes in the regulations analyzed from different perspectives leading to the implementation of Solvency II in its entirety in the Republic of North Macedonia. Changes will be made in several parts of the current regulation, such as:

- Licensing of companies

- Capital requirements, calculation of required level and solvency margin, recognition and valuation of free assets

- Calculation and valuation of technical provisions

- Valuation and recognition of the assets that cover the technical provisions

- The tasks of the certified actuary

- Cooperation of supervisory authorities in the country and abroad

Some of these changes are among the most important that insurance companies will have to face over the coming years, however, others will arise. The procedures for obtaining permits and consent for undertaking insurance work in the Republic of North Macedonia are regulated by the Law on Insurance Supervision, adopted in 2002. After an analysis of the financial sector by the World Bank and the European Commission in 2007, in terms of compliance with the basic insurance principles and the amendments to the law adopted in 2007, the legal requirements relating to permits and consents were supplemented to reduce the risk of arbitrary interpretation. (European Commission, 2022). In this section, the changes that are referred to are the capital quantitative requirements for undertaking insurance work in separate classes of insurance, and the fulfilment of personal, technical and IT requirements relating to the capital requirements. The remainder of the legal requirements for obtaining a license are in accordance with Solvency II regulations and should remain unchanged.

The second amendment is one of the most important; it deals with capital requirements, solvency margin calculations, recognition, and free asset calculations. Chapter 5.3 of

this Master's thesis explains how the Solvency Margin is calculated in North Macedonia.

In addition to the stated thresholds in this Chapter which an insurance company must maintain a statutory value of capital which is dependent on the class of insurance, another quantitative requirement for maintaining the value of capital is also statutory. This refers to maintaining the value of the guarantee fund above a certain amount in euros as protection against an increase in the exchange rate of MKD to the euro. This will represent a risk of reducing or increasing the required capital in the future, which is the main issue explained in this thesis, that is, the problem of assets and liabilities mismatched due to currency risk.

The way of calculating the required level of solvency margin for performing Non-Life Insurance and/or reinsurance activities and for performing Life Insurance activities, as well as the calculation of available capital, must follow the Directives adopted by the European Parliament and Council, which are in use in the member states, using the concept known as Solvency I.

Deviations, mentioned at the beginning of Chapter 4.1.1, is concerning the requirements prescribed by the directives, and is the means of approving the capital category. In the Republic of Macedonia, the capital means the amount obtained after the calculation in the manner described in this chapter whereas in the member states of the European Union, capital means the total value of assets after the reduction of all foreseeable liabilities, and it is required that the solvency margin is calculated using the standard formula of Solvency II.

However, the new way of calculating the required capital for the solvency of insurance companies in the Republic of Macedonia should not cause significant changes in the required level of solvency margin for existing insurance companies.

More attention should be devoted to the prescription and implementation of mandatory requirements for the possession and maintenance of the value of own assets of insurance companies. Therefore, according to Solvency II, insurance and reinsurance companies are always obliged to possess acceptable Own Funds as a cover for the required capital for solvency and the minimum required capital.

The directive of the European Parliament and the Council known as Solvency II defines own funds as the sum of basic Own Funds and Additional Own Funds. Basic Own Funds consist of the following items:

1. Excess of assets over liabilities

2. Subordinated liabilities

Additional Own Funds consist of items that are not included in the basic own funds and which can be used by the insurance company for covering losses incurred from the operation. The following items are considered additional own funds if they are not already included as items in the basic own funds:

(a) Claims based on unpaid share capital or claims for unpaid initial capital

(b) Letters of credit and guarantees

(c) Any type of claim of the insurance and reinsurance company if they are legally founded i.e. if there are legal documents from which an obligation arises for the insurance and reinsurance companies

In cases where an insurance company considers additional Own Funds as part of its funds, it must receive approval from the supervisory authority. In such cases, the supervisory authority performs a careful and realistic assessment of the value of each item included in Additional Own Funds, in terms of whether and to what extent, they can be used to cover losses. If the item is part of the Additional Own Funds and reads at nominal value, the value of this item will be equal to its nominal value, as long as it adequately reflects its value to cover losses. The supervisory authority should approve either the monetary amount of each of the items included in the Additional Own Funds or the method that will be used to determine the amount of each of the items of the additional own funds. In these cases, the supervisory approval for the amount calculated using that method should be given for a limited period. Dependent on the characteristics of the assets, the classification is carried out according to the three pillars, whereby the insurance and reinsurance company must ensure that the sum of its Own Funds is at least the amount of the required capital for solvency, while the sum of its Own Funds, classified in the first and second pillars, should be equal to or greater than the minimum required capital.

In the sequel, technical provisions calculations and valuations will be explained. Insurance and reinsurance companies in the Republic of Macedonia calculate technical provisions in the manner prescribed by the Law on Insurance Supervision and the Rulebook on the Method of Calculation of Technical Provisions. With regards to integrating Solvency II into the legal system of the Republic of Macedonia, changes will be needed to the calculation and valuation of technical provisions, changes will also be needed in the regulations that refer to the acceptance of the methods used in the Solvency II chapter of this thesis. In particular, the new Solvency II directive regarding the calculation of the value of technical provisions as a sum of the calculated amount of best estimate and risk margin.

The real challenge for insurance companies, as well as the regulatory bodies in the Republic of Macedonia, will be the new way of valuing technical reserves according to Solvency II. Namely, technical reserves will be calculated as a weighted average of the

expected future cash flows, taking into account the time value of money and including a risk margin. Nowadays, claims reserves are usually calculated using traditional deterministic actuarial techniques, which rely on data on claims incurred. Under Solvency II, not only will these reserve calculations need to be discounted, but will also entail the preparation of payment projections, and a keen awareness of the uncertainty of these reserves will also need to be demonstrated. The same approach will be required concerning the determination of liabilities based on unexpired risks that insurance companies can calculate as part of the reserves for transferable premiums in the present.

As Macedonia adopts Solvency II regulation, technical reserves valuation and recognition of the assets that cover the technical reserves will also change. Insurance and reinsurance companies in the Republic of Macedonia, according to the provisions of the Law on Commercial Companies, have to apply international accounting standards (IAS) and international financial reporting standards (IFRS) in relation to the method of preparing financial statements, i.e. the method of recognition, measurement and disclosure of assets and liabilities.

These international accounting standards provide a general framework for the preparation of financial statements of public companies, including insurance and reinsurance companies. Very often the content of these standards is subject to different interpretations and there is a need to request interpretation. This implies a lengthy process, as it takes into consideration the legal competence of the regulatory authorities. The Insurance Supervision Agency adopted a rulebook that regulates additional issues that are not regulated by law and refer to the method of valuation of certain items from the balance sheet of insurance and reinsurance companies, as well as regulations on the permitted investment of funds covering technical provisions.

Claims based on insurance are considered admissible assets that cover the technical provisions, but the ratio cannot be higher than 20% of the net reserves for transferable premiums. For these claims, the insurance and reinsurance companies will have to conduct the accounting policy of assessment, categorization and valuation to the extent that it can be carried out for each individual debtor. The claims and reserves will be categorized according to maturity.

In the short term, such regulations are expected to require more careful management of the sale of insurance policies and a subsequent reduction in profits in the first years after the application of the regulation. However, it will result in improved liquidity of insurance companies in the long term.

Regarding the reinsurance program after the implementation of Solvency II in the Republic of Macedonia's perspective, care should be taken as to whether the insurance companies in the Republic of Macedonia can, and have, the institutional capacity and the willingness to perform an analysis of the credit risk of reinsurers. In addition,

whether they can and have the will to do regular basis calculations on the impact of these risks on the available capital and the required capital. Credit risk, in this case, refers to the probability that the reinsurer will not fulfil the obligations under the reinsurance contracts concluded with the (re) insurance companies that are established in the Republic of Macedonia. The degree of development of insurance supervision in the Republic of Macedonia is important from the perspective of the Supervisory Authority's role in ensuring that insurance companies in the Republic of Macedonia are solvent under the new Solvency II rules. The Macedonian insurance companies must also demonstrate the willingness to establish and maintain international cooperation with the relevant insurance supervisory authorities of the countries in whose territory these reinsurance companies are established. i.e. with the countries in whose territory the retrocession companies are established which, in the subsequent reinsurance arrangements, take over the insurance risk.

In connection with the acceptance of Solvency II and the new capital standards for insurance companies, insurance companies and regulatory bodies should be aware of the function of the actuary. Actuaries must have a greater presence in the work meetings related to the planning and drafting of the new regulatory framework. Hence, it would be desirable to consider the possibility of institutionalizing this profession in the Republic of Macedonia.

Through the exchange of data and information, supervision authorities can plan and implement more efficiently and effectively and provide a more in-depth analysis of the risk profile of financial institutions. The directives of the European Council and the European Parliament establishing Solvency II in the member states of the European Union contain a separate chapter that refers to the cooperation of the competent authorities, as well as integrating and coordinating the recommended processes and procedures of insurance supervision into the insurance companies globally.

The Macedonian Insurance Companies and the Macedonian Supervisory Authority should be aware of the changes and start to prepare early for the challenges which will arise from the new regulation.

In Solvency II, much more importance is given to market risk, which causes an increased need to use Asset Liability Management. In Chapter 5, the Asset Liability Management concept is explained in a more detailed way.

3 ASSET LIABILITY MANAGEMENT

3.1 Brief History and Definition of Asset Liability Management

When we mention a concept, we need to explain its origin. In this case, our concept is Asset Liability Management. If we look at its origins, we recognise Reddington and how his technique has evolved to structure assets and liabilities in a manner that reduces

the effects of interest rate fluctuation. (Cambridge University, 2021). For this immunization, we can see more flexibility when compared to absolute matching since it does not require exact matching between each asset cash flow and each liability cash flow.

From the beginning of its development to the present day, Asset Liability Management has undergone numerous changes. Furthermore, the current definition of ALM states that ALM is an ongoing process of formulating, checking, and revising strategies linked to asset and liabilities strategies to accomplish a company's financial goals, given the company's risk tolerances and other constraints (Baznik, Beach, Greenberg, Isakina & Young, 2003).

Redington's discovery linked many concepts in his model, including the concept of duration, which was developed by Macaulay (1938) and Hicks (1939) and subsequently reintroduced by Samuelson (1945) and Redington (1952).

The primary purpose of ALM is to reduce interest rate risk, which was a major problem in the 1970s when interest rates increased and became more volatile. Volatility proved a problem for many insurers, and consequently, insurance regulations had to find a way to solve this issue. This problem affected developed countries and resulted in losses due to asset and liabilities mismatch. During the 1970s all assets and liabilities were held at book value which hid financial risk arising from the market fluctuation of value.

In solving the risk arising from the market fluctuation of value, the regulators have taken a few steps forward. Firstly, the implementation of mandatory annual analysis to verify their interest rate risk management, Secondly, the National Association of Insurance Commissioners amended the Standard Valuation Law in 1990 after an in-depth analysis of the impact of several scenarios where different interest rates of the cash flow of asset and liability were taken.

The growth of the insurance market has further increased the importance of ALM. Due to Solvency II regulation, ALM modelling has become "mandatory", not only in the insurance sector but in all financial institutions. ALM is the process of evaluating an insurance company's exposure to asset-liability risk, defining its risk tolerance and its financial goals and subsequently planning the actions it should take to limit exposure to risk while reaching those goals. (Brainmize, 2022).

ALM has two goals, the first goal is to cover liquidity and interest rate risk to ensure the solvency of the company, that is, evaluating its capability to meet all its financial obligations, and the second goal is to increase the profitability of the company.

As previously stated, ALM has particular relevance to the insurance industry, because one of the key objectives in the insurance business is to guarantee the solvency of the insurance company itself.

The ALM process acts as a link between risk management and strategic planning, as it offers solutions to mitigate and hedge risks arising from the interface between assets and liabilities, but it also ensures good practice in both the insurance and banking sectors. (Corlosequet-Habart, Gehing, Janssen & Mance, 2015).

ALM plays a central role in an insurance company's financial strategy. The other focus of ALM is ensuring the proper coordination of assets and liabilities necessary to achieve a financial goal while incorporating an accepted level of risk under predefined constraints. ALM studies produce recommendations on marketing strategy and asset allocation as well as calculating the capital requirement for market risks in the respective ALM framework.

The concept of ALM has continued to be used and perfected by insurance companies to the present day for several reasons. Firstly, to achieve a financial goal with an acceptable level of risk within predefined constraints through strategic coordination of assets and liabilities.(Gilbert, 2016).

Secondly, ALM produces studies that provide recommendations on marketing strategy and asset allocation.

And finally, ALM can be used to calculate the capital requirement for market risk under Solvency II regulation, which is also part of this thesis.

This Master Thesis focuses on the first reason which is related to asset liability mismatching. Various variables are used such as interest rates, macroeconomic indicators, currency rates, and other market variables. Insurance companies aim to manage the balance between resources and expenses, that is, assets and liabilities when they take on risk while conforming to a regulatory framework and the desired profitability level. (Giandomenico, 2016).

To model liabilities, policyholder behaviour is analyzed to determine all liability possibilities and outcomes, and the type of insurance products should also be taken into consideration. These liabilities are determined by the contract agreed with the client. From the contract, we can see the premium payable to the company, the sum payable to the beneficiary in case of the insured's death and the conditions for the surrender of the policy before termination. Insurance liability is affected over time until termination by the probability of death of the insured and the likelihood of the policy being surrendered, also there are other things like options and quarantees build into life products. As a result, the liability represents the expected present value of the payments until the contract termination. The most important thing that actuaries should consider is the distribution of potential future outcomes when determining the Best Estimate Liability and the Best Estimate Assumptions.

An insurance company must manage interest rate risk since assets mainly consist of bonds, in addition to liquidity risks, when it cannot sell an asset or liability at its valuation price, and currency risks which are fluctuations in currency prices.

To understand the concept of asset-liability mismatch and why it occurs, we first need to get acquainted with the balance sheet of an insurance company. The balance sheet is a measure of the solvency of the insurance company and shows the construction of the owner's investment which is the most crucial part as it protects creditors. The balance sheet is a standard report that complies with accounting standards globally A balance sheet, regardless of whether it is from a financial or non-financial institution, shows that the assets (active) are equal to the equity plus liabilities (passive). The assets can comprise various subcategories, but this Master's Thesis will focus on financial instruments. Financial instruments can be classified into the following:- bonds, both corporate and government, stocks, mortgages, real estate holdings and policy loans. From the balance sheet point of view, the assets can be split into two groups: one group of assets with short-term duration, and the other one with long-term duration. This is important because it shows whether assets are matched with the liabilities side of the balance sheet or they are not matched. Contractual obligations for benefit payments, such as life insurance policies, can be settled through the general account, and investment risk pass-through products, such as Variable Annuities and Variable Life Insurance are held in a separate account. Under US legislation, you may only invest in common stocks or bonds, or a combination of these investments. One of the tasks in this thesis is to demonstrate how the government can issue bonds and how these bonds can play a role in stimulating the insurance sector. Bonds can be defined as publicly traded debt securities, which often have low risk and a greater certainty of return. Insurance companies are major investors in bonds. The two main characteristics of bonds are maturity and quality. Bonds have an expiration date which is sometime in the future, and this is known as the maturity date. If we take statistical data of Life Insurance companies in the USA, we can see that in 2018, 30 % of general account bonds held a maturity of between 5 and 10 years, the other 25 % matured over 20 years and only 7 % had a maturity of one year. (PWC, 2017). The second characteristic of the bond is quality. Quality bonds have a lower risk, and investors can be assured that their money will be returned at maturity. Investors should investigate the quality of bonds before purchasing them. To conclude, bonds of high quality are therefore ideal for capital accumulation over the long term. Bonds are categorized, into six quality classes which are established by the National Association of Insurance Commissioners, and this categorisation is similarly used in the EU.

An insurance company's liabilities include a certain amount of the benefit it promises to pay to policyholders and beneficiaries, sometimes in the form of invested returns, as well as other obligations in an insurance contract. Life Insurance liabilities tend to be long-term in nature. For example, in a Whole Life Insurance type which has a duration of 28 years, an individual would pay a certain benefit in the future upon the death of this

28-year-old. The insurance company may not expect to pay out an amount of money so soon since they would expect a 28-year-old to live many years before he/she dies. This major characteristic, to a large extent, determines the type of investment strategy a Life Insurance company takes on. Insurance liabilities are also known as balance sheet reserves and are used to pay any claims filed by clients. According to the state where the company is based, there are different standards for setting up balance sheet reserves. An insurance company is legally required to maintain balance sheet reserves to guarantee that it can pay any claim, or benefit promised to policyholders.

Life Insurance companies should assess and maintain the following technical and mathematical provisions as follows: Mathematical Reserves, Unearned Premium Reserves, Reserve for additional benefits, Reserve for claims reported but not settled (RBNS), Reserves for claims incurred but not reported (IBNR), Reserve for unexpired risk, which represents a part of the liabilities of one insurance company.

Some important features of assets and liabilities are listed in this chapter, and how a mismatch can occur between those two items which together with equity constitute the balance sheet.

The mismatch between assets and liabilities can occur because of fluctuations in the risks to which every insurance company is exposed. Some of the risks will be explained below, but the most important one in the context of this thesis is market risk.

The balance sheet shall show assets and liabilities at the end of the financial year. First, the assets will be classified. An asset is a resource controlled by the enterprise as a result of past events and from which future economic benefits are expected to flow to the enterprise, in addition, the asset is recognized in the balance sheet when it is probable that the future economic benefits will flow to the entity and the asset has a cost or value that can be measured reliably (IFRS Framework, 4.44).

We notice a significant difference between a balance sheet from an insurance company and one from another financial institution. Considering the characteristics of Life Insurance liabilities, most of the Life Insurance company's assets will be invested in long-term fixed income assets such as bonds, prefered stocks, and mortgage loans. A predetermined amount of money will be paid at set times with these assets, which is a perfect tool for financing future obligations. A state may regulate what types of assets an insurance company may invest in, as well as how risky they may be. A company's invested assets are also assessed by rating agencies and stock analysts during the rating process.

According to Life Insurance policies, a life insurer's liabilities include benefits promised to policyholders and their beneficiaries, calculated according to the return expected on their investments and other obligations. Liabilities arising from Life Insurance are usually long-term in nature. A 30-year-old with Whole Life insurance, for

example, would get a certain benefit in the future if he or she died, while a 20-year-old is predicted to live many more years before he/she dies, and the insurance company would not expect to pay out such a large sum in the near future, therefore, the 20-year-old would pay a lesser premium. A Life Insurance company's investment strategy is largely determined by this major characteristic.

Implementing a framework of ALM can offer a lot of benefits for the whole financial sector. One of those benefits is the ability to understand the dynamics of assets and liabilities. The most significant part of ALM allows insurance companies to identify the risk present on their balance sheet and to reduce risk resulting from the mismatch which can occur between assets and liabilities. We will discuss two aspects of ALM in this Master's Thesis. The first one will be a mismatch between asset and liability duration, and the second one will be a mismatch caused by currency exchange rate risk.

3.1.1 Duration Mismatch Between Assets and Liabilities

To understand how duration mismatches occur, we need to understand how insurance companies behave in the capital market. Policyholders pay a predetermined amount of premium to the insurance industry in advance. The insurance company takes on the risk that is, they transfer risk from individual entities. Typically, the amount an insurance company collects from the insured person for their premiums is greater than the total amount it pays to them for the sums insured (the difference represents the insurance company's profit).

Securities are a major form of investment for insurance companies. Insurance companies that invest in securities usually invest in highly liquid securities. It is much easier to create a diversified portfolio in the field of Life Insurance, as it has much higher predictability of collection and payout. For insurance companies to be efficient, it is important to have the ability to manage large sums of money on their own. Since Life insurance is dominated by stable long-term sources of funds, it makes sense for the company to invest predominantly in long-term bonds. A duration mismatch can occur when assets (bonds and other assets) have a shorter duration of insurance liability, therefore ensuring that this doesn't occur is one way to avoid such a mismatch. American and Japanese insurance companies' assets are dominated by bonds, which account for over half of their total assets. (Kazutoshi, Yoshiyuki, Yoshiyuki & Shinichi, 2013). European Union directives related to life insurance and other types of insurance determine the structure of assets of insurance companies. Moreover, Macedonian regulations follow European regulations and have a few of their own specific limitations related to insurance companies' investments. One of these limitations is that they cannot invest in EU bonds, only in domestic ones. This is a negative aspect of Macedonian regulation and should be changed in the future. Conservative investment policies are predominant among insurance companies. As quoted above, the majority of their bonds are high quality. A few insurance companies are very active in trading their securities to

take advantage of interest rate changes, another risk that ALM manages. To increase return on investment, some insurance companies purchase low-rated bonds.

The structure of the insurance portfolio is primarily dependent on the activity with which the company deals, as well as on the portfolio size. When placing their assets, the insurance company is not interested in the risk and the yield of a specified financial instrument but in the overall performance of the portfolio made up of different financial instruments. Most of the portfolios in insurance companies consist of government bonds because most countries have regulations which contain certain incentives, such as exemption from tax for insurance companies if they invest in such securities. In addition, insurance companies invest in property and corporate bonds with attention given to their rating when they are purchased. For the construction of the portfolio, they use different strategies such as passive and active investment strategies. Passive portfolio management is investing according to known advanced rules and based on historic data. The active strategy is based on current forecasts.

Regardless of whether the portfolio is built using an active or passive method, every portfolio holds a certain degree of risk. This is one of the reasons why insurance companies apply risk-reduction strategies such as ALM.

One of the strategies used by insurance companies is immunization of the insurance portfolio, and the second one is the duration of the portfolio. If the majority of an insurance company's portfolio is invested in long-term bonds, the question is about how such a portfolio will perform under fluctuating interest rate conditions. This is an additional issue dealt with by ALM. Interest rates will sometimes cause a reduction in the price of bonds, and consequently, there will be a capital loss for insurance companies. Portfolio management can help to mitigate the loss by increasing reinvestment returns or investing in new bonds with greater returns. However, each change in the opposite direction will incur the risk of reinvesting. This means that compensation of loss is not always possible, since the duration of the bonds and duration of the liabilities are different. The duration which is left from the bond side would not be equal to the duration of the new bonds. Immunization, however, provides for a reduction in the risk of reinvestment, or capital compensation. This is accomplished by purchasing bonds with a duration that corresponds to the investor's liability maturity dates. Based on the concept of duration, portfolio immunization is achieved by establishing a portfolio of bonds with an average maturity that corresponds to the average maturity of the liabilities side of the balance sheet. A second alternative is the purchase of swaps or futures.

The duration mismatch between assets and liabilities is the source of interest rate risk. When the maturities of assets and liabilities match, the change in the market value of assets and liabilities is almost the same if the interest rates of all maturities rise at the same pace. Thus, the market value of net assets is calculated as the difference between

assets and liabilities. Furthermore, when the duration mismatch is large, fluctuations in the market value of net assets can increase due to an interest rate change. When the maturity of liabilities for life insurance companies is lengthy, an increase in interest rates reduces the market value of liabilities more than that of assets, and consequently net assets increase. The amount of interest rate risk on the asset side of life insurance companies balance sheets rises when interest rates of all maturities rise, reflecting the rise in long-term government bond investments. On the other hand, the amount of interest rate risk on the liabilities side exceeds that on the asset side. This means that when the interest rate declines, the market value of net assets decreases.

Interest rate risk is calculated based on changes in the market value of assets and liabilities, but the solvency margin ratio for Macedonian Life insurance companies does not reflect the market value of liabilities. As quoted previously, life insurers are exposed to interest rate risk, and their liability side is more sensitive to interest rate changes than their asset side.

On the asset side, our focus will be on bonds, because they are the most common financial instrument used by Life Insurance Companies in the Republic of North Macedonia.

Duration is a measure of the sensitivity of the price of the bond to a change in interest rates, and because many forms of duration measurements are also computed in years, the length of the bond is frequently confused with its term or time to maturity. In other words, the duration can measure how long it takes, in years, for an investor to be repaid the bond's price through the bond's total cash flows; in this case, the duration can also measure the sensitivity of a bond or fixed income portfolio's price to changes in interest rates. For example, the higher the duration, the more a bond's price will drop as interest rates rise, the consequence is an increased interest rate risk. Using numbers to illustrate: If the rate increases by 1%, a bond that has a five-year average duration would be likely to lose approximately 5% of its value. Two situations can affect a bond's duration. The first case is the time till maturity, which explains why if we have longer maturity, we also have a higher duration and that means a greater interest rate risk. For example, if we make a comparison of two bonds that each yield 5% and cost €1,000 but have different maturities, we can conclude that the bond that matures faster, with a maturity of 5 years, would repay its true cost faster than the other bond with a maturity of 10 years. From this, we can conclude that the shorter-maturity bond would have a lower duration and therefore less risk. The second case is the coupon rate which represents a key factor when we want to calculate duration and is the rate of interest paid by bond issuers on the bond's face value. In the case where we have an identical bond but with a different coupon rate, then the bond with the higher coupon rate will pay back its original costs faster than the other bond. From this, we can conclude that the higher the coupon rate, the lower the duration, and the lower the interest rate. That also means a bond with a higher coupon rate will pay back its original costs faster.

It is essential to know the duration of Life insurance to match assets and liabilities which is the main theme of this thesis. Macaulay Duration is one way to calculate the duration of a bond.(McCaulay, 2013). In the sequel, we will present a definition and one example of how duration can be measured.

The Macaulay Duration is the weighted average term to maturity of the cash flow from a bond. The weight of each cash flow is determined by dividing the present value of the cash flow by the price.(Corporate Finance Institute, 2022).

Below is the formula used to calculate duration (Nickolas, 2021).

$$Macaulay\ Duration = \frac{\sum_{t=1}^{n}(\frac{t*C}{(1+y)^t}+\frac{n*M}{(1+y)^n})}{Current\ Bond\ Price} \quad (8)$$

In the formula above:

t = respective time period

C_t = periodic coupon payment

y = periodic yield

n = total number of periods

M = maturity value

Current Bond Price = present value of cash flows

Let's assume that a €1,000 face-value bond pays a 6% coupon and matures in three years and the interest rate is a 6% coupon and has a maturity of three years. Interest rates are 6% per annum, with semiannual compounding. The bond pays the coupon twice a year and pays the principal with the final payment. (James Chen, 2020).

The cash flow that is expected over the three years is separated into 6 periods, which means €30 from Period 1 to Period 5 per period, and for period 6 - €1,030. We know that for each period if the cash flow is known we should calculate a discount factor and for that we use the following formula;

$$Discount\ factor = \frac{1}{(1+r)^n} \quad (9)$$

r = interest rate

n = period number

In the sequel the discount factor for all 6 periods will be calculated;

$$Discount\ factor\ 1 = \frac{1}{(1+0.03)^1} = 0{,}97\ ; \quad (10)$$

$$Discount\ factor\ 2 = \frac{1}{(1+0.03)^2} = 0.94\ ; \quad (11)$$

$$Discount\ factor\ 3 = \frac{1}{(1+0.03)^3} = 0.91\ ; \quad (12)$$

$$Discount\ factor\ 4 = \frac{1}{(1+0.03)^4} = 0.89\ ; \quad (13)$$

$$Discount\ factor\ 5 = \frac{1}{(1+0.03)^5} = 0.86; \quad (14)$$

$$Discount\ factor = \frac{1}{(1+0.03)^6} = 0.83; \quad (15)$$

The next step is multiplying the period's cash flow by the period number and by its corresponding discount factor to find the present value of the cash flow:

Period 1: $1 \times €30 \times 0.97 = €29.13$ (16)

Period 2: $2 \times €30 \times 0.94 = €56.56$ (17)

Period 3: $3 \times €30 \times 0.91 = €82.36$ (18)

Period 4: $4 \times €30 \times 0.88 = €106.62$ (19)

Period 5: $5 \times €30 \times 0.86 = €129.39$ (20)

Period 6: $6 \times €1{,}030 \times 0.83 = €5{,}175.65$ (21)

$\sum_{n=1}^{6} = €5{,}579.71$ (Note: numerator of the formula above)

$Current\ Bond\ Price = \sum_{PV\ Cash\ Flows=1}^{6} = 30 \div 1 + 0.03^1 + 30 \div (1+0.03)^2 + \cdots + 1030 \div (1+0.03)^6 = €1{,}000$

If we put the current bond price (€1,000) in the formula (4.1.1) above we will obtain a Macaulay Duration of 5.58 years.

In the sequel, there will be a description of how we can apply Macaulay Duration in the case of insurance liabilities using an example from Milliman (2019).

For this calculation, the interest rate used is 4.50%. Table 8 below will explain how Macaulay Duration is calculated.

Table 8: Macaulay Duration calculation

Time (1)	Age (2)	Amount (3)	Discount amount (4)	(5) = (4)/90.058 Disc Weight	(1)*(5) Weighted Time Average
0	60	0	0	0.00%	0.0000
1	61	0	0	0.00%	0.0000
2	62	0	0	0.00%	0.0000
3	63	0	0	0.00%	0.0000
4	64	0	0	0.00%	0.0000
5	65	10.000	8.025	8.91%	0.4455
6	66	10.000	7.679	8.53%	0.5116
7	67	10.000	7.348	8.16%	0.5712
8	68	10.000	7.032	7.81%	0.6247
9	69	10.000	6.729	7.47%	0.6725
10	70	10.000	6.439	7.15%	0.7150
11	71	10.000	6.162	6.48%	0.7526
12	72	10.000	5.897	6.55%	0.7857
13	73	10.000	5.643	6.27%	0.8145
14	74	10.000	5.400	6.00%	0.8394
15	75	10.000	5.167	5.74%	0.8606
16	76	10.000	4.945	5.49%	0.8785
17	77	10.000	4.732	5.25%	0.8932
18	78	10.000	4.528	5.03%	0.9050
19	79	10.000	4.333	4.81%	0.9142
		SUM	90.058	100%	11.18
				Macaulay duration	11.18

Source: Milliman, 2019

We can conclude that life insurers are exposed to interest rate risk because of the duration mismatch between assets and liabilities. Managing this risk is the task of ALM, it focuses on reducing the duration gap and protecting portfolios against interest rate fluctuations. To hedge the interest rate risk exposure, life insurers strategically manage their asset portfolios, which primarily consist of bonds, to align the duration of their assets with liabilities. The asset-liability portfolios of life insurance are typically mismatched. Exposure to interest rate risk for Life Insurance Companies in the Republic of North Macedonia exists by investing in bonds. The explanation of the example of calculating duration using Macaulay's Duration (

Table 9) will be explained in more detail in Chapter 4.1.1.

The interest rate can affect the duration of the bond portfolio in two ways. The first way is that the duration is a function of the interest rate, which means the interest rate changes the duration of the assets, even if the company holds the bond. The second way is that the interest rate may change the duration because insurers might react to the interest rate change by restructuring bond portfolios.

How life insurers react to interest rate movements is important and of interest. ALM structures the balance sheet in such a way that all changes in the value of liabilities correspond to an equivalent change in the value of assets. Theoretically, the simplest

and most effective technique consists of cash flow matching, however, the costs are high

A good example is in the case of life insurance companies, however, it is difficult to find assets with durations equal to those of certain liabilities. In the Macedonian Life Insurance Market, the government should issue more bonds with long durations. In addition, insurance companies portfolio's should include other derivatives such as swaps which are a useful tool to deal with duration mismatch between assets and liabilities This is the goal of this Master's thesis.

In practice, ALM aims to reduce the gap between the sensitivity of assets and liabilities to interest rate changes. Duration can initially be used as a proxy for sensitivity. It is, therefore, necessary to refine this management approach by measuring not only the duration but also the convexity, which can then be used to estimate the second-order effects, as duration estimates only the first effects of a change in the rate of return on assets or liabilities. We can conclude this chapter with a more realistic example of the life insurance companies to better understand the duration issues.

Assume that we have a classic example taken from Interest rates and Security valuation where an insurer pays a lump sum when the holder reaches retirement age. In this case, a Life Insurance Company has the risk that interest rates on the funds generated from investing the policyholder's premiums have decreased. Thus, the accumulated returns on the premiums invested do not reach the promised amount. In effect, the insurance company can pay that amount by drawing on its reserves and net worth to meet its commitments.

For this example, we will assume that it is 2019 and the insurer must make a guaranteed payment to an investor in five years -2024. For simplicity, we can assume that the target guaranteed payment is €1,469, a lump-sum policy payout on retirement, equivalent to investing €1,000 at an annually compounded rate of 8 % over five years, bearing in mind that in a real case scenario this amount will be much higher.

So to meet this liability, the insurer needs to determine which investments would produce the cash flow equivalent to the exact amount of liabilities that we have, in this case, €1,469 in five years. As stated previously, one way to protect the insurer is by investing in the exact duration (5 years) coupon bond. This is the case, when we have a €1000 face value and an 8% yield and we can assume that there is annual compound interest, the current price per five-year discount bond is €680,58 which we can calculate in the following way if we use equation (9):

$$P = \frac{1{,}000}{1{,}08^5} = 680{,}58 \tag{22}$$

This means that if the insurer buys €1,469 of these bonds at a total cost of €1000 in 2019, this investment would produce €1,469 on maturity in five years. The reason is that the duration of this bond portfolio exactly matches the target horizon for the insurer's future liability to its policyholders. Intuitively, since the insurer of discount bonds pays no intervening cash flows or coupons, future changes in interest rates have no reinvestment income effect, and because of that, the return would be unaffected by intervening interest rate changes.

However, it may not always be possible to perfectly match assets and liabilities. Most commonly, this is because the duration of life insurance is longer than the duration of assets which are available on the market, therefore in the case above we selected the 5-year bond, which does not have an exact duration match with the liabilities that the insurer has obligations to pay to the policyholder.

Table 9: Calculation of Macaulay duration

T	CF_t	$\frac{1}{(1+8\%)^t}$	$\frac{CF_t}{(1+8\%)^t}$	$\frac{CF_t * t}{(1+8\%)^t}$
1	80	0.9259	74.07	74.07
2	80	0.8573	68.59	137.18
3	80	0.7938	63.51	190.53
4	80	0.7350	58.80	235.20
5	80	0.6806	54.45	272.25
6	80	0.6302	680.58	4,083.48

Source: Faculty Babson, 2011

The calculation of the duration of this bond is:

$$Duration = \frac{4{,}992.71}{1{,}000.00} = 4.993\ years \quad (23)$$

In this case, the portfolio manager may seek to invest in appropriate duration coupon bonds to hedge interest rate risk. Take into consideration a six-year maturity bond with an 8 % coupon which is paid annually, an 8 % yield and €1.000 face value. Our interest lies in the duration of the bond which is calculated at 4.993 years. So, if we potentially buy this bond, the duration exactly matches the insurer's target horizon. In the sequel, we will explain that the cash flow generated is €1,469, regardless of whether the interest rate stays as we predict at 8%, immediately rises to 9% or falls to 7%. Thus, buying a coupon bond whose duration exactly matches the investment time horizon of the insurer, also immunizes the insurer against interest rate changes.(Yifan,2020).

To start with the example that the interest rate falls to 7%, calculating the coupons gives €400 (5 * €80), the reinvestment income is 60, and the bond sale proceeds to 1,009. If

we take the sum of these three, we get exactly €1,469. These three parts are crucial when the interest rate decreases.

The following analysis will be about the coupons which are unchanged since the insurer still receives five annual coupons of €80.

If we analyse the reinvestment income, we will see that the coupons can now be reinvested but at a lower rate of 7%. Thus, at the end of five year annual coupons of €80.

$$(FVIFA_{5,7} = 80 * 5.5751) = \text{€}460 \quad (11)$$

In this instance, the coupon payments are €60 (calculated as the difference between original coupon payments and the coupon payments with 7%), meaning that in this case, investors have 9% less reinvestment income at the end.

If the six-year-maturity bond is sold at the end of the fifth year with one cash flow of €1,080 remaining, then the investor would have to pay more than €1,009 which is calculated when 1,080 is divided by 1.07.

From this case, we can conclude that the bond can be sold for €9 more than when rates were 8%. The reason is that investors can get only 7% on newly issued bonds, but this older bond was issued with a higher coupon of 8%. A comparison of reinvestment income with bond sale proceeds indicates that the decrease in rates has produced a gain. This offsets the loss of reinvestment income of €9 as a result of reinvesting at a lower interest rate. But most importantly, the total cash flows remain unchanged, and the amount is €1,469.

The second scenario which is possible is that the interest rates go up by 1%. In that case, the percentage will be 9. What will the effects be on coupons, reinvestment income, and bond sale proceeds? The rise in interest rates leaves the final terminal cash flow unaffected at €1,469. We can explain that if we take the rise in interest rate immediately generated as extra reinvestment income, but the price at which the bond can be sold at the end of the fifth year has declined by the same as the capital loss in this case when it is €9. In this case, the bond sale is €991. And at the end, we can conclude that the gain in reinvestment income is exactly offset by the capital loss on the sale of the bond.

The issue related to this protection strategy is that the maturity of assets was shorter than that of liabilities since the holdings of super-long-term government bonds which exist on the market are not sufficient. In 2018, for the first time in the Macedonian market, the government issued a 30-year government bond. To resolve the mismatch, life insurance companies should increase their investment in super-long-term government bonds. It is important for the Government and Ministry of Finance in North Macedonia to be aware of how important and helpful for insurance companies it is to issue

Government Bonds of long duration to reduce the mismatch between assets and liabilities. In addition, there is a low-development procedure (means that they do not pay attention of the procedures to check how insurance companies deal with the duration risk) that ISA can use to check whether Insurance Companies are matching correctly. In Appendix 4 we can see the interface of the data which companies submitted to the Regulatory Body in North Macedonia.

3.1.2 ALM and Foreign Exchange Risk

ALM deals with foreign exchange risk. Foreign Exchange risk can be defined as the change when an investment's value decreases or increases due to changes in currency exchange rates. Foreign exchange risk refers to the losses that an international financial transaction may incur due to exchange rate fluctuations. (Mangat, 2012)

On the other hand, currency risk means the sensitivity of the values of assets, liabilities and financial instruments to changes in the level of currency exchange rates or the volatility of currency exchange rates. This risk comes from the sensitivity of the value of assets, liabilities and financial instruments to:

- the level of currency exchange rates

- the volatility of currency exchange rates

For a better understanding of the concept of foreign exchange risk, we can look at the concept from the balance sheet point of view. A balance sheet is one of the four most important financial reports, that life insurance company should submit to ISA at least once a year.

The regulatory authority (ISA), regulates the financial reports, and one of the most important rules which life insurance companies should follow is that items regardless of their position on the asset or liabilities side, should be written in the national currency (MKD) in Macedonia. There is where the currency issue begins.

Life Insurance Companies in the Macedonian Insurance Market on the liabilities side must denote mathematical provisions in euro. There are a lot of questions about why in real life insurance companies adopted this practice when the obligations related to some of the life insurance products must be paid in Euros, as this practice, exposes them to foreign exchange risk.

Using an example to explain the issue that Macedonian Life Insurance should aim to solve is as follows.

Let's assume that on the liabilities side we have 1.000.000 €. Mathematical reserves are calculated in euros. For the purpose of this example, let's say the foreign exchange rate

is 1 euro = 61 MKD. This assumption is true if the *ceteris paribus* is met, which means that all other indicators remain the same.

One indicator that we used for this scenario is the foreign exchange rates and their consequences on the balance sheet equation. Suppose a change od 10% in the foreign exchange rate, then the ratio between the euro and MKD will change. In this scenario, we will use the exchange rate between the two currencies as follows 1 euro = 67.1 MKD. As a result of all items on the balance sheet staying in MKD asset-liability mismatch can occur. The passive side of the balance sheet will grow with the changes in interest rates, but the asset side will stay the same. If we take into consideration the change which occurred in the ratio between the two values, the liabilities side will have a value of 67,100,000 MKD.

If we have grown on the liability side and the asset side stays the same there are negative foreign exchange differences. This item is part of the income statement classed as an expense. As they are part of expenses, if the expenses increase by the amount of the negative currency differences, it will have an influence on the capital, which consequently has decreased. The Solvency ratio of the company will decrease as well.

Life Insurance Companies should pay attention to this problem because this problem is related to the Solvency of the Insurance Companies.

ALM will determine the right protection to protect Insurance companies. There are several ways that it can help to protect the companies. Firstly, investing the same amount in our scenario 1.000.000 on the asset side as financial instruments in domestic currency, but related to the FX clause. This is an efficient way to protect against foreign exchange currency risk. If we have a devaluation of the MKD value, not only will liabilities be increased by the changes, but there will be the same effect on the asset side. With this kind of protection, we can neutralize the negative currency difference which exists as a value on the income statement.

Attention should be paid to the identification of which position in the balance sheet is related to currency risk and for that item, we should choose the right investment instrument in the same currency.

In Macedonia, companies are exposed to foreign currency risk inherent in financial investment as well as in assets and liabilities arising out of reinsurance activities, however, the companies do not apply any special financial instruments as a hedge against their risk, since such instruments are not in common use in the Republic of North Macedonia.

Furthermore, one real case from Triglav insurance Ad Skopje will be explained. First, take into consideration which asset is related to euro fluctuation. We can see from Table 6 the structure of assets and liabilities in the currency amount.

Table 10: Notes to the financial statement

31 December 2019	EUR	USD	Other FC	MKD	Total
Financial assets					
Financial investments	459,280	-	-	1,128,356	1,587,636
AFS	459,280	-	-	642,827	1,102,107
Debt instruments	459,280			637,196	1,096,476
Equity instruments	-	-	-	5,631	5,631
Loans and receivables	-	-	-	485,529	485,529
Deposits (term),GF investments and loans	-	-	-	481,024	481,024
Debt instruments (Treasury Bills)	-	-	-	4,505	4,505
Reinsurers' share of technical provisions	180,160	38,108	3,588	-	221,856
Receivables	9,515	-	-	350,014	359,529
Other assets	-	-	-	5,527	5,527
Cash and cash equivalents	52	-	-	14,918	14,970
Total financial assets	**649,007**	**38,108**	**3,588**	**1,498,815**	**2,189,518**
Financial liabilities					
Insurance technical provisions	250,593	-	20,266	1,070,532	1,341,391
Employee benefits	-	-	-	13,978	13,978
Other provisions	-	-	-	9,404	9,404
Financial liabilities	-	-	-	1,724	1,724
Lease liabilities				65,247	65,247
Operating liabilities	54,945	37,258	944	24,396	117,543
Other liabilities	1,841	-	-	71,941	73,782
Total financial liabilities	**307,379**	**37,258**	**21,210**	**1,257,222**	**1,623,069**

Source: Triglav (2019)

North Macedonia Insurance companies are exposed to euro fluctuations. Table 10, above, shows Triglav Insurance AD Skopje financial statement, if there is a 10% increase or decrease in MKD to the euro exchange rate. If we compare that to calculate the table above, they used the foreign exchange rate from 31.12.2019, which was 61.4856.(NBRM, 2021). The sensitivity analysis includes outstanding foreign currency rates. As we said in the previous part, if we make liabilities increase by a 10% change in foreign exchange rates, the new value of the currency rate will be 67.6285. If we calculate the liabilities by applying the new currency rate that will be 338,088,000.

If we subtract the old value of the liabilities from the new one, we can conclude that there is a negative currency difference which will directly affect the capital of the insurance company. In this case, the difference is 30,709 MKD.

Applying the same foreign exchange rate on the asset side, since the Company's assets which are denominated in foreign currency are much higher than the liabilities, strengthening of MKD against the euro (10 % decrease) would lead to negative exchange rate differences, whereas, weakening of MKD against the EUR (10 %) would lead to an equal but opposite impact on the profit, in other words, it will lead to positive exchange rate differences.

Macedonian Insurance Companies are not exposed to a high level of currency risk, because they are pegged to one currency (EUR), which hasn't a high exposure to

volatility. This could be one of the reasons that Macedonian Insurance Companies do not use derivatives, which are used in other countries that deal with this kind of risk.

Despite the risk being not so high, the ISA has a template that Insurance Companies should submit to their regulatory body. The data which is required is seen in Appendix 4.

CONCLUSION

There is great potential for increasing the awareness of and the presence of the Life Insurance market in the Republic of Macedonia. If there is an increase in financial literacy and education of the population, this potential can be used to achieve a better understanding the Life Insurance products. It is of great importance to educate people about the benefits of Life Insurance and the development of new products. Life Insurance will be more accessible to the population due to significant growth in the penetration of Life Insurance in the Republic of Macedonia. The global growth of the insurance market has further increased the importance of ALM (asset-liability management modelling) As a direct consequence of the new Solvency II regulations ALM is now mandatory not only in the insurance sector but in all financial services institutions across the world. ALM is the process of analyzing an insurance company's exposure to asset-liability risk, defining its risk tolerance and its financial goals and planning the actions it should take to limit exposure to risk while reaching these goals.

In this thesis, the subject of research was ALM, viewed from the asset-liability mismatch perspective. In North Macedonia, this concept is not well developed. Insurance companies do not use preventive measures to protect against the mismatches that arise as a result of currency risk. Article 73-a of the Insurance Supervision Law mandates that funds must be kept in accounts and placements in the Republic of Macedonia. Only Macedonian government bonds are possible investments, and this is considered a deficiency in the Macedonian insurance market. A major cause concerning the insurance sector in the Republic of Macedonia is that Life Insurance companies cannot invest in Eurobonds, which are considered vital instruments in reducing the mismatch between assets and liabilities.

The Ministry of Finance, the Government, and the ISA should change this law and allow Macedonian Insurance companies to invest in Eurobonds. In order to protect themselves from the outflow of foreign currency, they can buy bonds on the primary market.

Solvency II dictates that if you take more risk, then you should have more capital, meaning that insurance companies need to reduce currency risk in order to be solvent. Recommendations for the Life Insurance companies, and ISA are that they should organize training and conferences with the countries currently using the Solvency

Regulations and start preparing and aligning current Macedonian regulations with the Solvency II regulations in order to reduce risk, especially over the transition period of Solvency I to Solvency II.

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APPENDICES

Appendix 1: Povzetek (Summary in Slovene language)

Ta raziskava bo vsebovala teoretično gradivo in zbiranje podatkov iz različnih virov. Predvsem bom preučila, kako se lahko spopademo s posledicami, ki vplivajo na neusklajenost sredstev in obveznosti. Uporabila bom tehnike, ki jih uporablja upravljanje sredstev in obveznosti. V analizi bom proučila naložbe in strukturo portfelja polic. Prednost tega magistrskega dela je, da bo zagotovilo priporočila za najpomembnejši odločitvi oblikovalcev politik: nadzorni agenciji, ministrstvu za finance in zavarovalnicam, ki so nosilciPilj 3 dela uredbe Solventnost II. V prvem delu magistrskega dela bo opisana rast trga življenjskih zavarovanj v Severni Makedoniji. Omenjene bodo življenjske zavarovalnice, ki obstajajo na makedonskem trgu. V tem delu bodo uporabljeni statistični podatki Agencije za zavarovalni nadzor Severne Makedonije in Narodne banke Severne Makedonije ter letna poročila petih življenjskih zavarovalnic, ki obstajajo na makedonskem zavarovalniškem trgu. Namen te diplomske naloge je ozavestiti zavarovalnice o potencialu, ki ga ima zavarovalniški trg, in spodbuditi inovativnost pri razvoju novih produktov, ki bodo povečali nizko stopnjo razširjenosti, ki še vedno obstaja v tej pokrajini. V drugem delu bo opisano, kaj je upravljanje sredstev in obveznosti ter zakaj je sestavni del zavarovalnega trga in kako prispeva k finančni stabilnosti celotnega gospodarstva. Nato bodo omenjena nekatera tveganja, ki so del okvira vsake zavarovalnice, poudarek pa bo na obravnavi valutnega tveganja in tveganja trajanja, na vprašanjih, ki se pojavljajo, in na tem, kako jih rešiti. Glavni cilj je izogniti se neusklajenosti. Uredba Solventnost II se osredotoča na vsa tveganja in oblikovanje njihovih skladov glede na izpostavljenost zavarovalnice tveganju. Da bi se pripravili na novo uredbo, se je treba osredotočiti na tveganja in na to, kako jih zavarovati. ALM predstavlja ključni del tega segmenta. V tretjem delu se bomo osredotočili na uredbo o solventnosti. Najprej bo opisana Solventnost I, nadaljeval pa se bo s pojmi Solventnost I in Solventnost II. Lažje je, če je večina družb, ki obstajajo na makedonskem zavarovalnem trgu, tuja naložba in predstavljajo del tuje korporacije, od katere se lahko učimo. Danes, ko imamo na voljo primere delovanja drugih držav, bi se morali znati izogniti nezaželenim posledicam in znati razviti najučinkovitejše načine za reševanje vprašanj, povezanih z njimi. Na te tri dele se osredotoča zato, ker želi Severna Makedonija postati del Evropske unije in slediti njenim predpisom, zato je čas, da začne svoje zakone, in zahteve usklajevati z direktivo Solventnost II.

Appendix 2: Number of contracts concluded in North Macedonia

		Number of contracts concluded							
		2012	2013	2014	2015	2016	2017	2018	2019
total life insurance	19		7,741	8,818	8,358	12,267	15,584	19,765	27.274
(with profit participation)	1901	6,971	7,739	8,809	8,120	11,704	15,068	19,082	5.235
total basic life insurance	190101	6,971	7,739	8,809	8,120	11,703	15,068	19,082	5.235
endowment	19010101	6,123	6,910	5,927	5,220	5,676	3,406	2,511	2.56
term	19010102	0	4	10	162	2,886	8,586	13,790	0
pure endowment	19010103	848	825	1,220	1,180	1,384	1,287	1,148	1159
endowment with CI	19010104			1,652	1,481	1,630	1,698	1,561	1.455
whole life	19010105			0	77	127	91	72	61
total supplementary insurance	190102	6,718	7,108	9,068	7,286	8,206	5,773	5,173	10.266
accident (death)	19010201	5,215	6,355	6,901	6,020	6,957	5,629	3,918	8.707
accident (invalidity)	19010202	5,682	5,893	7,280	5,667	5,688	4,525	4,417	4.545
health (supplementary LVHI)	19010203	0	0	0	0	0	0	0	0
health (private LVHI)	19010204	0	0	0	0	0	0	0	0
health (other)	19010205	1,517	1,638	1,609	1,400	1,410	1,163	1,011	1.009
total annuity insurance	190103	0	0	0	0	1	0	0	0
personal whole life annuity	19010301	0	0	0	0	0	0	0	0
personal term life annuity	19010302	0	0	0	0	1	0	0	0
other annuities	19010399	0	0	0	0	0	0	0	0
(without profit participation)	1902	0	2	9	238	563	516	683	22.039
total basic life insurance	190201	0	2	9	238	563	516	683	22.039
endowment	19020101	0	0	0	0	0	0	0	0
term	19020102	0	2	9	238	563	516	683	22.039
pure endowment	19020103	0	0	0	0	0	0	0	0
endowment with CI	19020104			0	0	0	0	0	0

(table continues)

(continued)

		Number of contracts concluded							
whole life	19020105			0	0	0	0	0	0
total supplementary insurance	190202	0	0	0	13	3	2	1	1
accident (death)	19020201	0	0	0	2	0	1	0	1
accident (invalidity)	19020202	0	0	0	11	3	2	1	0
health (supplementary LVHI)	19020203	0	0	0	0	0	0	0	0
health (private LVHI)	19020204	0	0	0	0	0	0	0	0
health (other)	19020205	0	0	0	0	0	0	0	0
total annuity insurance	190203	0	0	0	0	0	0	0	0
personal whole life annuity	19020301	0	0	0	0	0	0	0	0
personal term life annuity	19020302	0	0	0	0	0	0	0	0
other annuities	19020399	0	0	0	0	0	0	0	0
marriage and birth	20	0	0	0	0	0	0	2	4
life insurance related to shares in investment funds	21	0	0	0	325	1,466	1,599	2,527	2.639
tontines	22	0	0	0	0	0	0	0	0
capital redemption operations	23	0	0	0	0	0	0	0	0
pension payout from second pillar	24			0	0	0	0	0	0
pension payout from third pillar	25			0	0	0	0	0	0
TOTAL	0000	6,971	7,741	8,818	8,683	13,733	17,183	22,294	29.917

Source 1: Own work

Appendix 3: Gross Written Premium for each class in North Macedonia

		Gross written premium for each class							
		2012	2013	2014	2015	2016	2017	2018	2019
total life insurance	19	598,134	729,459	888,329	1,093,280	1,234,211	1,345,494	1,502,400	1.603.231
(with profit participation)	1901	597,181	725,468	877,334	1,064,382	1,182,060	1,283,160	1,432,408	1.252.996
total basic life insurance	190101	546,222	663,488	800,693	978,181	1,089,309	1,187,718	1,338,553	1.156.099
Endowment	19010101	522,185	627,301	634,907	756,257	793,410	777,718	787,182	779.857
Term	19010102	0	3	51	232	29,264	90,306	206,239	11
pure endowment	19010103	24,037	36,184	57,805	85,553	105,596	131,118	142,210	151.806
endowment with CI	19010104			107,930	135,795	159,792	186,273	199,962	220.994
whole life	19010105			0	344	1,247	2,303	2,960	3.431
total supplementary insurance	190102	50,959	61,980	76,641	86,201	92,259	95,442	93,855	96.897
accident (death)	19010201	19,634	23,574	30,792	32,936	33,985	33,765	31,620	31.513
accident (invalidity)	19010202	27,846	33,387	39,218	44,981	48,686	50,653	50,438	51.91
health (supplementary LVHI)	19010203	0	0	0	0	0	0	0	0
health (private LVHI)	19010204	0	0	0	0	0	0	0	0
health (other)	19010205	3,479	5,019	6,631	8,284	9,588	11,024	11,797	13.474
total annuity insurance	190103	0	0	0	0	492	0	0	0
personal whole life annuity	19010301	0	0	0	0	0	0	0	0
personal term life annuity	19010302	0	0	0	0	492	0	0	0
other annuities	19010399	0	0	0	0	0	0	0	0
(without profit participation)	1902	953	3,991	10,995	28,898	52,151	62,334	69,992	350.235
total basic life insurance	190201	953	3,148	9,495	23,177	42,494	48,865	53,695	330.565
endowment	19020101	0	0	0	0	0	0	0	0
term	19020102	953	3,148	9,495	23,177	42,494	48,865	53,695	330.565

(table continues)

(continued)

		Gross written premium for each class							
pure endowment	1902 0103	0	0	0	0	0	0	0	0
endowment with CI	1902 0104			0	0	0	0	0	0
whole life	1902 0105			0	0	0	0	0	0
total supplementary insurance	1902 02	0	843	1,500	5,721	9,657	13,469	16,297	19,660
accident (death)	1902 0201	0	0	6	267	1,499	3,050	4,208	6.009
accident (invalidity)	1902 0202	0	843	1,494	5,454	8,158	10,419	12,089	13,653
health (supplementary LVHI)	1902 0203	0	0	0	0	0	0	0	0
health (private LVHI)	1902 0204	0	0	0	0	0	0	0	0
health (other)	1902 0205	0	0	0	0	0	0	0	0
total annuity insurance	1902 03	0	0	0	0	0	0	0	0
personal whole life annuity	1902 0301	0	0	0	0	0	0	0	0
personal term life annuity	1902 0302	0	0	0	0	0	0	0	0
other annuities	1902 0399	0	0	0	0	0	0	0	0
marriage and birth	20	0	0	0	0	0	0	889	1.020
life insurance related to shares in investment funds	21	0	0	0	7,711	57,459	100,494	166,589	226.538
tontines	22	0	0	0	0	0	0	0	0
capital redemption operations	23	0	0	0	0	0	0	0	0
pension payout from second pillar	24			0	0	0	0	0	0
pension payout from third pillar	25			0	0	0	0	0	0
TOTAL	0000	598,134	729,459	888,329	1,100,991	1,291,670	1,445,988	1,669,878	1.830.789

Source 2: Own work

Appendix 4: Report of Duration of Assets and Liabilities

Item	Number	Up to 1 year	1-3 years	3-5 years	10-15 years	15-20 years	20+ years	Total
1	**2**							
I. Total assets	**001**							
1. Intangible assets	002							
2. Investments	003							
3. Part of co-insurance and reinsurance in gross technical provisions	004							
4. Financial investments for which the insured assumes the investment risk (insurance contracts)	005							
5. Deferred and current tax assets	006							
6. Claims	007							
7. Other assets	008							
8. Active time limitations	009							
II. Total liabilities	**010**							
1. Capital and reserves	011							
2. Subordinated liabilities	012							
3. Gross technical provisions	013							
4. Gross technical provisions in respect of contracts where the policyholder assumes the investment risk	014							
5. Other provisions	015							

(table continues)

(continued)

Item	Number	Up to 1 year	1-3 years	3-5 years	10-15 years	15-20 years	20+ years	Total
6. Deferred and current tax liabilities	016							
7. Liabilities arising from deposits of companies with reinsurance ceding, based on reinsurance contracts	017							
8.Liabilities from direct insurance operations, co-insurance and reinsurance, and other liabilities	018							
9. Passive time limitations	019							
III.Difference - differing currency structure	020							

Source 3: ISA