Charles University in Prague

Faculty of Social Sciences
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MASTER'S THESIS

The Impact of the Macroeconomic Environment on Insurance Companies

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Declaration of Authorship

Hereby I declare that I compiled this thesis independently, using only the listed resources and literature.

Prague, July 23, 2015

Signature

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Hereby, I would like to extend my sincere gratitude to my supervisor PhDr. Ing. Petr Jakubík, Ph.D. for his valuable suggestions and comments throughout writing this diploma thesis.

Abstract

This thesis assesses the impact of economic, institutional and demographic factors on the life and non-life gross written premiums of insurance companies. A dynamic panel data regression using the system generalized method of moments is applied on data of 29 European countries collected by EIOPA covering the period from 2005 to 2013. The results reveal that economic and institutional factors drive both life and non-life insurance industry. On the other hand, we cannot confirm that demographic factors are significant determinants of the growth in GWPs. Subsequently, the hypothesis that there are substantial cross-countries differences among the importance of different macroeconomic determinants on the insurance sector development is explored and confirmed.

This work shines new light on the development of the quantitative macroprudential framework used to determine different economic scenarios affecting insurance companies' balance sheets. Moreover, a broader set of panel data and more variables explaining the growth in insurance sector bring new contributions to the current discussion in academic literature.

JEL Classification	G22, E66
Keywords	Gross written premiums, life insurance, non-life insurance

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Abstrakt

Tato práce posuzuje vliv ekonomických, institucionálních a demografických faktorů na hrubé životní a neživotní pojistné. Dynamická panelová regrese využívající model GMM je aplikována na data z 29 zemí získaná v období mezi roky 2005 a 2013. Výsledky ukazují, že ekonomické a institucionální faktory mají vliv jak na životní, tak na neživotní sektor pojišťoven. Významnost demografických faktorů na růst hrubého pojistného ale není potvrzena. Práce dále testuje hypotézu, zda se makroekonomické faktory ovlivňující sektor pojišťoven pro každou zemi výrazně liší.

Hlavním přínosem práce je rozvoj makroekonomické analýzy, která slouží k odhadu různých ekonomických situací ovlivňujících příjmy pojišťoven. Práce zároveň využívá více dostupných dat a testuje více vysvětlujících proměnných než ostatní studie a přispívá tak k akademické literatuře.

Klasifikace JEL	G22, E66
Klíčová slova	Hrubé pojistné, životní pojištění, neživotní pojištění

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Acronyms

GWP gross written premium

GDP gross domestic product

OECD Organisation for Economic Co-operation and Development

PCI Property-casualty insurance consumption

PLI Property-liability insurance

CESEE Central, Eastern and Southeastern Europe

CEE Central and Eastern Europe

EIOPA European Insurance and Occupational Pensions Authority

UNESCO The United Nations Educational Scientific and Cultural Organization

WGI The Worldwide Governance Indicators database

WDI World development indicators database

UNDP United nations development programme

EUROSTAT European Statistics Office

QE Quantitative Easing

Master's Thesis Proposal

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Proposed topic	The Impact of the Macroeconomic Environment on Insurance Companies

Motivation The insurance sector plays an important role for financial and economic development and might significantly affect stability of the financial system. There is therefore a need to examine the impact of macroeconomic determinants on insurance companies to control potential systemic risk. By introducing quantitative macro-prudential frameworks, the main risks and weaknesses threatening financial stability of the European insurance sector can be reduced. The determination of this framework could support policy-makers to detect and quantify different economic scenarios affecting insurance companies' balance sheets. Variables as gross written premium (GWP) or lapse rates are among the key factors influencing insurance market growth which is strongly linked with the macroeconomic environment (Faugere & Erlach, 2003). This thesis therefore examines those relationships and assesses the growth of insurance sector during 2005 - 2012.

It is not easy to refer to relevant previous research of this topic, as the available literature is thin on the ground. However, some papers have been published particularly by institutions ensuring the stability of the insurance sector. Haiss & Sümegi (2008) estimated cross-country panel regression of 29 European countries from 1992 to 2004. They provide evidence that economic growth is positively influenced by the life insurance sector in countries of EU-15 while growth in Central and Eastern Europe (CEE) countries is much more influenced by the non-life sector. Feyen et al. (2011) summarizes results of previous studies and shows the impact of variables that should drive the development of the insurance industry. He showed that income distribution,

demographic structures, population size and other factors have an impact on both life and non-life premiums. Christophersen & Jakubik (2014) explain growth in GWP by changes in interest rates, unemployment rates and nominal GDP. Another important variable determining insurance growth are lapse rates (Eling & Kochanski, 2013). Kim (2005) applied logistic regression model to examine which economic variables affect lapse rates in the Korean insurance market. Her study is extended by Kiesenbauer (2011) who studies the determinants of lapse using macroeconomic data of 133 life insurers from Germany between 1997 and 2009. The results are very similar to those of Kim (2005) and show that there is a strong correlation between lapse rates and macroeconomic variables.

Hypotheses

1. There is a strong correlation between the growth in gross written premiums in the life insurance sector and the macroeconomic determinants (unemployment rate, nominal and real GDP, permanent income and interest rates).
2. There is a strong correlation between the growth in gross written premiums in the non-life insurance sector and the macroeconomic determinants (unemployment rate, nominal and real GDP, permanent income and interest rates).
3. There are substantial cross-countries differences among the importance of different macroeconomic determinants on the insurance sector development.
4. The lapse rates in the life insurance industry are highly correlated with the macroeconomic growth.

Methodology The relationship between insurance business growth and the macroeconomic environment will be modeled by employing a panel regression with fixed effects separately for life and non-life insurance sector. The choice of appropriate dependent variable influencing the growth in the insurance sector must be subject of detailed analysis. However the variables as GWP, lapse rates etc. will be considered. The key macroeconomic indicators as population, permanent income, unemployment rate, inflation rate, nominal gross domestic product (GDP) and real GDP etc. will be used in regressions as independent variables.

I will use the set of data collected by national authorities which is available for download at the EIOPA's (European Insurance and Occupational Pensions Authority) website. These annual data contain the information about GWPs

for both life and non-life sector of 30 European countries from 2005. Another data source is EUROSTAT collecting the relevant data for estimation of our hypotheses.

Expected Contribution I will set out an estimation strategy used to estimate the macroeconomic factors that drive growth of both life and non-life insurance sector which is not very well developed by other researchers. The results can provide the reaction of the insurance sector on different macroeconomic scenarios and detect if the explaining factors have positive or negative impact on insurance market growth. These findings could offer several useful insights for policy-makers and researchers. A broader set of panel data of European member states collected by EIOPA and more variables explaining the growth in insurance sector bring new contributions to the current discussion in the academic literature.

Outline

1. Introduction and Motivation:
   (a) Overview of the European insurance sector
   (b) Key risks for insurance sector
2. Literature Review:
   I will briefly describe the relevant previous research related to relationship between the insurance sector and macroeconomic environment.
3. Methodology:
   See section "Methodology"
4. Data:
   I will describe the data collected by European Insurance and Occupational Pensions Authority (EIOPA).
5. Results:
   I will analyze and interpret the research results.
6. Conclusions:
   I will summarize my findings and suggestions for policy-makers and researchers.

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Author Supervisor

Chapter 1

Introduction

The insurance sector plays an important role for the financial and economic development of both developed and developing countries. The increasing growth of insurance markets constituting a large part of overall financial sector might significantly affect stability of the financial system. Insurance companies provide financial services and together with pension funds belong to the major investors into financial markets and their influence is likely to increase because of the worldwide integration, ageing population and growing income imbalances. Market activity of insurance companies includes providing the risk transfer and financial intermediation (Peter Haiss and Kjell Sümegi 2008).

In 2013, companies in the global insurance industry wrote in real terms to USD 4 641 billion in direct premiums, which is approximately 6% of GDP worldwide. Thus, this amount of money was used to buy different insurance services and products. Since 1990 there has been rapid insurance sector growth. Between the years 2005 and 2013, the number of direct premiums written worldwide has risen by 135%. Even though, insurance sector and return on investment were negatively influenced by economic crisis in 2009, the insurance market did not stop growing in the following years (Swiss Re 2014).

A proper market activity of insurance companies facilitates efficient allocation of the capital of a country and also transfers savings from insured people to investment projects. Providing financial services and a risk transfer, the insurance sector has an impact on actions of both individuals and firms. Insurance companies as financial intermediaries play a key role in these functions and hence, they are very essential for sustained growth and financial stability of the insurance sector in Europe. In addition, insurance companies and pension funds are long-term investors for which the duration of liabilities is longer

than the duration of assets. Thus, they might be important investors in the long-term investment projects.

The main objective of this thesis is therefore the development of a model that examines the impact of macroeconomic determinants on insurance companies. By introducing quantitative macro-prudential frameworks, the main risks and weaknesses threatening financial stability of the European insurance sector can be reduced. The determination of this framework could support policy-makers to detect and quantify all different economic scenarios affecting insurance companies' balance sheets and to control potential systemic risk.

Gross written premiums range among the key factors influencing insurance market growth that are strongly linked to the macroeconomic environment. This thesis assesses the impact of economic, institutional and demographic factors on gross written premiums of insurance companies in 29 European countries from 2005 to 2013. The hypothesis that there is a strong correlation between the growth in gross written premiums and the macroeconomic determinants is explored by employing a dynamic panel regression using the system generalized method of moments. Life and non-life insurance sectors are examined separately because we expect the effects of selected variables on these sectors to be different. The impact of particular economies of countries might be influenced by the aggregation of data. Thus, we will attempt to confirm our last hypothesis that there are substantial cross-countries differences among the importance of different macroeconomic determinants on the insurance sector development.

The thesis is structured as follows. Following this introductory Chapter, Chapter 2 provides the theoretical background of the thesis. After an overview of the European insurance sector, we specify key risks that may threaten the stability of insurance companies and describe the indicators used in order to measure the importance of insurance sector. Chapter 3 summarizes the results of the existing literature relating to the demand for insurance and highlights the most important findings. After that, the results of the international published research regarding the relation between insurance and economic growth are presented. Furthermore, Chapter 4 contains data description and descriptive statistics. It also provides definitions of the dependent and independent variables and establishes the rationale for the expected signs of the impact of macroeconomic determinants on gross written premiums. Chapter 5 provides a description of methodology used to test our hypothesis and considerable part is devoted to justification for the choice of applied estimation method. In

addition, Chapter 6 interprets the findings of the research carried out and provides policy implications along with possible areas of further research. Lastly, Chapter 7 summarizes the thesis and emphasizes the most important research results.

Chapter 2

Theoretical background

This Chapter provides the theoretical background of the thesis. After an overview of the European insurance sector, we specify the key risks insurance companies have to face and describe the indicators used in order to measure the importance of insurance sector.

In the recent past, the economic significance of the insurance industry has been on the rise both in developed and developing countries. The products and services of insurance institutions constitute a growing part of the financial sector of people's households, and also in the global capital markets insurance companies play critical role. In addition, economic liberalization, strengthening of the financial system and high usage of contractual savings products contributed to the rapid growth of the insurance sector worldwide (UNCTAD 2005).

2.1 Overview of the European Insurance Sector

Over the past 20 years there has been a dramatic change in the financial services provided by insurance sector. Insurance represents a significant share of financial sector, and thus of the whole economy. Insurance companies offer except basic contracts also saving vehicles, particularly in the life sector. The ageing population also contributes to this trend. The financial difference between people who are working and retired population will have to be managed by future society. This might be a problem particularly in countries on the west of Europe. Therefore, most of the European countries privatized their pension system. Many people intend to purchase products of life insurance which turned into long-term saving vehicles (Lorent 2008).

In 2013, European life premiums accounted for 60% of the total European premiums. European life premiums per capita amounted to 1120 Euros. Compared to 990 Euros in 2004, we might say that demand for life insurance has increased. Even though the macroeconomic environment in 2013 was not optimal, the European life insurance sector turned out well with a growth of premium 3,1% (Insurance Europe 2014).

Generally, insurance companies have three separable basic functions. Firstly, they provide a protection to risk averse people by risk transferring to institutions which are able to manage risk better in exchange for premium. Thus, the insurance sector has an impact on actions of both individuals and firms. Secondly, they spread risk by selling insurance products to numerous individuals in order to avoid the risk that all losses will occur at the same time. Finally, they improve resource allocation and thus reduce the level of risk by allocating the right amount of premium to both firms and individuals (Lorent 2008).

To provide a protection against early death has been a principal role of life insurers in the past. The premiums paid as claims by the policyholders were influenced by the time of individual's death. In recent years, there has been a change in activities provided by life insurance companies which are more and more similar to those of banks. These new products of life insurers are sold based on their investment features, i.e. liquidity and return. For example, unit-linked, universal and investment contracts are products offered with investment characteristics. In the non-life insurance sector, the nature of an unexpected event and the level of damage influence the amount of claims the insurer has to pay. However, when the policyholder's portfolio is diversified and large enough, the claims should be equal to value of premiums (Lorent 2008).

Market activity of insurance companies includes financial intermediation and thus, insurers contribute to the transformation of assets. Through the process of financial intermediation, the obtained premiums from consumers are invested via the financial markets (Lorent 2008). The insurance sector invested almost 8400bn Euros in the global economy in 2012, which is about 58% of the GDP of the European Union. Insurance companies form the largest pool of investment funds in the European Union. As a major source of investment, the insurance sector contributes to supply the funds from which the retirement for current working population is paid (Insurance Europe 2013).

The European insurance sector is influenced by several economic trends. In 2013, the macroeconomic situation in Europe was quite bad even though there was economic growth. The environment was different for every country, but

the GDP of all member states of European Union raised by 0,1% which was less than in the previous years 2012 and 2011. The reason of such a performance was mainly tight fiscal policy of countries and various developments all over the world. Nearly all countries of European Union increased taxes and lowered public spending to rebalance their budgets. The consumer demand was therefore lower and together with a monetary policy of the European Central Bank supporting low interest rates created unfavorable macroeconomic conditions for European insurance companies in 2013. On the other hand, this was compensated by performance of financial markets which experienced increased investment trend (Insurance Europe 2014).

2.2 Key Risks for Insurance Sector

Insurance companies have to deal with several risks which may threaten their stability. Interest rate risk, underwriting risk and catastrophe risk are the main risks on the liability side of insurer's balance-sheet. On the asset side, insurers must remain vulnerable particularly to credit risk, systemic risk, market and liquidity risk. Compared with insurers with non-traditional business, insurance companies based on traditional business are not so resistant to economic and financial changes. Among non-traditional business activities provided by insurers belong for instance financial guarantee insurance or insurance-linked securities (Komarkova & Gronychova 2012).

Market risk is the risk arising from market movements which have impact on both asset and liability side of balance sheets. From insurer's point of view, market risk can be defined as the extent to which the asset value is not compensated by change in liability value as a result of market movements in exchange rates, interest rates, equity prices, etc (IAIS 2003).

The main risk for life insurance sector are movements in interest rates because they influence the values of assets and liabilities (KPMG 2002). Moreover, they indirectly affect policyholders. An increase in interest rates may result in conclusions to lapse policies because policyholders expect higher borrowing costs (Komarkova & Gronychova 2012). Insurers must deal with permanently low interest rate environment in non-life sector. Changes in interest rates are not a main risk, since duration of non-life insurance contracts is short-term. However, they can influence the rate of return on investments (EIOPA 2014).

As duration of liabilities is higher than duration of assets, insurance compa-

nies have to face the reinvestment risk. Recently, insurers have struggled with low interest rates. The major issue is that present lower yielding investments fail to meet prior return assumptions. The level of the duration mismatch between liabilities and assets has impact on the degree of the reinvestment risk the insurer has to deal with (The Center for Insurance Policy and Research 2012).

Exchange rate risk occurs when there are influential foreign liabilities which are not compensated by investments in the same currency. This kind of risk is less significant for life insurance sector than non-life (KPMG 2002).

Recently, there have been significant exchange rate movements of the US Dollar and the Swiss Franc when both currencies appreciated against the Euro. This fact might have negative impact on the profitability of insurance companies and their solvency. The problem arises when big insurance groups finance their business activities in countries with the Euro currency from Switzerland and vice versa. Analogously, it holds for the appreciation of the US Dollar against the Euro. Therefore, particularly insurers conducting business in foreign countries should consider application of suitable hedging strategies (EIOPA 2015).

One of the key risks for the insurance companies is credit risk. According to IAIS (2003), credit risk represents the likelihood that a counter-party will not meet its obligations. Counter-parties of insurance company might be borrowers, policyholders, debtors, brokers and reinsurers. Credit risk may also arise via various financial instruments such as securitisations and derivatives or guarantees. In 2014, credit risk exhibits a challenge except some signs of little improvement. Credit default spreads on insurance bonds are tight. Therefore, the expectations on market performance of insurers are positive (EIOPA 2014).

Liquidity risk is related to the inability of insurer to liquidate assets when it is necessary or to fund its obligations when they are due. Group risk is mostly connected with contagion risk. Determinants to consider are for example the impact on the company if financial support is not guaranteed by the parent anymore or the insurer is not able to acquire repatriate funds (IAIS 2003; Komarkova & Gronychova 2012).

Systemic risk relates to local or global social or economic determinants that indirectly influence insurance sector. Insurance companies are usually not able to affect various events but may be able to control for possible risks (KPMG 2002). Moreover, contagion risk might have impact through the financial system from one sector to another. The sector of banks is sensitive to financial

cycle and to contagion. The asset side of insurers may be influenced via bad market conditions, for instance banks must sell securities and asset's values considerably decrease (Komarkova & Gronychova 2012). Economic cycle might also have significant effect on insurer's balance sheets. Downturns will boost terminations of contracts such as lapses and surrenders caused by failures to pay premiums in life insurance sector. In non-life sector, higher unemployment rate will increase the number of losses because of crime and recession will decrease the premium levels (KPMG 2002).

Even though there are some positive market developments in 2014, general downside risks have raised. This is caused by a contradictory market with macroeconomic imbalances which are induced by accommodative monetary policies and cause price misalignments of assets. As it is mentioned above, one of the main risks threatening the insurance industry is credit risk. Then it is the persistent low yield environment induced by raising deflationary risk in the countries with Euro currency. The last key risk is weak macroeconomic environment (EIOPA 2014).

In March 2015, the European Quantitative Easing (QE) policy was employed with the aim to influence growth parameters that will affect insurance industry. In the long term, QE programme should positively influence European insurers and pension funds. However, new issues have arisen in the short run. The essential transmission channel of quantitative easing is portfolio rebalancing. It decreases the risk-free rate and cost of funding and thus, it should have favorable impact on insurance and pension industry. Moreover, as a consequence of rebalanced investment portfolios into more risky assets, lending spreads should be lowered. Furthermore, decreasing of risk free rates generates substantial challenge for insurer's yields. Insurance companies naturally want to assure matching of assets and liabilities and to control their duration. Overall, the implied QE programme along with moderate growth is lowering yields and result in a low yield environment expectations (EIOPA 2015).

Insurance companies must react to this environment and adjust their business models. Particularly life insurers do this adjustment because their business must face to permanent low interest rates environment. Recently, there has been very low economic growth which supported almost no growth of life insurance sector. However, the retirement needs and health solutions for policyholders sustain the overall positive premium growth for both life and non-life insurance sector. Generally, a danger of macroeconomic risks has slowed down the growth of insurance market (EIOPA 2014).

2.3 Measuring the Importance of Insurance Sector

In 2013, global life and non-life premium growth slowed down. Compared to 2.5% increase in total growth in 2012, it has increased only by 1.4% in 2013. According to Swiss Re (2014) study, the slowdown was mainly caused by the instability of the advanced life insurance markets. In 2013, world life premiums increased only by 0.7% to USD 2 608 billion, with Asian markets offsetting a strong performance in almost all emerging markets. Just as life premiums also non-life premiums grew less than the prior year (2.3%) due to growth slowdown in the emerging and advanced markets.

In order to measure the significance of the insurance sector in different countries generally there are two following indicators used: Insurance penetration and Insurance density.

2.3.1 Insurance penetration

Insurance penetration rate expresses the degree of insurance sector development of a country. It is the ratio between premiums written in a certain period and the GDP. The advantage is that this ratio does not take into account fluctuations of a currency. However, it does not consider different price levels and typical features of insurance market.

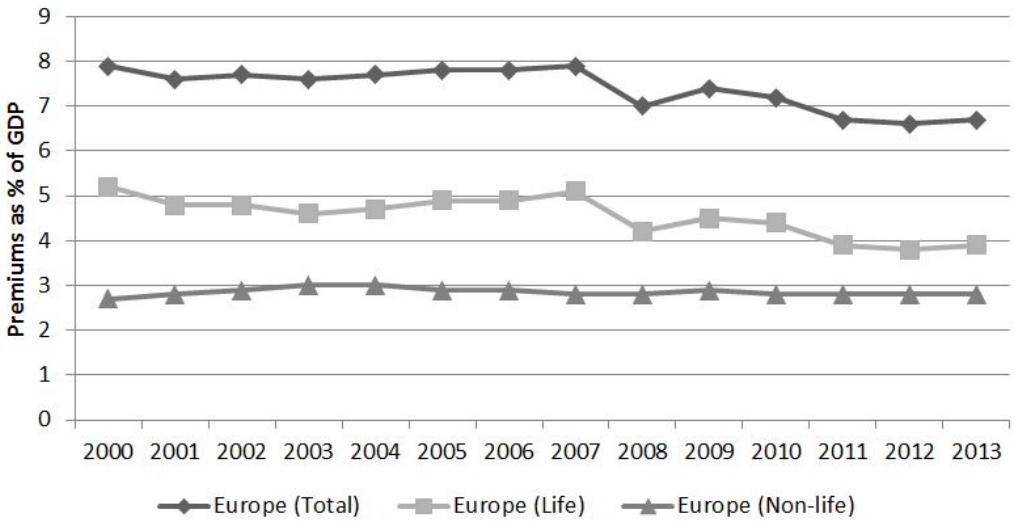
Figure 2.1 provides the development of the total insurance penetration rate in all European countries from 2000 to 2013. The figure reveals that there has been a slight growth in the total penetration rate since 2001. In 2007, there was a steep decline following the financial crisis between 2007 and 2008.

2.3.2 Insurance density

Insurance density is calculated as the ratio of premiums written to population in a country. In other words, it shows how much money each citizen within a country spends on insurance products. The insurance density ratio considers fluctuations of the currency (Outreville 2011).

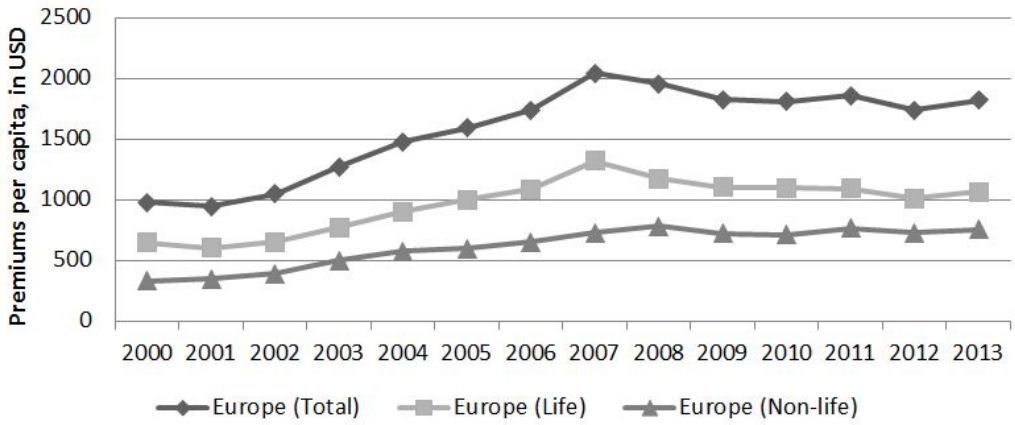
The figure 2.2 shows that total insurance density in Europe increased gradually between 2000 and 2007. From 2007 onwards there was a gradual drop followed by fluctuations. In 2011 total European premiums per capita started to decrease again which was caused by the slowdown in the overall economy.

Figure 2.1: Insurance Penetration in Europe



Source: Sigma world insurance database.

Figure 2.2: Insurance Density in Europe



Source: Sigma world insurance database.

The table 2.1 below illustrates life and non-life premiums and both indicators insurance density and penetration in the major insurance markets in 2013. The penetration ratio is for all countries with advanced markets higher than 5%. For almost all countries with emerging markets is a ratio between total premiums written and the GDP equal or lower than 3%. Except for few national economies, over the last four decades penetration ratio has increased all over the world. In 1990, almost every country had this ratio lower than 7. We may therefore say that the significance of the insurance market activity is increasing (Swiss Re 2014).

Table 2.1: Developments in the Major Insurance Markets in 2013

	Life premiums		Non-life premiums		Total premiums		ID** (USD)	IP***
	USD bn	Change* vs 2012	USD bn	Change* vs 2012	2013	vs 2012	2013	2013
Advanced Markets	**2200**	**-0,20%**	**1653**	**1,10%**	**3853**	**0,30%**	**3621**	**8,30%**
United States	553	-7,70%	726	1,70%	1259	-2,50%	3979	7,50%
Japan	423	1,40%	109	2,00%	532	1,50%	4207	11,10%
United Kingdom	223	2,60%	107	-1,80%	330	1,20%	4561	11,50%
France	160	3,90%	95	1,10%	255	2,80%	3736	9,00%
Germany	114	2,20%	133	0,60%	247	1,30%	2977	6,70%
Italy	118	21,10%	51	-5,00%	169	11,90%	2645	7,60%
South Korea	91	-12,40%	54	0,30%	145	-8,00%	2895	11,90%
Emerging markets	**408**	**6,40%**	**380**	**8,30%**	**788**	**7,40%**	**129**	**2,70%**
Latin America, Caribbean	80	12,20%	103	7,20%	184	9,40%	300	3,20%
Brazil	49	14,70%	40	9,80%	89	12,50%	443	4,00%
Mexico	12	7,30%	15	5,70%	27	6,40%	223	2,20%
Central, Eastern Europe	21	-3,20%	55	2,50%	76	0,80%	235	1,90%
Russia	3	47,40%	26	1,50%	28	4,50%	199	1,30%
South and East Asia	250	4,10%	159	13,40%	410	7,50%	112	3,00%
China	152	3,10%	126	15,50%	278	8,30%	201	3,00%
India	52	0,50%	13	4,10%	66	1,20%	52	3,90%
Middle East, Central Asia	12	5,60%	35	1,70%	47	2,60%	140	1,50%
United Arab Emirates	2	17,80%	6	7,70%	8	10,00%	872	2,00%
Africa	50	12,80%	22	2,10%	72	10,20%	66	3,50%
World	**2608**	**0,70%**	**2033**	**2,30%**	**4641**	**1,40%**	**652**	**6,30%**

* In real terms, ie adjusted for inflation
** Insurance Density
*** Insurance Penetration

Source: Swiss Re (2014)

On one hand, there is a difference in life penetration ratio between developed and developing countries where people do not spend a lot of money on life insurance. On the other hand the differences among developing countries are remarkable. Although, the life penetration ratio in Paraguay in 2013 was only 0,2%, in South Africa it was 12,2% (OECD 2014). These substantial cross-countries' differences are one of the reasons why it is interesting to determine the impact of different macroeconomic factors on the life insurance sector development.

Insurance density and penetration indicate the economic significance of the insurance sector from a different perspective. No doubt that GDP and insurance density will be positively correlated because countries with high gross domestic product will purchase more insurance products in absolute terms.

However, the importance of insurance sector in relative terms can be different for countries which have comparable GDP per capita. Moreover, every country is determined by its fiscal and legal rules that consequently have impact on the life and non-life insurance market (Outreville 2011).

Another possibility how to measure the importance of insurance business is to identify a relationship between the financial development degree and the size of the insurance sector. This measurement is calculated as a ratio of M2 to GDP (financial deepening). M2 denotes so called broad money and includes assets that are highly liquid. Broad money is usually considered as a measurement of a size of financial sector. Apparently this ratio is positively correlated with insurance demand. The measurement of financial deepening depends on the level of economic development and legal environment of a country. Beck & Webb (2003) suggested using the ratio of the size of the insurance sector to the stage of banking sector development.

Chapter 3

Literature review

This chapter summarizes the results of theoretical studies on the demand for insurance and emphasizes the most important findings. The second part of literature review presents the results of the international published research regarding the relation between insurance and economic growth. In recent past, the impact of insurance companies on financial and economic development is the main area of interest of institutions such as The World Bank or International monetary fund (UNCTAD 2005).

3.1 Theoretical Studies

The theoretical model explaining the demand for insurance was first developed by Yaari (1964) and Hakansson (1969). Yaari (1964) showed that the insurance demand is dependent on the allocation process of consumer during his whole life. In his life-cycle approach, Yaari (1964) worked with the issue of uncertainty of a consumer's life span. He proved that the consumer's lifetime utility function is influenced by the time of individual's death, his inclination to bequeath income for dependents and to direct a part of his earnings towards retirement. The lifetime utility function of a consumer is maximized by a vector of prices (containing insurance premiums) and by a vector of interest rates. This approach assumes that the life insurance demand is dependent on interest rates, expected earnings of individual during his life, wealth and the price for insurance products.

Pissarides (1980) followed the model of Yaari (1964) and to the bequest motive implemented also the saving motive for the retirement. His extended model allows to life insurance to deal with fluctuations in individual's income

during his life. Therefore, the bequest and consumption are not influenced by the time when the income is produced.

Lewis (1989) extended the model of Yaari (1964) by allowing the preferences of beneficiaries and dependents. In other words, he included also other members of the household in his model, not just the main earner as in the approach of Yaari (1964). The life insurance demand developed by Lewis (1989) is described in the following equation in more detail as it is an initial point for several empirical studies.

$$(1 - lp)F = max\left\{[(1 - lp)/l(1 - p)]^{1/\delta}\, TC - W, 0\right\} \tag{3.1}$$

Where index l represents policy-loading factor measuring the ratio between the insurance cost and its actuarial value, F is the face value of the life insurance written on the main earner's life and index p denotes the probability of the main earner's death. Index TC denotes the present value of consumption of all children till they leave the household, δ shows the risk aversion of the beneficiary and finally index W represents net wealth of the household. The probability of the main earner's death and the risk degree are positively correlated with the life insurance demand. Respectively, the household's wealth and policy-loading factor l is negatively linked with the insurance demand.

However, there are many other factors driving the insurance consumption. Among the most substantial belong price of insurance, stability of monetary system, development of banking and market sector, urbanization or corruption control. In the approach of Lewis (1989), these determinants could be expressed by the policy-loading factor because they are supposed to influence the insurance costs.

Some researchers, for instance Beenstock *et al.* (1988), explored insurance supply and demand independently. However these empirical models were limited by the availability of necessary data. It was not possible to analyze the difference between supply and demand using the accessible data. Furthermore, premium data are a combination of coverage and price, so researchers were not able to explore how much of insurance coverage was purchased (Beck & Webb 2003).

In the theoretical studies on the demand for insurance were usually used factors like interest rate, savings in the form of wealth and income as factors affecting individual's insurance consumption. However, the impact of institutional and demographic factors on insurance consumption was also examined

in theoretical studies. Unfortunately, we are not able to say which additional economic determinants might be significant using theoretical models. The following subsection presents the results of the empirical studies exploring the impact of various determinants on insurance demand (Sen 2008).

3.2 Empirical Studies

The relationship between economic growth and the growth in the insurance sector is not as well developed as the relation between the economic growth and the capital markets or economic growth and bank lending (Outreville 2011). It is not easy to refer to relevant previous research of this topic, as the available literature is thin on the ground. However, some papers have been published particularly by institutions ensuring the stability of the insurance sector.

Several researchers proved in their empirical studies that there is a substantial relationship between the economic growth and insurance sector growth (Peter Haiss and Kjell Sümegi 2008). There are two causality links which have been examined so far. The first one is a supply-leading approach which studies to what extent the growth of insurance sector affects the economic growth of a country. The second approach is a demand-following. This approach examines the influence of economic growth and of other determinants on growth of insurance companies and their assets (UNCTAD 2005).

One of the first papers estimating cross-country data was written by Beenstock *et al.* (1988). Property-liability insurance premiums were explained by income and interest rates using cross-section and time-series analysis. The results suggest that the long-run marginal propensity to insure is always higher than in the short-run and that there are substantial cross-countries differences among the marginal propensities to insure. Beck & Webb (2003) studied which economic determinants predict using of life insurance. They applied time-series and cross-country analysis and found out that income per capita, development of the banking sector and inflation are the most significant. On the other hand, the demographic variables and schooling do not affect life insurance consumption. Ye *et al.* (2009) explored the variables influencing foreign participation in life insurance markets across 24 OECD countries. The analysis suggests that market structure, socio-economic and also legal determinants have positive influence.

Esho *et al.* (2004) took into consideration legal rights and enforcement and tests the influence of legal factors on the link between GDP and Property-

casualty insurance consumption (PCI). Even though he used different methodologies such as GMM, OLS and FE estimations, the obtained results are very similar and confirm that there is positive relationship between PCI, the strength of the property rights and real GPD. The data showed that the developments of country are very different for different legal origins (GDP, PCI). Legal rules and their enforcement have substantial impact on market development. The rule of law and the strength of influence of authority had impact on the success of the insurance sector development. Legal environment providing protection to investor, induce a higher level of financial intermediation and growth. Countries where legal codes protect the rights of creditors have higher insurance demand than countries where laws are more lax to creditors (Porta *et al.* 1997; Levine 1998).

The empirical study of Outreville (1990) examined the link between economic and financial development and Property-liability insurance (PLI) premiums. He applied a cross-section analysis of 55 developing countries and his results clearly indicate the importance of financial development (ratio of M2 to GDP) and income for PLI premiums. However, the following study of Outreville (1996) does not confirm the previous results and provides evidence that financial development is not significant. Outreville (1996) showed strong negative effect of a monopolistic market structure on the growth of life insurance.

Peter Haiss and Kjell Sümegi (2008) estimated cross-country panel regression of 29 European countries from 1992 to 2004. They provided evidence that economic growth is positively influenced by the life insurance sector in countries of EU-15 while growth in CEE countries is much more influenced by the non-life sector. Bianchi *et al.* (2011) examined the influence of GDP growth on insurance premium growth in Central, Eastern and Southeastern Europe (CESEE). Nevertheless, other possible explanatory variables were not included into a panel regression. Feyen *et al.* (2011) summarized results of previous studies and shows the impact of variables that should drive the development of the insurance industry. He showed that income distribution, demographic structures, population size and other factors have an impact on both life and non-life premiums. Christophersen & Jakubik (2014) explained growth in GWP by changes in interest rates, unemployment rates and nominal GDP.

Another important variable determining insurance growth are lapse rates (Eling & Kochanski 2013). Kim (2005) applied logistic regression model to examine which economic variables affect lapse rates in the Korean insurance market. Her study is extended by Kiesenbauer (2012) who studied the deter-

minants of lapse using macroeconomic data of 133 life insurers from Germany between 1997 and 2009. The results were very similar to those of Kim (2005) and showed that there was a strong correlation between lapse rates and macroeconomic variables.

It is important to mention that there is set of papers investigating the contribution to financial development by insurance market activity as it is both financial intermediary and risk transfer provider. Arena (2006) examined whether there is a correlation between life and non-life insurance activity and economic growth using GMM estimation for dynamic models. The findings indicate that both life and non-life insurance positively and significantly influence economic growth. The correlation for high-income countries is stronger in the case of life insurers, for developing countries in the case of non-life insurers. Kugler & Ofoghi (2005) in his study examined the link between economic growth and insurance markets size for the UK in the long-run. The market size is measured by net written premiums in each market in insurance industry (general and long-term insurance). The results confirm that long-run relationship between economic growth and insurance market size development is significant for majority of all variables.

Different macroeconomic determinants that have a profound effect on the growth of the insurance industry such as life expectancy (Beenstock *et al.* 1988; Sen 2008) or risk aversion (Schlesinger 1981) are mentioned in the empirical papers.[1] The human capital index (Peter Haiss and Kjell Sümegi 2008), social security programs (Lewis 1989) or market structure (Outreville 1996) are considered to be drivers of the insurance development. Feyen *et al.* (2011); Esho *et al.* (2004) examined demographic factors such as the size of the population and urbanization. Institutional factor examined by Porta *et al.* (1997) is a dummy variable demonstrating if a country is a member of the European Union or not. As a European Union member, the country has more opened financial markets. The increasing number of companies from foreign countries entering the internal market results in competition. This leads to fair prices, adequate supplies for consumers and a more equitable distribution of income. Therefore, there may be higher demand for insurance products in EU countries. The relationship between European Union membership variable and GWP was positive. Some papers are focused on variables as banking sector development (Beck & Webb 2003), price of insurance and financial development (Outreville 1990). The availability of data for all examined countries was one key moti-

[1] All studies mentioned in the literature review are summarized in the Tables 3.1 and 3.2.

vating factor behind selection of the macroeconomic determinants employed in the empirical analysis of this thesis. The selected determinants are divided into three groups and described in detail in the following subsection Data.

Table 3.1: The Empirical Literature Dealing with the Interaction between Insurance and Economic Growth (a)

Author	**Year**	**Region of Sample Coverage**	**Time of Sample Coverage**	**Dependent Variable**
Beenstock et al.	1988	12 countries, 45 countries	1970 - 1981, 1981	property liability insurance premiums
Beck and Webb	2002	68 countries (incl. 14 EU countries)	1961 - 2000	life insurance penetration, density, life insurance in private savings
Ye et al.	2009	24 OECD countries	1993 - 2000	foreign participation in life insurance markets
Esho et al.	2003	44 countries (incl. 12 EU countries)	1984 - 1998	property-casualty insurance consumption
Porta	1997	49 countries	1994 - 1996	debt/GNP, domestic firms/population, external market capitalization
Levine	1998	43 countries	1976 - 1993	per capita GDP growth, per capita capital stock growth
Outreville	1990	55 countries	1983 - 1984	property liability insurance premiums
Outreville	1996	48 countries	1986	gross life insurance premiums
Haiss & Sümegi	2008	29 European countries	1992 - 2004	real GDP per employee
Bianchi et al.	2011	7 countries of CESSE	2000 - 2010	real insurance premium growth
Feyen et al.	2011	90 countries	2000 - 2008	life and non-life premiums
Jakubik et al.	2014	30 European countries	2005 - 2012	GWP growth
Kim	2005		1997 - 2000	surrender and lapse rates
Kiesenbauer	2011	133 life insurers from Germany	1997 - 2009	lapse rates
Arena	2006	56 countries	1976 - 2004	average rate of real per capita GDP growth
Kugler & Ofoghi	2005	life and non-life british insurers	1971 -2003	net written premiums
Sen	2008	12 Asian countries	1994 - 2004	insurance penetration, insurance density

Source: Author

Table 3.2: The Empirical Literature Dealing with the Interaction between Insurance and Economic Growth (b)

Author	**Year**	**Explanatory Variable**	**Methodology**
Beenstock et al.	1988	GNP, interest and unemployment rate, income	OLS on pooled time series and cross section data
Beck and Webb	2002	income per capita, inflation, banking sector development, religious and institutional indicators, education, life expectancy	OLS and estimation of FE, cross-country and time-series analysis
Ye et al.	2009	life expectancy, foreign market share, income, financial development	OLS and estimation of FE, cross-country and time-series analysis
Esho et al.	2003	real GDP, price of insurance, education, legal rights and enforcement	OLS estimation, GMM dynamic system estimator
Porta	1997	GDP growth, real GNP, rule of law, legal origin, creditor rights	OLS on cross-section data
Levine	1998	creditor rights,law and contract enforcement,	GMM estimation
Outreville	1990	insurance price, financial development, GDP, education, labour force	OLS on cross-section data
Outreville	1996	inflation, GDP, financial development, life expectancy, education level	OLS on cross-section data
Haiss & Sümegi	2008	physical and human capital stock, interest and inflation rate, income	LSDV, static variable-intercept panel data model with country fixed and time-fixed effects
Bianchi et al.	2011	real GDP growth	Panel regression - cross-section with FE
Feyen et al.	2011	income distribution, demographic structures, population size	Multivariate regression analysis on pooled data
Jakubik et al.	2014	interest rates, unemployment rates, nominal GDP	Generalized method of moments
Kim	2005	difference between crediting rates, policy age since issue, unemployment rates, seasonal effects	Arctangent, logit and CLL model
Kiesenbauer	2011	buyer confidence, current yield, stock performance, GDP, UR, company age and size	Logit and CLL model
Arena	2006	the origin of the legal code, religious composition, GDP per capita growth, inflation, human capital, stock market turnover	GMM estimation for dynamic models
Kugler & Ofoghi	2005	yearly and single life premiums, individual pensions, annuities, health, property, reinsurance	DF-GLS test, Johansens cointegration test
Sen	2008	gross domestic savings per-capita, financial depth, urban population, life expectancy, CPI, young dependency ratio	Fixed and random effect test (The ADF Test, the Kwiatkowski-Phillips-Schmidt-Shin Test)

Source: Author

Chapter 4

Data

In the empirical part of the thesis we will set out an estimation strategy used to estimate the macroeconomic factors that drive growth of both life and non-life insurance sector based on the theoretical background from the previous chapters. As already mentioned, the research to date has tended to focus rather on identification of potential risks for banks than for insurance companies because banking sector plays a key role for financial and economic development of countries. However, insurance markets constitute a significant part of financial sector and have a substantial impact on the stability of the financial system. Chapter 2 describes key risks which may threaten the stability of insurance companies and highlights the importance of the impact of macroeconomic determinants on insurance companies to control potential systemic risk.

The aim of this study is to shine new light on the determination of this framework through an examination of the macroeconomic factors that determine the growth of insurance sector during 2005-2013. This chapter provides data description and descriptive statistics.

4.1 Data Description

The choice of appropriate dependent variables affecting the growth in the insurance sector was subject of detailed analysis and was especially influenced by the availability of data of all examined countries. Based on our theoretical and empirical literature review, we have selected key macroeconomic factors that might have substantial impact on the demand for life and non-life insurance and, thus, on gross written premiums of insurance companies. The factors are divided into three groups:

- **Economic:** nominal GDP, interest rate, inflation rate, unemployment rate

- **Institutional:** Rule of law, Corruption control, Political Stability and Absence of Violence and Government Effectiveness

- **Demographic:** Young dependency ratio, Old dependency ratio, Life expectancy, Level of education

The relevant data for the estimation of our hypotheses were obtained from different data sources. We are going to use the set of data collected by national authorities which is available for download at the EIOPA website. These annual data contain the information about gross written premiums for both life and non-life sector of 26 countries of the European Union (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and United Kingdom) and three European countries (Iceland, Latvia and Norway) for the period starting from 2005 to 2013.

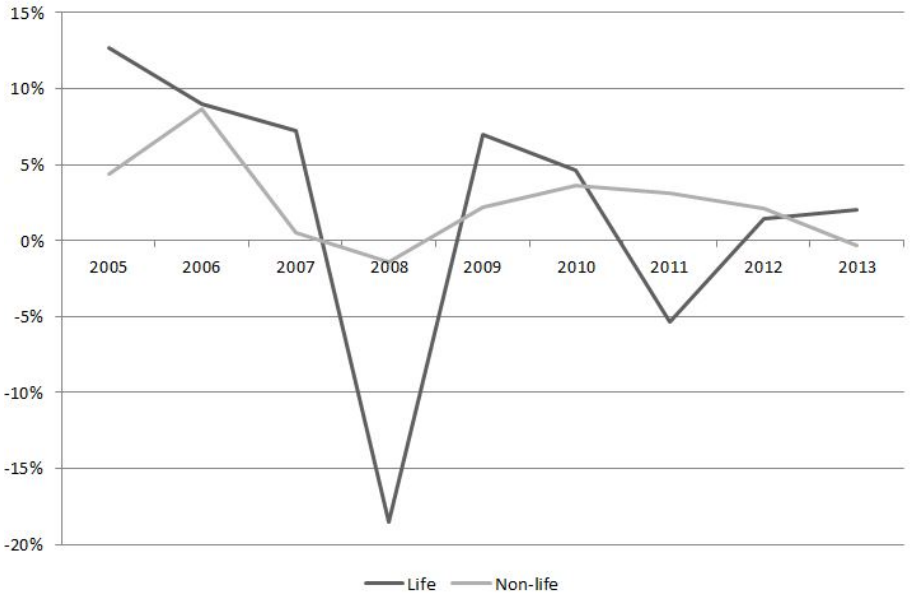
All institutional determinants (Rule of law, Corruption control, Political Stability and Absence of Violence and Government Effectiveness) are provided by The Worldwide Governance Indicators database (WGI). Inflation rate as well as young and old dependency ratio are obtained from the World development indicators database (WDI). European Statistics Office (EUROSTAT) provides data with the information about interest rates, unemployment rates, nominal GDP and level of education. Finally, the data for life expectation at birth is available on United nations development programme (UNDP) website.

Before describing the choice of appropriate dependent variables affecting the growth in the insurance sector, the definition of **gross written premium** should be mentioned. Gross written premiums represent the total of revenues (premiums) the clients are supposed to pay for insurance products which were written during a specific period of time. These refer to both earned and unearned premiums. Insurance companies usually buy a risk protection in a form of reinsurance. After deduction of reinsurance costs from premiums we get net written premiums. To examine insurance market growth we will use GWPs of life and non-life enterprises separately.

The figure below presents the growth in gross written premiums of European countries examined in our study between 2005 and 2013. From the figure we

can see that both life and non-life GWPs declined significantly in 2007 resulting from negative impacts of financial crisis. Most of the countries had to deal with low employment rates and slight development of GDP growth.

Figure 4.1: Annual growth in gross written premiums in Europe



Source: EIOPA, Insurance Europe.

It is important to notice that the impact of particular economies of countries might be influenced by the aggregation of data. For this reason, it is more relevant to observe the relationship between life and non-life GWPs and macroeconomic determinants for every country separately. Figure 4.2 shows GWP growth in life and non-life insurance sector for all examined countries on the vertical axis and GDP per capita growth on the horizontal axis. Figure 4.2 reveals that there are differences among every particular country. From the chart, it can be seen that there is a substantial relationship between both life and non-life GWPs and GDP growth.

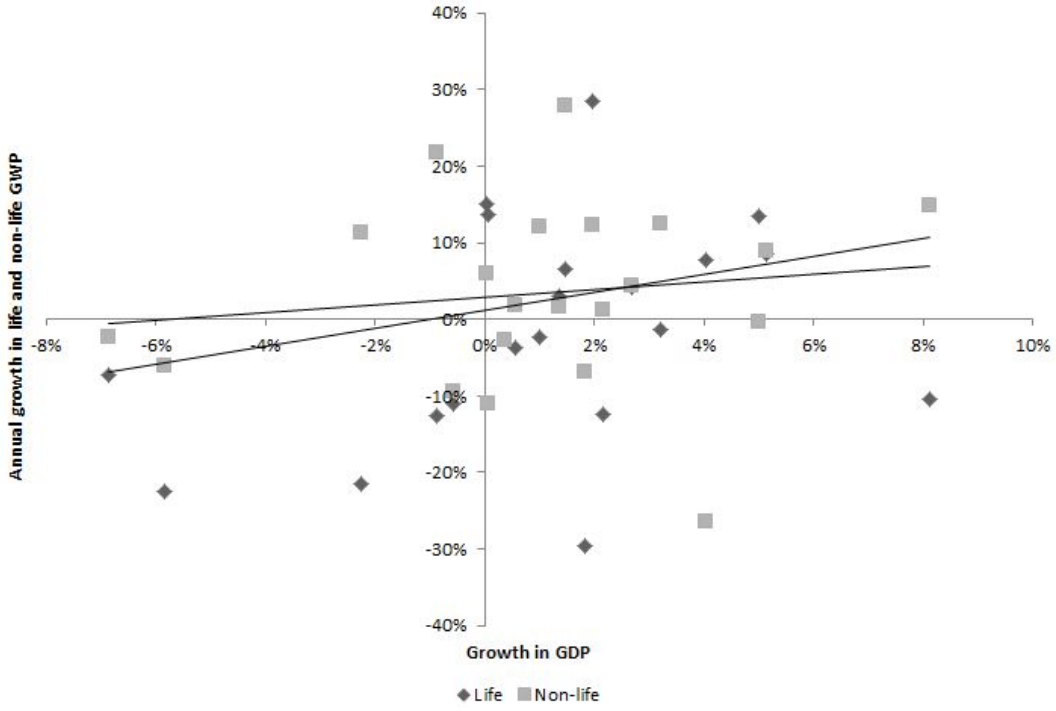
4.1.1 Economic Factors

Nominal GDP

The substantial relationship between the total output in the economy and the growth in the insurance sector was affirmed by several authors (Esho *et al.* 2004; Beck & Webb 2003; Outreville 1996). The results show that along with the higher GPD is the insurance growth greater for both life and non-life sector.

This is because usually with increasing income, individuals spend more money to meet their needs and buy goods and services such as houses and vehicles that need to be insured. The greater demand for non-life insurance is therefore created. Moreover, the increasing income might be the reason why people direct a part of their earnings towards retirement and buy insurance products related to investment (Beck & Webb 2003). Respectively, then the life insurance demand grows. We use nominal GDP in our regression and we suppose a positive correlation with the GWP growth.

Figure 4.2: GWP growth in life and non-life sector vs. growth in GDP for all examined countries in 2013



Source: EIOPA, EUROSTAT.

Interest rates

Interest rates indicate the real return of money invested by insurers. Along with higher interest rate the profitability of insurance companies increases. As a consequence, increased profits of insurers offer an opportunity for greater profitability of consumers of life insurance policies (Beck & Webb 2003). On the contrary, purchases of life insurance may decrease with higher interest rates because people expect higher returns and find another way how to accumulate

money (Lenten & Rulli 2006). The findings on the relation between the insurance demand and interest rate are not certain. Outreville (1996) found out that real interest rate does not influence the demand for life insurance. On the other hand, Beck & Webb (2003) found a positive correlation. Therefore, we expect the impact of interest rate to be ambiguous.

Inflation

The increase in inflation encourages consumers to reduce their savings and influences monetary profits in the long-term period. Therefore, it negatively affects the insurance growth which was demonstrated by several authors in the empirical literature (Beck & Webb 2003; Outreville 1996).

Unemployment

The relationship between unemployment and the demand for life and non-life insurance has been carried out only by few researchers. The reason might be that the influence of this variable is partly demonstrated by the income variable (Lenten & Rulli 2006). However we will include unemployment into our regression because its effect on this relationship cannot be properly explained only by the income effect. We expect negative effect of high unemployment rate on the dependent variable because people with lower income are not able to buy insurance products and the demand for insurance decreases.

4.1.2 Institutional Factors

Legal rules and their enforcement as well as political stability in the country have substantial impact on the market development. When the legal and also political system are stable then the citizens have an incentive to purchase life insurance and to conclude a long-term agreement with insurance companies.

Porta *et al.* (1997) showed that the rule of law and the strength of influence of authority have impact on the success of the insurance sector development. Legal environment providing protection to investor, induce a higher level of financial intermediation and growth. Countries where legal codes protect the rights of creditors have higher insurance demand than countries where laws are more lax to creditors (Levine 1998). Therefore, determinants as Rule of law, Corruption control, Political Stability and Absence of Violence and Government

Effectiveness provided by WGI are used to measure political and institutional determinants.

Political Stability and Absence of Violence measures the probability that revolutions motivated by the political situation in the country will threaten the government stability. **Rule of Law** measures the degree to which agents in the country can rely on the rules of society and the degree to which they behave accordingly to these rules. Rule of Law also gives us information about the property rights, the courts and the quality of contract enforcement. The variable **Control of Corruption** shows us to what extent the state is being corrupted and the power of the public sector used for private interests and gains. The quality of policy implementation, public and civil service and the level to which these services are influenced by political effects is measured by **Government Effectiveness**. The annual data of these four determinants are expressed in units scaled approximately from -2,5 to 2,5. The greater the values, the better the outcomes of the government system are. Data are available from 2002 to 2013 (Kaufmann *et al.* 2010).

4.1.3 Demographic Factors

Among the most commonly used products offered by the life insurance belongs protection in the event of early death and method of saving in the long-term period. In line with earlier studies (Beck & Webb 2003; Sen 2008; Ye *et al.* 2009), we suppose that variables as dependency ratio, life expectancy and level of education will strongly influence the insurance sector growth.

Total Dependency Ratio

Total dependency ratio is measured as the ratio between the number of people aged between 0 and 14 and over 65 (dependents) and the number of people aged between 15 and 64. In other words, this ratio shows the number of people who are not working compared to those of working age. In our thesis, we are going to divide total dependency ratio into two variables. The young dependency ratio, which considers only people under 15, and the old dependency ratio, which considers people over 65. According to the study of Beck & Webb (2003), we expect both young and old dependency ratio to have ambiguous effect on the life insurance demand because they have opposite effects on the savings and mortality components of life insurance.

Level of Education

Level of education is assumed to have a positive relationship with the insurance consumption. According to Outreville (1996), the level of education influences individual's degree of risk aversion and perception of protection needs. People with high level of education are usually able to realize benefits of long-term savings and risk management (Beck & Webb 2003). On the other side, the higher number of people who are studying, the less labor force is used and so the GDP of the country decreases. For that reason our expectation is that the impact of the level of education on insurance consumption is ambiguous. While Outreville (1996) showed that the impact is positive, Beck & Webb (2003) proved that this variable is insignificant. In order to measure the level of education, Beck & Webb (2003) used the gross tertiary enrollment ratio in his study. This ratio demonstrates the overall enrollment in university level of education within a country and is expressed as a ratio between the number of enrolled students and the number of students who may potentially enroll in university level of education. Due to lack of data for all examined countries, we are going to use a dataset containing information about population with tertiary education attainment provided by EUROSTAT. The educational attainment of an individual aged from 15 to 64 demonstrates the tertiary level of education successfully completed.

Life Expectancy

Life expectancy of the total population at birth tells us how long a newborn infant would live if conditions of mortality at the time of infant's birth were the same during the whole of its life. Data containing information about this variable will be obtained from UNDP database. Sen (2008) and Beck & Webb (2003) proved that this demographic determinant was significantly correlated with demand for insurance products and suggested that conditions in which people are living enhance the length of life. The longer life expectancy, the higher the probability of using insurance products to generate benefits is. Therefore, the expected sign of life expectancy at birth is positive.

4.2 Descriptive Statistics

It is essential to make suitable transformations in order to deal with biased results caused by seasonality of determinants in the regression. The natural

logarithm transformation is employed to variables such as GWP and nominal GDP. To all variables are employed first differences transformations in order to provide their stationarity in the time-series regression. Then, variables such as Unemployment rate, Interest rate, Young dependency ratio, Old dependency ratio, Life expectancy and Inflation rate are expressed by rate value form. All institutional factors are expressed in the percentile rank.

The table 4.1 illustrates some of the main characteristics of the data. Table provides data description, transformation which will applied to all variables examined in our study, the expected signs of variables and finally, data sources.

Table 4.1: Data Description

Notation	Description	T*	Sign	Source
$GWPL_{i,t}$	Total GWP in the country for the life insurance sector	Log-diff		EIOPA
$GWPN_{i,t}$	Total GWP in the country for the non-life insurance sector	Log-diff		EIOPA
	Economic factors:			
$GDP_{i,t}$	Nominal GDP in country i on time t	Log-diff	+	EUROSTAT
$IR_{i,t}$	Interest rate (%) in country i on time t	FD	+/-	EUROSTAT
$INF_{i,t}$	Inflation, GDP deflator (annual %)	FD	-	WDI
$UR_{i,t}$	Unemployment, total (% of total labor force)	FD	-	EUROSTAT
	Institutional factors:			
$ROL_{i,t}$	Country data for Rule of law in time t (percentile rank)	FD	+	WGI
$CCON_{i,t}$	Country data for Corruption control in time t (percentile rank)	FD	+	WGI
$PSTA_{i,t}$	Country data for Political stability in time t (percentile rank)	FD	+	WGI
$GEFF_{i,t}$	Country data for Goverment effectivness in time t (percentile rank)	FD	+	WGI
	Demographic factors			
$YDEP_{i,t}$	Age dependency ratio, young (% of working-age population)	FD	+	WDI
$ODEP_{i,t}$	Age dependency ratio, old (% of working-age population)	FD	+	WDI
$LEXP_{i,t}$	Life expectancy at birth, total (years)	FD	+/-	UNDP
$LEDU_{i,t}$	Population with tertiary education attainment, both sexes (%)	FD	+/-	EUROSTAT

* Transformation

Source: Author

Table 4.2 presents basic descriptive statistics for all determinants examined in 29 European countries from 2005 to 2013. The total number of observations for all independent variables is 261 except variable interest rate. Nine observations are missing for Estonia and Romania. The number of observations is lower also for dependent variables because some annual data on life and non-life insurance premiums are missing for Denmark, Greece, Romania, Slovenia and United Kingdom. The number is therefore reduced to 256 for life GWPs and to 255 for non-life GWPs. The lowest value for non-life GWPs corresponds to the premiums of Slovakia in 2005. The minimum value for life GWPs was 18,97 and belongs to Iceland in 2009. The highest life premiums were in United Kingdom in 2007 and non-life premiums in Germany in the last observed year. The

Table 4.2: Descriptive Statistics

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
gwpl	256	16179.01	36118.99	18.97	277312.7
gwpn	255	11904.25	23514.33	17	109454.6
gdp	261	428280.2	648645.9	4669.9	2737600
ir	252	4.710397	2.38383	1.4	22.5
inf	261	2.839605	3.074359	-5.3903	20.29545
ur	261	8.39069	4.145721	2.3	27.5
odep	261	23.81512	3.98905	15.46	32.60865
ydep	261	24.06138	3.360133	19.28	33.31229
lexp	261	78.19004	3.161958	71.3	82.4
ledu	261	22.95747	7.016359	9.1	36.3
psta	261	0.7993467	0.4170017	-0.47	1.59
geff	261	1.198533	0.6107249	-0.35593	2.36
rol	261	1.193968	0.6026148	-0.17213	2
ccon	261	1.117747	0.8335929	-0.3	2.55

Source: Author

maximum GDP is in Luxembourg and the lowest in Bulgaria which corresponds to the economic situations of the countries.

There is a gradual increase for life expectancy at birth for all examined countries. For this reason, the lowest values are observed in 2005, particularly in Bulgaria, Latvia and Lithuania. Almost all examined countries reached the minimum level of inflation in 2007 due to the overall financial crisis with the lowest value in Norway. Institutional factors, such as political stability, rule of law and corruption control have the lowest percentile rank in Bulgaria and the highest in Denmark.

Chapter 5

Methodology

This chapter provides a description of methodology used to test our hypothesis and considerable part consists of justification for the choice of applied estimation method. The effects of selected variables on insurance growth might be different for life and non-life insurance sector. For that reason the relationship between insurance business growth and the macroeconomic environment will be examined for both sectors separately. According to previous studies in the literature review, the static model of a panel regression with fixed effects and the dynamic panel regression with the use of the generalized method of moments will be described. Our hypothesis will be tested by Arrelano-Bond estimation.

The advantage of using panel data is getting more efficient estimates due to more information about the dataset and more attained variations. Consequently, the number of degrees of freedom is higher and multicollinearity within independent determinants is reduced. Moreover, using longitudinal data allows to deal with cross-section heterogeneity, resulting in improved efficiency of estimates. The panel regression is able to determine effects of variables which are hard to examine by pure cross-sections. In contrast with OLS etimates, panel estimations enable us to control for mismeasured, as well as unobserved time-specific and country-specific effects which have impact on the dependent variable. Furthermore, using the panel data gives us possibility to measure influences of determinants that change little among countries and that change substantially across countries (Hsiao 2003). The essential sources used in the following section 5.1 are Greene (2012) and Wooldridge (2009).

5.1 Static Panel Regression with the Fixed Effects

The basic equation for the panel data is a regression model of the form:

$$y_{it} = \beta_0 + \sum_{s=1}^{l} \beta_s x_{its} + a_i + u_{it}; i = 1, \ldots, N; t = 1, \ldots, T \tag{5.1}$$

where index i represents the country, the index t denotes time, y_{it} is a dependent variable, x_{it} is a vector of time and country-varying independent variables and β_s is the set of coefficients to be estimated. The term a_i denotes unobserved effect on the dependent variable y_{it}. The error term that varies over time is represented by u_{it}.

First of all, the method of first differencing should be mentioned. This approach is used to deal with unobserved heterogeneity. In other words, to deal with the correlation between explanatory variables and unobserved effect. The method is based on following equation:

$$\Delta y_i = \sum_{s=1}^{l} \beta_s \Delta x_{is} + \Delta u_i \tag{5.2}$$

Biased estimates would occur as a result of unobserved heterogeneity. Therefore, the first differencing method is used to exclude the fixed effects.

As can be seen from the equation 5.2, both unobserved effect on the dependent variable i and the intercept β_0 were so called differenced away. Moreover, this transformation results in reduction of the degrees of freedom from $nT - l$ to $nT - n - l$. The coefficient of determination indicates the amount of variance of the independent determinants explained by the dependent determinant as a result of first differencing.

5.2 Dynamic Panel Regression using the Generalized Method of Moments

When examining the impact of macroeconomic determinants on insurance premiums, one of the main problems that might occur is the endogeneity problem, i.e. explanatory variables and error term are correlated. Because of this, the Ordinary Least Squares exogeneity assumption is violated and estimation results would be inconsistent and biased. To avoid this problem it is possible to substitute variables suffering from endogeneity for instrument variables. However in

our case it is not easy to find appropriate instrumental variables. Therefore, we will employ a dynamic panel regression using the system generalized method of moments (GMM) that is able to deal with endogenity problem in the independent variables. Moreover, this method uses lagged variables as instruments instead of new ones. We assume our dependent variable GWP for life and non-life sector to be persistent which supports the use of dynamic model. Our data set contains time-series and cross-country observations in the short time horizon and GMM provides more robust estimates than other methods.

Thus, there is several reasons why we prefer to use the generalized method of moments that is able to cope with specifications of dynamic regressions. Arellano-Bond estimation was applied by Arellano & Bond (1991) and Arellano-Bover estimation by Arellano & Bover (1995). Both are intended for dynamic models of panel data. The main source used in the section 5.2 is Roodman (2009).

5.2.1 The Arellano-Bond estimation

There are several advantages of using the Arellano-Bond estimation. The process is dynamic, so the past variables affect the present realizations of the explanatory one. Estimation method contains specific periodic intercepts so that we are able to avoid time-specific unobserved effects. In order to address the problem of country-specific effects and endogenous independent variables it is necessary to control for it by differencing and using GMM. The strong endogeneity assumption of independent variables is relaxed, so these variables might be correlated with the error term u_{it}. Moreover, the estimators are able to deal with heteroskedasticity and individual fixed effects.

The model we will estimate is the following:

$$y_{it} = \alpha y_{i,t-1} + X_{it}\beta + \epsilon_{it} \tag{5.3}$$

$$\epsilon_{it} = \mu_i + \upsilon_{it} \tag{5.4}$$

where $y_{i,t}$ represents life or non-life gross written premiums, dynamic variable $y_{i,t-1}$ is the lagged value of the GWPs and X is the vector of economic, institutional and demographic explanatory variables. The disturbance term is composed from the fixed unobserved country-specific effect μ_i and the idiosyncratic shock υ_{it}.

The involvement of a lagged dependent variable leads to the correlation between $y_{i,t-1}$ and the disturbance term because $y_{i,t-1}$ is a function of the country-specific effect as well as the dependent variable. It is essential to tranform the data in order to eliminate dynamic panel bias. Arellano & Bond (1991) uses difference GMM which is based on the first-difference transformation and removes the country-specific effect μ_i. After application of the transformation to 4.3 we get the following equation:

$$\Delta y_i = \alpha \Delta y_{i,t-1} + \Delta X_{i,t}\beta + \Delta \nu_{i,t} \tag{5.5}$$

Similarly to the equation 5.2 we can see that the fixed effects are removed, however the lagged variable $y_{i,t-1}$ might still be endogenous because it is included in $\Delta y_{i,t-1}$ which is correlated with $\nu_{i,t-1}$ in $\Delta \nu_{it}$. As it was already mentioned, another positive thing about using the first-difference transformation is that we can use lagged values of gross written premiums as instrument variables. Accordingly, the dependent variable that is transformed and lagged can be treated as not strictly exogenous variables influencing $y_{i,t}$ in our regression. Our data set includes observations in the short time horizon from 2005 to 2013. Therefore, the model will contain only two lags of transformed GWPs.

The weakness of the first-difference transformation is that it enlarges gaps in unbalanced data sets. If someone tests only few time periods with some missing dependent variables, then $\Delta y_{i,t}$ as well as $\Delta y_{i,t+1}$ are absent in the transformed data or may be entirely missing in first differences. However our panel data contain nine periods of time and there are only four observations missing for the life insurance sector and five for the non-life insurance sector. Thus, we can use first-difference transformation with no worries.

5.2.2 Instrumenting with lags

The panel bias is removed by transforming our data. Hence the main issue is now to deal with endogeneity. As discussed in subsection 5.2.1 we can use instrument variables from our data set. The instruments in the differenced case for $y_{i,t}$ may be either $y_{i,t-1}$ or $\Delta y_{i,t-1}$ because both are supposed to be correlated with transformed life and non-life GWPs and uncorrelated with $\nu_{i,t}$. Determinants such as GDP per capita, interest rates and unemployment will be also instrumented with two lags. The inclusion of more lags as instrument variables can result in improved efficiency, however a period of nine years allows us to use only two lags.

It should be mentioned that using too many instruments in difference GMM estimator can lead to specification tests that are not accurate. In the first case, there is not enough individuals so the tested sample is too small. In the second one, the data set spans a period of too many years. Our panel sample is quite small as there is examined data of 29 countries over nine time periods. Therefore, it is needed to reduce the number of instruments to prevent from the problems that can arise. As described in the previous section, instead of using all possible lags we will use only first two lags for the selected variables.

5.2.3 Autocorrelation testing

After GMM estimation the Hansen test is employed to test for joint validity of instrument. Moreover, Arellano & Bond (1991) tests autocorrelation in the disturbance term $\nu_{i,t}$. In other words, this test reveals invalid instruments. Obviously, the error term is supposed to be autocorrelated as it includes fixed effects and GMM estimators are intended to deal with this issue. However, disturbance term can be serially correlated. Thus, for example, the second lag of the dependent variable is endogenous to the disturbance term in $\Delta\epsilon_{it} = \nu_{it} - \nu_{i,t-1}$ and can make it possible invalid instrument. The testing for autocorrelation in our regression will be examined by Arelano-Bond test because it is valid for GMM estimation with fixed effects.

Chapter 6

Results and Policy Implications

The aim of this chapter is to interpret the research results of the relationship between gross written premiums of insurance companies and macroeconomic determinants. It analyses the impact of economic, institutional and demographic factors on the insurance growth in 29 European countries from 2005 to 2013. Life and non-life insurance sectors are examined separately because the effects of selected variables on these sectors are expected to be different. The impact of particular economies of countries might be influenced by the aggregation of data. Thus, we will attempt to confirm our last hypothesis that there are substantial cross-countries differences among the importance of different macroeconomic determinants on the insurance sector development.

It was essential to make suitable transformations in order to deal with biased results caused by seasonality of determinants in the regression. The natural logarithm transformation was employed to variables such as GWP and nominal GDP. To all variables were employed first differences transformations in order to provide their stationarity in the time-series regression.

6.1 Life Insurance Sector

Our first hypothesis that there is a strong correlation between the growth in gross written premiums in the life insurance sector and the macroeconomic determinants will be tested. First of all, we will show that difference GMM dynamic panel estimator is suitable method to test this hypothesis.

We employ a Wooldridge test for serial correlation by Wooldridge (2002). As can be seen from the table 6.1, we may reject the null of no first-order autocorrelation for life gross written premiums (Drukker 2003). Thus, our

dependent variable is persistent and lagged effect in the time series is present. It is appropriate to use a dynamic panel regression.

Table 6.1: Wooldridge test for autocorrelation in panel data (life sector)

	F-statistic	**p-value**
GWPL	54,301	0.000
	F(1,27)	

Note: H0: no first-order autocorrelation

Source: Author's computations.

The univariate regression is employed to identify transformed and lagged variables that are significant. Each macroeconomic variable is incorporated as a single variable in the model. Based on the results of this analysis we obtain variables that fit our model in the best possible way. Table 6.2 shows the results of univariate regression for all transformed variables, results of lagged variables are included only if they are significant. The number of observations is different for each determinant as some annual data are missing for some countries. As can be seen from the table, seven coefficients are significant at least at 10% level of significance and we will include them into our final model. Apart from them, we will include also one year lagged GDP. Even though its p-value is 0.145, we expect that the effect of lagged level of GDP on life gross written premiums is substantial. Generally, the estimates show that all coefficients have the expected signs. Thus, we use the following variables to estimate our GMM regression: two lags of dependent variable (dynamic components $lag1\_gwpl$ and $lag2\_gwpl$), economic variables gross domestic product up to lag one (dl_gdp, $lag1\_gdp$) and two lags of unemployment rate ($lag1\_ur$, $lag2\_ur$) and goverment effectiveness representing institutional factors (dl_geff, $lag1\_geff$).

The dynamic panel-data estimation using one-step difference GMM is used to estimate our model. The STATA statistical software is employed using the command *xtabond2* provided by Roodman (2009). Table 6.3 presents the results obtained from the estimation. As can be seen from the table, both dynamic components - lagged dependent variables are negative and strongly significant. This result is assumed because life insurance growth exhibits persistence over time. Similar outcome was attained for instance by Christophersen & Jakubik (2014). The most important driving factor of life gross written premiums is GDP growth. It positively affects insurance growth even at 1% level

Table 6.2: The Univariate Regression (life insurance sector)

Explanatory Variable	**Number of Observations**	**Coefficient**	**Standart Error**	**P-value**
lag1_gwpl	**198**	**-0.0227574**	**0.0108049**	**0.036**
lag2_gwpl	**169**	**-0.110097**	**0.0663216**	**0.099**
dl_gdp	**227**	**1.151424**	**0.2030293**	**0.000**
lag1_gdp	**227**	**0.3946994**	**0.2698674**	**0.145**
d_ir	219	-0.0144615	0.00961	0.134
d_inf	227	0.0082372	0.0054647	0.133
d_ur	277	-0.00611	0.0089763	0.497
lag1_ur	**227**	**-0.0267777**	**0.0087566**	**0.002**
lag2_ur	**200**	**-0.0161914**	**0.0093827**	**0.086**
d_odep	227	0.0036303	0.0606724	0.952
d_ydep	227	0.1217059	0.1614078	0.452
d_lexp	227	-0.0757793	0.22535	0.737
d_psta	227	0.111664	0.1332415	0.403
d_geff	**227**	**0.1345794**	**0.0575942**	**0.020**
lag1_geff	**200**	**0.3715532**	**0.1675057**	**0.028**
d_rol	227	0.3236722	0.2625367	0.219
d_ccon	227	-0.1316789	0.1688283	0.436
d_ledu	227	-0.0207263	0.0226317	0.361

Source: Author's computations.

of significance. While a one year lag of unemployment rate is not significant, a two year lag negatively influences our dependent variable. A one percentage point increase of two years delayed unemployment rate factor results in 2,7% decrease in life premiums. People with lower income are not able to buy insurance products and therefore the demand for insurance decreases. Expected positive sign have coefficients of transformed and one year lagged government effectiveness in the country. The fact that strength of influence of authority has impact on the success of the insurance sector development is in line with the results of Porta *et al.* (1997). The estimates show that all coefficients have the signs we expected.

Table 6.4 shows results of tests that are applied. Arrelano-Bond tests for the first and second order autocorrelation and Hansen test of over-identifying restrictions are done to control for validity of instruments. The Arrelano-Bond test is employed to the differenced residuals in order to purge autocorrelated and unobserved disturbance term ν_i. GMM estimator expects the first differences to be autocorrelated because $\Delta\mu_{i,t} = \mu_{i,t} - \mu_{i,t-1}$ is supposed to be correlated with $\Delta\mu_{i,t-1} = \mu_{i,t-1} - \mu_{i,t-2}$ as they have common $\mu_{i,t-1}$ term (Roodman 2009). The p-value of AR(2) test in differences is 0,159. Therefore, we could not reject the null hypothesis of no autocorrelation of second order.

Table 6.3: Dynamic panel-data estimation (life insurance sector) one-step difference GMM

	dl_gwpl
lag1_gwpl	-0.494***
	(-9.54)
lag2_gwpl	-0.307***
	(-5.26)
dl_gdp	1.372***
	(3.86)
lag1_gdp	0.590*
	(2.62)
lag1_ur	0.0176
	(1.29)
lag2_ur	-0.0272**
	(-3.30)
d_geff	0.578**
	(2.95)
lag1_geff	0.571*
	(2.45)
Observations	140

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations.

Table 6.4: Arrelano-Bond and Hansen tests (life insurance sector)

Test	**Coefficient**	**p-value**
F-test	48.49	0.000
Arrelano-Bond test AR(1)	-2.31	0.021
Arrelano-Bond test AR(2)	-1.41	0.159
Hansen test	23.40	0.220

Source: Author's computations.

The results of Hansen test of over-identifying restrictions confirm the validity of instruments because we fail to reject the null hypothesis of the validity of over-identifying restrictions. The F test results show that hypothesis of joint significance of variables is rejected.

To control for the validity of our estimates we investigate properties of time series and compare the consistent GMM estimators to simpler FE model and OLS model, which are expected to have different estimates of coefficients on lagged dependent variable (Bond 2002). The bias detected in FE and OLS models leads to lower estimate of FE and higher estimate of OLS. We employ both regressions and their results presented in table 6.5 confirm that coefficient estimates of our GMM method are valid. This analysis shows that dynamic panel regressions are more appropriate for estimating life insurance growth than static.

Table 6.5: Robustness check

	GMM estimation	**OLS model**	**FE model**
GWPL	-0.494	-0.23	-0.629

Note: The table contains coefficients of lagged value of life gross premiums.

Source: Author's computations.

Overall, the presented results indicate that our first hypothesis that macroeconomic factors are significant determinants of the growth in gross written premiums in the life insurance sector was confirmed. Among the key drivers of life insurance belong GDP growth, unemployment rate and government effectiveness in the country. On the other hand, none of the demographic factors is significant. These results contradict to findings of Sen (2008) and Feyen *et al.* (2011) who found that demographic factors have substantial impact on insurance growth. Generally, our results show that the insurance business is strongly cyclical.

6.2 Non-life Insurance Sector

This section will provide results of testing our second hypothesis, that there is a strong correlation between the growth in gross written premiums in the non-life insurance sector and the macroeconomic determinants. The estimation process is very similar to the previous section.

Firstly, we apply analysis for serial correlation by Wooldridge (2009) to make sure that GMM method is suitable to test our hypothesis. The result of the Wooldridge test is presented in the table 6.6 below. We reject the null hypothesis of no first-order autocorrelation and show that also non-life gross written premiums are persistent. A dynamic panel regression is therefore appropriate method to test the relationship between insurance growth and macroeconomic determinants.

Table 6.6: Wooldridge test for autocorrelation in panel data (non-life sector)

	F-statistic	**p-value**
GWPL	54,822	0.000
	F(1,27)	

Note: H0: no first-order autocorrelation

Source: Author's computations.

The univariate regression is used in order to obtain transformed and lagged variables that are significant and the most appropriate for our model. Each macroeconomic variable is incorporated as a single variable in the model. Table 6.7 shows the results of univariate regression for all transformed variables, results of lagged variables are included only if they are significant. The number of observations differs from 168 to 226 as some annual data are missing for some countries. According to the table, eight coefficients are significant at least at 5% level of significance and we will include them into our final model. Generally, the estimates show that all coefficients have the expected signs. Only the relevant variables remained in our dynamic panel regression. The selected variables used to estimate our model are: two lags of dependent variable (dynamic components $lag1\_gwpn$ and $lag2\_gwpn$), economic variables gross domestic product up to lag two (dl_gdp, $lag1\_gdp$, $lag2\_gdp$) and first lag of interest rate ($lag1\_ur$) and finally, goverment effectiveness representing institutional group of factors (dl_geff, $lag1\_geff$).

Table 6.8 provides the coefficient estimations and t-statistic obtained from the GMM regression. Compared to the previous section regarding the life insurance sector, unemployment rate is not one of the factors driving the non-life insurance sector but first lag of interest rate was included in our model based on results of univariate regression. Both dynamic components - lagged dependent variables are negative and strongly significant. As already mentioned, we ex-

Table 6.7: The Univariate Regression (non-life insurance sector)

Explanatory Variable	**Number of Observations**	**Coefficient**	**Standart Error**	**P-value**
lag1_gwpn	**197**	**-0.0139473**	**0.0057652**	**0.016**
lag2_gwpn	**168**	**-0.0182333**	**0.0066036**	**0.006**
dl_gdp	**226**	**0.9046917**	**0.1240068**	**0.000**
lag1_gdp	**226**	**0.4819832**	**0.1284911**	**0.000**
lag2_gdp	**200**	**0.2974678**	**0.1259923**	**0.019**
d_ir	218	0.0016791	0.0060018	0.780
d_inf	226	-0.0055007	0.0034704	0.114
d_ur	226	-0.0307547	0.1026791	0.765
lag1_ur	**226**	**-0.0194361**	**0.00556**	**0.001**
d_odep	226	-0.0073921	0.0386216	0.848
d_ydep	226	0.0709859	0.1026089	0.490
d_lexp	226	-0.0356884	0.1440288	0.805
d_psta	226	0.0459841	0.0885894	0.604
d_geff	**226**	**0.0255743**	**0.0054156**	**0.000**
lag1_geff	**200**	**0.1133155**	**0.0362773**	**0.002**
d_rol	226	0.0635185	0.1643121	0.699
d_ccon	226	0.0232507	0.1076545	0.829
d_ledu	226	-0.0132658	0.0143811	0.357

Source: Author's computations.

pected such result because life insurance growth exhibits persistence over time. The significant variable is GDP growth and its two lags. The results reveal that one percentage increase of one year lagged interest rate decreases non-life premium growth by 1,4%. We assumed the impact of interest rates on non-life insurance sector to be ambiguous, but the negative sign might be influenced by people's expectations of higher returns. Thus, they prefer another way how to accumulate money and do not buy insurance. As in the previous section, the non-life premiums are also affected by an institutional factor government effectiveness. However, the first lag of this institutional variable is significant only at 10% level in explaining life insurance growth and a one year lag of government effectiveness is not significant.

The results of Arrelano-Bond tests presented in table 6.9 are similar to those from the previous section. The autocorrelation of first differences is expected when using GMM estimator. We reject the null hypothesis of no autocorrelation. According to the p-value of 0.334, the AR(2) is not present in our model and we fail to reject the null hypothesis. The Hansen test of over-identifying restrictions is applied and its p-value was 0.485. Thus, the null hypothesis of valid instruments could not be rejected. The F test results shows that hypothesis of joint significance of variables is rejected.

Table 6.8: Dynamic panel-data estimation (non-life insurance sector) one-step difference GMM

	dl_gwpn
lag1_gwpn	-0.466***
	(-3.92)
lag2_gwpn	-0.353**
	(-3.51)
dl_gdp	0.890**
	(3.27)
lag1_gdp	0.577***
	(3.73)
lag2_gdp	0.705**
	(2.78)
lag1_ir	-0.0137*
	(-2.15)
d_geff	0.317*
	(2.72)
lag1_geff	0.252
	(1.73)
Observations	134

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Author's computations.

Table 6.9: Arrelano-Bond and Hansen tests (non-life insurance sector)

Test	**Coefficient**	**p-value**
F-test	66.68	0.000
Arrelano-Bond test AR(1)	-1.91	0.025
Arrelano-Bond test AR(2)	-0.97	0.334
Hansen test	18.56	0.485

Source: Author's computations.

In the end, we control for the validity of our estimates by comparing GMM estimates to estimates of FE and OLS models. According to Bond (2002), the OLS estimate should be higher and FE estimate lower than our GMM estimate due to dynamic panel data bias. As it can be seen from the table 6.10, results of all applied regressions confirm the validity of our consistent GMM estimations and show that dynamic panel regression is a suitable method to estimate the non-life insurance growth.

Table 6.10: Robustness check (non-life sector)

	GMM estimation	**OLS model**	**FE model**
GWPL	-0.466	-0.099	-0.728

Note: The table contains coefficients of lagged value of non-life gross premiums.

Source: Author's computations.

To sum up, we may conclude that our hypothesis that macroeconomic factors influence non-life insurance sector growth is confirmed. Our results support findings of Beck & Webb (2003) and Lenten & Rulli (2006) who found positive impact of GDP and negative impact of interest rates on insurance premiums. On the other hand, we did not find any evidence that demographic factors such as life expectancy or age dependency ratio influences our dependent variable. This finding is in contradiction with Sen (2008) and Outreville (1996).

6.3 Cross-country differences

In the previous sections we have showed which macroeconomic determinants are significant drivers of insurance growth. However, it is important to notice that the impact of particular economies of countries might be influenced by the aggregation of data. For this reason, it is appropriate to observe the relationship between life and non-life GWPs and macroeconomic determinants for every country separately. Even though countries of European Union are economically and politically connected by European integration, individual states still exhibit substantial heterogeneities accordingly to their economic performance and the macroeconomic influence on insurance business might vary country from country.

We test our last hypothesis that there are substantial cross-countries differences among the importance of different macroeconomic determinants on

the insurance sector development. Our data-set did not allow us to estimate regression coefficients separately for every country because we would have only nine observations for each regression. Therefore, we divide European countries according to their economic situation. We compare GDP per capita of countries obtained from WDI from the lowest to the highest value and the table 6.11 provides the division of examined countries into two basic groups that seem to be the most heterogeneous.

Table 6.11: Country division

Group 1	**Group 2**
Austria, Belgium, Germany, Denmark, Finland, France, Ireland, Luxembourg, Netherlands, Sweden, United Kingdom, Iceland, Norway	Bulgaria, Cyprus, Czech Republic, Estonia, Spain, Greece, Hungary, Italy, Lithuania, Malta, Portugal, Slovakia, Romania, Slovenia, Poland, Latvia

Source: Author

We may notice, that the first group contains more developed countries from Western and Northern Europe such as United Kingdom, France and Germany that are the largest markets for life insurance premiums and account for most of European life benefits paid. While in the second group are states mostly from Eastern and Southern Europe such as Spain, Italy, Romania or Greece that have to deal with economic uncertainty. The poor economic performance and political instability might distract people from buying insurance to protect their health, their cars or houses.

Dynamic panel regression is applied to data from both groups of countries independently. Respectively, life and non-life sector is examined separately. We use results from sections 6.1 and 6.2 and examine only relevant determinants which have significant impact on the life and non-life insurance growth. Table 6.12 provides results of all GMM regressions, the regressions 1 and 2 present the results of both groups of countries for life insurance sector and the regressions 3 and 4 for non-life sector. Consistent with our hypothesis, we find that determinants driving the insurance growth are different for each group.

When we compare regressions for life insurance sector, we find that both lags of dependent variable are negatively and significantly related to insurance growth. The GDP growth is statistically significant at the 1% level for Group 2 but only at 10% level for Group 1. The other determinants affecting life insurance business are different. While the insurance in Western and Northern

Table 6.12: GMM dynamic panel-data estimation across countries

	(1) Group 1 dl_gwpl	(2) Group 2 dl_gwpl	(3) Group 1 dl_gwpn	(4) Group 2 dl_gwpn
lag1_gwpl	-0.485***	-0.433***		
	(-8.40)	(-9.07)		
lag2_gwpl	-0.251*	-0.380**		
	(-2.74)	(-3.27)		
lag1_gwpn			-0.629***	-0.209**
			(-5.16)	(-3.42)
lag2_gwpn			-0.200*	-0.472***
			(-2.26)	(-4.12)
dl_gdp	1.314*	1.166**	0.866**	0.819**
	(2.19)	(3.63)	(3.95)	(2.98)
lag1_gdp				0.435**
				(3.93)
lag2_gdp				1.038***
				(8.91)
d_geff	0.748**		0.480**	-0.240*
	(3.54)		(3.89)	(-2.23)
lag1_ir				-0.0144*
				(-2.17)
lag2_ur		-0.0282*		
		(-2.72)		
Observations	64	76	63	71

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The regressions contain only determinants significant at least at 10% level.

Source: Author's computations.

Europe is dependent on the government effectiveness, the Eastern and Southern Europe is negatively affected by two year lagged unemployment rate.

In the non-life sector, both dynamic components are negative and significant in regressions 3 and 4. The GDP growth and its two lagged values are key drivers for non-life premiums in the countries of Group 2. Generally, Group 2 is influenced by more factors than Group 1. One of them is the first lag of interest rate. A 1% change of interest rate decreases non-life premium growth in Southern and Northern European countries by 1.4%. We find that insurance business growth in both groups is positively related to the government effectiveness, for Group 1 even at 1% level of significance.

As in the previous sections, the Arrelano-Bond tests for the first and second order autocorrelation and Hansen test of over-identifying restrictions is done to control for validity of instruments. The results of all four regressions are very similar. We assumed to reject the null of no autocorrelation of first order but we could not reject the one of the second order. We fail to reject the null hypothesis of valid instruments for all regressions.

6.4 Policy Implications

The research results show that both life and non-life insurance business is strongly cyclical. Generally, life insurance sector appears to be more connected with macroeconomic environment. However, non-life insurance sector is more sensitive to economic factors. Consistent with our last hypothesis, the importance of macroeconomic determinants on the insurance sector development is different across countries.

Even though it is not easy to assess the link between economic determinants and insurance sector as the gross premiums also depend on microeconomic determinants and on the used business models, the findings of this study can provide useful suggestions for policy-makers and regulators. Particularly in the times of financial instability and economic crisis, policy-makers should pay more attention to estimations of gross written premiums development.

Our results contribute strong evidence that macroeconomic determinants influence insurance business growth. By introducing quantitative macro-prudential frameworks, the main risks and weaknesses threatening financial stability of the insurance sector can be reduced. The determination of this framework could be useful for insurers with the specific information about insurance sector in order to detect and quantify possible economic situations affecting insurance

companies' balance sheets. Currently, the implied QE programme along with moderate growth is lowering yields and result in a low yield environment expectations. Therefore, it is essential for policy-makers to determine the possible consequences of continued low yield environment.

To complete the determination of the macro-prudential framework, variables such as lapse rates or profitability should be taken into account. They belong to key factors influencing insurer's performance and are strongly linked to the macroeconomic environment. Furthermore, to obtain more accurate results, more developed models including data of insurance companies should be employed. Solvency ratio is a key measure of risk faced by an insurer arising from disability to absorb its claims. Thus, it is a significant indicator of the insurer's financial stability and health and shows if the company is able to keep its performance in the long term. However, in the Solvency I framework, solvency ratio is insensitive to market price changes and therefore it would not correspond to our research needs. The situation will change in 2016 when the Solvency II will come into effect and insurers will have to change their regulatory regimes in order to harmonize European insurance sector.

Recently, the EIOPA Insurance stress test (2014) was employed with the aim to examine the stability of European insurance sector in different market situations and to strengthen the resistance of the financial system. Further development of quantitative framework is necessary to conduct top-down stress test to determine the macro-prudential impact on insurer's growth and solvency in all respects.

Chapter 7

Conclusion

In the recent past, the economic significance of the insurance industry has been on the rise both in developed and developing countries. The insurance sector plays an important role for financial and economic development and might substantially affect the stability of the financial system. There is a need to determine macro-prudential framework to quantify different economic scenarios affecting insurance companies' balance sheets and to control potential systemic risk. Furthermore, the relevant previous research of this topic is not very well developed. The objective of this thesis is therefore to examine the impact of macroeconomic determinants on insurance companies.

To reach the objective, three hypothesis are tested. The first one examines three groups of the macroeconomic factors (economic, institutional and demographic) that determine the growth of life gross written premiums during 2005-2013 in 29 European countries. Based on the research of Arellano & Bond (1991), we employ a dynamic panel regression using the system generalized method of moments which is the most suitable method to test our hypothesis. The most important driving factor of life insurance growth is GDP growth representing the group of economic factors. Among institutional factors affecting GWPs belong a two year lag of unemployment rate and government effectiveness measuring the quality of policy implementation, public and civil service and the level to which these services are influenced by political effects. Additionally, our model contains first and second lag of GWP because life insurance sector exhibits persistence over time. Both dynamic components are strongly significant. Overall, the results indicate that economic and institutional factors are significant determinants of the growth in life GWPs. On the other hand, we cannot confirm that demographic factors drive the life insurance

growth.

The second hypothesis tests whether there is a strong correlation between the growth in GWPs in the non-life insurance sector and the macroeconomic determinants. We employ a dynamic panel regression using the system generalized method of moments again and find the positive impact of GDP growth and negative impact of interest rates on non-life insurance premiums. First and second lag of gross premiums are negative and significant. We may conclude that our second hypothesis is confirmed. Similarly to the life insurance sector, we did not find any evidence that demographic factors such as life expectancy or age dependency ratio significantly influences our dependent variable.

The last hypothesis states that there are substantial cross-countries differences among the importance of different macroeconomic determinants on the insurance sector development. Considering short time periods, our data-set does not allow us to estimate regression coefficients separately for every country. Therefore, we divide European countries into two groups according to their economic situation measured by GDP per capita. Dynamic panel regression is applied to data from both groups of countries separately. Consistent with our hypothesis, we find that determinants driving the insurance growth are different for each group. While the life insurance in Western and Northern Europe is dependent on the government effectiveness, the Eastern and Southern Europe is negatively affected by unemployment rate. In the non-life insurance sector, the GDP growth is the main driver of insurance business for both groups of countries. However, the group including less developed countries is affected also by interest rate and two lags of GDP, while the other group is not.

In conclusion, this thesis shines new light on the development of an estimation strategy used to determine the macroeconomic factors that drive growth of both life and non-life insurance sector which is not very well developed by other researchers. Moreover, a broader set of panel data of 29 European countries collected by EIOPA and more variables explaining the growth in insurance sector bring new contributions to the current discussion in the academic literature. Our results provide strong evidence that macroeconomic determinants influence insurance business growth. This determination could be useful for insurers with specific information about insurance sector in order to detect and quantify possible economic situations affecting companies' balance sheets. Our study provides a useful suggestions to policy-makers and regulators who should pay more attention to estimation of gross premiums development, particularly in the times of financial instability and economic crisis.

Within the scope of this thesis, the current writer cannot hope to cover all the possible implications of the question. Further research should be done especially in the area of the determination of the macro-prudential framework. Variables such as lapse rates or profitability should be taken into account. Solvency ratio as a significant indicator of insurer's financial stability will correspond with our research needs when Solvency II will come into effect. Furthermore, to obtain more accurate results, more developed models including data of insurance companies should be employed.

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