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MASTER´S FINAL WORK
DISSERTATION

THE INSURANCE-GROWTH NEXUS IN PORTUGAL: A MULTIVARIATE TODA-YAMAMOTO GRANGER CAUSALITY TEST.

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GLOSSARY

GDP – Gross Domestic Product.

GFCF – Gross Fixed Capital Formation.

VAR – Vector Autoregressive Model.

VECM – Vector Error Correction Model.

ADF – Augmented Dickey-Fuller.

PP – Phillips Perron.

KPSS – Kwiatkowski–Phillips–Schmidt–Shin.

T-Y – Toda and Yamamoto.

EG – Engle-Granger.

PO – Phillips-Oulians.

AIC – Akaike Information Criterion.

SC – Schwarz Information Criterion.

HQ – Hannan–Quinn Information Criterion.

IMF – International Monetary Fund.

OECD – Organization for Economic Co-operation and Development.

ESRB – European Systemic Risk Board.

EIOPA – European Insurance and Occupational Pensions Authority.

IAIS – International Association of Insurance Supervisors.

AIG – American International Group.

TFP – Total Factor Productivity.

CDS – Credit Default Swaps.

SCR – Solvency Capital Requirements.

MCR – Minimum Capital Requirements.

ABSTRACT.

This dissertation provides new insights on the insurance-growth nexus in Portugal, using a multivariate time series analysis over the period 1983-2020. The analysis performed is based around the Granger causality concept, using the Toda and Yamamoto methodology as a consequence of the statistical properties of our time series. The results suggest that there is no causality relation in the Granger sense between economic growth and insurance development in Portugal.

KEYWORDS: Economic growth; Insurance; Granger causality; Toda and Yamamoto.

JEL CODES: E44; G22; G23; O44.

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1. Introduction.

The economic importance of the insurance sector for a modern economy goes beyond some of the metrics often used to measure the relevance of an industry such as its size, the number of employees or the contribution to national activity. Already in the first half of the twentieth century Justice Black, a member of the United States Supreme Court, wrote: "perhaps no modern commercial enterprise directly affects so many persons in all walks of life as does the insurance business. Insurance touches the home, the family, and the occupation or the business of almost every person in the United States" (Black, 1944).

The different channels through which the insurance sector might influence economic growth are varied and, sometimes, difficult to measure. Starting with the main activity performed by the insurance companies, the first contribution to economic growth has to do with the transference of risks, having this an ex-ante and an ex-post component (Zweifel & Eisen, 2012). The insurance contract, even if the risk does not materialise, reduces the uncertainty associated to a certain event and allows economic agents to reduce precautionary savings. These outcomes are likely to foster consumption and investment, ultimately exerting some influence on the business cycle. On an ex-post basis, the financial compensations derived from the materialisation of the risk contribute to the smoothing of individual shocks. When it comes to risk it is also important to mention that the role of insurance companies generating, aggregating and intermediating information might benefit positively economic growth as it reduces the likelihood of the risk-taking place as well as the extent and severity of losses (ESRB, 2015). From the perspective of capital markets, the large amounts of premiums paid by clients positions the insurance sector as one of the main institutional investors. In this regard, insurance companies can be understood as big poolers of liquidity with the ability to ease the overall financing conditions through their investments. According to the data provided by the European Insurance and Occupational Pensions Authority (EIOPA), insurance companies were one of the main institutional investors in the Eurozone at the end of 2020 with around €10 trillion in assets. If it is true that there are some important differences when considering the different national insurance markets existent in the Euro area countries, on aggregate, the investments of insurance companies are mainly allocated in collective investment allocations (31,91%), Government bonds (29,13%), corporate bonds (17,67%) and equity

(11,67%). Additionally, through the provision of secure funding as a consequence of the investment behaviour, holding liabilities until their maturity, as well as the characteristics of some of their products and assets, insurance companies facilitate for the development of the capital markets and foster economic growth. Finally, the insurance sector is also able to exert an influence on gross domestic product (GDP) through its contribution to the stability of the financial system creating, absorbing or propagating systemic risk[1].

Since the 1990s, academics have developed a lot of interest about the degree in which the level of financial development can help when explaining economic growth as well as the possible direction of causality of this relation (Beck, 2012). As a result, the study of the finance-growth nexus has been evolving through the years, following the appearance of new econometric techniques as well as datasets. Even if it is possible to say that on average the nexus between finance and growth is positive, the degree of unanimity among the different results does not allow to provide a clear-cut answer to this question. In addition to this, the conclusions of these results cannot be generalised for the whole financial intermediaries, as the majority of analysis performed have been focused on banks and financial markets. In light of the increased relevance of the insurance sector in the recent years and the relative lack of literature studying the insurance-growth nexus, the present article aims to shed some light on the question. For the purpose of the study, a causality analysis between insurance development, measured as the number of total premiums per capita, and the GDP per capita in the case of Portugal will be performed. The analysis will be carried out with the end goal of testing the four possible hypotheses that can take place when exploring the direction of causality. In the context of the finance-growth nexus these are the supply-leading hypothesis, the demand-following hypothesis, the feedback hypothesis and the neutrality hypothesis.

In order to provide an answer to the research question and, following the previous literature on finance development and growth, the analysis will be done using the concept of Granger causality. This approach considers that the causality relation exists if the variable of interest can be better predicted when taking into account the lagged values of other variables. Given the fact that the time series used do not fulfil the necessary statistical requirements for the Granger methodology (Granger, 1969), the study of the causality relation will be conducted following the Toda and Yamamoto methodology

[1] Systemic risk is referred to the risk that materializes when some parts of the financial system are unable to perform key economic functions, impairing the real economy.

(Toda & Yamamoto, 1995). With the objective of avoiding the possibility of a spurious correlation taking place, the analysis will be conducted under a multivariate framework. Concerning the control variables, the Gross Capital Formation (GCF) and the level of employment, are taken into account.

The results of the estimation of the causality exercise enable us to conclude that there is no causality relationship in the Granger sense between economic growth and insurance sector development in Portugal during the period between 1983 and 2020.

When compared with the previous literature, the study is the first one that has been applied in the context of the Portuguese economy on an individual basis. In addition, the use of a multivariate framework is another one of the differences of this study with respect to others.

The remainder of the paper is organised as follows. Section 2 presents a literature review on the insurance-growth nexus. Section 3 explains the methodological framework. Section 4 describes the data and reports the empirical results obtained. Section 5 concludes.

2. Literature review.

This section explores the two strands of the literature in which this work can be classified, the finance-growth-nexus as well as the insurance-growth causality analysis.

2.1 Exploring the finance-growth nexus.

On a general way, this paper can be classified under the literature studying the relationship between financial development and growth. Although the relationship between these two variables, as shown by (Beck, 2012; Popov, 2017), has been extensively studied the results of the different analysis are far from being homogeneous and evolve with the quality of data sets and economic methods. Quoting Ross Levine, one of the main authors studying the finance-growth nexus, it is possible to say that “we are far from definite answers to the question: does finance cause growth, and if it does, how?” (Levine, 2005).

On a historical perspective, the first authors talking about the relationship of finance and growth where Walter Bagehot (Bagehot, 1873) and Joseph Schumpeter (Schumpeter,

1912). While the former argued that finance, through the mobilisation of capital, was a key element during the Industrial Revolution in England, the latter highlighted the pivotal role of the financial intermediaries, relocating financial resources to the most innovative entrepreneurs, in the well-known "creative destruction" process. In clear contrast with the previous ideas, some other authors consider that finance is irrelevant when talking about economic growth. As pointed by (Meier & Seers, 1984), "finance is not even discussed in a collection of essays by the pioneers of development economics". Following the same lines, Robert Lucas also stated that "the importance of financial matters is very badly over-stressed in popular and even much professional discussion". (Lucas, 1988).

When it comes to the first seminal empirical study, (King & Levine, 1993)[2] studied the relation between economic growth and financial development, measured with four indicators[3]. The study used a panel data approach for 77 countries during the period between from 1960 to 1989. Based on their results, they concluded that there was a strong and significant correlation between measures of financial development and economic growth. After this paper, several authors started to conduct studies about this topic applying a different array of methodologies and datasets, sometimes pointing to different results.

Adding another layer of complexity to the finance-growth nexus literature, some authors have claimed that the relation between the two variables is not as clear as previously stated. In this regard some studies have pointed to the existence of a turning point between financial development and per capita growth (Paniza et al, 2015). The existence of an inverted U-shaped relationship tells us that there is a point from which higher levels of financial development start having negative effects on growth. In the case of the banking sector, some studies have empathised those high levels of credit might contribute to the appearance of banking crises (Reinhart & Kaminsky, 1999; Schularick & Taylor 2012). From the perspective of investment, (Beck et al, 2012), argue that the negative effect of credit on growth might be related with the share of credit financing household consumption, instead of enterprise lending. In this sense, it is possible to say that oversized financial sectors tend to favour low productive industries, changing the

[2] Even though the paper of (King & Levine, 1993) is considered the seminal publication, Goldsmith (1969) was the first author applying a modern econometrical approach to the study of the relationship between growth and finance.

[3] The indicators used are: ratio of liquid liabilities to GDP, deposit money bank domestic credit divided by deposit money bank plus central bank domestic credit, ratio of claims on the nonfinancial private sector to total domestic credit and the ratio of claims on the nonfinancial private sector to GDP.

sectorial composition of economies (Cecchetti & Kharroubi, 2012). In addition to this, other of the negative effects of an oversized financial sectors have to do with the increased volatility and the probability of financial crashes (Minsky, 1974; Kindleberger, 2005) and the possible existence of a "brain drain" for the other productive sectors of the economy (Tobin, 1984).

On a more specific way, the literature has also found different channels through which insurance activities can influence economic growth. As our work tries to explore the relationship between these two variables, it is important to mention the possible channels through which the insurance activities can influence the level of growth for the economy.

Starting with the main activity of the insurance business, it is argued that the provision of insurance, through the transference of risk might contribute to economic growth. The transference of risks is at the core of the insurance business and allows clients to cover against specific risks in exchange of the periodical payment of premiums. In exchange of these premiums, insurance companies, in case the defined outcome is realised, have the legal obligation to compensate the policyholders for the agreed part of the losses incurred. Even though the distribution of claims follows a heavy tail distribution, the provision of coverage is sound in economic terms due to the fact that the pay out on claims is expected to approach the average claim, small in quantity. Furthermore, the polling of risks, as well as the classification of policies in homogeneous groups, allow insurance companies to even out some idiosyncratic risks. As a consequence of the inexistence of insurance contracts for all the states of the nature, insurance markets are defined as incomplete (Schlesinger & Doherty, 1985).

In the context of the transference of risk, it is also important to note that insurance might contribute to the creation of information asymmetries because of the possible behavioral changes. Firstly, the existence of insurance can lead to the appearance of moral hazard as it can induce agents to have a less prudent behavior, reducing the effort at preventing losses and taking fewer mitigating actions (Cohen & Siegelman, 2009). Secondly, the problem of adverse selection can also appear in the insurance markets. The appearance of adverse selection has to do with the lack of information of insurance companies when it comes to the true risk profile of the insurance buyers. Applying the contribution of (Akerlof, 1970) to the insurance sector, it is reasonable to say that, in

presence of adverse selection, the general increase in the level of premiums[4] will induce the risk averse agents not to take out insurance and, as a consequence, the insurance market will be predominantly defined by the existence of no risk averse agents. As argued by (Pauly, 1974; Rothschild & Stiglitz, 1976), in presence of adverse selection low risk clients are likely to migrate to other companies offering insurance contracts more tailored towards their risk profile. In response to the higher share of risk "lover" clients, the insurance company must adjust the premiums upwards, reinforcing the incentives of the remaining risk averse clients to switch to other contracts. The adverse selection spiral might, in the long run, force insurance companies into insolvency (Zweifel & Eisen, 2012). Ultimately, given that there is no market for information, the insurance sector is more efficient than individuals agents when generating, aggregating and intermediating information about risk (e.g. probability of occurrence of an event, costs associated to the risky event and correlation of events) (OECD, 2013). As a result of this information intermediation, policyholders are able to assess and understand in a better way the risks they face, reducing the probability of the risk taking place as well as the extent of losses (ESRB, 2015).

Concerning the intermediation of risk, it takes place as a consequence of the different levels of risk aversion of economic agents and, from the client perspective, it allows for the smoothing of individual shocks. At first place, this transfer of risk might be good for consumption and investment due to the decrease in the ex-ante uncertainty associated with insurance. When it comes to consumption, the existence of insurance might contribute positively to the level of demand as it can reduce the amount of precautionary savings (Liedtke, 2007). In the case of investment, as shown by some studies for the Nigerian economy, insurance reduces the likelihood of the negative outcomes thus, increasing the level of resources allocated to investment activities (Olarinre et al, 2022; Ume et al, 2019). The positive effect on these two variables makes it possible to say that insurance activities allow for a better smoothing of the business cycle. Additionally, when taking into account the investment on activities with uncertain results, insurance contributes positively to the allocation of capital towards research activities, fostering productivity growth, innovation, market dynamism and competition (Ward & Zurbruegg,

[4] The increase in the price of premiums takes place because there is a positive correlation between the price and the average risk of the pool of clients.

2000). Some authors have also pointed to the importance of the insurance sector when it comes to the expansion of trade, transportation and capital lending (Han et al, 2010).

Taking into account the asset side of the balance sheet, the investments of the insurance companies can also steer economic growth. From the perspective of the financial markets, the large volume of assets that insurance companies invest contribute positively to the development of these, understanding development as higher liquidity and depth. These developments concerning liquidity and to a lesser extent depth, increase the overall availability of funding in the financial markets, leading to lower financing costs (ESRB, 2016; Claessens, 2006). In a more general way, the investment behaviour of the insurance companies, investing in long term assets (Shirakawa, 2011; EU Commission, 2014), creates, in some cases, a heightened demand for the different financial assets in which they invest. This has to do with the idea that insurers can stabilise financial markets as they can respond countercyclically to the changes in the prices of assets. The long duration of the liabilities induces insurers to hold assets until maturity and to buy those assets whose value is declining. Despite this, the evidence on the behaviour of insurance companies under periods of financial turmoil leads to inconclusive results (Timmer, 2018; De Haan, & Kakes, 2011; Linda & Giuzio, 2019).

From the liability side, the financial transfers and indemnifications of the insurance companies can also contribute positively to economic growth (Ward & Zurbruegg, 2000). Furthermore, some of the financial instruments used by insurance companies to raise capital can also influence economic growth as a consequence of the diversification benefits they provide. A clear example of this are the catastrophe bonds, assets issued by insurance and reinsurance companies with the aim of getting financing in the case of a catastrophe. Apart from their historically strong returns, their low correlation with the returns of other financial market instruments makes them attractive for different institutional investors (Polacek, 2018).

From a macroeconomic point of view, if the amount of insurance covering aggregate risk is large with respect to the economy, there might be some positive macroeconomic spillovers. As argued by (ESRB, 2015), insurance, offering compensation in the case of large shocks, contributes to the stabilisation of aggregate demand, reducing the pressure on the general budget as well as facilitating the financing of the current account deficit. Furthermore, the authors also emphasise that credit insurance may also reinforce the credit cycle. Assuming that premiums reflect the current default rates, a decrease in those

rates during the upswings of the business cycle will support the credit boom. On the contrary, downturns in economic activity will lead to a decrease in the overall amount of credit.

Beyond the above-mentioned contributions, the insurance sector can also exert a positive impact on economic growth because of its role in the financial system, creating, propagating or reducing systemic risk. If it is true that in the past the behaviour of insurance companies did not contribute to the creation of systemic risk, the situation in the last years might have changed. The irrelevance of insurance companies as a source and transmission channel of systemic risk in the past had to do with their balance sheet composition as well as the reduced interconnection with other parts of the financial system. Concerning the balance sheet, insurance companies were characterised by diversified assets as well as long-term liabilities. When it comes to assets, the existence of a diversified portfolio reduces the exposure to aggregate risk, thus diminishing the likelihood of the insurance companies decreasing the funding they provide in a procyclical manner during periods of market turmoil. On the liability side, the existence of long-term secure funding allowed insurance companies to be less dependent on short-term wholesale funding. When it comes to systemic risk, the higher dependency on long-term funding proves to be positive as insurers are likely to react in a less-procyclical way to the changing in funding conditions or to the occurrence of losses. In this light, they will be less likely to reduce the funding they provide or to sell a big amount of their assets in a rapid fashion[5].

Concerning the evolution of the insurance sector in the last years and, taking into account the level of heterogeneity among companies and countries, it is possible to say that the insurance companies might have become more important when it comes to systemic risk. As argued by (IMF, 2016), the increase in importance has been mainly related to their higher exposure to non-diversifiable aggregate risk as well as assets with higher βs[6], their higher involvement in non-traditional insurance activities[7], their procyclicality of pricing and investment derived from the commonality of the assets, their

[5] This process is sometimes referred as fire sales and implies a downward pressure on the prices of certain assets. This depreciation, if fast, may induce other financial institutions to sell their assets as a consequence of the possible balance sheet impairments, derived from the change in prices.
[6] The betas are used to measure the relative volatility of one asset with respect to the one from market one.
[7] According to the International Association of Insurers Supervisors (IAIS) these activities have to do mainly with the existence of non-policy holder liabilities and non-insurance revenues, the participation of insurance companies in derivatives trading, the existence of short-term funding and financial guarantees as well as the existence of intra-group commitments.

interconnections with other financial institutions, their relative size, the riskier profile as a result of the low rates environment[8] and the pressures on their business model as well as the lack of substitute services. When it comes to systemic risk, the best example showing the importance of the insurance companies was the case of American International Group (AIG) in 2008. The exposure of the company to the US housing market through the activities related with the issuance of Credit Default Swaps (CDS) lead to a sudden increase in claims, increasing the short-term liquidity necessities of the company in a moment in which banks and markets were highly reluctant to provide financing. Apart from the activities related to the issuance of CDS, the participation in the securities lending business and, more specifically the unexpected end of the transactions by the borrowers, also contributed in an important manner to the increase in the liquidity needs of the company. The financial difficulties, together with the linkages of AIG with banks, pension funds, and public entities, as well as the importance of the company in the commercial paper market, made the US authorities to offer financial assistance to the company (McDonald & Paulson, 2015; Engbith & Jeffereis, 2021).

For the case of reinsurers, if it is true that their systemic impact can be also understood through the reasons mentioned above, it is also important to take some specificities into consideration. These specificities include the interconnectedness with other primary insurance and reinsurance companies, a high market concentration as well as the existence of captive insurers[9] and regulatory arbitrage[10].

2.2. Empirical studies on insurance-growth causality.

When it comes to the study of the relation between insurance and economic growth, the topic has been analysed considering different arrays of methodological approaches and data sets from cross-country to country-specific cases.

[8] Concerning the increase in risk taking by insurance companies as a consequence of the search for yield, different studies point to different results. While (IMF, 2017) point to the non-increase in the risk-taking behavior of insurance companies, (Becker & Ivashina, 2015) find the opposite for when it comes to investments in the bond markets.

[9] In the paper captive insurers refers to a fully owned subsidiary insurer that provides insurance services to the parent company.

[10] As shown by (Yogo, 2014), life insurers were able to decrease the applicable capital requirements through the creation of captive reinsurers in the US states with lower capital requirements. The Federal Reserve raised concerns about these companies because of the lack of transparency of their risks as well as the underfunding of the Special Purpose Vehicles behind them. Even though some regional regulations such as Solvency II as well as the "equivalence process" of the European Systemic Risk Board may avoid the capital alleviation using captives, the indirect exposure to the US insurance market via investments may create problems in other jurisdictions.

For the case of Sweden, (Adams et al, 2009) study the historical relation among commercial bank lending, insurance and economic growth. For the period from 1830 to 1998 they analyse the relation of causality among economic growth and the two financial indicators. Firstly, they try to shed light on the causality relation using the Granger causality tests (Granger, 1969)[11] but due to the properties of the time series used (see section 3), the authors need to study the relationship following (Toda & Yamamoto, 1995). In order to apply the methodology, the authors introduce a Vector Autoregression Model[12] (VAR) in levels to test the causality relationship. Focusing on the results for the insurance sector, the authors argue that insurance activities mattered for the development of the Swedish economy. The results, following the supply-leading hypothesis, suggest that financial development causes economic growth.

In the case of the Nigerian economy, (Akinlo, 2013) examines the causal relationship between insurance and economic growth for the period from 1986 to 2010. In this regard, the authors use a Vector Error Correction Model (VECM) consisting of 4 equations regressing GDP, the level of total premiums, inflation and interest rates against their respective past values, the past values of the other variables as well as the lagged error-correction term. In light of the results, the author argues that since there is absence of causality between insurance and economic growth in both directions, the neutrality hypothesis holds. In addition, (Yinusa & Akinlo, 2013) replicate the same analysis for the same period. As a difference with the previous study, the authors, following an endogenous growth model with a modified Cobb-Douglass production function with constant returns to scale, include in the regression two variables referred to physical and human capital. As a result of the existence of cointegration, a VECM is used. The data also points to the existence of a neutrality relationship.

(Alhassan & Fiador, 2014), following an autoregressive distributed lag bounds approach, study the long run causal relationship between the insurance penetration and economic growth in Ghana for the years from 1990 to 2010. In order to perform the analysis, the authors introduce different control variables referred to investment, inflation and trade volume. The results corroborate the existence of a long-run positive relationship between insurance penetration and economic growth. In this light, a unidirectional

[11] From now on, this methodology will be referred in the text as Granger methodology.

[12] The VAR models are used for bivariate or multivariate time series analysis. In these models, each variable is a linear function of the past lags of the variable studied as well as the past lag of other variables.

causality relation was found to run from aggregate insurance penetration to economic growth. Non-life insurance was found to have a greater impact on economic growth. The results support the supply-leading hypothesis.

(Bonn, 2005) performs several causality analyses to take some conclusions about the relationship between different financial indicators and economic growth in Singapore for the years 1991 to 2002. For the financial indicators the author chooses the value of bank loans, stock market capitalisation as well as insurance funds. The proxies capturing the level of economic growth are GDP per capita and the per capital real gross fixed capital formation (GFCF). The decision regarding the variables selected to show the level of economic growth has to do with the different ways in which the financial intermediaries influence growth. As highlighted by (Pagano 1993), the indicators referred to economic growth should reflect increases in productivity, investment or savings. In this regard, the author, acknowledging that the savings rate has an unambiguous effect on growth and that the measurement of the Total Factor Productivity (TFP) tends to be difficult, chooses GDP and real GFCF in per capita levels to show the level of economic growth. When applying the Granger methodology, the author highlights the existence of some statistical problems related with the correlation of the series. In order to overcome it, the model is converted into a VECM. Concerning the insurance companies, the author finds that there is a long-term causality relation from insurance to GDP as well as a long and short term causality relation from insurance to GFCF. The results are in line with the supply-leading hypothesis in the short run. The author also empathises that the results of the growth-finance nexus analysis are very much dependent on the indicators used when measuring our variables of interests.

Following the same methodology, the Granger causality adapted with a VECM, (Chau et al., 2013) analyse the long and short term relationship between insurance consumption, on a general level as well as for the life sector, and GDP, for Malaysia for the period from 1970 to 2012. The equation used to test causality regresses GDP against its past value, the error term as well as the pasts values of the capital stock, total employment, life premiums and general premiums. The author finds that there is a positive and significant relationship between life insurance premiums and growth in the short term. Continuing the analysis for the Malaysian economy (Ching et al., 2010), with quarterly data for the period from 1997 to 2008 and following the Granger methodology adapted to include a VECM, find a long-term relationship between the total assets of the

life insurance companies and real GDP as well as a short run causal relationship from the real GDP to the life insurance indicator. The results confirm the existence of a demand-following hypothesis and supply-leading hypothesis in the short and long term, respectively.

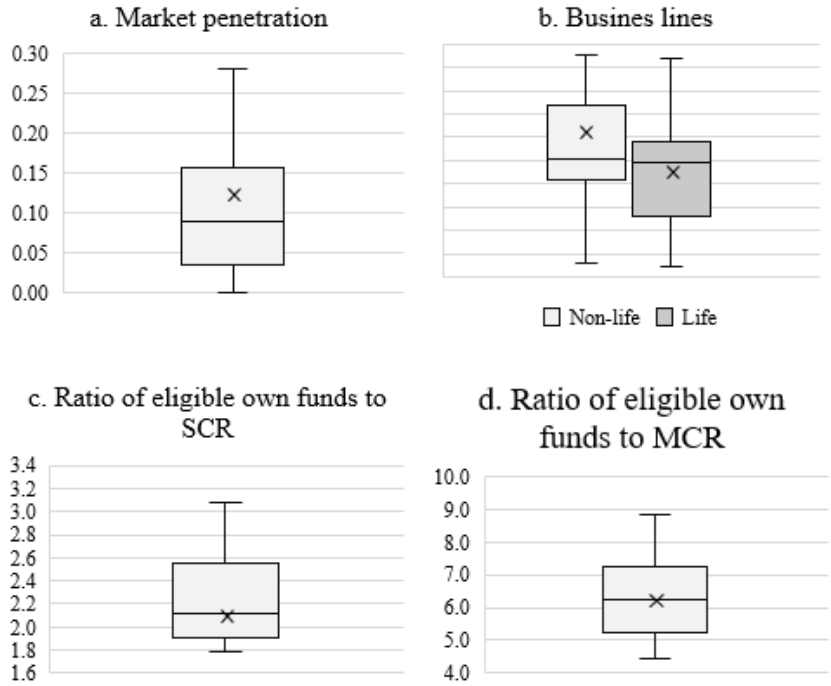
Regarding the Iranian economy, (Nejad & Kermani, 2012) perform an analysis for the insurance-growth nexus for the period from 1960 to 2010. The study of causality is done using the Granger causality method with a VECM to overcome the problems related with the non-cointegrated series. The variables used correspond to GDP per capita and the real annual premiums per capita. The results obtained show that there is a unidirectional Granger causality relation from insurance development to economic growth, confirming the supply-leading hypothesis. (Jahromi & Goudarzi, 2014) also developed a Granger causality analysis for the same economy for the period from 1982 to 2011. In this case, the authors investigate the causality relation among GDP, inflation and national per capita income with the insurance penetration ratio, measured as the ratio of premiums to GDP. The results show that there is a short-term bidirectional causal relationship between the per capita income and the insurance penetration ratio. In the long run, the causal relationship from insurance penetration to per capita income becomes unidirectional, confirming the supply leading hypothesis.

Concerning the British economy, a causality analysis on a disaggregated level is performed by (Kugler & Ofoghi, 2005). The causality exercise explores the relationship between real GDP and different types of insurance[13] measured through premiums. The method used relies on a VECM in the Granger causality analysis. When it comes to the long run causality from insurance premiums to GDP, all the types of insurance, except from the pecuniary loss type, show it. For the short-term relation, there is a causality relation between life, liability and pecuniary and loss insurance and GDP. When studying the opposite direction of causality, the authors find that short-term causality relation between GDP and pecuniary loss insurance as well as a long-term relation between GDP and liability, pecuniary loss and reinsurance premiums. A bidirectional long-term relation is found between GDP and marine, aviation and motor, pecuniary loss and reinsurance premiums.

[13] The types of insurance included in the study refer to: life insurance, motor insurance, accident and health, property, liability, pecuniary loss, reinsurance as well to marine, aviation and transport insurance.

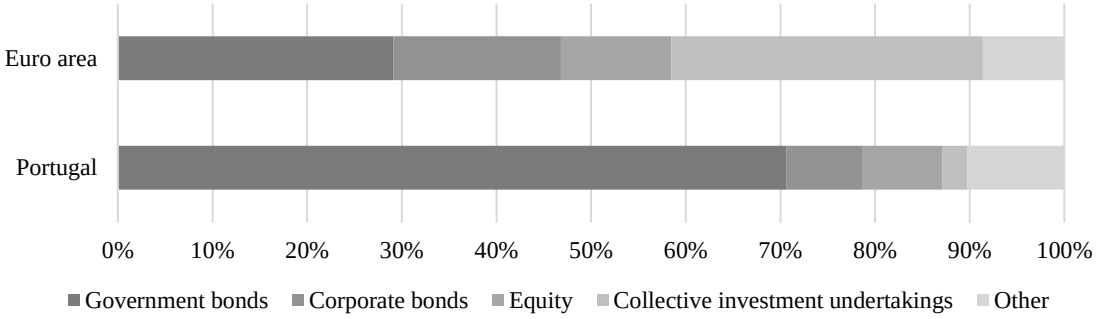
2.3. A brief characterisation of the Portuguese insurance sector.

When comparing the insurance markets of the euro area countries, it is possible to see some differences between the Portuguese and the euro area insurance markets.



Source: Own elaboration with data from EIOPA.

Figure 1 – Characterization of the Portuguese insurance sector



Source: EIOPA

Figure 2 – Asset composition insurance companies

When it comes to the ratio between premiums and GDP, the data shows that Portugal ranks slightly above the euro zone average as its market penetration rate is 0.13 percent compared with the 0.11 percent in the eurozone (Figure 1.a). Concerning the different business areas, insurance companies with activities in the euro countries tend to be more focused on non-life business areas (Figure 1.b). In the case of Portugal, this trend is more pronounced as the non-life premiums represent around the 70% of the total premiums. From a regulatory point of view, the insurance companies whose activities are concentrated in the eurozone fulfill the Solvency II capital requirements as their own funds are above the ones required by regulation. While for the ratio of eligible own funds to Minimum Capital Requirements (MCR) of the eurozone insurance companies is 2.12 percent, the ratio of eligible own funds to Solvency Capital Requirements (SCR) is around 6.27 percent. In the case of Portugal, both ratios are slightly lower being 2.06 and 5.08 percent respectively (Figure 1.a, b).

For the composition of assets, the investments of Portuguese insurers are not very diversified and are mainly biased towards sovereign debt, representing nearly the 70% of the total assets. In contrast with this, the data for the other European countries shows a higher diversification of assets, being the collective investments undertakings, with nearly the 33% of the total assets, the most predominant investment in their portfolios (Figure 2).

3. Methodology.

For the study of the causality relationship between insurance and growth, a time series analysis is going to be conducted. If it is true that in the context of finance and growth a lot of studies have relied on the use of panel data, the decision regarding the methodology used is related with the research question and, more precisely, with the inexistence of previous analysis using time series for the case of Portugal. The methodology adopted follows (Clarke & Mirza, 2004), which find that the analyses based around an overfitted VAR (such as Toda and Yamamoto), instead of a VECM, result in a better control of the Type I[14] error probability with often little loss in power.

[14] The Type I error refers to the possibility of rejecting the null hypothesis when it is true.

When studying the causality relationship, it is possible to talk about the existence of three types of relationships: unidirectional, bidirectional or not causality at all. Applying these three cases to the finance-growth literature, the causality relationships can be framed under four different hypotheses. In the first place, following the Schumpeterian view, it is possible to talk about a supply-lead hypothesis as the level of financial development can lead to economic growth. Secondly, it is also possible to talk about the existence of a demand-following hypothesis from which economic growth contributes positively to financial development. Thirdly, the feedback hypothesis will take place if there is a bidirectional relation between our two variables. Finally, in line with the opinions of Lucas, mentioned earlier, the neutrality hypothesis will exist if there is no causality relationship between financial development and growth.

Following previous literature on the topic, the Granger causality methodology (Granger, 1969) will be used to check the relationship between our variables of interest. In line with Granger's contribution, causality takes place when the current value of a variable can be better explained considering the lagged values of another variable, together with the past values of the variable that we want to predict. In line with this reasoning, it is possible to say that X_t is Granger causing Y_t if the prediction of Y_t can be improved through the addition of past information about X_t. The methodology is applied with the regression of the two stationary time series, following the VAR model expressed in equation (1) and (2):

$$Y_t = \sum_{j=1}^{m} \delta_k \, Y_{t-j} + \sum_{j=1}^{m} \beta_k \, X_{t-j} + \mu_t \qquad (1)$$

$$X_t = \sum_{j=1}^{m} \delta_j \, X_{t-j} + \sum_{j=1}^{m} \beta_j \, Y_{t-j} + \varepsilon_t \qquad (2)$$

In the equations, μ_t and ε_t are error terms considered to be white noise (zero mean, constant variance and serially uncorrelated). The index *t* (*t = 1,...,T*) denotes the period and *j* the lag.

The Granger causality test consider the null hypothesis of no causality, *H0:* $\beta_i = 0$.

Understanding Y_t as the indicator of financial development and X_t as the variable referred to economic growth, the four hypotheses can be shown through our set of equations:

- Supply-lead hypothesis: in this case, there is a unilateral causality from Y_t to X_t. In our equations this is possible if $\sum \beta_j \neq 0$ and $\sum \beta_k = 0$.

- Demand-following hypothesis: the unilateral causality from X_t to Y_t is indicated if $\sum \beta_j = 0$ and $\sum \beta_k \neq 0$.

- Feedback hypothesis: the bilateral relationship will take place if $\sum \beta_j \neq 0$ and $\sum \beta_k \neq 0$.

- Neutrality hypothesis: there will be no relationship if $\sum \beta_j = 0$ and $\sum \beta_k = 0$.

In order to apply this test, the data series must be stationary[15]. If the series are non-stationary our results might show invalid estimates leading to false or spurious relationships. In this situation, the interpretations of the results in the model can lead to conclusions without economic meaning. In case the series turn out to be non-stationary, a differentiation can be done with the purpose of making the series stationary. If the series become stationary after the *d* differentiations, they are called integrated series of order *d* of *I(d)*. Additionally, as argued by C. Granger (1988), we need our series to be cointegrated[16] as a mere differentiation can lead to wrong results because of the existence of spurious correlation. The study of stationarity has been done through the use of unit root tests, being those the Augmented Dickey-Fuller (ADF) test, the Phillips Perron (PP) test and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. While the null hypothesis of the ADF and PP tests state that our series is non-stationary, the null hypothesis of the KPSS tests indicates that our series is stationary. When it comes to the statistical analysis, the tests have been conducted in levels and first differences considering the existence of time series with an intercept as well as an intercept with trend.

[15] A series is stationary if its mean, variance and covariance are not time dependent.
[16] Two time series are cointegrated if a linear combination of those variables has a lower order of integration. In economic terms that means that there is some sort of relationship between the variables that holds over time.

For the cointegration analysis, the Engle-Granger (EG) and the Phillips-Oulians (PO) tests have been used. For both tests, the null hypothesis refers to no cointegration.

In case our series turn out to be non-cointegrated, (Toda & Yamamoto, 1995)[17] suggest a method to test for Granger causality using an augmented or "overfitted" VAR in levels. As the authors suggest, the method allows for the testing of "linear or nonlinear restrictions on the coefficients by estimating a VAR in levels and applying the Wald criterion, paying little attention to the integration and cointegration properties of the time series data in hand". The Wald criterion allows to study the significance of one or several parameters of the model. The parameter of interest is considered as significant if it is different from zero, adding some value to the model.

In all the tests, a significance level of 95% has been considered. Additionally, the results will be accepted if all the tests for stationarity and cointegration point to similar results.

To apply the T-Y method, it is necessary to estimate a VAR model with (*k* + *dmax)* lags, where *k* refers to the lag length of the model and *dmax* refers to the maximum order of integration. On a generic way, using our X_t and Y_t variables, our VAR model will follow this structure:

$$Y_t = \gamma_0 + \sum_{i=1}^{d+n} \gamma_k \, Y_{t-1} + \sum_{j=i}^{d+n} \beta_k \, X_{t-1} + \mu_t \qquad (3)$$

$$X_t = \gamma_0 + \sum_{i=1}^{d+n} \gamma_j \, X_{t-1} + \sum_{i=1}^{d+n} \beta_j \, Y_{t-1} + \varepsilon_t \qquad (4)$$

After the modification of the model has been done, it is possible to apply the Granger causality test considering the null hypothesis of no causality, H_0: $\beta_i = 0$. The same conditions for the previous hypotheses apply.

To determine the right model, it is necessary to select the adequate number of lags as well as the maximum order of integration. To determine the lag's structure, the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC) and the Hannan–Quinn Information Criterion (HQ) have been used. The criteria used weights two conflictive goals, the goodness of fit and the parsimony of the model. While the goodness

[17] From now on this will be referred as T-Y method.

of fit is referred to the ability of the model to fit the data, the parsimony of the model indicates the number of parameters needed to explain the data. All the criteria reward those models with high goodness of fit and penalize the high parsimony (e.g. existence of too many variables). The lower the AIC, SEC and HQ, the better the model. Concerning the maximum order of integration, it has been obtained using the above-mentioned stationarity tests.

Even though the T-Y methodology can shed some light on the possible relationship between economic growth and financial development, the study on a bivariate context can introduce a bias in the results due to the omission of variables. In order to overcome the problem of misspecification, the causality exercise can be improved with the use of a multivariate framework through the addition of some control variables.

With the purpose of adding the control variables, following the methodology of (Yinusa & Akinlo, 2013), an endogenous growth model based around the Cobb-Douglass function with constant returns to scale has been considered. As a result, two new variables accounting for the production factors, capital and labour, have be added to the VAR model. The addition of these factors of production allows to take into consideration some other variables influencing economic growth and might be understood as a simplifying assumption. As argued by (Chirwa & Odhiambo, 2018) understanding the dynamics of economic growth might be a complex exercise as a wide range of variables, apart from capital and labour, can exert influence on it.

Introducing the modifications of the multivariate framework and considering P, K, L and GDP, as total premiums per capita, gross capital formation, labour market participation and the natural logarithm of GDP per capita respectively, the augmented VAR system can be shown as:

$$\begin{bmatrix} GDP_t \\ P_t \\ K_t \\ L_t \end{bmatrix} = \begin{bmatrix} \alpha_G \\ \alpha_P \\ \alpha_k \\ \alpha_L \end{bmatrix} + \sum_{i=1}^{d+n} \begin{bmatrix} \alpha_{GG,i} & \alpha_{GP,i} & \alpha_{GK,i} & \alpha_{GL,i} \\ \alpha_{PG,i} & \alpha_{PP,i} & \alpha_{PK,i} & \alpha_{PL,i} \\ \alpha_{KG,i} & \alpha_{KP,i} & \alpha_{KK,i} & \alpha_{KL,i} \\ \alpha_{LG,i} & \alpha_{LP,i} & \alpha_{LK,i} & \alpha_{LL,i} \end{bmatrix} \begin{bmatrix} GDP_{t-1} \\ P_{t-1} \\ K_{t-1} \\ L_{t-1} \end{bmatrix} +$$

$$\sum_{i=1}^{d+n} \begin{bmatrix} \beta_{GG,i} & \beta_{GP,i} & \beta_{GK,i} & \beta_{GL,i} \\ \beta_{PG,i} & \beta_{PP,i} & \beta_{PK,i} & \beta_{PL,i} \\ \beta_{KG,i} & \beta_{KP,i} & \beta_{KK,i} & \beta_{KL,i} \\ \beta_{LG,i} & \beta_{LP,i} & \beta_{LK,i} & \beta_{LL,i} \end{bmatrix} \begin{bmatrix} GDP_{t-1} \\ P_{t-1} \\ K_{t-1} \\ L_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_G \\ \varepsilon_P \\ \varepsilon_K \\ \varepsilon_L \end{bmatrix} \quad (5)$$

In the equations, the vector ε_t refers to the error terms, considered to be white noise (zero mean, constant variance and serially uncorrelated). The index *t* (*t = 1,...,T*) denotes the period.

Even though the augmented VAR allows for the study of causality among all the variables selected, the objective of this analysis is related with the causality relation between GDP (GDP_t) per capita and total premiums per capita (P_t). Considering these variables, the four hypotheses mentioned above can be shown through our system of equations:

- Supply-lead hypothesis: in this case, there is a unilateral causality from P_t to GDP_t. In our equations this is possible if $\sum \beta_{GP} \neq 0$ and $\sum \beta_{PG} = 0$.

- Demand-following hypothesis: the unilateral causality from GDP_t to P_t is indicated if $\sum \beta_{PG} \neq 0$ and $\sum \beta_{GP} = 0$.

- Feedback hypothesis: the bilateral relationship will take place if $\sum \beta_{GP} \neq 0$ and $\sum \beta_{PG} \neq 0$.

- Neutrality hypothesis: there will be no relationship if $\sum \beta_{GP} = 0$ and $\sum \beta_{PG} = 0$.

The estimation of the VAR needs to be complemented with a heteroscedasticity analysis as well as a study of the stability of the model. For the purpose of the heteroscedasticity analysis, a Breusch-Godfrey LM test (T. Breusch & A. Pagan, 1979) is used to check for the existence of no serial correlation (homoscedasticity) in the error

terms. It is important to be sure that the disturbances of the model are homoscedastic as the existence of autocorrelation (heteroscedasticity) leads to biased estimators and invalid inferences. For the stability of the model and, as pointed by (H. Lütkepohl, 2005), a graphic check, representing the eigenvalues together with the unit root circle, is applied. For a VAR model to be stable, all the eigenvalues of the coefficient matrix, in absolute terms, must be inside the unit circle, being all of them less than one. Additionally, and, with the purpose of controlling for the existence of possible structural breaks, a second VAR model has been estimated. In this model, a dummy variable controlling for the possible effects of the Great Financial Crisis of 2008 has been used. In order to decide which model to use, a likelihood-ratio test has been applied.

4. Empirical assessment.

In this section the data set, together with the statistical analysis as well as the results, are presented.

4.1. Data.

Concerning the exercise of causality between economic growth and insurance development, the multivariate T-Y methodology is applied for the case of Portugal. When it comes to the period of analysis, the years between 1983 and 2020 have been considered as a result of the availability of data.

For the economic growth, the variable GDP per capita, expressed in US current prices, has been used. In the case of the insurance sector development, the total level of gross premiums per capita is considered. The GCF data per capita is expressed in US current prices. The series for employed population refers to those people aged between 15 and 64 years old who have worked for at least one hour in the previous week or who had a job but were absent from work during the reference week. For the data of the level of total premiums registered, there is a missing value in the data source for the year 2000 which has been estimated through a linear extrapolation. The data has been obtained from the IMF, the OECD and the World Bank. The statistical software used to conduct the analysis has been Eviews12. The results obtained in the analysis can be provided upon request.

As shown in the Table I, a simple correlation analysis allows to see that, in principle, there is a positive and strong correlation among the variables. For the variables of interest,

GDP and premiums per capita, the study of correlation has been complemented with a T test. The results point to the existence of a statistically significant correlation.

TABLE I
CORRELATION MATRIX

	GDP	Premiums	GCF	Employment
GDP	1	-	-	-
Premiums	0.95	1	-	-
GCF	0.90	0.88	1	-
Employment	0.65	0.65	0.86	1

TABLE II
DESCRIPTIVE STATISTICS

	GDP	PREMIUMS	GCF	EMPLOYMENT
Mean	14612.21	0.88	3146.43	4661.28
Median	12707.64	0.73	3266.55	4631.21
Standard Deviation	7130.41	0.65	1308.82	341.15
Minimum	2596.07	0.02	579.00	4057
Maximum	24946.25	2.14	5882.85	5143
Observations	38	38	38	38

In line with (Bonn, 2005), it is important to highlight that the choices concerning the variable referred to financial development will likely influence the outcome of our analysis. Furthermore, when using the level of total gross premiums per capita, we are neglecting the asset side of the insurance companies and hence, the investment function of these is not properly captured. In addition, in the case of the liability side, the contribution to growth, as a consequence of the financial transfers and indemnifications can be better captured using data relative to the gross claim payments but due to the data availability constraint, just covering twenty-seven years, the level of total gross premiums per capita has been used. Finally, it is also worth mentioning that the insurance development proxy used does not capture the other non-balance sheet channels through which the insurance activities can exert an influence on economic growth (e.g. the systemic importance of the insurance companies).

4.2. *Statistical analysis and results*.

Starting with the study of the stationary properties of our series, Table III shows the results of the ADF, PP and KPSS tests. In light of the results, it is possible to say that all our variables, are stationary in first differences, I(1). Although the variables, according to the KPSS tests results are stationary in levels, a more robust analysis can be obtained if all the three tests point to the existence of stationarity in first differences.

TABLE III

STATIONARITY ANALYSIS

		logGDP	Premiums	GCF	Employment
Levels					
ADF	Interceipt	0.06	0.59	0.42	0.16
	Trend and int.	0.88	0.94	0.80	0.53
PP	Interceipt	0.05	0.59	0.41	0.39
	Trend and int.	0.88	0.92	0.72	0.76
KPSS	Interceipt	0.67*	0.60*	0.56*	0.38*
	Trend and int.	0.18*	0.12*	0.16*	0.15*
First differences					
ADF	Interceipt	0.00*	0.00*	0.00*	0.01*
	Trend and int.	0.00*	0.00*	0.00*	0.04*
PP	Interceipt	0.00*	0.00*	0.00*	0.01*
	Trend and int.	0.00*	0.00*	0.00*	0.04*
KPSS	Interceipt	0.45*	0.23*	0.14*	0.13*
	Trend and int.	0.05*	0.13*	0.05*	0.06*

Note: ADF, Augmented Dickey-Fuller; PP, Phillips Perron; KPSS, Kwiatkowski–Phillips–Schmidt–Shin.

* Shows a level of significance of 5%.

Concerning the cointegration analysis the tests EG and PO show that our series are not cointegrated, except for the case of GCF when using the tau statistic (Table IV).

TABLE IV

COINTEGRATION ANALYSIS

	EG		PO	
	tau st.	z st.	tau st.	z st.
logGDP = f(c, Premiums, GFC, Employment)	0.80	0.89	0.72	0.79
Premiums = f(c, logGDP, GFC, Employment)	0.88	0.88	0.88	0.89
GCF = f(c, logGDP, Premiums, Employment)	0.02*	1.00	0.52	0.45
Employment = (c, logGDP, Premiums, GCF)	0.78	0.76	0.66	0.60

Note: EG, Engle-Granger; PO, Phillips-Oulians.

* Shows a level of significance of 5%.

As mentioned above, in presence of non-cointegrated series it is not possible to apply the Granger methodology and, as a result, the analysis will be applied using the T-Y methodology. The "overfitted" VAR necessary for T-Y requires for the determination of lags, calculated as a sum of the maximum order of integration (*dmax*) and the actual level of lags (*k*), as determined by AIC, SC and HQ.

As previously showed with the stationarity exercise, the series are stationary of order 1. When it comes to the actual level of lags of the VAR model, the SC and the HQ criterion point to the use of two lags. If it is true that the AIC criteria select 5 lags as the most convenient number, but the decision to select two lags has to do with the existence of two criteria determining that number of lags (Table V).

TABLE V

OPTIMAL LAGS FOR THE VAR MODEL

Lags	AIC	SC	HQ
1	37.18	38.79	37.71
2	37.16	38.09*	37.48*
3	37.59	39.95	38.39
4	37.35	40.44	38.39
5	36.88*	40.69	38.16

After determining the maximum level of integration and the number of lags of the VAR model, an overfitted VAR (*k + dmax)* with three lags can be estimated. The VAR model obtained is shown in the equation (6):

$$\begin{bmatrix} logGDP_t \\ P_t \\ GCF_t \\ E_t \end{bmatrix} = \begin{bmatrix} \alpha_{LG} \\ \alpha_P \\ \alpha_{GCF} \\ \alpha_E \end{bmatrix} + \sum_{i=1}^{3} \begin{bmatrix} \alpha_{LGLG,i} & \alpha_{LGP,i} & \alpha_{LGCF,i} & \alpha_{LGE,i} \\ \alpha_{PLG,i} & \alpha_{PP,i} & \alpha_{PGCF,i} & \alpha_{PE,i} \\ \alpha_{GCFLG,i} & \alpha_{GCFP,i} & \alpha_{GCFK,i} & \alpha_{GCFE,i} \\ \alpha_{ELG,i} & \alpha_{EP,i} & \alpha_{EGCF,i} & \alpha_{EE,i} \end{bmatrix} \begin{bmatrix} logGDP_{t-1} \\ P_{t-1} \\ GCF_{t-1} \\ E_{t-1} \end{bmatrix} + \tag{6}$$

$$\sum_{i=1}^{3} \begin{bmatrix} \alpha_{LGLG,i} & \alpha_{LGP,i} & \alpha_{LGCF,i} & \alpha_{LGE,i} \\ \alpha_{PLG,i} & \alpha_{PP,i} & \alpha_{PGCF,i} & \alpha_{PE,i} \\ \alpha_{GCFLG,i} & \alpha_{GCFP,i} & \alpha_{GCFK,i} & \alpha_{GCFE,i} \\ \alpha_{ELG,i} & \alpha_{EP,i} & \alpha_{EGCF,i} & \alpha_{EE,i} \end{bmatrix} \begin{bmatrix} logGDP_{t-1} \\ P_{t-1} \\ GCF_{t-1} \\ E_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{LG} \\ \varepsilon_P \\ \varepsilon_{GCF} \\ \varepsilon_E \end{bmatrix}$$

In the equations *LG*, *P*, *GCF*, *E* stand for logGDP, premiums, Gross Capital Formation and employment, respectively.

The matrices $\begin{bmatrix} \alpha_{LG} \\ \alpha_P \\ \alpha_{GCF} \\ \alpha_E \end{bmatrix}$ and $\begin{bmatrix} \varepsilon_{LG} \\ \varepsilon_P \\ \varepsilon_{GCF} \\ \varepsilon_E \end{bmatrix}$ refer to the constants and error terms respectively.

Once the regressions are done, we obtain the parameters for the four equations. The VAR model is shown in the Table VII.

After the application of the LM test, it is possible to say that there is no autocorrelation in our model. In the case of the stability of the model, as all the eigenvalues of the coefficient matrix are less than one, the model can be considered to be stable (Figure 2).

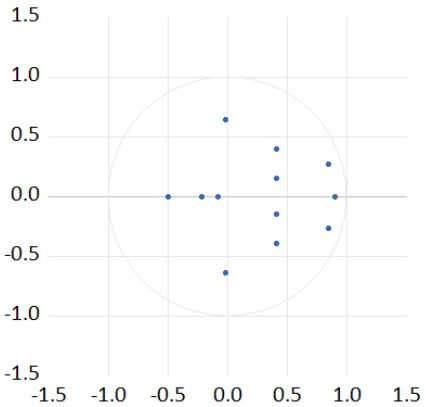


Figure 3 – VAR stability test: inverse roots of AR characteristic polynomial

The application of the likelihood test shows that the introduction of a dummy variable taking into account the effects of the crisis does not influence in a significant manner the results obtained. Following the T-Y methodology, applying the Wald tests, the results obtained point to the inexistence of a Granger causality relationship between our two variables of interest, GDP and gross insurance premiums (Table VI). In light of these results, it is possible to say that the neutrality hypothesis takes place. Even though the study was focused on the relation between the two variables mentioned above, a secondary result of the analysis shows that the level of employment has a positive effect on economic growth.

TABLE VI
CAUSALITY RESULTS

Independent variable	Causality direction	Result
LogGDP	Premiums → LogGDP	No
	GCF → LogGDP	No
	Employment → LogGDP	Yes
Premiums	LogGDP → Premiums	No
	GCF → Premiums	No
	Employment → Premiums	No
GCF	LogGDP→ GCF	No
	Premiums → GCF	No
	Employment → GCF	No
Employment	LogGDP → Employment	No
	Premiums → Employment	No
	GCF → Employment	No

TABLE VII

VAR ESTIMATION

	Independent variables			
	$LogGDP_t$	**$Premiums_t$**	**GCF_t**	**$Employment_t$**
$LogGDP_{t-1}$	0.726249282	0.441069794	-237.7687089	-418896.8905
	(0.274152)	(0.650879)	(1454.383855)	(346632.29000)
$LogGDP_{t-2}$	0.036514594	-0.602159892	131.0008017	308135.0966
	(0.373857448)	(0.887593415)	(1983.321227)	(472697.2053)
$LogGDP_{t-3}$	0.056002824	0.278863509	382.2998474	133778.8712
	(0.229143247)	(0.54402029)	(1215.609502)	(289723.7253)
$Premiums_{t-1}$	0.090128143	0.831713676	397.8599977	133547.7365
	(0.117810447)	(0.279699596)	(624.9867756)	(148956.9607)
$Premiums_{t-2}$	-0.099243504	-0.38842739	-544.5229326	-150507.1202
	(0.140465782)	(0.333486745)	(745.1737793)	(177601.8721)
$Premiums_{t-3}$	0.159406498	0.374345293	377.7944377	27861.99296
	(0.105884394)	(0.251385364)	(561.7188228)	(133877.9185)
GCF_{t-1}	-3.00E-05	-7.74E-05	0.742785311	27.11214931
	(7.88E-05)	(0.000187062)	(0.417989006)	(99.62190295)
GCF_{t-2}	-5.92E-05	0.000160454	-0.133742924	-11.94274858
	(0.000105914)	(0.000251455)	(0.561874484)	(133.9150182)
GCF_{t-3}	-2.52E-05	-0.000180331	-0.21133336	-52.40571263
	(7.64E-05)	(0.000181444)	(0.405434244)	(96.62964897)
$Employment_{t-1}$	9.76E-08	-1.07E-08	0.00076989	1.161059425
	(1.93E-07)	(4.58E-07)	(0.001023137)	(0.243850575)
$Employment_{t-2}$	2.20E-07	3.90E-08	0.00010812	-0.095686237
	(2.93E-07)	(6.95E-07)	(0.001552139)	(0.369930912)
$Employment_{t-3}$	-1.51E-08	4.82E-07	0.00011626	-0.181369114
	(2.03E-07)	(4.82E-07)	(0.001076874)	(0.001076874)
C	0.605724882	-2.978739073	-5412.934756	468183.9478
	(0.773535583)	(1.836488997)	(4103.621714)	(978041.5241)
R^2	0.98267958	0.935607128	0.900409693	0.924438183
Adj. R^2	0.973232078	0.900483744	0.846087707	0.883222646

Note: Standard errors in ( ).

5. Conclusion.

In this dissertation, a study on the causality relationship between economic growth and insurance sector development for the Portuguese economy from 1983 to 2020 has been performed. In this regard, a Granger causality analysis, following the Toda and Yamamoto methodology has been applied through the use of an augmented VAR. Apart from the variables of interest, total premiums and GDP, the model has been estimated in a multivariate framework in order to avoid the problems derived from the misspecification of the equation. The control variables used in the model correspond to the Gross Capital Formation, accounting for the aggregate investment, and the level of employment.

The results point to the inexistence of a causality relationship in the Granger sense between economic growth and insurance sector development in Portugal, following the neutrality hypothesis. In light of this result, it is possible to say that the level of GDP (total premiums) today cannot be predicted in a better way when considering the pasts levels of insurance premiums (GDP), together with the past levels of GDP (total premiums). The inclusion of a structural break, corresponding to the years of the Great Financial Crisis, do not change the causality relationship results. On a more generic way, beyond our variables of interests, the analysis shows the existence of bidirectional causality in the Granger sense between the level of employment and GDP growth. When it comes to the relationship between GDP growth and the total level of insurance premiums, the conclusions of this study point in the same direction than (Akinlo, 2013) and (Yinusa & Akinlo, 2013).

When compared with other studies, this work studies growth-insurance nexus in the Portuguese economy from a time series perspective, following a multivariate framework. Regarding the limitations of the study, the variable used to consider the level of development of the insurance sector does not account for all the possible channels through which the insurance sector can influence economic growth as it just takes into account one part of the liabilities of the insurance companies. In this regard, future lines of research can try to shed some light on the insurance-growth nexus through the use of different variables. In addition, a deeper understanding of the main factors behind the economic growth of the Portuguese economy might also be positive as it can help defining the control variables in a better way.

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