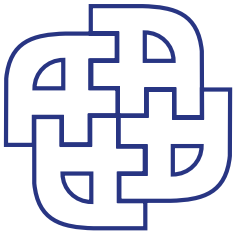

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Country factors behavior for integration improvement of European life insurance markets

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*ESTE TRABAJO OBTUVO UN ACCESIT EN 2020

PREMIOS DE INVESTIGACIÓN Y ESTUDIO
ANTONIO DIONIS SOLER 2020

ISBN: 978-84-09-28704-8
Depósito legal: M-8078-2021
Edita: Fundación de Estudios Financieros
Imprime: Reimpventa

Country factors behavior for integration improvement of European life insurance markets*

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ABSTRACT

This paper provides evidence of the role that national financial markets development and institutional quality play in the integration of European Union (EU) life insurance markets. It analyzes 10 EU life insurance markets over the period 1998-2014. The meta-technology cost/revenue efficiency ratios, estimated under the meta-frontier DEA framework, are used as a measure of integration and the analysis is conducted by applying Tobit panel regression models. We find that, in terms of cost efficiency, stock market development contributes to this integration but banking sector development prevents it, suggesting that the market-based financial systems enhance cost performance and integration of EU life insurance markets. Results also show that in countries where *bancassurance* is the main life insurance distribution channel, banking sector development contributes to integration in terms of revenue efficiency, indicating that *bancassurance* architectural offers benefits for integration improvement. We also find that better outcomes in national institutional quality facilitates (prevents) integration of EU life insurance markets in terms of cost (revenue) efficiency. Results also indicate that EU common law and German civil law countries are at the forefront of technology.

Keywords: Integration; Financial markets development; Institutional quality; EU life insurance markets.

JEL classification: G22, C61, F36.

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* The authors gratefully acknowledge financial support from the Spanish Ministry of Science, Innovation and Universities (Project RTI2018-097620-B-100) and *Universidad de Málaga Campus de Excelencia Internacional Andalucía Tech.*

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1. INTRODUCTION

Over the last decades, the European Union (EU) has encouraged a series of initiatives and legislative reforms with the aim to improve the integration of the EU financial services industry in order to create EU single markets in providing banking, insurance and other financial services. Financial integration is expected to promote competition and efficiency in financial markets, so a way to evaluate whether EU financial integration has taken place has been analyzing convergence in efficiency across EU financial markets. Most of this literature shows that, in general, a process of financial integration has happened in the recent decades, both in EU banking markets (see e.g. Weill, 2009; Casu and Girardone, 2010; Degl'Innocenty et al., 2017; Tziogkidis et al., 2020) and in EU life insurance markets (see Cummins and Rubio-Misas, 2020). However, researchers emphasize that there are country characteristics in terms of economic and financial environment as well as other legal, cultural and institutional factors that are acting as barriers of the EU financial integration process (see e.g. Berger, 2007; Cummins and Venard, 2008; Goddard et al., 2015). Yet, in spite of the relative large number of papers analyzing convergence in efficiency across EU financial markets, we are not aware of any paper exploring country factors that prevent /contribute to EU financial integration. Investigating country factors behavior for integration improvement is particularly of concern for regulators and policyholders especially when a current debate exists on further EU financial integration.

This paper comes to solve this lack in literature by analyzing country characteristics influencing integration of 10 EU life insurance markets over the period 1998-2014. The country factors we focus on are financial markets development (including capital markets development and banking sector development) and institutional quality (measured through governance dimensions of a country as well as the origin of a country's legal system). We frame our analysis within the context of the frontier efficiency and productivity analysis and pursue to answer the following main questions: (i) Does a country's financial markets development influence the integration of EU life insurance markets; (ii) Does a country's institutional quality affect the integration of EU life insurance markets; and (iii) Is the role of a country's financial markets development and institutional quality on integration of EU life insurance markets different in terms of cost efficiency than in terms of revenue efficiency?

To answer these questions we depart from the fact that the EU offers a heterogeneous life insurance production environment. In modern frontier efficiency and productivity methodologies, a way to take into consideration heterogeneity among groups

(in our case, among countries) is using the meta-frontier Data Envelopment Analysis (DEA) framework (see O'Donnell, Rao and Battese, 2008). This approach involves estimating country frontiers as well as a meta-frontier which envelopes the frontiers of all countries, taking into account that the frontiers are formed by the leading firms of the reference set in terms of efficiency. Thus, efficiency measured relative to the meta-frontier can be decomposed into two components: a component that measures efficiency relative to the own-country frontier; and a component that measures technology gap, which is the distance between a country's frontier and the meta-frontier. Within this context, we argue that because financial integration is expected to promote competition and efficiency, we could expect that financial integration would imply that the leading firms in a country in terms of efficiency (these firms would be on the country frontier) would also be the leading firms in the EU in terms of efficiency (these firms would be on the meta-frontier). Based on this reasoning, technology gap can be used as measure of integration. The lower the technology gap, the higher the level of integration. Consequently, we conduct our analysis by regressing technology gap (both in costs and in revenues) on proxy variables of a country's financial markets development and institutional quality as well as a set of control variables both at the country level and at the firm level. As stated before, this analysis would be particularly useful for policymakers and regulators because it allows knowing the behavior of these key country variables in order to design programs that involve changes in them to improve performance and integration (see O'Donnell, Rao and Battese, 2008).

Regarding the effect of a country's financial markets development on the integration of EU life insurance markets, one, a priori, may expect a positive relationship. Higher levels of capital markets development and banking sector development within the country where the insurer is settled facilitate raising external capital and conducting investment operations. This could enable insurers in such countries to be dominant insurers in the EU in terms of efficiency and, hence, may contribute to reducing the gap between the country frontier and the European meta-frontier. However, we provide no directional expectation on the role that a country's institutional quality plays in the integration of EU life insurance markets. On one hand, we can expect that a lower national institutional quality impedes the development of a healthy life insurance market affecting its performance negatively within the country and abroad. On the other hand, because a country's institutional quality implies a better overall environment, lower risk-taking and fewer market frictions, one could expect lower performance and financial integration as well.

To sum up, this paper belongs to the growing literature on the integration of EU

financial services markets by being the first, in the context of efficiency and productivity analysis, that provides evidence on country factors affecting integration among EU life insurance markets. The rest of the paper is structured as follows: Section 2 presents an overview of the life insurance industry in the analysed EU countries; Section 3 discusses theoretical considerations; Section 4 describes the empirical modelling strategy and the data; Section 5 presents the results and discussion, followed by a concluding section.

2. OVERVIEW OF THE ANALYZED EU INSURANCE MARKETS

Table 1 presents figures for the first and the last year of the sample period of five key aspects of the insurance industry in the analyzed countries. They provide a picture of the importance that the insurance industry has in each country as well as information on the structure of the life insurance market. These five aspects are: life insurance share, life insurance penetration, life insurance density, insurers' investment portfolio to GDP and the cumulative market share of the top five life insurers. Table 1 first presents the importance that each insurance segment (life and non-life) has within the national insurance industry. In doing so, it shows the life insurance share, which is calculated as life premiums to total premiums. We observe that from 1998 to 2014 life insurance share augmented in six out of the ten countries. Nevertheless, in countries where life insurance dominated the insurance landscape in 1998 (Belgium, Denmark, France, the UK, Italy, the Netherlands, and Sweden), this segment continued dominating in 2014, except in the Netherlands where non-life insurance dominated the insurance landscape in 2014 (OECD, 2018).

Traditionally, two measures are used to show the relative importance of insurance within national economies: insurance penetration and insurance density. Insurance penetration is the ratio of direct premium written to GDP. Related to this measure, we can see from Table 1 that even though life insurance penetration has tended to increase over the sample period in almost all countries (except Austria, the Netherlands and the UK), differences continue to exist. In 1998 life insurance penetration ranged from 2.1% in Austria to 9.1 % in the UK, and in 2014 it ranged from 2% in Austria to 7.4% in the UK. Meanwhile insurance density indicates how much each inhabitant of a country spends on insurance on average and it is calculated as the average annual per capital premiums within a country. Table 1 shows that life insurance density (life premiums per inhabitant) widely differs among countries. In 1998, it ranged from

336.7 USD in Spain to 2,560.7 USD in the UK, while it ranged from 710.3 USD in Spain to 4,106.3 USD in Denmark in 2014 (OECD, 2018).

Furthermore, since insurance companies are among the largest institutional investors, together with pension funds and investment funds, the ratio of investment portfolio to GDP is another indicator of the relative importance of insurance in the economy. It also enables comparison of the development of the insurance sector from country to country. Table 1 shows the ratio of investment portfolio to GDP (including both the life and the non-life segment) per country. We observe that this ratio has risen over the sample period in all countries. However, there are important differences among them. In 1998 it ranged from 9.3% in Spain to 83.3% in the UK, and in 2014 it ranged from 25. 9% in Austria to 103. 1 % in France (CEA, 2010; Insurance Europe, 2018). Lastly, Table 1 also shows information on the market structure of the life insurance industry in each country by providing the cumulative market share of the five top life insurers (CR5) in each country. We can see that CR5 differs significantly among countries. In 1998, it ranged from 23% in Spain to 80% in Sweden, while in 2014 it ranged from 49.3% in the UK to 88% in Sweden (Insurance Europe, 2018). The extant differences among the analyzed EU life insurance markets reveal that there is a long way to get a fully integrated EU life insurance market as well as the importance of knowing how country factors behave for integration improvement.

3. THEORETICAL BACKGROUND

This section discusses the theoretical basis concerning the main issues analyzed in this paper and present hypotheses. As stated before, we frame our paper within the context of the growing strand of literature that studies integration of the EU financial services industry by analysing convergence in efficiency and productivity across EU financial markets. In order to understand the contribution of our paper to literature, we highlight two key issues. On one hand, although researchers emphasize that country factors are conditioning the process of financial integration, we are not aware of any papers analyzing this issue in the context of efficiency and productivity analysis. On the other hand, most literature analyzing convergence in efficiency and productivity across EU financial markets performs the efficiency and productivity analysis on a common frontier technology, assuming that the EU offers a homogeneous production environment. However, EU countries show a heterogeneous life insurance production environment that needs to be addressed. To our knowledge, only two recent

papers analyzing EU financial integration took into account heterogeneity among countries: Casu et al. (2016) used a parametric meta-frontier Divisia index to estimate convergence in productivity across nine EU banking markets; Cummins and Rubio-Misas (2020) utilized the meta-frontier DEA framework to evaluate convergence in efficiency across ten EU life insurance markets. We follow Cummins and Rubio-Misas (2020) and take into consideration heterogeneity among countries by using the meta-frontier DEA framework to estimate technology gap (both in costs and revenues) as a measure of financial integration. Then, we regress technology gap on variables that proxy a country's financial markets development and institutional quality as well as a set of control variables both at the country level and at the firm level. Consequently, we are the first who, in the context of the efficiency and productivity analysis, explore country factors that prevent/contribute to EU financial integration.

We focus on financial markets development and institutional quality as country variables that may condition the process of integration of EU life insurance markets because literature has shown that they influence both life insurance consumption (see e.g. Beck and Webb, 2003; Li et al., 2007) and insurer performance (see e.g. Pope and Ma, 2008; Fields et al., 2012; Berry-Stölzle et al., 2013; Cummins et al., 2017).

3.1. FINANCIAL MARKETS DEVELOPMENT AND INTEGRATION OF EU LIFE INSURANCE MARKETS

Higher levels of capital markets development and banking sector development within the country where the insurer is settled facilitate raising external capital and conducting investment operations. This could enable firms in such countries to be the dominant firms in the EU in terms of efficiency and, hence, may contribute to reducing the gap between the country frontier and the European meta-frontier. From the financing side, firms can obtain external capital either through securities markets (stock and bond markets) or through the banking system. In countries where these markets are well developed, there are more opportunities to raise external capital, ameliorate information asymmetries, and reduce transaction costs (Levine, 1997). Furthermore, from the investment side, capital market development is critical for life insurers because they are also important institutional investors and well-developed capital markets provide more opportunities to invest efficiently and earn higher in-

vestment returns[1]. In addition, well-functioning banks may provide life insurers with an efficient payment system and increase the confidence of consumers in other financial institutions such as life insurers (Beck and Webb, 2003). These arguments lead us to the following hypothesis:

H1: Financial markets development contributes to EU life insurance markets integration.

The contribution of the banking sector development to performance enhancement and integration improvement of European life insurance markets should be particularly emphasized when these two segments (the banking and the life insurance sectors) of the financial services industry converge through the *bancassurance* phenomenon. That is, in many western European countries, *bancassurance* has become the key distribution channel of life insurance products. This fact may make the effect of banking sector development on the performance of EU life insurers in countries where *bancassurance* is the main life insurance distribution channel different from countries where it is not. The bank distribution channel has some important advantages over the traditional agency channel. Selling insurance through salaried bank employees is usually less expensive than selling insurance through agents. Another advantage is that banks offer a form of "one stop shopping" for financial services and revenue synergies may exist if consumers are willing to pay higher prices for this kind of services (see e.g. Berger et al. 2000). Accordingly, we state the following hypothesis:

H2: The effect of banking sector development on the integration of EU life insurance markets is different in countries where bancassurance is the main life insurance distribution channel from countries where it is not.

3.2. INSTITUTIONAL QUALITY AND INTEGRATION OF EU LIFE INSURANCE MARKETS

The institutional framework and political stability of each member country of the

[1] Insurance companies are the largest institutional investors in the European economy, with more than 10 trillion euros worth of assets under management in 2018. The investment portfolio of EU insurers was equivalent to 58% of the EU GDP in 2018 and accounts for over half of all institutional investment in Europe (see European Insurance in Figures-2018 data, available at https://www.insuranceeurope.eu/european-insurance-figures-2018-data).

EU may affect the performance of life insurers both within the country and abroad and, hence, the integration of European life insurance markets. Consequently, we test whether differences in the institutions quality across countries may explain the divergence between European life insurance markets. To measure institutional and political factors influencing the performance of life insurers, we focus on four dimensions of governance: (1) political stability and absence of violence, (2) government effectiveness, (3) regulatory quality, and (4) rule of law. In addition, we calculate a general institutional development indicator as an average of six governance indicators: the previously mentioned four dimensions of governance along with indicators of voice and accountability and control of corruption (see Kaufmann, Kraay and Mastruzzi, 2010)[2]. These five governance indicators are measured in units ranging from about -2.5 to 2.5, with higher values corresponding to better governance outcomes. Firstly, we can think that the lack of these dimensions of governance may impede the development of a healthy life insurance market by reducing the economic horizon of both potential buyers and suppliers of life insurance products (Beck and Webb, 2003) and consequently may affect performance and integration negatively. However, given the positive relationship between risk and return, because higher levels of these variables imply a better overall environment, we could expect that this would imply lower risk-taking and fewer market frictions and, therefore, lower performance as well (see Fields et al., 2012)[3]. For these reasons, we provide no directional expectation on the role that institutional and political factors play in the integration of EU life insurance markets.

We complete the analysis of institutional and political factors affecting performance and integration of EU life insurers, by grouping the countries of our sample according to their legal heritage based on the law and finance literature that maintains that the origin of a country's legal system determines the level of success in implementing institutions conducive to property right protection[4]. That is, we classified the countries of our sample into four groups: English common law countries, French civil law countries, German civil law countries, and Scandinavian civil law countries. We

[2] We do not present separate analyses on the dimensions of governance voice and accountability and control of corruption because, in general, the coefficients of these variables are not statistically significant in the multiple regression analysis.

[3] Empirical evidence on a cross-country analysis of listed insurers showed that better operating environment decreases risk taking without a concomitant impact on profitability (Fields et al., 2012).

[4] See Marcelin and Mathur (2014) for a framework for understanding the interactions between political and legal institutions, property rights protection and their implication for financial development.

take into account that La Porta el al. (1998) found that common law countries provided the greatest protection of shareholder and creditor rights, while French civil law countries provided the least protection. With this classification, we aim to test whether technological divergences among these groups of EU markets exist, first at all on the idea that behind this classification there are differences in the levels of protection of shareholder and creditor rights, but also keeping in mind that legal heritage influences insurance contract law and life insurance product design[5]. There are causes for positive and negative relationships between shareholder protection and corporate risk taking (see John et al., 2008). Consequently, a priori, the expected relationship between shareholder protection and an insurer's performance is not clear, as well as the expected sign of variable coefficients representing the different groups of countries by legal heritage in our study of life insurers´ performance and integration[6].

In the analysis of institutional and political factors affecting the performance of EU life insurers, we are aware that different dimensions of governance of a country as well as the origin of a country's legal system also represent differences in a country's corporate governance model, which may explain differences in the development of financial markets (see e.g. Beck et al., 2003, Marcelin and Mathur, 2014). Consequently, we conduct both analyses (the financial markets development and institutional quality analyses) separately.

[5] Differences in EU national contract law may have been hampered the efforts to expand intra-EU trade in insurance. Insurance coverage is a service that is defined by legal terms and provisions. As a consequence, if an insurer wishes to offer their products in other EU countries, they usually may have to design different products for each of the intended national market to comply with the national insurance law, with the corresponding additional costs. For this reason, removing contract-related barriers to cross-border insurance services in order insurers to take the advantage of the European single market is a priority of the European Commission " Europe 2020" strategy for promoting sustainable economic growth throughout Europe (see https://ec.europa.eu/info/business-economy-euro/doing-business-eu/contract-rules/insurance-contracts/insurance-contract-rules_en)

[6] Related with this issue, Fields et al. (2012) found that operating in a common law country affects the expenses ratios (measured as underwriting expenses not including claims to net premiums written) of life insurance companies positively and consequently affects performance negatively.

4. EMPIRICAL MODELLING STRATEGY, VARIABLES DEFINITION AND DATA

4.1. EMPIRICAL MODELLING STRATEGY AND VARIABLES DEFINITION

The basic model that we use in this study is specified as follows:

$$MCER_{ijt} \text{ or } MRER_{ijt} = \alpha + \beta_1 CountryKey_{jt} + \beta_2 CountryControl_{jt} + \beta_3 D_j + \beta_4 Crisis_t + \beta_5 Firmcontrol_{ijt} + \eta_{ij} + \varepsilon_{ijt} \quad (1)$$

Indices *i, j, t* stand respectively for insurer, country and year. The dependent variable which is used as a proxy of financial integration is the meta-technology cost efficiency ratio ($MCER_{ijt}$) or meta-technology revenue efficiency ratio ($MRER_{ijt}$). These ratios are estimated using the modern frontier efficiency analysis that takes into account the multidimensionality of the firm's production process. It involves measuring the performance of each firm relative to "best practice" efficient frontiers consisting of the dominant firms in the reference set. We particularly use the meta-frontier DEA framework that, taking into consideration the extant heterogeneity among countries, estimates country frontiers and an EU meta-frontier that envelopes the frontiers of all countries (see e.g. O'Donnell, Rao and Battese, 2008; Cummins and Rubio-Misas, 2020). Therefore, efficiency measured relative to the meta-frontier can be decomposed into a component that measures efficiency relative to the own-country frontier and a component that measures the meta-technology efficiency ratio, which is the reciprocal of the distance between the country frontier and the meta-frontier. Consequently, the meta-technology efficiency ratio ranges between zero and one, and the closer it is to one, the lower the distance is between the country frontier and the meta-frontier and the higher the level of integration is[7]. We conduct both the cost analysis and the revenue analysis to provide a comprehensive picture of insurer performance since according to the traditional microeconomic theory, firms are profit maximizers by minimizing costs and maximizing revenues (see e.g. Cummins and Rubio-Misas, 2006; Cummins and Weiss, 2013). A more detailed description of the estimation procedure of the meta-technology efficiency ratio is available in the Appendix.

We use Tobit regression models as meta-technology cost/revenue efficiency ratio scores fall between zero and one, thus making the dependent variable a limited dependent variable. Furthermore, we adopt a Tobit random-effects regression model

[7] The meta-technology efficiency ratio is the reciprocal of technology gap.

because our sample consists of panel data (see e.g. Peng et al., 2017 for a similar procedure). Tobit fixed-effects models are not used, basically because unconditional fixed-effects estimates are biased and do not provide a sufficient statistic to allow the fixed effects to be conditioned out of the likelihood (Wooldridge, 2002).

The $CountryKey_{jt}$ vector of variables includes the country-factors allowing the analysis of the main issues of the present paper. As we stated above, these country factors are capital markets development, banking sector development and institutional quality (see e.g. Gaganis et al., 2016; Cummins et al., 2017; Gaganis et al., 2019; Rubio-Misas, 2020; Gaganis et al., 2020 for recent cross-countries studies on the insurance industry where these country factors are emphasized). As country control variables ($CountryControl_{jt}$) we include two variables for the main macroeconomic conditions under which the life insurers of each country are operating: the inflation rate and GDP growth (see e.g. Cummins et al., 2017; Gaganis et al., 2019). We also include a country variable capturing the structure of the life insurance market in each country which is given by the cumulative market share of the 5 largest life insurers in each market (CR5) in terms of premiums (see e.g. Cummins et al., 2017). In addition, we include three other country control factors: a measure of the country's social security size, a demographic variable capturing the old-age dependency ratio and a measure of the importance of private pensions in the national economy. We include them because there are empirical evidence (see Beck and Webb, 2003; Li et al., 2007) of the relationship between the first two variables and the level of insurance activity in a country. The reason for including the importance of private pensions in the national economy as a control variable is due to the fact that private pensions are important competitors of life insurers and because important differences exist among the EU countries of our sample in terms of the weight that this financial sector has in the national economy D_j. is a vector of country dummy variables to control for country effects constant over time. Furthermore, we take into account the period since the financial crisis started (i.e. 2008-2014) by including a crisis dummy variable $(Crisis_t)$.

At the firm level, the control variables $(FirmControl_{ijt})$ include size, capitalization and ownership. They measure the financial and operating characteristics of firms in the industry (see e.g. Cummins et al., 2010; Gaganis et al., 2016). We also include the insurer fixed n_{ij} to control for unobservable insurer characteristics constant over time, and ε_{ijt} is a random error. A positive coefficient of the explanatory variable would imply that higher levels in this variable increase the meta-technology efficiency ratio and, hence, contribute to the performance and integration of European life insurance markets by reducing the gap between the country frontier and the European

meta-frontier. Negative coefficients would convey the opposite implication. To provide information on the country variables included in the regression analysis we include two Tables: Table 2 provides the definition of the country variables included in the multiple regression analysis; Table 3 shows mean values of the key explanatory variables per country, where we observe the wide heterogeneity that exists among the analyzed countries with respect to them.

4.2. DATA AND SOURCES

Our sample consists of an unbalanced panel of life insurers from 10 EU countries (Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, and the UK) spanning a 17-year-period from 1998 to 2014. We select the countries based upon the length of time they have been in the EU and also on considerations of data availability. To construct the relevant variables of interest per firm we used annual financial statements, which were obtained from the Orbis Insurance Focus dataset provided by Bureau van Dijk. We use reports prepared under International Financial Reporting Standards/International Accounting Standards (IFRS/IAS) where they exist. Otherwise, we use reports prepared under local generally accepted accounting principles. Unconsolidated data are used for unaffiliated single insurance companies and consolidated data are used for groups of insurers. Unaffiliated insurers are linked to the country where they are domiciled. Groups of insurers are associated to the country where the group is domiciled, although a group may have subsidiaries domiciled in different countries from the group. Groups' subsidiaries are not included to avoid double counting. The final sample is a result of a series of screening tests. We eliminated non-viable firms such as firms with non-positive invested assets, equity capital, total debt, incurred benefits, net premiums or operating expenses. The final sample includes a total of 8,594 year-firm observations. All monetary variables are expressed in millions of euros and deflated by the country-specific Consumer Price Index (CPI) to the base year 2000, which were obtained from the International Labor Organization (ILO).

The country level data were obtained from a variety of sources. Information on capital markets development and banking sector development were collected from the updated version of the World Bank database on financial development and structure (Beck et al., 2010; Cihák et al., 2012). The governance dimensions of the country were obtained from the updated World Bank database on governance indicators (Kaufman

et al., 2010). The ratio of the market share held by the five largest life insurers in each national market was obtained from the European Insurance and Reinsurance Federation, Insurance Europe. Growth in real per capita GDP was sourced from the World Development Indicators and inflation rates from the Eurostat database. Information on the size of the country's social security, the importance of private pensions in the national economy as well as the old-age dependency ratio of the country where the insurer is settled, were collected from the OECD Economic Outlook database. Table 4 reports the descriptive statistics for the variables included in the regression analysis. We highlight from this table that the mean (median) values for the MCER and MRER are 0.9177 (0.9447) and 0.5532 (0.5782), respectively. These figures indicate that, on average, technology gap between the country frontiers and the EU meta-frontier is higher in terms of revenue efficiency than in terms of cost efficiency for the analyzed EU life insurance markets over the period 1998-2014.

5. RESULTS AND DISCUSSION

This section presents results of the multiple regression analysis using the Tobit random-effects regression model. As we stated above, the analysis of the effects of financial markets development on meta-technology efficiency ratios is conducted separately from the analysis of the effects of institutional quality on meta-technology efficiency ratios[8].

5.1. FINANCIAL MARKETS DEVELOPMENT AND META-TECHNOLOGY EFFICIENCY RATIOS

The regression results on the effects of financial markets development on meta-technology efficiency ratios are presented in Tables 5 and 6 for the cost and revenue analysis respectively. We show results from 8 models. A correspondence exists between

[8] As a robustness test, we conducted the multiple regression analysis by using panel data fixed effects. Results (available upon request) from this analysis with respect to the key variables are generally consistent with the results provided in the paper by using Tobit random-effects regressions. Nevertheless, we did not test with panel data fixed effects whether differences exist by groups of countries according to their legal heritage since these variables are time invariant. Furthermore, we did not include in the analysis country fixed effects because country dummies are also time invariant.

the models of the two tables in terms of the included variables. Model 1 involves the two macroeconomic variables, the market concentration variable, two out of three additional country control variables (that is, variables proxy for the size of a country's social security and the old-age dependency ratio), the firm-level control variables, the crisis dummy variable, the country dummy variables as well as the country key variables measuring the stock market development and the banking sector development. Model 2 additionally includes the variable proxies for the importance of private pensions in the national economy. This last variable is not included in all the models because of data availability (that is, there is not information on it for most of the countries of the sample for the first three years of the sample period). Model 3 adds the public bond sector development variable to Model 1. Again this last variable is not included in all the models because of data availability (in this case, there are not data on it for an important number of countries for 2012, 2013 and 2014).

Model 4 adds the variables proxy for the importance of private pensions in the national economy and public bond sector development to Model 1, reducing the sample size to 5,637 observations. Subsequently, to test hypothesis H2, that is, if the effect of banking sector development on the integration of EU life insurance markets is different in countries where *bancassurance* is the main life insurance distribution channel than in countries where it is not , we include the *bancassurance* interaction term. This interaction term is formed by a dummy variable (that takes 1 if in this country *bancassurance* is the main life insurance distribution channel, that is, for Austria, Belgium, France, Italy and Spain) and the level of banking sector development[9]. As a consequence, Models 5 to 8 present the results of the regressions where this *bancassurance* interaction term is included along with the corresponding variables involved in Models 1 to 4, respectively.

Because security markets incorporate both stock and debt markets, we use two variables to measure the level of capital market development in a country. The stock turnover ratio, which measures the activity or liquidity of the stock market relative to its size, (see Beck et al., 2010) is used to proxy for the level of development of the stock market. Our proxy for debt market development is the ratio public bond market capitalization to GDP.

All regression models in Table 5 show a positive and significant relationship between

[9] It would be preferable using information on distribution channel at the firm level instead of using this dummy variable. However, the data to do this are not available.

the level of stock market development and the meta-technology cost efficiency ratio. This provides evidence that the higher the liquidity of the stock market of the country where the firm is headquartered, the lower the gap between the country cost frontier and the European cost meta-frontier. The results also show a positive and significant relationship between the size of the debt market and the meta-technology cost efficiency ratio in the 4 regressions where this variable is included. These results confirm our expectation that higher levels of capital market development within the country where the insurer is settled facilitate raising external capital and also conducting investment operations, making the leading firms in the country being the leading firms in the EU in terms of cost minimization.

The level of banking sector development is proxied by private credit by deposit money in banks and other financial institutions to GDP (see e.g. Beck and Webb, 2003; Arena, 2008). This variable is negative and significant in Models 1 to 4 in the cost analysis (see Table 5) but positive and significant in the same models in the revenue analysis (see Table 6). These results first suggest that higher levels of banking sector development contribute to increasing the gap between the country cost frontier and the European cost meta-frontier but to decreasing the gap between the country revenue frontier and the European revenue meta-frontier. These results may be indicating a cost penalty of leading insurers in countries where the level of banking sector development is more developed but a revenue compensation as well.

Nevertheless, we also analyze whether the level of banking sector development has the same impact across countries where *bancassurance* is key and countries where this is not the main life insurance distribution channel. As we stated above, we perform this analysis by including the *bancassurance* interaction term. Results are presented in Models 5 to 8 in Tables 5 and 6 for the cost and revenue analysis, respectively. For all the specifications, the coefficient of the banking sector development variable remains negative and significant in the cost analysis (see Table 5). It is especially remarkable now that the *bancassurance* interaction term is always positive and statistically significant (at 1%) both in the cost and the revenue analyses. Consequently, this finding seems to indicate that in countries where *bancassurance* is not the key distribution channel, banking sector development has a cost penalty in the performance of leading life insurers. However, in countries where *bancassurance* is key, in addition to this cost penalty, it seems that there is a cost compensation. In the revenue analysis, results indicate that the positive revenue effect of banking sector development occurs in countries where *bancassurance* is key. As we stated above, the positive effect of *bancassurance* as a distribution channel, at the cost side, could be because selling insurance

through banks could be less expensive than using traditional agents. The positive effect, at the revenue side, could be as a consequence of banks offering a form of "one stop shopping" for financial services and revenue synergies may exist when consumers are willing to pay higher prices for this kind of services. Consequently, our results on *bancassurance* interaction terms provide certain evidence of synergies between life insurers and banking and suggest that the *bancassurance* architectural structure for financial firms offer some benefits. These findings are in line with literature providing evidence of the existence of synergies in the convergence of these two financial services (e.g. Fields et al., 2007).

To sum up, our results partially support hypothesis H1 and strongly support hypothesis H2. Related to the first hypothesis, we find that in terms of cost efficiency, national stocks markets development contributes to the performance and integration of EU life insurance markets, but national banking sector development prevents this integration. However, with regard to hypothesis H2, we additionally find that in countries where *bancassurance* is the main life insurance distribution channel, national banking sector development contributes to the integration of EU life insurance markets, in terms of revenue efficiency.

5.2. INSTITUTIONAL QUALITY AND META-TECHNOLOGY EFFICIENCY RATIOS

The analysis of the effect of institutional quality on meta-technology efficiency ratios through governance dimensions of the country where the firm is headquartered is presented in Models 1 to 5 of Tables 7 and 8, for the cost and revenue analysis, respectively. A correspondence exists between the models of the two tables in terms of the included variables. As we stated above, we do not include the variables proxy for financial markets development now. That is, we do not include stock market development, banking sector development, public bond market development and private pension development. In addition, as governance dimension measures are correlated they are included one by one. Results show that the coefficients of the political stability and absence of violence variable and the regulatory quality variable as well as the general indicator of institutional development coefficient are positive and statistically significant in the cost analysis (see Table 7). These results indicate that the higher the level of these dimensions of governance, the easier the development of a healthy life insurance market by increasing the economics horizons of both potential buyers and suppliers of life insurance products, contributing to national leaders being leaders in

the European Union in terms of costs minimization. However, in the revenue analysis (see Table 8), the coefficient of the government effectiveness variable is positive and statistically significant but the coefficients of the political stability and absence of violence, the regulatory quality and the institutional development variables are negative and significant[10]. These last results seem to suggest that, in general, better outcomes in political stability and absence of violence, regulatory quality and institutional development increase the gap between the country revenue frontier and the European revenue meta-frontier and, hence, decrease performance in terms of revenue efficiency. This last finding may be due to the fact that, better outcomes on these governance dimensions may result in lower insurance prices with the corresponding negative effect on revenues[11].

Model 6 (Table 7 and 8 for the cost and revenue analysis, respectively) presents results where the countries of our sample are grouped by their legal heritage. Dummy variables are used to represent the origin of a country's legal system (see La Porta et al., 1998). We include three dummy variables in the regression analysis: one for French civil law countries (Belgium, France, Italy, Netherlands and Spain in this study); another for German civil law countries (Austria and Germany in this study); and another for Scandinavian civil law countries (Denmark and Sweden in this study). The omitted variable is the English common law country of our sample (the UK). As we noted above, since there is evidence on how the origin of a country`s legal system influences the development of capital markets and banking (see e.g. Beck et al., 2003), we omit the variables that proxy for these country factors from the analysis. We also exclude dummies per country. Results show that the coefficients of the French and Scandinavian dummy variables are always negative and significant, but the coefficient of the German dummy variable is negative and significant in the cost analysis, but positive and significant in the revenue analysis. These findings suggest that the ranking of the

[10] As a robustness test, we also estimated Models 1 to 5 by including additional variables to proxy for stock market and banking sector development as well as the *bancassurance* interaction term. Results (available upon request) on the political stability and absence of violence, regulatory quality and institutional development indicators prevail (present the same sign and significance) in the cost analysis. In the revenue analysis, results on the regulatory quality and institutional development indicators also maintain (present the same sign and significance). Regarding the financial market development variables, in the cost analysis results maintain for the stock market development, banking sector development and *bancassurance* interaction term, while in the revenue analysis results prevail for the *bancassurance* interaction term.

[11] In line with this reasoning, several authors provide evidence that the cost of financial intermediation for households and firms is lower in countries with better institutions (see e.g. Demirgüç-Kunt et al., 2004; Leaven and Majnoni, 2005).

analyzed countries in terms of cost technology would be (1) the English common law country and the German civil law countries, (2) the French civil law countries and (3) the Scandinavian civil law countries. However, the ranking of the groups of countries in terms of revenues technology would be (1) the German civil law countries, (2) the English common law country, (3) the French civil law countries and (4) the Scandinavian civil law countries[12]. Behind these findings, possible reasons could be that associated to different legal heritage there are differences in the level of protection in property rights, differences in insurance contract law, but also differences in offered products that may also have been conditioned by national insurance legislation[13].

5.3. CONTROL VARIABLES

Focusing now on the control variables and taking into consideration both the financial markets development and the institutional quality analyses, we observe that the coefficient of the concentration variable is positive and significant in 12 out of 14 regressions in the revenue analysis (see Tables 6 and 8), indicating that a higher life insurance concentration level decreases the distance between the country revenue frontier and the revenue meta-frontier. This finding could be explained by two main reasons: One may be that the relatively low competition in the country where the firm is headquartered may allow the leading firms to exercise market power in setting insurance prices with the corresponding effects on revenues. Another reason is that associated to higher level market concentration, there may be a higher level of revenue efficiency, because the former could be due to a consolidation process as a competition consequence.

Results on national macroeconomic control variables indicate that, in general, GDP growth and inflation contribute positively to the performance and integration of EU life insurance markets since the coefficients are, in general, positive and significant (see Tables 5 to 8). In addition, the coefficient of the country control variable size of a country's social security is positive and significant for all the specifications in the cost

[12] These results prevail when we also include in the regression variables measures of the stock market and banking sector development and *bancassurance* interaction term. They also prevail when we additionally include in the analysis the country governance dimension variables one by one. Results from these additional analyses are available upon request.

[13] Unfortunately, data availability prevent us to test the influence of the inter country differences in life insurance offered products on the integration of European life Insurance markets.

analysis (see Tables 5 and 7) and for most of them in the revenue analysis (see Tables 6 and 8), but the coefficient of the old-age dependency ratio is always negative and significant in the cost analysis. With regard to the coefficient of the private pension variable, results show that it is negative (positive) and significant in 3 out of 4 regressions in the cost (revenue) analysis. Consequently, results seem to suggest that the higher the importance in a country of this inter-industry competitor of the life insurance industry, the higher (lower) the gap between the country cost (revenue) frontier and the European cost (revenue) meta-frontier.

With regard to the firm characteristics control variables, the log of total assets is included in the regression to control for firm size (see e.g. Cummins el al., 2017; Gaganis et al., 2019). Firm size is positively related to the meta-technology cost efficiency ratio and to the meta-technology revenue efficiency ratio. Thus, our results suggest that firm size contributes to the life insurers' reference set in a country being the life insurers' reference set in the European Union and, hence, contributes to homogenizing European life insurance markets. This could be due to the fact that larger insurers tend to be more likely to gain access to economies of diversification, ameliorating market performance.

To control for capitalization we include the ratio of equity capital to total assets (see e.g. Cummins et al., 2010; Fields et al., 2012). The coefficient of this variable is negative and significant in both the cost and revenue analyses. These results suggest that a higher level of capitalization tends to increase the gap between the country frontier and the European meta-frontier, suggesting both a cost and a revenue penalty of the firms that consume proportionately more capital. In addition, we use a dummy variable that takes 1 if the decision making unit is a group of insurers and 0 if it is an unaffiliated single company. Results show a positive and significant relationship between this variable and the meta-technology cost efficiency ratio in 10 out of 14 regressions, providing evidence of a certain compensation for being a group. Lastly, we observe that the coefficient of the crisis dummy variable is positive and significant for all the specifications in the revenue analysis, indicating an increase in MRERs in the post-crisis period[14].

[14] The finding of an increase in MRERs in the post-crisis period is confirmed when we include in the analysis year dummies instead of a crisis dummy. These results are available upon request.

5.4. ANALYSIS OF THE EUROZONE COUNTRIES

The introduction of the Euro in 1999 was a step taken towards an integrated European life insurance market. Since not all the countries of our sample belong to the Eurozone, we performed the whole analysis focusing exclusively on the Eurozone countries of our sample (Austria, Belgium, France, Germany, Italy, Netherlands and Spain) in order to know if the behavior of the analyzed country variables for integration improvement of EU life insurance markets differs between the countries belonging to the Eurozone and those that do not. All results are available upon request but not reported here to save space.

Results with respect to the multiple regression analysis conducted on the Eurozone countries confirm a positive and significant relationship between the level of stock market development and the meta-technology cost efficiency ratio. They also confirm a positive and significant relationship between banking sector development and the meta-technology revenue efficiency ratio that seems to be reinforced in countries where "*bancassurance*" is the main life insurance distribution channel. In addition, the coefficient of the concentration ratio appears negative and significant in the cost analysis (in 10 out of 14 regressions) but positive and significant in the revenue analysis (in 9 out of 14 regressions). Interestingly, the coefficient of the crisis dummy is positive and significant for most of the specifications not only in the revenue analysis (which was the case in the study of the 10 EU countries) but also in the cost analysis indicating that, in the Eurozone countries, technology gaps (both in cost and revenues) decreased in the post-crisis period compared to the pre-crisis period.

Regarding the governance dimension variables, results confirm a positive and significant relationship between better outcomes of political stability and absence of violence, rule of law and, in general, institutional development with respect to the meta-technology cost efficiency ratio. They also confirm a negative and significant relationship between superior outcomes of political stability and absence of violence and, in general, institutional development with respect to the meta-technology revenue efficiency ratio. Finally, the analysis of groups of countries according to their legal heritage, which is now reduced to French civil law countries and German civil law countries, reveals that German civil law countries show the highest meta-technology ratios of the analyzed Eurozone countries.

6. SUMMARY AND CONCLUSIONS

This paper provides evidence of country factors influencing integration of 10 EU life insurance markets over the period 1998-2014. It particularly evaluates whether (and if so, how), national financial markets development and institutional quality affect the performance and integration of EU life insurance markets as well as if the role of these national factors on EU life insurance integration is different in terms of cost efficiency than in terms of revenue efficiency. As proxies of integration, we use meta-technology cost/revenue efficiency ratios, which are calculated using the meta-frontier DEA framework. This framework involves estimating country frontiers (formed by the leading firms in a country in terms of efficiency) and an EU meta-frontier which envelopes the frontiers of all countries. For each operating point, efficiency scores are calculated with respect to both the EU meta-frontier and the own-country frontier. Then, the meta-technology efficiency ratio is obtained by dividing the meta-frontier efficiency score to the country efficiency score and it measures how close the country frontier is to the meta-frontier. The intuition behind the use of the meta-technology cost/revenue efficiency ratio as a measure of integration is that because financial integration is expected to promote competition and efficiency, we could expect that this would imply that the leading firms in a country in terms of efficiency would be also the leading firms in the EU in terms of efficiency. Consequently, one may assume that the higher the meta-technology cost/revenue efficiency ratio is, the higher integration is. The analysis is conducted by applying the Tobit random-effects regression model since dependent variable scores fall between zero and one and our sample consists of panel data.

Our regression results support the general hypothesis that motivates this paper. That is, we find that, in general, national financial market development as well as country institutional quality influence performance and integration of EU life insurance markets. Results also show that the effect of these national factors on the integration of EU life insurance markets is different in terms of cost efficiency than in terms of revenue efficiency. Focusing on the analysis of the effects of financial markets development, we particularly find that in terms of costs efficiency, stock market development contributes to the integration of EU life insurance markets but banking sector development prevents this integration. These findings seem to indicate that market-based financial systems are more reliable than bank-based financial systems for improving cost performance and integration of EU life insurance markets. Nevertheless, in addition to these results, we find that in countries where *bancassurance* is the main life insurance distribution channel, the negative effect of banking sector development to the per-

formance and integration of EU life insurance markets is partially compensated by a positive effect and that banking sector development contributes to integration in terms of revenue efficiency. These last results suggest that *bancassurance* architectural offers benefit for integration improvement.

The analysis of the effect of national institutional quality on integration of EU life insurance markets shows that, in general, better outcomes of institutional development in a country, particularly with respect to political stability and absence of violence and rule of law increase the meta-technology cost efficiency ratio. However, in general, superior results of institutional development in a country, particularly concerning dimension of governance, political stability and absence of violence, decrease the meta-technology revenue efficiency ratio. More research is needed to know how this dimension of governance contributes to integration in cost efficiency but prevents integration in revenue efficiency. Results also show that there are technological discrepancies between the groups of countries of our sample classified according to their legal heritage. Common law and German civil law countries are at the forefront of technology, followed by countries with French civil law and Scandinavian civil law heritage. We also find that higher market concentration ratios tend to increase the meta-technology revenue efficiency ratio. In addition, results also indicate that firm size contributes to integrating European life insurance markets but a higher level of capitalization tends to increase the gap between the country frontier and the European meta-frontier.

Some of the implications of this research are that regulators and policymakers should be concerned about designing programs involving the development of the stock market as well as the convergence of financial services via *bancassurance* in order to improve performance and achieve a more integrated EU life insurance market. Policymakers in French civil law and Scandinavian civil law countries should focus on national law constraints that may be impeding their life insurance leaders in terms of cost and revenues efficiency to be leaders in the EU. The fact that, in general, better outcomes in national institutional quality contributes to integration of EU life insurance markets in cost efficiency but prevents integration in revenue efficiency asks for additional research to know whether institutional quality influences life insurance prices and consumer welfare. The analysis presented here should also stimulate future research on country factors that influence performance and integration in the EU non-life insurance market according to the special characteristics of this insurance segment.

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APPENDIX. DEA META-TECHNOLOGY EFFICIENCY RATIO ESTIMATIONS

We use the *data envelopment analysis* (DEA) which is a non-parametric frontier approach (see e.g. Cooper et al., 2011) to estimate cost and revenue frontiers consisting of the most efficient firms in the reference set. Cost and revenue efficiency for each firm in the sample are measured relative to "best practice" cost and revenue frontiers, respectively. Firms on the frontiers have efficiency scores of one and firms that are not on the frontiers have efficiency scores between zero and one. In calculating efficiency using DEA, we utilize input-oriented DEA to estimate cost efficiency and output-oriented DEA to estimate revenue efficiency. This choice is based on the microeconomic theory of the firm. That is, since the objective of the firm is to maximize profits by minimizing costs and maximizing revenues, cost minimization involves choosing the optimal quantities of inputs to produce a given output vector (i.e., minimizing costs conditional on outputs), and revenue maximization involves choosing the optimal quantities of outputs conditional on the input vector (i.e., maximizing revenues conditional on inputs) (see, Cummins et al., 2010).

We follow a two-step procedure to estimate cost efficiency. First, we estimate the input vector that minimizes the cost by solving a linear programming problem; second, we calculate the minimum cost (cost of a fully efficient firm with the same output quantities and input prices) to the firm cost ratio to get the cost efficiency measure. To estimate revenue efficiency, we also follow a two-step procedure. First, we solve a linear programming model to estimate the output vector that maximizes revenues; second, we calculate the ratio firm revenues to maximum revenues (revenues of a fully efficient firm with the same output price vector and input vector) to get the revenue efficiency measure.

We adopt the meta-frontier approach suggested by O'Donnell, Rao and Battese (2008) for estimation of meta-frontier and group-frontier (country-frontier) efficiencies. The construction of separate country frontiers makes sense when hypothesizing the presence of heterogeneity in production possibility sets among countries. The meta-frontier envelops the frontiers of all countries. The process for estimating the meta-technology cost/revenue efficiency ratio is as follows. For each operating point, efficiency is measured both relative to the own-country frontier and to the meta-frontier. Then, a measure of how close the country frontier is to the meta-frontier is obtained by calculating the ratio of the meta-frontier efficiency to the country efficiency. This ratio is named the meta-technology efficiency ratio which has a value between zero and one. The closer the country frontier is to the meta-frontier, the closer the meta-technology efficiency ratio would be to one (see e.g. Barros and Wanke, 2017; Cummins and Rubio-Misas, 2020).

We use a modified version of the value-added approach to measure insurance outputs, inputs and output and input prices. Most of the existing studies recognize that risk-pooling and risk bearing services, real financial services related to insured losses and intermediation services are the three main services in creating value for insurers (Cummins and Weiss, 2013). We use the value of real incurred benefits plus addition to reserves (see e.g. Cummins, Tennyson and Weiss 1999; Cummins and Weiss, 2013) as a proxy for the amount of risk pooling/bearing and real insurance services provided by life insurers. The real value of invested assets gives a satisfactory proxy for the intermediation function (see Cummins and Weiss, 2013). The price of the insurance output (P_{IB}) is defined as $P_{IB}=(P\text{-}IB))/IB$ where P denotes the premiums; and expresses the value of real incurred benefits plus addition to reserves. We utilize the ratio of net investment income to invested assets for the price of the invested assets output.

In addition, according to the valued-added approach (see Cummins and Weiss, 2013), insurers use three primary inputs: labor, material and business services, and capital. Due to data unavailability, we combine labor input and materials and the business services input to make another input category constructed from the operating expenses category. This combination is commonly used in other international insurance efficiency studies (see e.g. Fenn et al., 2008). Operating expenses include commission expenses, claims handling expenses, management expenses as well as expenses from investment management. We follow previous research (e.g. Cummins, Weiss and Zi, 1999; Cummins, Rubio-Misas and Zi, 2004) and calculate the quantity of the operating expenses input by dividing operating expenses by the wage rate used as a price of this input. The other two inputs used in this study, which are standard in insurance efficiency research, are equity capital and debt capital. Equity capital is defined as the policyholders' surplus. Debt capital is defined as the sum of net loss reserves, net unearned premium reserves, other technical reserves, and total other liabilities (borrowed money).

We use an index based on the wages and salaries of the industry and services for each year and country of the sample period provided by Eurostat as a proxy for the price of the operating expenses input. The price of equity capital is determined by using the 20-year rolling average of the yearly rates of total return of the country specific MSCI stock market indices. The price of debt capital is proxied by the 10-year-Treasury-Bill rates for each year and country of the sample period provided by the OECD Economic Outlook database (see e.g. Eling and Luhnen, 2010). Mean values of outputs, inputs, output prices and input prices per country are shown in Table A1.

Table 1. Overview of the insurance industry in the analyzed EU countries, 1998 and 2014

	Life insurance share		Life insurance penetration		Life insurance density		Investment to GDP ratio		CR5 market share	
	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014
Austria	35.7%	35.5%	2.1%	2.0%	571.6	1,049.1	15.4%	25.9%	56.0%	70.0%
Belgium	55.2%	56.5%	3.5%	4.0%	902.4	1,918.7	27.0%	71.7%	58.0%	59.0%
Denmark	59.5%	67.7%	4.2%	6.6%	1,404.6	4,106.3	62.3%	103.1%	63.0%	56.6%
France	60.4%	64.2%	4.8%	6.0%	1,212.8	2,594.0	46.3%	99.8%	53.0%	53.4%
Germany	38.4%	35.9%	2.6%	2.9%	714.8	1,416.5	23.8%	62.4%	26.0%	50.1%
Italy	51.1%	76.8%	2.3%	6.5%	518.8	2,300.8	11.3%	38.8%	34.0%	58.6%
Netherlands	57.8%	47.7%	5.1%	2.6%	1,424.8	1,384.3	54.9%	69.8%	39.0%	80.0%
Spain	46.2%	43.9%	2.2%	2.4%	336.7	710.3	9.3%	27.0%	23.0%	53.5%
Sweden	62.7%	69.6%	3.5%	5.0%	1,041.0	2,939.0	60.1%	95.7%	80.0%	88.0%
UK	64.5%	73.4%	9.1%	7.4%	2,560.7	3,488.6	83.3%	89.6%	41.0%	49.3%

This table reports figures for 1998 and 2014 of five important aspects of the insurance industry in the analyzed countries: life insurance share (calculated as life premiums to total premiums) in percentage, life insurance penetration (calculated as direct life premiums written to GDP) in percentage, life insurance density (calculated as life premiums to inhabitants) in USD per inhabitants, insurers' investment portfolio (including both life and non-life segments) to GDP in percentage and the cumulative market share of the top five life insurers (CR5) in percentage. Sources: CEA, Insurance Europe, OECD, Sigma Swiss Re.

Table 2. Definition of country variables in the multiple regression analysis

Variable	Definition	Source
Stock market development	Stock market turnover ratio. That is the ratio of the value of total shares traded to average real market capitalization	WBDFDS
Public bond market development	Public bond market capitalization to GDP. That is public domestic debt securities issued by government as a share of GDP	WBDFDS
Banking sector development	Private credit by deposit money banks and other financial institutions to GDP	WBDFDS
CR5 life ratio	Cumulative market share of the five largest life insurers in a country	Insurance Europe
Political stability and absence of violence	Capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political-motivated violence and terrorism	WBDGI
Government effectiveness	Capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	WBDGI
Regulatory quality	Capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development (Kaufmann et al. 2010, page 6)	WBDGI
Rule of law	Capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence	WBDGI
Institutional development	An average of six indicators measuring voice and accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption (see Kaufman et al. 2010)	WBDGI
Origin of the country law system	We use 3 dummies variables: L1 takes 1 for French civil law countries (Belgium, France, Italy, Netherlands and Spain in this study), 0 otherwise; L2 takes 1 for German civil law countries (Austria and Germany in this study), 0 otherwise; L3 takes 1 for Scandinavian civil law countries (Denmark and Sweden in this study), 0 otherwise. The omitted variable is English common law countries.	
Pensions funds development	Pensions funds investment as a share of GDP. An indicator of the maturity of the system and the importance of private pensions relative to the size of the economy.	OECD
Old-age dependency ratio	The number of individuals aged 65 and over per 100 people of working age defined as those aged between 20 and 64	OECD
Size of the country's social security	Social expenditure in percentage of Gross Domestic Product. Indicator of social policy in a country. The main social policy areas are as follows: old age, survivors, incapacity-related benefits, health, family, active labor market programs, unemployment, housing and other social policy areas.	OECD

Notes: WBDFDS means World Bank database on Financial Development and Structure; WBDGI means World Bank database on Governance Indicators; Insurance Europe was formerly known as Comité Européen des Assurances (CEA) until 2012. OECD means Organization for Economic Co-operation and Development.

Table 3. Mean values per country of the key explanatory variables

	Austria	Belgium	Denmark	France	Germany	Italy	Netherlands	Spain	Sweden	UK
Financial markets development										
Stock market development	0.375	0.421	0.722	0.796	1.233	1.417	1.146	1.324	1.007	1.064
Public bond market development	0.335	0.764	0.423	0.515	0.390	0.860	0.441	0.415	0.333	0.352
Banking sector development	1.010	0.663	1.523	0.888	1.013	0.833	1.337	1.391	1.035	1.522
Governance dimensions										
Political stability and absence of violence	1.154	0.853	1.183	0.571	0.957	0.610	1.156	-0.015	1.237	0.531
Government effectiveness	1.801	1.650	2.105	1.561	1.636	0.545	1.894	1.255	1.960	1.719
Regulatory quality	1.539	1.286	1.800	1.129	1.524	0.892	1.804	1.185	1.636	1.783
Rule of law	1.866	1.361	1.927	1.434	1.686	0.576	1.800	1.207	1.805	1.716
Institutional development	1.593	1.330	1.829	1.222	1.503	0.669	1.716	0.979	1.721	1.491

Note: This table reports mean values of the key explanatory variables per country. Measures of financial markets development were obtained from the World Bank database on financial development and structure. The governance dimensions of the country were obtained from the World Bank database on governance indicators

Table 4. Summary Statistics: Variables in the Regression Analysis, 1998-2014

	Mean	Median	Std. Dev
Dependent variables			
Meta-technology cost efficiency ratio(MCER)	0.9177	0.9447	0.1149
Meta-technology revenue efficiency ratio (MRER)	0.5532	0.5782	0.3126
Key explanatory variables			
Capital market development			
Stock market development	1.1254	1.0632	0.4853
Public bond market development	0.4583	0.4107	0.1688
Banking sector development			
Banking sector development	1.1263	1.0835	0.3376
Governance dimensions			
Political stability and absence of violence	0.7584	0.8422	0.4193
Government effectiveness	1.7001	1.6611	0.1969
Regulatory quality	1.5445	1.5548	0.1865
Rule of law	1.6899	1.6649	0.1948
Institutional development	1.4600	1.4800	0.2072
Control variables			
Macroeconomic variables			
Inflation rate	1.8197	1.8000	0.9271
Growth in real per capita GDP	0.8999	1.3000	2.1080
Concentration			
Cumulative market share 5 largest insurers	0.4898	0.5012	0.1387
Size of a country's social security			
Social expenditure in percentage of GDP	24.96	25.38	2.92
Private pensions development			
Investment as a share of GDP	21.28	5.52	33.00
Demographic variable			
Old-age dependency ratio	29.48	28.80	3.36
Firm Level Control Variables			
Log of total assets	6.0771	6.1419	0.9587
Equity capital/Total assets	0.1021	0.0470	0.1592
Group	0.0812	0.0000	0.2732
Number of observations	8594 (a)		

Notes: We also classify countries by the origin of the country law system and alternatively use 3 dummies variables: L1 takes 1 for French civil law countries (Belgium, France, Italy, Netherlands and Spain in this study), 0 otherwise; L2 takes 1 for German civil law countries (Austria and Germany in this study), 0 otherwise; L3 takes 1 for Scandinavian civil law countries (Denmark and Sweden in this study), 0 otherwise. The omitted variable is English common law countries. (a) The number of observations to calculate descriptive statistics of public bond market development and private pension plan development was 7,205 and 7,026, respectively.

Table 5. Multiple Regression Analysis on Meta-technology Cost Efficiency Ratios and Financial Markets Development, 1998-2014. Tobit Random Effects

Model	1		2		3		4		5		6		7		8	
Control variables																
Country factors																
Inflation	0.009	***	0.010	***	0.006	***	0.005	***	0.009	***	0.010	***	0.006	***	0.006	***
Growth	0.001	***	0.001	***	0.002	***	0.001	***	0.001	***	0.001	**	0.002	***	0.001	**
Concentration (CR5)	-0.004		-0.007		-0.030	***	-0.041	***	-0.012	*	-0.016	**	-0.045	**	-0.060	***
Social security size	0.008	***	0.007	***	0.008	***	0.005	***	0.008	***	0.007	***	0.008	***	0.005	***
Private pensions funds			-0.001	***			-0.001	***			-0.001	***			0.000	**
Old- age dependency ratio	-0.006	***	-0.006	***	-0.005	***	-0.005	***	-0.006	***	-0.006	***	-0.005	***	-0.005	***
Firm characteristics																
Log of assets	0.032	***	0.031	***	0.027	***	0.023	***	0.032	***	0.031	***	0.026	***	0.023	***
Capitalization	-0.133	***	-0.123	***	-0.143	***	-0.143	***	-0.134	***	-0.122	***	-0.144	***	-0.142	***
Group	0.004		0.005		0.012	**	0.015	***	0.005		0.006		0.012	**	0.015	**
Crisis dummy	0.003		0.009	***	0.007	***	0.011	***	0.003		0.007	***	0.008	***	0.010	***
Country dummies	yes		yes		yes		yes		yes		yes		yes		yes	
Key variables																
Financial markets development																
Stock market development	0.018	***	0.015	***	0.020	***	0.020	***	0.019	***	0.016	***	0.021	***	0.021	***
Public bond market development					0.021	*	0.097	***					0.033	***	0.105	***
Banking sector development	-0.0495	***	-0.041	***	-0.046	***	-0.026	***	-0.056	***	-0.059	***	-0.051	***	-0.048	***
Banking sector development**Bancassurance*									0.029	***	0.046	***	0.034	***	0.056	***
Log likelihood	12,382		10,545		10,570		8,664		12,390		10,557		10,580		8,678	
Observations	8594		7026		7205		5637		8594		7026		7205		5637	

Notes: Coefficients for intercept and country dummies variables are not reported. *** ,** and * mean statistical significance at 1%, 5% and 10%, respectively.

Table 6. Multiple Regression Analysis on Meta-technology Revenue Efficiency Ratios and Financial Markets Development, 1998-2014. Tobit Random Effects

Model	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**	
Control variables																
Country factors																
Inflation	0.004	**	0.002		0.005	***	0.002		0.003	**	0.003	*	0.004	**	0.003	*
Growth	0.001	**	0.002	***	0.001	*	0.002	**	0.001	**	0.001	**	0.001		0.000	
Concentration (CR5)	0.069	***	0.050	***	0.088	***	0.052	***	0.027	**	0.028	**	0.026		0.001	
Social security size	0.005	***	0.002		0.006	***	0.000		0.003	***	0.003	**	0.002		-0.001	
Private pensions funds			0.001	**			0.000				0.001	***			0.001	**
Old- age dependency ratio	0.000		-0.001		0.001		-0.001		0.000		-0.001		0.000		-0.001	
Firm characteristics																
Log of assets	0.097	***	0.095	***	0.107	***	0.108	***	0.095	***	0.095	***	0.104	***	0.109	***
Capitalization	-0.223	***	-0.212	***	-0.201	***	-0.178	***	-0.228	***	-0.211	***	-0.206	***	-0.176	***
Group	0.006		0.003		-0.009		-0.013		0.008		0.006		-0.007		-0.014	
Crisis dummy	0.020	***	0.023	***	0.017	***	0.023	***	0.019	***	0.019	***	0.018	***	0.019	***
Country dummies	yes		yes		yes		yes		yes		yes		yes		yes	
Key variables																
Financial markets development																
Stock market development	-0.002		-0.001		-0.002		0.000		0.003		0.003		0.003		0.003	
Public bond market development					-0.064	***	0.031						-0.013		0.053	*
Banking sector development	0.046	***	0.054	***	0.034	***	0.071	***	0.013		0.006		0.011		0.011	
Banking sector development**Bancassurance*									0.145	***	0.121	***	0.151	***	0.151	***
Log likelihood	6,995		5,691		5897		4,551		7,048		5,711		5,946		4574	
Observations	8594		7026		7205		5637		8594		7026		7205		5637	

Notes: Coefficients for intercept and country dummies variables are not reported. *** ,** and * mean statistical significance at 1%, 5% and 10%, respectively.

Table 7. Multiple Regression Analysis on Meta-technology Cost Efficiency Ratios and Institutional Quality, 1998-2014. Tobit Random Effects

Model	**1**		**2**		**3**		**4**		**5**		**6**	
Control variables												
Country factors												
Inflation	0.010	***	0.009	***	0.009	***	0.009	***	0.009	***	0.009	***
Growth	0.000		0.001	**	0.001	**	0.001	**	0.001	*	0.000	
Concentration (CR5)	0.007		-0.005		-0.004		-0.005		-0.001		-0.022	***
Social security size	0.006	***	0.004	***	0.004	***	0.004	***	0.005	***	0.003	***
Private pensions funds												
Old- age dependency ratio	-0.003	***	-0.000	***	-0.000	***	-0.004	***	-0.003	***	-0.003	***
Firm characteristics												
Log of assets	0.031	***	0.029	***	0.029	***	0.029	***	0.030	***	0.026	***
Capitalization	-0.135	***	-0.138	***	-0.138	***	-0.138	***	-0.137	***	-0.142	***
Group	0.010	*	0.010	**	0.010	*	0.010	**	0.011	**	0.010	*
Crisis dummy	-0.004	**	-0.001		0.000		-0.001		-0.002		0.002	
Country dummies	yes		yes		yes		yes		yes		non	
Key variables												
Governance dimensions												
PS	0.022	***										
GE			-0.003									
RQ					0.024	***						
RL							-0.007					
ID									0.036	***		
Country legal system												
French civil law countries											-0.099	***
German civil law countries											-0.003	
Scandinavian civil law countries											-0.185	***
Log likelihood	12,274		12,245		12,249		12,245		12,252		12,057	
Observations	8594		8594		8594		8594		8594		8594	

Notes: Coefficients for intercept and country dummies variables are not reported. PS, GE, RQ, RL and ID mean Political stability and absence of violence, Government effectiveness, Regulatory quality, Rule of law and Institutional development, respectively. *** ,** and * mean statistical significance at 1%, 5% and 10%, respectively.

Table 8. Multiple Regression Analysis on Meta-technology Revenue Efficiency Ratios and Institutional Quality, 1998-2014. Tobit Random Effects

Model	1		2		3		4		5		6	
Control variables												
Country factors												
Inflation	0.006	***	0.007	***	0.007	***	0.006	***	0.006	***	0.005	***
Growth	0.001	*	0.000		0.001		0.001		0.001		0.000	
Concentration (CR5)	0.058	***	0.073	***	0.071	***	0.072	***	0.067	***	0.047	***
Social security size	0.007	***	0.009	***	0.008	***	0.008	***	0.008	***	0.005	***
Private pensions funds												
Old- age dependency ratio	-0.002	***	0.000		0.000		-0.001		-0.002	**	0.000	
Firm characteristics												
Log of assets	0.098	***	0.100	***	0.100	***	0.101	***	0.100	***	0.100	***
Capitalization	-0.223	***	-0.218	***	-0.220	***	-0.219	***	-0.221	***	-0.228	***
Group	0.004		0.004		0.003		0.003		0.002		0.007	
Crisis dummy	0.021	***	0.014	***	0.016	***	0.017	***	0.018	***	0.020	***
Country dummies	yes		yes		yes		yes		yes		non	
Key variables												
Governance dimensions												
PS	-0.026	***										
GE			0.031	***								
RQ					-0.032	**						
RL							-0.007					
ID									-0.049	***		
Country legal system												
French civil law countries											-0.311	***
German civil law countries											0.190	***
Scandinavian civil law countries											-0.467	***
Log likelihood	6,985		6,977		6,976		6,974		6,977		6,737	
Observations	8594		8594		8594		8594		8594		8594	

Notes: Coefficients for intercept and country dummies variables are not reported. PS, GE, RQ and RL mean Political stability and absence of violence, Government effectiveness, Regulatory quality and Rule of law, respectively. *** ,** and * mean statistical significance at 1%, 5% and 10%, respectively.

Table A1. Mean values per country of outputs, inputs, output prices and input prices to estimate meta-technology cost/revenue efficiency ratio, 1998-2014

	Austria	Belgium	Denmark	France	Germany	Italy	Netherland	Spain	Sweden	UK
Output quantity										
Incurred benefits plus addition to reserves	169.16	147.76	295.12	734.21	382.55	648.41	921.10	214.83	354.27	1345.09
Invested assets	2376.04	1536.45	6535.46	10279.33	4373.19	4838.34	22110.97	1377.19	12858.75	20232.77
Input quantity										
Equity capital	96.34	79.90	421.95	467.04	89.34	212.73	1196.25	80.52	4516.05	914.96
Debt capital	2339.37	1515.10	6320.14	10317.11	4501.38	5033.08	22686.15	1357.17	8731.65	20444.90
Operating expenses quantity	40.88	16.72	27.58	86.05	63.40	94.07	237.40	14.14	54.83	244.56
Output price										
Price of the insurance output	1.999	2.220	1.710	0.980	2.999	2.077	1.264	1.031	1.565	1.417
Price of the invested assets output	0.039	0.033	0.033	0.035	0.041	0.026	0.037	0.040	0.032	0.033
Input price										
Equity capital price	0.143	0.153	0.162	0.152	0.141	0.136	0.126	0.169	0.183	0.129
Debt capital price	0.041	0.039	0.040	0.040	0.036	0.045	0.038	0.044	0.037	0.043
Operating expenses price	1.217	1.328	1.258	1.249	1.203	1.230	1.263	1.363	1.351	1.383

Note: Monetary variables are expressed in constant millions 2000 Euros deflated by the country-specific consumer price indices.

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