**Solvency II mandatory implementation and analysts' information properties**


## Abstract

From 1st of January 2016, insurance firms in the European Union (EU) are required to adhere to the Solvency II regulation. As such, for the first time ever, they have to provide mandatory market, risk-related, disclosures on an annual basis via the publication of a single report: the Solvency and Financial Condition Report (SFCR). Considering that analysts are perceived as the main recipients of the report, it is an open empirical question whether and how analyst forecast properties are influenced by the publication of Solvency II related information. Using a sample of EEA insurers for the period between 2013 and 2018 and a difference-in-difference design, we show improvement in analysts' information properties in the post Solvency II period as proxied by decrease in EPS forecast dispersion, while in the same direction, though weak, are the evidence on consensus analyst EPS forecast error and following. Focusing on the individual EPS forecast error for a set of analysts covering EEA insurers pre and post Solvency II, a decrease in the forecast error after Solvency II implementation is documented, showing the beneficial effect of the new information available on analyst assessment. The results extend the financial and risk-based reporting literature in insurance industry in general, and with reference to Solvency II framework. Further, the study informs the relevant regulatory authorities on the beneficial effects of Solvency II disclosures on analysts, as major stakeholder group.



***Keywords:*** Solvency and Financial Condition Report, SFCR, Solvency II, analysts' forecasts, analysts' dispersion, analysts' following, analyst properties, insurance firms

***JEL Classification:*** G14, G22, G28

## 1. Introduction

The current study investigates the effect of the mandatory implementation of Solvency II framework for insurance undertakings in the European Union/European Economic Area (EEA) on analysts' forecast properties.

Solvency II framework was implemented to safeguard insurers' financial soundness as a response to the deficiencies of the previous regulatory regimes (the latest being Solvency I) (Erdelyi 2016, p.14). Prescribing mandatory public disclosures as part of its 3-pillar structure, called Solvency and Financial Condition Report (SFCR), regulators aimed to enhance transparency and market discipline by providing risk-relevant information to stakeholders (EIOPA 2015, 2017; Eckert and Gatzert 2018). However, not all stakeholders have the same level of education and understanding, and prior evidence indicates that risk-relevant information is difficult to be interpreted by financially illiterate stakeholders (Malafronte, Porzio and Starita 2016), which include customers/policyholders, among others. This has been acknowledged by regulators who have recognised that the majority of SFCR content is in fact addressed to analysts/investors (EIOPA 2017; PRA 2017; EIOPA 2020; EU 2021). While there is some anecdotal evidence that analysts might consider Solvency II related disclosures as information source , there is lack of empirical evidence on the effect of Solvency II disclosures on analysts' forecast properties.

Existing evidence on EEA insurers' risk-related disclosures are rather limited and dispersed in various time and research settings. A significant strand of literature on insurers' risk-related disclosures is limited to the period before Solvency II adoption, and in absence of Pillar 3 reporting, prior literature examined risk disclosures in annual reports (e.g., Höring and Gründl 2011; Malafronte et al 2016; Malafronte, Starita and Pereira 2018) or voluntary schemes (e.g. EEV, MCEV; El-Gazzar, Jacob and McGregor 2022). Findings on traditional annual reporting indicate an increase in the quantity of risk disclosures through time, though the quality remained the same (Höring and Gründl 2011, Malafronte et al 2016, 2018). On the other hand, international evidence on embedded value reporting demonstrates the beneficial effects of these voluntary disclosures on forecast dispersion and error as more insurance-tailored accounting and performance metrics (El-Gazzar et al 2022). Findings after Solvency II implementation are, initially, time-limited around the first disclosure of the SFCR report (Gatzert and Heidinger 2020; PRA 2017). While the evidence suggests that investors reacted on Solvency II figures disclosed in SFCR (Gatzert and Heidinger 2020) and that analysts might consider SFCR as information source (PRA 2017), the short window explored impairs the ability to generalise as practice changes through time. Only the study of Mukhtarov, Schoute and Wielhouwer (2021) expands to more than one year after Solvency II implementation and they document a higher comparative informativeness of unexpected Solvency II ratio with unexpected earnings and Solvency I ratio in the post-Solvency II period. Collectively, though, academic evidence on the impact of Solvency II disclosures (see Gatzert and Heidinger 2020; Mukhtarov et al 2021) is mainly focused on the broader investors' context, which are considered as less sophisticated compared with sell-side analysts (see Bonner, Walther and Young 2003) and with different role in the financial markets1.

We use a sample of 39 EEA insurers, 218 firm/year consensus forecasts and 2,452 individual EPS forecasts, for a period starting from FY2013 to FY2018. This represents 68.42% of EEA listed insurers with available earnings forecasts during the sample period. The study follows a difference-in-difference (DiD) design while using US insurers as control sample to alleviate potential confounding effects. The results document an improvement in analyst forecast properties in terms of forecast dispersion, while in the same direction, though weak, are the evidence on consensus analyst EPS forecast error and following. Focusing on individual forecasts of analysts covering EEA insurers pre and post Solvency II, evidence illustrates the beneficial effect of Solvency II implementation as expressed by lower individual analyst's EPS forecast error after Solvency II implementation. To support the findings, additional tests were conducted to observe whether the results are attributed to analysts' information discovery or interpretative role and whether the results are attributed to voluntary embedded value reporting (for life insurers). The results indicate that the lower levels of forecast error are attributed to analysts' information discovery role. Further, life insurers' commitment to voluntarily disclose embedded value report doesn't seem to create differences in the forecast error compared with EEA life insurers who don't, supporting the argument that Solvency II disclosures have a beneficial effect on analysts' forecast properties after the mandatory implementation. The results are also resilient in a battery of robustness tests, using alternative periods and a "placebo" effect as well as entropy balancing.

The study makes a significant contribution to the accounting and finance literature as follows. It is the first study examining the impact of Solvency II on analysts' forecast

[1] Security (sell-side) analysts have a pivotal role in the financial markets, as they broadly possess the function of information intermediaries between the covered firms and various investor categories (Ljungqvist et al., 2007; Chen, Cheng and Lo 2010; Bowers et al., 2014). They are considered among the market specialists and sophisticated users of the financial statements by providing valuation insights, forecasts, recommendations and other information to investors or financial intermediaries (Schipper, 1991; Lang and Lundholm, 1996; Ivković and Jegadeesh, 2004; Bradshaw, 2009).

properties, complementing the recent, yet emerging, literature on the impact of Solvency II disclosures on investors (Gatzert and Heidinger 2020; Mukhtarov et al 2021). From a wider perspective, the current study also provides feedback to the risk disclosure literature with reference to insurance industry (e.g. Höring and Gründl 2011; Malafronte et al 2016; Malafronte et al 2018). Existing evidence was limited on the risk disclosures through annual reports before Solvency II adoption, while the current study focuses explicitly on related risk disclosures arising from the implementation of Solvency II. To the extent, also, that Pillar 3 reporting partly substituted voluntary reporting schemes in the EEA insurance industry, our study complements the recent international evidence on the impact of unregulated embedded value reporting on analyst forecast properties (El-Gazzar et al 2022). We advance this strand of the literature by providing evidence about the effect of dedicated, market-related, risk reporting, as prescribed by central regulatory authority, on one on the key stakeholder groups (analysts) for which, to the best of our knowledge, evidence is absent so far.

Apart from the academic contributions, our study also has significant policy-related contributions. Solvency II was to be implemented as a more comprehensive, sophisticated and risk-based framework to assess an EU insurance undertaking, following the regulatory risk-based mentality in financial industry (Haan and Kakes 2010) while prescribing relevant disclosures to a wide range of stakeholders (EIOPA 2015, 2017; Eckert and Gatzert 2018). To the extent that policyholders hardly provided any comments on SFCR (in the UK, PRA 2017) and early evidence in the investors' context showed some positive evidence (Gatzert and Heidinger 2020; Mukhtarov et al 2021), the current study demonstrates that Solvency II information is fit for analysts' purposes as illustrated by lower EPS forecast errors. Because of that, we provide insights which are in support of the recent amendments in Solvency II regulation, following the feedback from the "Solvency II 2020 review" by European Insurance and Occupational Pensions Authority (EIOPA). Focusing on the Pillar 3 disclosures, EIOPA and the Commission recognized the way SFCR is currently constructed is not fit for policyholders needs, as it is fairly technical and received little attention (for policyholders' focus on SFCR see PRA 2017). For this reason, one of the adopted amendments was the SFCR split in two sections, one including policyholder relevant information and one with analysts or other stakeholder relevant information, with the former including information of simplified nature (EIOPA 2020; EU 2021). While this is a very recent change, our evidence provides additional insights over the perceived usefulness of Pillar 3 disclosures by analysts which could improve regulators' understanding.

The remainder of the paper is structured as follows: Section 2 provides the regulatory context around the SII implementation, literature review, motivation and the research questions. Section 3 presents the research design. Section 4 discusses the empirical results as well as additional and robustness tests. Finally, section 5 concludes the study.

## 2. Regulatory context, literature review and research questions

### *2.1 Insurance reporting and disclosures in the EAA*

Solvency II came into effect on 1st of January 2016 as a comprehensive regulatory framework for insurance supervision (Eckert and Gatzert 2018; EU 2015). Following a principles-based approach in the regulation formulation and enforcement, Solvency II alleviated outstanding issues associated with Solvency I and previous frameworks. First, it enhanced the proper functioning of the single market, by applying a uniform set of rules and enforcement of law. Second, being a risk sensitive framework by nature, Solvency II takes a holistic, market based, approach for the insurer's solvency assessment (Swain and Swallow 2015), with insurers being solvent when the ratio of eligible own funds over solvency capital requirements is above 100% (for ratio formula see Mukhtarov et al 2021). Third, and using similar methodology with the Basel Accord, Solvency II follows a three-pillar structure where the quantitative (Pillar 1) and qualitative/governance (Pillar 2) requirements are disclosed to the regulators (Regular Supervisory Report (RSR)) and the public (through SFCR) following the proportionality principle to public disclosures (EU 2015; Eckert and Gatzert 2018). While insurers used to report to supervisors, SFCR is contemporary, following the trend in the banking industry.

While Pillar 3 disclosures is commonplace in the banking industry for many years, it was only after Solvency II implementation that became available in EEA insurance industry. However, the discussion for need of public disclosures started as early as 2000. During the early steps where the need for fundamental regulatory reform in the industry was recognised (EC 1998, 1999). the International Association of Insurance Supervision (IAIS) published a paper called *"On Solvency, Solvency Assessment and Actuarial Issues"*, discussing the various perspectives and factors that regulators should consider for the solvency framework development (IAIS, 2000). While the study was conducted with international relevance, it underlined the need for risk-related, forward-looking information, especially around solvency margins (both minimum and available) and insurers risk profile which would be publicly disclosed for the stakeholders to assess (IAIS 2000). In detail, the IAIS paper mentions that *"An insurance company should publicly disclose qualitative and quantitative information* *about its risk exposures, taking into account a degree of confidentiality needed to preserve the access to proprietary information provided to supervisors. Together with the disclosure of an insurance company's capital position, information about its risk exposure helps illustrate whether an insurance company will be able to remain solvent in times of stress."* (IAIS 2000, p. 16) while also mentions that *"transparency regarding the insurance company's risk profile provides information about the stability of an institution's financial position and the sensitivity of its earnings to changes in market conditions"* (IAIS 2000, p. 16). This study, along with other international regulatory frameworks that were in place, were considered during the extensive background study conducted for Solvency II, mainly called and referred as *"KPMG Report"* (KPMG 2002) while the need for separate public disclosures was stressed during the entire implementation process.

Further, concerns were expressed regarding the role of accounting standards on defining solvency margins. At that time, International Accounting Standards (IAS) were scheduled to be implemented across the member states and it was considered as a positive development towards convergence of accounting practices (KPMG 2002). There was an increased concern, though, how potential changes in accounting standards could impact the solvency assessment, as figures technical provisions can have an impact on regulatory ratios (KPMG 2002). Besides that, different recognition options allowed in various accounting standards could also have an impact on the final figures used in regulatory ratios, reducing also the comparability among insurers in different countries (KPMG 2002). This was evident even after International Financial Reporting Standards implementation (IFRS) in 2005 as, for example, IFRS 4 – insurance contracts - was considered as transitional standard which allowed the country-specific GAAP to be followed (Whittington 2005).

As a response to deficiencies of traditional reporting which impeded their ability to provide relevant information to stakeholders (Serafeim 2011), some life insurance undertakings (or insurers with a life insurance division) provided the, so called, embedded value report for their life activities on a voluntary basis. While embedded value reporting comes with shortcomings, analysts showed strong preference (before Solvency II implementation) on the figures provided compared with IFRS reporting, as they could easily assess insurers' value drivers (PriceWaterhouseCoopers 2007). Moreover, it is a clear indication that insurance undertakings started developing economic capital models before Solvency II, the results of which were disseminated in public voluntary disclosures (Rae et al. 2018). After Solvency II implementation, it was presented a decrease in embedded value reporting. The main reason is the additional reporting effort and costs that Solvency II introduced as well as a convergence of economic capital methodology towards Solvency II, thus there was some overlap of information between the two reports (Crean and Foroughi 2017; Milliman 2017).

Overall, it can be observed that annual reporting might not reflect the "true picture" of insurers' solvency while voluntary schemes in place (in this case, MCEV) is industry-specific and partly substituted by SFCR. In that context, SFCR disclosures are expected to be of relevance to insurers' stakeholders.

### *2.2 Literature review*

Evidence on insurers' risk disclosures in the EEA region before Solvency II implementation is rather limited and, mainly, with reference to annual reporting. For a sample of European insurers included in Dow Jones Stoxx 600 Insurance Index during the period 2005-2009, Höring and Gründl (2011) examine the risk disclosure practices in conjunction with a series of firm characteristics. The results indicate an upward trend of the amount of relevant risk disclosures and a positive relationship with firm size, risk cross listing and ownership dispersion, mainly influenced by developments around IFRS 7, Basel II and the financial crisis (Höring and Gründl 2011). Malafronte et al (2016) examine the disclosure practices of European insurance industry from 2005 to 2010, documenting that insurers increase the quantity of risk related information, while keeping the quality constant (using readability proxies). This is mainly due to lower cost associated with quantity versus quality, while the targeted audience are financially literate people (Malafronte et al. 2016). Using a European sample from 2005 to 2010, Malafronte et al (2018) examine the impact of risk disclosure practices on stock return volatility, and document increase in volatility with greater disclosures, though volatility is lower when firms report positive results. The results are in large conformity with relevant research in other financial institutions (e.g. banking industry; Pérignon and Smith 2010) as well as non-financial firms (e.g. Linsley and Lawrence 2007).

Focusing on investors, the limited early evidence indicates that the Solvency II ratio is significant for them. Gatzert and Heidinger (2020) examine the market reaction to the first SFCR report in 2016. Using a sample of 48 insurers from 15 EEA countries, the results indicate that SFCR readability metrics are insignificant due to their descriptive attributes. On the other hand, they illustrate a positive relationship between the Solvency II ratio (without the use of adjustment figures) and cumulative abnormal returns (CAR), showing that Solvency II ratio contains relevant information to investor needs (Gatzert and Heidinger 2020). Mukhtarov et al (2021) examine the relative informational properties of Solvency II compared to Solvency I and earnings for a sample of 571 announcements of 46 EEA insurers for the period 2012-2018. The results indicate that Solvency II ratio is taken into account as a new and more relevant forward-looking information as they document a positive relationship between unexpected Solvency II ratio and abnormal returns, while the significance of the relationship between unexpected earnings and abnormal returns to decrease when earnings and Solvency II ratio are announced together.

Focusing on analysts, evidence is rather limited and mainly focused on the banking sector[2]. In insurance context, Chen et al. (2022) examine how the extend of analyst coverage affects the risk-taking behaviour of insurance firms. Using a US property and casualty insurers sample from 2001-2017, the study provides evidence that low levels of analyst coverage are linked with higher insurers' risk-taking behaviour (Chen et al. 2022). Driven by the evidence, the results indicates that analyst coverage is closely linked with market discipline, thus a decrease in insurers' analyst following is associated with a deterioration of market discipline (Chen et al. 2022). Evidence of insurers' risk disclosures on analyst behaviour is limited to the embedded value voluntary reporting context[3]. While embedded value reporting is not considered as regulatory or accounting framework (such as Solvency II and IFRS respectively), its overall purpose is to provide risk-related performance information to the stakeholders, thus belongs to the same disclosure category (Deloitte 2018). Using an international sample of 100 life insurers for the period 2006 to 2016, El-Gazzar et al (2022) find a positive relationship between embedded value disclosure and forecast properties. This suggests that embedded value reporting is beneficial by improving forecast accuracy and reducing the forecast dispersion.

Collectively, prior literature establishes the importance and role of market discipline, which is further enhanced in the presence of risk disclosures. Considering that early evidence on Solvency II information documents beneficial effects in the equity market more widely (Gatzert and Heidinger 2020; Mukhtarov et al 2021), a gap emerges on what the effect of Pillar 3 reporting is on analyst forecast properties.

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[2] Anolli, Beccalli and Molyneux (2014) examine the analyst forecast accuracy for the banking context in the light of the financial crisis. Using 411 European banks from 2003 to 2009, it is indicated that, during the global financial crisis, analysts' forecast abilities significantly deteriorate in the presence of risk, though before crisis seems to be insignificant (Anolli et al 2014). Considering that analyst use risk-related information, questions arose around the effective implementation of the market discipline process (Anolli et al 2014). Niessen-Ruenzi et al. (2015) examined the effect of Pillar 3 disclosures on equity analyst research. For a sample of 8 listed Australian banks and a period starting from 2004 to 2012, evidence illustrate a positive direction on recommendation as well as forecast informativeness and accuracy after pillar 3 disclosures, confirming the relevance of information and enhanced market discipline.

[3] Embedded value reporting (with the latest scheme being the "Market Consistent Embedded Value" (MCEV) is a voluntary reporting scheme designed by the European Insurance CFO Forum ("CFO Forum") and its purpose is to provide insurer-specific value and performance reporting.

### 2.3 Motivation and research questions

Analysts' informational needs in the insurance sector substantially differ from industrial or other financial firms (e.g. banks). Since insurers cover and spread risk as part of their business purpose, the inherent risk and uncertainty linked with the inversion of production cycle[4] makes imperative the consideration of risk in their information processing (Nissim 2013; Malafronte et al 2016). Further, insurers' ability to conduct business and generate premiums is linked with the level of regulatory capital and solvency metrics, as potential regulatory breaches could lead to cease of business (Nissim 2013). Thus, the analyst interest on risk-related disclosures and relevant value drivers is pertinent. However, the *"traditional"* performance and book value metrics do not reflect the economic profits and risks (Goldman Sachs 2018). Also, the recent developments in IFRS (forthcoming IFRS 17 Insurance Contracts), alignment of market consistent embedded value reporting (MCEV) with Solvency II (CFO Forum 2016) and decline of MCEV reporting (PRA 2017) position Solvency II disclosures among analysts' main sources of information, as there is prescription of methodologies along with uniformity in disclosures (PriceWaterhouseCoopers 2015).

From a broad perspective, the uniform adoption of regulation and standards, might drive to information cost reduction relevant to acquisition and processing, as in the case of mandatory implementation of IFRS in the EU for example (Tan, Wang and Welker 2011; Houqe, Easton and van Zijl 2014). This could motivate the beneficial effects of Solvency II implementation. Analysts express significant interest around firms' dividend capacity, reserves as well as capital generation, quality and adequacy (Crean and Foroughi 2017; Mercer/Guy Carpenter 2017; KPMG 2019). These areas of interest became pertinent even before Solvency II implementation as they are closely linked with Solvency II figures (Crean and Foroughi 2017; Mukhtarov et al 2021). From a theoretical perspective, dividend payout has a substantial role in firm valuation while, from a practical perspective, it is closely linked with the amount of economic capital generated during the year, both depending on the Solvency II ratio and requirements (Honour 2016; Crean and Foroughi 2017; KPMG 2019; Mukhtarov et al 2021). Finally, Solvency II regulation might have an impact on insurers' investment allocation (Mukhtarov et al 2021). For example, long-term investments might be linked with higher

[4] When an insurer underwrites an insurance contract, the outcome/liability is not known ex ante (IAIS 2002; Lorent 2008; Nissim 2013; Malafronte et al 2016). Known as "inversion of the production cycle" (Lorent 2008; Malafronte et al 2016), the difference between the initiation of insurance contract and the actual claim settlement can be from a couple of days to many years (Lorent 2008).

capital requirements, resulting in change in investment allocation policy, which is closely linked with insurers' potential for profitability.

Significant concerns have been expressed, though, over Solvency II disclosures. SFCR report is a mixture of quantitative reporting templates (QRT; tabulated, risk-based information) and narrative explanation. While there is evidence that reporting tables are important for analyst and investors, the narrative part holding the largest part of the report is largely boilerplate and of little assistance the stakeholders (Gatzert and Heidinger 2020; Insurance Europe 2021a, 2021b). Deriving from developments in the banking sector, it was also argued that, while additional disclosures might be disseminated in the market, it is ambiguous whether additional information will be properly used by analysts (Baumann and Nier 2004). Moreover, there are divergent audit practices: For some countries, partial audit is mandatory (e.g. audit of balance sheet, UK) while for other it is based on the voluntary initiative of firms. While audit of SFCR report is an additional cost that piles up to the already burdensome cost of Solvency II reporting (Insurance Europe 2021a, 2021b), deviation of audit practices for SFCR reporting might impede the reliability and quality of the relevant disclosures, which are cornerstones for successful market discipline (Accountancy Europe 2020). Finally, in a well-regulated setting like Basel Accord or Solvency II, compliance could take the form of *"compliance in form"* providing only the necessary/prescribed disclosures or "compliance in substance" where firms provide high quality and relevant risk-specific information that can be effectively used by stakeholders (Bischof et al. 2022).

Collectively, the effect of Solvency II implementation on analysts' forecast properties is unexplored and the effect could be positive or negative. Against this backdrop, we examine the following research questions in this study:

- **RQ1:** Do Solvency II implementation and disclosures improve analysts' forecast properties?
- **RQ2:** Do individual analyst earnings forecasts become more accurate for analysts covering EEA insurers, after Solvency II implementation?

## 3. Research Design

### *3.1 Sample selection process*

The sample initially focused on all publicly listed insurance undertakings incorporated in the 28 European Union member states at the time of the Solvency II implementation.[5] Further, insurance firms from Norway, Liechtenstein, and Iceland were also added because these countries elected to conform with Solvency II regulation as members of the EEA[6]. It is noted that Switzerland is part of the European Free Trade Area (EFTA) and participates in the EU single market. However, it uses its own solvency assessment, called Swiss Solvency Test (SST). While there are many similarities with Solvency II in terms of solvency metrics and underlined prudential philosophy, there are also significant differences that impair the ability for immediate comparison with Solvency II on one-by-one basis[7]. Therefore, Switzerland is excluded from the analysis.

Datastream Worldscope lists are used from Thomson Reuters Datastream database. The lists are constructed on a country basis, constituted by all publicly listed firms, both active and delisted (dead) firms, ensuring elimination of survivorship bias. The industry status of EEA insurers is identified based on the Standard Industry Classification (SIC). To alleviate any potential concerns of omitting firms that have insurance as a secondary activity and comply with Solvency II regulation, both SIC Codes 1 (WC07021) and 2 (WC07022) are used[8] yielding an initial sample of 88 insurance undertakings. Following that, firms without an S&P Market Intelligence Identifier or relevant data (17 firms) are eliminated. Finally, firms without an I/B/E/S ticker in Datastream or lack of relevant data in I/B/E/S databases are excluded, as these firms represent insurance undertakings without any analyst coverage during the sample period (14 firms). Therefore, the initial sample selection yields a sample of 57 insurance undertakings. This sample selection process is illustrated in Table 1.

**[Table 1 around here]**

[5] The sample period ends on December 2018. As such, UK insurance firms had to comply with Solvency II for all the period under examination.

[6] Directives 2009/138/EC and 2015/35/EC were published with EEA relevance.

[7] Discussions for the SST framework were initiated in 2003, introduced in 2006 with a 5-year transitional period and 2008/44 is the relevant Circular before the reform (Eling, Gatzert, and Schmeiser 2008; KPMG 2016; Severinson and Yermo 2012; Swiss Re 2016; The Geneva Association 2016). Circular 2017/3 was published as a revision of 2008/44 to amend certain aspects of SST framework (FINMA 2016; KPMG 2016). While SST framework received equivalence for Solvency II purposes, there are significant differences. Risk measurement under SST is conducted with a 99% shortfall measure (tail VaR) that yields greater requirements, transitional measures are estimated differently, both of which have impact on the central solvency metric (Swiss Re 2016). Also, Swiss-located insurance undertakings publish their own Pillar 3 report in slightly different format and from different point in time (SST report published from 2017 and onwards).

[8] SIC classification of insurance activities include the codes between 6300 and 6399.

The sample of individual analysts' earnings forecasts comprises the one-year ahead earnings forecasts, referring to the period 2013 to 2018, and included an initial sample of 17,602 individual analyst forecasts. The one-year ahead earnings forecasts are selected because: (i) they are more commonly produced by analysts (compared with forecasts for longer horizons, e.g., 2, 3, 4 and 5 year ahead forecasts), and (ii) the measurement of forecast accuracy is better aligned with contemporaneous information available to analysts. Forecasts provided by group of analysts are eliminated as well as earnings forecasts provided 360 days before the forecasted fiscal year end or after the fiscal year to exclude potentially stall forecasts (-2,718), leaving the sample with 14,884 observations. In general, analysts can provide more than one analyst earnings forecast during the year, as their projections for the firm might change. Following prior literature (e.g. Byard, Li, and Yu 2011), and for modelling purposes, only the last earnings forecast (the one closer to the fiscal year end) is retained, yielding a sample of 4,439 observations. For the dependent variable estimation, actual earnings per share should be available, thus, 82 analyst/firm/year observations with missing actual EPS are excluded, bringing the sample to 4,357 forecasts. Following Bae, Tan and Welker (2008), 78 analyst/firm/year observations for firms that are covered by fewer than 3 analysts per fiscal year or with missing dispersion data are dropped. This is to ensure the reliability of the earnings forecast error and dispersion measures. Further, 155 analyst/firm/year observations are deleted for firms with unavailable financial, solvency and country metrics. Finally, 182 analyst/firm/year observations for firms that do not have available firm data pre and post Solvency II are dropped and so are 1,490 analyst/firm/year observations for analysts that did not actively provide forecasts pre and post Solvency II[9]. By doing so, it is ensured that relevant inferences obtained are not driven by firm sample changes or analysts that stopped covering firms post Solvency II (e.g. laid off analysts; Byard et al 2011; Horton, Serafeim and Serafeim 2013; Li and Zhang 2020; Tan et al 2011)[10]. The final sample consists of 39 EEA insurance undertakings and 2,452 analyst/firm/year observations, representing 68.42% of EEA listed insurers with available earnings forecasts during the sample period. For modelling purposes,

[9] Because of the time difference between Solvency II adoption (1st of January 2016) and disclosure of the first SFCR report during 2017, the firm and analyst matching for the two periods is conducted by considering firms and analysts that are active during the periods 2013-2015 and 2017-2018. This alleviates concerns that analysts might have been active till 2016 but not providing earnings forecasts during 2017, when the SFCR report becomes available.

[10] In the excluded sample, 2 Bermuda firms are also included. While both firms are listed in the London Stock Exchange (LSE), they provide SFCR report only for the UK subsidiaries and not at the consolidated firm level for the entire period after Solvency II. At group level, firms provide the relevant report following the Bermuda regulation, called Financial Condition Report. To alleviate potential concerns of comparability between EEA and Bermuda firms, they are excluded from the analysis.

US insurance undertakings are included as a control sample for DiD analysis, following the same sample selection process as was described for EEA sample. US insurers' public reporting remained unchanged throughout the period examined; thus it is considered appropriate for the purpose of the current study.

**[Table 2 around here]**

### *3.2 Testing for analysts' forecast properties and individual analyst forecast error*

The central forecasted metric used to accommodate the research purpose of the study is the EPS forecast. While sell-side analysts provide a variety of firm-specific outcomes such as EPS, other financial ratio forecasts, target stock prices and recommendations, the current study focuses on EPS forecasts for the following reasons: Firstly, it is considered as the primary performance metric that stakeholders give greater weighing (Anolli et al 2014). From a regulatory perspective, while Solvency II ratio's primary function is to illustrate insurer's capital adequacy, the managerial activities to accommodate these regulatory needs have a direct impact on firm's performance, book value, dividend capacity and cash remittances (Crean and Foroughi 2017; Mercer/Guy Carpenter 2017; KPMG 2019). Thus, it provides significant motivation to examine the impact of Solvency II disclosures on analysts' ability to provide more accurate earnings forecasts.

In substance, the modelling implemented here follows key studies in the accounting and finance literature which examine changes in analysts' properties following the implementation/introduction of new reporting regulations (e.g., Tan et al 2011; Horton et al 2013; Li and Zhang 2020). Informed by these, to test RQ1, OLS regression on the unbalanced panel of firm/year observations is conducted. Solvency II implementation date is on 1st of January 2016, meaning that firms with fiscal year end during the calendar year 2016 should disclose the SFCR after the fiscal year end (FY2016), thus analysts will have available information for forecasting during the next financial period (CY2017). As a result, SII_2017 is a time variable which is equal to one for firm/year observations starting after the adoption of Solvency II. For example, for a firm with FY end 31/12/2016, SII_2017 equals to one for the next reporting period (i.e. 31/12/2017) and zero otherwise. With this specification, it is ensured that analysts will have the available Solvency II information from the FY2016 report during EPS forecasting of FY2017 and FY2018. Solvency II implementation and Pillar 3 disclosures along with analysts' potential use of SFCR related information is presented in the figure 1 below.

**[Figure 1 around here]**

However, there is an argument around whether the results are attributed to Solvency II implementation or potential confounding effects. For this reason, the study follows a DiD approach and include a firm-specific variable, EEA_SAMPLE, which is equal to one for firms located in the EEA, zero otherwise. For modelling purposes, and methodologically in line with Daske et al. (2013) and Horton et al (2013), US insurance undertakings are included as a control sample to control for potential confounding effects. Following prior literature (Bae et al 2008; Bae et al 2008; Tan et al 2011; Horton et al 2013; Anolli et al 2014; Gaganis, Liu and Pasiouras 2015; Duru et al 2020; El-Gazzar et al 2022**),** the models incorporate analyst and broker-specific characteristics, firm-specific characteristics, as well as country-specific variables. The models used are expressed as follows:

$$AFE\_MEAN_{it}=a_0+a_1SII\_2017_{it}+a_2EEA\_SAMPLE_{it}+a_3SII\_2017*EEA\_SAMPLE_{it} +a_4FOL\_DUMMY_{it}+a_5EVR_{it}+a_6BTM_{it-1}+a_7LEVERAGE_{it-1}+a_8LN\_MVE_{it-1}+a_9ROA_{it-1} +a_{10}VOLATILITY_{it-1}+a_{11}STRAT\_OWN_{it-1}+a_{12}RETURNS_{it-1}+a_{13}ST\_TURN_{it-1}+a_{14}SIFI_{it} +a_{15}SPOWER_{it}+a_{16}INST\_DEV_{it}+a_{17}INSUR\_PEN_{it}$$

*(Equation 1)*

$$DISPERSION_{it}=a_0+a_1SII\_2017_{it}+a_2EEA\_SAMPLE_{it}+a_3SII\_2017*EEA\_SAMPLE_{it} +a_4FOL\_DUMMY_{it}+a_5EVR_{it}+a_6BTM_{it-1}+a_7LEVERAGE_{it-1}+a_8LN\_MVE_{it-1}+a_9ROA_{it-1} +a_{10}VOLATILITY_{it-1}+a_{11}STRAT\_OWN_{it-1}+a_{12}RETURNS_{it-1}+a_{13}ST\_TURN_{it-1}+a_{14}SIFI_{it} +a_{15}SPOWER_{it}+a_{16}INST\_DEV_{it}+a_{17}INSUR\_PEN_{it}$$

*(Equation 2)*

$$FOLLOWING_{it}=a_0+a_1SII\_2017_{it}+a_2EEA\_SAMPLE_{it}+a_3SII\_2017*EEA\_SAMPLE_{it} +a_4FOL\_DUMMY_{it}+a_5EVR_{it}+a_6BTM_{it-1}+a_7LEVERAGE_{it-1}+a_8LN\_MVE_{it-1}+a_9ROA_{it-1} +a_{10}VOLATILITY_{it-1}+a_{11}STRAT\_OWN_{it-1}+a_{12}RETURNS_{it-1}+a_{13}ST\_TURN_{it-1}+a_{14}SIFI_{it} +a_{15}SPOWER_{it}+a_{16}INST\_DEV_{it}+a_{17}INSUR\_PEN_{it}$$

*(Equation 3)*

Consensus metrics used for the estimation of dependent variables are based on I/B/E/S Summary file data[11]. $AFE\_MEAN_{it}$ is the absolute difference between the consensus earnings forecast and the actual EPS, deflated by the stock price at the beginning of the year, $DISPERSION_{it}$ is the standard deviation of analysts' EPS forecasts while $FOLLOWING_{it}$ is the number of analysts following a firm.

[11] Taking as an example Kaplan, Martin, and Xie (2021), the self-construction of consensus metrics from the detail file does not yield the same results with the readily available consensus metrics. While I/B/E/S provides a coding approximation for replication of the summary data and incorporates the excluded and stopped estimates (Kaplan et al 2021; Shvorob 2006), it does not provide the necessary documentation on how the consensus metrics available through Summary File are constructed (Shvorob 2006). In addition, some analysts (e.g. Goldman Sachs) might provide forecast for consensus metrics rather than the detail file (Kaplan et al 2021). To better reflect the forecast properties, the I/B/E/S Summary File data is preferred for the purpose of the current analysis.

For RQ2, a similar specification with equation 1 is followed, using individual analysts' forecast error ($AFE_{ijt}$) as dependent variable, defined as the absolute difference between the actual and forecasted EPS, deflated by the stock price at the beginning of the year (Bae et al 2008; Byard et al 2011; Tan et al 2011). By using individual analyst forecast error in the specific research design, and in contrast with the consensus EPS forecast metric, it allows for analyst and broker specific controls, alleviate concerns related to unobservable analyst behaviour (e.g. laid-off analysts) and, potentially, better assessment of forecast error due to detailed sample (for the potential of better assessment, see Li and Zhang 2020). A second metric used in the study is the analyst forecast bias, which is estimated as the signed (non-absolute) difference between actual and forecasted EPS deflated by the stock price at the beginning of the year (formulation similar with Anolli et al 2014). A positive value indicates analyst optimism while negative values are related to analyst pessimism, compared with the actual EPS. Following prior literature (Clement 1999; Bae et al 2008; Bae et al 2008; Tan et al 2011; Horton et al 2013; Anolli et al 2014; Gaganis et al.. 2015; Duru et al 2020; El-Gazzar et al 2022)**,** the models incorporate analyst and broker-specific characteristics, firm-specific characteristics, as well as country-specific variables. The models specified as follows:

$$\begin{aligned}AFE_{ijt}=&a_0+a_1SII\_2017_{it}+a_2EEA\_SAMPLE_{it}+a_3SII\_2017*EEA\_SAMPLE_{it}\\&+a_4GEXP_{ijt}+a_5FEXP_{ijt}+a_6NCOS_{ijt}+a_7DTOP10_{ijt}+a_8HORIZON_{ijt}+a_9FOL\_DUMMY_{it}\\&+a_{10}EVR_{it}+a_{11}BTM_{it-1}+a_{12}LEVERAGE_{it-1}+a_{13}LN\_MVE_{it-1}+a_{14}ROA_{it-1}+a_{15}VOLATILITY_{it-1}\\&+a_{16}STRAT\_OWN_{it-1}+a_{17}RETURNS_{it-1}+a_{18}ST\_TURN_{it-1}+a_{19}SIFI_{it}+a_{20}SPOWER_{it}\\&+a_{21}INST\_DEV_{it}+a_{22}INSUR\_PEN_{it}\end{aligned}$$

*(Equation 4)*

$$\begin{aligned}FE_{ijt}=&a_0+a_1SII\_2017_{it}+a_2EEA\_SAMPLE_{it}+a_3SII\_2017*EEA\_SAMPLE_{it}\\&+a_4GEXP_{ijt}+a_5FEXP_{ijt}+a_6NCOS_{ijt}+a_7DTOP10_{ijt}+a_8HORIZON_{ijt}+a_9FOL\_DUMMY_{it}\\&+a_{10}EVR_{it}+a_{11}BTM_{it-1}+a_{12}LEVERAGE_{it-1}+a_{13}LN\_MVE_{it-1}+a_{14}ROA_{it-1}+a_{15}VOLATILITY_{it-1}\\&+a_{16}STRAT\_OWN_{it-1}+a_{17}RETURNS_{it-1}+a_{18}ST\_TURN_{it-1}+a_{19}SIFI_{it}+a_{20}SPOWER_{it}\\&+a_{21}INST\_DEV_{it}+a_{22}INSUR\_PEN_{it}\end{aligned}$$

*(Equation 5)*

Detailed definition of all the variables is provided in Appendix 1.

## 4. Empirical analysis

### *4.1 Descriptive statistics*

Table 3 (Panel A) presents the geographic location of the sample firms. The majority of observations from the EEA sample relate to UK listed insurance undertakings with 66 firm/year and 777 analyst/firm/year observations, followed by German (27/461), Italian (23/205) and

French (22/250) firm/year and analyst/firm/year observations respectively. This distribution is broadly in line with Mukhtarov et al (2021). Comparing the treated (EEA) with the control sample (US), the EEA sample is smaller than the US sample (2,452 observations and 39 firms for EEA vs. 2,704 observations and 57 firms for US). The treated sample could be considered in line with those in Gatzert et al (2020) and Mukhtarov et al (2021) who also examine the Solvency II effect more broadly. In the current study, though, the number of firms under examination is smaller because of the different study scope and exclusion of firms with missing earnings forecasts data which are not consider in prior literature.

Table 3 (Panel B) provides the sample decomposition based on insurers' line of business (LOB) per region. While a relative consensus exists for life and health, and reinsurance among EEA and the US sample, EEA insurers are more concentrated on multiline LOB while US insurers on property and casualty LOB, showing that there are regional differences in terms of customers' demand for insurance coverage. To alleviate any concerns arising from this imbalance, sub-industry fixed effects are incorporated in the regression analysis.

**[Table 3 around here]**

Focusing first on the dependent variables, a DiD univariate analysis is employed. Following Daske et al (2008, p. 1105) *"this is a simple way to account for unobserved differences between treatment and control firms and to adjust observed changes for the treatment firms by concurrent changes that are also experienced by the control firms"*. Table 4 illustrates the mean values of the dependent variable along with the differences between the two samples and the two sample periods. Analysts covering EEA insurers face a decrease of -0.183 in the analyst forecast error (AFE [t]), providing some preliminary and significant at 1% evidence on the Solvency II adoption impact. For the control sample, there is an increase of 0.265 in the analyst forecast error, significant at 1%. The difference between the changes per sample is equal with -0.488 and significant at 1%, providing some preliminary evidence that analysts covering EEA insurers enjoy lower forecast error compared with the control sample in the post-Solvency II period. In terms of FE [t], EEA sample mean decreases by -0.025, providing some preliminary evidence of pessimism in the earnings forecast after Solvency II adoption, though insignificant. The control sample presents an increase of 0.329 ($p<0.01$) in the forecast bias while the difference between these two is negative at -0.354 ($p<0.01$) showing that analysts covering EEA insurers are more pessimistic after the Solvency II adoption. For the firm level analysis, the same pattern exists for the AFE_MEAN [t]. While the decrease in the forecast error (-0.232) is not significant, the comparative effect indicates that EEA insurers have lower forecast error compared with US insurers after Solvency II adoption (-0.622, p<0.01). The same holds for DISPERSION [t], though none of the differences presents statistical significance. For FOLLOWING [t], a negative trend is presented in both samples, higher for the EEA insurers. However, the difference between the changes is not significant. Overall, the univariate difference-in-difference analysis provides some preliminary evidence of improvement in the forecast properties of analysts covering EEA insurers, though not statistically significant in all formulations. By design, though, univariate analysis cannot provide conclusive evidence on the stated research questions, hence they are further explored with multivariate analysis in the following sections.

**[Table 4 around here]**

Table 5 present the descriptive statistics for the sample, decomposed into control and treated sample, followed by the mean and median differences as well as differences in terms of Solvency II adoption. In relation to AFE [t], FE [t], AFE_MEAN [t] and DISPERSION [t], there are differences between the mean and median, indicating some skewness in the sample. For analyst experience indicators, the mean values of FEXP [t], GEXP [t] and NCOS [t] are higher for the control sample (p<0.01), while analyst following (FOLLOWING [t]) is higher for EEA firms. This indicates that EEA insurers have greater following by analysts, though relatively inexperienced compared with firms in the control sample. In terms of firm level characteristics, EEA firms present lower leverage, higher market value, lower profitability, higher volatility and lower stock turnover (all mean and median differences significant at 1%). Finally, in terms of country-specific variables, EEA sample presents higher levels of INST_DEV [t] (average of the six factors: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption) and lower levels of insurance penetration (INSUR_PEN [t]). This illustrates differences between the two markets, with the EEA market presenting (on average) higher levels of the institutional development factors while insurance penetration underlines the greater weight given on insurance in US.

**[Table 5 around here]**

Looking at the decomposition of the control and treated sample into pre and post Solvency II reporting in table 6, the skewness findings for the dependent variables remain largely the same. In terms of experience indicators, firm experience declines (FEXP [t], p<0.01) while the number of firms that analysts cover increases (NCOS [t], p<0.01), for both control and treated samples after Solvency II implementation. Regarding the firm-specific characteristics of the treated sample, the mean and median differences of RETURNS $[t-1]$ declines after

Solvency II implementation (p<0.01) while the INSUR_PEN [t] increases (p<0.05). The remaining of the control variables do not present significant mean or median increase/decrease. This provides some early evidence that the regression inferences for the treated sample are not driven by significant changes in the data underlying the control variables. For the control sample, BTM [t-1] decreases after Solvency II (p<0.01) while LN_MVE [t-1] and LEVERAGE [t-1] increases, though the significance levels are weak in mean comparison (p<0.1). Both institutional development (INST_DEV [t], p<0.01) and insurance penetration (INSUR_PEN [t], p<0.01) increase, showing that country factors have been slightly improved. The rest of the variables do not present statistical significance, or the evidence are weak. This provides some early indications that the regression inferences for the US sample are not driven by changes in the control variables.

**[Table 6 around here]**

Finally, in results not disclosed here, the Spearman and Pearson correlations among variables was examined. There are mixed results for the correlation between SII_2017 [t] and AFE [t] (0.014 & -0.016), though insignificant. EEA_SAMPLE [t] and AFE [t] have a positive and significant association (0.164 & 0.276), confirming the descriptive statistics on the higher levels of forecast error for EEA insurers compared with control sample. For the remaining of the relations, high correlations also exist between FOL_DUMMY [t] and LN_MVE [t-1] (0.579 & 0.561). This is expected as larger firms are usually followed by more analysts. High negative correlation also exists between ST_TURN [t-1], SPOWER [t] and INSUR_PEN [t] on the one hand compared with EEA_SAMPLE [t] on the other. The high levels of correlation are linked with the descriptive statistics analysed above. The EEA insurance firms are those who present lower levels of ST_TURN [t-1], SPOWER [t] and INSUR_PEN [t]. For relationships with relatively high correlation figures, multicollinearity test is also conducted at regression level to alleviate any concerns. In all models, the mean VIF value is well below the accepted threshold of 10 (Gujarati, 2003, p. 262), thus multicollinearity is unlikely to be of concern.

### *4.2 Regression results*

#### *4.2.1 Impact of Solvency II implementation on analyst forecast properties*

Table 7 reports the baseline regression results for RQ1 which tests whether Solvency II implementation results in improved analysts' forecast properties by using three different proxies, namely absolute forecast error (columns 1-3), forecast dispersion (columns 4-6) and analyst following (column 7-9). AFE [t] and DISPERSION [t] models utilise an OLS specification (e.g. Horton et al 2013) while FOLLOWING [t] model utilizes a negative binomial model in accordance with Tan et al (2011). All specifications include sub-insurance industry fixed effects, clustered at firm level.

**[Table 7 around here]**

In column 3, SII_2017 [t] coefficient is 0.639 (p<0.01), indicating higher forecast error for control sample in the post-Solvency II period. EEA_SAMPLE [t] also reports a positive coefficient (1.382, p<0.01), indicating that analysts covering EEA insurance undertakings face higher forecast errors compared with the control sample in the pre-Solvency II period. After Solvency II adoption, the increase in the forecast error levels of EEA insurers is eliminated, as the interaction term coefficient SII_2017*EEA_SAMPLE is negative and significant (-0.993, p<0.01). However, the overall effect, i.e. the sum of SII_2017 [t] and EEA_SAMPLE*SII_2017 [t] is insignificant (p=0.130), impairing the ability to conclude that forecast error decreases for analysts covering the EEA insurers. In line with Tan et al (2011), a marginal effect analysis is also conducted. *Pre-Solvency II predicted value* represents the predicted value of the dependent variable for EEA (US) insurers when SII_2017 [t]=0 and control variables are constant to mean values of EEA (US) insurers. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EEA (US) insurers. The pre-Solvency II predicted value is 1.78 for the EEA sample while, for the US sample is 0.397. The marginal effect for the EEA insurers is -0.354, indicating that, during the Solvency II transition, forecast error decreased by 19.89% (-0.354/1.78) while the same figure for the US Sample is equal with a positive figure of 160.96% (0.639/0.397). However, the marginal effect for the EEA insurers is insignificant and, also considering the insignificant sum of coefficients from the interaction, the decrease in the forecast error cannot be confirmed.

Column 6 examines the effect of Solvency II adoption for EEA insurers on dispersion. The SII_2017 coefficient is 0.079, providing insignificant evidence that dispersion increases for control sample in the post-Solvency II period. EEA_SAMPLE coefficient is also positive (0.944, p<0.01), showing higher dispersion of earnings forecasts provided for EEA insurers in the pre-Solvency II period. After Solvency II adoption, the increased dispersion levels for EEA insurers are reversed, as the coefficient of the interaction term SII_2017*EEA_SAMPLE is negative and significant (-0.278, p<0.01) while the sum of the coefficients SII_2017 [t] and SII_2017 [t] * EEA_SAMPLE [t] is also significant (p<0.05), confirming the beneficial effect of Solvency II implementation for analysts covering EEA insurers on earnings forecast dispersion. To further examine the effect, marginal effect analysis is also conducted. The pre-Solvency II predicted value for EEA insurers is equal with 1.168 while for the US insurers is 0.223. The marginal effect for the EEA insurers is equal with -0.199 and significant at 5%, confirming that, for the EEA insurers, forecast dispersion reduces by 17.04% (-0.199/1.168) while for the US insurers increases by 35.43%. Overall, the results and postestimation tests provide conclusive evidence on the beneficial effect of Solvency II adoption for the analysts covering EEA insurers on dispersion.

Finally, column 9 examines the effect of Solvency II adoption for EEA insurers on analyst following using a negative binomial regression (Tan et al 2011). The SII_2017 coefficient is -0.285 ($p<0.01$), providing evidence that following decreases for control sample in the post-Solvency II period. EEA_SAMPLE coefficient is positive (0.397, $p<0.01$), showing higher following for EEA insurers in the pre-Solvency II period. After Solvency II adoption, there is a relative increase in the analyst following of EEA insurers, as the coefficient of the interaction term SII_2017*EEA_SAMPLE is positive and significant (0.098, $p<0.05$), while the sum of the coefficients SII_2017 [t] and SII_2017 [t] * EEA_SAMPLE [t] is also significant ($p<0.01$). This confirms the beneficial effect of Solvency II adoption for EEA insurers on analyst following. However, caution is needed in the interpretation of the findings, as illustrated both from the regression and the postestimation tests. In detail, the pre-Solvency II predicted value for the EEA insurers is equal with 16.07 while the marginal effect illustrates a decrease in analyst following by 17.05% (-2.74/16.07). On the other hand, the pre-Solvency II predicted value for the US sample is 10.8 while the marginal effect illustrates a decrease of 24.82% (-2.681/10.8). Thus, the improvement in analyst following is relative to the control sample, as both samples present a decrease in analyst following, though lower for EEA insurers.

In terms of control variables, and broadly in line with prior literature (e.g. Horton et al 2013; Tan et al 2011), significant is the impact of analyst following on AFE [t] and DISPERSION[t] as following above the median is associated with lower levels of forecast error and dispersion. In these two models, there is positive association of the dependent variables with BTM[t-1] while, for AFE [t] model, positive is also the coefficient of STRAT_OWN[t-1], ST_TURN[t-1] and INSUR_PEN[t-1], showing that forecast error increases with higher book-to-market values, institutional ownership, stock turnover and insurance penetration in the market. On contrary, forecast error is reduced in the presence of higher returns (RETURNS[t-1]). For FOLLOWING [t] regression, higher following is associated with lower book-to-market values, higher firm capitalisation, volatility, stock turnover and institutional development.

Overall, the results provide some evidence of improvement in analysts' forecast properties after Solvency II implementation and disclosures, though not strong in all specifications. Empirical findings confirm the improvement in the forecast properties through DISPERSION [t], being lower in the SII_2017 [t] period, though the results are not confirmed for the AFE [t] as well. Contrary, findings related with FOLLOWING [t] shows a decline in following in the SII_2017 [t] period for the EEA sample. However, the effect is stronger for the control sample compared with the EEA Sample. Thus, the relatively better results for the EEA sample which could be partly attributed to Solvency II adoption.

### *4.2.2 Impact of Solvency II implementation on individual analysts' forecast error*

Table 8 reports the regression results on the individual analyst forecast error for analysts covering EEA insurers due to Solvency II implementation. Column 3 provides the baseline OLS regression results, using sub-industry fixed effects and clustering at analyst level.

**[Table 8 around here]**

The coefficient of SII_2017 is 0.514 ($p<0.01$), indicating higher forecast error for analysts covering the control sample in the post-Solvency II period. EEA_SAMPLE coefficient is also positive (1.429, $p<0.01$), showing that analysts covering EEA insurance undertakings face higher forecast errors compared with the control sample in the pre-Solvency II period. After Solvency II adoption, the increase in the forecast error levels is reversed, as the coefficient of the interaction term SII_2017*EEA_SAMPLE is negative and significant (-0.835, $p<0.01$). The negative coefficient along with the statistical significance of the sum SII_2017 [t] and SII_2017*EEA_SAMPLE indicates that, after Solvency II adoption, analysts covering EEA insurers enjoy a decrease in the forecast error. In terms of marginal effect analysis, the pre-Solvency II predicted value is 1.725 for the EEA sample while, for the US sample is 0.296. The marginal effect for the EEA insurers is -0.321 and significant at 1%, indicating that, during the Solvency II transition, forecast error decreased by 18.61% (-0.321/1.725) while the same figure for the US Sample is equal with a positive figure of 173.64% (0.514/0.296).

In terms of control variables, HORIZON [t] coefficient is positive (0.001, $p<0.05$) indicating that forecasts provided closer to the fiscal year end are more accurate while the negative coefficient of FOL_DUMMY [t] (-0.440, $p<0.01$) illustrates that analysts covering firms with following above the median face lower forecast errors. The EVR [t] coefficient is negative (-0.195, $p<0.10$) providing some weak evidence that analysts provide more accurate forecasts for firms that provide (or used to provide) embedded value report, which could be attributed to firm's continuous efforts for transparency (see the discussion in papers of Hail 2011; Serafeim 2011). Negative coefficients are generated for LN_MVE [t-1] (-0.164, p<0.01) and RETURNS [t-1] (-0.007, p<0.01), showing that analysts covering large firms with high stock returns enjoy more accurate forecasts. On the contrary, positive coefficients exists for BTM [t-1] (1.294, p<0.01), ST_TURN [t-1] (0.268, p<0.01) and SIFI [t] (0.334, p<0.01), indicating lower analyst ability to provide accurate earnings forecasts for insurers with high book-to-market ratio, stock turnover or firms classified (or used to be classified) as Systematically Important Financial Institutions. In terms of country specific variables, evidence suggests increase in forecast error for analysts covering insurers with high supervisory power (0.141, p<0.10), high levels of institutional development (0.296, p<0.05) and insurance penetration in the market (0.068,p<0.01).

To further examine the above-mentioned relationship, some additional sensitivity tests are conducted. First, the UK domiciled insurers are excluded as they represent the largest EEA subsample, and the relationships along with the postestimation tests remain largely unchanged. Second, 2016 is excluded as it was the year of Solvency II adoption, but EEA insurers were not mandated to provide solvency disclosures, and the results along with postestimation are unchanged. Third, a comparative analysis between 2015 and 2016 (column 6), and 2016 and 2017 (column 7) is conducted to closely examine the effects of Solvency II implementation and 1st year of Solvency II disclosures respectively. In the first regression specification, the coefficient of the interaction term SII_2017*EEA_SAMPLE is positive but insignificant, the overall effect as illustrated by the sum of coefficient SII_2017 and SII_2017*EEA_SAMPLE is insignificant and the same holds for the marginal effect, showing that the Solvency II adoption itself does not provide any beneficial effect on analyst forecasts. In the second specification (FY2016 vs FY2017) the results are largely in alignment with the baseline regression, showing that, during the first year of Solvency II disclosures (SFCR report) analyst present significant reduction of EPS forecast error.

Finally, forecast bias (optimism/pessimism) is examined as an additional dimension to the factors affecting the analysts' forecast assessment. SII_2017 coefficient is positive (0.340) and statistically significant at 1%, indicating higher optimism for control sample in the post-Solvency II period. The same holds for EEA_SAMPLE (0.627, p<0.1) indicating that analysts are more optimistic when they provide earnings forecast for EEA insurers compared with the control sample in the pre-Solvency II period. However, the higher analyst optimism is reversed after Solvency II as the coefficient of interaction term SII_2017*EEA_SAMPLE turns negative (-0.548, p<0.01). Taken together, there is conclusive evidence that analysts became more pessimistic for the EEA firms compared with the control sample. The same post estimation tests are conducted. The pre-Solvency II predicted value the EEA sample is 0.307 while the marginal effect illustrates that, after the Solvency II transition, the analyst bias decreased by 67.43% (-0.207/0.307), i.e., became pessimistic. For the control sample, the pre-Solvency II predicted value is equal with -0.32, showing that analysts are pessimistic. After the Solvency II transition, US firms present an increase in analysts' optimism by 106.25% (0.34/-0.32) while the movement of the overall numbers illustrate analyst optimism.

Overall, evidence suggests that individual analyst earnings forecasts became more accurate for analysts covering EEA insurers after Solvency II implementation. Results indicate that analysts are benefitted in terms of information provided after the Solvency II implementation, illustrated by the lower levels of absolute earnings forecast error. The results are robust in several different specifications, while the forecast bias analysis illustrates that analysts became more conservative and pessimistic when providing earnings forecasts after Solvency II disclosures, in light of the new information available.

### *4.3 Additional tests*

Two additional tests are performed to explore potential other channels on which improvement of analyst forecast error might be attributed to. The tests are motivated from insurers' reporting environment as well as analysts' informational role. The first test explores the relative forecast assessment for analysts covering firms which report (or used to report) the embedded value report. The second examines whether the results are attributed to analyst information or interpretation role.

#### *4.3.1 Embedded Value Adopters*

Considering that embedded value reporters are voluntary disclosers of risk-related, insurance-specific information, an open empirical question is to see whether the introduction of Solvency II disclosures altered analysts' earnings forecast error. Table 9 illustrates the regression results using embedded value adopters (EVR [t]) as variable of interest. EVR [t] is equal to one for insurers providing (or used to provide) embedded value report, zero otherwise.

**[Table 9 around here]**

Columns 1-3 provide the relevant results using EEA sample of insurers (US insurers do not provide embedded value report) and excluding property and casualty firms (as embedded value report is not designed for them). Analysing column 3, it can be observed that none of the interaction terms presents statistical significance. Considering that recent prior literature (El-

Gazzar et al 2022) provides conclusive evidence on the beneficial effect of embedded value reporting on analyst forecast error, the insignificant results presented in Table 9 can be interpreted as successful implementation of Solvency II disclosures that provide value relevant information to analysts covering all EEA insurers which does not create any differences between the two groups (voluntary disclosers and not).

### *4.3.2 Informative vs Interpretative role of analysts*

Analysts' work can be broadly disentangled into information interpretation and information discovery role (Livnat and Zhang 2012). Considering that the above-mentioned analysis is mainly focused on analyst's last earnings forecast before the fiscal year end, these forecasts mainly incorporate the element of information discovery role as the final output is based on a mosaic of relevant information provided through public means during the year as well as some private sources of information. (Livnat and Zhang 2012). However, an open empirical question is whether Solvency II disclosures provide analysts with an information interpretational role close to the SFCR report announcement dates, i.e., using the disclosures close to SFCR announcement date as sources to modify their earnings forecasts.

For this reason, the current test utilises the individual analyst earnings forecasts close to the SFCR reporting date. Table 10 presents the regression results using a different set of analysts' forecasts. For modelling purposes, the cut-off period chosen is after July (rather than the actual SFCR disclosure date) to utilise all the years, including those that analysts do not have SFCR reporting.

Column 1 presents the results for the full sample. While the interaction terms retain the same direction and significance at 1%, the sum of SII_2017 and SII_2017*EEA_SAMPLE as well as the marginal effects are insignificant. However, excluding the FY2015 and FY2016 (column 2), there is weak evidence ($p<0.1$) both for the sum of interaction terms and the marginal effect while the forecast bias regression (column 3) provides insignificant results in the same fields. Overall, the results provide some weak evidence on the information interpretation role, though weak compared to the information discovery role. When the transitional years are excluded, analysts seem to utilize the SFCR reporting as a source to early moderate their earnings forecasts, though not with the same significance as closer to the fiscal year end. However, the results should be interpreted with caution for two reasons. First, the statistical significance is weak ($p<0.1$) thus the inferences cannot be made with the same confidence as before. Most important, though, prior literature (Horton et al 2013) successfully indicated that analyst forecasts made closer to the fiscal year end are more accurate as analysts has more information at hand, thus the reduced effect described before could be attributed to that as well.

**[Table 10 around here]**

### *4.4 Robustness tests*

Two robustness tests are performed to explore potential issues with the tests conducted for RQ1 and RQ2. The first test is running the OLS regression under different time specifications to observe whether the results are time sensitive. The second test performs entropy balancing of the sample to improve the balance of covariates between control and treated group (see Hainmueller and Xu 2013).

#### *4.4.1 Alternative periods*

Prior evidence illustrated that EEA insurers were proactive in providing Solvency II information, voluntarily before Solvency II implementation. Hence a question that arise is whether this improvement on analyst information properties is presented before Solvency II implementation. Thus, it is examined the resilience of results under different time specifications as well as introduce a *"placebo"* effect by removing the last two years where disclosures take place.

Table 11 presents the findings on the analysts' forecast assessment for alternative periods. In column 1, FY2013 and FY2014 are excluded, while in column 2, 2015 and 2016 are excluded. The same analysis is conducted in column 3 when 2017 and 2018 are excluded to examine the effect if the years of mandatory disclosures are excluded. As it can be observed, for columns 1 and 2, the interaction terms remain in the same direction and significant at 1% while the same holds for the sum of SII_2017 and SII_2017*EEA_SAMPLE as well as the marginal effects. In the third column (Solvency II disclosure years are excluded), the interaction term, the two-tailed test and the marginal effects are insignificant.

Overall, the importance of Solvency II disclosures on analyst forecast error is confirmed as, in the presence of disclosures, and under different time specifications, the beneficial effect is evident.

**[Table 12 around here]**

### 4.4.2 *Entropy Balancing*

As an alternative to the RQ1, the study utilizes an entropy balancing approach for sample matching between control and treated sample to alleviate potential covariance differences between the control and treated sample (Bonsall, Holzman, and Miller 2017; Chapman, Miller, and White 2019; Hainmueller and Xu 2013; Hsu and Wang 2021; Quinn 2018). Under this method, each observation is assigned with a weight to ensure that the post balancing data sample presents identical distribution and balanced covariates (Chapman et al 2019). While prior literature extensively utilized propensity score matching (PSM) for sample matching, entropy balancing is preferred as more suitable for the current study for the following reasons. First, under entropy balancing and estimation of weights in each observation, the sample size remains the same while PSM performs logit estimation for the inclusion of matched observations, driving to much lower sample size (Chapman et al 2019). Second, the sample size is small by nature, thus PSM implementation and further reduction of the sample size could lead to biased inferences (Hsu and Wang 2021; Shipman, Swanquist, and Whited 2017).

Table 12 provides the descriptive statistics for entropy balancing, showing convergence of the statistical properties of the variables used for entropy balancing while the standardized differences are equal with zero, confirming the successful implementation of entropy balancing. For the balancing, firm control variables are used, namely BTM [t-1], LEVERAGE [t-1], LN_MVE[t-1], ROA[t-1], VOLATILITY[t-1], STRAT_OWN[t-1] and RETURNS[t-1]. Table 13 provides the regression results after the entropy balancing. As it can be illustrated in column 1, the interaction coefficients and postestimation tests remains statistically insignificant in line with the baseline regression results. In terms of DISPERSION[t] (column 2), the interaction terms and postestimations tests retains their statistical significance, confirming the robustness of the baseline regression. However, the regression results in terms of FOLLOWING[t] does not retain the statistical significance of the interaction, though the postestimation tests provide significant evidence. In general terms, the results are in broad alignment with the baseline regression results, confirming the resilience and robustness of the findings. For robustness purposes, a PSM matching was performed in undisclosed results. However, because of the reasons mentioned above, balancing of covariates between the two groups failed while the sample size decreased by more than 50% (see also Chapman et al 2019).

**[Table 12 around here]**

**[Table 13 around here]**

## 5. Conclusions

The current study examines whether Solvency II adoption by EEA insurance undertakings drive to improvement of analysts' forecast properties. For both research questions, the study is methodologically based on prior literature examining the impact of accounting regime change on analysts' forecast properties (in IFRS; Byard et al 2011; Tan et al 2011; Horton et al 2013; Hoque et al 2014).

Focusing on RQ1, the objective is to explore whether Solvency II implementation led to improvement in analysts' forecast properties, proxied by consensus metrics of 1-year ahead EPS forecasts, dispersion of these forecasts as well as analyst following of insurers. First, evidence illustrated the beneficial effect of mandatory Solvency II implementation on EPS forecast dispersion, both at EEA level and in DiD design with US control sample, by showing lower levels of dispersion while holds to a battery of postestimation and robustness tests. Focusing on analyst following, first it should be considered the declining numbers of analyst following in both control and treated samples, as showed in the descriptive statistics and mean/median comparison tests. Based on that, multivariate analysis illustrated this decrease of analyst following in both samples but lower for the EEA insurers, showing potential beneficial effects of Solvency II disclosures. However, evidence on that proxy should be cautiously considered as do not hold after entropy balancing of sample. Finally, evidence on consensus analyst forecast error are weak as it fails to conclusively illustrate the beneficial effect of Solvency II disclosures. Collectively, the results suggest a relative convergence of earnings forecasts after the mandatory implementation, though cannot conclusively indicate whether it drove to more accurate forecasting at consensus level. This could be attributed to divergence of assessment practices and methods, partly explaining the inconclusive evidence on forecast error at consensus level. Considering also the time-intensiveness of Solvency II data collection (Kinrade and Coatesworth 2013) and the relevant reduction of resources in light of MIFID II in EU, it explains the findings in terms of analyst following. Broadly, the findings on dispersion are in alignment with El-Gazzar et al (2022) on unregulated embedded value reporting. While the study does not illustrate a similar significant relationship for consensus earnings forecast error as El-Gazzar et al (2022), this could be attributed to differences in the sample selection, country and industry focus.

Focusing on RQ2, the objective is to explore whether Solvency II implementation drove to reduction of EPS forecast error at individual (analyst) level. Using a sample of individual 1-year ahead earnings forecasts for analysts covering both periods (pre and post Solvency II), evidence conclusively illustrate the beneficial effect of Solvency II disclosures, by showing a reduction of individual forecast errors, both at EEA and DiD level, holding to a battery of postestimation and robustness tests. The lower levels of analyst forecast error could be attributed to enhanced analyst perception of firm prospects during the assessment process and potential consideration of contemporary solvency-related metrics for earnings forecasting. This argument is further supported by the evidence in the forecast bias change after Solvency II implementation. The positive impact on Pillar 3 disclosures is also illustrated by Niessen-Ruenzi et al (2015) in the banking context, though the current study provides additional dimensions on analyst assessment change which could be generalizable in the banking context as well.

Concluding, the current study is subject to certain caveats. First, it is recognized that the study is limited by context (insurance), thus potential generalisability of results should be cautiously considered. Second, by design, the exploration of analysts' forecast properties is limited to EPS forecasts as environmental proxies. However, it fails to explore the impact of Solvency II disclosures on other aspects of analysts' production, such as recommendations and target prices, which could be considered by future research. Finally, while the study concludes that analysts' forecast properties and properties improve, it does not explore whether the results are translated to greater analyst informativeness as proxied by abnormal returns, leaving it to future research to explore.

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**Appendix 1.** Definition of variables

| Variable | Definition | Source |
|---|---|---|
| ***Dependent Variables*** | | |
| AFE | Analyst's absolute forecast error scaled by stock price at the beginning of the year. It is estimated as the absolute difference between the analyst's last forecasted 1-year EPS before fiscal year end date and actual EPS for firm i in year t, scaled by stock price at the beginning of the year. We multiply the figure with 100 to accommodate the interpretation needs. | I/B/E/S International Detail |
| FE | Analyst's forecast error scaled by stock price at the beginning of the year. It is estimated as the difference between the analyst's last forecasted 1-year EPS before fiscal year end date and actual EPS for firm i in year t, scaled by stock price at the beginning of the year. We multiply the figure with 100 to accommodate the interpretation needs | I/B/E/S International Detail |
| AFE_ MEAN | Consensus absolute forecast error scaled by stock price at the beginning of the year. It is estimated as the absolute difference between the mean EPS forecast before fiscal year end date and actual EPS for firm i in year t, scaled by stock price at the beginning of the year. We multiply the figure with 100 to accommodate the interpretation needs. | I/B/E/S International Detail |
| DISPERSION | Standard deviation of analysts' forecasts for firm i in year t, scaled by stock price at the beginning of the year | I/B/E/S International Detail |
| FOLLOWING | Number of analysts covering the firm i in year t | I/B/E/S International Detail |
| ***Solvency-Specific Variables*** | | |
| SII_2016 | Time variable which is equal to 1 for firm/year observations starting after the Solvency II implementation (01/01/2016), zero otherwise. | S&P Market Intelligence, I/B/E/S International Detail |
| SII_2017 | Time variable which is equal to 1 for firm/year observations starting the year when Pillar 3 reporting was first initiated. For example, for a firm with FY end 31/12/2016, SII_2017 equals to 1 for the next reporting period (i.e. 31/12/2017), zero otherwise | S&P Market Intelligence, I/B/E/S International Detail |
| EEA_SAMPLE | Firm-specific dummy variable. It is equal to 1 for firms incorporated and located in the European Union or European Economic Area, zero otherwise | S&P Market Intelligence, Thomson Reuters Datastream/Worldscope |
| SIFI | Firm Specific dummy variable. It is equal to 1 if insurer is (or was in the past) a Systematically Important Financial Institution, zero otherwise | Financial Stability Board |
| EVR | Firm Specific dummy variable. It is equal to 1 if insurer provides (or used to provide) a separate Embedded Value report before Solvency II adoption, zero otherwise | S&P Market Intelligence |
| | ***Analyst-Specific Variables*** | |
| GEXP | Analyst's general experience, estimated as the number of years for which analyst j provide EPS forecast in general, up to year t | I/B/E/S International Detail |

| | | |
|---|---|---|
| FEXP | Analyst's firm experience, estimated as the number of years for which analyst j provide EPS forecast for firm i, up to year t | I/B/E/S International Detail |
| NCOS | Number of firms that analyst j covers in year t | I/B/E/S International Detail |
| DTOP10 | Dummy variable equals to 1 if analyst j is employed in brokerage house ranked in top decile based on total analysts employed per brokerage house in year t | I/B/E/S International Detail |
| HORIZON | Number of days between the last available forecast of analyst j for firm i in year t and the fiscal year end of the forecasted period | I/B/E/S International Detail |
| FOL_DUMMY | Dummy variable equals to 1 for firms that have analyst following above mean following for year t, zero otherwise | I/B/E/S International Detail |
| ***Firm-Specific Variables*** | | |
| LEVERAGE | Firm's leverage at the beginning of the year, estimated as the ratio of long-term debt to total assets | Thomson Reuters Datastream/Worldscope |
| ROA | Ratio of profit before interest, tax and policyholder surplus divided to average total assets, at the beginning of the year | Thomson Reuters Datastream/Worldscope |
| LN_MVE | Natural logarithm of the market value of equity at the beginning of the year | Thomson Reuters Datastream/Worldscope |
| BTM | Book to Market Ratio at the beginning of the year, estimated as the firm's book value divided by firm's market capitalisation | Thomson Reuters Datastream/Worldscope |
| VOLATILITY | Return volatility at the beginning of the year, measured as the standard deviation of daily returns for the last 250 days up to date t-1 | Thomson Reuters Datastream/Worldscope |
| STRAT_OWN | Percentage of strategic ownership at the beginning of the year, defined as the sum of percentage of free float investment closely held and percentage of free float that pension fund held | NOSHIC+NOSHPF, Thomson Reuters Datastream |
| RETURNS | Past raw stock returns for an insurer, starting from year t-2 up to year t-1 | Thomson Reuters Datastream |
| ST_TURN | Percentage of traded shares over the previous year divided by the total shares outstanding. | Thomson Reuters Datastream |
| ***Country-Specific Variables*** | | |
| SPOWER | Supervisory Power based on the metrics of Barth et al (2013). It is a dummy variable equals to 1 for countries presenting metric above the sample mean, zero otherwise | Barth et al (2013) |
| INST_DEV | Institutional metric based on Kaufmann et al (2007), defined as the mean of all the relevant metrics (average of the six factors: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption) | Kaufmann et al (2007) |
| INSUR_PEN | Ratio of Premiums Written in the country as percentage of GDP | OECD |

**Figure 1.** Solvency II implementation and Pillar 3 disclosures along with analysts' potential use of SFCR related information

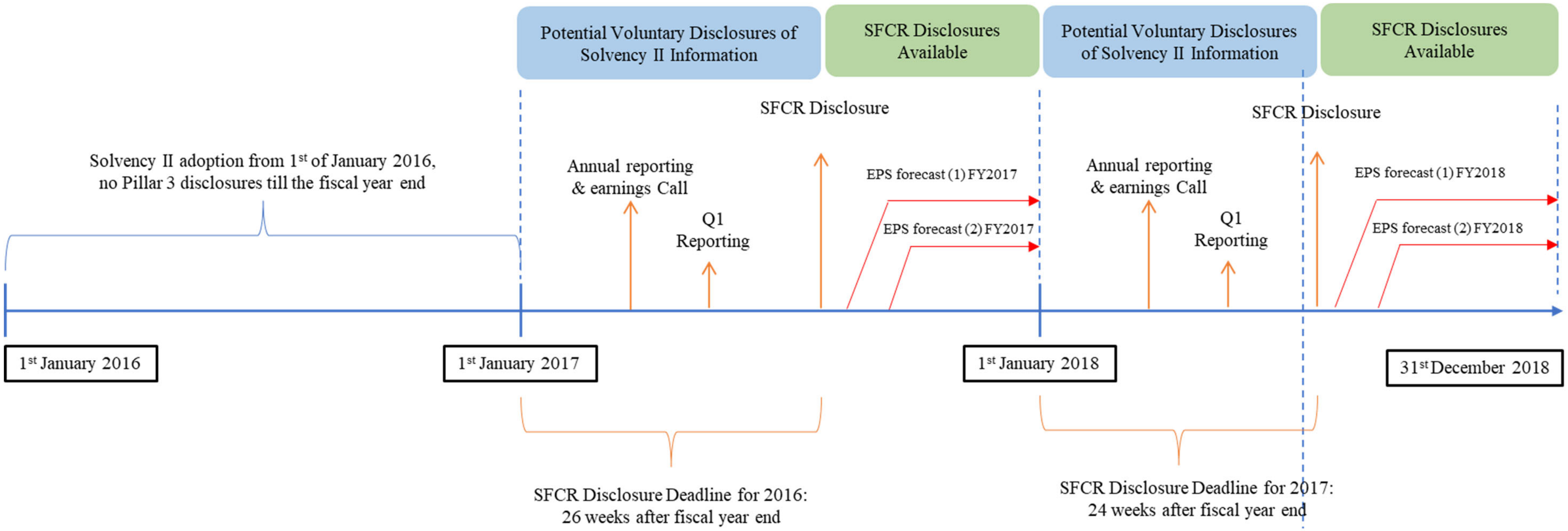

**Table 1.** Stage 1 - sample selection of firms

| *Stage 1: Sample Selection (Firm Level)* | | All firms | | EU firms | |
|---|---|---|---|---|---|
| | | #Firms | #Firms Dropped | #Firms | #Firms Dropped |
| Panel A: Sample Selection Process | | | | | |
| Stage 1: Firm sample Selection | | | | | |
| | ***Identification of EEA insurers & control (US) Sample*** | | | | |
| 1 | Identify listed insurance firms in the European Union/EEA. Insurance firms are identified based on SIC Level 1 (WC07021) and SIC Level 2 (WC07022) to isolate firms having insurance as primary or secondary activity | 234 | | 88 | |
| 2 | Eliminate firms with missing Identifiers or relevant data from S&P Market Intelligence | 204 | -30 | 71 | -17 |
| 3 | Eliminate firms with missing I/B/E/S Identifier or I/B/E/S EPS forecasts | 151 | -53 | 57 | -14 |
| | Initial Sample of EEA insurance undertakings | 151 | | 57 | |

.

**Table 2.** Stage 2 - sample selection criteria

| | ***Stage 2: Sample Selection (Analyst/Firm Level)*** | **All firms** #Firms | #Analyst / Firm / Year Obs Dropped | Analyst / Firm / Year Obs | Firm / Year Obs | **EU firms** #Firms | #Analyst / Firm / Year Dropped | Analyst / Firm / Year Obs | Firm / Year Obs |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Total number of individual analyst 1-year EPS forecasts (fpi=1) for the period 2013-2018 | 151 | - | 41,856 | 821 | 57 | - | 17,602 | 310 |
| 2 | Eliminate forecasts provided by group of analysts (analys=0 or 1), forecasts provided after the fiscal year end or 360 days before and duplicated observations (to obtain consensus metrics) | 150 | -4,880 | 36,976 | 818 | 56 | -2,718 | 14,884 | 308 |
| 3 | Keep only the last forecast per analyst/firm/year | 150 | -28,011 | 8,965 | 818 | 56 | -10,445 | 4,439 | 308 |
| 4 | Eliminate observations with missing actual EPS data from I/B/E/S | 145 | -204 | 8,761 | 769 | 56 | -82 | 4,357 | 292 |
| 5 | Drop firm-year observations for firm coverage less than 3 analyst following or missing dispersion data | 126 | -335 | 8,426 | 626 | 48 | -78 | 4,279 | 251 |
| 6 | Drop observations with unavailable financial, solvency and country data | 124 | -631 | 8,130 | 653 | 47 | -155 | 4,124 | 239 |
| 7 | Drop firms that do not have coverage pre and post Solvency II | 96 | -819 | 7,607 | 533 | 39 | -182 | 3,942 | 218 |
| 8 | Drop analysts not covering both periods | 96 | -2,974 | 5,156 | 536 | 39 | -1,490 | 2,452 | 218 |
| | Final Sample | 96 | | 5,156 | | 39 | | 2,452 | |

**Table 3.** Geographic Allocation of sample

| Panel A: Geographic Allocation of the sample | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Analyst/Firm/Year Sample | | | | | | Firm/Year Sample | | | | | |
| | US Sample | | | EEA Sample | | | US Sample | | | EEA Sample | | |
| | Pre SII | Post SII | Total | Pre SII | Post SII | Total | Pre SII | Post SII | Total | Pre SII | Post SII | Total |
| Austria | | | | 60 | 17 | 77 | | | | 8 | 4 | 12 |
| Belgium | | | | 38 | 25 | 63 | | | | 4 | 2 | 6 |
| Denmark | | | | 58 | 40 | 98 | | | | 6 | 4 | 10 |
| Finland | | | | 63 | 31 | 94 | | | | 4 | 2 | 6 |
| France | | | | 164 | 86 | 250 | | | | 14 | 8 | 22 |
| Germany | | | | 300 | 161 | 461 | | | | 17 | 10 | 27 |
| Ireland | | | | 11 | 7 | 18 | | | | 4 | 2 | 6 |
| Italy | | | | 139 | 66 | 205 | | | | 16 | 7 | 23 |
| Netherlands | | | | 96 | 54 | 150 | | | | 6 | 4 | 10 |
| Norway | | | | 88 | 52 | 140 | | | | 8 | 4 | 12 |
| Poland | | | | 33 | 13 | 46 | | | | 4 | 2 | 6 |
| Spain | | | | 50 | 23 | 73 | | | | 8 | 4 | 12 |
| United Kingdom | | | | 513 | 264 | 777 | | | | 43 | 23 | 66 |
| United States | 1,746 | 958 | 2,704 | | | | 207 | 108 | 315 | | | |

| Panel B: Industry Allocation of the sample | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Life & Health | 512 | 270 | 782 | 427 | 250 | 677 | 48 | 26 | 74 | 41 | 24 | 65 |
| Multiline | 197 | 117 | 314 | 737 | 356 | 1,093 | 21 | 12 | 33 | 67 | 33 | 100 |
| Property & Casualty | 901 | 500 | 1,401 | 228 | 121 | 349 | 119 | 61 | 180 | 22 | 13 | 35 |
| Reinsurance | 136 | 71 | 207 | 221 | 112 | 333 | 19 | 9 | 28 | 12 | 6 | 18 |
| Total Sample | 1,746 | 958 | 2,704 | 1,613 | 839 | 2,452 | 207 | 108 | 315 | 142 | 76 | 218 |

**Table 4.** Difference-in-Difference Univariate analysis (mean values, differences and t-test)

AFE [t]

| | | (A) US Sample | (B) EEA Sample | | |
|---|---|---|---|---|---|
| (C) | Pre Solvency II | 0.678 | 1.354 | 0.675*** | (B)-(A) |
| (D) | Post Solvency II | 0.943 | 1.171 | 0.228*** | (B)-(A) |
| | | 0.265*** | -0.183*** | -0.448*** | |
| | | (D)-(C) | (D)-(C) | | |

FE [t]

| | | (A) US Sample | (B) EEA Sample | | |
|---|---|---|---|---|---|
| (C) | Pre Solvency II | -0.097 | 0.003 | 0.100* | (B)-(A) |
| (D) | Post Solvency II | 0.232 | -0.022 | -0.254*** | (B)-(A) |
| | | 0.329*** | -0.025 | -0.354*** | |
| | | (D)-(C) | (D)-(C) | | |

AFE _MEAN [t]

| | | (A) US Sample | (B) EEA Sample | | |
|---|---|---|---|---|---|
| (C) | Pre Solvency II | 0.81 | 1.265 | 0.455** | (B)-(A) |
| (D) | Post Solvency II | 1.2 | 1.032 | -0.168 | (B)-(A) |
| | | 0.390* | -0.232 | -0.622* | |
| | | (D)-(C) | (D)-(C) | | |

DISPERSION [t]

| | | (A) US Sample | (B) EEA Sample | | |
|---|---|---|---|---|---|
| (C) | Pre Solvency II | 0.321 | 1.036 | 0.715*** | (B)-(A) |
| (D) | Post Solvency II | 0.342 | 0.891 | 0.549*** | (B)-(A) |
| | | 0.021 | -0.145 | -0.166 | |
| | | (D)-(C) | (D)-(C) | | |

FOLLOWING [t]

| | | (A) US Sample | (B) EEA Sample | | |
|---|---|---|---|---|---|
| (C) | Pre Solvency II | 10.343 | 16 | 5.657*** | (B)-(A) |
| (D) | Post Solvency II | 8.714 | 13.5 | 4.759*** | (B)-(A) |
| | | -1.602* | -2.5** | 0.494 | |
| | | (D)-(C) | (D)-(C) | | |

**Table 5.** Descriptive Statistics

| | EU Sample | | | | | | | Control (US) Sample | | | | | | | Mean/Median Tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs. | Mean | Median | Min | Max | 25th | 75th | Obs. | Mean | Median | Min | Max | 25th | 75th | T-test (mean) | Mann–Whitney U test (median) |
| AFE [t] | 2452 | 1.291 | 0.694 | 0.000 | 9.823 | 0.297 | 1.539 | 2704 | 0.772 | 0.314 | 0.000 | 9.823 | 0.134 | 0.709 | .519*** | .38*** |
| FE [t] | 2452 | -0.006 | -0.024 | -6.238 | 7.500 | -0.733 | 0.658 | 2704 | 0.020 | -0.113 | -6.238 | 7.500 | -0.409 | 0.182 | -0.025 | .089* |
| FEXP [t] | 2452 | 6.856 | 6.000 | 1.000 | 22.000 | 4.000 | 9.000 | 2704 | 8.356 | 7.000 | 1.000 | 22.000 | 5.000 | 11.000 | -1.5*** | -1*** |
| GEXP [t] | 2452 | 11.477 | 10.000 | 3.000 | 30.000 | 7.000 | 15.000 | 2704 | 14.626 | 12.000 | 2.000 | 35.000 | 8.000 | 21.000 | -3.149*** | -2*** |
| NCOS [t] | 2452 | 14.206 | 13.000 | 2.000 | 41.000 | 10.000 | 18.000 | 2704 | 21.750 | 21.000 | 2.000 | 41.000 | 15.000 | 28.000 | -7.544*** | -8*** |
| DTOP10 [t] | 2452 | 0.750 | 1.000 | 0.000 | 1.000 | 1.000 | 1.000 | 2704 | 0.723 | 1.000 | 0.000 | 1.000 | 0.000 | 1.000 | .028** | 0** |
| HORIZON [t] | 2452 | 69.748 | 55.000 | 1.000 | 182.000 | 38.000 | 101.000 | 2704 | 57.723 | 58.000 | 3.000 | 182.000 | 46.000 | 65.000 | 12.025*** | -3*** |
| DISPERSION [t] | 218 | 0.986 | 0.673 | 0.115 | 4.098 | 0.411 | 1.200 | 315 | 0.328 | 0.174 | 0.018 | 4.098 | 0.093 | 0.332 | .657*** | .498*** |
| AFE_MEAN [t] | 218 | 1.184 | 0.590 | 0.000 | 12.082 | 0.269 | 1.423 | 315 | 0.944 | 0.320 | 0.000 | 12.082 | 0.131 | 0.745 | 0.24 | .27*** |
| FOLLOWING [t] | 218 | 15.128 | 15.000 | 3.000 | 36.000 | 8.000 | 20.000 | 315 | 9.794 | 7.000 | 3.000 | 28.000 | 5.000 | 15.000 | 5.335*** | 8*** |
| EU_SAMPLE [t] | 218 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 315 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1 | 1*** |
| SII_2017 [t] | 218 | 0.349 | 0.000 | 0.000 | 1.000 | 0.000 | 1.000 | 315 | 0.343 | 0.000 | 0.000 | 1.000 | 0.000 | 1.000 | 0.006 | 0 |
| FOL_DUMMY [t] | 218 | 0.518 | 1.000 | 0.000 | 1.000 | 0.000 | 1.000 | 315 | 0.546 | 1.000 | 0.000 | 1.000 | 0.000 | 1.000 | -0.028 | 0 |
| EVR [t] | 218 | 0.606 | 1.000 | 0.000 | 1.000 | 0.000 | 1.000 | 315 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | .606*** | 1*** |
| BTM [t-1] | 218 | 0.868 | 0.795 | 0.143 | 2.952 | 0.471 | 1.178 | 315 | 0.841 | 0.765 | 0.143 | 2.952 | 0.579 | 0.964 | 0.027 | 0.03 |
| LEVERAGE [t-1] | 218 | 4.193 | 3.657 | 0.000 | 16.895 | 1.925 | 5.733 | 315 | 5.395 | 4.895 | 0.000 | 20.421 | 2.605 | 6.862 | -1.201*** | -1.238*** |
| LN_MVE [t-1] | 218 | 15.621 | 15.672 | 12.664 | 17.929 | 14.829 | 16.320 | 315 | 15.114 | 15.060 | 12.411 | 17.929 | 14.240 | 15.977 | .507*** | .613*** |
| ROA [t-1] | 218 | 1.851 | 0.940 | -6.670 | 12.760 | 0.510 | 2.310 | 315 | 2.644 | 2.370 | -6.670 | 12.760 | 1.000 | 3.550 | -.794*** | -1.43*** |
| VOLATILITY [t-1] | 218 | 26.292 | 23.955 | 12.630 | 64.060 | 20.410 | 29.640 | 315 | 23.172 | 20.640 | 12.180 | 64.060 | 17.130 | 26.200 | 3.12*** | 3.315*** |
| STRAT_OWN [t-1] | 218 | 4.817 | 0.000 | 0.000 | 62.000 | 0.000 | 6.000 | 315 | 11.597 | 8.000 | 0.000 | 90.000 | 0.000 | 14.000 | -6.78*** | -8*** |
| RETURNS [t-1] | 218 | 19.406 | 17.125 | -38.679 | 97.635 | 6.368 | 33.493 | 315 | 21.197 | 19.716 | -38.679 | 97.635 | 9.147 | 32.345 | -1.791 | -2.591 |
| ST_TURN [t-1] | 218 | 0.564 | 0.509 | 0.002 | 3.968 | 0.212 | 0.744 | 315 | 1.496 | 1.349 | 0.113 | 4.042 | 0.929 | 1.867 | -.932*** | -.84*** |
| SIFI [t] | 218 | 0.165 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 315 | 0.038 | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | .127*** | 0*** |
| SPOWER [t] | 218 | 0.431 | 0.000 | 0.000 | 1.000 | 0.000 | 1.000 | 315 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | -.569*** | -1*** |
| INST_DEV [t] | 218 | 1.308 | 1.435 | 0.480 | 1.819 | 1.106 | 1.516 | 315 | 1.249 | 1.250 | 1.232 | 1.266 | 1.235 | 1.260 | .059*** | .185*** |
| INSUR_PEN [t] | 218 | 8.474 | 8.864 | 3.160 | 13.110 | 6.175 | 10.709 | 315 | 11.062 | 11.182 | 10.716 | 11.248 | 10.852 | 11.208 | -2.589*** | -2.318*** |

**Table 6.** Mean/Median Comparison Tests

| Analyst Level | EU Sample | | | | | | US Sample | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Post SII (839) | | Pre SII (1.613) | | Mean/Median Tests | | Post SII (958) | | Pre SII (1.746) | | Mean/Median Tests | |
| | Mean | Median | Mean | Median | T-test (mean) | Mann–Whitney U test (median) | Mean | Median | Mean | Median | T-test (mean) | Mann–Whitney U test (median) |
| AFE [t] | 1.171 | 0.609 | 1.354 | 0.765 | -.183** | -.156*** | 0.943 | 0.337 | 0.678 | 0.301 | .265*** | .036** |
| FE [t] | -0.022 | 0 | 0.003 | -0.049 | -0.025 | 0.049 | 0.232 | 0 | -0.097 | -0.163 | .329*** | .163*** |
| FEXP [t] | 6.309 | 5 | 7.14 | 6 | -.831*** | -1*** | 7.651 | 6 | 8.742 | 7 | -1.091*** | -1*** |
| GEXP_[t] | 11.385 | 9 | 11.524 | 10 | -0.14 | -1 | 14.43 | 12 | 14.734 | 12 | -0.304 | 0* |
| NCOS [t] | 14.79 | 14 | 13.902 | 13 | .888*** | 1*** | 23.149 | 22 | 20.982 | 21 | 2.167*** | 1*** |
| DTOP10 [t] | 0.771 | 1 | 0.74 | 1 | .032* | 0* | 0.694 | 1 | 0.738 | 1 | -.044** | 0** |
| HORIZON [t] | 72.93 | 59 | 68.093 | 55 | 4.837*** | 4** | 54.276 | 55 | 59.615 | 58 | -5.339*** | -3*** |

| Firm Level | Post SII (79) | | Pre SII (142) | | Mean/Median Tests | | Post SII (108) | | Pre SII (207) | | Mean/Median Tests | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Median | Mean | Median | T-test (mean) | Mann–Whitney U test (median) | Mean | Median | Mean | Median | T-test (mean) | Mann–Whitney U test (median) |
| DISPERSION [t] | 0.891 | 0.569 | 1.036 | 0.74 | -0.145 | -0.171 | 0.342 | 0.157 | 0.321 | 0.183 | 0.021 | -0.026 |
| AFE_MEAN [t] | 1.032 | 0.502 | 1.265 | 0.652 | -0.232 | -.149* | 1.2 | 0.304 | 0.81 | 0.347 | .39* | -0.043 |
| FOLLOWING [t] | 13.5 | 14 | 16 | 16 | -2.5** | -2** | 8.741 | 7 | 10.343 | 7 | -1.602** | 0 |
| EU_SAMPLE [t] | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SII_2017 [t] | 1 | 1 | 0 | 0 | 1 | 1*** | 1 | 1 | 0 | 0 | 1 | 1*** |
| FOL_DUMMY [t] | 0.513 | 1 | 0.521 | 1 | -0.008 | 0 | 0.546 | 1 | 0.546 | 1 | 0 | 0 |
| EVR [t] | 0.605 | 1 | 0.606 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BTM [t-1] | 0.869 | 0.834 | 0.867 | 0.778 | 0.002 | 0.056 | 0.75 | 0.675 | 0.888 | 0.823 | -.138*** | -.147*** |
| LEVERAGE [t-1] | 4.484 | 3.752 | 4.037 | 3.609 | 0.447 | 0.142 | 5.915 | 5.468 | 5.123 | 4.549 | .791* | .919** |
| LN_MVE [t-1] | 15.692 | 15.731 | 15.583 | 15.652 | 0.109 | 0.078 | 15.31 | 15.263 | 15.012 | 14.974 | .298* | .289* |
| ROA [t-1] | 1.719 | 0.85 | 1.921 | 0.97 | -0.202 | -0.12 | 2.289 | 2.015 | 2.83 | 2.58 | -0.541 | -.565* |
| VOLATILITY [t-1] | 26.074 | 25.04 | 26.409 | 23.42 | -0.335 | 1.62 | 23.763 | 21.08 | 22.863 | 20.15 | 0.9 | 0.93 |
| STRAT_OWN [t-1] | 4.605 | 2.5 | 4.93 | 0 | -0.324 | 2.5 | 12.111 | 8 | 11.329 | 7 | 0.783 | 1 |
| RETURNS [t-1] | 15.054 | 11.766 | 21.735 | 20.126 | -6.681** | -8.360** | 20.364 | 20.484 | 21.632 | 19.078 | -1.268 | 1.406 |
| ST_TURN [t-1] | 0.549 | 0.584 | 0.572 | 0.487 | -0.023 | 0.097 | 1.441 | 1.332 | 1.524 | 1.361 | -0.084 | -0.029 |
| SIFI [t] | 0.158 | 0 | 0.169 | 0 | -0.011 | 0 | 0.037 | 0 | 0.039 | 0 | -0.002 | 0 |
| SPOWER [t] | 0.434 | 0 | 0.43 | 0 | 0.005 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |
| INST_DEV [t] | 1.292 | 1.386 | 1.316 | 1.462 | -0.024 | -.076* | 1.263 | 1.266 | 1.241 | 1.246 | .022*** | .019*** |
| INSUR_PEN [t] | 9.072 | 9.476 | 8.153 | 8.819 | .919** | .657** | 11.214 | 11.182 | 10.983 | 11.095 | .232*** | .087*** |

**Table 7.** Solvency II implementation and analysts' forecast properties

| | AFE_MEAN [t] | | | DISPERSION [t] | | | FOLLOWING [t] | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| SII_2017 [t] [A] | 0.259* | | 0.639*** | -0.009 | | 0.079 | -0.226*** | | -0.285*** |
| | (1.665) | | (3.193) | (-0.199) | | (1.434) | (-9.195) | | (-8.074) |
| EEA_SAMPLE [t] | | 1.024*** | 1.382*** | | 0.829*** | 0.944*** | | 0.409*** | 0.397*** |
| | | (3.306) | (4.192) | | (4.287) | (4.884) | | (3.666) | (3.459) |
| SII_2017 [t]* EEA_SAMPLE [t] [B] | | | -0.993*** | | | -0.278*** | | | 0.098** |
| | | | (-3.247) | | | (-2.822) | | | (2.302) |
| FOL_DUMMY [t] | -0.549** | -0.601** | -0.549** | -0.130 | -0.147** | -0.145* | | | |
| | (-2.329) | (-2.482) | (-2.379) | (-1.605) | (-2.024) | (-1.973) | | | |
| EVR [t] | 0.202 | -0.067 | -0.042 | 0.347** | 0.111 | 0.122 | 0.151* | -0.014 | -0.006 |
| | (0.555) | (-0.174) | (-0.110) | (2.031) | (0.610) | (0.672) | (1.648) | (-0.146) | (-0.062) |
| BTM [t-1] | 1.545*** | 1.419*** | 1.524*** | 0.576*** | 0.507*** | 0.520*** | -0.182** | -0.166** | -0.199*** |
| | (4.062) | (3.877) | (4.077) | (3.946) | (4.024) | (4.106) | (-2.192) | (-2.105) | (-2.581) |
| LEVERAGE [t-1] | 0.019 | 0.023 | 0.017 | 0.015 | 0.013 | 0.014 | -0.011 | -0.018* | -0.012 |
| | (0.487) | (0.617) | (0.451) | (1.041) | (0.989) | (1.022) | (-1.158) | (-1.886) | (-1.188) |
| LN_MVE [t-1] | -0.130 | -0.097 | -0.142 | -0.055 | -0.055 | -0.055 | 0.397*** | 0.385*** | 0.404*** |
| | (-1.281) | (-1.015) | (-1.522) | (-1.204) | (-1.325) | (-1.312) | (15.480) | (15.447) | (16.066) |
| ROA [t-1] | 0.054 | 0.040 | 0.051 | -0.009 | -0.018 | -0.016 | 0.008 | 0.006 | 0.003 |
| | (1.631) | (1.223) | (1.567) | (-0.557) | (-1.197) | (-1.098) | (0.577) | (0.481) | (0.205) |
| VOLATILITY [t-1] | 0.018 | 0.015 | 0.009 | 0.012 | 0.006 | 0.006 | 0.008*** | 0.003 | 0.006** |
| | (1.328) | (1.141) | (0.721) | (1.621) | (1.025) | (0.937) | (2.983) | (1.032) | (2.143) |
| STRAT_OWN [t-1] | 0.009** | 0.013*** | 0.013*** | -0.004* | -0.001 | -0.001 | -0.003 | -0.002 | -0.002 |
| | (2.028) | (2.697) | (2.689) | (-1.695) | (-0.361) | (-0.390) | (-1.529) | (-0.803) | (-0.772) |
| RETURNS [t-1] | -0.008*** | -0.008*** | -0.008*** | -0.000 | -0.001 | -0.001 | -0.001 | -0.000 | -0.001 |
| | (-2.661) | (-2.786) | (-2.715) | (-0.191) | (-0.278) | (-0.391) | (-1.121) | (-0.236) | (-1.093) |
| ST_TURN [t-1] | 0.214 | 0.361* | 0.373** | -0.031 | 0.105 | 0.103 | 0.095** | 0.184*** | 0.160*** |
| | (1.112) | (1.930) | (2.019) | (-0.417) | (1.465) | (1.449) | (2.259) | (3.999) | (3.410) |
| SIFI [t] | 0.325 | 0.231 | 0.291 | 0.053 | 0.033 | 0.024 | -0.116 | -0.079 | -0.138 |
| | (0.874) | (0.695) | (0.876) | (0.200) | (0.147) | (0.106) | (-1.055) | (-0.874) | (-1.484) |
| SPOWER [t] | -0.322 | 0.202 | 0.173 | -0.386*** | 0.009 | 0.021 | -0.055 | 0.080 | 0.125 |
| | (-1.420) | (0.783) | (0.657) | (-2.853) | (0.060) | (0.151) | (-0.716) | (0.907) | (1.406) |
| INST_DEV [t] | 0.196 | 0.234 | 0.164 | 0.117 | 0.138 | 0.123 | 0.405** | 0.370*** | 0.372*** |
| | (0.426) | (0.606) | (0.442) | (0.533) | (0.736) | (0.653) | (2.371) | (2.664) | (2.657) |
| INSUR_PEN [t] | 0.039 | 0.106** | 0.107** | 0.012 | 0.054** | 0.061** | -0.034** | -0.031** | -0.016 |
| | (0.703) | (2.241) | (2.268) | (0.407) | (2.019) | (2.327) | (-2.197) | (-2.134) | (-1.081) |
| Constant | 0.735 | -1.095 | -0.528 | 0.554 | -0.435 | -0.520 | -3.966*** | -4.038*** | -4.460*** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (0.302) | (-0.517) | (-0.258) | (0.657) | (-0.510) | (-0.599) | (-7.060) | (-7.731) | (-8.491) |
| lnalpha | | | | | | | -3.612*** | -3.450*** | -3.961*** |
| | | | | | | | (-7.897) | (-10.818) | (-7.806) |
| Observations | 533 | 533 | 533 | 533 | 533 | 533 | 533 | 533 | 533 |
| R-squared | 0.329 | 0.339 | 0.358 | 0.350 | 0.405 | 0.413 | | | |
| Sample | Full | Full | Full | Full | Full | Full | Full | Full | Full |
| Sub-Insurance FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| [A]+[B] = 0 [p-value, two-tailed] | | | 0.130 | | | 0.012 | | | 0.000 |
| **Non EEA Sample** | | | | | | | | | |
| Pre-Solvency II Predicted Value | | | 0.397*** | | | 0.223*** | | | 10.8*** |
| *Marginal Effect* | | | 0.639*** | | | 0.079 | | | -2.681*** |
| **EEA Sample** | | | | | | | | | |
| Pre-Solvency II Predicted Value | | | 1.78*** | | | 1.168*** | | | 16.07*** |
| *Marginal Effect* | | | -0.354 | | | -0.199** | | | -2.74*** |
| Log_Likelihood | | | | | | | -1440.6 | -1447.0 | -1420.2 |

Notes: Table 7 illustrates the effect of Solvency II adoption for EEA insurance undertakings on analysts' forecast properties. Columns 1 - 3 regards the effect on AFE_MEAN, columns 4-6 the effect on DISPERSION [t] and columns 7-9 the effect on FOLLOWING [t]. In terms of econometric modelling, OLS regression is conducted for columns 1-6 and negative binomial model for columns 7-9 using sub-insurance industry FE and clustering at firm level. In post-estimation section, [A]+[B]=0 [p-value, two-tailed] illustrates the statistical significance of the overall change of dependent variable for EEA insurance undertakings after Solvency II. Pre-Solvency II Predicted value represents the predicted value of the dependent variable for EEA (US) insurers when SII_2017 [t] = 0 and control variables are constant to mean values of EEA (US) insurers. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EEA (US) insurers. Definition of variables is provided in Appendix 1. ***, ** and * illustrates statistical significance at 1%, 5% and 10% respectively.

**Table 8.** Solvency II implementation and individual analyst's forecast error

| | Baseline Reg: AFE [t] | | | Excl. UK | Excl. 2016 | 2015 vs 2016 | 2016 vs 2017 | FE [t] |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| SII_2017 [t] [A] | 0.154*** | | 0.514*** | 0.554*** | 0.514*** | | 0.488*** | 0.340*** |
| | (3.042) | | (8.786) | (9.713) | (7.286) | | (5.827) | (5.999) |
| EEA_SAMPLE [t] | | 1.110*** | 1.429*** | 1.085*** | 1.400*** | 1.099*** | 1.572*** | 0.627*** |
| | | (8.503) | (10.708) | (7.089) | (8.530) | (6.337) | (9.026) | (4.401) |
| SII_2017 [t] * EEA_SAMPLE [t] [B] | | | -0.835*** | -0.715*** | -0.794*** | | -0.994*** | -0.548*** |
| | | | (-9.401) | (-7.322) | (-8.059) | | (-7.549) | (-5.733) |
| SII_2016 [t] [A] | | | | | | -0.156** | | |
| | | | | | | (-2.360) | | |
| SII_2016 [t] * EEA_SAMPLE [t] [B] | | | | | | 0.234 | | |
| | | | | | | (1.646) | | |
| FEXP [t] | -0.006 | -0.006 | -0.004 | -0.004 | -0.004 | -0.014* | 0.003 | -0.008 |
| | (-1.031) | (-1.123) | (-0.697) | (-0.859) | (-0.662) | (-1.713) | (0.379) | (-1.235) |
| GEXP_[t] | -0.008* | -0.006 | -0.006 | -0.004 | -0.008 | 0.001 | -0.005 | -0.003 |
| | (-1.817) | (-1.250) | (-1.281) | (-0.990) | (-1.601) | (0.212) | (-0.870) | (-0.857) |
| NCOS [t] | -0.005 | 0.001 | -0.001 | -0.002 | -0.001 | -0.004 | 0.005 | 0.000 |
| | (-1.590) | (0.435) | (-0.186) | (-0.652) | (-0.263) | (-0.825) | (1.073) | (0.130) |
| DTOP10 [t] | -0.030 | -0.055 | -0.027 | -0.007 | -0.031 | 0.020 | -0.104 | 0.028 |
| | (-0.436) | (-0.884) | (-0.428) | (-0.123) | (-0.473) | (0.237) | (-1.009) | (0.462) |
| HORIZON [t] | 0.001* | 0.001 | 0.001** | 0.001* | 0.001* | 0.002 | 0.003** | 0.001 |
| | (1.751) | (1.517) | (2.020) | (1.830) | (1.955) | (1.518) | (2.485) | (1.060) |
| FOL_DUMMY [t] | -0.436*** | -0.478*** | -0.440*** | -0.405*** | -0.394*** | -0.425*** | -0.540*** | -0.458*** |
| | (-5.516) | (-5.771) | (-5.585) | (-4.881) | (-5.434) | (-3.975) | (-3.672) | (-5.429) |
| EVR [t] | 0.183* | -0.208* | -0.195* | -0.554*** | -0.218* | -0.065 | -0.085 | -0.398*** |
| | (1.748) | (-1.917) | (-1.842) | (-4.395) | (-1.859) | (-0.456) | (-0.548) | (-3.580) |
| BTM [t-1] | 1.275*** | 1.210*** | 1.294*** | 1.506*** | 1.320*** | 1.222*** | 1.080*** | 0.366** |
| | (10.114) | (10.109) | (10.968) | (12.428) | (10.614) | (9.912) | (6.621) | (2.546) |
| LEVERAGE [t-1] | 0.002 | 0.005 | 0.001 | 0.008 | 0.008 | 0.003 | -0.037*** | -0.031*** |
| | (0.227) | (0.624) | (0.119) | (1.004) | (0.727) | (0.347) | (-3.740) | (-3.333) |
| LN_MVE [t-1] | -0.185*** | -0.145*** | -0.164*** | -0.152*** | -0.180*** | -0.035 | -0.202*** | 0.199*** |
| | (-4.639) | (-3.778) | (-4.521) | (-3.833) | (-5.071) | (-0.610) | (-3.547) | (4.831) |
| ROA [t-1] | 0.013 | 0.002 | 0.013 | 0.032** | -0.001 | 0.050*** | 0.001 | 0.005 |
| | (1.018) | (0.134) | (0.976) | (1.981) | (-0.034) | (3.244) | (0.085) | (0.331) |
| VOLATILITY [t-1] | 0.010** | 0.006 | 0.004 | 0.011** | -0.000 | 0.035*** | -0.001 | -0.014*** |
| | (2.387) | (1.441) | (0.927) | (2.332) | (-0.011) | (2.908) | (-0.072) | (-2.872) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| STRAT_OWN [t-1] | -0.001 | 0.003** | 0.003* | 0.001 | 0.005** | 0.000 | 0.001 | 0.004** |
| | (-0.340) | (2.112) | (1.943) | (0.869) | (2.586) | (0.231) | (0.690) | (1.979) |
| RETURNS [t-1] | -0.006*** | -0.006*** | -0.007*** | -0.007*** | -0.006*** | -0.007*** | -0.013*** | -0.006*** |
| | (-4.732) | (-4.940) | (-5.780) | (-5.345) | (-4.320) | (-2.765) | (-5.548) | (-2.846) |
| ST_TURN [t-1] | 0.101 | 0.259*** | 0.268*** | 0.197*** | 0.211*** | 0.157* | 0.680*** | -0.066 |
| | (1.536) | (4.681) | (4.835) | (3.420) | (3.702) | (1.698) | (7.118) | (-0.938) |
| SIFI [t] | 0.434*** | 0.334*** | 0.334*** | 0.471*** | 0.284** | 0.429** | 0.226 | -0.471** |
| | (3.734) | (2.929) | (2.949) | (3.649) | (2.430) | (2.255) | (1.380) | (-2.556) |
| SPOWER [t] | -0.318*** | 0.133 | 0.141* | 0.539*** | 0.203** | 0.275** | -0.346*** | 0.097 |
| | (-3.606) | (1.527) | (1.656) | (6.619) | (2.192) | (2.140) | (-3.033) | (1.079) |
| INST_DEV [t] | 0.357** | 0.342*** | 0.296** | 0.219* | 0.045 | 0.784*** | 1.082*** | -0.940*** |
| | (2.199) | (2.706) | (2.444) | (1.964) | (0.346) | (5.138) | (5.867) | (-7.934) |
| INSUR_PEN [t] | 0.003 | 0.061*** | 0.068*** | -0.013 | 0.065*** | 0.133*** | 0.070** | 0.100*** |
| | (0.149) | (3.314) | (3.617) | (-0.488) | (3.045) | (3.965) | (2.236) | (4.209) |
| Constant | 2.792*** | 0.855 | 0.886 | 0.764 | 1.567** | -3.007** | 0.644 | -2.379*** |
| | (3.406) | (1.100) | (1.227) | (0.997) | (2.163) | (-2.234) | (0.473) | (-2.744) |
| Observations | 5156 | 5156 | 5156 | 4379 | 4175 | 1897 | 1954 | 5156 |
| R-squared | 0.258 | 0.275 | 0.291 | 0.334 | 0.284 | 0.295 | 0.337 | 0.073 |
| Sample | Full | Full | Full | Excl. UK | Excl. 2016 | 2015 - 2016 | 2016 - 2017 | Full |
| Sub-Insurance FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster | Analyst | Analyst | Analyst | Analyst | Analyst | Analyst | Analyst | Analyst |
| [A]+[B] = 0 [p-value, two-tailed] | | | 0.000 | 0.033 | 0.000 | 0.570 | 0.000 | 0.008 |
| **Non EEA Sample** | | | | | | | | |
| Pre-Solvency II Predicted Value | | | 0.296*** | 0.428*** | 0.283*** | 0.521*** | 0.294*** | -0.32*** |
| *Marginal Effect* | | | 0.514*** | 0.554*** | 0.514*** | -0.156** | 0.488*** | 0.34*** |
| **EEA Sample** | | | | | | | | |
| Pre-Solvency II Predicted Value | | | 1.725*** | 1.513*** | 1.682*** | 1.62*** | 1.867*** | 0.307*** |
| *Marginal Effect* | | | -0.321*** | -0.16** | -0.28*** | 0.078 | -0.506*** | -0.207*** |

Notes: Table 8 illustrates the individual analyst's forecast error for EEA insurance undertakings after Solvency II. Columns 1 - 3 include the baseline regressions, column 4 excludes UK insurers, column 5 excludes FY2016, column 6 illustrates the individual analyst forecast error change using FY2015 and FY2016, column 7 the the individual analyst forecast error change using FY2016 and FY2017 and column 8 the forecast bias. In terms of econometric modelling, OLS regression is conducted in all models, using sub-insurance industry FE and clustering at analyst level. In post-estimation section, [A]+[B]=0 [p-value, two-tailed] illustrates the statistical significance of the overall change of dependent variable for EEA insurance undertakings after Solvency II. Pre-Solvency II Predicted value represents the predicted value of the dependent variable for EEA (US) insurers when SII_2017 [t] = 0 and control variables are constant to mean values of EEA (US) insurers. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EEA (US) insurers. Definition of variables is provided in Appendix 1. ***, ** and * illustrates statistical significance at 1%, 5% and 10% respectively.

**Table 9.** Additional Test - Embedded Value Reporters

| | AFE [t] | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| SII_2017 [t] | -0.198*** | | -0.004 |
| | (-2.734) | | (-0.021) |
| EVR [t] | | -0.291 | -0.201 |
| | | (-1.624) | (-1.148) |
| SII_2017 [t] * EVR [t] | | | -0.229 |
| | | | (-1.092) |
| Analyst, Firm and Country specific variables | Yes | Yes | Yes |
| Sub-Insurance FE | Yes | Yes | Yes |
| Constant | 8.368*** | 9.195*** | 8.387*** |
| | (5.936) | (6.542) | (6.192) |
| Observations | 2103 | 2103 | 2103 |
| R-squared | 0.302 | 0.302 | 0.304 |
| Sample | EEA Sample excl P&C | EEA Sample excl P&C | EEA Sample excl P&C |
| Cluster | Analyst | Analyst | Analyst |
| [A]+[B] = 0 [p-value, two-tailed] | | | 0.001 |
| **Non EVR Sample** | | | |
| Pre-Solvency II Predicted Value | | | 1.53*** |
| *Marginal Effect* | | | -0.004 |
| **EVR Sample** | | | |
| Pre-Solvency II Predicted Value | | | 1.329*** |
| *Marginal Effect* | | | -0.233*** |

Notes: Table 10 illustrates the individual analyst's forecast error for EEA insurance undertakings that are embedded value reporters. In terms of econometric modelling, OLS regression is conducted in all models, using sub-insurance industry FE, clustering at analyst level and using only EEA insurance undertakings that are not classified as Property and Casualty. In post-estimation section, [A]+[B]=0 [p-value, two-tailed] illustrates the statistical significance of the overall change of dependent variable for EU insurance undertakings after Solvency II. Pre-Solvency II Predicted value represents the predicted value of the dependent variable for EVR (non EVR) insurers when SII_2017 [t] = 0 and control variables are constant to mean values of EVR (non EVR) insurers. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EVR (non EVR) insurers. Definition of variables is provided in Appendix 1. ***, ** and * illustrates statistical significance at 1%, 5% and 10% respectively.

**Table 10.** Additional Test - Informative vs Interpretative Role

| | Interpretative Role | | |
|---|---|---|---|
| | Full Sample | Excl. 2015 & 2016 | Forecast Bias |
| | (1) | (2) | (3) |
| SII_2017 [t] [A] | 1.018*** | 1.064*** | 1.364*** |
| | (10.503) | (8.352) | (7.989) |
| EEA_SAMPLE [t] | 1.141*** | 1.521*** | 0.729*** |
| | (7.281) | (6.683) | (3.709) |
| SII_2017 [t] * EEA_SAMPLE [t] [B] | -1.106*** | -1.285*** | -1.376*** |
| | (-8.867) | (-8.316) | (-6.488) |
| Analyst, Firm and Country specific variables | Yes | Yes | Yes |
| Sub_Insurance_FE | Yes | Yes | Yes |
| Constant | 0.842 | 1.585* | -0.086 |
| | (1.063) | (1.892) | (-0.088) |
| Observations | 5156 | 3259 | 5156 |
| R-squared | 0.299 | 0.319 | 0.106 |
| Sample | Full Sample | Excl. 2015 & 2016 | Full Sample |
| Cluster | Analyst | Analyst | Analyst |
| | | | |
| [A]+[B] = 0 [p-value, two-tailed] | 0.289 | 0.0833 | 0.926 |
| | | | |
| **Non EEA Sample** | | | |
| Pre-Solvency II Predicted Value | 0.793*** | 0.638*** | -0.39*** |
| *Marginal Effect* | 1.018*** | 1.064*** | 1.364*** |
| | | | |
| **EEA Sample** | | | |
| Pre-Solvency II Predicted Value | 1.934*** | 2.158*** | 0.339*** |
| *Marginal Effect* | -0.0884 | -0.221* | -0.0118 |

Notes: Table 10 presents the impact on individual analyst's forecast error of Solvency II adoption for EEA insurance undertakings using AFE [t] as dependent variable for forecasts provided closer to SFCR reporting deadline. Columns 1 - 3 provides evidence on the individual analyst's forecast error. Evidence is provided in terms of full sample (column 1), excluding FY2015 and FY 2016 (column 2) and forecast bias (column 3). In terms of econometric modelling, OLS regression is conducted in all models, using sub-insurance industry FE and clustering at analyst level. In post-estimation section, [A]+[B]=0 [p-value, two-tailed] illustrates the statistical significance of the overall change of dependent variable for EEA insurance undertakings after Solvency II. Pre-Solvency II Predicted value represents the predicted value of the dependent variable for EEA (US) insurers when SII_2017 [t] = 0 and control variables are constant to mean values of EEA (US) insurers. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EEA (US) insurers. Definition of variables is provided in Appendix 1. ***, ** and * illustrates statistical significance at 1%, 5% and 10% respectively.

**Table 11.** Robustness Test - Alternative Periods

| | Alternative Periods | | |
|---|---|---|---|
| | 2015-2018 | 2013-2014 & 2017-2018 | 2013-2016 |
| | (1) | (2) | (3) |
| SII_2017 [t] [A] | 0.495*** | 0.614*** | |
| | (8.632) | (6.630) | |
| EU_SAMPLE [t] | 1.275*** | 1.650*** | 1.532*** |
| | (9.222) | (8.771) | (8.955) |
| SII_2017 [t] * EU_SAMPLE [t] [B] | -0.805*** | -0.951*** | |
| | (-8.430) | (-8.313) | |
| SII_2015 [t] [A] | | | 0.188** |
| | | | (2.585) |
| SII_2015 [t] * EU_SAMPLE [t] [B] | | | -0.065 |
| | | | (-0.644) |
| Analyst, Firm and Country specific variables | Included | Included | Included |
| Sub_Insurance_FE | Included | Included | Included |
| Observations | 3694 | 3259 | 3359 |
| R-squared | 0.299 | 0.310 | 0.296 |
| Sample | Excl. 2013 & 2014 | Excl. 2015 & 2016 | Excl. 2017 & 2018 |
| Cluster | Analyst | Analyst | Analyst |
| [A]+[B] = 0 [p-value, two-tailed] | 0.000 | 0.001 | 0.130 |
| **Non EEA Sample** | | | |
| Pre-Solvency II Predicted Value | 0.375*** | 0.141 | 0.178** |
| *Marginal Effect* | 0.495*** | 0.614*** | 0.188*** |
| **EEA Sample** | | | |
| Pre-Solvency II Predicted Value | 1.651*** | 1.792*** | 1.711*** |
| *Marginal Effect* | -0.311*** | -0.337*** | 0.122 |

Notes: Table 11 illustrates the individual analysts' forecast error for EEA insurance undertakings after Solvency II using alternative periods. Columns 1 excludes FY2013 and FY2014, column 2 excludes FY2015 and FY2016 and column 3 excludes FY2017 and FY 2018. In terms of econometric modelling, OLS regression is conducted in all models, using sub-insurance industry FE and clustering at analyst level. In post-estimation section, [A]+[B]=0 [p-value, two-tailed] illustrates the statistical significance of the overall change of dependent variable for EEA insurance undertakings sample after Solvency II. Pre-Solvency II Predicted value represents the predicted value of the dependent variable for EEA (US) insurers sample when SII_2017 [t] = 0 and control variables are constant to mean values of EEA (US) insurers sample. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EEA (US) insurers sample. Definition of variables is provided in Appendix 1. ***, ** and * illustrates statistical significance at 1%, 5% and 10% respectively.

**Table 12.** Robustness Test: Descriptive Statistics for Entropy Balancing

| | Mean EEA Sample | Reweighted Mean US Sample | Variance EEA Sample | Reweighted Variance US Sample | Standardized Differences Post Entropy Balancing |
|---|---|---|---|---|---|
| BTM [t-1] | 0.87 | 0.87 | 0.26 | 0.16 | 0.00 |
| LEVERAGE [t-1] | 4.19 | 4.19 | 9.83 | 11.72 | 0.00 |
| LN_MVE [t-1] | 15.62 | 15.62 | 1.34 | 2.38 | 0.00 |
| ROA [t-1] | 1.85 | 1.85 | 5.91 | 8.44 | 0.00 |
| VOLATILITY [t-1] | 26.29 | 26.29 | 86.56 | 102.53 | 0.00 |
| STRAT_OWN [t-1] | 4.82 | 4.83 | 52.51 | 27.41 | 0.00 |
| RETURNS [t-1] | 19.41 | 19.41 | 488.55 | 492.40 | 0.00 |

**Table 13.** Robustness Test - Entropy Balancing

| | AFE_MEAN [t] | DISPERSION [t] | FOLLOWING [t] |
|---|---|---|---|
| | (1) | (2) | (3) |
| SII_2017 [t] [A] | 0.441** | 0.111 | -0.288*** |
| | (2.091) | (0.958) | (-3.517) |
| EEA_SAMPLE [t] | 1.319*** | 0.807*** | 0.407*** |
| | (3.564) | (3.832) | (3.007) |
| SII_2017 [t]*EEA_SAMPLE [t] [B] | -0.773** | -0.292* | 0.090 |
| | (-2.422) | (-1.964) | (1.054) |
| Firm and Country specific variables | Yes | Yes | Yes |
| Sub-Insurance FE | Yes | Yes | Yes |
| Constant | 2.251 | 0.856 | -4.944*** |
| | (0.868) | (0.705) | (-8.796) |
| Observations | 533 | 533 | 533 |
| R-squared | 0.313 | 0.393 | |
| Sample | Full Sample | Full Sample | Full Sample |
| Cluster | Firm | Firm | Firm |
| | | | |
| [A]+[B] = 0 [p-value, two-tailed] | 0.166 | 0.026 | 0.000 |
| **Non EEA Sample** | | | |
| Pre-Solvency II Predicted Value | 0.318* | 0.261** | 12.09*** |
| *Marginal Effect* | 0.441** | 0.111 | -3.023*** |
| **EEA Sample** | | | |
| Pre-Solvency II Predicted Value | 1.637*** | 1.068*** | 18.16*** |
| *Marginal Effect* | -0.332 | -0.182** | -3.266*** |
| Log_Likelihood | | | -1151.700 |

Notes: Table 12 and 13 presents the effect of Solvency II adoption for EEA insurance undertakings on analysts' forecast properties after performing entropy balancing. Column (1) presents the results on AFE_MEAN [t], column (2) on DISPERSION [t] and column (3) on FOLLOWING [t]. In terms of econometric modelling, an OLS regression is conducted for columns 1 and 2 while a negative binomial regression for column 3, using sub-insurance industry FE and clustering at firm level. In post-estimation section, [A]+[B]=0 [p-value, two-tailed] illustrates the statistical significance of the overall change of dependent variable for EEA insurance undertakings after Solvency II. Pre-Solvency II Predicted value represents the predicted value of the dependent variable for EEA (US) insurers when SII_2017 [t] = 0 and control variables are constant to mean values of EEA (US) insurers. Marginal effect is the change of the dependent variable from pre to post Solvency II and control variables are constant to mean values of EEA (US) insurers. Definition of variables is provided in Appendix 1. ***, ** and * illustrates statistical significance at 1%, 5% and 10% respectively.