



**LISBOA
SCHOOL OF
ECONOMICS &
MANAGEMENT**

**MASTER OF SCIENCE IN
ACTUARIAL SCIENCE**

**MASTERS FINAL WORK
INTERNSHIP REPORT**

**RISK ANALYSIS AND SOLVENCY IMPACT OF THE
EXPOSURE OF PORTUGUESE INSURANCE AND
PENSION FUNDS SECTOR TO THE PROPERTY MARKET**

FRANCISCO MIGUEL PIRES NUNES TIAGO LOUREIRO

OCTOBER - 2015



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Abstract

The origin and consequences of the financial crisis bursting in the summer of 2007 accentuate the concerns regarding the impacts of exposure to property linked assets in the stability of the financial system. In the scope of supervision of insurance companies and pension funds the emphasis lays upon the possible influence of these assets in the perception of such undertakings' financial and solvency positions, and capability to cover liabilities.

This text is the report of a curricular internship developed in the Portuguese Insurance and Pension Funds Supervisory Authority. The underlying study, performed in the Solvency II environment, targets the analysis of property related investments of the supervised entities, aiming to protect policyholders and beneficiaries from the potential impacts of this cyclical market, generator of systemic risk and financial bubbles.

Keywords: *Solvency II, financial stability, property, asset valuation.*

Resumo

A origem e consequências da crise financeira com início no verão de 2007 acentuaram as preocupações relativas aos impactos da exposição a ativos imobiliários na estabilidade do sistema financeiro. No âmbito da supervisão de empresas de seguros e fundos de pensões a ênfase centra-se na possível influência destes ativos na aferição das posições financeira e de solvência, e capacidade de cumprir responsabilidades por parte destas entidades.

Este texto é o relatório de estágio curricular realizado na Autoridade de Supervisão de Seguros e Fundos de Pensões. O estudo subjacente, realizado em ambiente de Solvência II, visa a análise do investimento em ativos imobiliários pelas entidades supervisionadas, para deste modo salvaguardar os tomadores de seguros e beneficiários dos potenciais impactos deste mercado cíclico, gerador de risco sistémico e bolhas financeiras.

Palavras-chave: *Solvência II, estabilidade financeira, imobiliário, valorização de ativos.*

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I am indebted to my supervisors: José Jardim and Hugo Borginho. I really need to thank José, not only for lending me his knowledge, but especially for his permanent availability. I want to mention Hugo for his confidence in me, guidance, and praise him on his ability to lead.

I dedicate not only this work, but this entire journey, to my parents and wife. To the force of nature that is my mom, who never lets me down. To the man of vision that is my father, who steered me in the right direction.

To my wife, who accumulates the position of my best friend and role model. I thank her for the support and belief in me, the maturity and will of accompanying me while taking a step sideways, before moving forward.

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Acronyms and Abbreviations

ALM	Asset-Liability Management
ASF	Portuguese Insurance and Pension Funds Supervisory Authority
BIS	Bank for International Settlements
BOF	Basic Own Funds
CMVM	National Supervisor for Financial Markets
CNSF	National Council of Financial Supervisors
ECB	European Central Bank
EIOPA	European Insurance and Occupational Pensions Authority
EMF	European Mortgage Federation
ESRB	European Systemic Risk Board
EU-28	European Union at 28 member states
GDP	Gross Domestic Product
HPI	House Price Index
IASB	International Accounting Standards Board
IAS	International Accounting Standards
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
INE	National Statistics Institute
IORP	Institution for Occupational Retirement Provision
LoB	Line of Business
NAV	Net Asset Value
REIF	Real Estate Investment Fund
REIT	Real Estate Investment Trust
SCR	Solvency Capital Requirement

1. Introduction

This Actuarial Science Masters Final Work comprises a six-month internship involved in the endeavours of the Risk Analysis and Solvency Department (DRS) of the Portuguese Insurance and Pension Funds Supervisory Authority (ASF), starting at the 2nd March 2015. DRS's mission is to operate under a risk-based perspective, aligned with European Insurance and Occupational Pensions Authority's (EIOPA) developments, actively promoting the solvency, financial soundness and transparency of the insurance and pension funds industry.

This internship offered the possibility of dealing with the challenges headlining the present and shaping the future of the insurance landscape. The highlight goes, logically, to *Solvency II*, a deep and comprehensive risk-based review of the regulatory and supervisory framework that the European (re)insurance companies must fit into, from the 1st January 2016 onwards. Also noteworthy is the exposure to the international developments pursuing the design of a regime with similar purposes to be applied to pension funds, which occurred in the form of a Quantitative Assessment (QA) and a Stress Test at the level of Institutions for Occupational Retirement Provisions (IORPs). These two experiences complement each other adequately, since while *Solvency II* is soon to be in force, the equivalent regime for pension funds is still utterly open to assessment and reshaping, providing exposure to two outcome-equivalent regimes to be applicable to two key functional areas of an actuary, but at dissimilar points of maturation. Finally, the participation in the drafting of the annual report of insurance and pension funds activity, which is very helpful to take the pulse of the Portuguese market.

A particular subject of relevance consists of taking as starting point the information and concerns of ASF, which are shared by the National Council of Financial Supervisors (CNSF), the European Systemic Risk Board (ESRB) and EIOPA, in the matter of repercussions of property exposure in the financial and solvency position of insurers and pension funds. Exposure may assume two typologies: direct exposure from owning immovable properties, and indirect which corresponded to underwriting of Real Estate Investment Funds' (REIFs) units.

In order to introduce the theme properly, it is essential to apprehend the influence of real estate linked investment in the shape of the financial system, due to the financial, economic and social impact it holds. It is also useful to distinguish real estate in two different perspectives: the underlying good alongside with the industrial process to produce and maintain it, from its price dynamics and consequences, role as an investment, an asset or a motivation to financial instruments.

From the first point of view, production techniques are developed and costs standardized, with efficient project management being the challenge. Regarding conservation, a predictive approach outperforms a merely reactive one, being more efficient and affordable, with costs estimated from the outset. The hold/usage expenses are acceptably manageable, except for taxes, which may change unilaterally.

So it is essentially in its dimension as a financial resource that property assets may become problematic, with the credit fed supply and demand spreading highly correlated default exposure, as financial institutions keep relevant portions of their portfolios as property related, since it should cover for a certain amount in liabilities in the case of insurance companies, and it is taken as an asset by pension funds. The variation of real estate prices affects the consumer's wealth and eventually his confidence and investment attitude, conditions the sustainability of the construction industry and with it its role in the economy, and impacts the financial sector by exposing it to credit risk. Hence real estate property plays a key financial role, with potential systemic and pro-cyclical effects.

The property market displays cyclicity, with an upwards phase where credit underwriting is of easier access and more affordable, leveraging the demand and with it the prices, inflating speculative bubbles. During the downwards phase of the cycle, credit risk aversion increases, the credit access is constrained, prices drop due to lesser demand, hitting the resilience of the financial institutions involved and economy as a whole. Severe as the consequences of the burst of such bubbles are, the frenzy of the expansionary phase of the cycle still originates recurrence of the bubble state.

Furthermore the connection of property to "originate to distribute" financial techniques, issuing loans to financially engineer it in tranches and sell to investors, disseminating vastly the ramifications of default scenarios through secondary mortgage markets. Structured financial products involving pooling of credits are extremely dependent on the default correlation between the underlying assets. By pooling mortgage credits, it allows the tendency for different borrowers to default simultaneously, especially as the so called "normal correlations" increase under stressed market conditions, an effect that *Solvency II* alerts for. Such approach, alongside with other securitization processes, give rise to a second layer of the potential effects of real estate in the financial environment, even more complex and unpredictable. In the American case, securities backed by subprime mortgages accounted for only around 3% of the United

States' (US) financial assets, but infected the whole country and global banking systems. Tranches from such products were rated as bonds, implying that the probability of experiencing a loss was the same than in an equally rated bond. Banks were avid clients of such tranches, targeting *regulatory arbitrage*, as the corresponding regulatory capital required was significantly lower than if holding the mortgages directly, and insurance companies, as the giant AIG, faced massive losses by issuing policies covering against losses in such products. In Portugal, mortgage loans securitisation funds ascended up to EUR35.000 million by 2009, dropping to less than 1/3 in mid-2013¹.

Property market developments have potential to damage the entire financial system, as it was the case for the recent global financial crisis triggered by the subprime segment of mortgage loans, with origin in the US but quickly spreading globally. Real estate bubbles also occurred in the UK (mostly London), Ireland, Spain or Iceland, to quote a few cases.

Monitoring this market is thus indispensable to prevent bubbles that may affect financial stability. A few examples of latent signals of property related crisis are an expansion of the gap between issued credit and GDP, total credit growth², the landscape of credit conditions stimulating credit issuance, a risk tolerant and market aggressive attitude of credit institutions, elevated *mortgage debt/total household debt* ratio, enlarged representativeness of construction in GDP, alongside with steep increase of property prices.

For the same line of reasons it is important, within the scope of ASF, to deepen the analysis on the exposure of the supervised entities to property, realizing how it evolved through time, especially under financial crisis stressed conditions, how it may influence their solvency position and ability to meet liabilities, contingently upon how accurately and opportunely value adjustments occur.

The agenda includes an overview of the Portuguese property market, at chapter 2, with special focus on the developments between 2010 and 2014, a period accounting, concurrently, for a financial crises and a depressed phase of the real estate cycle. In the third chapter the emphasis will be on the real estate linked investments of insurers and pension funds. Chapter 4 focuses on risks, providing an outlook of the ones incurred due to property exposure. For insurers the context will be linked to *Solvency II* in the form of Solvency Capital Requirements (SCR) arising from property exposure. To attain similar insight for pension funds, the shocks established by the QA of IORPs to the submodule of property risk will be used. Still in the fourth chapter will be analysed the impact of property exposure in Asset-Liability Management (ALM), given the nature of liabilities. Chapter 5 focuses on the valuation process, aiming to connect methodologies to the developments verified in the supervised entities' exposures. The final chapter is set for conclusions.

¹ CMVM data.

² May be detailed to the level of non-financial corporations and households.

2. The Portuguese real estate market

2.1. The immovable property market

The Portuguese market endured a significant hit with the financial crisis and the bailout program. It was registered a severe decrease of real estate investment, both residential and other, with fewer issued construction licenses and concluded undertakings.

From 2007/08 to 2012/13 the residential construction investment has fallen more than 50%, as house prices fell more than 10%³. The evolution of residential property market is linked to the banking availability to leverage it; across this period banks faced liquidity constraints and aversion towards credit default exposure. According to European Central Bank (ECB) and European Mortgage Federation (EMF), in 2013 the residential mortgage debt represented 64% of the Portuguese GDP.

Conditions to credit concession were tightened and the average bank valuation decreased⁴, which is connected with additional prudence from the banking industry with respect to default scenarios, and potentially with the uncertainty component of risk in the valuation. Coincidentally the average *Loan-To-Value ratio*⁵ for residential mortgage loans dropped five percentage points between 2007 and 2013 (64% in the latter). Such chain of reactions, justified by the amount of credit default at stake, produced pro-cyclical effects. The credit risk premium of banks (spreads) overpowered the *EURIBOR*, commanding the trend of interest rates. Both pre-crisis and afterwards the prevailing typology of interest rate is variable, and it will remain as such, since more than 90% of new loans are issued attached to variable interest rates⁶. The typical mortgage maturity was evaluated in 2013 at 29 years, a top tier value at the European level, signalling that the wealth of Portuguese households is conditioned for long-term, due to home acquisition.

³ Source: Eurostat.

⁴ Source: INE.

⁵ LTV ratio = Mortgage amount / Appraised property value.

⁶ Source: ECB and National sources.

The residential market accumulated the most significant burden at mid-2013, slightly recovering since⁷. Worth mentioning, to analyse possible effects in the renting market, that the ratio between purchase and renting costs has fallen below 1 in late pre-crisis and remained in a descending tendency⁸. After aggregating the quoted shocks, the number of houses per head still displays a growing trajectory, unchanged by the financial crisis.

Office property market was also impacted by the descending phase of the cycle, hitting in 2013 historical minimums in the levels of demand and absorption. This segment is intimately linked to the corporate landscape, which tends to display lower confidence through severely depressed periods of economy, consequently the market value of such properties dropped as well, since the yields conveyed are significantly lower than in 2010. The exposed facts, alongside with favourable developments registered in 2014 on most office property market indexes⁹ (e.g. number of transactions, average transacted area, vacancy rates) suggest that, throughout this period, the evolution of office real estate is considerably correlated to residential, both being proportional to the shape of economy and the financial system.

The financial crisis severely impacted consumption, hence the retail property market as well. For the most part of this period the offer was barely expanded, as the already vast market and depressed consumption levels advised against financing, or investing in, such undertakings. Again, the second half of 2013 displayed market recovery¹⁰, similarly to the residential and office segments.

Anti-cyclically were implemented measures targeting foreign investment, as the attribution of *golden visas* in exchange of purchasing a property priced above half a million euros. This approach provided a considerable boost during the year of 2013, via the high-end market¹¹. The Portuguese market benefits from foreign attraction towards southern Europe spreading beyond Spain. Despite the constraints of fiscal incentives arising from home purchase and the growth of municipal property taxes endured by Portuguese households, still national property taxes revenue (1.5% of GDP in 2012) is below the average for EU-28 (2.3%¹² for the homologous period), reinforcing the perception of the country as an attractive property investment location. Investors' confidence has also strengthened due to the exit clean from the EUR78.000 million EU/IMF bailout and the forecast of 1.5% growth in GDP for 2015. Still some investors point the limited number of assets that can earn top return as the concern¹³.

⁷ Eurostat, BIS, National sources.

⁸ Ratio between the expenses, for a similar property and equal period of time, arising from acquisition or rental.

⁹ Source: *Jones Lang LaSalle (JLL)* report on Portuguese real estate market (2014).

¹⁰ Source: *JLL*.

¹¹ Source: Banco de Portugal on direct foreign investment in Portuguese real estate.

¹² Source: Eurostat.

¹³ Source: *Emerging Trends in Real Estate® Europe 2015*.

2.2. The Real Estate Investment Funds market

Portuguese REIFs¹⁴ became an investment alternative in 1985, but the market only matured when Portugal joined the Euro zone, as the elimination of currency risk with respect to most European countries contributed to the attraction of foreign investors. The market expanded until 2010, wavering since then at around EUR12.000 million in total *Net Asset Value* (NAV)¹⁵ and 250 funds.

The total number of participants, which tended to revert to a mean of 120.000 participants since 2005, reached a maximum at mid-2010, slightly above 133.000 participants, decreasing 50% in the subsequent three-year period. The steep fall may be explained by the scarcity of attractive returns, while liquidity needs may also have forced some participants to drop their units. Although the number of participants registered such severe decline, the REIF market totals for NAV and number of funds did not endure a proportional hit, which is significantly due to the expansion of REIF investments by insurers, specially the Life sector.

The dominant types of property usage in REIFs' asset portfolios are services (EUR4.000 million) and commerce (EUR2.500 million), both in slightly decreasing amounts since 2010. There is stronger investment in housing (EUR1.500 million by the end of 2012) and industry usage, as funds seem to promote diversification in this matter¹⁶. Since REIFs must keep real estate related investments as their core, such measures promote diversification. It is, nonetheless, a field of business where correlations tend to be significant, an effect hardly diversifiable under this framework, as shown in section 2.1, with properties from different segments declining in value throughout the crisis, and also by recalling the difficulties of REIFs to obtain attractive results after the burst of the crisis.

In 2015 the REIFs operating under national jurisdiction are programmed to be exempt of taxation on most returns, with taxes only applying at the level of fund unit holders, at the cashing-in of returns.

¹⁴ In this work the term Real Estate Investment Funds will be used, simplified as REIFs, since it corresponds to CMVM's English translation for "Fundos de Investimento Imobiliário". This has been the vehicle available in Portugal for indirect exposure to real estate throughout the period of analysis. Useful to bear in mind, though, that Portuguese legislators have been working on the introduction of a distinct vehicle of investment in real estate assets, the Real Estate Investment Trusts (REITs), in Portuguese "Sociedades de Investimento em Património Imobiliário". This investment vehicle was originally introduced in 1960 by the American Congress, and already exists in the major European legal systems. REITs have historically been particularly important to attract capital to real estate investment, due to its particularly favorable fiscal regime.

¹⁵ Throughout the period of analysis, NAV remained above EUR12.000 million the majority of the time. From 2011 onwards there have been periods of sustained decrease, but at the end of 2013 a combined value of EUR13.000 million was exceeded. In early 2014 is recorded a steep decrease.

¹⁶ From CMVM data.

3. The real estate exposure of insurance companies and pension funds

3.1. The dataset

The analysis heading this chapter is based on the dataset assembled as ASF requested from the supervised undertakings information concerning their real estate investment positions as at 31st December of years 2010 to 2014. The set of assumptions established to deal with sources of noise in the data regarding the direct exposure is enclosed in appendix A1.

3.2. Direct exposure of the supervised undertakings

In this subsection, a brief description of the industry's property portfolio is performed, and then the evolution of the exposure and embedded prudency is evaluated within our timeframe. Monetary values are expressed in **millions of euros**, unless stated otherwise.

3.2.1 The property portfolio of the insurance industry

For decades the insurance industry has been developing a real estate patrimony that fulfills investment, marketability and operational purposes. Taking as reference values in force at the end of 2014, around half of property patrimony entered portfolios before 1990. Mainly, insurance companies hold Income Property, *i.e.* yield producing property assets (the representativeness of properties for own use is around one third, using as reference the held properties, and respective values in force, at the end of 2014). The directly held properties are mostly allocated to commercial¹⁷/offices purposes.

Direct exposure applies mainly to the Non-Life sector, and so will do the subsequent analysis and concerns, as its direct exposure is around seven times the homologous for Life¹⁸.

¹⁷ Generic label for property meant for the practice of commercial activities. Often literature links "commercial real estate" to income production purposes, regardless of use.

¹⁸ Source: ASF data.

3.2.2. The property portfolio of the pension funds sector

Pension funds currently display considerably heavier direct real estate exposure than insurers; however such patrimony entered the portfolios much later. Taking values in force at 2014, more than 80% of such value entered portfolios already during the 21st century. Recalling that pension funds are often connected to other financial institutions, such evolution should be linked to the perception that, due to the long-term horizon of pension funds liabilities, the lack of liquidity arising from property exposure is more suitable to be allocated to their portfolios. The properties detained by pension funds are mostly destined to office usage.

3.2.3. Geographical and seismic distribution of the supervised entities' properties

Within the period of analysis, the properties detained are located in national territory. There is a predominance of properties located in the district of Lisboa, accompanied by an unbalanced distribution leaning towards the coast side of the country. For insurers, the district of Évora emerges as a noteworthy outlier, contradicting the reigning trend. Broadly, the islands tend to rank between the districts from the coast side and the ones from the interior.

Using as reference the property portfolios and values in force at the end of 2014, the following distributions are obtained. For each district or seismic zone¹⁹, the first value is meant for insurers whereas the second is for pension funds.

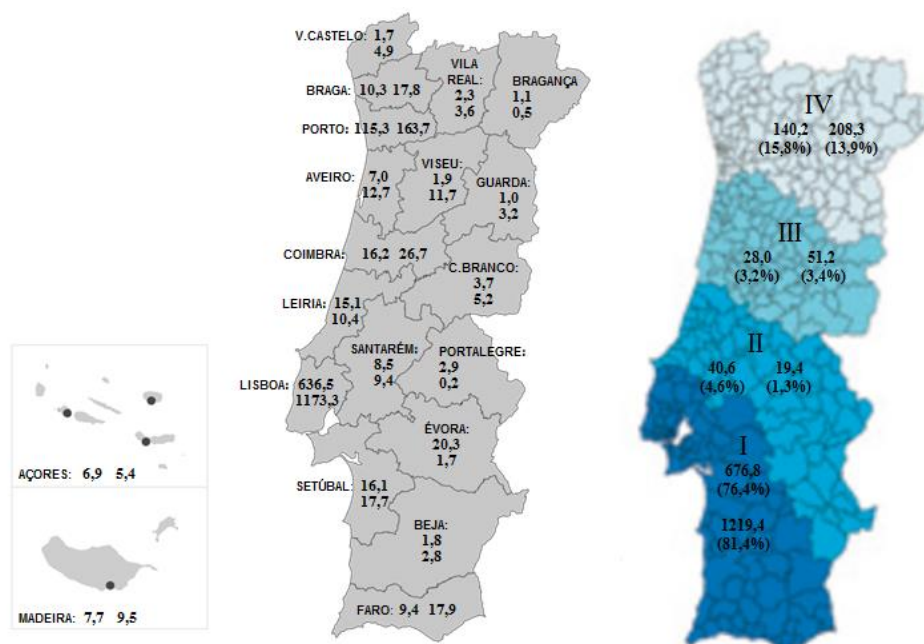


Figure 1: Geographical and seismic distribution (EUR millions) of the properties detained by the supervised insurers and pension funds²⁰.

¹⁹ Basis: ASF seismic zones (Zone I corresponds to most intense seismic activity, Zone IV to fewest). (Açores: zone I, Madeira: zone IV)

²⁰ Note: The islands are represented in different scales.

3.2.4. Evolution of the direct exposure of insurers

From 31/12/2010 to 31/12/2014, the direct exposure of insurers suffered a total 14% reduction, due to property portfolio entrances/exits²¹ and value variation of properties re-assessed meanwhile. One will pursue more granular detail on this regard, since it is entirely different if the reduction in value of property assets derives mostly from willingly unload properties (*i.e.* exits overwhelming entrances), or mostly from decrease in asset value motivated by the valuation process. Using the dataset to deepen such conclusions, by isolating effects, it is observable that the valuation effect overpowered the entrances/exits contribution, commanding a trend of decline in property asset value as new appraisals took place.

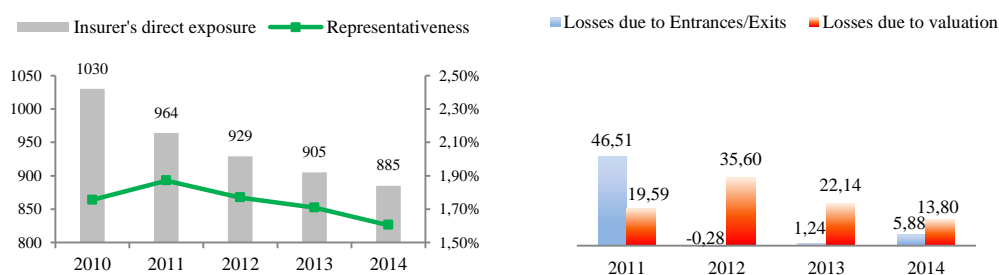


Figure 2: Evolution of insurer's direct exposure and effects generating the losses (EUR millions).

The outlier is the amount in exits during 2011, justified by a particularly significant selling attitude of one insurer. But 2012, 2013, and even 2014, confirm 2011 as exception, since for 2012/13 virtually no impact arises from entrances/exits, but updated valuations generate dozens of millions in property value decrease. So, isolating the individual effect of one company in 2011, insurers seem to have interpreted that throughout financial turbulent times, and a depressed phase of the property market, it would be preferable to adopt a holding posture, rather than unload assets while worth bottom tier value.

Concurrently acquisitions occurred, generating that, from 2012 to 2014, the effect of property entrances/exits from portfolios did not caused a yearly decrease of exposure surpassing 1%.

3.2.5. Evolution of the direct exposure of pension funds

The direct exposure of pension funds endured a decline, mostly due to the valuation process.

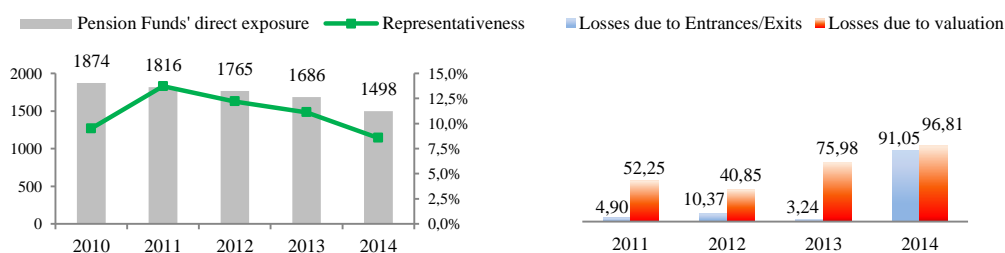


Figure 3: Evolution of pension funds' direct exposure and effects generating the losses (EUR millions).

²¹ Entrances/Exits nomenclature favors coherence. Entrances are equivalent to acquisitions, since a purchased property enters portfolio at the acquisition value until further valuation. However the exits differ from the sales: once a property is sold there is the theoretical value that exits portfolio (valuation in force) and the effective amount the sale occurs at.

Again there is an outlier related with the level of exits, in this case at 2014, leveraged by the selling emphasis of two pension fund management companies. For the remaining period, entrances/exits produced a yearly reduction of exposure inferior to 1%, thus pension funds did not interpret this depressed period as suitable for property unloading.

3.2.6. Insurers: valuation prudence and fitting in real estate indexes

Prior analysis confirmed that throughout this period insurer's properties devaluated and were mostly kept in the portfolios. Hence the point will precisely be if the held properties had its value readjusted coherently, or prudently, to the market²², to detect possible asset overvaluation, *i.e.* artificial technical provisions coverage and protection of policyholders/beneficiaries.

To reach for such conclusions two complementary analyses will be performed: the comparison to a market index that should work as a benchmark, and the losses, or surpluses, generated as held properties were sold.

For market fitting, the choice fell on the *House Price Index (HPI)*²³. HPI expresses prices with reference to their average value in 2010 (2010=100), and is proportional to the effect that real estate causes in the economy and the financial system, as it is extremely broad by being linked to dimension of property that is more extensible to all citizens: housing purposes.

It is coherent in first degree to economic principles, as it is obtained from the quoted price in active market for that specific asset, thus extremely reactive. Evidently the range of properties used as data to HPI production does not match the segments mostly sought-after by insurers, but one should retrieve that the focus is upon financial impact of real estate, rather than property features. Furthermore, as described in section 2.1, during the period of analysis the residential, office and retail segments registered analogous developments²⁴, and recall 2.2, where is stated that REIFs could hardly obtain attractive returns despite promoting property usage diversification, proving that developments in these segments are not far apart.

In order to proceed with index fitting, the gathered values from property investment positions of insurers were treated in such a way that could make them classifiable into the index's concept, *i.e.* were empirically expressed with reference to the respective value at 2010. Some assumptions were required, alongside with simple calculations; both are set in the appendix A2, alongside with extra commentaries on HPI.

Through a broad indicator of the Portuguese property market evolution, one can witness that prices took a considerable hit throughout this period. The quarterly HPI series (see appendix A2) shows that the hardest fall occurred at the second quarter of 2013, followed by a light

²² Valuations should have a minimum frequency of once every 3 years, and properties worth above EUR7,5 million require two independent valuations, with the lower one standing. It should exist diversification among appraisers.

²³ HPI describes the price developments of all residential properties purchased by households, both newly built and existing, independently of their final use and independently of their previous owners. The Member States' HPIs are compiled by the National Statistical Institutes while the euro area and the EU aggregate HPIs are compiled by Eurostat.

Sources: National sources, BIS Residential Property Price database, <http://www.bis.org/statistics/pp.htm>

²⁴ Corroborated by Gyourko (2009).

recovery, still at the end of 2014 there is approximately a 10% loss when comparing to the reference of 2010=100.

Let us now analyze the evolution of our empirical values obtained for insurers:

Scenario:	2011	2012	2013	2014	Correlation with HPI
HPI ²⁵	91.51	87.75	88.39	90.34	-
A	97,88	94,36	91,95	90,46	0,3953
B	98,62	95,06	92,82	91,45	0,4162
C	98,83	95,47	93,90	92,92	0,4824
D	99,33	94,00	90,34	88,46	0,4172
E	97,07	94,15	90,06	87,37	0,2228

- A Excluding the properties for which assumptions were required to register either the sale price or appraisal values (common to all scenarios). Allowance for the presence of outliers.
- B Removal of outliers, by considering as an outlier any property which during the period was valued at more than 200%, or less than 50%, of the reference level.
- C Removal of outliers and only properties located in Lisboa.
- D Removal of outliers and only properties located in Porto.
- E Removal outliers and only properties located neither in Lisboa nor Porto.

Table 1: Empirical values for the insurance sector.

It is observable that the evolution of insurer's property values recognizes the occurrence of a downwards phase of the market. Notwithstanding, such appraisals took a considerable delay in reflecting the pace, and even the trend, of such developments, since while the market steeply fell in 2011, accumulating up to the harshest hit at 2012/2013, and lightly recovered since, insurer's properties remain on descending trajectory still not touching the minimums the market verified two years ago. By the end of 2014, while the market is recovering and appraisals react with inertia, insurers' property values are closer to the index than ever before, within this interval. Since this matching occurs while market and insures evolve on opposite trajectories, and the correlation between both is positive but lower than 0,5, it should be prudently considered that such circumstance may not be a solid symptom of reinforced accuracy on valuations.

The removal of outliers enabled to conclude that their presence functioned as prudency add-on, pulling the insurer's value nearer to the market's (also correlation increases slightly from 0,3953 to 0,4162). But since the criteria for outlier label was quite bland, given how short the period of analysis is, it seems fair to consider that outlier removal is an enhancement to the sample.

For extra detail, geographical segregation was tested, showing that properties in Lisboa were considered to have retained value better than the remaining. Since the reference index does not

²⁵ Values selected from the HPI quarterly series for Portugal. For each year it was only selected the value for the fourth quarter, due to comparability reasons, since in the data collection implemented by ASF the yearly property investment position is for the 31st of December.

provide information detailed up to geographical level, no further conclusions can be added on this regard.

It is also useful to reproduce the same empirical reasoning using the sub-sample of properties sold throughout this period, by expressing their sale amount in function of their worth in 2010, and compare the outcome with both HPI and the evolution of insurer's property values:

Empirical values:	2011	2012	2013	2014
Sales	84,74	75,93	68,15	83,46
Sales vs. HPI	-6,77	-11,92	-20,24	-6,88
Sales vs. Scenario B	-13,88	-19,13	-24,67	-7,99

Table 2: Insurers: Empirical values for sales.

As aforementioned, insurers did not display consolidated eagerness of unloading properties during this period, so the sub-sample for sales is not vast, especially as it is split yearly. The upside, though, is that sales may then be taken as performed by a willing, but not desperate, seller, hence their respective values are legitimate to analyze under market logic. By doing so, disturbing results are verified, as effective transactions occur at a shortfall hardly accounted for by the pace insurers adjust valuations. Additionally, HPI was a far better estimate of what to expect when insurer's properties hit the market, rather than their own valuations. In the previous table is shown that the discrepancies between real values for insurers (*i.e.* effective sales) vs. theoretical values for insurers (*i.e.* appraisals in force by the time of sale) are much greater than the ones between effective sales vs. the generic HPI.

For the sake of intellectual honesty, it should be mentioned that part of these deviations certainly arise from the fact that while the official HPI is computed with reference to effective sales in 2010 (therefore reflecting 100% of the shock suffered by the market up to that point), the empirical values for insurers were obtained with reference to the valuations in force at 31st December 2010, which were not already capturing all the burden endured by the market until then, dragging artificially to the period of analysis some inaccuracies²⁶ whose inception actually occurs between 2008 and 2010, at the earlier stages of the crisis. Other criticism that may be pointed out is that while HPI only incorporates *prices*, the empirical analysis performed above uses *values* as reference but also uses *prices*. Although from a purist's point of view such mix is undesirable, *value* should function as an unbiased estimator of *price*, and especially as we link the issue to real estate, a seller expects to sell a property by an amount similar to the valuation in force, because under the interpretation of absence of material changes in value, therefore no need for updated valuation, *value* is not supposed to be an inflated forecast of *price*²⁷.

²⁶ Note that if the values in force at 31.12.2010 were already more accurate (lower) the perception of downwards adjustment in the following years could be even smaller.

²⁷ Conceptual differences settled by *International Financial Reporting Standards* (IFRS) between value and price can be found later.

Still it is a matter of deep concern that when properties from insurers' portfolios hit the market, the amounts yielded by the transactions are better predicted by an arguably too generic property index, than by the valuations in force, which are supposed to be calibrated to each individual property.

Complementarily, one can affirm that through this period insurers took to the market a set of properties²⁸ whose valuations programmed cashing-in a total of EUR55,8 million, but yielded just EUR46,1 million, thus generating a EUR9,7 million loss. This shortfall corresponds to about 17,4% of the total estimated worth, sustaining that properties have been overvalued or market decay poorly reflected. In the appendix A3 there are further references for this analysis.

3.2.7. Pension funds: valuation prudence and fitting in real estate indexes

Once more, the focus is to comprehend if the decrease in property value is market coherent, or prudent, and to attain comparability between pension funds and insurers as well, will be applied an equivalent empirical reasoning:

	2011	2012	2013	2014	Correlation ²⁹ :
Empirical values for pension funds	96,89	94,80	90,28	87,20	1
Empirical values for insurers (B)	98,62	95,06	92,82	91,45	0,9555
HPI index	91,51	87,85	88,39	90,34	0,1368

Table 3: Empirical values for pension funds.

Pension funds display a superior level of prudence, despite the lower correlation with HPI of such empirical values than the homologous for insurers. The empirical values for pension funds and insurers display almost a perfect correlation, suggesting that both industries reveal a degree of delay to reflect in their direct exposure the developments of property market.

Extending such logic to sold properties, summarized in the following table, in 2011/12 pension funds performed selling deals with very low decrease in value with reference to 2010. During 2013 the value decrease was larger, but the retained worth of the sub-sample of sold properties still outperformed HPI. In 2014 losses occurred, as sale values were underwhelming given both the estimate of current worth by the appraisal in force, and the decrease in value, with respect to 2010, predicted by HPI. This should be, at least partially, connected with the unusual selling appetite of two pension funds affecting regular market logic.

Empirical values:	2011	2012	2013	2014
Sales	98,08	98,76	91,04	78,59
Sales vs. HPI	6,57	10,91	2,65	-11,75
Sales vs. Pension Funds' values	1,19	3,96	0,76	-8,61

Table 4: Pension Funds: Empirical values for sales.

²⁸ Subsample of outflowing properties for which no assumptions were required (71% representativeness, in value, of the set of properties exiting portfolios).

²⁹ Correlations with the empirical values for pension funds.

The positive differences in *Sales vs. HPI* and *Sales vs. Pension Fund's values* do not mean that pension funds were undervaluing properties at some point. Given the differences in sample size, such conclusions are not plausible to extrapolate to the whole property portfolio, also because throughout this period pension funds sold a set of properties valued at a total of EUR177,9 million, cashing-in a total of EUR159,1 million, thus experiencing a negative surplus of EUR18,8 million, *i.e.* a 10,6% loss. Definitely worth reference that above 90% of the EUR18⁺ million losses took place within 2014, which was a particular sub-interval due to the quoted reasons. Isolating such contribution proves that superior appraisal prudence results in greater matching between expected worth and actual worth once property assets are cashed-in.

Additionally, pension funds are likely to have finished 2010 with property values more in line with the market than insurers, enabling that although posterior decreasing adjustments are not as significant as HPI, losses arising from sales are lower (10,6% *vs.* 17,4%).

It was expectable that pension funds would display superior prudence on property values, given the features of the respective liabilities, which put less immediate pressure on asset valuation.

3.3. Indirect exposure of the supervised undertakings

Subscribing REIFs allows for distancing from management, operation, depreciation dynamics of the good itself, or conservation, in favor of a strictly yield oriented *equity approach*. That preference was expectable, as most corporates opt for subcontracting such services, rather than dealing directly with it.

Hence, given the investment nature of the insurance or pension business, linking the involvement in property markets to a *holding investment units* perspective is relatively natural. It enables to interpret property assets as purely financial securities, to monitor returns simply through the value of the REIF's unit, and dividends potentially paid, while cutting on valuation expenses.

Indirect exposure offers a more straightforward way to diversify real estate investment, to invest internationally, or to pursue returns in expansionary markets, through investment vehicles in general subjected to prudential supervision themselves.

3.3.1. Indirect exposure of insurers

The indirect property exposure, unlike direct ownership, is leveraged by the Life sector. The supervised insurers largely favor the underwriting of Portuguese REIFs over foreign, with Life insurers significantly more exposed in either case.

The Life sector more than doubled its indirect exposure, via Portuguese REIFs, within three years, whereas about half of the remaining participants redeemed their respective investments. It is critical to bear in mind that this behavior is not transversal; instead it was leveraged by the investments performed by a specific insurance company operating in the Life segment.

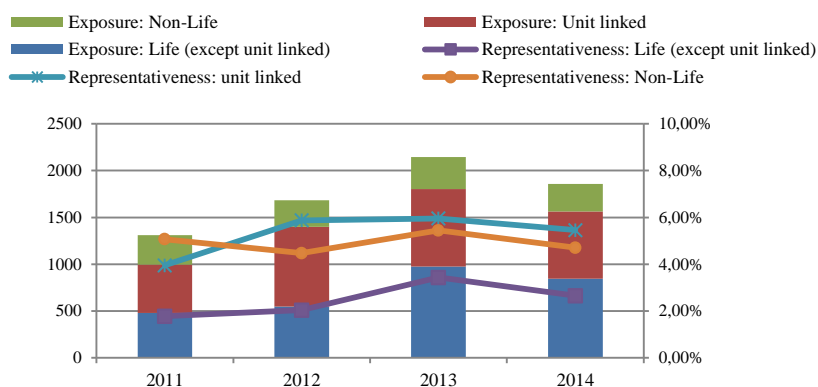


Figure 4: Indirect exposure in the insurance industry (EUR millions).

Although the quoted REIFs' redemptions may have been inevitable due to liquidity reasons, or actually meant as a shift of investment direction motivated by skepticism about real estate returns, still the Life sector became considerably more exposed to a segment that one in every two investors was leaving. This expansion of exposure is, nonetheless, concentrated on a single Life insurer, and via REIFs related to the same economic group.

Given the scale of the Life sector investment, the Non-Life plays a diminished role in terms of global indirect exposure, as underwriting, redemptions and oscillations in the REIFs' unit value combine for a relatively unchanged level of exposure. It is worth mentioning that the Non-Life's course of actions is far from neutral: the number of units held in 2013 more than doubles the number of units held in 2010 (whereas in 2012 it was lower). Such variations may be interpreted as the Non-Life sector strategically pursuing reinforcement/releasing of indirect property investment, contingent upon unit value evolution. The total level of investment remains stable, because the average value of the REIF unit held in 2013 dropped to less than half of the correspondent in 2010, neutralizing the potential effect in indirect exposure of the reinforced underwriting.

3.3.2. Indirect exposure of pension funds

Pension funds launched the period of analysis with vaster indirect exposure than insurers, the situation was reversed due to the increased underwriting performed by the Life sector.

In terms of number of units, is observed significant subscription of foreign REIFs, deriving almost uniquely from the investment activity of a specific pension fund management company. Nevertheless, national REIFs represent the vast majority of the financial indirect exposure.

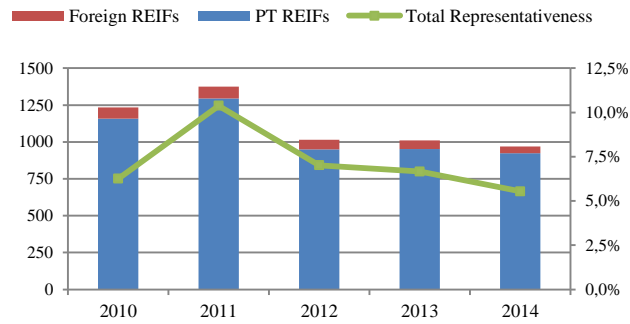


Figure 5: Indirect exposure of pension funds.

At the beginning of the period of analysis occurred a reinforcement of underwriting, followed by a considerable number of redemptions in 2012. Since then, the level of attraction towards REIFs (*i.e.* number of subscribed fund units) remained stable, with the level of tied-up capital evolving accordingly. The almost perfectly negative correlation between subscription of units and average value of the unit held (-0,9754), suggests a common embedded strategy of subscription at lower tier value, to redeem at higher tier one.

4. Outlook of the supervised insurers and pension funds exposure to property

This chapter presents the overview of property exposure (4.1), followed by the respective risk analysis (4.2) and solvency impact (4.3 and 4.4). In subsection 4.5, the ALM role of property assets is discussed, given the nature of liabilities.

4.1. Overview of property exposure

Throughout this period, the total property investment of insurers surpassed the homologous for pension funds, despite the almost EUR1.000 million gap registered initially. This reversion is mostly justified by the growth of indirect exposure of the Life sector, notwithstanding the particularity mentioned in the section 3.3.1.

For insurers, the direct and indirect exposures were strongly negatively correlated (-0,8955), as the Life sector's exposure to REIFs expanded while Non-Life lost value in held properties. Concurrently, for pension funds, both exposures were considerably positively correlated (0,7250).

All supervised undertakings lost value on direct property ownership, despite acknowledging it differently on their asset portfolio re-valuation. Non-Life and pension funds treat REIF units exactly as shares, with an embedded strategy of purchasing at lower value and redeeming at a higher one, operating in short cycles.

From the perspective of representativeness per type of exposure, pension funds display heaviest proportions both at direct and indirect exposure. Among insurers, indirect exposure outweighs direct ownership, whereas for pension funds the direct hold of properties occurs in heavier proportion.

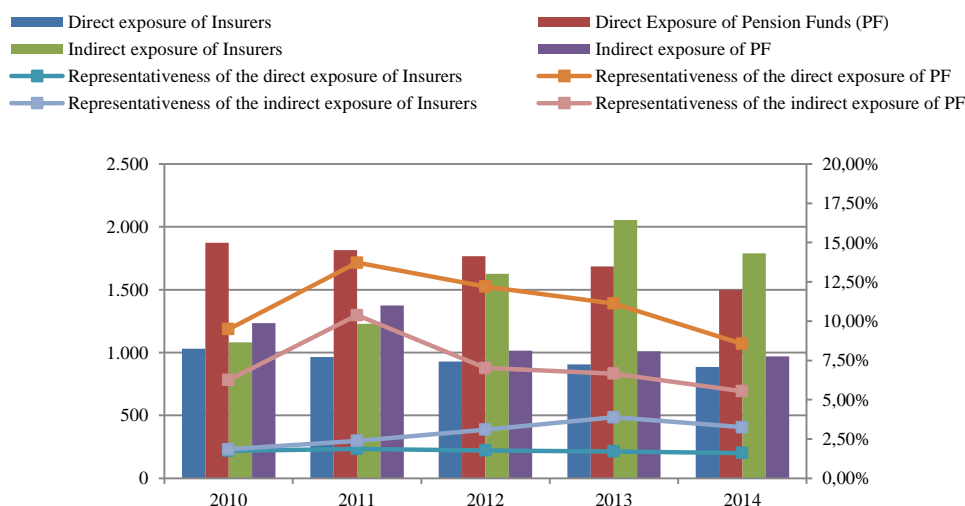


Figure 6: Overview of exposure (EUR millions) and representativeness of property related assets.

4.2. Risks arising from property exposure

By directly owning property, insurance companies and pension funds become exposed to a set of risks debated in this subsection.

Liquidity risk plays a key role, as owned properties are highly illiquid assets, their transactions involve temporal costs and, especially under liquidity pressure, may yield an amount considerably beneath their projected value. There is the strategic risk of investing in a cyclical type of market, recurrently revisiting a depressive state, alongside with speculation risk due to exposure to a market likely to generate *bubble* scenarios, and *diversification risk*, since property market tends to fall as a whole, jeopardizing diversification among the same class of assets. It should also be considered the pro-cyclicality risk, given that when the cycle enters downwards motion then most of the market players³⁰ tend to display extended risk aversion, aggravating the market shape, and *hedging risk*, as there are no matured mechanisms to directly hedge against property-linked losses. The valuation process generates exposure to the systematic, and non-diversifiable, uncertainty component of risk, due to inaccuracies in appraisal models/parameters. Considering that insurers and pension funds invest mostly in income properties, there is exposure to vacancy risk arising from insufficient demand.

The effectiveness of these risks is proved by the scarcity of REIFs attaining attractive returns during depressive phases of the cycle, but may be mitigated for insurers and pension funds purely because, unlike REIFs, property investment is not their core activity, thus the exposure is smaller. Nonetheless, for supervisory reasons it is important to be aware of these risks, because exposure to cyclical and speculative markets for which the typical risk mitigation techniques are

³⁰ Particularly credit institutions, which leverage the market while exposing themselves to default risk.

hardly feasible, and where liquidity is constrained, may ultimately affect policyholders and beneficiaries.

Then there is catastrophic risk arising from holding immovable goods, which is insurable, legal risk as legislation changes may impact income generating capability or add expenses other than taxes (*e.g.* compulsory energetic certificates for transacted properties, possible shortening of the period among consecutive appraisals), and tax risks as property taxes are a vehicle to increase sovereign or municipal income. It should also be mentioned the depreciation risk from holding an asset that, by nature, endures physical wear down and becomes economic and functional obsolete at a pace linked to conservation, and conservation risk itself, from exposure to the interconnectedness between the deferment of the property's obsolescence, its lifespan and net income generating capability. Operational risk may be included, in a broad manner.

For the indirect exposure, the risks quoted in the immediately previous paragraph will only apply in a collateral form, with potential impact in the value of the REIF unit. The remaining risks are however applicable to indirect exposure, with exception of liquidity issues, which may be assuaged.

4.3. Framing property exposure into Solvency II

For the case of insurers, property exposure will be linked to the regulatory capital charges specified by *Solvency II*, which are meant to be proportional to risk exposure and reflect the change in the excess of assets over liabilities, from normal conditions to after-shock ones. The shocks are designed to portray an unfavourable development in a type of risk, impacting the value of assets and liabilities exposed to it. The submodules that must be taken in account both belong to the module of market risk, and are property risk (subsection 4.3.1) and concentration risk in case of immovable properties (4.3.2), if applicable.

4.3.1. Mkt_{prop} : property risk capital charge

Property risk arises from the sensitivity of assets, liabilities and financial investments to the level or volatility of property market prices. The SCR for property risk (Mkt_{prop}) is obtained as:

$$Mkt_{prop} = \text{Max} (\Delta BOF \mid \text{propertyShock}; 0)$$

with: $BOF = \text{Net value of assets} - \text{Liabilities}$

The property shock is the immediate effect on the net value of assets and liabilities in the occurrence of an instantaneous decrease of 25% in the value of investments in immovable properties, taking in account all the direct and indirect exposures to property prices³¹.

³¹ The scenario should be set without taking in account the loss absorbing capacity of technical provisions (TP), *i.e.* the change in the value of TP due to benefits is somewhat conditional or discretionary. When one accounts for it, obtains $nMkt_{prop}$, the capital requirement including the loss absorbing capacity of TP.

For the supervised insurers, the Mkt_{prop} for each exercise year may be taken as the impact on assets of a 25% loss of value in property, yielding that the market's aggregate values would be:

	Dec-2010	Dec-2011	Dec-2012	Dec-2013	Dec-2014
Mkt_{prop}	541	574	664	778	699

Table 5: Insurers: total capital charges from property risk submodule (EUR millions)³².

To obtain individual company values, the aggregate value would be split between each exposed insurer, proportionally to the weight of its exposure in the total for the industry. For 2014, the capital requirement for this submodule exhibits representativeness of 7,5%, 21,7% and 8,3%, respectively for Life, Non-Life and composites, in the total SCR for the market risk module, before considering diversification benefits.

Quantifying the SCR for property risk stresses the relevancy of this work by displaying the role of Mkt_{prop} in Basic Own Funds (BOF) consumption, although the burden could be assuaged due to diversification effects, as the capital charges for different submodules are combined. It is also a synonym of *Solvency II*'s concerns towards property exposure, the appraisal process, and the perils of targeting *fair values* in the absence of univocal standards.

Up next, are presented statistical tests which enable to argue that, for the national market, the prescribed 25% shock cannot be considered excessive, at least given the evidences unveiled during this period.

First statistical test: Examining the existence of overall bias in the valuation of insurer's directly hold properties.

Previous note:

The following reasoning is inspired by the signs tests lectured in *Actuarial Topics* during the Master, at the time regarding the exam of the existence of overall bias in graduation processes applied to crude mortality rates obtained from mortality studies.

Framework:

Previously it was performed a quantitative analysis centered on the losses/gains arising from relationship between *sale price* and *valuation in force*. Here the scope will be to search for statistical evidence of possible overall bias in the valuation process.

Assumptions:

Firstly, the cases where properties were sold within a 10% deviation (above or below) of their value in force will be considered as accurate. Then it will be searched for statistical evidence of

³² Not taking in account that part of the exposure is allocated to unit-linked portfolios.

global bias for the properties valued inaccurately, which is to say if there is a systematic scenario of overvaluation or undervaluation, given inaccuracy.

There are 61 trials (transactions associated with a deviation superior to 10% of the expected property value). If there is no overall bias in the valuations, then, in case of inaccurate valuation, negative and positive deviations should be equally likely. Hence:

$$P = \text{"number of positive/negative deviations"} \sim \text{Binomial}(61; 0,5)$$

For the *null hypothesis*:

H_0 : Approximately the same number of positive and negative deviations are expected, *i.e.* no systematic bias in the appraisals.

Test:

The observed number of negative deviations (losses) is 42, while the positive (gains) is 19. Using a *p-value* approach, that provides insight about the probability of a scenario equally or more extreme than the one foreseen by the *null*, given the observed evidences:

$$p\text{-value} \cong 2 \times \text{Prob.}(P \leq 19) = 0,0044.$$

Conclusion:

Since the *p-value* is $\ll 5\%$ we find strong statistical evidence to reject the *null*, for such significance level. Thus there is indeed systematic bias in the appraisals, which, linked to previous acknowledgements, leads to the conclusion that overall bias is in favor of overvaluation.

Second statistical test: Proportionality between Solvency II's 25% downwards property shock and the insurance industry appraisal's landscape.

Here will be considered a weaker measure of accuracy, allowing for 20% deviation (for any side) and still take the valuation as accuracy. The sample is reduced to 46 trials.

Such a bland consideration for accuracy aims to analyze if the size of the shock programmed by Solvency II is a proportional protection measure, given the developments in the appraisals requested by insurers. In this case:

$$P = \text{"number of positive/negative deviations"} \sim \text{Binomial}(46; 0,5)$$

Test:

By defining the same *null* than previously, having 31 negative deviations (losses) and 15 positive ones (gains), the *p-value* is:

$$p\text{-value} \cong 2 \times \text{Prob. } (P \leq 15) = 0,0259.$$

Decision:

Since the *p-value* is $< 5\%$ there still is statistical evidence to reject the *null*. Thus there is systematic bias in the appraisals remaining as inaccurate under such weak accuracy criteria.

Conclusion:

If the procedure is repeated while allowing for 25% deviation (again for both sides) as still an accurate valuation, then the *null* can finally be not rejected, for the 5% significance level.

So, considering evidences of the quoted period of time, if there is the need for 25% tolerance as accuracy criteria to not reject the non-existence of overall bias in the valuations, then the size of the property shock established by *Solvency II* does not seem to be disproportionate. In fact, for this period, the 25% programed fluctuation seems to be more within appraisal inaccuracy territory than simulating an objective downwards shock in the value of property investments supposedly kept at *fair value*.

A summary of the latter test:

Keeping the *null* hypothesis, and with:

$$P = \text{"number of positive/negative deviations"} \sim \text{Binomial } (40; 0,5)$$

Were observed 26 negative deviations and 14 positive ones. And:

$$p\text{-value} \cong 2 \times \text{Prob. } (P \leq 14) = 0,0807 > 5\% \Rightarrow \text{Thus do not reject the } \textit{null}.$$

4.3.2. Concentration risk in case of immovable properties

Concentration risk arises from inadequate diversification, generating an excess of volatility that could be otherwise diversified away. In property context, overexposure corresponds to exceed the threshold of a *single property*³³ weighing more than 10% of the company's total assets, whether via direct ownership or indirect exposure.

While for direct ownership it is straightforward, the indirect exposure would formally require a *look through* approach to the subscribed REIFs, to identify the actual assets the underwriter is exposed to. Such analysis enables to fulfil a *Solvency II* principle of *substance over form*, which in this case translates into decomposing indirect exposure into the (mostly) property assets the insurer is exposed to, by investing in each REIF.

³³ Single property defined as properties located in the same building or sufficiently nearby.

Since this work comprehends the whole national insurance market, such analysis is evidently not feasible, and a simplification will be used. One will assume that given the relatively reduced weight of REIFs in each insurer's portfolio, and that investment funds use diversification strategies, no single property exposure arises from REIF underwriting. The assumption that exposure to a single REIF does not generate property overexposure is not problematic, since even in the extreme case of the entire exposure to a REIF corresponding a 100% to a single property, it would still not account for 10% of any company's assets.

The potential issue, though, is the disregard of possible situations where combining indirect exposure and directly held properties, or different underwritten REIFs, could generate *single property* excessive exposure by being exposed to it through different manners.

i. Identification of excessive exposure

Among the 22 insurers reporting directly owned properties, there are two incurring in excessive exposure. Additionally, two out of the remaining 20 verified *single property* exposures near the threshold in certain years. Nevertheless, the majority of insurers are far from such concentration, which provides an extra comfort with respect to the aforementioned simplification, regarding cases of concentration deriving from the aggregation of direct with indirect exposures.

In terms of overexposure arising from the combination of multiple indirect exposures, sustaining the previously enunciated simplification is equivalent to assume that the low representativeness of each individual REIF, alongside with the fact that REIFs are supervised and must use diversification measures, is enough to avoid generation of excessive exposure this way.

ii. Concentration risk capital charge

The capital charge per excessive exposure i is calculated as the product of the excess exposure on a single name exposure (XS_i) and a risk factor g_i . For the case of exposures to a single property shall be assigned a risk factor of 12%.

$$Conc_i = XS_i * g_i$$

The XS_i is here interpreted as the excess of exposure to a single property. It is obtained as:

$$XS_i = \text{Max} (0; E_i - CT_i * Assets)$$

Where E_i denotes the exposure at default to a single name exposure i (here a single property i) that is included in the calculation base of the market risk concentration submodule. CT_i denotes the relative excess exposure threshold, which in the case is, as seen above, of 10%. If XS_i is

positive, then there is indeed a case of overexposure, thus a capital charge. The combined charges arising from concentration risk to immovable properties would be:

Dec-2010	Dec-2011	Dec-2012	Dec-2013	Dec-2014
1,55	1,32	0,91	0,92	1,07

Table 6: Capital charge: concentration risk in case of immovable properties (EUR millions).

The presented aggregate values would be unevenly split between the two insurers incurring in concentration, due to different degrees of excessive exposure.

4.4. Theoretical property capital charges for pension funds

In this section the purpose is to reproduce an equivalent approach to the property exposure of pension funds, using the shocks specified for property risk exposure and concentration risk in case of immovable properties, by the Quantitative Assessment (QA) of IORPs. To these two specific submodules the shocks programmed in the QA are exactly identical to the ones in *Solvency II* for insurers.

4.4.1. Property risk capital charge

According to the technical specifications of the QA, the capital requirement for property risk is determined as the result of the pre-defined scenario of an instantaneous 25% decrease in the total value of property investments.

$$Mkt_{prop} = \text{Max} (\Delta NAV \mid \text{propertyShock}; 0)$$

The application of the described scenario is straightforward that:

	Dec-2010	Dec-2011	Dec-2012	Dec-2013	Dec-2014
Mkt_{prop}	777	798	695	674	617

Table 7: Pension funds: aggregate capital charges from property risk submodule (EUR millions).

4.4.2. Concentration risk in case of immovable properties

Until this point the term mostly used has been *pension funds*, but in this subsection is emphasized that the search for overexposure is performed at the scope of *pension fund managing company*, since it is the level of detail comprehended in the data.

Although there is loss of generality, as may be overlooked situations where overexposure could occur at the pension fund level, despite not occurring at the pension funds management company level, this approach is the one feasible.

Globally, the pension funds sector tends to be closer to the perils of concentration in this context, in comparison to insurers, due to greater *single property* exposure and, in general,

smaller total asset value. Among the 11 pension funds managing companies reporting direct exposure to property, there is one case of single property excessive exposure. Given it occurs at such level, it would certainly occur as well at the level of the particular pension fund the property is allocated to. There are at least two other cases where the level of exposure at management company level is very likely to originate concentration risk at pension fund level. For the first mentioned case, the correspondent theoretical capital charge would be:

Dec-2010	Dec-2011	Dec-2012	Dec-2013	Dec-2014
4,01	5,31	3,01	0,45	0 ³⁴

Table 8: Capital charges at the level of pension funds management companies (EUR millions).

In regard to indirect exposure, there are three pension funds management companies exposed slightly above 10% to a specific REIF. However, the diversification within each REIF erases potential *single property* overexposure via single REIF underwriting.

As mentioned for insurers, the indirect exposure would ideally have required a *look through* approach to identify the effective assets that REIFs invested in. Such vastly increased level of minutiae would enable to track down potential *single property* overexposures arising from combining direct/indirect exposures, or multiple indirect exposures, but would be an excessive burden to apply for the entire market.

4.5. ALM effect of property assets: adequacy to the nature of liabilities

The ALM adequacy of property investments depends upon the level of liquidity and duration of the underlying liabilities, and how relevant lapse risk is., *i.e.* is linked to the risk of a mismatch between assets and liabilities. The liquidity of liabilities corresponds to how likely the generation of instant impactful capital outflow is, therefore demanding quickly callable coverage capability on the asset side.

Direct exposure is highly illiquid, presuming longer-term investment, and liquidation may occur at a deflated value, especially if executed under timing pressure. Indirect exposure is more flexible and redemptions occur at market quoted values.

For the Life sector, liquidity constraints arise mostly from lapse risk or mortality shocks, with some products being more connected to the macroeconomic environment, while others are conditioned by actuarial risks (more likely to be reinsured). There is variability of the market's size, with coverage perceived as an investment and thus linked to the society's capability of building personal savings. In general there is more asset flexibility. The suitability of direct property investment for Life insurers is linked to the prevalent type of payments made

³⁴ No excessive exposure.

(annuities are of low liquidity), and how relevant, stable, and known lapse risk is (for larger portfolios it may be more stabilized). Another important factor is the predictability and stability of the income of new premiums, which work as source of liquidity, and tend to be more volatile if influenced by the liquidity needs of a bank within the same economic group. Keeping a liquidity buffer may be recommended, however there is still some room for investment in more illiquid assets. In Portugal the Life sector visibly prefers to invest in property indirectly.

For Non-Life, coverage is in most cases not optional, and for the lines of business (LoB) of “mass insurance” there tends to exist diversification among the universe of risks, as well as more detailed actuarial data. For smaller portfolios, or LoB prone to the risk of adverse selection, the resulting higher volatility may generate superior liquidity needs. For Non-Life the lapse risk is much less impactful, due to shorter contract maturities and renewal not contingent on the insurer's investment performance (although production is linked to the macroeconomic environment, especially in cases of LoBs as worker's compensation or motor insurance). The use of reinsurance allows for hedging against liquidity peaks. Hence the suitability of directly holding properties depends from the LoB and type of payments to be made (*e.g.*: worker's compensation annuities), but the diminished relevance of lapse risk and the inflow of premiums from mandatory insurance coverage favor such suitability. Underwriting REIFs may be regarded, for ALM purposes and minding prudence, as as adequate as holding equity. The national Non-Life segment has, so far, favored direct property exposure.

For the case of pension funds, liquidity needs are typically minimal and benefits tend to be paid in a very long horizon. The age profile of the participants must be attended, as well as the portability of future benefits, which may impact liquidity. The use of a life-cycle approach will justify progressively lesser property representativeness as the run-off occurs. This sector is the most adequate for direct property investment, as it happens in the Portuguese case, with pension funds displaying the heaviest direct ownership, but the levels of representativeness should be minded.

5. Property appraisal and valuation on the insurance and pension funds industry

Estimating the value of property is important for a variety of endeavours, such as investment decisions³⁵, transactions, financing, taxation, asset valuation, liability coverage capability or property insurance, and thus also relevant for supervising purposes.

5.1. Valuation basics and accepted approaches

As one enters valuation matters, it is relevant to differentiate *value* from *price* from *cost*.

Price is the amount asked, offered or paid in a transaction, it is historical data referring to real transactions.

Cost is related with production, reflecting the expenses of industrial procedures to reproduce or replace.

*Value*³⁶ is an economical concept that refers to the most likely price that seller and buyer will meet at, for a transaction of an available asset at a given date, under a set of circumstances. Property value is created and maintained through the combination of utility to consumers, scarcity/availability of properties, desire and power of acquisition.

Nationally, pension funds and REIFs operate under the framework of *fair value*. For insurers, as well as for banks, should be distinguished the accountancy perspective from the prudential. For accountancy purposes the norms defined by the International Accounting Standards Board (IASB) are in force³⁷, allowing for either *fair value* or *value of cost*. The latter when used towards immovable properties does not favour market awareness, so prudentially, in order to ensure the solvability of financial institutions and the stability of the system, insurance

³⁵ In periods of low interest rates, as it happens currently and may remain for the foreseeable future, investors' concerns about pricing are assuaged if the potential income returns of real estate are seen as attractive when compared to other asset classes

³⁶ There are several notions of value, such as market value, insurable value, investment value, or liquidation value, with market value being however the basis for most real estate valuations.

³⁷ *International Accounting Standards (IAS)* and *International Financial Reporting Standards (IFRS)*.

companies should value all properties in the balance sheet under *fair value*. For the banking industry there is distinction between property assets in the balance sheets from the ones as collateral for issued credits.

The norm IFRS 13, which is mandatory for the EU credit and insurance institutions, defines *fair value* as “the price that would be received to sell an asset, or paid to transfer a liability, in an orderly transaction between market participants at the measurement date”. Hence *fair value* is a market-based approach, rather than an entity-specific measurement.

For non-financial assets, the IFRS 13 also establishes the premise of *highest and best use*, which in the property context can be defined as the most likely usage that is physically possible, appropriately justified, legally allowed, financially executable, and results in the highest value for the property in appraisal.

Valuation should be appropriate to the circumstances, have sufficient available data, maximise the use of observable input and minimising the use of unobservable. For valuation purposes three different approaches are preconized:

- (i) *Market approach*, which uses prices and other relevant information generated by market transactions involving identical or comparable properties;
- (ii) *Income approach*, which converts future cash flows in a single current amount, *i.e.* translates current market expectations of future amounts;
- (iii) *Cost approach*, which reflects the amount currently required to replace the property.

It is important to mention the absence of a single norm internationally accepted for property appraisal, which significantly harms uniformity and comparability across the financial system. The matter generates concern both among the National Council of Financial Supervisors (CNSF) and at the European level as well.

5.2. Appraisal methods: theoretical analysis

In the appendix A4 a previous point regarding the heterogeneity in appraisal terminology is set. Through the data collection, implemented by ASF, the following methods, or combination of methods, were available by default:

Comparative: enables the valuation of the property through comparison³⁸, using transactions or effective proposals placed for properties defined as *comparables*.

The comparison is performed over one or multiple variables taken as explanatory of value. Suitable features of comparison may be: location, economical features, property rights

³⁸ It is not possible to present a closed form for the comparative method, as it may be translated through numerous mathematical forms. *E.g.* linear or multiple regression; factorial analysis; beta techniques based on proportionality between the level of the property in the feature taken as explanatory of value and its price. While researching for property appraisal, it is possible to find a plethora of mathematical/statistical tools labelled as a method *per se*, but here were interpreted as mere tools to fulfil a valuation that, regardless of the mathematical/statistical concepts involved, is still based on comparison and market fitting.

transmitted, financing conditions, terms of sale, expenses immediately after acquisition, physical attributes of land and construction, or permits or restrictions regarding use.

As advantages of the method should be mentioned the intuitiveness of the comparative concept, coherence with economic principles and the possibility of emphasizing the comparison on the features perceived as key decision makers. Thus this method replicates a process of appraisal while explicitly maximizing financial *utility* for the party requesting the appraisal, taking in account both the features of the asset and the risk profile of the investor. Finally the method implies the logic of *law of one price*, which in theory introduces reasonability in the process.

On the downside, it may be pointed out the fallibility of the *comparable* concept, as defining the comparables based on larger set of features shrinks the size of the comparison sample, jeopardizing application, but using fewer features compromises the reliability of the comparables. In this regard must be added that the access, by the appraiser, to data concerning the amounts involved in effective transactions/proposals is constrained, due to competitiveness between investors, real estate consultants and appraisers themselves. The consequence is the issuance of appraisals using the asked price of arguably comparable properties advertised for sale, because it is the only amount the appraisers can access to, instead of the actual inputs the method presumes.

As market fitted as this method would ideally be, in order to be indeed market coherent it simultaneously requires market depth and regular activity within that real estate segment, and additionally the appraiser must have access to the details of a sufficient portion of such deals. His knowledge must include the amounts of effective deals or proposals, not asked prices on properties up for sale, because those reflect the expectations of a seller, not the worth the market is available to pay for the property. Since the expectation of the seller normally exceeds market worth, this mismatch introduces an imprudent bias. In the following sections it is important to monitor the representativeness of this method and the consequences of its usage.

It is worth to mention, though, that the underlying principle of comparison will be recurrent in the alternative methods, for instance to estimate market-based income in the method of present value of future cash-flows, to determine a proper discount rate coherent with current market conditions, or to price the land component in the substitutive method.

Present value of future cash-flows: delivers the property value as the present value of cash-flows that it effectively or potentially assures, as well of its residual value at the end of the investment period or of the structure's serviceable life. Discounting should be performed at market coherent rate reflecting the level of risk.

This method is linked to investment purposes and is suitable for valuation of properties effectively generating income, or for properties meant as an investment and for which there is a

broad range of similar ones generating income, enabling to estimate the potential cash-flows it is likely to yield.

If the income is effective the valuation can be more accurate, as long as the discount rate reflects properly the risks. Underestimating the level of risk, therefore the discount rate, results in property overvaluation. When the income is effective the method is quite similar to bond pricing, for instance. However if the income is potential and market-based, the method eventually absorbs the *pros* and *cons* of the comparative method.

A positive feature of this method is that regardless of being investment-oriented, it still incorporates the lifespan and residual value of the underlying good. Contingent upon how long the horizon is, using a single discount rate to the entire period may be inadequate, as the real estate market risks are dynamic.

Yield multiples³⁹: valuation of the property through the ratio between the effective or potential yearly income it produces, net of conservation and maintenance expenses, and the targeted yield. The yield should be established proportionally to the features of the asset and the level of risk involved, given the shape of real estate market at the valuation moment. The method may be interpreted as the present value of a perpetual annuity paid once a year.

Conceptually, the method corresponds to a measure of investment performance operated in reverse logic, as it returns the upper bound of the amount an investor should be willing to pay for the property in order to assure the targeted yield and invest coherently with the level of risk. If a buyer manages to secure the property below that amount, and establishing a parallel to bond acquisition, the purchase occurs at a discount with the achieved yield surpassing the one initially targeted (excess of return given the risks incurred). A deal occurring above the property value returned by the method will work reversely, the purchase occurs at a premium, granting therefore lower yield.

The risk that real conservation expenses exceed the ones estimated from the outset is allocated to the investor, and future cuts on such expenses may negatively impact the property's income generating capability. This is crucial since, by not inputting any time horizon, the method implies a perpetual capability of the property to grant returns, which can only be attained through thorough conservation. The perpetual context raises concerns to the fact that a unique rate is used to an unbounded horizon, while the yearly net income is not updated as well, *i.e.* assuming that the growth in incomes would cancel with the one in expenses.

As the property value is linked to the targeted yield, the method demands prudence in the analysis of the risks incurred. For instance, if an investor is using this method for acquisition purposes, overestimating risks (with it the targeted yield) will result in a very conservative offered amount, possibly derailing any deals, though. If this method is selected by a supervised

³⁹ In Portuguese literature labelled as "*Métodos dos Múltiplos do Rendimento*".

undertaking to appraise a held property, increasing the targeted yield (*i.e.* assuming higher risks) will result in a more conservative asset valuation, while underestimating risks generates overvaluation.

Again, if inputs to the method are obtained as potential and market-based basis, the method eventually inherits the *pros* and *cons* of the comparative method.

Substitutive (or **method of cost**): valuation of the immovable property through the sum of the market value of the implementation land, obtained via comparison techniques, with the costs of producing a structure that would either replicate (*copy*) or replace (*substitute the utility of*) the one in appraisal. Since the method assesses an existing structure with reference to a hypothetical new one, adjustments must be made in order to reflect the depreciation endured and remaining serviceable life of the property under valuation, as well as the profitability of the construction undertaking that would produce the replicating or replacing asset.

Since this method has low representativeness for both insurers and pension funds, it will only be discussed in further detail in the appendix A5.

5.3. Appraisal methods in the insurance industry

The appraisals of properties detained by insurance companies display a strong tendency towards the *Comparative method*, meaning that the insurer's properties are mostly valued under a market approach targeting coherence with economic principles.

Although it seems appropriate, the consistency with economic principles is only possible via *mark-to-model* techniques, maximising the use of observable market variables, or at best via quoted price in an active market for a similar asset, and then adjustments are made (the two hierarchic levels are hardly distinguishable in this context). Through this processes inaccuracies tend to arise, mostly leaning towards the insufficiently prudent side.

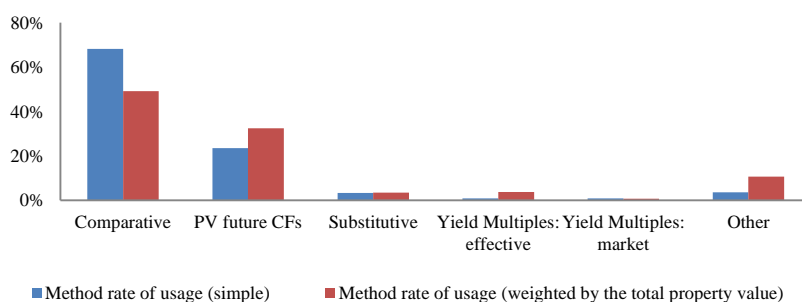


Figure 7: Appraisal methods: rates of usage in the insurance industry.

The *Comparative* prevails, whether the analysis is per appraisal or weighted by property value. Its usage decreases among properties of higher tier value, since if the property value significantly increases then the universe of comparison becomes more restrict, converging to the point of no possible application of the method.

It is also registered a significant usage of the *Present value of future cash-flows*, corresponding to a valuation centred on income. The low representativeness of the *Yield Multiples* suggests that insurers do not select a method implying perpetuity. Income oriented methods extend representativeness among properties of higher tier value.

Still, given most of the properties held by insurers are directed to income purposes, it raises the question of why the methods purely structured on income do not prevail over the *Comparative*.

5.3.1. Influence of the selected method in the appraisal's accuracy or prudence

Subsequently to the previous analysis, the next step is to search for possible connection between method selection and accuracy, or prudence, on the appraisals. There will be computed the correlations between specific weight of the method in the appraisal and deviations in *sale value vs. valuation in force*, regardless if the deviation corresponds to a gain or a loss (blue bars). The reasoning is then repeated, but exclusively in regard to deviations originating losses (red bars). Through this process the property values are used for ponderation purposes, since a similar relative deviation generates a heavier loss in the case of properties of higher tier worth.

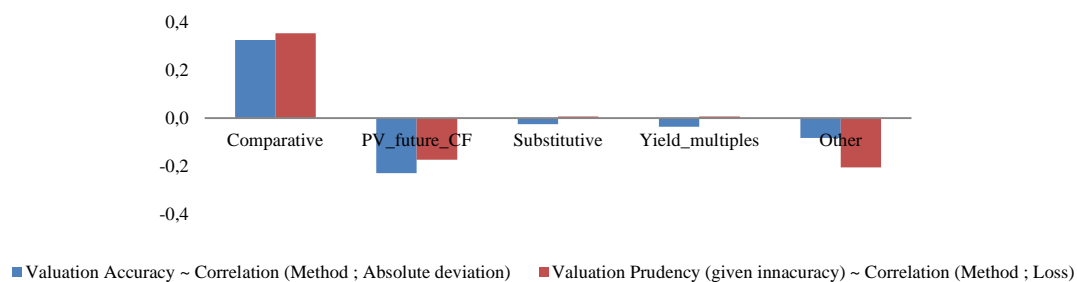


Figure 8: Appraisal methods in the Insurance industry: correlations with absolute deviation and Losses⁴⁰.

The *Comparative* method verifies the highest correlation with absolute deviations between *sale amount* and *value in force* at the timing of sale, thus provides the heaviest contribution to inaccuracy of expected worth at the moment of transaction.

When the same analysis is replicated to elaborate about prudence, using the losses arising from *sale value vs. valuation in force*, rather than any deviation, is observed that the *Comparative* is the method more linked to losses occurrence, hence its inaccuracies are mostly on the non-prudent side. On the other hand the *Present Value of future CFs* displays a negative correlation with both inaccuracy size and endured losses.

5.4. Appraisal methods in the pension funds industry

On the pension funds side, the tendency leans toward the usage of the *Yield multiples method*, with effective yearly net income. So pension funds prefer a method that considers the income

⁴⁰ Due to the residual weight, in this analysis there is no split between real or market-based income for the *Yield Multiples* method.

under an implicit perpetual basis, which seems coherent with the very long-term horizon of their liabilities.

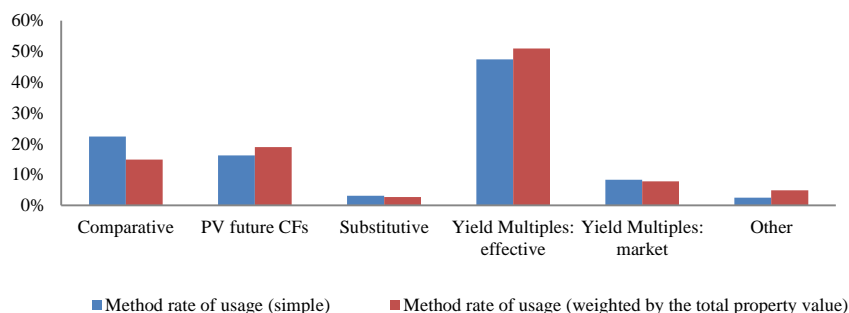


Figure 9: Appraisal methods: rates of usage in the pension funds industry.

For the *Yield multiples*, when using *effective yearly net income*, the average *targeted yield* utilized to describe the level of risk was 7,36%, while the correlation between property value and level of risk considered is basically zero (-0,0177). When using potential/market-based income the mean *targeted yield* was 7,87%.

It is possible to argue that, throughout troubled times of the real estate market, a greater risk add-on should have occurred if effective income is swapped for theoretical. While the cycle is on expansionary phase, the property being vacated increases variance, possibly working out in favour of the property holder, which may secure an advantageous renting contract shortly after. However, during the descending phase of the cycle, as it was mostly the case, vacancy risk assumes critical relevancy, therefore a currently existing renting contract may be seen as a plus for the property under appraisal, due to the resulting risk reduction.

The *Comparative* method is much less heavily represented in this case, while the *Present value of future cash-flows* is still quite meaningful. Thus, globally, the pension fund sector appraises properties using the conveyed income as the key input to the process.

5.5. Appraisal features

In the following sub-sections will be debated appraisal related aspects other than the methods.

5.5.1. Periodicity

Given timing and environment, different hierarchies may occur among the concepts of *value*, *cost* and *price*. Yet the valuations should be frequent enough so that *value* is as reliable as possible of an indicator of *price*. Such fulfilment is the expected outcome of the discretionary (bounded) margin conceded to the supervised entities regarding valuation frequency, stating that consecutive appraisals should not distance more than 3 years (for open pension funds it is 1 year).

Within the considered 4-year timeframe, for the set of the properties held throughout the entire period, the average number of appraisals was 2,27 for insurers, consistent with a 1,76 *years* periodicity. The mean number of appraisals per property can be decomposed in the mean number of times the value of a property was negatively adjusted (1,69 negative adjustments per property), while the remaining 0,58 adjustments per property generated an increase of value.

For pension funds, the homologous mean is 1,52 appraisals per property, consistent with 2,63 *years* periodicity.

This analysis enables to conclude that the supervised entities recognized that it would be adequate to exceed the minimum appraisal frequency required, given the market's volatility. Insurance companies requested appraisals almost doubly as frequently as the absolute minimum required, cutting the verified periodicity to almost half the maximum allowed. This fact suggests that the discrepancies found between *appraisal value in force* and *price* of transacted properties may be more linked to deficiencies in the appraisal process itself, although the increased frequency is justified.

A future regime could involve swapping the fixed 3-year maximum period between appraisals for varying periodicities indexed to the real estate market volatility, since the current regime would allow for a supervised entity to keep in force unchanged property values while a market index fell more than 10 percentage points.

Other possibility would be to link the periodicity to entity specific measures translating their respective solvency positions. The latest has the merit of being proportional to the specifics of each supervised undertaking and the risks it presents to policyholders and beneficiaries, however more frequent asset valuation under increasingly stressed positions could easily hurt the reliability of the property appraisal, and would mean extra expenses for already troubled companies.

5.5.2. Overexposure to appraisers

While some supervised entities promote diversification regarding valuation experts, others do not⁴¹. There is overexposure regarding the weight of a specific appraiser in some of the supervised undertakings' appraisals, suggesting that potentially the excessive exposure may be mutual. Such concentration phenomenon between counterparties in the context of requesting/providing property appraisal is not desirable, as it may harm the credibility of the property value through time, generate dependency or conflicts of interest.

Still it is possible to find extreme cases where, at a given time, companies report 100% of their valuations performed by the same entity.

⁴¹ The regime in force throughout this period states that concentration should be avoided (at a static point in time), and does not make specifications regarding rotation.

5.5.3. Compulsory second appraisal for properties exceeding a value threshold

The regime in force throughout this period requires two independent appraisals for properties with worth exceeding the threshold of EUR7,5 million, and the lower one stands as final.

The interpretation is that properties of top tier worth justify extra attention, however only the lowest outcome is materialized, as the remaining just provides extra comfort regarding the sense of prudence. Potential shortcomings of this approach are:

(i). Notwithstanding targeting the properties more likely to generate the riskiest exposures, the measure is not actually proportional to the property's specific weight. Depending on portfolio dimension, the constraints to the ability of a company to cover liabilities is not exposed to the worth of the property *per se*, but to its specific weight on total assets.

(ii). It does not account for the dimension of the discrepancies verified among the two appraisals. Both being close enough is what indeed reinforces the sense of *fair value*, more than thoughtlessly taking the lowest value between two potentially far apart appraisals;

(iii). The demand for prudence generates a context where double the information is required (*i.e.* two independent valuations for the same property), but then half of such information is simply discarded, depending only upon the hierarchy of the output values, and independently of the substance.

When both valuations are indeed close, accuracy is more likely met, but otherwise the comfort of a prudence-oriented measure may be artificial. By taking merely the lower value, regardless of differences and content, is nourished a scenario that may result in labelling some experts as the ones which under direct comparison typically issue the lower/higher values;

(iv). In absence of an explicit base of comparability between the two appraisals (deeper than comparing the final values) the value standing in the end does not really incorporate double the expertise. The valuations enter a context of functioning essentially to validate/invalidate the other. It is created a scenario of direct comparison with potential to generate conflicts of interest to the appraisers.

Possible alternatives:

Possible alternatives could involve, for (a), to index the requirement for a second valuation to the specific weight of the property in the portfolio, favouring proportionality.

For (b) to (d), the establishment of baseline scenarios to be included in the appraisals, as it occurs with quantitative assessments or stress tests, to attain content-based comparability. Alternatively design a scenario where both valuation experts would perform one analysis

following exclusively their own expertise, and another applying their expertise to a basis defined by the other expert, including the methods to use, the respective weight and the key inputs to be determined.

6. Conclusions

This study was programmed to comprise the impacts of the financial crisis, the occurrence and the aftermath of a bailout program, and a downwards phase of the property cycle, in the value of a segment of assets which remains absent of uniform internationally accepted norms.

The concerns rise mainly from the fact that the detained properties remain overvalued, incoherent with the market dynamics, whether one prefers to assess it by index benchmarking, or exclusively by comparing *expected property value* with *transaction value*.

In the context of insurance companies the consequences are the biasedness of their solvency situation and liability coverage capability, whereas for pension funds there is artificial perception of available resources callable to pay benefits.

Although, to limited extent, it is understandable the reluctance to acknowledge decay of worth in relatively unchanged immovable goods, from the perspective of safeguarding policyholders/beneficiaries it is indispensable to monitor the prudence embedded in the valuation of a segment of assets that, ultimately, if liquidated, evidences are it would not worth the total amount their respective appraisals allude for.

Concurrently, the prevalence among insurers of the *Comparative* method, in a landscape of properties meant for income, is a dominant aspect, particularly after witnessing the contributions of this method to situations of inaccurate valuations resulting in losses. During this period, the *Comparative* method transmitted an artificial sense of market fitting, given reports of scarceness of transacted investment properties⁴², affecting the assembly of a plausible comparison sample, particularly for the range of properties with potential to cause the heaviest losses. Still appraisers insisted on establishing a sample of comparison, supposed to be statistically significant even after applying filters as location, similar income generating potential, and especially access to information regarding transaction/offered values within a sufficiently short

⁴² JLL.

period, resisting adapting to the insufficiency of comparison inputs the market generated within these years. Moreover, within the course of valuations, there are no evidences that sensible inputs as the discount rate in the *Present value of future CFs*, or the targeted yield in the *Yield Multiples*, have significantly been problematic.

The significant size of the shock designed for the property risk SCR (25%) is proportional to the concerns regarding the possible effect of property exposure in the insurance industry. Still, in the near future, as this significant capital charge comes in force, it will be extremely relevant to monitor the actual impacts of it. Will insurers tend to disengage from property related investments? Will the sector reinforce the efforts relating to property valuation? Or will property investment still be a possible vehicle, although less attractive now, to artificially exhibit asset value? After deducting capital charges, still every 1EUR inflated in property asset value enables to net 0,75EUR in artificial excess of assets over liabilities. The effect of deferred taxes reduces the quoted gain⁴³, while diversification benefits amplify it, with the point being that it still will exist one.

Nationally, for the upcoming years, should be scrutinized the direct exposure of Non-Life, namely the adjustments that will be made, as the market displays signals of recovery, to the values of properties that do not reflect the fall it endured during the downwards phase, also the outcome of the reinforced underwriting of indirect exposure performed by the Life sector (although it is focused on one Life company), and the consequences of the total property exposure of pension funds on their long-horizon liabilities. Another extremely important aspect is the influence of intra economic group dynamics in the evolution of the supervised entities' exposure to the real estate market.

Another driver to potentially impact the upcoming property investment strategies is the European Commission willing to incentivize, via amendments to capital charges in Solvency II, insurers to fulfil a relevant institutional investor role in infrastructures. Albeit real estate is a substantially different asset from infrastructures, still both correspond to invest in physical illiquid assets, meant for long term, targeting attractive returns, via stable cash flows, while getting exposed to a set of risks likely to cross the core expertise of insurers. Consequently, late selective regulatory incentive may play a relevant role.

As a final balance, I believe this internship should be regarded as a profound case of success, enabling to start a career in Actuarial Science while giving proper sequence to the learning curve initiated in the Master's Degree, as the academically acquired competences are applied in professional context and market awareness is embodied.

⁴³ In this context, the concept of deferred taxes enables to recognize as a liability the taxes over capital gains arising instantaneously from the hypothetical sale of the immovable asset, versus its acquisition price.

A. Appendixes

A1. Assumptions for the dataset to property exposure

The following assumptions were assumed:

- (i). For properties entering the portfolio of a currently existing insurance company, or pension fund, due to absorption/acquisition by such institution of a pre-existing one, the unreported property values for the years within the interval 2010-2014 prior to that absorption, were taken as equal to the following available valuation. Such decision aimed to avoid registering fictitious acquisitions and therefore artificial interest in property investment. The acquiring companies merely expanded their property exposure as collateral of absorbing the acquired institution's assets;
- (ii). Properties which were sold, but lack record reliability regarding the respective amount, were considered to be sold at par with the valuation in force, to avoid artificial introduction of losses/gains arising from selling price *vs.* valuation in force;
- (iii). For properties which were under construction activities for a considerable part of the time interval, therefore not subjected to valuation meanwhile, and then sold, their values for the years for which no valuation is available were extrapolated (taken as equal) from the following valuation or the selling price. This assumption aims to reflect the presence of properties that indeed were included in the patrimony each year, avoiding inflating the weight of sold properties scaled to the total, by not artificially shrink the total.

The previous assumptions are only meant for coherent file construction and overview. Since reliability was priority in more detailed analysis, the properties requiring assumptions, or extrapolations, were excluded from the sub-samples used for conclusions where the variables requiring assumptions were key inputs or outputs. This preserved reliability without compromising interpretation, since the large total sample size could accommodate noise elimination without hurting descriptive power or scalability of conclusions.

The information concerning indirect exposure is much simpler to record and analyze, therefore no assumptions were required in such regard.

A2. Assumptions for empirical HPI comparison

HPI is produced by official institutions through techniques common to, for instance, the Consumer's Price Index, *i.e.* economic milestones. For the Portuguese case, given the residential purchase weight, the index may even be broader.

Information regarding this index can be found in the website of Bank for International Settlements and corroborated in the website of Eurostat, allowing for certainty about the reliability of data. The index uses as reference the average for 2010 = 100, describing posterior price level with reference to the average throughout 2010.

For the Portuguese case, the time series for HPI is as follows:

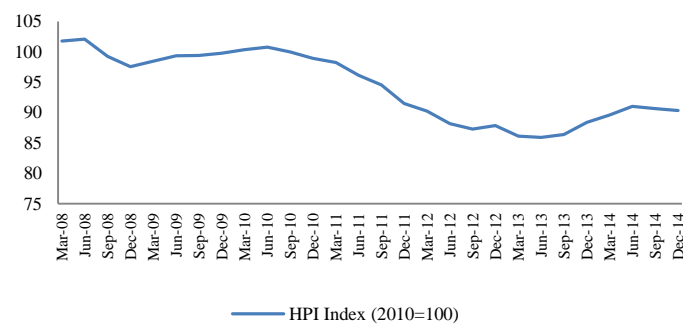


Figure 10: Quarterly series of the HPI index for Portugal

The assumptions involved in the empirical HPI comparison were:

- (i). the sample is formed by the properties included in the portfolios from the end of 2010 to the end of 2014. Such sub-sample's representativeness corresponds, in value, to roughly 92% of the total property assets held at the end of 2010.
- (ii). the reference property value level was the one specified by the appraisal in force at the beginning of the period of analysis (31st December 2010), which is to say: Value in force at the end of 2010 = 100.
- (iii). for each property, for each year ranging from 2011 to 2014, is estimated an empirical value relatable with the HPI concept, obtained through the ratio between the property value at that year, and the reference value.
- (iv). the yearly total values, that will be compared with the HPI index, were, for each year t , obtained as weighted averages of the individual values as above, using as weights the respective property value at 31st December 2010, in order to introduce proportionality to the loss causing potential.

A3. Commentaries on the sample used for empirical sales comparison

The analysis took in account a vast sub-set of the properties that were sold, including each one for which the insurance companies fully provided to ASF the selling price and the appraisal value in force at the moment, without transmitting any reserves regarding their reliability.

Properties that were sold within the time interval, but for which the insurers struggled to fully report in a reliable manner some of the inputs, were left out. Any source of bias is thus linked to the data reporting process upstream of the analysis.

Finally, mention that were included five properties which were under construction activities during some of the reference points in time, therefore had unavailable intermediate valuations in force, so were not possible to include in the previous analysis but met the requirements to be included in this one. The individual contribution of that set of properties was a positive surplus of EUR0,14 million, so its presence contributes to cause an effect of thin relief, comparing to its absence, creating a less than significant force in favor of valuation's prudence.

A4. Heterogeneity on appraisal terminology

There is profound heterogeneity in nomenclature in the context of property appraisal. The overlapping starts immediately with the mix of terms as valuation *approach*, *method* or *technique*, making it hard to realise the differences or hierarchy between such terms, if any.

The interpretation in this work is that valuation *approach* describes the core concept structuring the valuation, and the three possibilities are explicit in IFRS13. *Method* was interpreted as a more hands-on concept that aids to materialise the core concept behind a possible approach, still it may have or not a closed form. *Technique* was merely interpreted as any mathematical tool used to give closed and directly applicable form to the concept commanding the valuation.

In this work the decision is to favour substance over form, focusing on the structural concept behind the valuation. Still, the needed labels used by ASF to identify different *methods* are in line with the ones established by CMVM to REIFs, favouring uniformity as one attempts to deal both with the direct and indirect exposures.

These conclusions were reinforced by witnessing struggles in multiple companies from which data was required, regarding of how to frame under substance-based nomenclature the contents of their valuation documents, falling excessively in the perception of using a method other than the ones pre-programmed.

A5. Advantages and disadvantages of the Substitutive method

This method retains usefulness as, theoretically, it may be applied to value any property, as the construction industry may produce any structure at any time, at standardized costs, and virtually anywhere. Hence this method is also applicable to real estate assets barely available or traded in the market, and for which no satisfactory comparison sample can be assembled.

The downside is that the asset value obtained should be interpreted cautiously, as it fully disregards time and logistic factors. The underlying principle is that no informed buyer would pay for an existing good more than it costs to substitute it, which is coherent with no rip-off, but it implies that the buyer would be willing to defer the fulfilment of his investment purpose until the virtual substitutive structure is actually produced, which should be a considerable deferment, as properties barely available in the market are often linked with larger, and more complex, preparatory and production periods. Additionally such principle implies that the investor would also be willing to get involved in triggering the construction undertaking.

Another shortcoming arises from landscape constraints: if valuating a building with prime location and large dimension, suitable for instance to accommodate a major insurer headquarters, which is coherent with the framework of few comparables, the substitutive method could determine that the property is overpriced as it presents itself more expensive than it would be to substitute it. However that may not an alternative, as similar land of implementation is hardly available.

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⁴⁴ Note: this paper should not be reported as representing the views of the ECB. The views expressed are those of the author and do not necessarily reflect those of the ECB.

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