What Drives Financial Complexity? A Look into the Retail Market for Structured Products

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Abstract

By focusing on the highly innovative retail market for structured products, we investigate the drivers of financial complexity. We perform a lexicographic analysis of the term sheets of all the retail structured products issued in Europe since 2002. Thus, we observe that financial complexity has been steadily increasing, even after the recent financial crisis. We show that financial institutions strategically use complexity to escape competition. First, complex products exhibit higher mark-ups and lower ex post performance than simpler products. Second, using issuance level data spanning 15 countries over the 2002-2010 period, we find that financial complexity increases when competition increases.

Keywords: Household Finance, Financial Literacy, Complexity

JEL codes: I22, G1, D18, D12

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1 Introduction

Complexity has dramatically increased in household finance over the last twenty years. Innovative products have constantly been introduced, both in the asset side (mutual funds) and the liability side (credit card, mortgages). In the meanwhile, financial literacy and sophistication seem to remain low (Lusardi et al. (2009), Lusardi et al. (2010)). What drives this increase in financial complexity? To answer this research question, we focus on a specific market that has met sustained growth and innovation in the last decade: the retail market for structured products. We develop a measure of product complexity, which we apply to a comprehensive dataset of all retail structured products sold in Europe. We observe that financial complexity is more prevalent among distributors targeting low sophisticated investors and during high volatility periods. We show that financial institutions strategically use financial complexity to escape competition. First, product complexity is associated with higher product profitability for banks and lower performance for investors. Second, using issuance level data spanning 15 countries over the 2002-2010 period, we find that product financial complexity increases when competition increases. Our paper provides empirical evidence on the relationship between competition and financial complexity that has been investigated in the theoretical literature (Carlin (2009)).

Financial complexity can increase households' utility, by completing product offers and thus markets. Hence, structured products bring the benefits of derivatives to investors who otherwise would not have access to them. Moreover, they can facilitate tax-efficient investments. However, financial complexity may also be used as a strategic tool by firms to increase search costs (Carlin (2009), Ellison and Wolitsky (2012)), price discriminate

(Ellison (2005)), and intentionally reset investors' learning (Carlin and Manso (2011)). Therefore, banks may use financial complexity to obfuscate retail investors.

Rationale for studying the financial complexity dynamics in the retail market for structured products is strong; its economic significance is high. In Europe alone, outstanding volumes of retail structured products add to more than EUR700bn, which is equivalent to 12% of the mutual fund industry. Assets under management have been steadily growing, despite the financial crisis. As direct participation has been structurally decreasing in Europe, structured products often represent a privileged way of getting exposure to stock markets. Additionally, information asymmetry is maximal between innovators, investment banks structuring the products, and the final consumer: the mass-market retail investor. We find countless examples of products marketed to savings bank customers (who are more likely to be unsophisticated) that pile up many complex features [1]. This finding illustrates the gap between supply-side complexity and demand-side sophistication. In this study, we define financial complexity from the investor's point of view, meaning how hard it is for him or her to understand a product and compare it with possible alternatives. [2]

Our empirical analysis relies on a lexicographic analysis of a dataset that contains detailed information on all the retail structured products that have been sold in Europe since 2002. This database has key characteristics allowing neat identification in an empirical industrial organization study. It covers 17 countries and 9 years of data, with

[1] See section 3 for an example.

[2] We do not take the structuring bank point of view: how difficult it is to create a given product. A product simple to understand can be challenging to structure. For instance, derivatives on real estate, although easily understood by retail investors are extremely difficult to structure for banks, mainly for liquidity reasons. The incentive is clear for a structuring bank to be the only one to price a product as it allows charging the monopolistic price.

both strong inter-country and inter-temporal heterogeneity. It includes 244 competitors. A detailed pay-off descriptive, information on distributors, and volume sold are available at issuance level. We develop an algorithm to precisely break-down and identify payoff structures for each product in the database. This methodology allows us to classify products along a tree like structure, and to measure their complexity by capturing the piling features. We use the length of the pay-off formula description, as well as its number of potential scenarios, as robustness checks for our measure of complexity.

By analyzing the product term sheets of all the retail structured products issued in Europe since 2002 through our lexicographic methodology, we observe a trend of increasing financial complexity that continues after the financial crisis. In our dataset, financial institutions that target low sophisticated investors offer relatively more complex products. Additionally, specific product features -e.g. monetizing a cap on the rise of the underlying index above a certain threshold, and more surprisingly monetizing the possibility to take a loss if the underlying index drops below a certain threshold - are more frequent when implicit volatility is high, leading to an increase in average product complexity during these periods.

In a second step of our analysis, we explore the relationship between financial complexity and product profitability. We price a representative subset of retail structured products with OLS MonteCarlo and then regress the markups on product complexity. Using this method, we find that the more complex a product is, the more profitable it becomes. Based on the realized ex-post performance of 48% of products that have matured, we also show that the more complex a product is, the lower its ex-post performance. These findings are consistent with higher complexity being associated with a

higher profit captured by banks.

Finally, we investigate empirically the effect of competition on financial complexity. Using issuance level data for 15 countries over the 2002-2010 period, we first show that product diversity as well as financial complexity increase when competition increases. We use the number of competitors and the Herfindahl concentration index as measures of product market competition. We also find that changes in complexity over the 2002-2010 period can be explained by the increase in market competition. Finally, to rule out potential reverse causality between competition and financial complexity, we exploit the fact that 50% of the distributors are active in different countries. We show that the average complexity they offer is higher in more competitive markets, which is consistent with distributors adapting to the competitive environment. Our results are robust to controlling for product characteristics such as maturity and format when regressing at the product level.

Our work contributes to the theoretical literature on financial complexity. Ellison (2005) and Gabaix and Laibson (2006) describe how inefficient product complexity emerge in a competitive equilibrium. To account for the increase in complexity in financial products, Carlin (2009) and Carlin and Manso (2011) develop models in which the fraction of unsophisticated investors is endogenous and increases with product complexity. Carlin (2009) shows that as competition increases, product complexity increases. Our paper identify empirically the role of competition in financial complexity.

Our project also complements the literature on the role of financial literacy and limited cognition in consumer financial choices and bank strategies. Bucks and Pence (2008) and Bergstresser and Beshears (2010) explore the relationship between cognitive ability and

mortgage choice. Lusardi and Tufano (2009) find that people with low financial literacy are more likely to have problems with debt. This also relates to the recent interest in the role of financial intermediaries in providing product recommendations to potentially uninformed consumers (Anagol and Cole (2013)).

Finally, our paper contributes to the literature on structured products. Hens and Rieger (2008) theoretically reject completing market as a motive for complexity by showing that the most represented structured products do not bring additional utility to investors in a rational framework. Empirical papers on the retail market for structured products have focused so far on the pricing of specific types of products. Henderson and Pearson (2011), on the basis of a detailed analysis of 64 issues of a popular type of retail structured products, identify overpricing by banks by almost 8%. This result challenges the completeness motive, as it will come at too high a cost.

The organization of our paper contains the following sections: we begin in section 2 by providing background information on the retail market for structured products. Our measure of complexity is described in section 3, as well as the increasing trend in complexity we observe. Section 4 presents new empirical findings based on this complexity measure, and section 5 explores retail structured product profitability and performance, and relates it to financial complexity. Section 6 empirically identifies the link between competition and financial complexity. Finally, section 7 concludes.

2 The Retail Market for Structured Products

2.1 Background

Retail Structured Products regroup any investment products marketed to retail investors whose payoff is determined following a formula defined ex-ante. They leave no place for discretionary investment decision along the life of the investment. Our study excludes pay-offs that are a linear function of a given underlying performance, e.g. ETFs. Retail structured products are typically structured with embedded options. Although they largely rely on equities, the exposure one can achieve with them is very broad: commodities, fixed income or other alternative underlyings, with some example of products even linked to the Soccer World Cup results.

Below is an example of a product commercialized by Banque Postale (French Post office Bank) in 2010:

> *Vivango is a 6-year maturity product whose final payoff is linked to a basket of 18 shares (largest companies by market capitalization within the Eurostoxx50). Every year, the average performance of the three best-performing shares in the basket, compared to their initial levels is recorded. These three shares are then removed from the basket for subsequent calculations. At maturity, the product offers guaranteed capital of 100%, plus 70% of the average of these performances recorded annually throughout the investment period.*

This illustrates the current gap between the complexity of a popular structured product and the level of financial of sophistication of the average client of Banque Postale. The

biased underlying dynamic selection and the averaging of performance across time makes the product complex to assess in terms of expected performance.

The retail market for structured products has emerged in 1996 and has been steadily growing from then on. In 2011, retail structured product assets under management stand for 700 billion euros in Europe, which is nearly 3% of all European financial savings, or 12% of mutual funds' asset under management. Europe, with a share of market of 64%, and 244 distributors in 2010 is by far the largest market. However, the US and Asia are catching up, with markets developing now faster. Regulation, especially the Glass Steagall act, which limited internal structuring of these products, is one of the explanation for how different the European and the US are in terms of maturity. The growth of this market has been fostered by an increasing demand for passive products, as active management added value has become more and more challenged (Jensen (1968); Grinblatt and Titman (1994)) on one side, and the profitability of these products for the banks structuring and distributing them, on the other side Henderson and Pearson (2011). Indeed on top of disclosed fees, some profits are hidden in the payoff structure that is hedged at better conditions than offered to investor. The incentive to hide markup within the product has been increased in Europe by recent MiFID regulation that makes compulsory for distributors to disclose commercial and management fees. In addition, structured retail products, when packaged as securities or deposits, can offer a funding alternative for banks, and a possible way of transferring some specific risks to retail investors [3].

The organization of the market for structured products is interesting in itself. Since

[3]Recent issuances often allow bank to transfer tail risk to retail investors, as product will incur losses only in case of strong decrease of the underlying, such as a 30% decrease in the index.

these products are very complex to structure, only large investment banks have the exotic trading platform it requires. On the other hand, distribution is diverse. Consequently, entities distributing the products to the retail investor are often, but not necessarily, distinct from investment banks structuring them. These products have been marketed by a large range of financial institutions, from commercial banks, saving banks and insurance, to wealth management and private banking. Many providers market themselves on their expertise in structuring whereas they do not actually structure the product, but only select them and implement a back to back transaction with an entity that can manage the market risk. Therefore competition is at two levels: between structurers, who market to distributors, and between distributors, who market to retail investors. Our analysis focuses on the latter level, as we are interested in the dynamics of financial complexity in retail markets.

Regulation framework is key in this market, in which both bank supervision and investor protection are at plays. European regulators, grouped in the European Securities and Markets Authority (ESMA), have kept a keen eye on protecting retail investors. They developed a regulatory framework defined by the UCITS Directive. However, until 2010, they mainly focused on disclosure requirements, which may have amplified asymmetry issues by providing too abundant or technical information to clients, such as back testing. MIFID regulation introduced client classification and corresponding products appropriateness. Investors are warned when they chose a product deemed unusual or inappropriate. In France, industry has been lobbying on regulators so that they focus on risk and not complexity. Indeed, French regulator mixes risk with complexity in his latest position (REF 2010), taking into account complexity if and only if capital is at risk.

2.2 Data

Our original data stems from a commercial database, Euromoney Structured Retail Products, which gathers detailed information on all the retail structured products that have been sold in Europe since market inception (1996). Although its exact scope is challenging to determine due to the absence of benchmark data sources, the different tests we conducted pointed towards it being comprehensive. [4]

The retail market for retail structured products is divided into three categories: flow, leverage, and tranche products. We focus on tranche products, which are non-standardized products with a limited offer period, usually 4 to 8 weeks, and a maturity date, as they have the largest investor base, the highest amount of assets under management (they stand for 90% of total volumes), the highest average volumes, and exhibit the largest heterogeneity in terms of pay-offs. We therefore exclude flow products, which are highly standardized and frequently issued products, as they represent a high number of issuances with very low volumes (sometimes even null)[5]. Leverage products, which are short term and open-ended products, also are excluded. Tranche product investors typically implement a buy and hold strategy (there are usually penalties for exiting before the maturity of the product). As of December 2010, volume and numbers of outstanding structured tranche products were respectively EUR 704bn and 41,277 in Europe[6] . Data are available for 17 countries in Europe, and cumulated volumes per country since market

[4]For instance, the coverage on Danish products is slightly larger than the one of hand collected data on the same market from Jorgensen, Norholm and Skovmand (2012)

[5]These products, for instance bonus and discount certificates, are very popular in Germany. Indeed, hundreds of flow products are issued every day and 825,063 of them have been issued from 2002 to 2010. However, their size is only 20,000 Euros on average, against 8.8 million euros for the core market that we consider

[6]If we include leverage and flow products, number of outstanding structured products are 406,037 products and volumes are EUR 822bn

inception are given in Table 1. Italy, Spain, Germany, and France dominate the market in terms of volume sold, totaling 60% of its total. We match this data with additional information on providers (Bankscope and manual collection), market conditions (Datastream) and macro-economic country variables (World Bank) at the time of issuance.

INSERT TABLE 1

Since 2002 the retail market for structured products has met two major trends: volume sold has exploded (Figure 1) and number of distributors has significantly increased (from 144 in 2002 to 244 in 2010), with a slight decrease since the financial crisis. (Table 2). The market is divided between commercial banks, private banks, saving banks and insurance companies, implying a heterogeneous investor base.

INSERT FIGURE 1

INSERT TABLE 2

Structured products formats can be divided into two main classes: non-collateralized assets, which bear issuer credit risk (securities and deposits), and collateralized assets (life insurance, funds and pension). Breakdown by format (in number of issuance) is given in Table B.2 in appendix. Non-collateralized products are usually targeted at more wealthy investors, and their horizon is usually shorter.

3 Measuring Financial Complexity

3.1 Classifying Payoffs

This subsection details how we measure product complexity in the retail market for structured products. The challenge we face is to translate 55,000 potentially unique pay-off descriptions into complexity measure. We opt for a lexicographic methodology. We run an algorithm on each individual product pay-off descriptive from our dataset [7], which allows classifying products along a tree. It corresponds to the steps the investors meet to precisely decompose the product formula he is facing. A simple typology of products with corresponding levels of complexity would not adequately capture the observed piling up of features from this market. Indeed a high diversity in pay-off formula is observed across SRP products, each one being potentially unique. Although it assumes that all features are equally complex, the break-down is precise enough to justify this assumption.

Each product formula description is scanned by an algorithm that looks for combinations of given group of words (see Appendix for examples). The objective is to pinpoint the exact combination of payoff features for each product, based on an exhaustive list of all the possible choices. Each node of our algorithm offers on average five branches, therefore more than 70,000 distinct classes of products can be identified. Our dataset exhibits more than 1500 of them.

The decomposition tree (Figure 2) details the algorithm that we developed to apprehend exhaustively the design of each product. It has two levels: two mandatory stages (underlying type and primary pay-off feature), and seven facultative ones. At each node,

[7] Formula descriptive have all been translated by the data provider, and only contains the necessary information to calculate the performance of the product.

features identified in the data but representing less than 1% have been aggregated into the category "other feature". Choices at a given node are exclusive from one another. We assume that a product including some additional features on top of the primary formula will be more complex that one that just relies on the latter.

INSERT FIGURE 2

3.2 Results

Fig 3 illustrates that complexity, measured as the number of pay-offs features, is an increasing function of time, with almost no decrease in its growth following the financial crisis.

Despite the widespread view that the crisis has led to a fall in complexity of financial instruments, which is undoubtedly true for some types of clients such as corporate, we find that the products targeted to retail investors became more and more complex, even after the crisis. This surprising fact points toward product structuring being driven by the supply side of the market, not the demand side. This result is robust to the measure of complexity used.

INSERT FIGURE 3

3.3 Robustness Checks

As a first robustness check for the proxy of complexity we consider, we use the length of the formula description, measured by the number of characters. The idea is that the more complex the structure is, the higher the number of words needed to describe it. Figure 1 in Appendix shows that this measure follows the same increasing trend.

We also consider the number of potential scenarios underlying the final return. One type of payoff can induce several returns depending on several conditions at maturity or along the life of the product. This measure is close to counting the number of kinks in the final payoff curves, while also accounting for path dependency that is not captured by the latter measure. Quantifying the number of conditions embedded in the text description by identifying conditional subordinating conjunctions such as "if", "when" and "whether" is therefore a tractable way of apprehending the complexity of a structured product. Figure 1 in Appendix illustrates that this complexity measure again displays a comparable increasing trend since market inception. We observe a correlation around 0.6 between our three different measures, which illustrates that they are coherent and complementary.

4 The Complexity Puzzle

In this section, we elaborate on puzzling facts about financial complexity. We look at two dimensions of the market: who buys complex products, and when complex products are sold.

4.1 Financial Sophistication

The objective of this subsection is to explore the gap between financial complexity and investor sophistication. Among retail investors, a natural hypothesis is that more complex products are offered to more sophisticated clients, as they possess both the skills to apprehend these products and the diversified portfolio that these products could complement.

The type of financial institution an investor is in a relationship with can be used as a proxy for its financial sophistication. For example, saving banks provide financial services mainly to rural and low to middle class households, whereas private banks mainly focus on high-income individuals. Hence, we group distributors into four categories: saving banks, commercial banks, insurance, and private banks /wealth managers [8]. Table B.1 in Appendix lists the 20 main distributor groups in 2010 in terms of number of products issued. Among them, three are savings banks (the Deutsche Volksbanken and Raiffeisenbanken, the Deutsche Sparkassen and the Spanish Caja de Ahorros), 12 are commercial banks (Deutsche Bank, RBS, KBC etc.) and 2 are private banks or wealth managers (Garantum and JP Morgan).

INSERT TABLE 3

Table 3 displays statistics on the level of complexity per type of distributor. We observe that saving banks distribute more complex products than the other types of distributors: commercial banks, insurance companies, and private banks/wealth managers. This finding is not consistent with the initial hypothesis that more complex products should be sold to more sophisticated investors. It signals a puzzling relationship between the average client sophistication, and the complexity of the product offered. A possible explanation for this relationship is that banks obfuscate clients through financial complexity.

[8] In Germany, savings banks include sparkassen (31% market share in 2010) and volksbanken/raiffeisenbanken (27% market share), the main commercial banks are Deutsche Bank (5%) and Commerzbank (3%), private banks include Sal. Oppenheim (0% market share in 2010).

4.2 Complexity and volatility

Volatility has a first order impact on option prices. As retail structured products are built with options, volatility is likely to impact significantly this market.

Under the assumption that retail investors are risk averse and conditionally on market participation, the demand for protection should increase with market volatility. Since financial institutions are considered as less risk-averse than retail investor, the share of products that are exposed to volatility should decrease when market volatility increases.

We use the implied volatility index on European stock markets (VSTOXX) in our analysis.

INSERT FIGURE 4

Figure 4 illustrates the evolution of short volatility products - products which performs well if volatility decreases during the life of the product. They include reverse convertible, cap, knock out, and callable products. Reverse convertible products are implicitly selling a call option, offering downside exposure to the underlying. On the opposite, cap, knock-out and callable features limit the product upside when market volatility is high. We observe an increase in the ratio of short volatility products when implicit volatility is high, an effect that is observable even after the financial crisis. Issuance features appear to be timing the market on levels of implied volatility.

These findings are not consistent with the assumption that financial institutions offer more protection when volatility increases. It rather suggests that financial institutions exploit market conditions to inflate investor expectations, as products including selling options can offer higher returns, although at a higher risk, when volatility is high. An

alternative explanation is that banks may use retail structured products to offload some risks from their books. Banks may be willing to get rid off volatility exposure, for instance to decrease their Value-At-Risk disclosed levels. The concave pay-offs offered to retail investors by short volatility products may be a way to achieve this goal.

5 Financial Complexity and Product Profitability

An important aspect of financial complexity to investigate is how it relates with product profitability on the bank side, and product performance on the investor side. This dimension is key in terms of regulatory implications, and put the previous findings in a different prospect.

We show in this section that financial complexity is correlated with higher product profitability and lower product performance. This finding is consistent with the existing empirical literature on retail structured products Henderson and Pearson (2011), which shows that retail structured products are a highly profitable segment. Our contribution to this growing strand is to establish a direct link between financial complexity and mark-ups: we find that banks charge significantly higher mark ups for more complex products. In addition, we show that more complex products exhibit lower Ex-post performance, even when controlling for the risk of the product, which is likely to be driven by the level of hidden mark-up. Financial complexity does not necessarily harm investor utility, as it may fit their utility function by diversifying their investment or providing them with an "easy to use" package. However, investors would be undoubtedly better off if mark-ups on complex products were lower, especially as they are hidden.

5.1 Product Markups and Complexity

In July 2009, 85 retail structured products indexed to Eurostoxx 50 were issued across our sample countries. This subsection of the paper presents estimates of the markups for these products, where the markup is defined as the difference between the offering price and the fair market value we calculate.

It is for several reasons that we focus on all the retail structured products indexed to Eurostoxx 50 that were issued in July 2009. First, for comparability purpose, and to discard any measurement errors in implied correlation, we opt for a sample of products with the same unique underlying. This also limits the concern that our results could be driven by difference in correlation or liquidity reserves by the exotic trader. This choice maximizes the comparability of calculated mark-ups, which is key for our relative analysis: our sample heterogeneity is only in terms of pay-off complexity. Second, we ensure comparability of market conditions by focusing on a given time window. We chose July 2009 as the number of issuances and heterogeneity of products during this month was one of the highest recorded since market inception. Third, the Eurostoxx 50 index is one of the most liquid financial index, and Eurostoxx 50 options with various moneyness and maturities trade daily. Detailed volatility data is therefore available from the market places, which is key for pricing accurately these complex products.

5.1.1 Methodology

In order to price a sub-sample of products, we rely on a local volatility diffusion model for the underlying asset with the following specification:

$$\frac{dS_t}{S_t} = r_t d_t + \sigma\left(t; S_t\right) dW_t$$

where S_t is the price of the underlying, $\sigma(t; St)$ is the volatility surface as a function of maturity and underlying spot price, W_t is a Brownian motion, and $r(t)$ is the interest rate yield. Using a local volatility specification is key for pricing the considered products because they frequently possess deeply out of the money embedded options. This is typically the case for reverse convertibles. [9]

Retail structured products pay-offs are also largely path dependent. To account for this specificity, we use the Least Square Monte Carlo (LSM) methodology (Longstaff and Schwartz (2001)), which is well recognized and implemented by both academics and professionals.. Performing accurately this calculation-intensive methodology that includes both volatility surface and path dependence was helped by the use of Lexifi© pricing tool.

Our implied volatility data is from the largest European derivative exchange: Eurex. We discount along the EUR swap rate curve. The daily stock prices used in the analysis and the historical values of the interbank rates (Euribor) were collected from Bloomberg. We then compute a constant dividend yield from future prices, also extracted from Bloomberg.

[9] this is not the case in Henderson and Pearson (2011), or in Jorgensen et al. (2011) who look mainly at products with at the money options.

By comparing the issuance price to the fair price calculated through LSM, we can estimate the hidden mark-up of the products.

5.1.2 Results

The details of each product we priced, as well as the estimated hidden mark-up, appear in Appendix B. We find average mark-ups of 2.5% without including entry and management fees. Our estimates excluding disclosed fees are lower than in Henderson and Pearson (2011), and we obtain 21 products with negative mark-ups. One possible reason is that we estimate products issued in 2009, when the market was relatively more mature. A second explanation could be that banks reduced the markup on the derivative component of non-collateralized products in the aftermath of the financial crisis to obtain valuable funding. We can control for this effect by identifying the non-collateralized products. Finally our calculation only measures hidden mark-ups. When we add disclosed mark-ups, we obtain an average of 6.3%, and only 14 products have negative mark-ups, the majority of which are not collateralized. In any case, the purpose of our pricing exercise is to identify a relationship between product complexity and profitability, therefore focusing of the relative markup within our sample.

INSERT TABLE 4

Table 4 shows the coefficient of an OLS regression of product markups on the complexity proxies. There is a statistically and economically significant relationship between complexity and profitability. One additional feature in a pay-off formula translates into an increase of the markup by 1 percent of notional, or 40% of the average mark-up. The results are robust to the complexity proxy used: an additional scenario also increases

product markups by 1 percentage point. Finally, a one standard deviation variation in the length of the description induces a 1.4 percentage point increase in the markup. Our model specifications look at both the total hidden mark-up, the mark-up normalized by the product maturity. [10] These results show that the more complex a product, the more profitable it is for the bank structuring it. The economic significance of this result is strikingly high, explaining the strong incentives banks have to issue complex products. Importantly, we control for the maturity of the product, as well as whether the product embeds uncollateralized issuer credit risk of the issuer, and therefore provides funding to the issuer.

To test the robustness of our results to our pricing model, we conduct the same analysis using a Partial Differential Equations model to estimate product fair prices. Although we obtain a smaller number of observations due to the computational challenge of some products, results (shown in appendix), are consistent with our MonteCarlo analysis.

5.2 Ex post performance

Finally, we test whether the higher level of *ex ante* mark-up of more complex products - at product issuance -translates into lower *ex post* performance- at product maturity. This is important to analyze the impact of financial complexity on investor surplus, as higher hidden fees could be offset by product performance. Our database includes the performance of 48% of the growth products that matured before 2011 [11]. We find a negative relationship between product complexity and performance, which is consistent with higher complexity being associated with a higher profit captured by banks.

[10] A product profitability is typically an increasing function of its maturity.

[11] Germany and Austria are excluded from this analysis as the performance ex post is not available for these countries

INSERT TABLE 5

Table 5 presents the OLS regression coefficients of the annualized performance on product complexity. We observe a significant negative correlation between a product complexity and its performance. Complexity seems therefore to reduce investor surplus ex-post. To ensure that different levels of risk related to the levels of complexity do not drive our results, we control with a dummy indicating whether or not the initial capital invested is protected.

6 Complexity and Competition

Despite the large number of competitors in this retail market for structured products, and although financial complexity appears to be associated with rent extraction from investors, we observe that it has been increasing over the years. This section shows empirically that financial institutions use financial complexity as a mean of escaping competition.

6.1 Methodology

We use an unbalanced panel spanning 15 countries from 2002 to 2010. Two countries are excluded due to low representativeness: Hungary and Poland. Volume sold since inception has been lower than 10 million euros in these countries. Norway is not taken into account over the 2008-2010 period due to a ban on selling structured products to retail investors.

We measure country-year market competition with two indicators. First, we compute

the number of competitors per year in each country. To ensure that the distributors we identify are independent competitors, we match our data with Bankscope. We then create provider groups and consider them as unique competitors. Saving banks have typically been regrouped into the same provider group as their geographical coverage does not overlap nationally. Hence, we indentify 486 competitors that have been active one or more years over the 2002-2010 period on the retail market for structured products. Second, we look at the Herfindahl concentration index. We use volume sold from our data provider to compute distributor market share. When volume sold per products are not available (for 70% of the products but less than 30% of estimated total volumes), we use a proxy based on volume sold by types of products (life insurance, security, deposit, fund or pension), year and provider.

Average financial complexity is captured through the previously used measured: number of payoff features, description length and number of scenarios, that we weight by volume sold and average at the country-year or distributor-year level.

6.2 Competition and Product Differentiation

Differentiation is high in the retail market for structured products. Based on our algorithm to identify payoff features, we count the number of differentiated products offered each year in each country. We observe for example that in France in 2010, 275 products were offered with 85 different payoff formulas. When product differentiation increases, search cost and information frictions increase. A large theoretical literature shows that costly search sustain price dispersion and rents even in homogeneous product markets.

To investigate the impact of competition on product differentiation, the model we

estimate is the following:

$$ProductDiversity_{c,y} = \alpha + \beta Competition_{c,y} + \delta_y + \theta_c + \epsilon_{c,y} \quad (1)$$

$ProductDiveristy$ is the number of product types sold in country c in year y. The parameter of interest is β, which measures the impact of an increase in the number of competitors on product diversity. Country fixed effects θ_c control for time invariant determinants of product diversity, such as the size of the market for example. Year fixed effects δ_y control for aggregate shocks or common trend in the retail market for structured products. We compute robust standard errors.

INSERT TABLE 6

Table 6 shows the regression coefficients of OLS estimation of the impact of the number of competitors and the Herfindahl index on product differentiation. Controlling for country and year fixed effects, we find that the number of product types increases when competition increases. Looking at the change in product differentiation over the 2004-2008 period in a cross country analysis, we obtain the same result. The more competition has increased, the higher the increase in the number of differentiated products.

6.3 Competition and Financial Complexity

Figure 6 gives a preview of our main result. It plots the change in the number of competitors between 2004 and 2008 in the x-axis against the change in the country-year average level of complexity on the y-axis. It shows a strong positive correlation between change in financial complexity and the number of net entries within a country.

INSERT FIGURE 6

We then estimate the following model:

$$FinancialComplexity_{c,y} = \alpha + \beta Competition_{c,y} + \delta_y + \theta_c + \epsilon_{c,y} \quad (2)$$

Columns (1) to (6) in Table 7 show the coefficients of our two measures of competition in OLS regressions in which the dependant variables are the country-year average of our three financial complexity measures. We observe that indeed, as competition increases, the level of financial complexity increases. Columns (7) to (8) show the impact of net entry and change in the Herfindahl Index on change in financial complexity in a cross-country analysis and confirm our results.

INSERT TABLE 7

One concern with our identification strategy is that it cannot rule out reverse causality between competition and financial complexity. For instance, competitors may be attracted in markets in which for some exogenous reasons - which can range from legal issues, regulations, financial literacy, cultural specificities - financial complexity is high. Another possibility is that competition and financial complexity are driven by the same exogeneous variables, such as the level of financial savings in a country, that allows for both diversification and competition. To rule out the first possibility, we look at how distributors adapt depending on the level of competition of the market in which they participate. We measure financial complexity at the distributor-country-year level. We exploit the fact that 51% of the providers participate in more than one market. We then

estimate the following model:

$$FinancialComplexity_{d,c,y} = \alpha + \beta Competition_{c,y} + \delta_y + \theta_c + \phi_d + \epsilon_{c,y} \quad (3)$$

Table 8 shows the results of this estimation. We observe that indeed, distributors adapt their offer to the level of complexity, which is consistent with competition having a causal effect on financial complexity.

INSERT TABLE 8

6.4 Robustness Checks

To ensure that our results are not driven by a systematic measurement error in our complexity index, we implement robustness checks for each of our results, using both the number of scenarios and the length of the descriptive. These checks reinforce our results as the coefficient remains of the same sign and significant in almost all our specifications. Second, we run regressions at the product level. Results are displayed in Table 9. This allows us to control for a large set of variables, in addition to country and year fixed effects. Hence, we control for the product type (security, deposit, insurance, fund or pension), the product maturity and, in columns 2, 4 and 6 distributor fixed effects. Standard errors are clustered at the country-year level. Our main result on the impact of competition on complexity is confirmed.

INSERT TABLE 9

7 Conclusion

Understanding the drivers of financial complexity is key to our understanding of financial markets. There exists an increasing gap between the high complexity in household finance and the low financial literacy of retail investors. Uninformed consumers tend to overpay products when they cannot observe their prices, as documented by several papers (Anagol and Cole (2013), Anagol and Kim (2012), Choi et al. (2010)).

We use unique data on the European retail market for structured product to study financial complexity, allowing a neat identification of its location and drivers. Based on a lexicographic analysis of the prospectuses of all the products sold since inception, we develop three measures of complexity. These measures all display a dramatic increase in complexity since market inception.

To improve our understanding of how firms exploit financial complexity to extract rents from consumers, we look at ex-ante product mark-ups. We use Monte-Carlo simulations over a representative sub-sample of our products. We find that the more complex a product is, the higher the markup for the bank. An ex-post performance measure of retail structured products confirms that these higher level of mark-up translates into lower performance for more complex products.

Finally, when investigating the relationship between complexity and competition in our data, we find evidence of a positive correlation. Based on a issuance-level data analysis spanning on 15 countries over the 2002-2010 period, we find that complexity is higher when product market competition is higher. When related to our results on product performance, this finding represents evidence of a potentially pernicious effect of competition and raises the question of regulation and investor protection in retail finance.

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A Figures

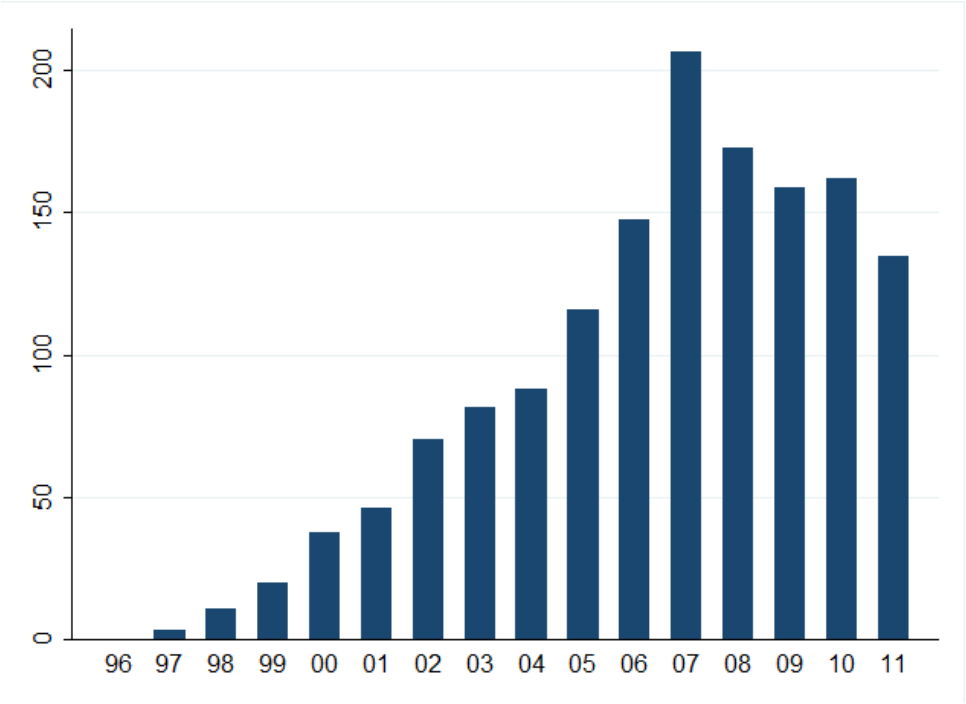

Figure 1. Volume Sold per Year, in billion euros

This figure shows volume issuance of tranche retail structured products over the period 1996-2011 in the European market, in billion Euros. Included countries are the following: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, UK.

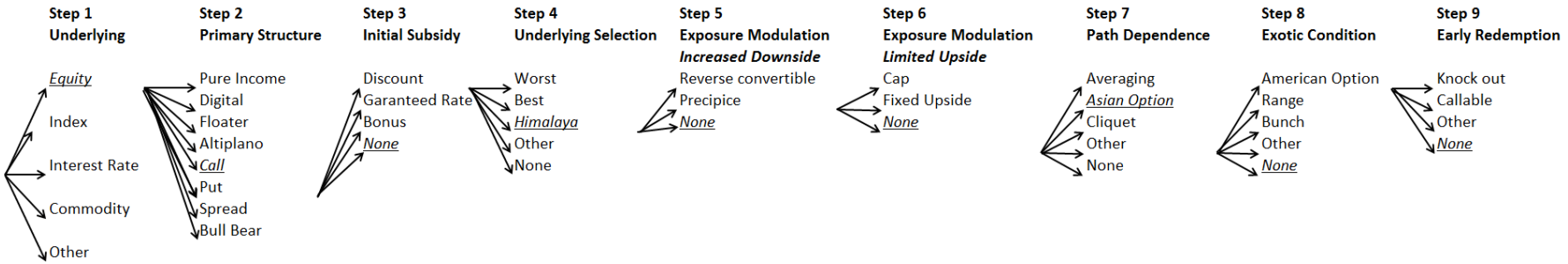

Figure 2. Structured Product Algorithm

This diagram summarizes the main steps in developing a structured product. It gives a formal structure that fits any retail structured products. Each product is defined by the choice of an underlying, a payoff type, and a primary structure. Diversification, exotic condition, underlying selection, exposure modulation, downside and upside, early maturity and path dependance features are optional. All these features are defined in Appendix.

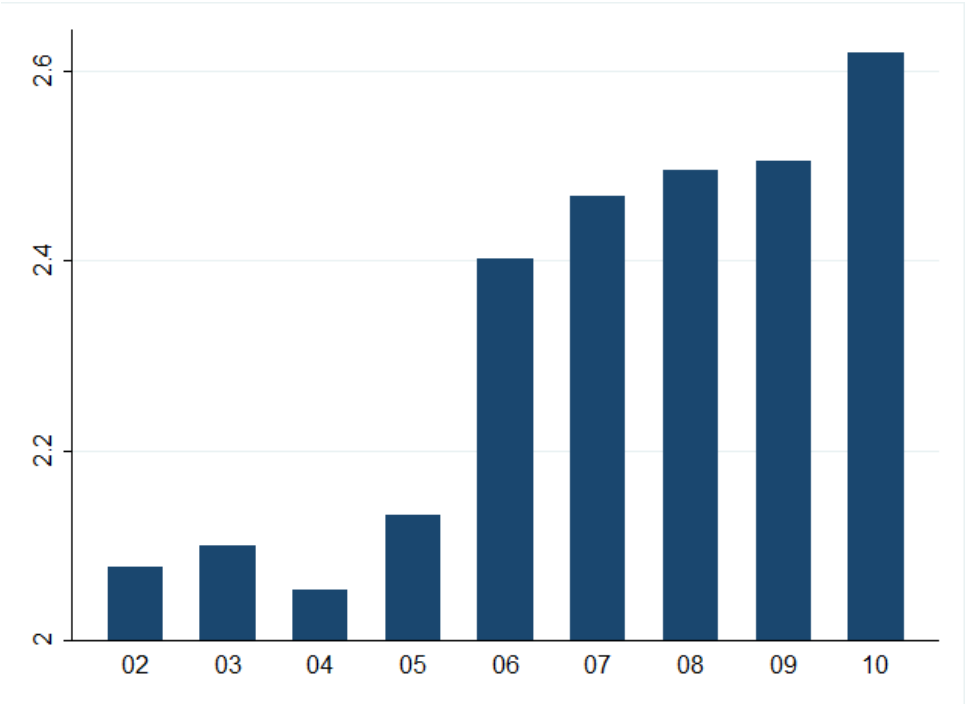

Figure 3. Evolution of Product Complexity over Years

This figure shows the average number of features embedded in the payoff formula of the retail structured products issued in Europe over years. We focus on tranche products, which are non-standardized products with a limited offer period, usually 4 to 8 weeks, and a maturity date, as they have the largest investor base, the highest amount of assets under management (they stand for 90% of total volumes), the highest average volumes, and exhibit the largest heterogeneity in terms of pay-offs. This database covers 17 countries and 55,585 products. The number of features embedded in the payoff formula of each retail structured product is obtained through a lexicographic analysis of the detailed pay-off descriptive (from Euromoney SRP). We develop an algorithm to precisely break-down and identify payoff structures. This methodology allows us to classify products along a tree like structure, and to measure their complexity by capturing the number of piling features.

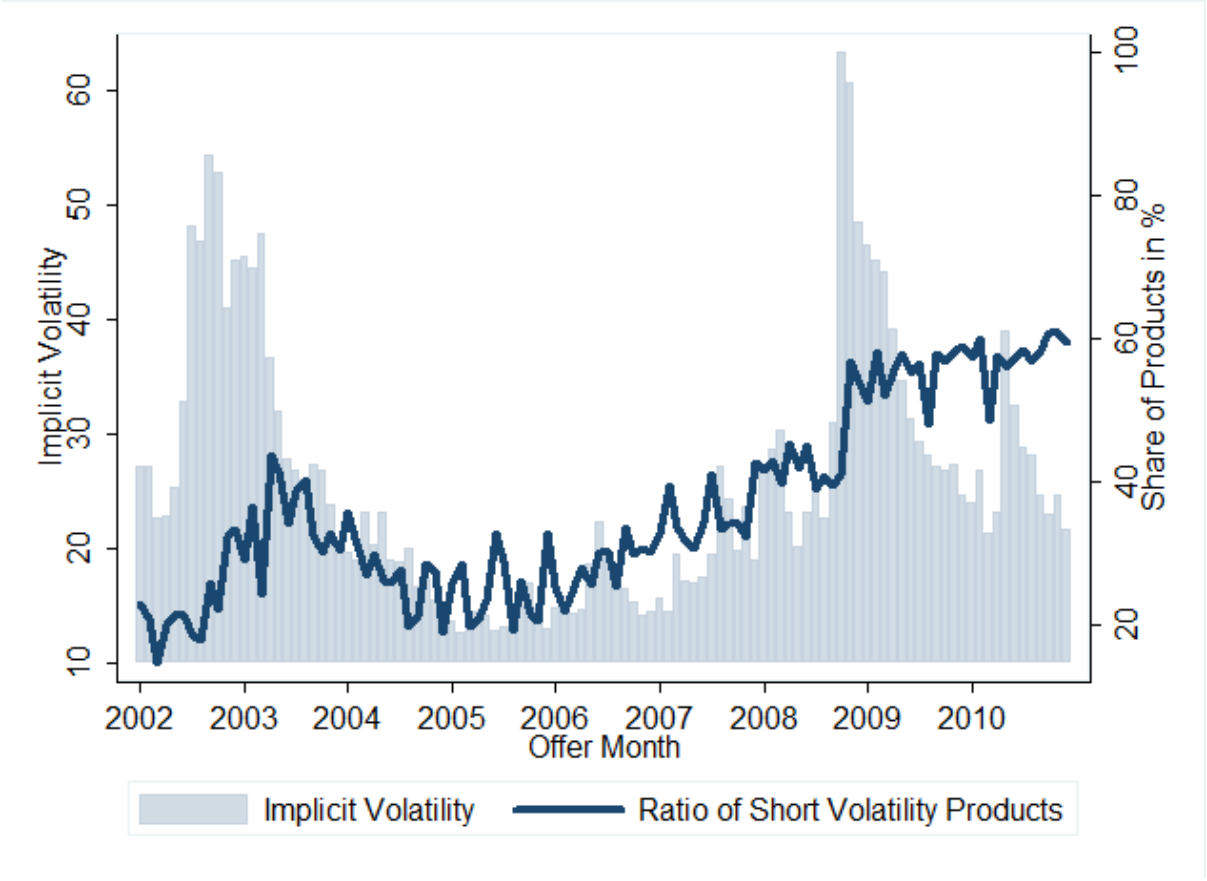

Figure 4. Ratio of Short Volatility Products and Implicit Volatility

This figure shows the share of short volatility products issued each month over the 2002-2011 period and the implicit volatility index. Short volatility products include products with one or several features that induce either a cap on the rise of the underlying index above a certain threshold (knock out, cap, fixed upside or callable features) or the possibility to take a loss when the underlying index drops below a certain threshold (reverse convertible feature). These features are defined in Appendix A. Implicit volatility is measured by the implied volatility index on European stock markets (VSTOXX).

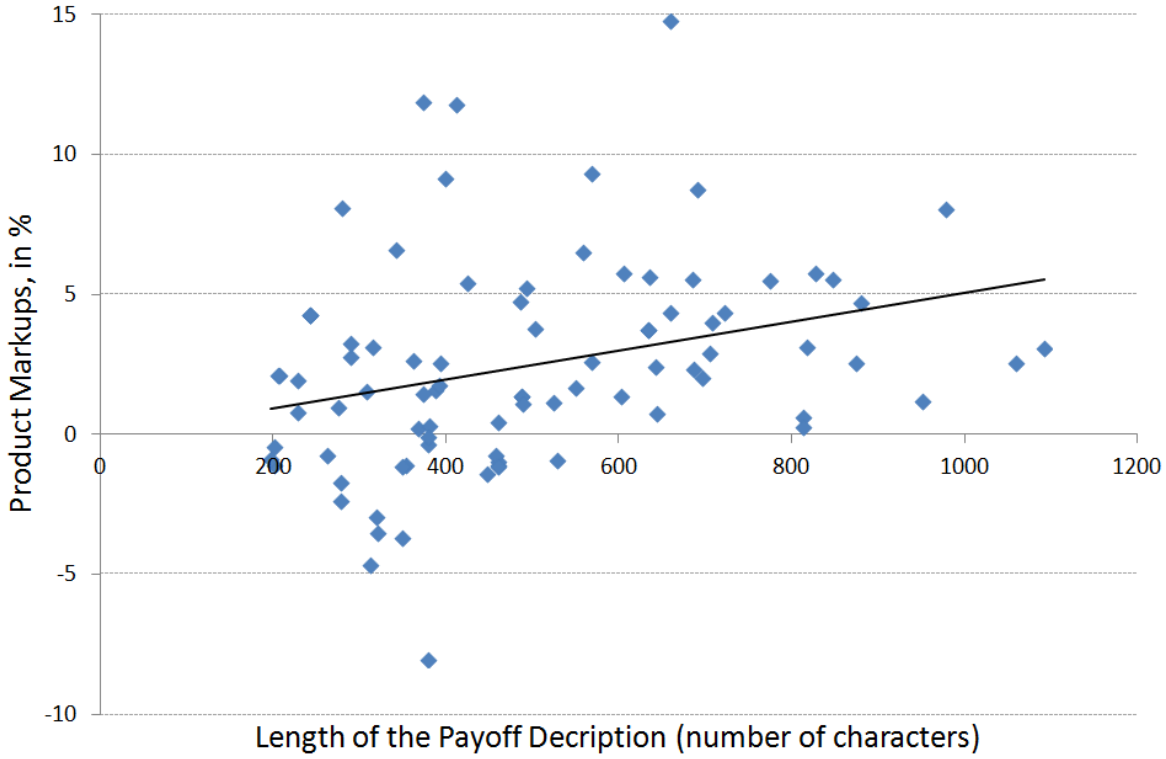

Figure 5. Description Length and Product Markups

This figure shows the markups and description length for 85 products issued in July 2009 and indexed to the Eurostoxx 50. Markups are computed as the difference between the offering price and the product calculated fair value, which are obtained by using Longstaff and Schwartz OLS MonteCarlo pricing methodology (Longstaff and Schwartz (2001)). Markups are expressed in % of notional, length in number of characters. Pay-off descriptions are from Euromoney SRP.

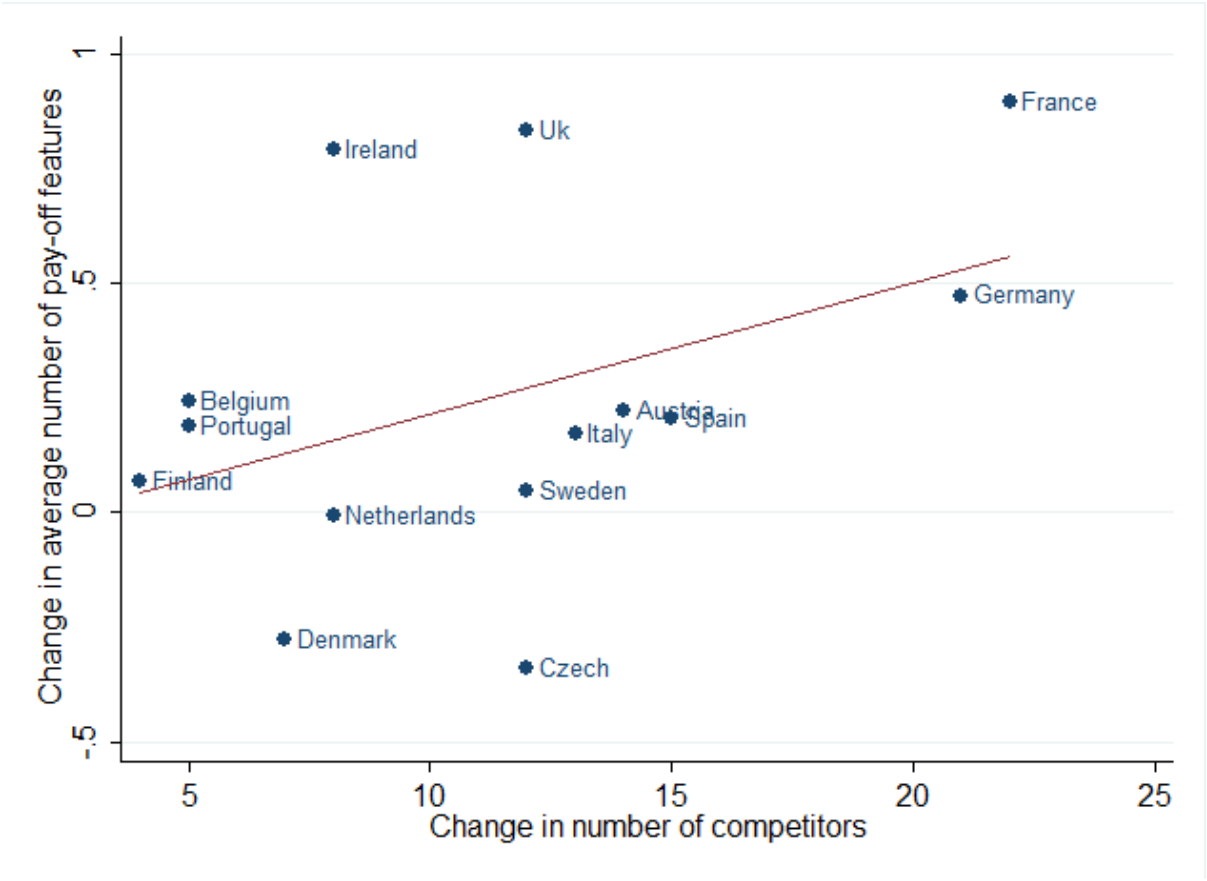

Figure 6. Competition and Financial Complexity

This figure plots the change in the number of competitors over the 2004-2008 period on the x-axis against the change in the average product complexity over the same period on the y-axis. Each point represents a country, there is a total of 14 countries. Hungary and Poland are excluded, since volume sold are lower than 10 billion since inception and stand for less than 2% of financial savings. Norway also is excluded since structured products have been banned in 2008.

B Tables

Table 1 . Country-Level Summary Statistics

Country	(1) Total Issue *Since 2002 (Billion Euros)*	(2) Number of Products *Since 2002*	(3) Number of Distributors *Since 2002*	(4) % of Fin. Savings *2010 (Percent)*	(5) % of Mutual Funds *2010 (Percent)*
Italy	343	5,724	79	2.8	28
Spain	204	4,734	60	2.8	37
Germany	162	14,861	43	2.3	22
France	158	1,801	73	2	12
Belgium	135	4,021	46	8.5	69
UK	110	6,135	141	1.1	8.3
Netherlands	37	2,741	36	1.1	30
Sweden	34	4,529	31	2	9
Portugal	24	928	24	3.2	73
Austria	20	3,275	42	3.3	28
Denmark	17	563	31	.82	7.2
Ireland	16	1,075	40	2.1	.91
Norway	15	1,288	25	.28	1.6
Finland	9	1,251	25	2.1	9.3
Poland	8	1,518	45	1.5	19
Czech Rep.	6	939	24	2.8	45
Hungary	2	202	15	1.9	22
European Market	*1,300*	*55,585*	-	*3*	*12.9*

This table reports the aggregated volume of retail structured product issuance (column (1)), the total number of products sold since inception (column (2)) and the number of distributors in each national markets (column (3)). Column (4) shows the penetration rate of retail structured products defined as the share of household financial savings and column (5) compares the size of assets under management of retail structured products to the one of the mutual fund industry. Retail structured products can take the form of a structured note, which is not included in the mutual fund industry. Figures in the table only include tranche products which are non-standardized structured products, with a limited offer period and a maturity date and which stand for 90% of the market in terms of volume. Flow products (e.g. bonus and discount certificates) and leverage products (e.g. warrants and turbos) are excluded (they stand for more than 1 million issues since 2002 but only 10% of the market in terms of volume). Data is from Euromoney Structured Retail Products.

Table 2 . Number of Distributors over Years and Types

Year	Commercial Banks	Savings Banks	Private Banks	Insurance	Other	Total
2002	66	16	44	14	4	**144**
2003	85	17	62	14	7	**185**
2004	86	17	72	18	8	**201**
2005	106	19	76	26	10	**237**
2006	106	18	87	23	12	**246**
2007	115	20	102	21	14	**272**
2008	110	21	120	24	11	**286**
2009	102	17	94	17	12	**242**
2010	97	18	100	18	11	**244**

This table reports the evolution of the number of distributors by type in the European retail market for structured products (17 countries). Data is from Euromoney Structured Retail Products.

Table 3 . Complexity Measures - Summary Statistics

	N. of Payoffs	N. of Scenarios	Length
Commercial Bank			
Mean	2.3	2.0	472.8
Sd	1.1	1.4	205.7
Max	7	11	2203
Savings Bank			
Mean	2.7	2.7	533.1
Sd	1.1	1.6	226.8
Max	9	16	2595
Private Banking			
Mean	2.5	2.2	503.9
Sd	1.1	1.5	212.7
Max	7	9	2102
Insurance			
Mean	2.4	1.6	480.9
Sd	11	1.0	187.8
Max	6	8	1308
Other			
Mean	2.6	2.1	552.4
Sd	1.2	1.6	249.3
Max	8	9	1624
Total			
Mean	2.5	2.2	493.7
Sd	1.1	1.5	213.8
Max	9	16	2595

This table displays summary statistics of three measures of complexity of retail structured products, by distributor type. Number of payoff features is obtained through a lexicographic analysis of the detailed pay-off descriptive. We develop an algorithm to precisely break-down and identify payoff structures. This methodology allows us to classify products along a tree of possible features. Number of scenarios is constructed by counting the number of conditions in the product descriptive. Length is the number of characters of the payoff descriptive. Data is from Euromoney Structured Retail Products.

Table 4. Product Complexity and Profitability

	Product Markup, in %					
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Per Year	Total	Per Year	Total	Per Year
N. Payoffs	1.00***	0.24***				
	(0.29)	(0.08)				
N. Scenarios			1.11***	0.30***		
			(0.24)	(0.07)		
Description Length/100					0.46**	0.11**
					(0.17)	(0.04)
Credit Risk Dummy	-1.79	-0.29	-2.44**	-0.47*	-1.58	-0.24
	(1.11)	(0.24)	(1.18)	(0.26)	(1.18)	(0.25)
Maturity	0.29		0.38*		0.32	
	(0.23)		(0.21)		(0.22)	
Observations	85	85	85	85	85	85
R^2	0.177	0.125	0.167	0.139	0.151	0.100

Standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

This table displays coefficients of OLS regressions, in which the dependent variable is the markup in % of product notional for all the products indexed to the Eurostoxx 50 sold in Europe in July 2009 (85 products). Markups are computed as the difference between the offering price and the product calculated fair value, which are obtained by using Longstaff and Schwartz OLS MonteCarlo pricing methodology (Longstaff and Schwartz (2001)). The explanatory variables are complexity proxies: number of pay-off features (columns (1) and (2)), number of scenarios (columns (3) and (4)), and length of the pay-off descriptive (columns (5) and (6)), a dummy indicating whether the product is subject to default risk (all columns) and the maturity of the product (columns (1), (3) and (5)). Standard errors are clustered at the distributor group level (30 clusters).

Table 5. Product Complexity and ex-post Performance

	Product Yearly Return, in %					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	ESTX50	All	ESTX50	All	ESTX50
N. Payoffs	-0.319***	-0.184				
	(0.078)	(0.138)				
N. Scenarios			-0.526***	-0.299**		
			(0.086)	(0.144)		
Description Length					-0.003***	-0.003***
					(0.000)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Underlying FE	Yes	-	Yes	-	Yes	-
Product Format FE	Yes	Yes	Yes	Yes	Yes	Yes
Capital Protection Dum.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,467	968	7,467	968	7,467	968
R^2	0.415	0.209	0.417	0.211	0.417	0.216

Standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

This table displays coefficients of OLS regressions, in which the dependent variable is the yearly rate of return for growth products that have reached their term. Columns (2), (4) and (6) give a focus on products indexed to the Eurostoxx 50. The explanatory variables are complexity proxies: number of pay-off features (columns (1) and (2)), number of scenarios (columns (3) and (4)), and length of the pay-off descriptive (columns (5) and (6)), and a dummy indicating whether the product is subject to issuer default risk. Regressions include year, capital protection and underlying fixed effects. Performance data is from Euromoney Structured Retail Products.

Table 6. Competition and Product Differentiation (Country Level)

	Number of Product Types (Country-Year)			
	(1)	(2)	(3)	(4)
	Level	*Level*	*Change*	*Change*
Number of Competitors	2.425***			
	(0.807)			
Herfindahl Index		-217.120***		
		(55.722)		
Change in Competitors			5.837**	
			(2.362)	
Change in Herfindahl Index				-330.672
				(281.120)
Observations	132	132	14	14
Year FE	Yes	Yes	No	No
Country FE	Yes	Yes	No	No
R^2	0.812	0.788	0.451	0.148

Robust standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

All regressions are estimated using an unbalanced panel of fifteen countries over the period 2002-2010. All countries are included except Norway from 2008, due to a ban on structured products, and Hungary and the Czech Republic with markets lower than 10 billion euros and standing for less than 2% of financial savings. The dependent variables are in column (1) and (2) the number of product varieties offered in the country, and in columns (3) and (4) the change in the number of product varieties over the 2004-2008 period. The explanatory variables are either the number of competitors in the country or the Herfindahl index of the retail market for structured products, computed at the country x year level based on estimated volumes. Regressions (1) and (2) include year and country fixed effects. The table shows robust standard errors.

Table 7. Competition and Financial Complexity (Country Level)

	Product Financial Complexity (Country-Year Average, Weighted by Volumes)					
	(1)	(2)	(3)	(4)	(5)	(6)
	N. Payoffs		N. Scenarios		Length	
Number of Competitors	0.012**		0.016**		2.795*	
	(0.005)		(0.007)		(1.425)	
Herfindahl Index		-0.361		-1.122***		-143.541*
		(0.635)		(0.305)		(84.403)
Observations	132	132	132	132	132	132
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.553	0.539	0.687	0.683	0.616	0.606

Robust standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

Regression (1) to (6) are estimated using an unbalanced panel of fifteen countries over the 2002-2010 period. All countries are included except Norway from 2008, due to a ban on selling structured products, and Hungary and the Czech Republic, with markets lower than 10 billion euros and standing for less than 2% of financial savings. The dependent variables are the country averages of our complexity proxies, weighted by volumes: the number of pay-off features (columns (1) and (2)), the number of scenarios (columns (3) and (4)) and the description length (columns (5) and (6)). The explanatory variables are either the number of competitors in the country or the Herfindahl concentration index of the retail market for structured products, computed at the country x year level based on estimated volumes. Regressions (7) and (8) are cross-country regressions in which the dependant variable is the change in the number of pay-off features from 2004 to 2008 and the explanatory variable the change in the number of competitors over the same period. Regressions (1) to (6) include year and country fixed effects. The table shows robust standard errors.

Table 8. Competition and Financial Complexity (Distributor Level)

	Product Financial Complexity (Distributor-Country-Year Average, weighted by volumes)					
	(1)	(2)	(3)	(4)	(5)	(6)
	N. Payoffs		N. Scenarios		Length	
Number of Competitors	0.010**	0.009**	0.010**	0.012***	0.104	0.625
	(0.005)	(0.004)	(0.004)	(0.004)	(0.894)	(0.865)
Observations	2,507	2,507	2,507	2,507	2,507	2,507
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Distributor FE	No	Yes	No	Yes	No	Yes
R^2	0.153	0.444	0.175	0.428	0.177	0.482

Robust standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

All regressions are estimated using an unbalanced panel of 428 distributors over the 2002-2010 period. 51% of these distributors offer products in more than one country. The dependent variable is the weighted average of our complexity proxies at the distributor level: the number of pay-off features (columns (1) and (2)), the number of scenarios (columns (3) and (4)) and the description length (columns (5) and (6)). The explanatory variable is the number of competitors in the country. All regressions include year and country fixed effects. Columns (2), (4) and (6) include distributor fixed effects. The table shows robust standard errors.

Table 9. Competition and Financial Complexity (Product Level)

	Product Financial Complexity					
	(1)	(2)	(3)	(4)	(5)	(6)
	N. Payoffs		N. Scenarios		Length	
Number of Competitors	0.007*		0.011***		1.961*	
	(0.004)		(0.004)		(1.019)	
Herfindahl Index		-0.157		-0.560***		-49.923
		(0.350)		(0.211)		(67.002)
Maturity	0.068***	0.068***	-0.031***	-0.031***	10.535***	10.511***
	(0.011)	(0.011)	(0.008)	(0.008)	(2.132)	(2.129)
Observations	50,753	50,753	50,753	50,753	50,753	50,753
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Product Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Distributor FE	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.248	0.310	0.313	0.311	0.269	0.267

Clustered standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

The dependent variables are our complexity proxies: the number of pay-off features (columns (1) and (2)), the number of scenarios (columns (3) and (4)) and the description length (columns (5) and (6)). The explanatory variable is either the number of competitors in the country or the country-year Herfindahl concentration index of the retail market for structured products. All regressions include year, country, distributors and product type fixed effects. We also control by product maturity. Standard errors are clustered by country and year.

Appendix A The Payoff Algorithm

Name	Description
	Step 1: Underlying
Equity (Single Index)	In frequency order: Eurostoxx50, FTSE100, SP500, DAX, Ibex35, OMSX30, Nikkei225, CAC40, BRIC40
Equity (Single Stock)	In frequency order: Deutsche Bank, Credit Suisse, Daimler, Zurich Finance, Roche, Abb, BASF, UBS, Siemens, Allianz, Nestle
Commodity	Physical commodities such as energy products, metals or agricultural products. In frequency order: gold, brent, electricity, silver, corn
Foreign Exchange	In frequency order: Euro/USD, PLN/Euro, CSK/Euro, CHF/Euro
Credit Default	The risk of default of a company or a country
Interest Rates	In frequency order: Euribor, Libor, Swap rate
Other	Inflation, Funds etc.
	Step 2: Primary Structure
Altiplano	The product offers a capital return of 100%, plus a series of fixed coupons on each sub periods if the underlying is above a predefined barrier.
Floater	The product offers a capital return of 100% plus a series of coupons that rise when the underlying reference rate rises.
Pure Income	The product offers a capital return of 100% plus a series of fixed coupons.
Digital	The product offers a capital return of 100%, plus a fixed coupon paid at maturity if the underlying is above a predefined barrier.
Call	The product offers a capital return of 100% plus a fixed participation in the rise of the underlying.
Put	The product offers a capital return of 100% plus a fixed participation in the absolute value of the fall of the underlying.
Spread	The product offers a capital return of 100% plus a participation related to the spread between the performances of different underlyings (shares, rates.).
Bull Bear	The final return is based on a percentage of the absolute performance of the underlying at maturity.
	Step 3: Initial Subsidy
Discount	
Guaranteed Rate	
Bonus	
	Step 4: Underlying Selection
Best of Option	The return is based on the performance of the best performing underlying assets.
Worst of Option	The return is based on the participation in the performance of the worst performing underlying assets.
Himalaya	A pre-selected number of best-performing assets are permanently removed from the basket, or frozen at their performance level, at the end of each period until the end of the investment.
Kilimanjaro	The lowest performing assets as well as the best performing assets have been progressively eliminated, or ignored from subsequent calculations, during the investment period.
Rainbow	Best performing assets are weighted more heavily than those which perform less well.

Name	Description
	Step 5: Exposure Modulation: Increased Downside
Reverse Convertible	The product is capital guaranteed unless a performance criterion is not satisfied. In this case, the capital return is reduced by the percentage fall in the underlying, or the product pays back a predefined number of shares/bonds.
Precipice	The product is capital guaranteed unless a performance criterion is not satisfied. In this case, the final return is 0.
	Step 6: Exposure Modulation: Limited Upside
Cap	The return is based on the participation in the performance of the worst performing underlying assets.
Fixed Upside	The best performances of a basket of stocks or of a set of subperiod returns are replaced by a predetermined fixed return.
Flip Flop	The coupons are fixed in the first periods, and the distributor has the right to switch you into floating.
	Step 7: Path Dependence
Cliquet	The final return is determined by the sum of returns over some pre-set periods.
Asian Option	The final return is determined by the average underlying returns over some pre-set periods.
Parisian Option	The value of the return depends on the number of days in the period in which the conditions are satisfied.
Averaging	The final index level is calculated as the average of the last readings over a given period (more than one month).
Delay	Coupons are rolled up and paid only at maturity.
Catch-up	If a coupon is not attributed in a given period because the condition required for the payment is not met, then that missed coupon and any subsequently missed coupon will be rolled-up and attributed the next period when the condition is met.
Lookback	The initial/final index level is replaced by the lowest/highest level over the period.
	Step 8: Exotic Condition
American Option	The conditions must be satisfied during the whole considered period.
Range	The performance of the underlying is within a range.
Target	The sum of the coupon reaches a predefined level.
Moving Strike	The conditional levels are moving.
Bunch	The top barrier/cap concerns each asset whereas the bottom barrier concerns the whole basket.
Podium	The underlying is a basket and the final returns depend on the number of shares satisfying the conditions.
Annapurna	The condition must be satisfied for any security in the underlying basket.
	Step 9: Early Redemption
Knockout	The product matures early if specific conditions are satisfied.
Callable	The issuer can terminate the product on any coupon date.
Puttable	The investor can terminate the product on any coupon date.

Appendix B

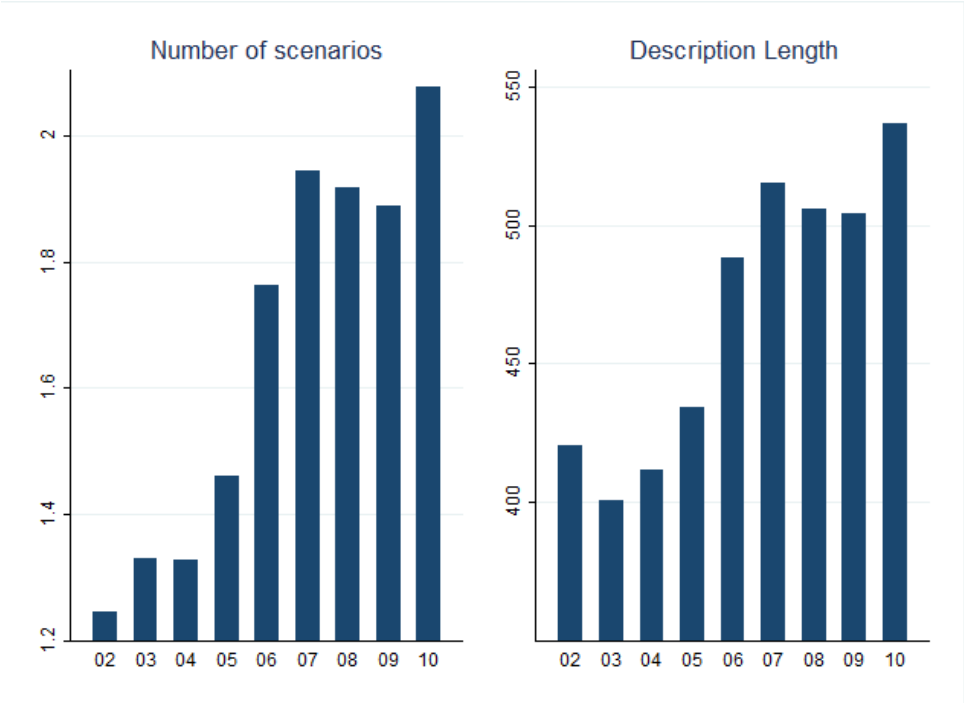

Figure 1. Evolution of Product Complexity over Years

This figure shows the average of our robustness checks proxies for complexity over years. *Number of Scenarios* measures the number of conditions embedded, and *Description Length* the number of characters in the standardized text description of the payoff formula.

Table B.1. 20 Main Distributors in terms of Market Share in 2010

Distributor	Country of Origin	Market Share in %	Average Complexity	Type	Ownership	Distribution Countries
Deutsche Volks & Raiffeisenb.	Germany	11.6	2.8	Savings B	Cooperative	AT DE IT PL
Deutsche Sparkassen	Germany	10.6	2.7	Savings B	State	AT CZ DE
Deutsche Bank	Germany	4.8	3.2	Commercial B	Listed	AT BE DE IT NL PL PT ES UK
UBS	Switzerland	4.1	2.3	Private B	Private	AT BE FR DE IT NL NO ES
RBS	Uk	3.9	2.1	Commercial B	Listed	AT BE DK FI FR DE IE IT NL PT ES SE UK
KBC	Belgium	2.8	2.8	Commercial B	Listed	BE CZ FR HU IE NL PL UK
Santander	Spain	2.7	2.4	Commercial B	Listed	PL PT ES UK
Unicredit	Italy	2.7	2.7	Commercial B	Listed	AT CZ DE HU IT PL ES
Commerzbank	Germany	2.5	2.8	Commercial B	Listed	AT BE FR DE HU IT NL NO PL ES
Barclays	Uk	2.5	2.5	Commercial B	Listed	AT BE CZ FR DE IE IT NL PT ES UK
Bnp Paribas	France	2.4	3.1	Commercial B	Listed	AT BE FR DE HU IT NL PL PT ES UK
Nordea	Sweden	2.3	2.0	Commercial B	Listed	DK FI IT NO PL SE
Garantum	Finland	2.1	3.5	Private B	Private	FI SE
Societe Generale	France	2.1	3.2	Commercial B	Listed	AT BE CZ FR DE IT NL PL ES UK
Caja De Ahorros	Spain	2.0	2.1	Savings B	Private	PT ES
Investec	South Africa	1.9	2.5	Private B	Private	IE UK
Seb	Sweden	1.4	2.1	Commercial B	Listed	DK FI DE NO PL SE
Osterreichische Volksbanken	Austria	1.4	1.5	Commercial B	Cooperative	AT DE HU
ING	Netherlands	1.4	2.7	Commercial B	Listed	AT BE CZ FR DE IT NL PL ES UK
Jp Morgan	Us	1.1	3.2	Private B	Listed	AT BE FR DE IT NL PL ES UK

Market share are computed in terms of number of product issued in Europe in 2010. Countries of distribution are idicated with their ISO 3166 code: Autria (AT), Berlgium (BE), Czech Republic (CZ), Denmark (DK), Germany, (DE), Spain (ES), Finland (FI), France (FR), Hungary (HU), Ireland (IE), Italy (IT), Netherlands (NL), Norway (NO), poland (PL), Portugal (PT), Sweden (SE), United-Kingdom (UK)

Table B.2 . Market Segments

Market Segment	Market Share	Product Maturity (in Years)
Non Collateralised Assets	**77%**	**3.9**
Securities	59%	4.1
Deposits	13%	3.3
Collateralised Assets	**23%**	**5.2**
Life Insurance Products	10%	5.7
Funds	9%	5
Pensions	4%	4.9

This table shows the breakdown of structured retail products issuances by formats of products, and their corresponding maturity. Data is from Euromoney Structured Retail Products.

Table B.3. Details of the 85 retail structured product issued in July 2009

Product Name	Provider Name	Country	Credit Risk	Maturity in years	Number Payoffs	Markup in %	Entry fees in %	Mana. fees in %
Sprint Zertifikat	Hypovereinsbank	Germany	yes	4.4	1	-8.0	2.0	0.0
Summer Invest	Allianz Belgium	Belgium	no	4.9	1	-4.6	4.0	0.0
Phoenix 2	Bank of Scotland	Ireland	yes	3.9	2	-3.6	3.5	0.0
Europa Anleihe 10% Plus 07/09-07/14	Barclays	Austria	yes	5	2	-3.5	5.0	0.0
Eurostoxx 50 Zins Anleihe 4	Barclays	Austria	yes	5	2	-2.9	2.5	0.0
4Y Eur Market Recovery Note	ING	Belgium	yes	4	1	-2.4	0.0	0.0
3Y Market Recovery Note	ING	Belgium	yes	3	1	-1.7	0.0	0.0
Europa Kupon Anleihe	Landesbank Berlin	Germany	yes	5	1	-1.4	0.0	0.0
Seguro Rentabilidad Eurostoxx 114 Db	Deutsche Bank	Spain	no	3.4	2	-1.1	0.0	1.4
Barrier Note Dj Eurostoxx50	ING	Belgium	yes	1.5	2	-1.1	0.0	0.0
Seguro Rentabilidad Eurostoxx 119 Db	Deutsche Bank	Spain	no	3.9	2	-1.1	0.0	1.4
Cs Garant 100 Anleihe 13 Dj Euro Stoxx 50	Credit Suisse	Austria	yes	5	2	-1.1	2.0	0.0
Europa Protect-Anleihe 07/09	West Lb	Germany	yes	4	3	-1.1	2.0	0.0
Seguro Rentabilidad Eurostoxx 122 Db	Deutsche Bank	Spain	no	4.4	2	-0.9	0.0	1.2
Euro Booster 200%	Swiss Life Banque Privee	France	yes	5	4	-0.9	0.0	0.0
Europa-Anleihe	Landesbank Berlin	Germany	yes	5	2	-0.8	0.0	0.0
Cs Top Bonus 115 200	Credit Suisse	Austria	yes	5	2	-0.7	3.5	0.0
Seguro Rentabilidad Eurostoxx 110 Db	Deutsche Bank	Spain	no	2.9	2	-0.7	0.0	1.0
Partizipationsanleihe 01/09	Nordlb	Germany	yes	4	2	-0.4	0.0	0.0
Vital Ibex Bolsa Garantizado	Caja Vital Kutxa	Spain	no	2.5	2	-0.3	5.0	5.6
Igc Dj Eurostoxx50 - Juli 2009	Van Lanschot Bankiers	Netherlands	no	5	2	-0.1	2.0	3.3
Dj Eurostoxx50 Partizipations-Anleihe	Landesbank Berlin	Germany	yes	5	3	0.2	1.5	0.0
Objectif 7.5% Juin 2009	Swiss Life Banque Privee	France	yes	8	4	0.3	0.0	0.0
Easy Bonus-Zertifikat	West Lb	Germany	yes	4.3	2	0.3	1.0	0.0
Equity Protection Switchable	Deutsche Bank	Italy	yes	5	2	0.5	3.3	0.0

Table B.4. Details of the 53 retail structured product issued in July 2009 (2)

Product Name	Provider Name	Country	Credit Risk	Maturity in years	Number Payoffs	Markup in %	Entry fees in %	Mana. fees in %
Objectif 7,5% Distribution Juillet 2009	Swiss Life Banque Privee	France	yes	8	4	0.6	0.0	0.0
Bs Garantia Extra 10	Banco Sabadell	Spain	no	3.1	3	0.8	5.0	3.0
Europa Protect-Anleihe Extra 03/09	West Lb	Germany	yes	6	2	0.8	2.5	0.0
Vr Extrachance Ii	Dz Bank	Germany	yes	4.4	2	1.0	3.0	0.0
Bbva Oportunidad Europa Bp	Bbva	Spain	no	2.9	2	1.1	5.0	6.8
Euro Booster	Swiss Life Banque Privee	France	yes	5	4	1.2	0.0	0.0
Ten Pea	Barclays	France	no	1	6	1.2	2.0	3.0
Dz Bank Bonuschance Control Iii 09/13	Dz Bank	Austria	yes	3.5	2	1.4	0.0	0.0
Dz Bank Bonuschance Control 3 09/13	Dz Bank	Germany	yes	3.5	2	1.4	0.0	0.0
Athena 11% Airbag	Swiss Life Banque Privee	France	yes	8	4	1.4	0.0	0.0
Bonus Pro Zertifikat	Hypovereinsbank	Germany	yes	4.4	1	1.5	2.0	0.0
Best-Entry Garant V-Anleihe	Bayerische Landesbank	Germany	yes	4.5	2	1.6	1.0	0.0
Europa Protect Anleihe Plus	Jpmorgan Chase	Germany	yes	6	2	1.6	2.0	0.0
Bbva Europa Garantizado	Bbva	Spain	no	2.9	3	1.7	5.0	3.6
Kbc-Life Mi Security Europe 2	Kbc Verzekeringen / Cbc Assurance	Belgium	no	7.6	2	1.8	3.0	18.2
Eurostoxx Serenite 2009	Credit Suisse	France	no	6	2	2.0	3.0	12.0
Deposito Imbatible 8-5	Bbk	Spain	yes	3.4	4	2.1	0.0	0.0
Dz Bank Indexklassik Garant 5 09/13	Dz Bank	Germany	yes	4.4	2	2.1	2.5	0.0
Dz Bank Indexklassik Garant V 09/13	Dz Bank	Austria	yes	4.4	2	2.1	2.5	0.0
Dj Eurostoxx 50 Bonus Minimax	Landesbank Berlin	Germany	yes	3	3	2.4	0.5	0.0
Express Zertifikat	Deutsche Bank	Austria	yes	2	4	2.4	1.0	0.0
Mes-Rendements 10%	Finance Selection	France	yes	5	5	2.6	0.0	0.0
Cs Memory Express Zertifikat 6	Credit Suisse	Germany	yes	6	5	2.6	2.5	0.0
Europa Callable Protect Anleihe	Jpmorgan Chase	Germany	yes	5	4	2.6	1.5	0.0

Table B.5. Details of the 53 retail structured product issued in July 2009 (3)

Product Name	Provider Name	Country	Credit Risk	Maturity in years	Number Payoffs	Markup in %	Entry fees in %	Mana. fees in %
Autofocus 9%	Credit Mutuel Arkea	France	no	5	3	2.6	2.0	3.5
Europa Garant Plus-Anleihe	Landesbank Berlin	Germany	yes	6	2	2.7	1.0	3.0
Dexia Clickinvest B Index Linked 7	Dexia Bank	Belgium	no	5.1	2	2.8	2.5	11.9
Eurostoxx 50 Flex-Express 02/09	West Lb	Germany	yes	3	1	3.0	1.0	0.0
Cs Top Memory Express	Credit Suisse	Germany	yes	4	6	3.1	1.0	0.0
Switch To Bond Note	Fortis	Belgium	yes	5	4	3.1	0.0	0.0
Indexanleihe	Nordlb	Germany	yes	1	2	3.1	0.0	0.0
Dexia Clickinvest B Index Linked 8	Dexia Bank	Belgium	no	5.1	2	3.3	2.5	11.9
Centea Fund Click Europe Surplus 10	Centea	Belgium	no	8.6	3	3.8	2.5	17.0
Kbc Clickplus Europe Best Of 42	Kbc Bank	Belgium	no	8.6	3	3.8	2.5	19.1
Zanonia-Deep-Zertifikat	Landesbank Bw	Germany	yes	4	3	3.8	1.0	0.0
Eurostoxx Fast 7%	Swiss Life Banque Privee	France	yes	8	4	4.0	0.0	0.0
Dz Bank Extrachance Pro V 09/13	Dz Bank	Austria	yes	4	2	4.3	2.3	0.0
Dz Bank Extrachance Pro 5 09/13	Dz Bank	Germany	yes	4	2	4.3	2.3	0.0
Dz Bank Vr Extrachance Iii 09/13	Dz Bank	Germany	yes	4	2	4.3	2.3	0.0
Express Zertifikat	Hypovereinsbank	Germany	yes	2	4	4.4	0.5	0.0
Bono Autocancelable 8% Cupon	Citibank	Spain	yes	5	3	4.4	3.0	0.0
Emtn Memory Express-Zertifikat 4	Societe Generale	Germany	yes	6	5	4.7	2.0	0.0
Bonus Control Iv	Dz Bank	Austria	yes	4	2	4.8	2.5	0.0
Seguro Recuperacion Eurostoxx Db	Deutsche Bank	Spain	no	3	1	5.3	0.0	1.0
Bankinter Eurostoxx 2012 Garantizado	Bankinter	Spain	no	3	3	5.4	5.0	6.8
Euro Memory	Nortia	France	yes	8	5	5.5	0.0	0.0
Reference 8,5%	Adequity	France	no	8	4	5.5	4.5	2.0
Sevales (Ex-Sevelys)	Gestion Privee Indosuez	France		5	4	5.5	2.5	12.5

Table B.6. Details of the 53 retail structured product issued in July 2009 (4)

Product Name	Provider Name	Country	Credit Risk	Maturity in years	Number Payoffs	Markup in %	Entry fees in %	Mana. fees in %
Optimiz 7%	Societe Generale	Italy	yes	8.2	2	5.6	0.0	0.0
Step Dj Eurostoxx 50	Banca Aletti	Italy	yes	3	3	5.8	0.0	0.0
Phoenix Memory	Adequity	Belgium	yes	4	5	5.8	0.0	0.0
Wgz Airbag-Zertifikat Mit Cap	Wgz Bank	Germany	yes	5	4	6.6	2.0	0.0
Wgz Easyexpress-Zertifikat 12	Wgz Bank	Germany	yes	4	2	6.6	2.0	0.0
Elixis 2	Credit Agricole	France	no	4.2	4	8.1	2.0	10.0
Cap Garanti 2015	Credit Mutuel	France	no	5.9	2	8.1	3.0	2.5
Sevea	Gestion Privee Indosuez	France	no	5	4	8.8	2.5	12.5
Ing (L) Selectis Euro Equity 1	Ing Luxembourg	Belgium	no	4.5	3	9.2	3.0	6.8
Bif Certi+ 200	Alternea	Belgium	no	6	3	9.4	5.0	7.2
Oriance Epargne 2	Credit Agricole	France	no	6.8	2	11.8	0.0	0.0
Euro Cap 2017	Hsbc Assurances Vie	France	no	6	3	11.9	0.0	0.0
Recovery Note	Abn Amro Bank	Netherlands	yes	5	3	14.8	0.0	0.0