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THE COMPLEXITY OF STRUCTURED PRODUCTS MARKETED IN FRANCE: WHAT IMPACT HAS THE AMF'S ACTION HAD?

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THE COMPLEXITY OF STRUCTURED PRODUCTS MARKETED IN FRANCE: WHAT IMPACT HAS THE AMF'S ACTION HAD?[1]

Summary

In October 2010, the Autorité des marches financiers (AMF) and the Autorité de contrôle prudentiel et de résolution (ACPR) the regulators of the French financial system, jointly published elements of policy aimed at limiting the complexity of products with a risk of capital loss that are marketed in France to retail investors in the form of formula-based funds or complex debt securities, those products can in particular be sold as vehicles for unit-linked life insurance policies. The main objective of this study is to assess the impact of this measure. Along the lines of the work carried out by Célérier & Vallée (2017) and based on data from Structured Retail Products, several indicators were used to analyse the changes in the complexity of these products between 2001 and 2018. Three indicators focused on the complexity of the product payoff formula (number of features, number of nodes in the decision tree and number of scenarios), and one on the complexity of the underlying asset. The number of features and, since 2017, the complexity of the underlying asset were taken into account in a binding way by the AMF when analysing product complexity.

The analysis shows a sharp decrease in complexity as measured by the number of features after 2010, but this was offset by an increase in the number of scenarios, which highlights a risk of circumventing the regulatory framework. Moreover, although the underlying assets considered as the most complex have been used less since 2017, so have the simplest underlyings, which is an additional area of focus.

The headline rates (annual returns received by the investor under the best-case scenario) highlighted in the marketing documents are positively correlated with all the complexity measures analysed (number of features, number of nodes, number of scenarios and underlying asset complexity). The most complex products are the worst performers at maturity, however.

The annualised gross nominal returns on structured products are overwhelmingly positive in most cases (above 5% for more than half of the products). Adjusted for inflation, 75% of matured products performed positively in real terms, but only accounted for 57% of the volumes sold. However, if we compare this performance with that of traditional financial investments (stock index with or without reinvested dividends), the results are less favourable. This shows that 43% of products linked to the equity markets (representing just over half of the volumes sold) would outperform a fund replicating the CAC 40. This figure falls to 21% (30% of volumes) when compared with a fund replicating the CAC 40 with reinvested dividends.

[1] We would like to thank Boris Vallée, member of the AMF's Scientific Advisory Board, for his invaluable assistance in writing this article. Errors and omissions are, of course, our own responsibility.

1. CONTEXT AND OBJECTIVES OF THE STUDY

In October 2010, the AMF and ACPR jointly published elements of policy relating to marketing of structured products posing a risk of capital loss greater than 10% of the amount invested and sold to retail investors. Those products are marketed in the form of formula-based funds or complex debt securities (AMF Position DOC-2010-05)[2], and can notably be sold as vehicles for unit-linked life insurance policies (ACPR Recommendation 2010-R-01)[3]. In these documents, the ACPR and the AMF defined four criteria for assessing whether there is a risk that retail investors will not understand the financial instruments offered or the risks incurred. If the financial product does not meet one of these criteria, it is considered to be at risk of being mis-sold. One of them concerns the number of features included in the payoff formula.[4] More specifically, if there are more than three different calculation features for determining the overall return of the product, the ACPR and the AMF consider this product to be difficult for investors to understand.[5]

These elements of policy were modified in December 2016, which led to include in the counting of features for calculating complexity the elements of complexity in the underlying asset to which the performance of the financial product is indexed.

Measuring the complexity of structured products has been the subject of academic work. In particular, Célérier & Vallée (2017) developed three indicators: the number of features, the number of scenarios and the number of words in the payoff formula. Using a database of structured products sold in Europe to retail clients between 2002 and 2010, they show that the complexity of structured finance products increased at least until 2008. Based on more recent data from the same data provider (Structured Retail Products), ESMA (2018) uses two of these three metrics (the number of scenarios and the number of words) and concludes that the average complexity of products sold in France and Italy increased between 2005 and 2017, unlike products sold in Germany.[6,7]

This study is a continuation of the work of Célérier & Vallée. It analyses the structured products marketed in France between 2001 and 2018, in order to assess the impact of the actions of the AMF and the ACPR on the level of complexity of those products.

The second part of the study focuses more specifically on product marketing. The aim here is to analyse whether the headline rate (i.e. the annual return received by the investor under the best-case scenario) highlighted in the product documentation is related to the level of complexity of the products. It also examines whether the names of the products reflect their characteristics.

Finally, the study looks at the *ex post* (and therefore observed) performance of structured products compared with traditional financial investments, particularly equity investments.

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[2] https://www.amf-france.org/en_US/Reglementation/Doctrine/Doctrine-list/Doctrine?docId=workspace%3A%2F%2FSpacesStore%2F8f1c7f9a-90bc-4afa-94cf-4b5db749a747&category=IV+-+Marketing+-+Customer+relationship&docVersion=4.0&langSwitch=true

[3] https://acpr.banque-france.fr/contenu-de-tableau/recommandation-2016-r-04-de-lautorite-de-controle-prudentiel-et-de-resolution-du-13-decembre-2016 (in French)

[4] The other criteria are a poor presentation, either written or verbal, of the product's risks and/or gain/loss profile (Criterion 1), the unfamiliarity of the product's underlying assets for the targeted retail client (Criterion 2) and the fact that the product's gain/loss profile is subject to the simultaneous fulfilment of several conditions on different asset classes (Criterion 3).

[5] The 90% guarantee threshold and marketing to retail clients are the conditions for the AMF and the ACPR to trigger the counting of features. Regarding the guarantee threshold, it should be noted that the ACPR and the AMF adopt slightly different approaches: the guarantee must apply at maturity for the AMF as opposed to the entire period for the ACPR.

[6] Hamourit, E., Harris, A., Reisch, M. (2018). *Structured Retail Products: the EU market. ESMA Report on Trends, Risks and Vulnerabilities.*

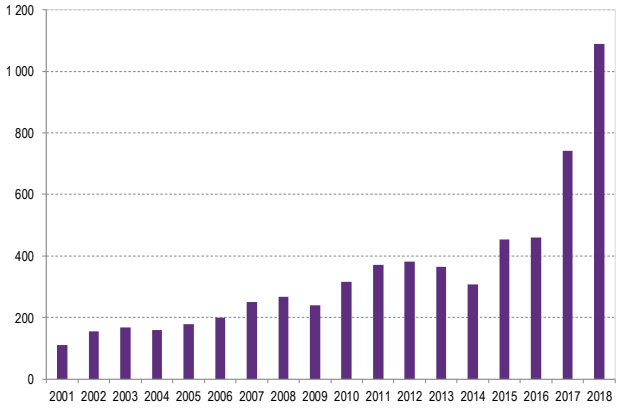
[7] These three countries were chosen because they are the three largest in terms of volumes sold.

2. PRESENTATION OF THE SAMPLE

Acquired from the data provider Structured Retail Products (hereinafter referred to as SRP) for the specific purposes of this study, the database consisted of 6,217 structured products (i.e. formula-based collective investment undertakings and complex debt securities) sold in France[8] between 2001 and November 2018. In more than three-quarters of cases (77%), these products are aimed at retail customers.[9] One of the benefits of the database is that it provides the amount of structured products actually marketed in a given country. This information is provided directly to SRP by the investment management companies or, failing that and where practicable, estimated by SRP. For France, the total subscriptions during the study period amounted to €219 billion. The assets under management at the end of 2018 were estimated at €52.8 billion (1% of the financial assets of French households),[10] which places France in terms of market size in fourth place in Europe, behind Germany, Italy and Belgium.[11]

With the exception of the 2012-2014 period, the number of structured products sold in France has grown steadily, with a significant acceleration since 2016 (Figure 1), reaching an all-time high in 2018. However, despite a significant strengthening from 2014 onwards, volumes sold did not follow the same trajectory: at the end of 2018, volumes sold were well below the peak achieved in 2007 (Figure 2).

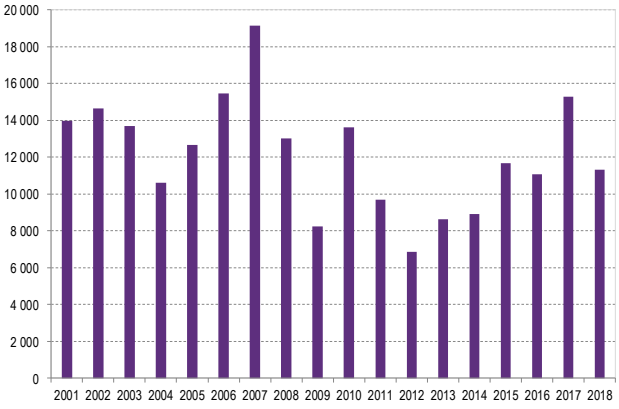
Figure 1: Number of products sold per year



Source: Structured Retail Products, AMF calculations

Figure 2: Volumes sold in France per year

In millions of euros



Source: Structured Retail Products, AMF calculations

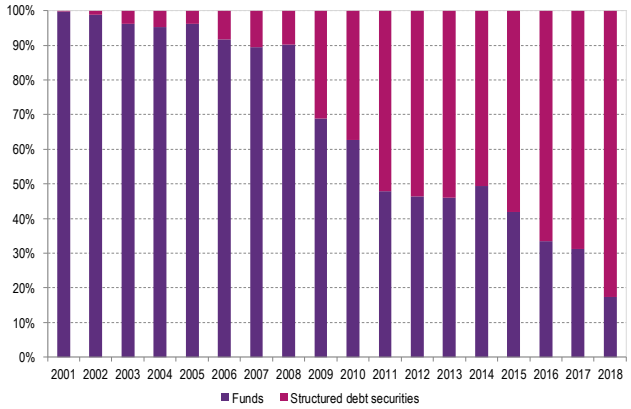
Originally composed almost entirely of collective investment funds, structured products have evolved considerably since the financial crisis broke out, increasingly taking the form of structured debt securities, which represented almost the entire market at the end of the study period in terms of the number of products and, more importantly, volumes.

[8] Products withdrawn during or shortly after the subscription period are not included in the sample.
[9] For 349 products, the volumes marketed were not provided or were not publicly available. These products were nevertheless retained because they are aimed at retail customers.
[10] This compares with 4% for the European Union as a whole (ESMA, 2018).
[11] The total value of assets marketed in Europe is estimated at €500 billion in 2017.

Figure 3: Type of products sold
As a % of total number

Source: Structured Retail Products, AMF calculations

Figure 4: Type of products sold
As a % of assets



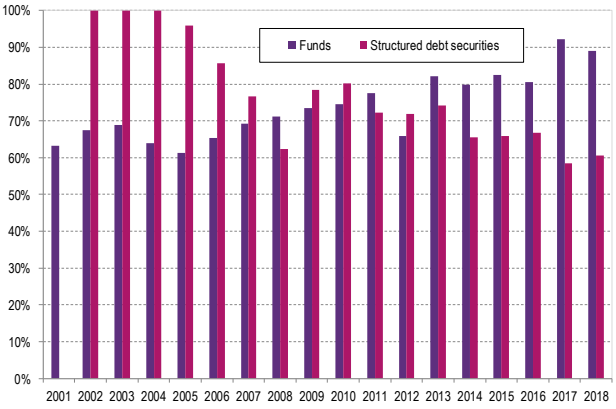
Source: Structured Retail Products, AMF calculations

The market for structured products appears to be fairly concentrated in terms of issuers. While the trend is towards less concentration for debt securities (in terms of number or volume), the opposite is true for funds. This latter trend can probably be explained by the significant decrease in the marketing of structured funds during the study period.

Figure 5: Percentage of top 3 issuers by product type (by number)

Source: Structured Retail Products, AMF calculations

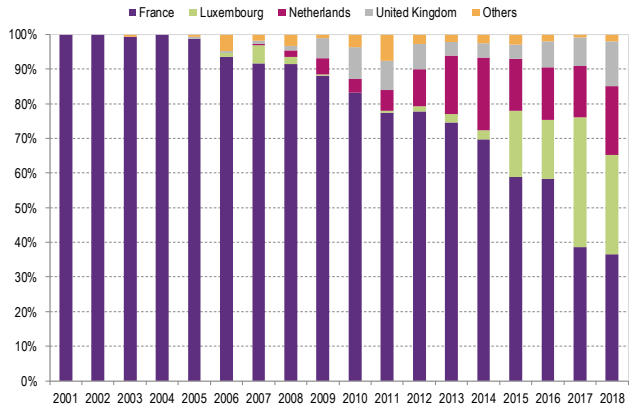
Figure 6: Percentage of top 3 issuers by product type (by volume)



Source: Structured Retail Products, AMF calculations

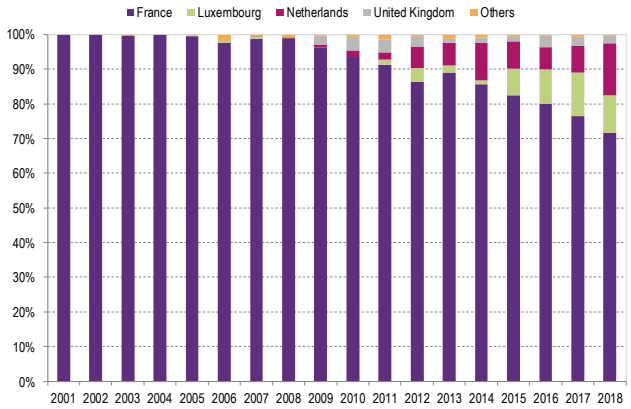
An increasing number of products marketed in France are domiciled in a country other than France. In 2018, 63% of the products sold in France were domiciled abroad, notably in Luxembourg, the Netherlands and the United Kingdom (Figure 7). However, this finding is put into perspective when looking at volumes sold, where France continues to be the main country of domicile (Figure 8).

Figure 7: Where products sold are domiciled
As a % of total number



Source: Structured Retail Products, AMF calculations

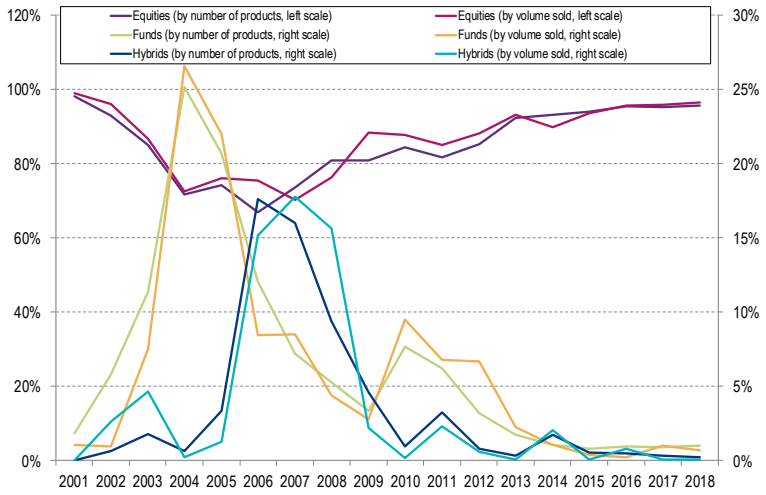
Figure 8: Where products sold are domiciled
As a % of total assets



Source: Structured Retail Products, AMF calculations

While products may be exposed to various underlying asset classes (equities, interest rates, commodities, currencies, etc.), equities (single security or index) were the major underlying asset class over the entire study period. It is notable that, following a decline after the internet bubble burst, the proportion of products exposed to equities and equity indices has risen steadily since 2006, despite the subprime mortgage crisis (Figure 9), to the detriment of products exposed to funds or hybrid underlying assets.

Figure 9: Percentage of products whose underlying assets are…

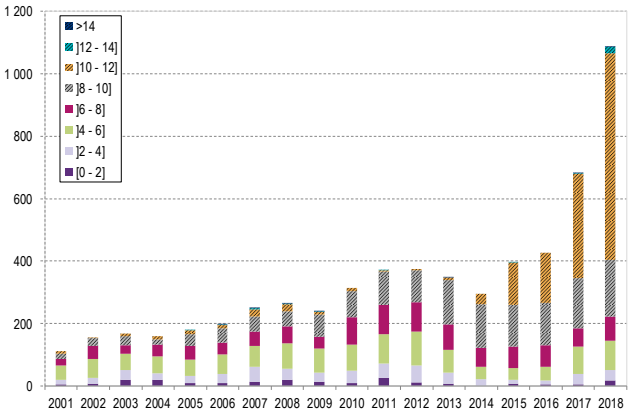


Source: Structured Retail Products, AMF calculations

Since 2011, this trend has been accompanied by an increase in the proportion of products with a theoretical maturity of more than 8 years,[12] which is found in terms of the number of products (Figure 10) and volumes sold (Figure 11). This trend in France is different from other European countries, where theoretical maturity has tended to decrease in recent years (ESMA, 2018).

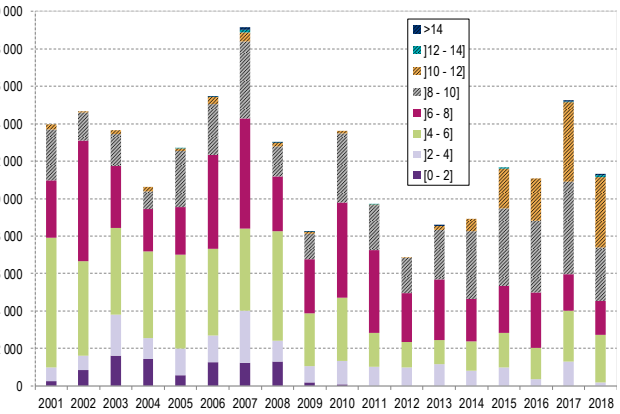
[12] Theoretical maturity is defined here as the difference between the last theoretical valuation date of the product and the first valuation date.

Figure 10: Number of products sold per year and by theoretical maturity



Source: Structured Retail Products, AMF calculations

Figure 11: Volumes sold in France per year and by theoretical maturity (in millions of euros)

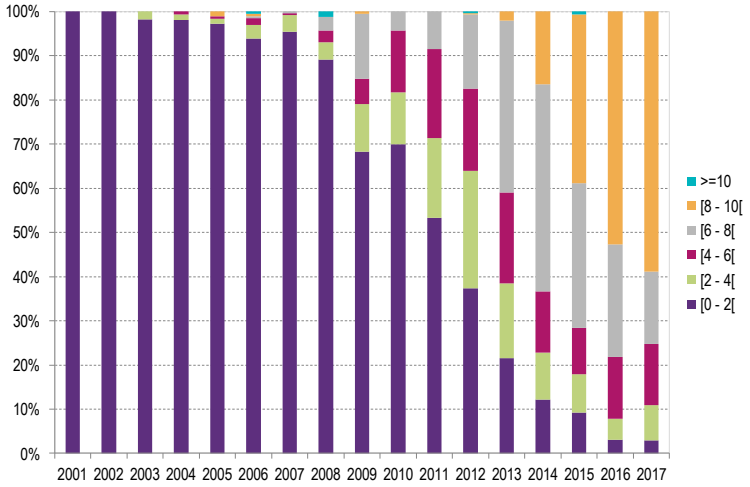


Source: Structured Retail Products, AMF calculations

Note: The hatched portion corresponds to the proportion of products with a theoretical maturity of 8 or more years.

However, when only matured products are used, there is an increasing difference over time between theoretical and actual maturity, reflecting the rise of products with early redemption clauses,[13] which had become almost systematic by the end of the study period (Figure 12).[14]

Figure 12: Breakdown of matured products by the difference (in number of years) between their theoretical and actual maturity

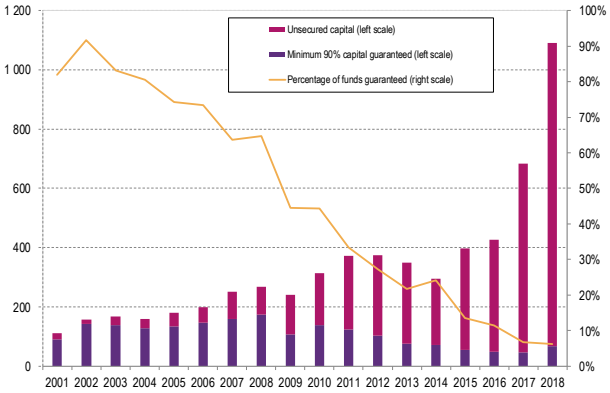


Source: Structured Retail Products, AMF calculations
Note: In 2017, 59% of products had a difference between their theoretical maturity and their actual maturity of between 8 and 10 years. This figure was 16% in 2014.

Finally, it is interesting to note the decline in the unconditional capital guarantee, particularly following the implementation of accommodative monetary policies after the subprime mortgage crisis erupted, which resulted in a search for returns and therefore an increase in the associated risk. Between 2001 and 2008, products with at least 90% capital protection averaged 77% of the sample, compared with 23% of the sample over the period 2009-2018 (Figure 13).

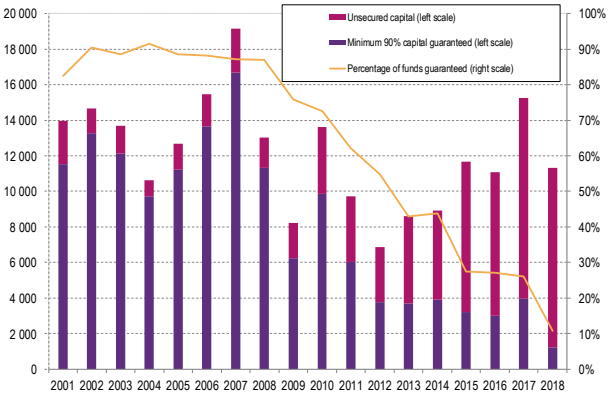
[13] These are known as Autocall (Automatically Callable) products.
[14] See section 3.1.1.

Figure 13: Number of products by existence of a capital guarantee



Source: Structured Retail Products, AMF calculations

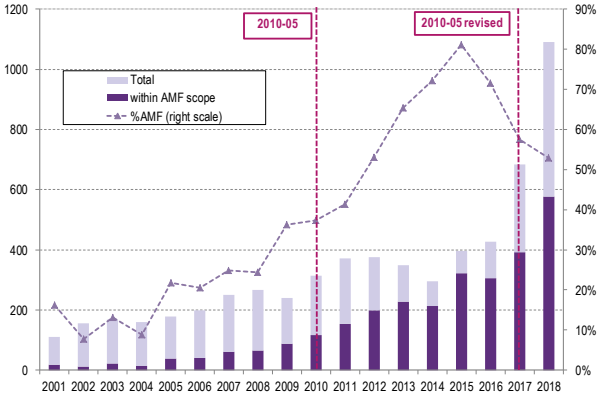
Figure 14: Volumes sold in France by existence of a capital guarantee (in millions of euros)



Source: Structured Retail Products, AMF calculations

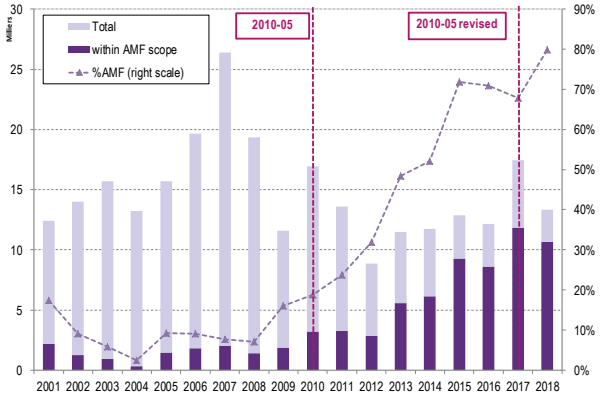
Due to the increase in the number of unsecured products, most of the products marketed in France (in number and volume) and referenced by Structured Retail Products now fall within the scope of Position 2010-05, and are therefore subject to review by the regulatory authorities, primarily by the AMF (Figure 15 and Figure 16). As a reminder, products with a risk of capital loss greater than 10% of the amount invested and sold to retail investors fall within the scope of the two regulators' policies.

Figure 15: Products falling or not within the scope of Position 2010-05: by number



Source: Structured Retail Products, AMF calculations

Figure 16: Products falling or not within the scope of Position 2010-05: by volume



Source: Structured Retail Products, AMF calculations

3. MEASURING COMPLEXITY: METHODS AND RESULTS

Four measures were used in this study to determine product complexity. Three indicators focussed on the complexity of the payoff formula and one on the complexity of the underlying asset to which the payoff is linked.

3.1. PAYOFF COMPLEXITY

3.1.1. Presentation of the measures

- **Count of the features in the payoff formula**

The first measure of complexity analysed was the total number of features in the payoff formula. The concept of complexity is multifaceted, and each feature here aimed to capture a dimension of complexity. The definition of the features used in this study and their categorisation is largely based on those proposed by Célérier & Vallée (2017).

Eight main dimensions of features were selected (details of these dimensions are provided in Annex 1). A first dimension includ basic payoff formulas, such as the issuance of a series of fixed coupons or the participating interest in the performance of the underlying asset. The other seven dimensions indicated respectively whether the payoff of the product is related to:

- *Dimension 2:* the existence of leverage;
- *Dimension 3:* the selection of certain securities of the underlying asset (selection or exclusion of the best/worst performing securities, etc.) or the addition of conditions on the underlying asset;
- *Dimension 4:* the existence of a capital guarantee conditional on the return on the underlying asset;
- *Dimension 5:* the possibility of adjusting the coupon characteristics (changing a fixed coupon into a variable coupon, or vice versa);
- *Dimension 6:* the existence of time constraints (deferred coupons, performance defined as an average of returns over a sub-period, etc.);
- *Dimension 7:* the possibility of early redemption;
- *Dimension 8:* the existence of exotic conditions (e.g. when the condition necessary for the issuance of the coupon must be fulfilled at any time or varies over time, etc.).

If the formula have one or more characteristics of a given category, its complexity is increased by one[15].

The database provided a detailed description of each product and, in particular, the payoff formula used. The features were identified in practice by a text-analysis algorithm that searches for keywords in this description.

The count carried out in this study can be likened in principle to the work carried out by the AMF in supervising the proper implementation of Position 2010-05. However, the elements of complexity selected and, consequently, their number, diverged from this in practice. For example, in this study, a product with a capital risk was considered more complex than a guaranteed product, all other things being equal. For the AMF and the ACPR, however, the absence of a capital guarantee does not play a role in counting the features. Yet, the absence of a guarantee justifies that the regulatory authorities examine the commercial documentation of these products. Another example in this study is the fact that the threshold for early redemption varies over time and is therefore an additional feature.

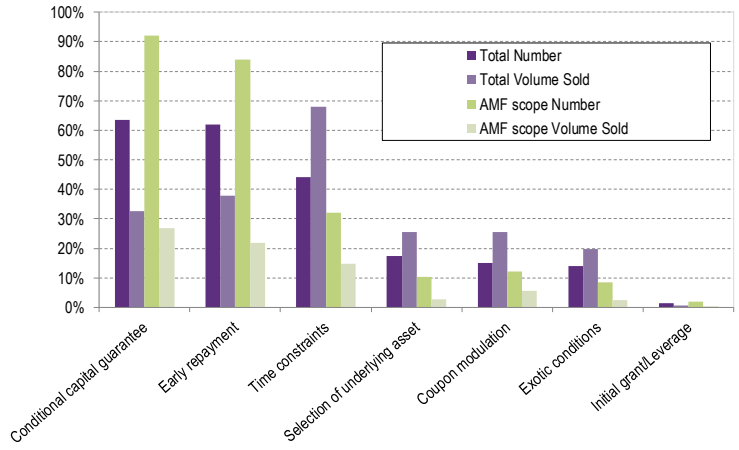
[15] Thus, the highest possible level of complexity cannot exceed 8.

Example 1: Counting the number of features

"This growth product is linked to the CAC. At maturity the product offers a capital return of 100% **plus 110% of the rise**[(1)] in the CAC **capped at 91%**[(2)], unless the index fell by more than 20% of its initial level. If the final value of the index is more than 20% below its initial value, **then the capital is reduced to parity for every 1% below 20.**[(3)] The initial value of the index is calculated as the average over the first five days. **The final value of the index is calculated as a weekly average over the previous three months."**[(4)]
Total features = 4 as follows: 1 – Basic feature; 2 – Cap on the increase in the underlying asset; 3 – The capital return is reduced if the performance criterion is not satisfied (Reverse Convertible); 4 – The final value of the index results from the calculation of an average.

The features implemented vary greatly depending on the product. Some dimensions are very rarely observed, such as leverage. Others are more common. For example, nearly two thirds of the products in the sample include the possibility of early redemption. This is also very common among the products examined by the AMF. Moreover, for one third of products, representing more than two thirds of the volume marketed, the payoff is subject to time constraints (Figure 17).

Figure 17: Characteristics of structured products issued between 2001 and 2018
(% of number and total amount)



Source: Structured Retail Products, AMF calculations

The features offered also vary greatly depending on the year in which the product was marketed. Among the most notable developments, in addition to the increase in the number of products with a capital risk, is the sharp decline in the number of features described as exotic, reflecting a growing standardisation of products sold in France since 2010 (Figure 18). Another striking fact is the generalisation of the early redemption option, which has been provided almost systematically from 2016 onwards (Figure 19).

Figure 18: Products whose performance is subject to exotic conditions

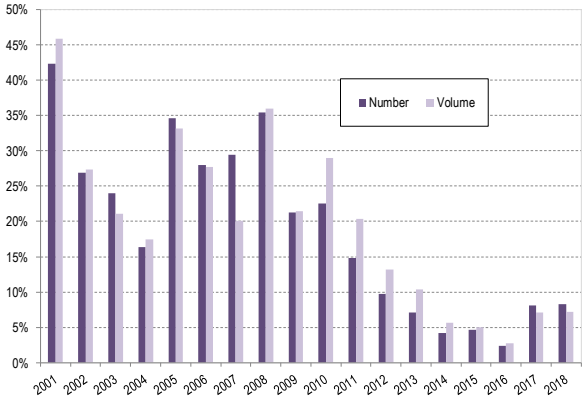


Figure 19: Products with possible early repayment

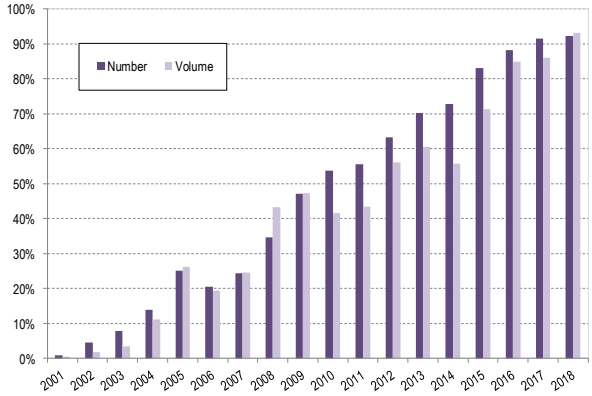


Figure 20: Existence of a conditional guarantee

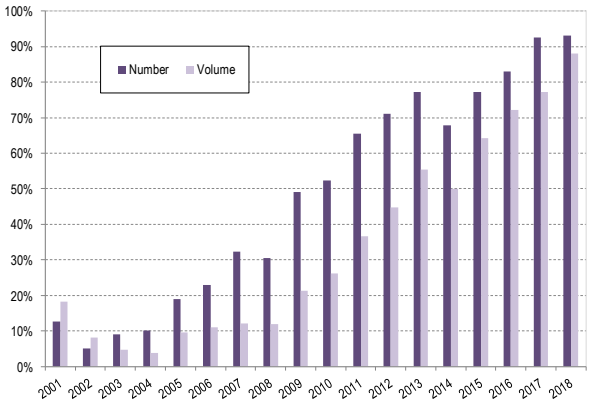


Figure 21: Time constraints

Source: Structured Retail Products, AMF calculations

- **Number of nodes in the decision tree**

The second measure of complexity analysed was the number of nodes in the decision tree represented in the payoff formula. The decision tree describes the payoff distribution, depending on whether events provided in the formula occur or not. Each node provides at least two possibilities with regard to the expected return and has therefore at least two scenarios (the "branches" of the tree). Significant expansion of the number of nodes makes virtually impossible any attempt to calculate the final return of the product. Thus, it is a source of complexity. This measure is used by the AMF for its overall assessment of complexity but is not used as a binding quantitative criterion in the Position 2010-05.

Basically, there are two types of nodes: firstly, intermediate nodes, which occur during the life of the product, and secondly, nodes that occur at maturity. If the same node repeats itself several times during the product's life (for example, every year), only one node is counted.

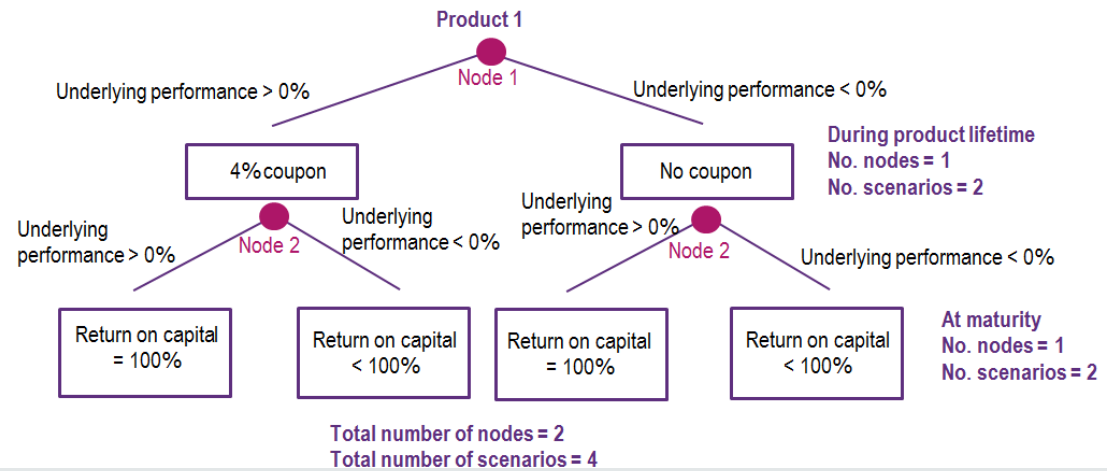
- **Number of scenarios**

The third measure of complexity, identical to that used by Célérier & Vallée and ESMA, was the number of scenarios affecting the product's performance. This was identified by searching for words such as "if", "as long as" or "otherwise" in the payoff formula description through a text analysis algorithm. This metric measures the number of branches in each node. However, as with the number of nodes, if the same scenarios are repeated on each reporting date, they are only counted once.

Example 2: Counting the number of nodes and scenarios for two different products

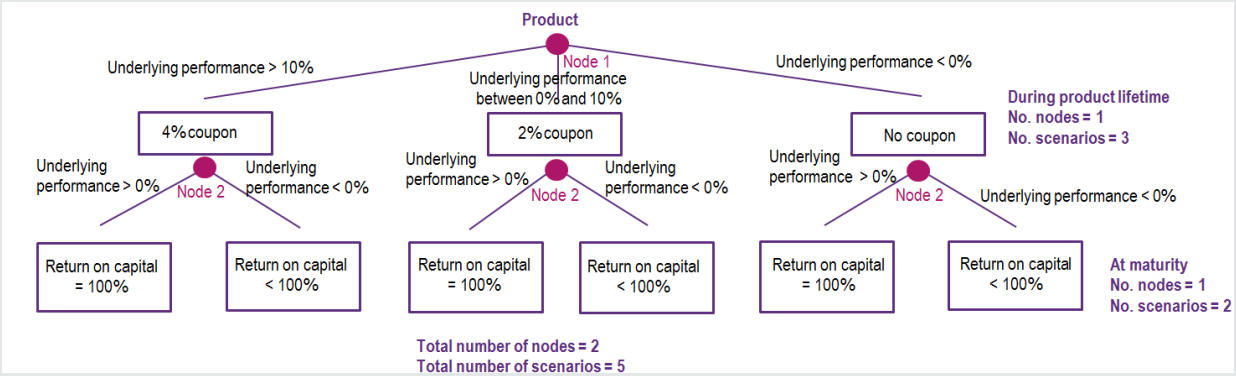
Product 1:

If on any of the reporting dates, the underlying asset closes above its initial level, a coupon of 4% is paid, otherwise none. In all cases, the product will not be reimbursed before its maturity. At maturity, if the underlying asset closes above its initial level, the investor is repaid at 100% of their initial invested capital. Otherwise, the investor receives the invested amount less the decrease in the underlying asset.



Product 2:

If on any of the reporting dates, the underlying asset has increased by 10% or more, a coupon of 4% is paid. If the performance of the underlying asset is positive but less than 10%, a coupon of 2% is paid. In other cases, no coupon is paid. In all cases, the product will not be reimbursed before its maturity. At maturity, if the underlying asset closes above its initial level, the investor is repaid at 100% of their initial invested capital. Otherwise, the investor receives the invested amount less the decrease in the underlying asset.



3.1.2. Results

The sample will be divided into 2 sub-groups for the presentation of the results. The first one is labelled “within scope of policy” and contains all the products falling within the scope of the AMF-ACPR policy (i.e. products that pose a risk of capital loss greater than 10% of the amount invested and are sold to retail investors). The second sub-group is called “outside scope of policy” and is made of all others products.

- **The regulators' action has resulted in a significant decrease in the level of product complexity measured by the number of features…**

Analysis of the features count for products falling within the scope of the AMF-ACPR policy clearly shows that the regulator's action has had a significant impact in terms of supervising products marketed in France. The proportion of products with more than three features[16] – by both number and volume – decreased sharply in the period from 2009 to 2011, which marks the implementation of the "complex products" policy. However, this trend was interrupted in terms of volumes marketed: from 2017 onwards, products with at least four features in their payoff formula were in fact the best sellers in France. In recent years, products with just one or two features have tended to disappear, thereby depriving retail investors of the least complex products.

Figure 22: Number of products by number of features – within scope of policy*

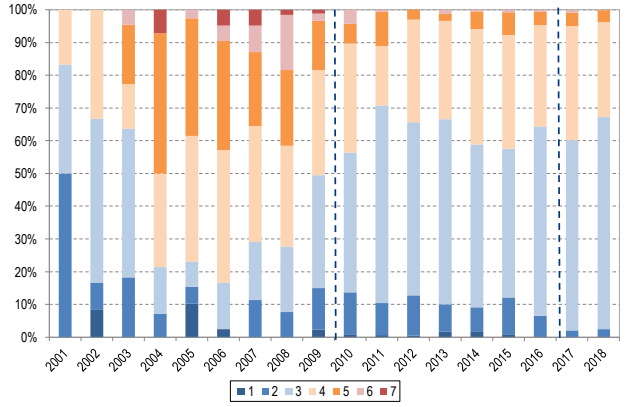
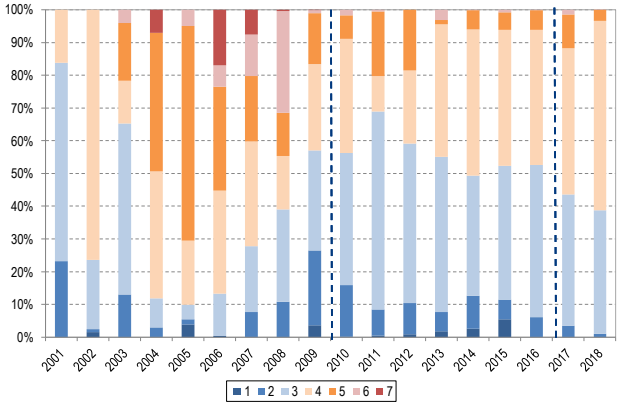


Figure 23: Volumes sold in France by number of features – within scope of policy*

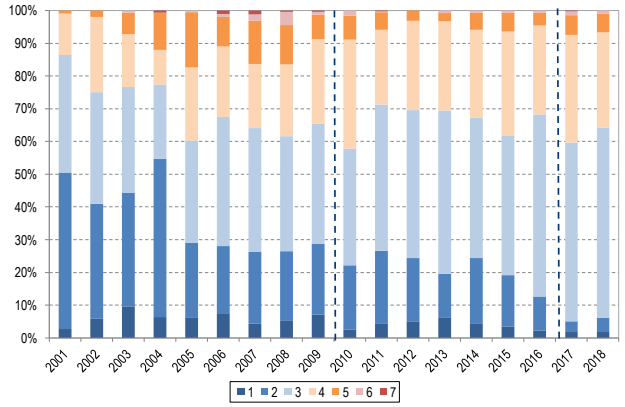


Source: Structured Retail Products, AMF calculations
** Products with a risk of capital loss greater than 10% of the amount invested and sold to the general public.*
Note: The vertical dashed lines indicate the dates of implementation and subsequent modification of the AMF and ACPR policies.

As regards the rest of the sample, the number of products with more than three complexity features has been relatively stable since 2006. These products were marketed less between 2010 and 2015. Since then, there has been a significant increase in sales volumes for the most complex products. As with products falling within the scope of the AMF-ACPR policy, the proportion of products with one or two features – by both number and volume – has decreased significantly in recent years.

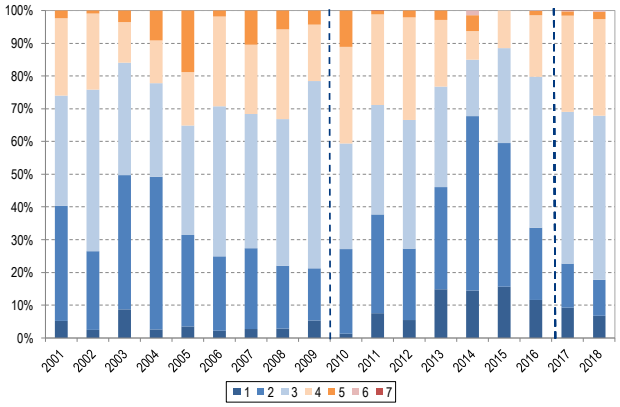
[16] Themaximum number of features permitted by the policy. It is important to remember that the number of features calculated here tends to be higher than the number of features calculated by the AMF.

Figure 24: Number of products by number of features – outside scope of policy



Source: Structured Retail Products, AMF calculations

Figure 25: Volumes sold in France by number of features – outside scope of policy*



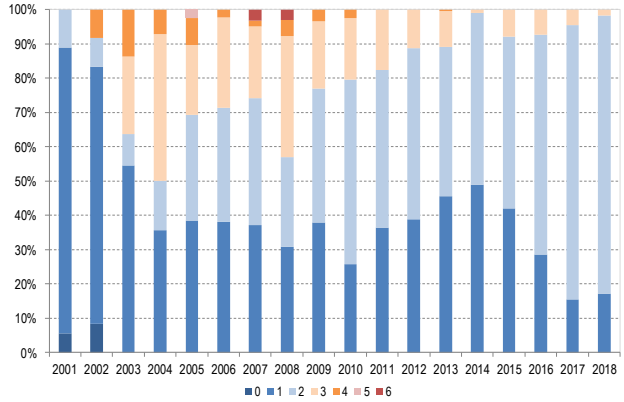
Source: Structured Retail Products, AMF calculations

- **… offset, however, by a recent increase in the number of nodes and scenarios**

The introduction of the "complex products" policy was accompanied by a decrease in the number of nodes in decision trees between 2010 and 2014 for all products (Figure 26 to 29). By this time, the proportion of products with more than two nodes had almost disappeared. This trend was then interrupted: between 2015 and 2017, the proportion of the least complex products (one node) declined significantly. By contrast, the number of products with at least two nodes increased sharply and represented 80% of the sample at the end of the study period, compared with less than 30% until 2004.

This phenomenon is evident for both debt securities and funds, although it is worth pointing out again that funds were in a very small minority at the end of the study period.

Figure 26: Number of products by number of nodes in the payoff formula's decision tree – within scope of policy



Source: Structured Retail Products, AMF calculations

Figure 27: Volumes sold in France by number of nodes in the payoff formula's decision tree – within scope of policy

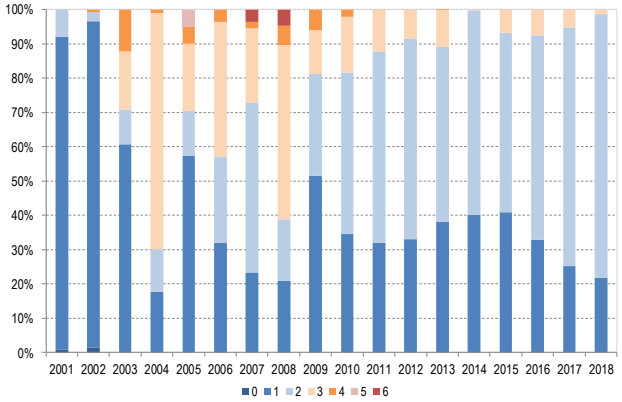


Figure 28: Number of products by number of nodes in the payoff formula's decision tree – outside scope of policy

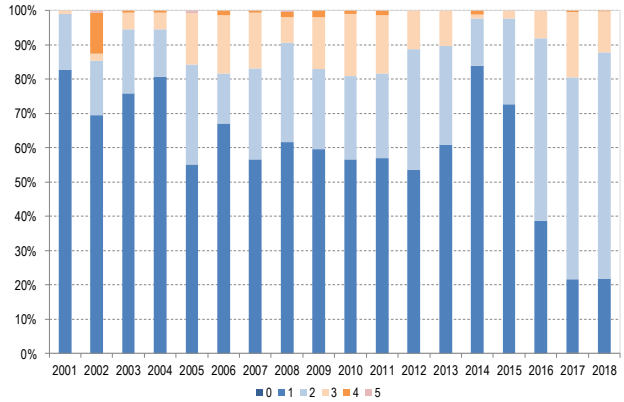
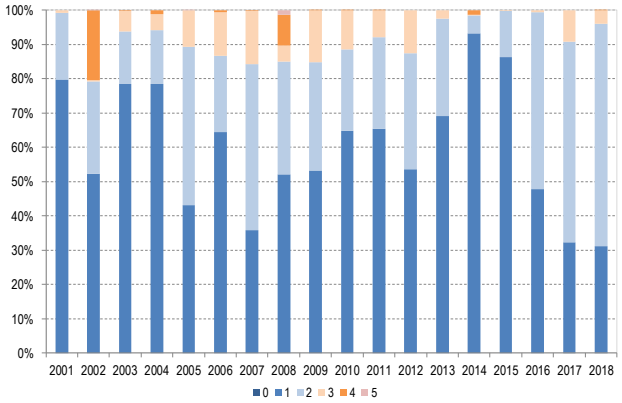


Figure 29: Volumes sold in France by number of nodes in the payoff formula's decision tree – outside scope of policy



Source: Structured Retail Products, AMF calculations

Similarly, an increase in the number of scenarios is evident. Over the years studied, products with two scenarios have become a minority and have gradually been replaced by products with at least three, then four or more scenarios. This trend, which began well before the implementation of the "complex products" policy, seems particularly marked for products located within the AMF's scope (Figures 30 to 33).

Figure 30: Number of products by number of scenarios – within scope of policy

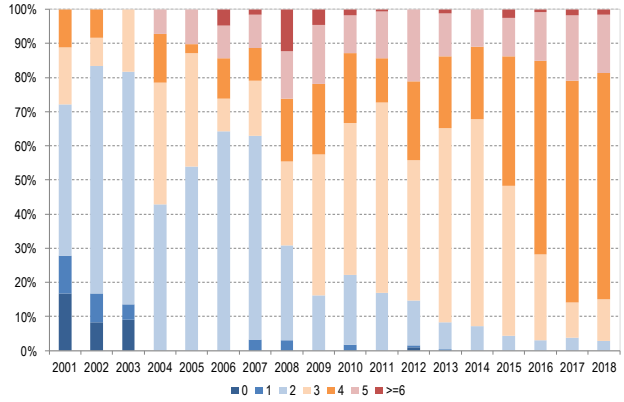


Figure 31: Volumes sold in France by number of scenarios – within scope of policy

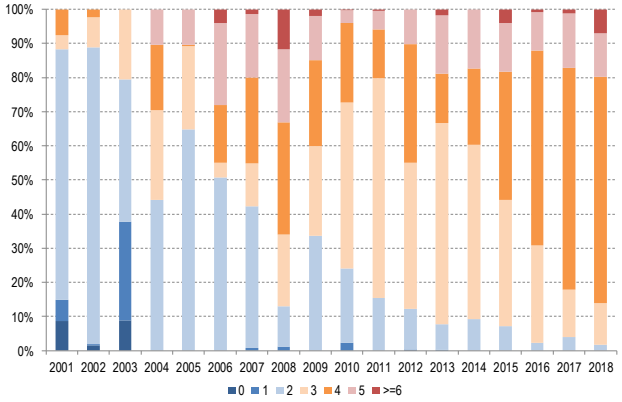


Figure 32: Number of products by number of scenarios – outside scope of policy

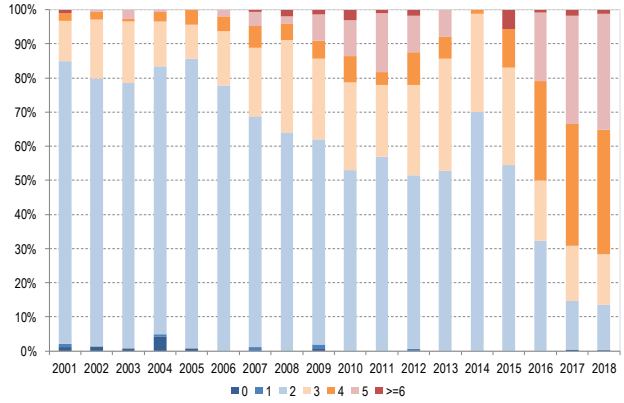
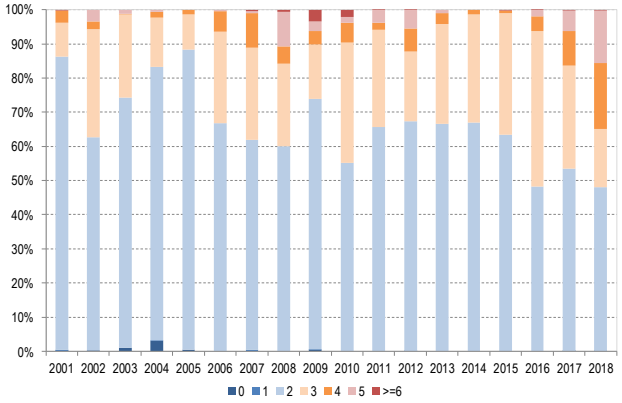


Figure 33: Volumes sold in France by number of scenarios – outside scope of policy



Source: Structured Retail Products, AMF calculations

3.2. UNDERLYING ASSET COMPLEXITY

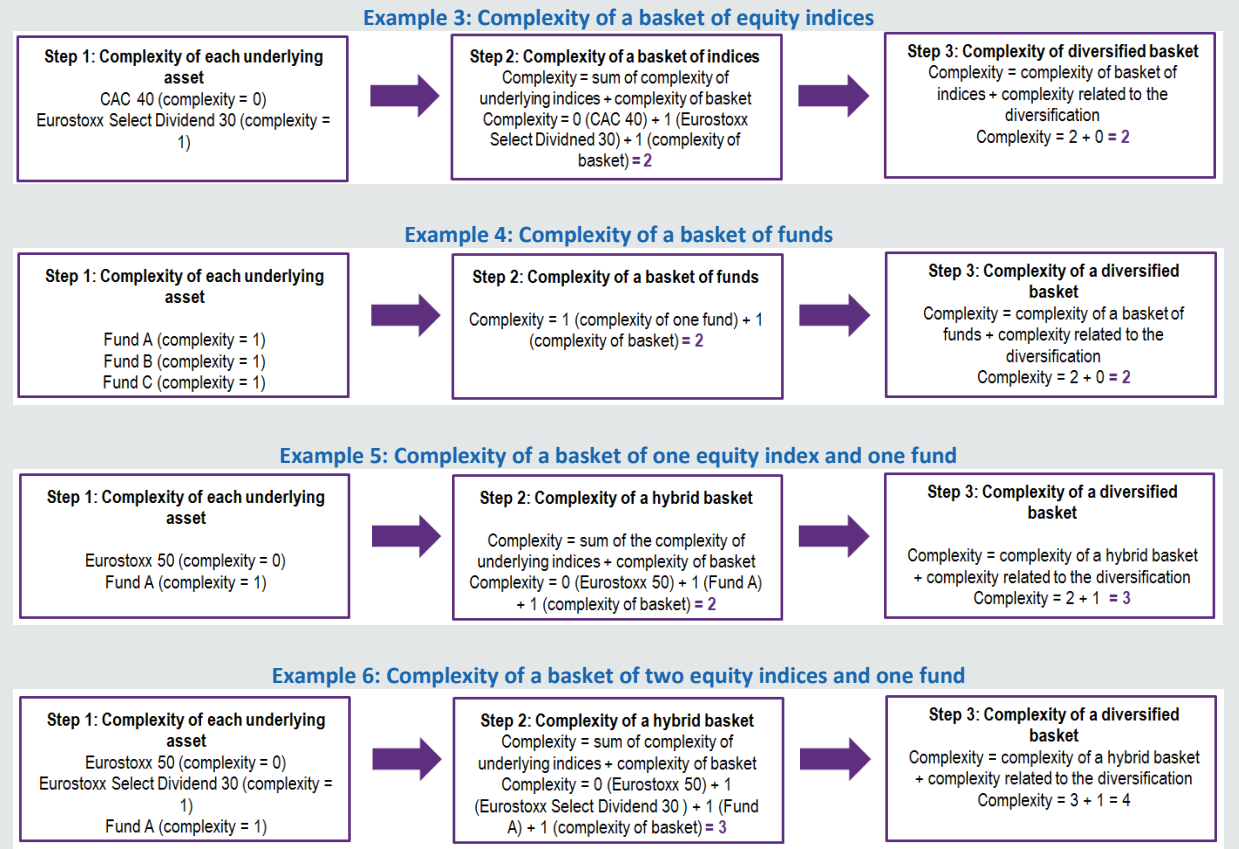
In addition to the complexity of the payoff formula, we also considered the complexity of the underlying asset to which the performance of the structured product is linked. This measure is new when compared with the existing academic literature. It is based on and justified by the fact that the decrease in complexity observed since 2010 in the number of features has been offset by an increase in the complexity of the underlying assets, thus creating a risk of circumventing the regulatory framework. This led to the amendment in 2016 of Position 2010-05, which now takes into account the complexity of the underlying in measuring the overall complexity of structured products.

3.2.1. Presentation of the measure

The indicator for measuring the complexity of the underlying index was constructed in a similar way to measuring the complexity of the features (additive complexity).

Firstly, an assessment of complexity according to the type of underlying asset was applied: when the performance of the product depended on the performance of a single financial security (a share or a bond), complexity was set at 0; when the underlying asset was a fund or a foreign exchange rate, it was set at 1. It seems to be more complicated to anticipate the performance of a fund whose management choices are discretionary or the fluctuations in an exchange rate that might be very volatile. When the underlying asset was a basket, an additional complexity mechanism related to the basket was counted because it is more difficult, particularly for a retail investor, to calculate the performance of a basket of indices or securities. The complexity of a basket was obtained by adding up the complexity of each component and adding one for the complexity of the basket. However, this rule did not apply to baskets of funds, as the funds' investments are managed as part of a regulatory scheme. In this specific case, the complexity of each fund was not considered on an individual basis, but a complexity mechanism was counted for the basket. More generally, an additional complexity mechanism was added if the basket is composed of different asset classes (diversification complexity).

When performance varied based on an index, a complexity mechanism was counted for each filter to obtain the composition and performance of the index (liquidity filter, dividend filter, subtraction of a lump sum amount, etc.). Benchmark indices, such as the CAC 40, were not considered as complex. As a result, their complexity indicator was set to 0. Basic socially responsible investment (SRI) filters were not counted as a complexity mechanism, in accordance with AMF Position 2010-05. However, when no index information was available, the highest complexity was attributed to the index.

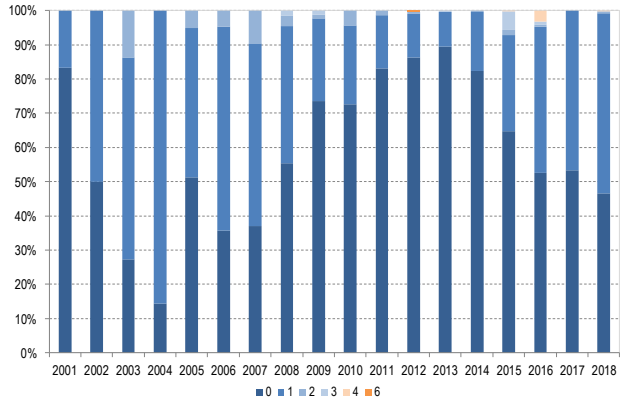


In general, the method used here to determine the complexity of underlying assets is similar to that used by the AMF. However, while the method used in this study did not impose any cap on the degree of complexity of the underlying asset, this is not the case for Position 2010-05, where a complex underlying asset adds an element of complexity to the product (and only one). As a result, for examples 3 to 6 presented above, the method applied here counts between 2 and 4 complexity mechanisms compared with only one for the AMF.

3.2.2. Results

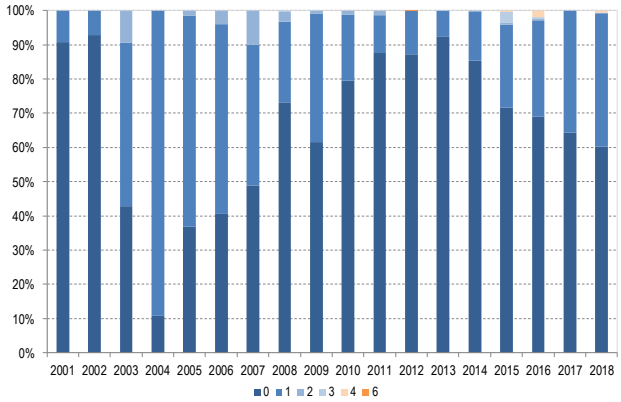
In practice, the underlying asset complexity is between 0 and 10, with a high concentration of underlying assets having a complexity level of 1 or lower (Figure 34 and Figure 35).

Figure 34: Number of products by underlying asset complexity level – within scope of policy



Source: Structured Retail Products, AMF calculations

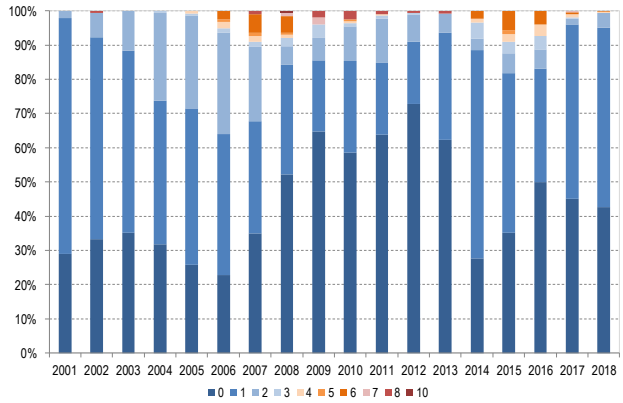
Figure 35: Volumes sold in France by underlying asset complexity level – within scope of policy



Source: Structured Retail Products, AMF calculations

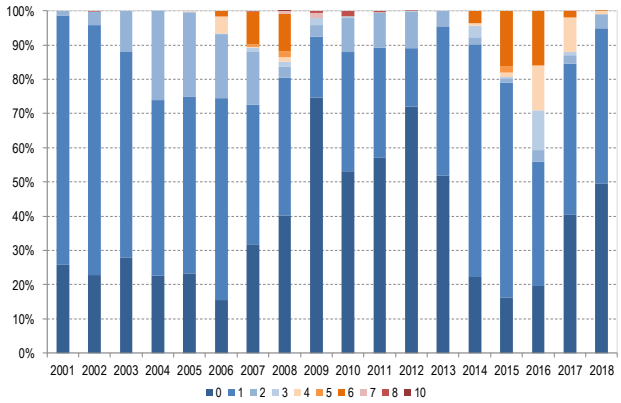
For products outside the scope of the policy, pre-crisis years were characterised by an increasing use of underlying assets with a complexity level of 3 or more, with a significant increase in underlying assets with a high complexity level (5 elements of compleity or more). Products with a high level of complexity returned between 2014 and 2016. After the end of 2016, less use was made of underlying assets with a complexity level of 3 or above. When we consider this in terms of the number of products, we see that this decrease in underlying assets with a complexity level of 3 or above has been made in favour of assets with a single filter. For example, equity-weighted indices, where dividends are reinvested but a lump sum amount or percentage is deducted (such as the CAC Large 60 Equal Weight Excess Return[17] or the SBF Top 80 Equal Weight Decrement 50 Points[18]) have become more and more popular in recent years. The decrease in the use of underlying assets with a complexity level of 0 in favour of assets with a filter is also found for products approved by the AMF. More generally with regard to AMF-approved products, it should be noted that the use of very complex underlying assets is very low, regardless of the period in question.

Figure 36: Number of products by underlying asset complexity level – outside scope of policy



Source: Structured Retail Products, AMF calculations

Figure 37: Volumes sold in France by underlying asset complexity level – outside scope of policy



Source: Structured Retail Products, AMF calculations

[17] This index combines the equity-weighted stocks of the CAC 40 and the CAC Next 20. The index is calculated by reinvesting dividends and subtracting a lump sum percentage of 5% per year.

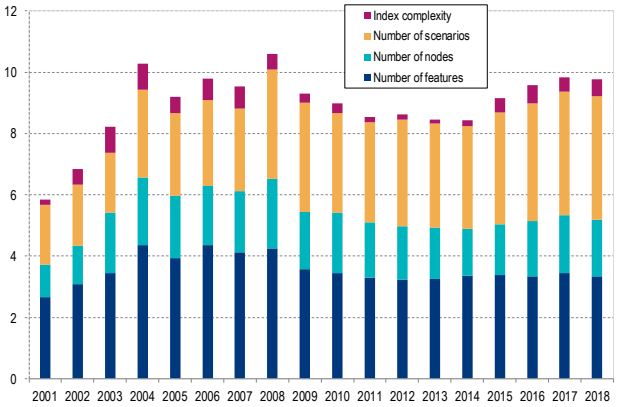
[18] This index consists of the 80 largest French equity-weighted companies. The index is calculated by reinvesting dividends and deducting a flat-rate levy of 50 index points.

3.3. OVERALL PRODUCT COMPLEXITY

In order to obtain an overall view of the complexity of the products sold, the averages of the number of features, number of nodes, number of scenarios and the underlying asset complexity were added together.

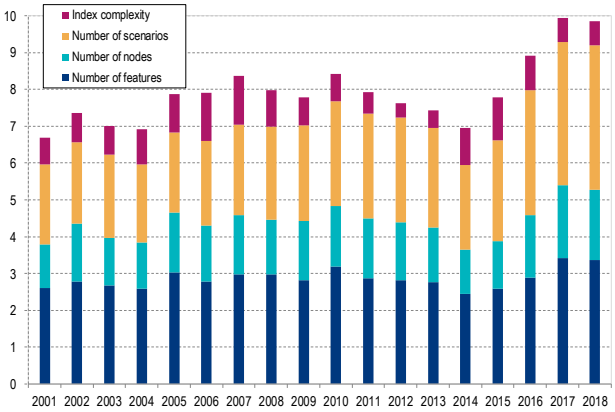
The average number of features of products under review by the AMF has been stable since 2011 at slightly above 3. This stability has been offset by an average number of nodes and scenarios per product and an average underlying asset complexity that have increased since 2014. For products not reviewed by the AMF, the same trend can be observed in relation to the number of nodes and scenarios. However, the average number of features has increased significantly since 2014.

Figure 38: Average number of features, number of nodes, number of scenarios and underlying asset complexity per year – within scope of policy



Source: Structured Retail Products, AMF calculations

Figure 39: Average number of features, number of nodes, number of scenarios and underlying asset complexity per year – outside scope of policy



Source: Structured Retail Products, AMF calculations

3.4. PRODUCT DESIGN

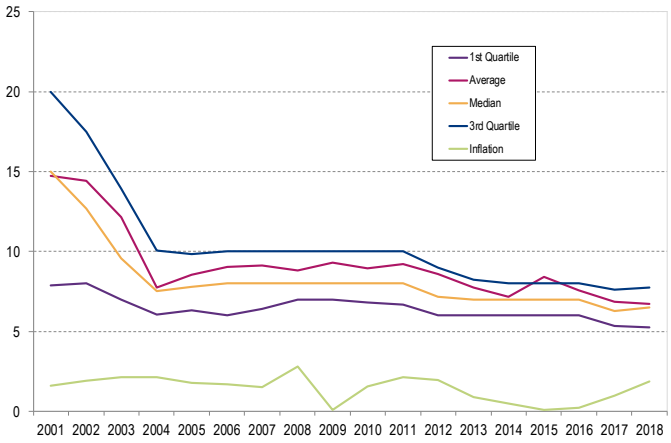
3.4.1. Products with the highest headline rates are the most complex

When the product is marketed, a headline rate can be specified. It corresponds to the annual return received by the investor under the best-case scenario, in other words, the maximum return that the investor can expect. It could not therefore be calculated in all cases, but only when a remuneration ceiling defined in absolute terms was clearly indicated in the product description.

It was possible to identify a headline rate in this way for 4,976 products (out of the 6,217 in the database). The headline rate seems to have been decreasing since 2001, whether we are considering the first quartile, the average rate, the median rate or the third quartile (Figure 40). The results show the stability of the headline rate since those obtained by Célérier & Vallée (2017), whose average headline rate between 2002 and 2010 was 8.2%.

The real average headline rate (i.e. adjusted for inflation) appears to have increased slightly between 2012 and 2015 following the fall in the inflation rate in France.

Figure 40: Trend in headline rate and French inflation



Source: Structured Retail Products, AMF calculations

For Célérier & Vallée (2017), the headline rate was positively correlated with the level of product complexity, this complexity being used as a means of increasing the headline rate to attract investors seeking a return. To study the relationship between headline rate and complexity, the same method as that used by Célérier & Vallée was applied. The headline rate was regressed by the ordinary least squares (OLS) method against product complexity, while taking into account the characteristics of the products.

$$\text{Headline rate}_i = \alpha * \text{complexity measure}_i + \beta X_i + \delta_y + \theta_d + \varepsilon_i$$

Where $\text{complexity measure}_i$ can be either the number of features, the number of nodes, the number of scenarios, the underlying asset complexity or overall complexity, X_i corresponds to the product characteristics (product type, underlying asset class, maturity, volume sold) and δ_y and θ_d are the fixed effects related to the year of issue and the issuer. The regression results are presented in Table 1.

Table 1: Regression of the headline rate against product complexity

	Headline rate (annual, in %)				
Number of features	0.813***				
Number of nodes		0.449***			
Number of scenarios			0.546***		
Underlying asset complexity				0.657***	
Overall complexity					0.317***
R^2	0.083	0.067	0.076	0.068	0.082
Number of observations	4,667	4,667	4,667	4,667	4,667

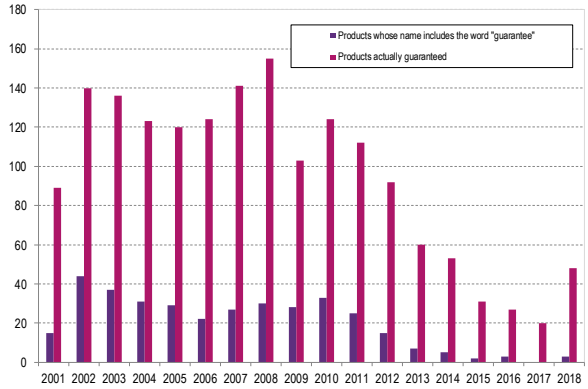
, ** and * represent statistical significance at the levels of 10%, 5% and 1% respectively.*
Source: Structured Retail Products, AMF

It therefore appears that the headline rate is positively correlated with the number of product features, the number of nodes, the number of scenarios, the complexity of the underlying assets and the overall measure of complexity (represented by the sum of the number of features, the number of nodes, the number of scenarios and the underlying asset complexity).

3.4.2. The financial context, the name of the product and its popularity seem to be linked

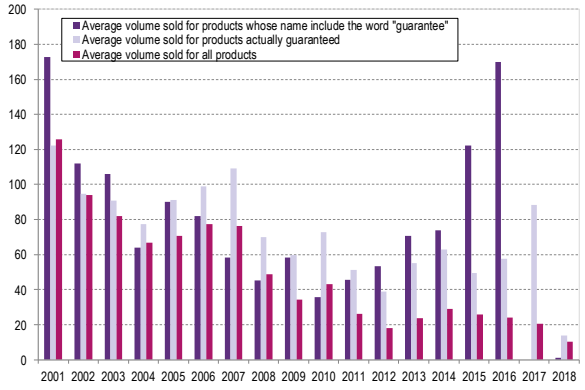
In addition to the headline rate, the choice of the product name is an integral part of marketing. For example, some producers highlight the capital guarantee in the name of their product, but its relative use remains limited compared to the total number of guaranteed products that are marketed and stable, even during periods of high financial instability, such as 2008-2010. The word "guaranteed", identified by an algorithm, appeared in the names of 382 products and had fallen sharply since 2010 (Figure 41), in line with the decrease in the number of guaranteed products observed since that date. Despite this recent decrease, the average volume of products sold with "guaranteed" in their name was higher than for all products over the entire period analysed (2001-2018).

Figure 41: Number of products whose name includes the word "guaranteed" and products actually guaranteed



Source: Structured Retail Products, AMF calculations

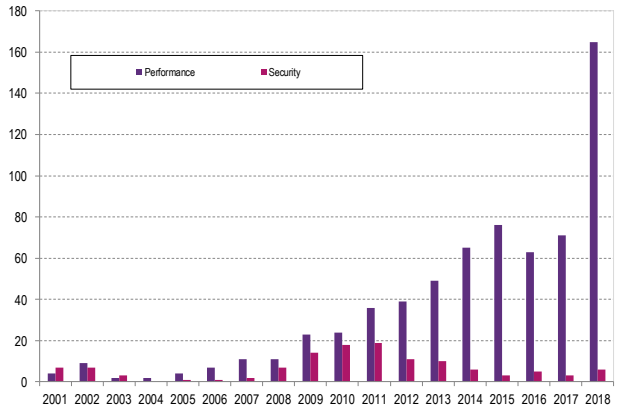
Graphique 42: Volume sold par year according to the characteristics of the products



Source: Structured Retail Products, AMF calculations

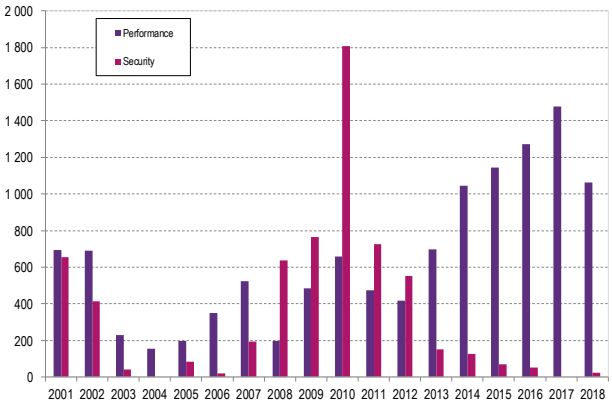
Some products also use security-related terms in their names (e.g. security, serenity, zen) while others emphasise performance (e.g. performance, return, growth, momentum, booster). The number and volume of product referring to performance have increased significantly in recent years in an environment of low interest rates and search for yield, while products referring to security have been used more frequently in the wake of the 2007 crisis (Figure 43 and Figure 44).

Figure 43: Number of products whose name refers to performance or security



Source: Structured Retail Products, AMF calculations

Figure 44: Volume of products sold whose name refers to performance or security



Source: Structured Retail Products, AMF calculations

4. ARE STRUCTURED PRODUCTS PROFITABLE?

The performance of structured products has already been the subject of several studies in the academic literature, which have concluded quite unanimously that issuers overestimate the selling price (Bergstresser (2008), Baule (2011), Henderson & Pearson (2011)). For Entrop et al. (2016), who analysed the products offered by a major German bank, the underperformance of complex products is also explained by investors' difficulties in differentiating products.

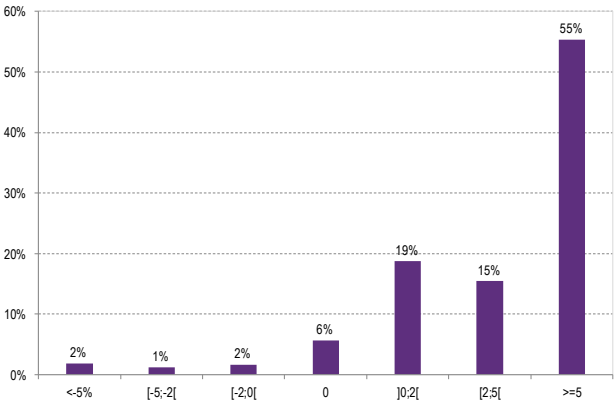
In the French market, of the 6,217 products in our sample, 3,717 products had reached maturity by the end of November 2018. For nearly 85% of them (3,157 products) – representing 92% of the volumes sold – the performance achieved (excluding fees) was available.

4.1. LARGELY POSITIVE AND CONSISTENT PERFORMANCE…

It is important to note that the performance presented below is the gross return. This does not take into account product-related fees, such as management fees, structuring fees or subscription fees. The availability of this data remained very limited for debt securities until 2018 and the entry into force of the PRIIPs Regulation.

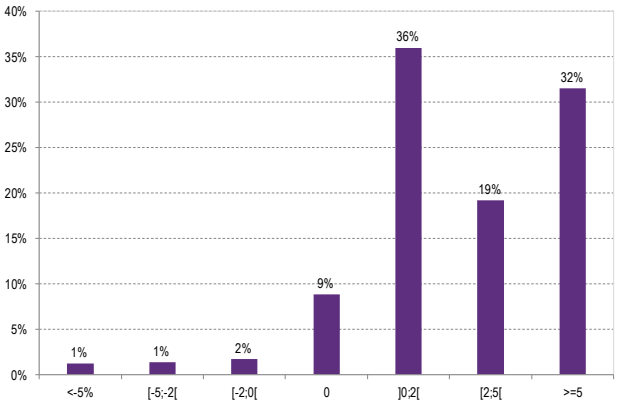
It appears that more than half the products provided a nominal annualised return excluding fees of 5% or more. By contrast, only 5% of products had negative returns and, in 6% of cases, the initial amount invested was only just preserved. In terms of volume, more than a third of products provided a nominal gross annualised return of between 0% and 2%. Furthermore, the proportion of products with performance less than or equal to 0 was higher when considering the volumes sold (14% compared with 11% by number).

Figure 45: Nominal gross annualised return (products matured between 2003 and November 2018, by number of products)



Source: Structured Retail Products, AMF calculations

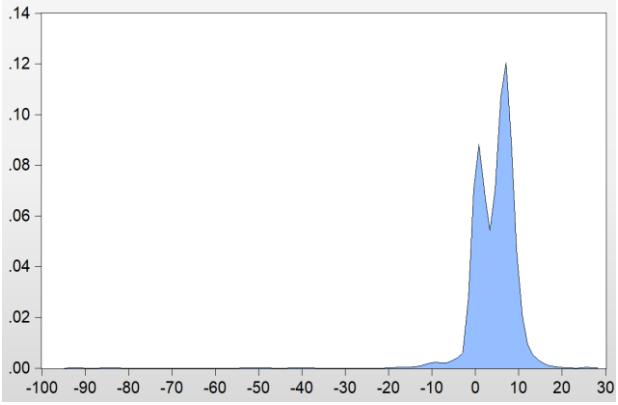
Figure 46: Nominal gross annualised return (products matured between 2003 and November 2018, by number of products)



Source: Structured Retail Products, AMF calculations

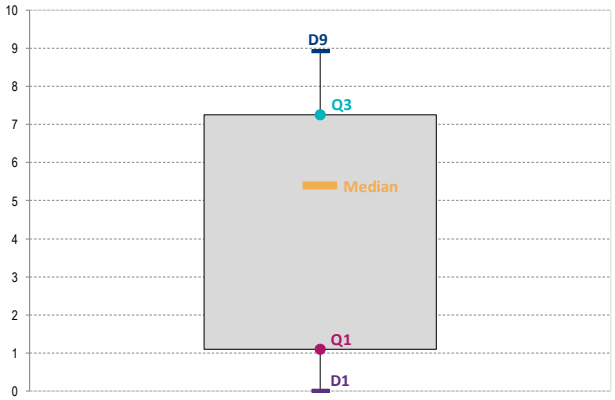
Return distribution appears to be concentrated around the average (with a kurtosis of 82.3) and some extreme negative values (with a skewness of -5.5).

Figure 47: Return distribution[19] of complex products



Source: Structured Retail Products, AMF

Figure 48: Gross return of complex products



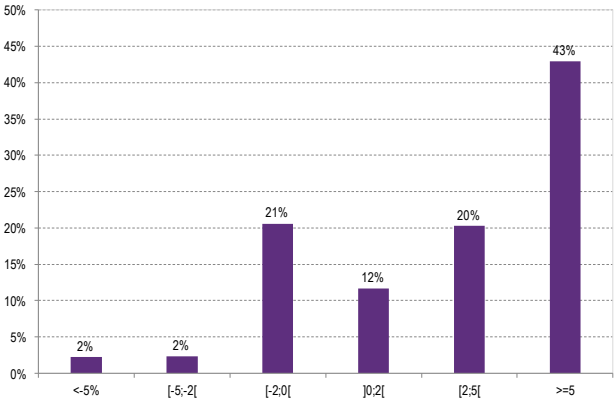
Source: Structured Retail Products, AMF

For six products in our sample, the nominal gross annualised return was between 40% and -92%. These are products linked to an index but issued at an inappropriate time (for example, investment in the CAC 40 in August 2007) or products linked to the shares of a single company that experienced major difficulties (Dexia or Abengoa,[20] for example).

By contrast, three products provided a nominal gross annualised return of more than 20%, with a maximum of 26%. These were products related to shares issued before a period of rising prices. These three products were repaid early.

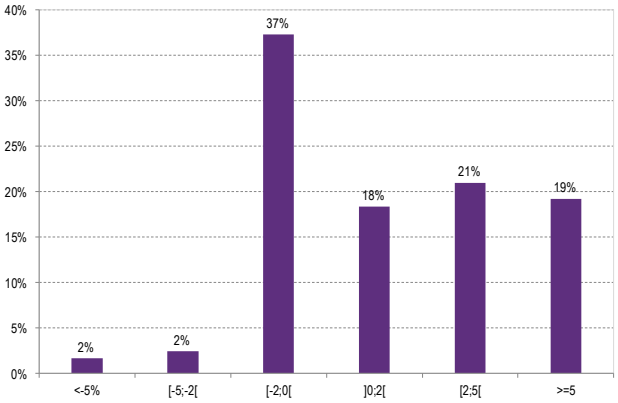
Adjusted for inflation, 75% of matured products delivered a positive return (compared to 89% without inflation). This proportion falls to 57% if we look at this in terms of volumes sold.

Figure 49: Real gross annualised return (products matured between 2003 and November 2018, by number of products)



Source: Structured Retail Products, AMF calculations

Figure 50: Real gross annualised return (products matured between 2003 and November 2018, by volume)

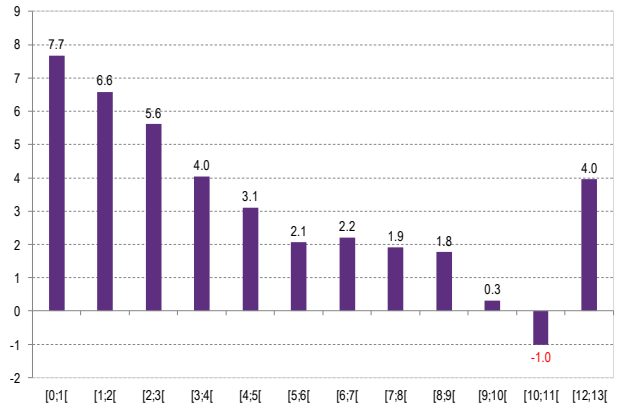


Source: Structured Retail Products, AMF calculations

Average annualised performance (nominal or real) appears to be negatively correlated with the effective maturity of the product (Figure 51 and Figure 52). The only exception is the category with maturity of 12 to 13 years, which includes only one product. It is worth reiterating that the performance presented is the gross return. Products with a short effective maturity may not necessarily be the most profitable after taking into account fees, as commission will apply to each reinvestment.

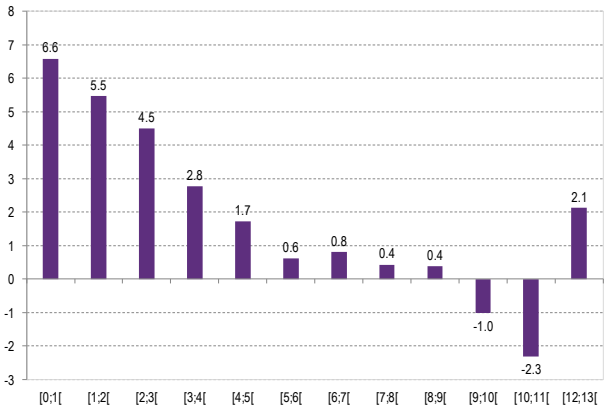
[19] The distributions are determined by applying the Kernel method with an Epanechnikov specification.
[20] Abengoa is a Spanish industrial and technological company that declared itself in default in November 2015.

Figure 51: Nominal average annualised return by effective product maturity



Source: Structured Retail Products, AMF calculations

Figure 52: Real average annualised return by effective product maturity

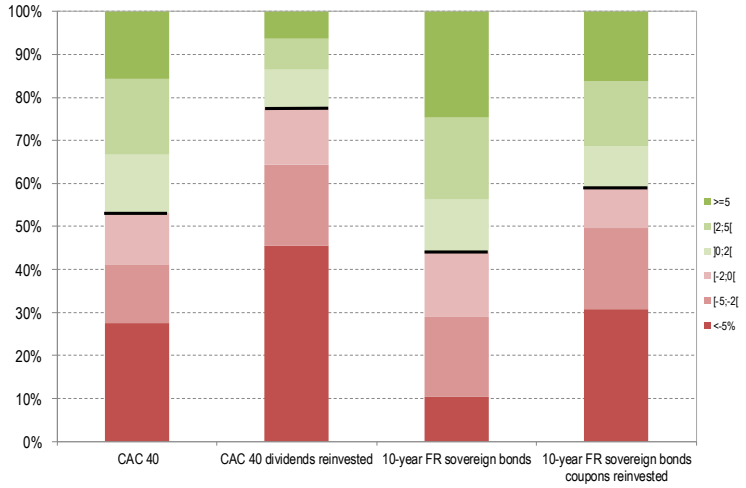


Source: Structured Retail Products, AMF calculations

4.2. …BUT OFTEN LOWER THAN TRADITIONAL FINANCIAL INVESTMENTS

Without prejudice to the level of fees, however, it is possible to compare the gross returns of structured products with the gross returns of traditional financial investments made during the same periods. Two types of investment were analysed: an equity fund replicating the performance of the CAC 40 and a bond fund investing in 10-year French sovereign bonds. It appeared that more than half of the structured products (56%) outperformed a fund replicating the performance of French sovereign bonds (Figure 53). Comparing structured products to equity markets, the situation was more mixed: fewer than half of the products in the sample (47%) outperformed a fund replicating the CAC 40, decreasing to less than a quarter (22%) of products when reinvested dividends were taken into account.

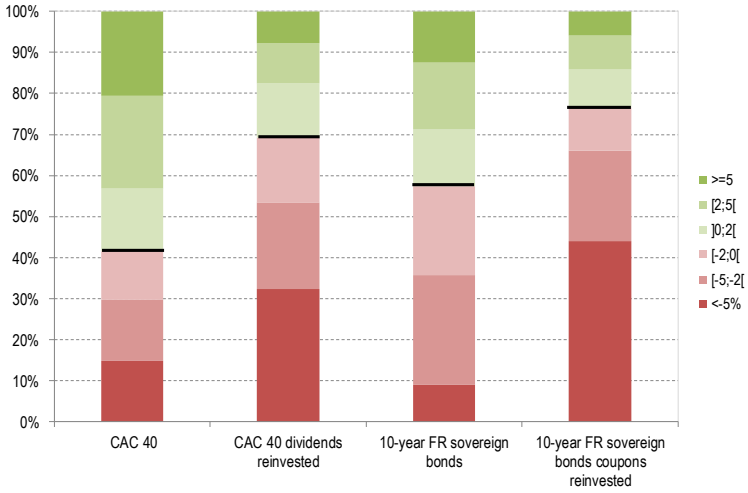
Figure 53: Proportion of structured products in the sample by their difference in annualised gross return with various indices:
by number



Source: Structured Retail Products, Datastream, AMF calculations
Note: Products above the black line are those with an annualised return higher than that of the CAC 40 or sovereign bonds.

When looking at this in terms of volumes sold, it appears that in two thirds of cases (69%), the gross performance would have been higher with an investment in French equities (dividends reinvested). This proportion increases to 77% when compared with an investment in French sovereign bonds (reinvested coupons).

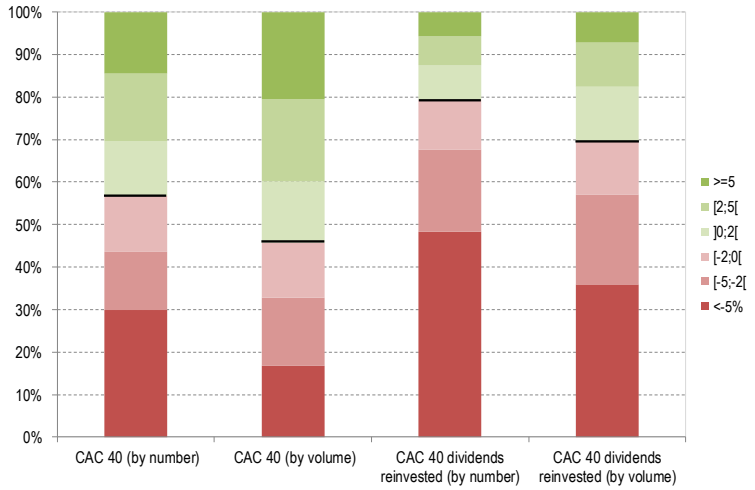
Figure 54: Proportion of structured products in the sample by their difference in annualised gross return with various indices: by volume



Source: Structured Retail Products, Datastream, AMF calculations
Note: Products above the black line are those with an annualised return higher than that of the CAC 40 or sovereign bonds.

When focusing on equity-exposed products, the results are similar: 43% of products outperform a fund investing in the CAC 40 (54% of volumes) and only 21% of products (30% of volumes) provide a return above the performance of the fund replicating the CAC 40 with reinvested dividends.

Figure 55: Proportion of equity-exposed structured products by their difference in annualised gross return with the CAC 40

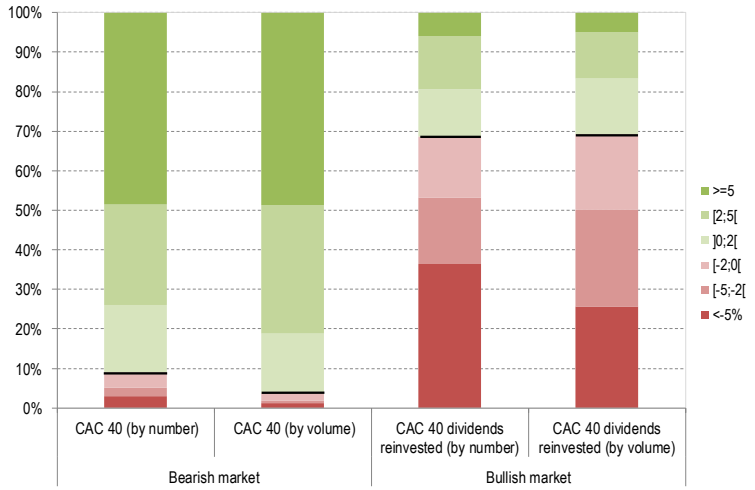


Source: Structured Retail Products, Datastream, AMF calculations
Note: Products above the black line are those with an annualised return higher than that of the CAC 40.

It seems relevant to analyse the comparative performance of equity-exposed products in relation to the macro-financial environment in order to study whether structured products outperform equity markets when they are bullish and bearish.[21]

[21] Products are ranked according to the annualised performance of the CAC 40 (excluding dividends) over their lifetime.

Figure 56: Proportion of equity-exposed structured products by their difference in annualised gross return with the CAC 40 by stock market environment

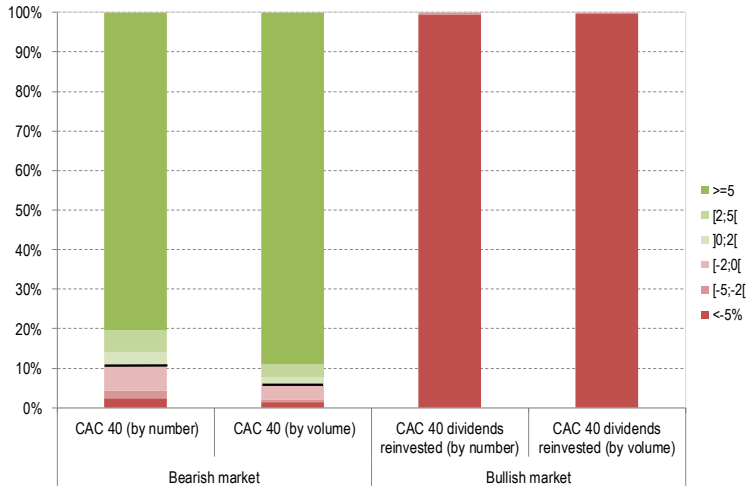


Source: Structured Retail Products, Datastream, AMF calculations

Figure 56 shows that structured products outperform equity markets more when they are bearish. This may be explained by the fact that structured products follow the performance of the underlying asset by generally incorporating ceiling or floor mechanisms. Thus, when markets are bearish (or bullish), this decrease (or increase) will not be fully reflected in the product's performance. Bear markets are therefore more favourable to structured products.

For products that were registered in the most or least favourable stock market environment,[22] the conclusions are still valid.

Figure 57: Proportion of equity-exposed structured products by their difference in annualised gross return with the CAC 40 by stock market environment



Source: Structured Retail Products, Datastream, AMF calculations

[22] An environment is defined as particularly favourable (or unfavourable) if the annualised performance of the CAC 40 (excluding dividends) over the life of the product has been higher than the last decile (or lower than the first decile), that is 18% and -6%.

Structured products outperform equity markets even more when they are strongly bearish. By contrast, when markets are strongly bullish, structured products systematically lose out compared with an investment that reflects the performance of the CAC 40.

4.3. COMPLEXITY DOES NOT GO HAND IN HAND WITH PROFITABILITY

To study the relationship between performance and complexity, the outperformance of equity-linked products relative to the CAC 40 was regressed by the ordinary least squares (OLS) method against product complexity, while taking into account product characteristics.

$$\text{Outperformance}_i = \alpha * \text{overall complexity}_i + \beta X_i + \delta_y + \theta_d + \varepsilon_i$$

Where Outperformance_i is the outperformance compared with the CAC index (with and without reinvestment of dividends), $\text{overall complexity}_i$ is the aggregation of the various complexity measures, X_i corresponds to the product characteristics (product type, effective maturity, volume sold) and δ_y and θ_d are the fixed effects related to the year of issue and the issuer. The results of the regressions are presented below.

Table 2: Regression of outperformance against product complexity

	CAC 40	CAC 40 TR
Overall complexity	-0.752***	-0.747***
R^2	0.283	0.298
Number of observations	2,679	2,679

, ** and * represent statistical significance at the levels of 10%, 5% and 1% respectively.*
TR refers to the Total Return index, therefore this is the reinvested dividends index
Source: Structured Retail Products, AMF

It therefore appears that the coefficient of the overall complexity variable is negative and significant for both regressions. The complexity of products therefore seems to have a negative impact on their performance.

CONCLUSION

The main objective of this study was to try to measure the impact of the AMF's action following the implementation of Position 2010-05, which aims to limit the degree of complexity of structured products marketed to the general public in France that have a capital risk of more than 10% (AMF Position DOC-2010-05).

The database consisted of 6,217 structured funds and complex debt securities sold in France between 2001 and November 2018, three-quarters of which targeted retail clients. Due to the increase in the number of unsecured products, most products sold in France now fall within the scope of Position 2010-05.

Originally, Position 2010-05 measured the complexity of structured products by the number of features included in the payoff formula for calculating the gain or loss in value of the financial instrument. This number has actually decreased since this policy was implemented in 2010. However, in recent years, the least complex products, with just one or two features, have tended to disappear. This movement was offset by an increase in the number of scenarios and nodes and by an increase in the complexity of the asset on which the performance of the financial product is indexed. This increase in the index complexity was only partially offset by the amendment of Position 2010-05 in 2016, which was intended to limit the risk of circumventing the regulatory framework by taking into account the complexity of the index when measuring the complexity of the products.

With regard to product marketing, the headline rates (the annual return received by the investor under the best-case scenario) highlighted in the marketing documents are positively correlated with the complexity.

With regard to the gross returns of structured products, they are very largely positive in most cases, even when adjusted for inflation. However, these products appear to perform relatively poorly when compared with traditional financial investments (investments in shares or bonds). Finally, the most complex products are the worst performers.

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Annex 1: Overview of the various product complexity characteristics

Feature Name	Definition
Dimension 1: Primary Feature	
Altiplano	The product offers a 100% return on capital plus a series of fixed coupons for each sub-period if the underlying asset is above a pre-defined level
Floater	The product offers a 100% return on capital plus a series of coupons that increase as the underlying benchmark rate increases
Pure Income	The product offers a 100% return on capital plus a series of fixed coupons
Digital	The product offers a 100% return on capital plus a series of fixed coupons paid at maturity if the underlying asset is above a pre-defined level
Call	The product offers a 100% return on capital plus a fixed participating interest in the growth of the underlying asset
Put	The product offers a return on capital of 100% plus a fixed participating interest in the decrease in absolute value of the underlying asset
Spread	The product offers a 100% return on capital plus a participating interest linked to the difference in performance between various underlying assets
Bull Bear	The final return is based on a percentage of the absolute performance of the underlying asset at maturity
Dimension 2: Initial Subsidy	
Discount	The product offers a discount on the purchase of the product
Leverage	The product has a leverage effect
Dimension 3: 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 participating interest in the performance of the worst performing underlying assets
Himalaya	A pre-selected number of the best performing underlying assets are removed from the basket or their performance is frozen at the end of each period until the investment ends
Kilimanjaro	The worst and best performing underlying assets are gradually withdrawn or ignored during the subsequent calculations
Rainbow	The weighting assigned to the best performing underlying assets is higher than that of the other underlying assets
Dimension 4: Exposure Modulation, Increased Downside	
Reverse Convertible	The product is capital guaranteed unless a performance condition is not met. In this case, the capital return is reduced by the percentage decrease in the underlying asset or the product repays a predefined number of shares or bonds
Precipice	The product is capital guaranteed unless a performance condition is not met
Dimension 5: Exposure Modulation, Limited Upside	
Cap	The return is based on the participating interest in the performance, the increase in which is capped
Fixed Upside	The best performance of a basket of shares or the performance of certain sub-periods are replaced by a predetermined fixed return
Flip Flop	The coupons are fixed during the initial periods and then the distributor may decide to make the coupon variable

Dimension 6: Path Dependence	
Ratchet	The final return is calculated as the sum of the returns over a predetermined period
Asian Option	The final return is calculated as the average of the returns over a predetermined period
Parisian Option	The return depends on the number of days the conditions were met
Averaging	The final level of the index is calculated as an average of the most recent points
Delay	Coupons are paid at maturity
Catch-up	If a coupon is not paid at a given period because the required condition is not met, this missing coupon and any subsequent missing coupons will be allocated to the next period that satisfies the condition
Lookback	The initial/final level of the index is replaced by the lowest/highest level of the period
Dimension 7: Exotic Conditions	
American Option	The conditions must be met over the entire period in question
Range	The performance of the underlying asset is within a specified range
Target	The sum of the coupons reaches a predefined level
Moving Strike	The conditional levels are variable
Bunch	The upper threshold relates to each asset, the lower threshold relates to the basket
Podium	The underlying asset is a basket and the final return depends on the number of shares that meet the conditions
Annapurna	The condition must be met for all securities in the basket
Dimension 8: Early Redemption	
Knockout	The product ends earlier if specific conditions are met
Callable	The issuer may end the product on any coupon detachment date
Putable	The investor may be repaid on any coupon detachment date

Source: Célérier, C., & Vallée, B. (2017). Catering to investors through security design: Headline rate and complexity. The Quarterly Journal of Economics, 132(3), 1469-1508.

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