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A Risk and Complexity Rating Framework for Investment Products

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Abstract

While risk indicators have been developed and widely accepted by the financial industry, hitherto no metric has been developed to measure a product's complexity. In the aftermath of the 2008 global financial crisis, regulators are increasingly concerned about consumer protection. The Lehman Bonds crisis showed that many investors who bought such investments did not have a clear understanding of the product's features. Part of the reasons is that such products are quite complex and embed features which are difficult to understand. This suggests that if the inherent risk and the complexity of a product's structure are not clearly understood by investors, they would not be in a position to make informed investment decisions. In recognizing that complexity is different from risk, some practitioners have recently attempted to calibrate product complexity. This paper proposes a simple framework to classify the risk and complexity of investment products. We propose to calibrate risk and complexity separately with a list of factors that contribute these attributes. The proposed framework is then used to calibrate a wide variety of investment products to demonstrate its simplicity and usefulness in helping investors make informed investment decisions.

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Introduction

Since the Global Financial Crisis of 2008-2009, the discussion to better regulate financial products has intensified. While risk assessment of products has a longer history and continues to attract keen interest in financial markets, the crisis has intensified the debate on regulation of complex financial products (see Brunnermeier and Ochmeke (2009), Schwarcz (2009) and Valentine (2008)). Understandably, research has been focused on issues of systemic risk to the financial system (see Pagliari and Stefano (2012) and Pearson and Pearson (2007)), risk management, analytics and measurement (see Bisias, Flood, Lo and Valavanis (2012), Billio, Getmansky, Lo and Pelizzon (2010) and Jorion (2009)). Given the public outcry and the increase in the number of law suits related to the mis-selling of financial products, regulators and market participants alike, have begun to discuss the development of a classification framework for complexity of financial products, in addition to classification of risk, to address the issue of suitability of such products for investors. In particular, there have been great efforts in focusing on the assessment of product suitability for retail investors who may not possess depth of knowledge, experience and sophistication.

A Joint Forum of the Bank of International Settlements (2006) has stated that the way financial firms approach the sale of financial products and services is at the core of consumer confidence in financial markets. Subsequently, the adopted sales approach by the industry has implications for soundness for the individual firm, the stability of the financial system, as well as the protection of the investors. Different supervisory authorities have adopted different approaches to regulate the sale of retail products. However, the basic approach and building block to investors' protection is to focus on mis-selling. Mis-selling refers to the inappropriate and legally questionable method of presenting the financial product as an attractive form of investment to the retail investor without sufficient explanation of the risk and complexity underlying the product. There is a strong belief that the main source of system stability and the weakest link of investor protection can be traced to mis-selling. The linkages among mis-selling, systematic risk and soundness of the firms are important topics to be explored.

The objective of this study is to provide a lead into these sets of complex linkages. This paper proposes a framework to rate risk and complexity of investment products. The contribution of this paper by way of the classification framework is an innovation and it provides a guide for implementation that will be of interest to regulators, product developers, product distributors and consumer advocates. In Section 1, we review the issues and measures currently adopted by various regulatory authorities. The sub-sections of the introduction provide a brief overview of the regulatory framework on investment suitability implemented in Europe, followed by a discussion on risk and complexity concepts and the state of discussion on product complexity by various regulators and investment consultants. In Section 2, we give an overview of the proposed risk and complexity framework. Sections 3 and 4 present the method of identification and calibration of the risk and complexity factors respectively. Section 5 provides a synthesis of the framework and the conclusion is presented in Section 6.

1. A Review of Regulatory Issues and Measures

1.1 Investment Suitability

In Europe, a uniform regulatory framework on investment suitability (the EU Markets in Financial Instruments Directive, MiFID) was implemented in 2007. The need for this recommendation grew out of concerns by institutions and private investors who had incurred losses on their investment

portfolios. One key focus of the MiFID investment suitability framework is a risk classification of complex and non-complex products to match the risk tolerance, knowledge, experience and investment objectives of investors.

Regulations and guidelines on investment suitability have also been adopted by various regulatory authorities in Asia such as the Monetary Authority of Singapore (MAS) and the Hong Kong Monetary Authority (HKMA). Besides EU, the Swiss Financial Market Supervisory Authority, FINMA, also amended its regulation regarding the sale process of financial instruments.

Besides regulatory bodies, private consultancy firms also attempt to develop frameworks relating to product risk and complexity. These firms include Ernst and Young¹ which developed a framework and proprietary tools to classify products to meet the multidimensional needs of investors.

In January 2012, the independent Financial Industry Regulatory Authority in U.S. (FINRA) released Regulatory Notice 12-03 titled “Complex Products: Heightened Supervision of Complex Products.” The Notice identifies the types of products that may be considered “complex” and provides guidance to member firms regarding supervisory concerns associated with sales of complex products. Until then, U.S. regulators have not addressed the issues pertaining to “complex” products.

1.2 Risk

Risk has been fairly well defined in many jurisdictions using various measures to capture the dispersion of or extent of downward movement in investment returns. Standard deviation is the most commonly used measure. Other statistical measures include Value-at-Risk (VaR), expected shortfall, semi-variance and so on.

Some countries also introduced product risk classification. For example, Germany enacted the “Investor Protection and Capital Markets Improvement Act” (*Anlegerschutz- und Funktionsverbesserungsgesetz*) to provide investors and savers better protection against mis-selling. A key objective is to improve product transparency and comparability using standardized information. A Synthetic Risk and Reward Indicator (SRRI) was devised and used to calibrate risk. The methodology used to compute the SRRI follows the Commission of European Securities Regulators (CESR) technical advice 09/1026 dated December 2009. The SRRI is a proxy for the annual volatility of each fund. Funds are assigned to one of seven risk categories using the SRRI. The SRRI has to be shown to investors before funds are sold.

For structured products, the German Derivative Association (Deutscher Derivate Verband, DDV) assigns each product to one of five risk categories based on its VaR, ranging from conservative (category 1) to speculative (category 5). However, there are occasions when the risks of products are classified differently using SSRI and DDV, resulting in confusion (see Structured Report (2011) by WestLB Equity Market Commentaries).

There are many useful studies on risk concepts pertaining to hedge funds (see Lambert (2012), Lo (2008) and Koh, Lee and Phoon (2002)). These studies have discussed various risk measures and factors, including the use of leverage and liquidity. These factors are included in this study.

¹ “Investment Suitability,” Ernst & Young Publications, 2009; Marc Ryser and Allesandro Lana, “Investment Suitability and Product Classification,” GARP Switzerland Chapter Meeting, 14 January 2010.

1.3 Complexity

The main motivation to add the complexity dimension in a study of product suitability is that investor sophistication has lagged behind the growing complexity of retail financial markets. Carlin and Gustavo (2011) developed a dynamic model to study the interaction between obfuscation and investor sophistication in mutual fund markets. They found that educational initiatives that were directed to facilitate learning by investors induced providers to increase wasteful obfuscation. Carlin (2009) discussed the benefits of complexity for strategic retailing of financial products. While complexity varies across different investment products, mis-selling of structured products has resulted in calls to regulate the issue of complexity that has challenged regulators (see Glen and Pinedo (2013)).

Products and portfolio investments have also been studied to ascertain various impacts due to their level of complexity. Franck and Walter (2012) examined the herd behaviour among equity funds in Germany and found the most pronounced levels of herding for funds choosing their stock portfolios from a broad, international and hence, more complex investment universe. Bigda and Wong (2012) and Roseen (2012) have expressed their concerns over the increasingly complicated and complex exchange-traded fund (ETF) contracts. Good (2011) concluded that the growing complexity of ETFs was seen as damaging to the business. On the other hand, Jackson (2012) found that Trusts' complexity did not sway investors who viewed discounts as a more important feature.

In the literature, many studies have discussed “complexity” but there is no commonly accepted definition. However, the International Organization of Securities Commissions (IOSCO) has provided a useful description of complex financial products. According to IOSCO, complex financial products refer to financial products:

- (a) With terms and features which are not likely to be understood by an average retail customer, (as opposed to more traditional or plain vanilla investment instruments);
- (b) Which are difficult to value (so that their valuations require specific skills and/or systems); and/or
- (c) Have a very limited or no secondary market (and are therefore potentially illiquid).

We used a similar characterisation of complex financial products in this study. Complex financial products generally include structured instruments, credit-linked notes, hybrid instruments, equity-linked instruments and instruments whose potential pay-off is linked to market parameters, asset-backed securities (ABSs), mortgage-backed securities (MBSs), collateralized debt securities, and other financial derivative instruments (including credit default swaps and covered warrants).

There are few international standards for classifying or evaluating complex products for compliance procedures. We are aware of only one jurisdiction (Denmark) that has classified products into three specific classes using product risk and complexity. Other regulators actively working to manage complex products include:

- (a) **USA.** FINRA has published a paper, “Characteristics of Complex Products and Heightened Supervision,” Regulatory Notice 12-03 in January 2012.
- (b) **Denmark.** The Danish Ministry of Economic and Business Affairs, issued a paper, “Risk-labelling of Investment Products” in October 2010.

- (c) **France.** France Autorite Des Marches Financiers issued “Criteria of Structured Investment Funds and Complex Debt Services (AMF Position No 2010-05-15) in October 2010.
- (d) **MiFID.** The European MiFID, issued the “Review of the Markets in Financial Instruments Directive” in December 2010.
- (e) **U.K.** The UK Financial Services Authority issued 3 papers: (a) “Indicators of Problems with Products: Flaw and Detrimental,” DP11/1, Jan 2011 and FS11/3, Jun 2011; (b) “Moratorium on the Distribution of Particularly Complex Structured Products”; July 2011 and (c) “Guidance on Product Design and Features”, Nov 2011.
- (f) **Belgium.** The Belgian Financial Services and Markets Authorities (FSMA) issued “Criteria for Moratorium on Sales of Complex Products,” in September 2011.
- (g) **Singapore.** Management Consultant Ernst and Young has developed a product suitability evaluation framework which incorporated product complexity as a risk factor.

2. BRIEF OVERVIEW OF RISK AND COMPLEXITY FRAMEWORK

Recent crises have shown that supposedly low-risk products have suffered massive losses with returns falling outside the normal range as predicted by historical or model-simulated data. One of the explanations for such shocking deviation is the degree of uncertainties in the pay-out caused by the complexity embedded in the structure of the product.

The proposed framework decomposes the degree of uncertainties into two components: risk and complexity. Risk can be quantified on a ratio scale and can be suitably managed. However, complexity is quantifiable perhaps only on an ordinal scale. We will use the findings from the literature and other empirical findings to define the factors contributing separately to risk and complexity. In the proposed framework, risk and complexity will form the axes in a 5-by-5 diagram as shown in Table 2.1. Constructed in this manner, products can be ranked by risk and complexity in the 2-dimensional space.

The basic rule of no free lunch is implicit in the framework. Given constant return, any attempt to lower risk by re-structuring may make a product more complex. The framework ensures that the structure of any product is made more transparent and will therefore provide investors more information to make informed decisions.

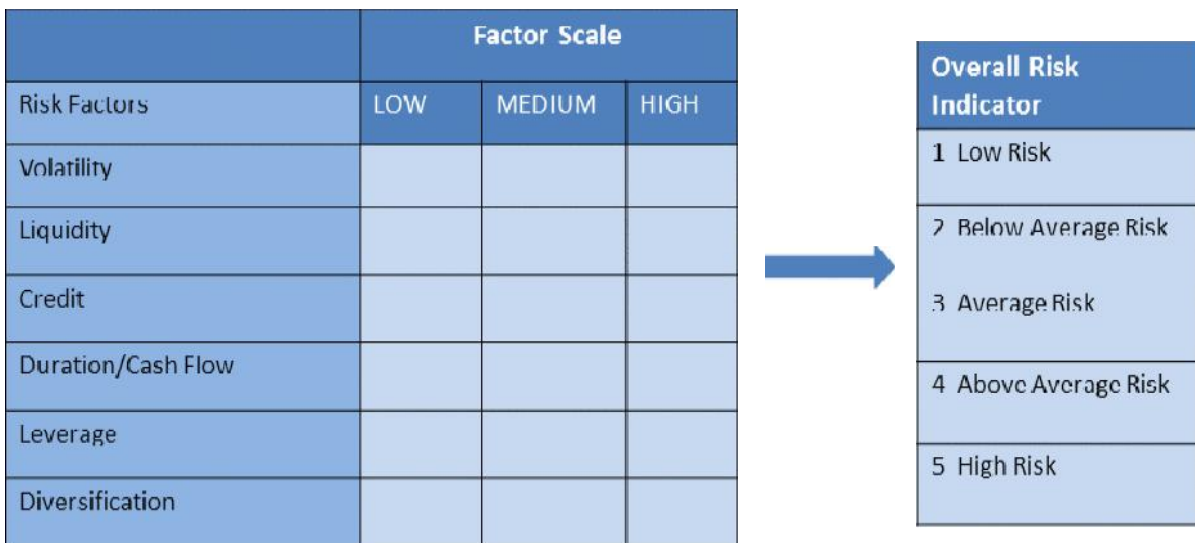
Table 2.1: 5x5 Matrix for Risk and Complexity Rating



Table 2.1 shows that the risk-complexity characteristics of an investment product are represented by a point in the 2-dimensional space. A location further to the right indicates higher complexity, while a location further to the top indicates higher risk. A risk-free asset would be positioned at the origin.

2.1 Risk Mapping

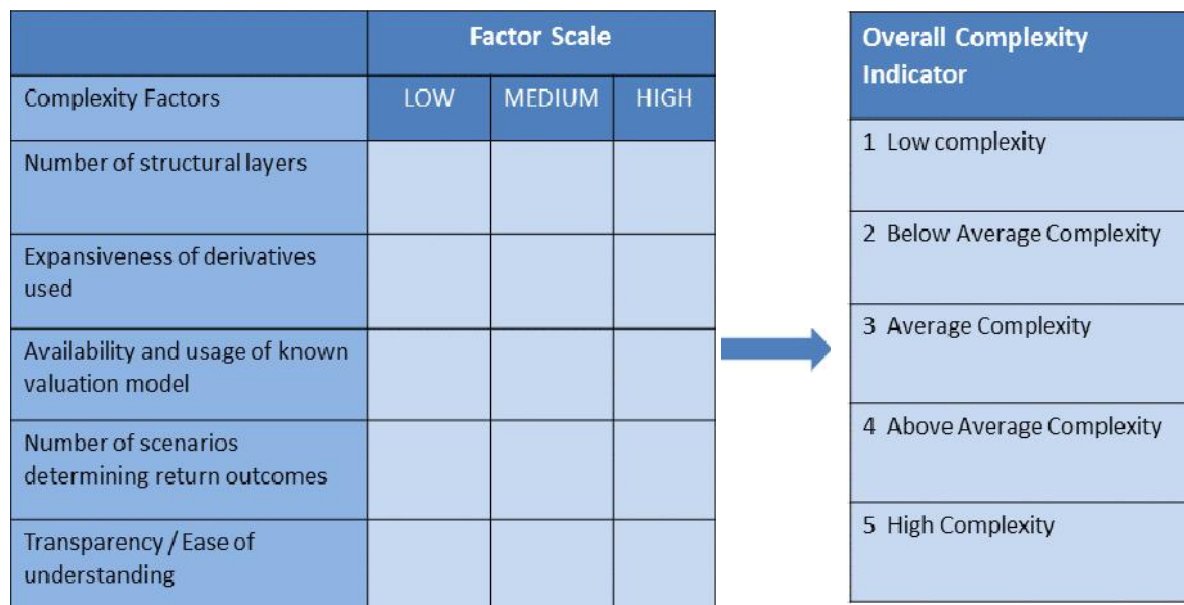
In the proposed framework, investment risk will be measured by six factors defined in section 3. Each investment product is fully assessed based on these factors and finally mapped into a 5-point risk scale as illustrated on the right-hand side of the diagram below:



Each risk factor on the left-hand side is scaled as low, medium or high by a set of criteria. The assigned scale is translated into factor scores contributing to the overall risk rating on the right-hand side. The calibration of risk is illustrated in section 4.3.

2.2 Complexity Mapping

In the proposed framework, investment complexity will be measured by five factors defined in section 4. Each investment product is fully assessed based on these factors and mapped into a 5-point complexity scale.



Each factor on the left-hand side is scaled as low, medium or high by a set of criteria. The assigned scale is translated into factor scores contributing to the overall complexity rating on the right-hand side of the diagram. The calibration of complexity is illustrated in section 4.

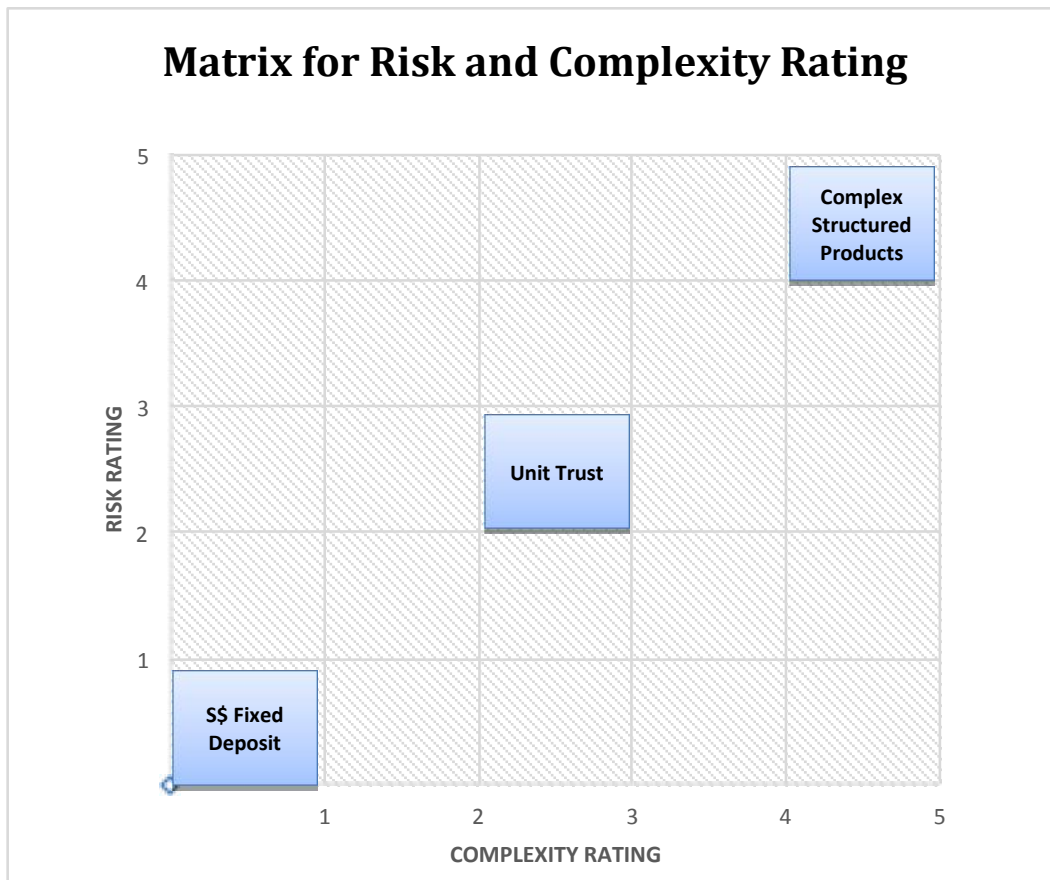
2.3 Product Sample

To develop the 2-dimension risk-complexity framework, a sample of 100 investment products are used for calibration. The sample used for calibration includes the following:

- (a) single securities and fixed deposits that were added to complete the framework;
- (b) money market funds and bond funds;
- (c) multi-asset classes funds;
- (d) unit trusts (mutual funds);
- (e) alternative assets funds; and
- (f) structured products.

2.4 Illustration

The outcome of the calibration exercise is a 5 by 5 matrix with each evaluated product occupying a “location” within the matrix based on its risk and complexity scores. This is illustrated as follows.



3. IDENTIFICATION AND CALIBRATION OF RISK FACTORS

3.1 Identification of Risk Factors

Risk will be defined as the probabilistic random losses which may arise from a number of factors that are systematic (market) or unsystematic (idiosyncratic) in nature. The factors as well as parameters underlying the probability distributions of the factors impact on the risk. These factors and parameters are:

- (a) Volatility
- (b) Liquidity
- (c) Issuer/counterparty credit worthiness and risks
- (d) Duration of cash flows
- (e) Leverage
- (f) Degree of diversification / Concentration of investments.

While we recognize that these attributes are affected by the underlying market conditions and may not be independent of each other, the various measures provide a comprehensive description of the risk environment for the investor. The overall risk rating of each product will be based on a combination of scores for each of the above key risk factors.

Table 3.1 below summarizes the factors, the threshold levels and their assigned scores.

Table 3.1 Risk Factors, Threshold levels and Factor Scores

Risk Dimension	Factor		Level			Note
			Low	Medium	High	
Risk	Annual Volatility (% p.a.)	Threshold	$\sigma \leq 5\%$	$5\% < \sigma \leq 15\%$	above 15%	standard deviation of returns
		Score	1	4	9	
	Liquidity	Threshold	above 1 mth	1 mth	daily price	price availability
		Score	3	2	1	
	Credit Rating	Threshold	BB+ and below	Investment Grade to A+	above A+	credit rating by rating agency
		Score	5	3	1	
	Duration / Cash Flow	Threshold	≤ 5 years	$5 < dur \leq 10$	$dur > 10$	in years
		Score	1	2	3	
	Leverage	Threshold	No leverage	2 times leverage	Above 2 times leverage	exposure as a factor of original capital
		Score	1	3	5	
	Diversification Degree	Threshold	3	2	1	threshold score is determined by 4 diversification sub-factors in Table 3.2
		Score	3	2	1	

3.1.1 Volatility

The volatility of a financial asset is measured by the dispersion of returns around its mean. There are several standard measures of volatility with the most common being standard deviation of returns. In this study, we have selected the standard deviation of returns of the product (or underlying) over a cycle of 5 years to estimate volatility. However, we may use a shorter horizon if the maturity of the product is shorter than the 5-year cycle or if the time since inception of a product is too short. In cases where prices of investment products are infrequent and lacking, we focus on the volatility of the underlying instrument as a proxy for that of the product.

While past financial crises have shown that extreme events do arise, Koh, Lee and Phoon (2002) argued that factors like liquidity, leverage and concentration (addition to volatility) account for exacerbated losses in extreme conditions. In addition, Fisher Black (1993) argued that the standard deviation of returns can be estimated with reduced error due to the relative stability and use of higher sampling frequency.

For liquid instruments with daily pricing, it is possible to calculate rolling annual returns. For liquid instruments with historical weekly and monthly pricing, we will calculate the annual mean return and standard volatility measures. In order to provide stability in the volatility measures, we will use a long historical period of 5 years wherever possible. In the case of products with discontinuous returns such

as structured products, it may not be possible to construct a time series of returns given that periodic prices may not be obtainable. In this case, the volatility of the underlying may be used as a proxy where the delta is approximately constant at unity.

In order to simplify the need to calculate historical prices for each product, it would be best to adopt comprehensive proxy indices across various asset classes and geographical regions. The volatility of the indices may then be used as a substitute for the underlying assets.

Where multiple asset classes exist the overall exposure contribution may be determined by assuming appropriate levels of co-movement between asset classes. This assumption is made with the expectation that in distressed periods, various asset classes move in tandem.

The use of other risk measures such as the Value-at-Risk (VaR), maximum drawdown and downside deviation has also been considered. We chose to use the standard deviation in the light of the following modelling principles:

- (a) Simplicity and parsimony
- (b) Relevance and usefulness
- (c) Effectiveness
- (d) Adaptable to a portfolio context
- (e) Ease of implementation
- (f) Ease of explanation and understanding
- (g) Universal applicability for all financial product types.

In order to use VaR, we need to estimate the underlying probability distribution of returns. The use of VaR is difficult to extend to more complex products with low liquidity and complex payoffs. For complex product, we measure the standard deviation of the underlying. In addition to the previous issues, maximum drawdown of complex products based on past history can be dichotomous at zero or total loss. Using maximum drawdown for complex products may therefore under-estimate the risk or over-penalize a product. Using standard deviation of the underlying or indices rather than downside risk measure is much simpler to implement. It is important to note that skewness, kurtosis and entire returns distribution also have an impact on the results. Our calibration results which are based on the stability of the relative ranking of the products suggest that skewness and kurtosis are not expected to be severe for the underlying assets or indices.

3.1.2 Liquidity

Many empirical studies, especially on hedge funds have highlighted that liquidity is a risk factor that impacts investment performance. Gibson and Wang (2013) found that outperformance weakens considerably after accounting for liquidity risk and the alphas of some funds entailed rents for their service as liquidity providers. Jawadi and Khanniche (2012) motivated the need in accounting of nonlinearity when modelling hedge fund exposure to risk factors due to the use of short selling, leverage, derivatives and illiquid assets by such funds.

Especially during market dislocations or when there is a specific risk associated with a particular product, illiquidity can result in severe losses in the quick exit of an investment. Thus having a

normally liquid market would greatly help exit of investments without incurring additional expenses through a distressed sale.

On the other hand, certain funds or investments that are infrequently traded or that the market maker provides bid prices infrequently would increase the risks to the investor should adverse events occur. Liquidity measures should include trading volume and bid-offer spreads. However, most unlisted products that are over-the-counter do not have two-way prices and volume data. Thus, we will need to set up criteria based on the frequency of trading, size of trades and quoted prices. We believe that while a trader would be concerned with liquidity from the standpoint of market clearing of trades, the investor would be more concerned about having the required window to exit the investment in a normal fashion. This applies to normal market conditions as during stressed conditions, prices would be additionally depressed due to overall illiquidity of the underlying instruments.

We use the measure of price availability as a proxy for liquidity. For example, a unit trust with daily prices quoted by its manager is deemed liquid even if the redemption amount is paid after two or more working days. Price availability of more than a day and less than a month is a measure of intermediate liquidity. Where prices are only available after more than a month, the investment is deemed most illiquid. While this is not a direct measure of liquidity from the standpoint of the ability of the market to clear trades quickly, it is a pertinent feature for general investors investing in financial products. Investors are concerned about the ability to exit a position through liquidation, prices notwithstanding.

3.1.3 Credit and issuer risk

Counter-party risk can give rise to credit contagion (see Brigo, Morini and Pallavinci (2013), Gregory and Gregory (2012) and Jorion and Zhang (2009)). Investment products carry the credit risk of the issuer and secondary parties linked to them. These parties include the note issuer, fund sponsor, fund guarantor or custodian. Such credit risks can be reflected by the credit ratings of the various parties, particularly that of the issuing entity. If a public rating is unavailable, an equivalent internal rating may be needed. The credit exposure will be the exposure to the underlying instruments. Besides the note issuer, the derivative swap that is responsible for the return performance of the product may be from a third party thus requiring further credit risk assessment of the third party.

Similarly, for balanced funds with bond investments, these funds carry the credit risk of the issuer and their riskiness may be factored by way of the underlying credit rating, parentage, covenants and embedded terms.

Counter-party risks also exist when investors face the distributor rather than the manufacturer of the financial product. This risk is most critical when the investor relies on such a provider to perform its obligations to deliver the stated performance according to the outcome of the investment. Most funds are ring-fenced with separate custody of the underlying assets and as such the investor does not face any default risk of the investment manager or fund distributor. We will also include the swap counter-party involved if derivative structures are being used. An assessment would have to be made of counter-party risks, including the use of custodians or trustees.

As a start and for uniformity, only ratings by the three key rating agencies (namely Standard & Poor, Moody's and Fitch) are used. Depending on the need, practical implementation may also take into consideration the equivalent outcomes from other local rating agencies and also internal ratings by financial institutions. Scores which are based on usual grades and their equivalence are categorized as A+ or better, A+, BB+, and below.

3.1.4 Duration risk

We have included duration risk especially to cater to fixed income instruments with attached cash flows. Daxner writing in Benefits Canada (2009) reiterated that in addition to balancing risk in pursuit of capital market returns, investors are also mindful of the need to set active duration targets. For such instruments, price volatility increases as duration lengthens. While certain long-duration bond prices may seem to be stable in a less liquid market, the instability will be more pronounced when uncertainty arises in the market. While not all financial instruments or products behave like bonds with clearly defined cash flows, we can nevertheless look at them as investments with cash flow even if they are irregular or uncertain. Thus a stock can be modelled as an investment with a series of dividends (if any) and a final sale price. Private equity does not have dividends but a final redemption price and proceeds are paid once the investment is liquidated. This approach allows us to assign a duration score to a financial product or instrument.

3.1.5 Leverage

Leverage is known to affect asset return volatility and has been regarded as a key risk factor (see Jawadi and Khanniche (2012) and Charath, Christie-Davis, Ramchander (2012)). Leverage utilized within a product or financial instrument is intended to magnify the potential returns. As such, the price volatility will also be magnified accordingly. The end result is an increase in the risk of the product or instrument from an investor's baseline position. It is important to determine the level of internal leverage in an instrument that utilizes derivatives. Leverage may also exist in a managed product such as funds through borrowing within the portfolio. Hence, we have to determine the level of such strategies being deployed in order to factor in the resultant additional risks incurred.

In our implementation we examine the overall leverage that is allowed in the mandates or structure. In cases where leverage ratio is greater than 1 but less than 2, the product is considered to have intermediate leverage. Only products that do not use leverage are given a low factor score. Ultimately the determination on how much the exposure to the underlying instrument is magnified beyond the original investment is a key determinant of risk and volatility.

3.1.6 Degree of diversification/Concentration of investments

Investments with a concentration of holdings in a few assets or classes expose investors to significant risks. Broadly diversified investments reduce risk to investors due to reduction in idiosyncratic risks. It is not always possible to model what is the resultant risk of the product based on the mix of instruments or asset class exposure². For funds with mixed asset classes, it would be useful to calculate the combined exposure using proxy indices and their corresponding degree of association across different market conditions.

The degree of diversification of a financial product is dependent on the geographical spread of its underlying investments, the number of asset classes and sector distribution as well as the concentration of investments in specific securities.

Table 3.2 provides a means of assessing the contribution to risk according to the presence or absence of diversification.

² See Hasse, Johannung, Rudolph and Schweizer (2012) for a discussion on diversification benefits with liquidity risks for open-ended property funds and Markowitz (1991) for a discussion on diversification benefits

Table 3.2 Diversification Sub-Factors

Factor		Level			Weights
		Low	Medium	High	
Geographical	Threshold	Country	Regional	Global	0.2
	Score	3	2	1	
Asset Class	Min	1	2	3	0.4
	Score	3	2	1	
Sector Distribution	Min	1	2	3	0.2
	Score	3	2	1	
Single Instrument Concentration	Max	100%	10%	5%	0.2
	Score	3	2	1	
				Total	1

Extreme Market Conditions

The proposed risk-rating methodology is based on long-term stable parameters characteristic of the product or underlying asset being modelled. This provides some level of stability to the relative ranking or position within the sample for the product risk categorization and avoids potential pitfalls of frequently changing risk ratings in an investor’s portfolio.

However, under extreme market conditions when the risk of market crashes for investment products is high, it is prudent to use a distressed market scenario. This is because the majority of investment losses and investor unhappiness would happen during such periods when severe price declines across volatile asset classes take place. Moreover, during such periods of market dislocation, major asset classes that are normally un-associated may start to fall in tandem. Low co-movement or negatively associated assets may develop into volatile high co-movement or positively associated assets under extreme events. In order to take into account such severe market scenarios, we can adopt appropriate penalty factors in the calculation of risk exposure for each of the risk factors wherever possible. These can be further fine tuned and adjusted by product providers in response to severe market conditions.

3.2 Calibration of Risk Factors

For each risk factor, scores are assigned according to the level of input measure used for each factor. The input measure is carefully chosen to best reflect the contribution to risk of that factor and its applicability across most products and financial instruments.

For example, we can use the volatility range of the underlying security or securities to scale the volatility factor. The advantage of looking at the generic underlying volatility is that we do not have to concern ourselves with other factors such as leverage that will alter the eventual volatility of the product. On the other hand, we are still able to determine the volatility of a hybrid such as a mix of stocks or even asset classes. This can be done by assigning appropriate proxies for those instruments or asset classes and by examining the volatility of the blended portfolio.

For each risk factor, calibration is made to determine the amount of contribution of that risk factor to the overall risk rating. This can be done on a continuous basis where the absolute value of the measure is translated to a common scoring scale. The score for each risk factor will take into account both the input measure level as well as the relationship between the measure and its contribution to overall investment risk.

Another approach that will be illustrated below is to score each factor into one of three levels: Low, Medium and High. Appropriate cut-off for each factor measure will be determined that will reflect the contribution of risk by the measure. A score will be assigned to each level of the risk factor that takes into account the relationship between the measure and its contribution to investment risk.

Across the various risk factors, each factor may carry a different penalty weight according to the severity of the risk contribution. The resulting score of the risk factor may or may not be linear, but will be calibrated to the overall risk of loss. This approach ensures that the contribution of each risk factor to the overall risk of the product is carefully considered taking into account its input level as well as the score assignment to the risk measure. The total score is then mapped into the overall risk rating indicator from 1 to 5 with 1 being the lowest risk level and 5 the highest risk level.

Although the various risk factors may be correlated, we believe that it is prudent practice to treat them as additive. This is in line with the thinking that in a stressed market scenario, all risk factors deteriorate at the same time in the same direction.

Table 3.1 shows how each risk factor is scored in the proposed risk framework. For example, volatility is rated as high when the investment's standard deviation exceeds 15% per annum and is scored 9 points in the proposed framework. A final rating can be obtained by summing up the risk factor scores and using Table 3.3 as follows.

Table 3.3 Overall Risk Rating Scoring

RISK RATING	1. LOW RISK	2. BELOW AVERAGE RISK	3. AVERAGE RISK	4. ABOVE AVERAGE RISK	5. HIGH RISK
TOTAL SCORE	6 to 8	9 to 11	12 to 15	16 to 19	20 to 28

4 IDENTIFICATION AND CALIBRATION OF COMPLEXITY FACTORS

4.1 Identification of Complexity Factors

Complexity is a qualitative dimension which interacts with the underlying risks, thus affecting, influencing, and modifying the final return outcome of financial products in a way that may not be expected by the average investor. While it is not a direct contributor to the overall underlying riskiness of the financial product, it nevertheless affects the way an investor understand its workings and how the return outcome is achieved. While some equate complexity with risk, they can be quite different. For example, risky products such as foreign currency denominated assets are not necessarily complex or difficult to understand. This is because what the investor sees in the price movement of the underlying assets is what determines his investment's final return. Hence, the investor can visualize his gain when the exchange rate appreciates or his losses when the exchange rate depreciates. On the other hand, a managed fund or unit trust has greater complexity because there are additional layers of opaqueness and uncertainty attributable to the stock selection and investment process for the fund. In addition to the prevailing performance of the stock market, the investor needs to know the specific assets the manager has invested in as well as the embedded fee structure before he can determine the return outcome of his investment. The same applies to all other forms of managed products where manager selection and performance plays an important role.

In a similar way, structured products with its embedded derivatives can result in a change of behaviour of the final return outcome that is significantly different from that of the underlying asset. A derivative typically alters the outcome of the investment by changing the risk and return profile of the underlying instrument. Thus, the embedded selling of puts in a structured product provides income to buffer against stock price declines but at the same time limits the upside return potential. Selling an amount of put beyond the notional value of the investment would provide greater income but would accelerate loss in any decline of the stock price. There are many ways derivatives can be introduced to products and they all alter the variability of the final outcome of the investment with respect to the underlying instrument.

Complexity is related to the ability of the investor to comprehend how an investment product works and how its potential return is derived. The introduction of derivatives may complicate an investor's understanding of how the potential investment return is determined. In addition, various derivatives are traded in sophisticated markets with prescribed rules and conditions that affect the valuation of derivatives and hence the final return received. Examples of these include market disruption events, defaults, counter-party performance and conditional triggers that may severely affect the outcome of investments. While most of these special conditions and events will be somehow documented in the product brochure or prospectus, the detailed information as well as technical jargon will be difficult for the average investor to digest. Investors may omit reading them, resulting in unexpected surprises during extreme events.

There may be a host of factors that contribute to complexity, but it is generally difficult to quantify them. This is because unlike risk, complexity affects the level of transparency of return outcome which is itself dependent on the sophistication level of investors. As such, it is best to simplify the problem by grading the complexity of products using factors that determine the difficulty of understanding the full impact of return outcomes to the average retail investor.

The key factors of complexity proposed in the framework include:

- (a) Structures and layers affecting payoffs of financial products
- (b) Expansiveness of derivatives used in financial products
- (c) Availability and usage of pricing and valuation models to price these products
- (d) Number of scenarios determining return outcomes
- (e) Amount of information disclosure required to describe a financial product and simplicity of language used

4.1.1 Structures and number of layers defining payoffs

Most financial products possess a basic structure which specifies the underlying securities, the product type and the characteristics of payoffs. The underlying security specifies whether the investment is linked to fixed income, equity, foreign exchange, commodities or some combination of these such as unit trusts. The product type specifies whether the primary source of return for the investment is income or growth in capital value. The characteristics of payoffs show how returns are computed in the interim or at maturity of the investment.

Investment products that are complex in nature have payoffs that are not solely dependent on the specification of the primary payoff structure. Additional layers of structure in complex products can include:

- (a) Conditions which reduce or enhance the payoffs specified in the primary structure (such as a call feature);
- (b) Specific selection features that specify how the payoffs depend on characteristics of several underlying assets (such as best performing underlying asset or worst performing underlying asset);
- (c) Exotic option conditions using complex formula (for example, the final index level is calculated as the average of the last readings over a given period); and
- (d) Term feature specifying how payoffs are terminated or aggregated during the duration of investment (such as a callable feature where an issuer can terminate the product on any coupon date).

The more layers of structure the investment product possesses, the more complex it is for investors to understand how returns are computed for their investment. Hence, the complexity of the product can be scored according to the number of layers of structure embedded in the product.

4.1.2 Expansiveness of derivatives and non-standard investment vehicles used

Investors generally regard derivatives as complex instruments due to the difficulty in determining its payoffs as well as the complexity of the pricing formula. The types and number of derivatives embedded in the investment product can be used to gauge its degree of complexity. The more types of derivatives or the number of derivatives structured into the product, the higher will be the complexity rating assigned to the product.

4.1.3 Amenability to valuation by standard and known valuation models

Investors generally do not regard common shares as a complex financial product as they can price them easily with well-known valuation models, and the data required by these models are readily available. For example, shares can be valued using the P/E model which requires as inputs an industry or peer P/E multiple and the company's prospective earnings per share. These inputs are easily obtainable from information providers such as Bloomberg or Reuters. The P/E pricing model is easy to understand and apply without the need to write complex computer programming codes.

In contrast, a CDO's (Collateralised Debt Obligation) cash flow tranches are difficult to value due to the lack of established valuation models can calibrate default risk and early repayment behaviour. Hence, such products, that are not easily valued with known asset pricing models, are perceived to be more complex. This problem is further exacerbated if market prices are not readily available. Like CDOs, structured products are generally traded OTC (over-the-counter) by the product provider who is also the market-maker. Thus, prices are not publicly available but can only be provided by the market-maker and investors will face great difficulties in valuing their investment holdings.

4.1.4 Number of scenarios required to quantify cashflows of investment product

Financial products with similar number of structural layers may have different degrees of complexity if their return outcomes have different dependencies on contingent events. For example, a product with a "knock-out" feature is more complex than one without this feature. Therefore, beyond the number of structural layers, another measure of complexity is the number of potential scenarios that can determine the final return outcome of the investment product. One way of gauging this is to map

the different possible pathways throughout the life of the product until maturity that will determine its final payoff.

4.1.5 Amount of information disclosure required and the simplicity of language used

A simple financial product is one that can be easily communicated to potential investors with a brief description. However, complex products often require very detailed description as well as illustration to convey their essential features to investors. Hence, a complex product whether because of structural layering or embedded derivatives would generally be accompanied with additional documentations in order to describe the terms and conditions of the investment and how various outcomes may arise depending on events and triggers. As such, the large amount of literature to be read and understood by potential investors may act as a hindrance to a full understanding of the way the investment behaves. During time-sensitive situations, naive investors, who are not knowledgeable about such complex products, may over-react and suffer large losses during extreme events.

Even with full documentation available to the investor, an investment product can sometimes be construed as complex due to vagueness of disclosure or technical jargon. The crux of the matter is whether an investor is able to understand the disclosed information easily in order to ascertain the return and risk trade-off of such products. Consequently, financial products that require prospectus as well as complex schedules and addendums would be regarded as complex.

4.2 Calibration of Complexity Factors

For each of the 5 complexity factors, scores are assigned according to the level of input measure used for each factor. The input measure will be carefully chosen to best reflect the overall degree of complexity of a wide pool of financial products. Each complexity factor is scored and classified into one of three levels: Low, Medium and High. Appropriate cut-offs for each factor measure will be determined that will reflect the contribution of complexity by the measure. A score will be assigned to each level of the complexity factor that takes into account the relationship between the measure and its contribution to overall degree of complexity of the investment product. For example, a financial product is gauged to be highly complex if the number of structural layers is 3 or more. The input score assigned to such highly complex products with many structural layers is 5. The higher the input score, the higher is the deemed complexity rating of the product.

Across the various complexity factors, each factor may carry a different weight according to the severity of the complexity contribution. The resulting score of the complexity factor may or may not be linear, but is calibrated to gauge the clarity of the likely investment outcomes at the point of entry into the investment. Table 4.1 illustrates how each complexity factor is scored in the proposed framework. For example, the usage of derivatives is measured by counting the number of derivatives embedded in the investment product. Usage of derivatives is rated as high when the number of derivatives embedded in the financial product is 3 or more and is scored 5 points in the proposed framework.

Table 4.1 Complexity Factors and their Rating

Complexity Dimension	Factor		Level			Note
Complexity	No. of structural layers	Threshold	One layer	2 layers	above 2 layers	
		Score	1	3	5	
	Usage of derivatives	Threshold	None	Up to 2	Above 2	Types or number of derivatives
		Score	1	3	5	
	Known valuation models	Threshold	Publicly available	Generic	Proprietary models	
		Score	1	2	3	
	no. of return outcome scenarios	Threshold	One	Two	More than two	
		Score	1	3	5	
	transparency of disclosure	Threshold	High	Medium	Low transparency	Factor is scored using a rubric
		Score	1	3	5	

An aggregate complexity score can be obtained by summing up the scores of all complexity sub-factors from Table 4.1. Each investment product is assessed based on the contribution of each and every one of these factors and mapped into a 5-point complexity indicator scale shown in Table 4.2. For example, a financial product with an aggregate complexity score of 13 would be assigned a category 3 “Average Complexity” rating.

Table 4.2 Overall Complexity Rating

COMPLEXITY RATING	1. LOW COMPLEXITY	2. BELOW AVERAGE COMPLEXITY	3. AVERAGE COMPLEXITY	4. ABOVE AVERAGE COMPLEXITY	5. HIGH COMPLEXITY
TOTAL SCORE	5 to 7	8 to 10	11 to 14	15 to 17	18 to 23

Given the general difficulty and potential subjectivity in assessing and measuring complexity, it is thus important to adopt a simple and parsimonious framework to rate the complexity of investment products. The proposed 5-point rating scheme should be relatively easy for retail investors to interpret the complexity rating assigned to each investment.

4.3 Illustration of Complexity Rating Framework

In this section, we show how the proposed complexity rating framework can be used to rate a unit trust and a structured product. The details of complexity factor scoring as well as the mapping from total complexity score to the final complexity rating is show below. As an illustration, the Asian Equity Fund (the unit trust) has an aggregate complexity score of 13. This score is computed from Table 4.3 as follows. Total Score = 3 + 5 + 1 + 1 + 3 = **13**

Table 4.3 Complexity Rating of the Asian Equity Fund

Complexity Factors	Factor Scale		
	LOW	MEDIUM	HIGH
Number of Structural Layers	One Layer	2 Layers	Above 2 Layers
Score		3	
Expansiveness of Derivatives Used	None	Up to Two	Above Two
Score			5
Availability and Usage of Known Valuation Model	Publicly Available	Generic Models	Proprietary Models
Score	1		
Number of Scenarios Determining Return Outcomes	One	Two	More than Two
Score	1		
Transparency/Ease of Understanding	High	Medium	Low
Score		3	

This aggregate complexity score of 13 is mapped into a 5-point complexity rating scheme in Table 4.2 giving a category 3 “Average complexity rating” for the Asian Equity Fund.

COMPLEXITY RATING	1. LOW COMPLEXITY	2. BELOW AVERAGE COMPLEXITY	3. AVERAGE COMPLEXITY	4. ABOVE AVERAGE COMPLEXITY	5. HIGH COMPLEXITY
TOTAL SCORE	5 to 7	8 to 10	11 to 14	15 to 17	18 to 23

As our second illustration, we rate the complexity level of a structured product “An equity participation note”. The details of complexity factor scoring for this product is shown in Table 4.4. Based on the complexity sub-factor scores, this structure product has an aggregate complexity score of 20 (Total Score = 3 + 5 + 2 + 5 + 5 = **20**).

Table 4.4 Complexity Rating of the Equity Participation Note

Complexity Factors	Factor Scale		
	LOW	MEDIUM	HIGH
Number of Structural Layers	One Layer	2 Layers	Above 2 Layers
Score		3	
Expansiveness of Derivatives Used	None	Up to Two	Above Two
Score			5
Availability and Usage of Known Valuation Model	Publicly Available	Generic Models	Proprietary Models
Score		2	
Number of Scenarios Determining Return Outcomes	One	Two	More than Two
Score			5
Transparency/Ease of Understanding	High	Medium	Low
Score			5

Using Table 4.2 , the structured product’s aggregate complexity score of 20 maps it into category 5 “High Complexity” as show below.

COMPLEXITY RATING	1. LOW COMPLEXITY	2. BELOW AVERAGE COMPLEXITY	3. AVERAGE COMPLEXITY	4. ABOVE AVERAGE COMPLEXITY	5. HIGH COMPLEXITY
TOTAL SCORE	5 to 7	8 to 10	11 to 14	15 to 17	18 to 23

5. SYNTHESIS OF RISK AND COMPLEXITY IN PROPOSED FRAMEWORK

5.1 Tabulation of Results

Sections 3 and 4 respectively discussed the methodology used to evaluate an investment product’s risk and complexity. Each of the 100 investment products was then rated using the same methodology. The ratings of different clusters of products are presented in Figures 5.1 to 5.6.

Our results are consistent with findings in the literature. In particular, we find that alternative investments (see Decker (2003)) and structured products (see Knop (2002) and Glen and Pinedo (2013)) can take on a wide range of risk levels and complexity (see article by Decker (2013)).

Figure 5.1: Rating of Single Securities

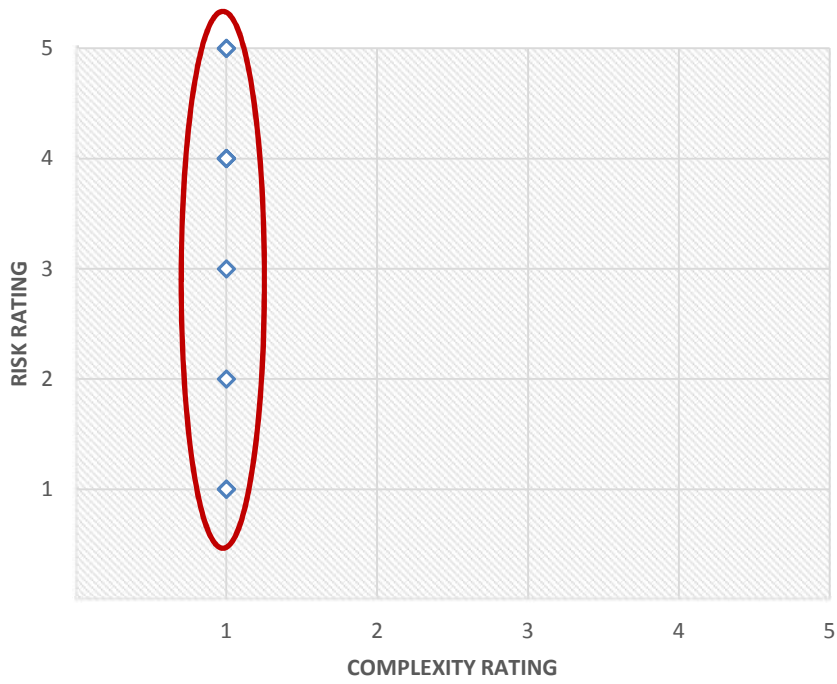


Figure 5.2: Rating of Money Market and Bond Funds

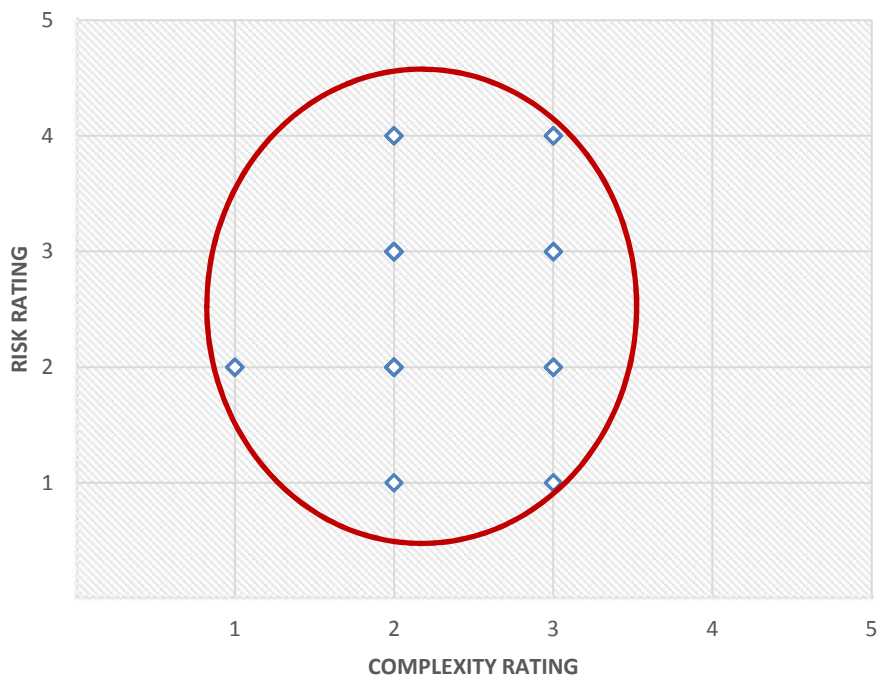


Figure 5.3: Rating of Multi Asset Funds

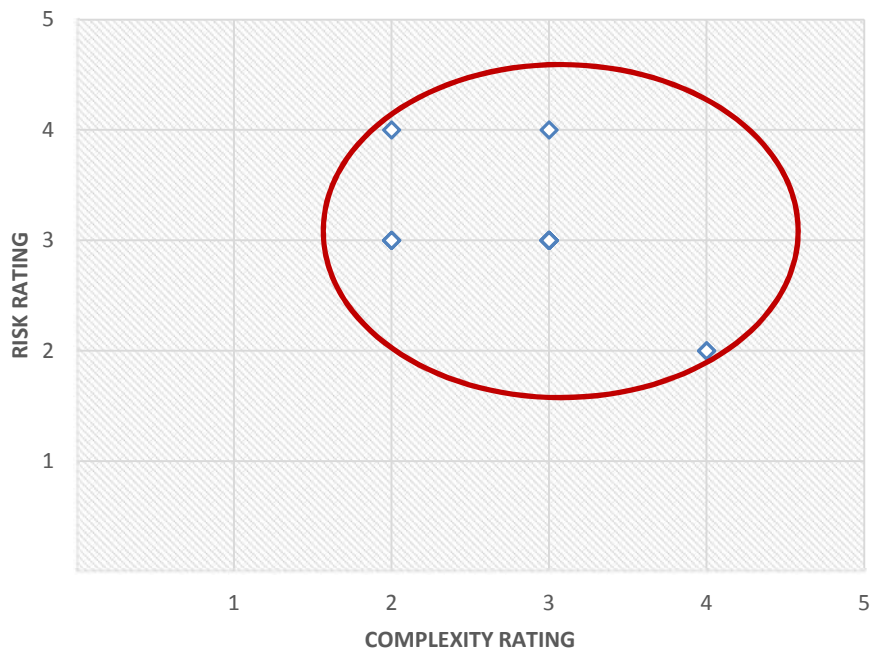


Figure 5.4: Rating of Equity Funds

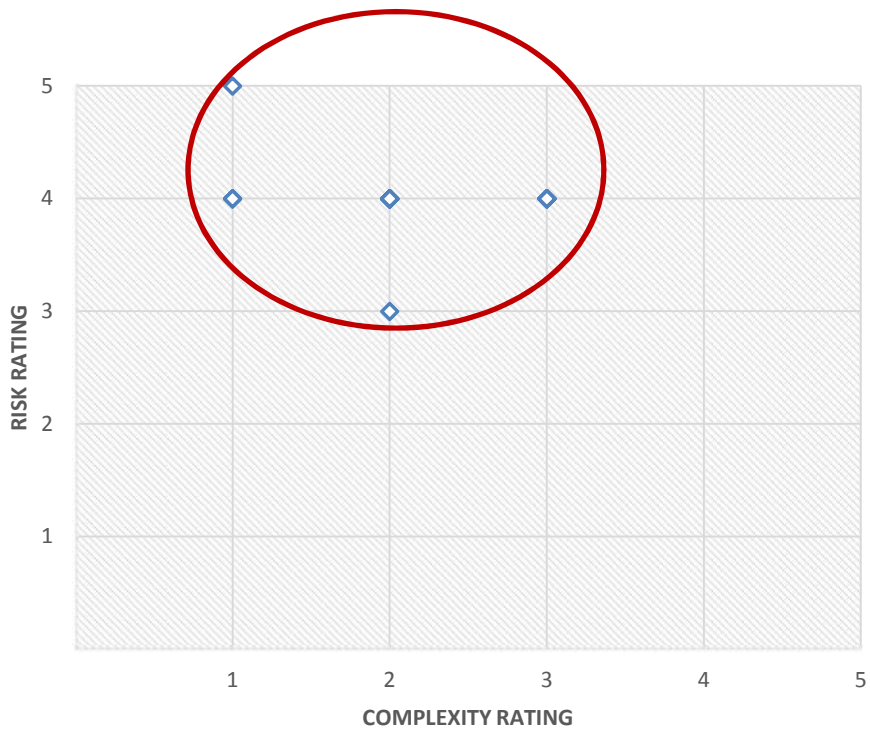


Figure 5.5: Rating of Alternative Funds

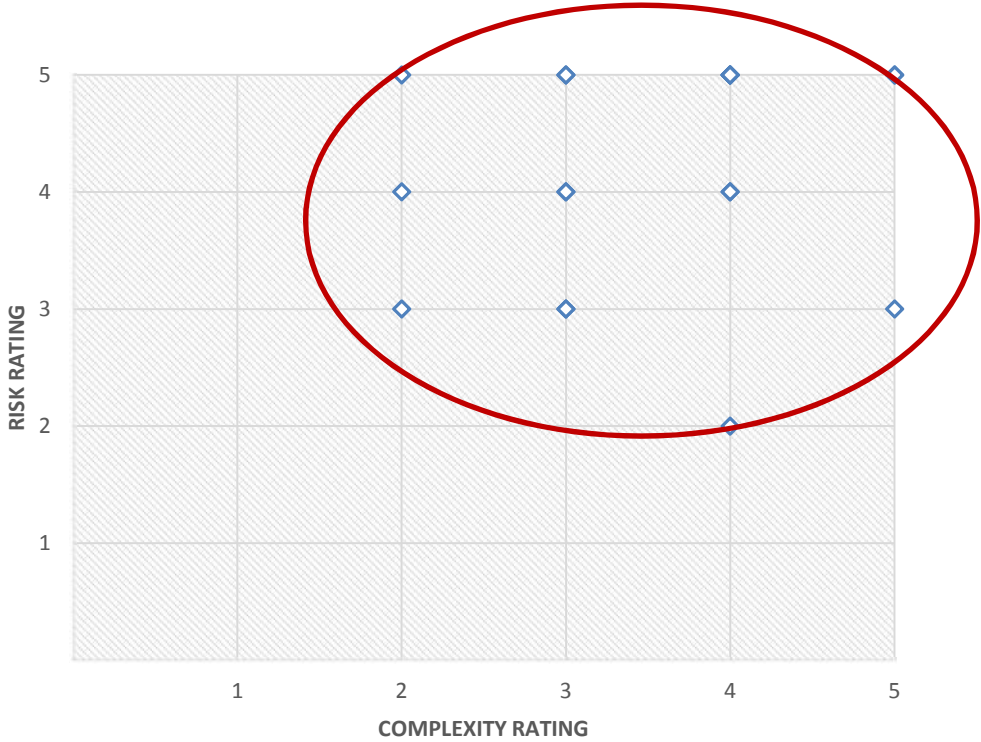
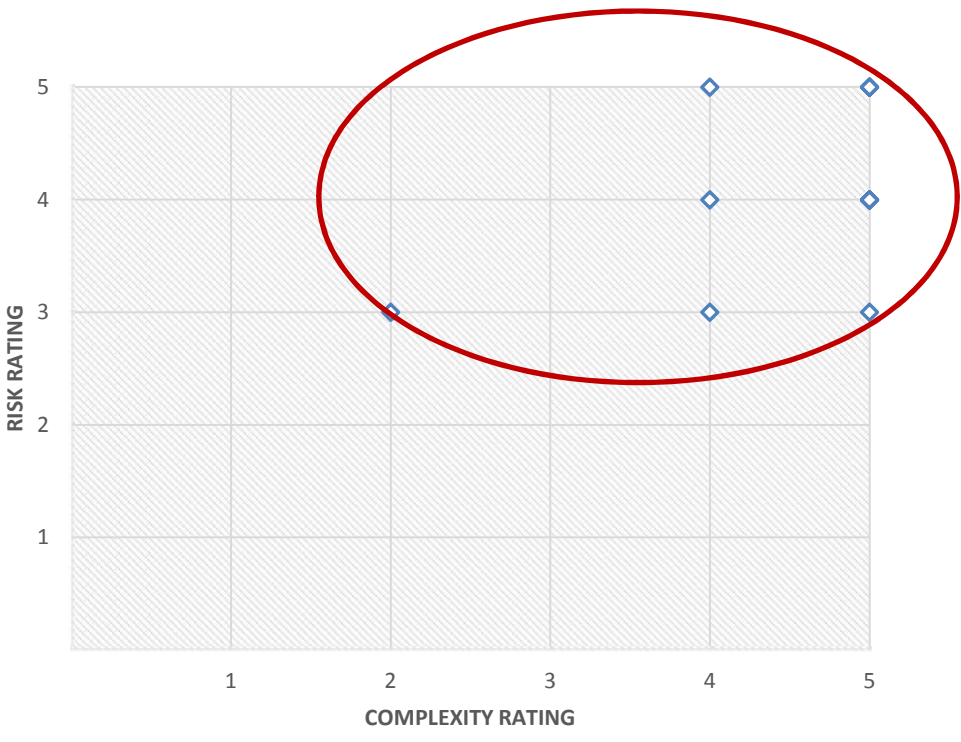


Figure 5.6: Rating of Structured Products



6. CONCLUDING NOTE

As financial markets develop, product vendors are innovating and introducing more sophisticated products to retail investors. These products are not your typical plain vanilla investments but are complicated investment schemes with derivatives embedded in them. While investors recognized that such products can be risky, they are less aware of their complexity. The structuring embedded in the investments makes it difficult for investors to determine the final outcome of their investment at maturity. To make informed investment decisions, investors would like to be cognizant of key product features, primarily its return, risk and contingent events that can result in potential loss. A framework that calibrates a financial product's underlying risk and complexity level can be useful in aiding investors make such trade-offs. It is also useful to financial institutions which are keen to get the right match between products and investors based on their risk tolerance and investment sophistication.

Extensive literature research on risk or complexity classifications adopted by other countries showed that no financial market regulator has hitherto implemented a robust framework that integrates both risk and complexity as two separate distinct dimensions. While classifying products into different risk classes has been widely adopted by regulators and practitioners for many years, classifying complexity is not as prevalent. Some practitioners have placed complex products into 3 categories, from highly complex products to simple products. Such a simple classification method does not break down complexity into contributing factors and is too subjective and not robust.

This paper proposed a framework which first characterizes product with two key dimensions, namely, risk and complexity. Risk is then decomposed into 6 main factors of volatility, liquidity, credit rating, duration, leverage and degree of diversification. Product complexity can be measured by 5 basic factors of number of structured layers, expansiveness of derivatives used, availability and usage of known valuation models, number of scenarios determining return outcomes and transparency /ease of understanding.

Some financial institutions in Singapore and Switzerland have started using in-house or proprietary classification of risk, and in some cases included complexity as a sub-factor of the overall risk. But our observation is that, the industry, as a whole, does not have a common coherent methodology. Addressing complexity through a risk classification system is an ad hoc adjustment.

We believe the proposed integrated framework can readily be adopted widely by industry players to make financial products more transparent for investment. This will ultimately help to spur financial product innovation and design, taking into consideration the appropriate combination of risk and complexity that will correspond with the investment suitability profile of investors. The methodology that we have developed can be further extended in future efforts towards building a portfolio risk assessment framework. This is made easier by having all portfolio products rated for risk and introducing an approach to amalgamate the individual contributions to the overall portfolio risk.

In developing an overall risk and complexity framework, the authors are well aware that it cannot be used without the corresponding "client investment profiling" process that is mandatory for all financial institutions as part of the sales and investment suitability process. In focusing solely on the product characteristics and in not dealing with client's investment preferences in this framework, we avoid making a judgment call on the type of clients who can invest in any product. This is best left to the distributor of the financial product and the Client Relationship Manager or Investment Advisor who can evaluate the disposition of his client holistically.

The advantage of our approach is that service providers retain the flexibility to segment their own market and match products to the appropriate risk tolerance and sophistication of these clients. Products properly classified by risk and complexity may, therefore, be offered to clients with the corresponding risk tolerance and levels of sophistication. In order for this to be possible, there would of course be some form of calibration and alignment of the risk profiling inputs so as to preserve the consistency and common language with regards to the levels of risks and complexity in question.

It is interesting to note that so far, low complexity products that generally have lower margins are usually offered to the more conservative public. More complex structured products that generally have higher margins are offered to the more sophisticated and high net-worth clients. In the absence of a comprehensive risk and complexity framework, this may be the best way to go about it. However, the proposed framework has the potential for better client-customization and risk/sophistication tuning to reach out to a wider group of investors who are offered products based appropriately on their appetite for risk and complexity.

We have simulated and stress-tested the proposed framework with a range of weights for the chosen factors. The proposed framework is technically robust and the relative classification by risk and complexity would not deviate drastically if factor scores are varied marginally. However, there is a caveat in the use of the proposed classification framework. The results, though robust under current normal and extreme market environment, is still largely sample specific and the initial classification has depended on the sample of funds. The relative ranking of products by risk or complexity will hold under normal and extreme conditions, but the factor scores may change if an evaluated product encounters new factors or situations not previously assessed. That is, while the current rankings are consistent with professional consensus, the relative positions may change if the market structure alters considerably.

The envisaged *portability* of the framework *is not limitless*. Though it could be rare, there could be situations where a qualitative assessment is further required to properly interpret or clarify the findings. This can happen within the same asset class or product offering when occasionally, one or two product rankings differ substantially from some preconceived experts' opinion. Hence, it may well be that some products would have to be evaluated on a "case-by-case" basis, particularly, individual products that are significantly "more complicated."

To implement such a classification scheme for the whole financial sector, the following should be taken into consideration:

- (a) All investment products are evaluated by a single agency to be appointed by the regulatory body to ensure uniformity and consistency;
- (b) Investment products will be evaluated by product distributors, allowing for minimal disruption to the distributors' own rating system and amicable to their own investment suitability framework and clientele; or
- (c) Products will be evaluated by product producers at factory door, given that producers know the products best and there is a single risk or complexity rating when a product is sold in the various distributors' network.

Implementation requires recalibration at regular intervals incorporating a wide range of different products. Regular monitoring and update are essential to ensure relevance to investors with the

changing investment environment. In general, there should at least be an annual review exercise for all products while maintaining flexibility to change any product rating anytime due to material change in the characteristic input factor conditions.

The implementation of the framework could initially be carried out on a *voluntary* basis. In this case, product producers or distributors may wish to voluntarily evaluate their investment products using rating procedures with the proposed or a similar framework of risk and complexity. This approach would promote wider understanding and acceptance for the concepts of, and factors contained within risk and complexity.

Organizations implementing or administering a framework for risk and complexity need to analyse the associated costs and benefits prior to implementation. A risk and complexity rating scheme may assist firms to communicate the product features and provide for effective branding. However, it is conceivable that some firms may not find the rating scheme useful and prefer to delay implementation until a later time.

A well-constructed framework will also provide warning to investors regarding the uncertainty of returns. Investors who require a higher rate of return should take cognizance of the higher complexity that often comes with seemingly lower risks. Besides simply evaluating risk and complexity of financial products, the advisors have to ensure that the range of products matches the needs of investors with average to high net worth. More importantly, producers and distributors of financial products have a common platform to develop and offer appropriate products to investors. The producers and distributors can also select their preferred market segments to focus on.

The successful implementation of any classification system of risk and complexity requires the buy-in and strong support of all interested parties. This may not be easy but is plausible. It would provide a major step forward in the smooth and efficient running of the financial markets.

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