European Commission

Baseline report on solutions for the posting of non-cash collateral to central counterparties by pension scheme arrangements

A report for the European Commission prepared by Europe Economics and Bourse Consult

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EU regulation designed to mitigate risk requires that standardised OTC derivatives are cleared via a central counterparty (CCP). Pension scheme arrangements (PSAs) have been granted a temporary exemption from this requirement.

The long-term nature of PSAs' liabilities and their exposure to variables such as interest rates mean that many PSAs hedge, e.g. using interest rate swaps. At the end of the exemption PSAs will be obliged to begin clearing OTC derivatives and posting the cash variation margin required by CCPs (current bilateral practice permits posting non-cash assets). Pension funds aim to be fully-invested and a requirement to hold cash against possible Variation Margin calls would affect investment performance. This study aims to understand the impact on PSAs of this and to assess potential solutions.

We developed representative portfolios to model the impacts on PSAs, estimating that to prepare for a 100 bps interest rate shock PSAs across the EU28 might need a cash buffer of €200–€250 billion, implying an investment drag of up to €3 billion per annum. Compounding this over the life of pensioners' contributions gives the impact on retirement incomes. This is significant: the cumulative cost in the 100 bps simulation is up to 3.1 per cent of incomes in the Netherlands and 2.3 per cent in the UK. The estimated impact across the EU28 is a 1.1–2.2 per cent reduction.

In terms of the alternatives to PSAs posting cash, no one solution stands out and there is little evidence that the industry is investing in innovative solutions to the problem. A large and liquid repo market is critical to the most likely solutions currently available but our analysis indicates that PSAs would not be able to rely fully on it, and therefore would need a substantial level of cash buffer, with its commensurate costs.

Le Règlement (UE) N° 648/2012, conçu pour atténuer les risques, impose une obligation de compensation des produits dérivés de gré à gré (OTC) standardisés par une contrepartie centrale (CCP). Les dispositifs de régime de retraite (PSA) bénéficient d'une dérogation temporaire à cette exigence.

La nature à long terme du passif des PSA et leur exposition à des variables telles que les taux d'intérêt implique que de nombreux PSA couvrent les risques en utilisant, par exemple, des swaps de taux d'intérêt. A l'issue de la période de dérogation, les PSA seront tenus de compenser les produits dérivés OTC et de verser une marge de variation en espèces (ou en cash) requise par les contreparties centrales (la pratique actuelle pour les opérations bilatérales autorise le dépôt de garanties sous forme d'actifs non monétaires). Les fonds de pension cherchent à investir la totalité de leurs actifs, et l'obligation de détenir des liquidités en prévision d'éventuels appels de marge variable nuirait à la performance des investissements. Cette étude vise à comprendre l'impact de cette obligation sur les PSA, ainsi qu'à examiner les solutions envisageables.

Nous avons développé des portefeuilles représentatifs pour modéliser les impacts sur les PSA et estimé que, pour se préparer à une hausse de taux d'intérêt de 100 points de base (pb), les PSA des 28 États membres de l'UE pourraient avoir besoin d'une réserve de liquidités de 200 à 250 milliards d'euros, ce qui entraînerait une baisse de performance des investissements pouvant atteindre 3 milliards d'euros par an. L'application de ces critères sur la durée des cotisations des retraités permet d'évaluer l'impact sur les prestations de retraite. Cet impact est significatif : le coût cumulé dans la simulation de 100 pb correspond à 3,1% des revenus aux Pays-Bas et 2,3% au

Royaume-Uni. Dans l'ensemble des 28 membres de l'UE, la baisse serait estimée à 1,1-2,2%.

Aucune solution alternative au dépôt de garanties en espèces par les PSA semble faisable, et rien ne semble indiquer que le secteur investit actuellement dans des solutions innovantes pour surmonter le problème. Un marché des pensions-livrées important et liquide est indispensable aux solutions dont nous disposons actuellement, mais notre analyse indique que les PSA ne pourront y avoir recours à chaque fois, et auront besoin par conséquent d'un niveau substantiel de réserves de liquidités, avec les coûts que cela entraîne.

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1. Executive Summary

1.1   Motivation of the study

REGULATION (EU) No 648/2012 on OTC derivatives, central counterparties and trade repositories (EMIR) is an EU Regulation designed to mitigate risks identified in the derivatives market. One of its pillars is ensuring that standardised OTC derivatives are cleared via a central counterparty (CCP). EMIR came into effect in August 2012, but "pension scheme arrangements" (PSAs) have been granted a temporary exemption from the central clearing requirement until August 2015.

The long-term nature of the liabilities of PSAs and their exposure to variables such as interest rates and inflation mean that PSAs seek to hedge against these risks. They can do this in a variety of ways, including the purchase of real assets — however the use of OTC derivatives is widespread market practice. Interest rate swaps, inflation swaps and FX forwards are commonly used instruments.

At the end of the exemption PSAs will be obliged to begin clearing their OTC derivative portfolios, at least to the extent that the instruments in these portfolios are clearable. CCPs require both variation and initial margin to be posted against all positions and, in particular, require variation margin to be posted in cash — current bilateral practice permits the posting of high-quality assets such as government bonds.

Pension funds aim to be fully-invested. Therefore the concern is that in order to hold cash to post variation margin pension funds would need to reduce their investments, which could have an impact upon investment returns. A solution to these issues would need to be found if pension schemes are to comply with the clearing requirements under EMIR without suffering a reduction in investment performance due to this siphoning of assets as margin or else passing on increased risk exposure to pensioners due to a reduction in hedging.

If the Commission feels that insufficient progress has been made by CCPs to develop appropriate solutions for the transfer of non-cash collateral as variation margin (VM), it can decide to extend the exemption from the central clearing requirement for up to three more years. This study is input into that decision.

The main objectives of this study are, therefore, to:

i) Identify the extent of over-the-counter (OTC) derivative use by PSAs, and the costs currently associated with bilateral collateralization.

ii) Identify the costs to PSAs and wider impacts if PSAs are required to meet cash VM requirements of CCPs, once the exemption of PSAs from mandatory central clearing expires.

iii) Assess a range of alternative solutions for the posting of non-cash collateral by PSAs once the exemption from mandatory central clearing expires.

1.2   Methodology

The first two objectives of the study mentioned above were met through modelling. We developed the following building blocks as part of our cost modelling:

- Development of three representative portfolios, based upon actual data obtained from the pension industry.

- Calculation of VM requirements for the representative portfolios under a range of simulated environments. The simulations included the historic market changes over the past five years, a 100bps increase in interest rates, and stressed market conditions scenarios published by the US Federal Reserve and by the European Banking Authority. These are credible candidates for the types of thought experiment and analysis which PSAs might undertake in determining how large a VM call they might be exposed to, and hence how large a cash buffer it would be appropriate to hold. In particular, the 100bps move has some currency amongst PSAs.

- Estimation of derivative usage across the EU industry such that the representative portfolios could be mapped across to the PSAs of each Member State.

The latter objective was met by examining a range of technical options for the posting of non-cash collateral and examining their feasibility, costs and impact with a range of PSAs, their investment managers, clearing members, CCPs and central banks.

In support of this this work we conducted fieldwork which was both extensive (pan-EU) and intensive (we worked closely with several PSAs seeking to understand the drivers and composition of the asset and OTC derivative portfolios that each had). The tools used included literature review, a focused survey of PSAs and structured interviews. The interview programme included PSAs, clearing members, CCPs and central banks.

1.3 Results

1.3.1 Significance of OTC derivatives to PSAs

The aggregate assets of the occupational pensions industry across the EU28 were just over €5.2 trillion in 2012. The UK, Netherlands and Denmark accounted for around 70 per cent of this, with the UK alone representing 43 per cent (around €2.3 trillion in assets).

We have noted at 1.1 why PSAs hedge, and identified some of the advantages of using OTC derivatives. The intensity of hedging effort and of derivative usage by a PSA is influenced by a variety of factors:

- The structure of the PSA, such as whether it is a defined benefit or a defined contribution scheme.

- The PSA's funding position. A fully funded PSA has sufficient assets to cover all its pension liabilities. In under-funded PSAs liabilities exceed the current value of its assets. The gap can be significant: the UK's pension funds have an aggregate funding ratio of 61 per cent. The hedging of interest rate and inflation risk is against the liabilities not the assets and managing liability risk will be particularly crucial in such under-funded funds.

- The PSA's asset allocation. This interacts with derivative use - hedging can be achieved by other means, such as the acquisition of physical assets.

- The size of the fund. Broadly speaking, there is a scale effect, with larger funds likely to have more developed derivative portfolios.

- In addition, regulators can encourage or provide incentives for hedging, which in turn make the use of derivatives more likely.

We developed a model of the relative intensity of derivative use which considered these variables. This enabled us to map across the representative portfolios to the wider EU-wide industry.

1.3.2   The costs and impacts of moving from bilateral collateralisation to central clearing and posting cash VM

The total estimated cost impact on PSAs will depend upon their reference point in setting a cash buffer. The table below summarises our estimated range of cash buffers, and the implied annual cost to PSAs in the EU28.

Table 1.1: Total annual costs of PSAs posting cash VM (EMIR without the exemption)

	Cash buffer (€bn)			Total annual cost (€bn)		
EU28 impact (100bps)	204.3	-	255.4	2.3	-	2.9
EU28 impact (historic)	109.6	-	137.1	1.3	-	1.6
EU28 impact (EBA)	301.3	-	376.6	3.4	-	4.2
EU28 impact (US Fed Adverse)	336.3	-	420.3	3.8	-	4.7

This compares to the estimated annual cost of the current bilateral arrangements of about €43 million, and of EMIR (with the exemption) of €52 million. This is a significant increase, driven mostly by PSAs increasing cash holdings in order to be able to post cash VM as and when required. (Collateral management costs also increase, but this is relatively inconsequential).

These results assume that PSAs create a cash buffer between 80 and 100% of the maximum expected VM call under each of the scenarios considered. Considering the 100bps simulation, as noted in the table, our modelling indicates that the aggregate VM call would be €204–255 billion for European PSAs. Of this, €98–123 billion (£82–103 billion) would relate to UK PSAs, and predominantly be linked to sterling assets, and €106–130 billion would relate to euro (and perhaps other currency) assets.

If all UK PSAs set the cash buffer at 80 per cent of the expected VM call, then they would need to enter into repo transactions of a value of about €25 billion. PSAs in the rest of the EU would similarly need to (reverse) repo about €26 billion. In the UK in particular this would likely exceed the daily capacity in the UK gilt repo market. In the rest of Europe capacity is less obviously constrained in the relevant parts of the European government bond repo market, but there would still be operational hurdles to overcome.

Given our views on the scale of the repo market at present (and the concern that it may be subject to future shrinkage due to increased regulatory-driven costs, even outside stressed market conditions) this implies that UK PSAs would be unlikely to set a cash buffer at below 80 per cent of the expected maximum - and perhaps the 90 and 100 per cent reference marks are more realistic indications of what UK PSAs may choose to do. PSAs based in the rest of the EU may be able to set a cash buffer further from the maximum – however the repo market is not a same day cash settlement market and PSAs would need to consider this also in determining the balance between reliance on a cash buffer and reliance on repo.

We also note that the implied conversion of pension assets into cash here is very significant, i.e. sufficiently large that a price impact on the assets themselves would be possible.

1.3.3 Technical solutions for the posting of non-cash collateral to CCPs

In the course of the study we examined seven potential technical solutions which could potentially mitigate the impact on the investment returns of PSAs arising from the posting of cash VM to CCPs. We begin briefly introducing these concepts:

- **Collateral transformation by clearing members (CMs):** This is a repo service provided by CMs in which a PSA would reverse repo securities from its portfolio and receive cash which could then be used to meet VM calls from a CCP.

- **Collateral transformation by CCPs:** This would be a repo service offered by CCPs to PSAs in which the CCP would be a principal, providing cash to the PSA in return for PSA securities and executing a back-to-back repo with a third party to raise the cash. We consider the situation that, in times of stress, the third party could be a central bank.

- **Direct acceptance of non-cash assets with pass through to receivers of VM:** Here the CCP would allow PSAs to post and receive VM in the form of securities.

- **Acceptance of non-cash assets with security interest passed through to receivers of VM:** The CCP would again allow PSAs to post VM in the form of securities. The CCP would create a security interest over the securities in favour of the VM receiver.

- **Quad-party collateral for VM security interest:** A variation of the previous solution in which the securities would be held, and the security interest created, by a custodian according to an agreement between itself, the PSA, the CM and the CCP.

- **Agency stock lending:** Here the PSA would lend securities from its portfolio and receive collateral in the form of cash from the borrower which could be used to meet VM calls.

- **Secured lending by cash-rich corporations:** A solution in which non-traditional sources of cash could be tapped to provide cash to PSAs – either through repos or secured loans – with securities being provided by the PSA to the lender as security.

CCPs differ in their treatment of the risk relating to the day-to-day changes in market value of an OTC derivatives contract from that employed in bilateral settlement.[1] Bilateral settlement under a Credit Support Annex (CSA) collateralises the changes in market value, whereas CCPs actually crystallise the profits and losses, resulting in the VM actually being a settlement payment from the loser to the gainer. This is the reason that CCPs currently only accept and pay out VM in cash, cash being the most negotiable instrument. This distinction plus the fact that the novation of an OTC derivatives trade by a CCP breaks the settlement trace between the two parties to the trade are critical to the assessment of these solutions. They also lie behind the reasons why some solutions which work adequately for bilateral settlement are not suitable for CCP clearing.

Three of the solutions – Direct acceptance of non-cash assets with pass-through to receivers of VM, Acceptance of non-cash assets with security interest passed through to receivers of VM and Quad-party collateral for VM security interest – would allow PSAs to use securities to cover VM calls, without having to transform them into cash. However, this gives rise to significant drawbacks: in particular, it would entail non-cash VM contracts being offered as separate product lines to cash VM products. The

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1   i.e. the risk which the posting of VM is intended to mitigate.

non-cash VM products would have lower liquidity and wider spreads than the cash products. Direct acceptance of non-cash assets with pass-through to receivers of VM would involve so much operational complexity as to rule it out.

The two solutions involving security interest would be easier to implement technically but potential differences in the law on security interests in the different Member State jurisdictions relevant to a transaction would heighten legal risk. Even if the legal uncertainty could be resolved, we would expect that the split of liquidity between cash and non-cash products would be enough to prevent the non-cash products from gaining traction.

Two of the solutions – Collateral transformation by CMs and Agency stock lending – build upon existing market competence. However they would not have the capacity to meet the full needs of the European PSAs and this capacity would probably not hold up in times of market stress.

Collateral transformation by CCPs appears to be an attractive solution, particularly in times of stressed markets. However, there are two main challenges. First, whether central banks would be prepared to offer liquidity to CCPs and whether, in practice, the conditions on which it might be offered be compatible with the solution. Second, the lack of appetite amongst CCPs to take on and manage the resulting increased risk (even with a changed appetite by CCPs it would be subject to regulatory approval) and likely concern about the ability of CCPs to maintain current levels of systemic security.

Agency stock lending can be attractive to PSAs because it can enhance investment returns, but its market capacity cannot be relied on and, at best, can only form a small part of the solution to the PSAs' needs.

Secured lending from cash-rich corporations is an interesting concept and could allow PSAs to tap into an additional pool of cash to which they currently have limited access. The investment required to develop it would require considerable commitment from a custodian or Central Securities Depositary. In addition, the cash is on balance sheets because of a lack of suitably attractive investment opportunities and has not been returned to investors due to a mix of faith in future opportunities and perhaps also the associated tax effects of returning cash to investors. These motivations may not be maintained indefinitely.

The table below summarises our assessment of each of the solutions in terms of its impact on cost and risk factors. Against each factor in the table we have assessed the relative appeal of each of the solutions.

Table 1.2: Summary of assessment of impact on cost and risk factors

	Collateral transformation by CMs	Collateral transformation by CCPs	Direct pass-through of non-cash assets to receivers of VM	Security interest in non-cash assets passed through to receivers of VM	Quad-party collateral for VM security interest	Agency stock lending	Secured lending by cash-rich corporations
Impact on Investment Performance	yellow	yellow	yellow	yellow	yellow	light green	yellow
Impact on Swap Market	yellow	yellow	red	red	red	yellow	yellow
Legal & regulatory complexity and risk	yellow	red	red	red	red	yellow	orange
Operational Cost							
PSAs	orange	orange	red	orange	orange	yellow	orange
CCPs	yellow	red	red	yellow	yellow	yellow	yellow
CMs	yellow	light green	red	yellow	yellow	yellow	yellow
Operational complexity and risk							
PSAs	orange	orange	red	orange	orange	yellow	orange
CCPs	yellow	red	orange	yellow	yellow	yellow	yellow
CMs	orange	light green	orange	yellow	yellow	yellow	yellow
Investment Required							
PSAs (inc. custodians)	orange	orange	orange	orange	orange	yellow	red
CCPs	yellow	red	red	red	red	yellow	yellow
CMs	yellow	yellow					
Counterparty Risk							
PSAs	yellow	yellow	yellow	orange	orange	yellow	light green
CCPs	yellow	orange	yellow	yellow	yellow	yellow	yellow
CMs	yellow	red	yellow	yellow	yellow	yellow	light green

Key: Relative Appeal
Best — green
— light green
— yellow
— orange
Worst — red

The table below summarises our assessment of the capacity of the solutions – i.e. the extent to which each solution would meet the full requirement of the PSAs in both normal and stressed market conditions.

Table 1.3: Summary of assessment of capacity of the solutions

	Collateral trans-formation by CMs	Collateral trans-formation by CCPs	Direct pass-through of non-cash assets to receivers of VM	Security interest in non-cash assets passed through to receivers of VM	Quad-party collateral for VM security interest	Agency stock lending	Secured lending by cash-rich corpora-tions
Market Capacity (Normal Conditions)	light green	light green	green	green	green	orange	orange
Market Capacity (Stressed Conditions)	orange	green	green	green	green	red	orange

Key: Capacity to meet PSAs VM requirement
Would fully meet requirement

Would meet a small part of requirement

1.4 Conclusions

1.4.1 Potential impact of posting cash VM on retirement incomes

We have identified substantial potential cost impacts which would ensue as and when PSAs are required to post cash VM to CCPs. To the extent that PSAs pass these total costs on to pensioners, these would represent a € for € reduction in retirement incomes. Whilst it is possible that — where relevant — corporates and other sponsors of PSAs could make good any shortfall by increasing their contributions to the funds, our fieldwork does not indicate that this is a likely outcome. It would, anyway, only substitute a reduction in pensioner incomes with a reduction in corporate profits.

The annual total costs as a percentage of PSAs' AUM would represent the annual reduction in investment returns. Compounding over the life of pensioners' contributions provides the cumulated effect and gives the impact on retirement incomes. This is significant – particularly in those countries with more extensive pension industries. The cumulative cost in the 100 bps simulation is up to 3.1 per cent in the Netherlands and 2.3 per cent in the UK. The estimated impact across the EU28 for the various simulations is shown below.

Table 1.4: Indicative cumulated reduction in retirement incomes over 20, 30 and 40 years

	20 years	30 years	40 years
EU28 impact (100bps)	1.1%	1.7%	2.2%
EU28 impact (historic)	0.6%	0.9%	1.3%
EU28 impact (EBA)	1.6%	2.4%	3.3%
EU28 impact (US Fed Adverse)	1.8%	2.7%	3.7%

The key driver of these opportunity costs is the difference in return between cash and higher yielding assets (in particular government bonds). At present these spreads are relatively low: if the spreads should widen – or if PSAs chose to fund the cash buffer from assets other than government bonds – then we would expect a much more

significant impact on retirement incomes. Similarly, if PSAs focused on an alternative simulation to the 100 bps one – such as the other stressed simulations – the impact would deepen. It is also worth noting that, no matter how well prepared PSAs may be, the *actual* shocks which they may eventually face could still be worse.

1.4.2   Conclusions relating to technical solutions

No one solution stands out as the obvious candidate and there is currently little hard evidence that the industry is investing in innovative solutions to the core problem.

Our assessment is that the three solutions involving the posting of non-cash VM are not viable because of the negative impact of all three on the pricing of the contracts, the operational complexity of one of them and the legal risk of the other two. PSAs must therefore expect to have to post and receive VM in cash for cleared contracts.

A PSA would therefore have to maintain a cash buffer in order to meet potential VM calls or rely on transforming securities from its portfolio into cash at short notice using one of the solutions described or, most likely, a combination of both.

The only substantial transformation solution with any expectation of traction at present is collateral transformation by CMs. A PSA's appetite for reliance on this solution will depend on how the cost of the solution compares to the opportunity cost of maintaining a larger cash buffer instead. Critically, it will also depend on its view of the capacity of the repo market to satisfy its likely needs. There are serious concerns that the repo market, as presently constructed, could not meet the liquidity demands of the PSAs in times of stress.

Our analysis indicates that UK PSAs as a group would not be able to rely fully on the gilt repo market in the UK, and most likely other EU PSAs would not be willing or able to rely fully on euro government bond repo markets in the rest of Europe. Whilst the repo of other assets could increase the potential capacity available these other repo markets are much more susceptible to losses of liquidity in a crisis situation. As such, reliance upon them is not likely to be seen as a prudent approach. Therefore, absent any change in the size of the repo market or very substantial progress on some other technical solution, PSAs would need to create a cash buffer to cover the shortfall over and above the capacity that they judge the repo market would be likely to be able to provide. The scale of this cash buffer is likely to be substantial, with commensurate costs.

1.5   Disclaimer

The information and views set out in this baseline report are those of the authors and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this baseline report. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for the use which may be made of the information contained therein.

2. Introduction to the Report

REGULATION (EU) No 648/2012 on OTC derivatives, central counterparties and trade repositories (EMIR) is an EU Regulation designed to mitigate risks identified in the derivatives market. One of its pillars is ensuring that standardised OTC derivatives are cleared via a central counterparty (CCP). EMIR came into effect in August 2012, but "pension scheme arrangements" have been granted a temporary exemption from the central clearing requirement until August 2015.

Under EMIR (Article 2(10)): pension scheme arrangement (PSA) means:

a) institutions for occupational retirement provision within the meaning of Article 6(a) of Directive 2003/41/EC, including any authorised entity responsible for managing such an institution and acting on its behalf as referred to in Article 2(1) of that Directive as well as any legal entity set up for the purpose of investment of such institutions, acting solely and exclusively in their interest;

b) occupational retirement provision businesses of institutions referred to in Article 3 of Directive 2003/41/EC;

c) occupational retirement provision businesses of life insurance undertakings covered by Directive 2002/83/EC, provided that all assets and liabilities corresponding to the business are ring-fenced, managed and organised separately from the other activities of the insurance undertaking, without any possibility of transfer; and

d) any other authorised and supervised entities, or arrangements, operating on a national basis, provided that:

(i) they are recognised under national law; and

(ii) their primary purpose is to provide retirement benefits.

This definition incorporates broad elements (i.e. (d)) and we conclude that it includes a very large part of the European pension fund industry.

PSAs use OTC derivatives for a variety of reasons. The central motivation is the hedging of their liabilities to current and future pensioners against relevant risks:

▪ Interest rate movements: interest rates can have a material impact on the value of a pension fund, especially where the fund holds a substantial amount of long-dated, floating-rate fixed income securities. A pension fund can hedge against interest rate moves by, e.g. purchasing interest rate swaps (IRS).

▪ Inflation: pension funds in environments where inflation is high or uncertain may wish to hedge against the effects of rising prices on the value of their portfolios, returns on investment, or pay-outs. This is especially important for defined benefit pension schemes (including hybrid schemes).

▪ Currency movements: investing in foreign currency-denominated assets carries foreign exchange (FX) risk in addition to the two risks mentioned above. FX risk may arise for pension funds in two ways. First, where large volumes of FX are needed to make future purchases, pension funds might not want to take a risk that domestic currency will depreciate versus foreign currency — thereby making the future purchase more expensive — and purchase an FX derivative to lock-in an exchange rate. This could be achieved by purchasing an FX forward, swap, or call option on the foreign currency. Second, a pension fund could face FX risk when realising returns on foreign investment. If the domestic currency appreciates

against the foreign currency, coupons on foreign-denominated bonds or capital gains on foreign-denominated assets could be worth less. Pension funds can hedge against this risk by purchasing the other side of an FX forward or swap or buying a put option on the foreign currency.

The long-term nature of the liabilities that PSAs are seeking to hedge against means that OTC derivatives are currently generally more suitable than any exchange traded alternatives, which are generally short-dated meaning contracts need to be rolled. The use of derivatives is not the only way in which some of these risks can be hedged: a PSA can also achieve an effective hedge in many instances through the acquisition of real assets. The choice to use derivatives is reflective of the trade-off between transactional and operational costs, and the extent of the hedging achieved. If the extent to which liabilities are hedged reduces, then ultimately the pensioner is exposed to increased risk and more volatile and, potentially, lower pension incomes are achieved.

PSAs have also used derivatives as an efficient way to enhance returns, e.g. through equity derivatives, by levering exposure more than would be possible with physical assets.

The level of collateral required by banks, as counterparties in OTC derivatives, is a feature of the perceived credit standing of the client. Consequently, until now, pension funds have typically not been required to post initial margin when trading bilaterally with banks, as they are considered highly creditworthy counterparties. The intention of EMIR is to bring more derivative transactions into central clearing through CCPs and, for those transactions that remain executed bilaterally, to require margining. Under EMIR, CCPs require both variation and initial margin to be posted against all positions and it is conventional for CCPs to require variation margin (VM) to be posted in cash. (Bilateral settlement under a Credit Support Annex (CSA) collateralises the changes in market value, whereas CCPs actually crystallise the profits and losses, resulting in the VM actually being a settlement payment from the loser to the gainer. This is the reason that CCPs currently only accept and pay out VM in cash, cash being the most negotiable instrument.[2]

Pension funds aim to be fully-invested. Therefore the concern is that in order to hold cash to post variation margin pension funds would need to reduce their investments, which could have an impact upon investment returns. A solution to these issues would need to be found if pension schemes are to comply with the clearing requirements under EMIR without suffering a reduction in investment performance due to this siphoning of assets as margin or else passing on increased risk exposure to pensioners due to a reduction in hedging.

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[2] A detailed explanation of the risk management of OTC derivatives (both bilateral and cleared) is provided as Appendix 1 to this document. It includes an explanation of some of the differences between bilateral settlement and CCP clearing of OTC derivatives contracts which lead CCPs to require variation margin in cash.

3. Overview of the EU Pensions Industry

In this section we present an overview of the pensions industry in the EU.

The information gathered here has been used to:

- Understand the potential size of the pensions industry subject to the temporary exemption from central clearing under EMIR — and which would therefore be affected by the termination of this exemption in the absence of a technical solution to the posting of non-cash collateral.

- Select sample Member States on which to focus our data gathering and modelling.

- Provide the basis for extrapolation of the results of this modelling to establish EU-wide impacts.

3.1   Size of the affected pensions industry

The aggregate assets of the occupational pensions industry across the EU28 were just over €5.2 trillion in 2012 according to PensionsEurope and the OECD.[3]   As shown in the chart below the UK, Netherlands and Denmark accounted for around 70 per cent of this, with the UK alone representing 43 per cent (around €2.3 trillion in assets).[4]

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3   The PensionsEurope data presented here includes voluntary and mandatory schemes, and excludes assets held under book reserves.

4   The OECD data do not include pension fund assets held as book reserves and as such differ from the data collected by PensionsEurope. There are some residual differences, even after this adjustment. The most notable differences are with respect to Germany, where pension assets are reported by OECD to be €168bn in 2012, and total occupational pension assets reported by PensionsEurope to be €500bn. Of the latter, around €265bn is in book reserves. We do not believe that these can qualify for the exemption and as such are not relevant to this analysis. It follows that the comparable figure to that presented by the OECD is €235bn.

Figure 3.1: Total assets of occupational pensions in the EU, 2012
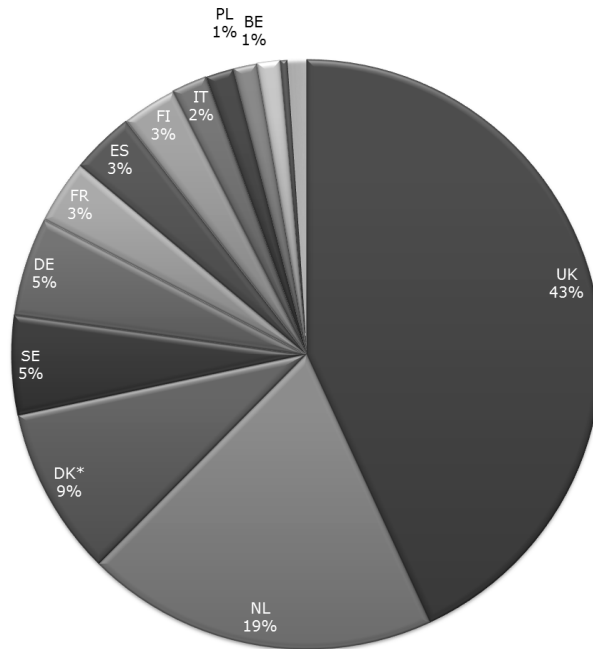
Source: PensionsEurope (2012) "Statistical Survey 2011". Data from 2011 are uplifted to 2012 values using the 2011/2012 ratio from the OECD dataset on private pensions.
Note: * represents data on private pensions from OECD (2013) "Pension Markets in Focus No.10".

Assets held within a country's pension schemes were highly significant relative to its GDP in a number of Member States. This is highlighted in the chart below, with such assets being nearly 200 per cent of GDP in Denmark and just under 170 per cent of GDP in the Netherlands.

Figure 3.2: Occupational pension assets relative to GDP, 2012
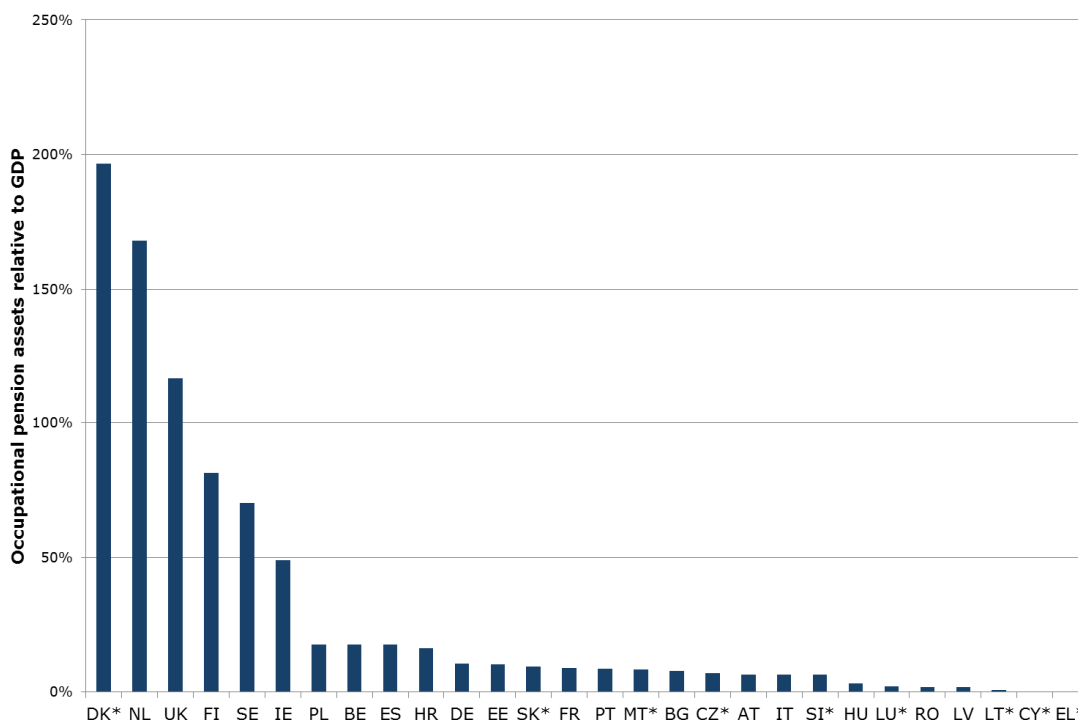
Notes: * represents data on private pensions from OECD (2013) "Pension Markets in Focus No.10"
Source: PensionsEurope (2012) "Statistical Survey 2011". Data from 2011 have been uplifted to estimated 2012 values using the 2011/2012 ratio from the OECD dataset on private pensions.

As noted above, the exemption in EMIR applies to PSAs as defined by Article 2(10) EMIR and includes institutions for occupational retirement provision and occupational retirement provision businesses of life insurance undertakings provided that all assets and liabilities corresponding to the business are ring-fenced from the other activities of the insurance undertakings.

An obligation to clear OTC derivatives would of course have greatest impact on PSAs that most actively use these instruments. OTC derivatives are generally used by PSAs to hedge risks associated with long-term liabilities (although they can also be used to enhance investment returns). Data on the level of derivative use among PSAs across the EU are very limited. However, there are a number of indicators that imply a level of derivative use for which data are available.

3.1.1 Defined benefit, defined contribution and hybrid schemes

Defined benefit (DB) pension schemes impose an obligation on the underlying institution to pay defined retirement benefits to the PSA's members. These retirement benefits represent liabilities of the PSA, and can change over time according to, most notably, interest rates (as interest rates fall, the value of pension liabilities increases and vice versa),[5] inflation[6] and longevity.[7]

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5   A decline in interest rates means that a larger asset base is needed when converting to an annuity to achieve the same level of annuitized benefits.

6   Defined benefit scheme may be obliged to increase pay‿outs in line with inflation, i.e. the benefits are set in real rather than nominal terms.

OTC derivatives, in particular interest rate and inflation swaps, can be used to hedge against these risks. Holding interest-bearing assets such as government and corporate bonds can also be used to hedge interest rate risks (and potentially inflation risks).

OTC derivatives have a number of advantages over physical assets:

(i) being capable of being designed to precisely fit an identified risk;

(ii) enabling the of unbundling risks (i.e. duration, convexity, and other risks can be dealt with individually);

(iii) having lower transaction costs (i.e. lower bid-offer spreads); and

(iv) using less of the PSA's available resources so that its assets can be worked harder in order to achieve — it is hoped — superior returns to bonds.

Benefit pay-outs under defined contribution (DC) schemes are typically based on the inputs made by members and on the investment performance achieved, rather than according to a pre-determined formula. As such those risks associated with the level of the final pay-out are generally speaking borne directly by the pensioners rather than by the fund or its funding entity.

In practice, certain DC schemes incorporate features such as guaranteed minimum returns which make the distinction with DB less clear cut. Local regulation can also encourage DC-style schemes to adopt practices which reduce the exposure of members to interest rate and other forms of risk. So-called collective DC schemes (such as in the Netherlands) incorporate a degree of risk-sharing between the sponsors and the employees. Nevertheless the use of OTC derivatives is more likely to be concentrated in Member States with significant use of defined benefit schemes, and this is an important driver of overall intensity of use (we discuss the others in the following sub-sections, concluding at 4.2.2). The chart below shows where defined benefit schemes are most common.

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7   An increase in life expectancy means that a larger asset base is needed to provide the same level of benefits over what should be a longer retirement period.

Figure 3.3: Defined benefit, defined contribution and hybrid schemes in selected EU Member States, 2012
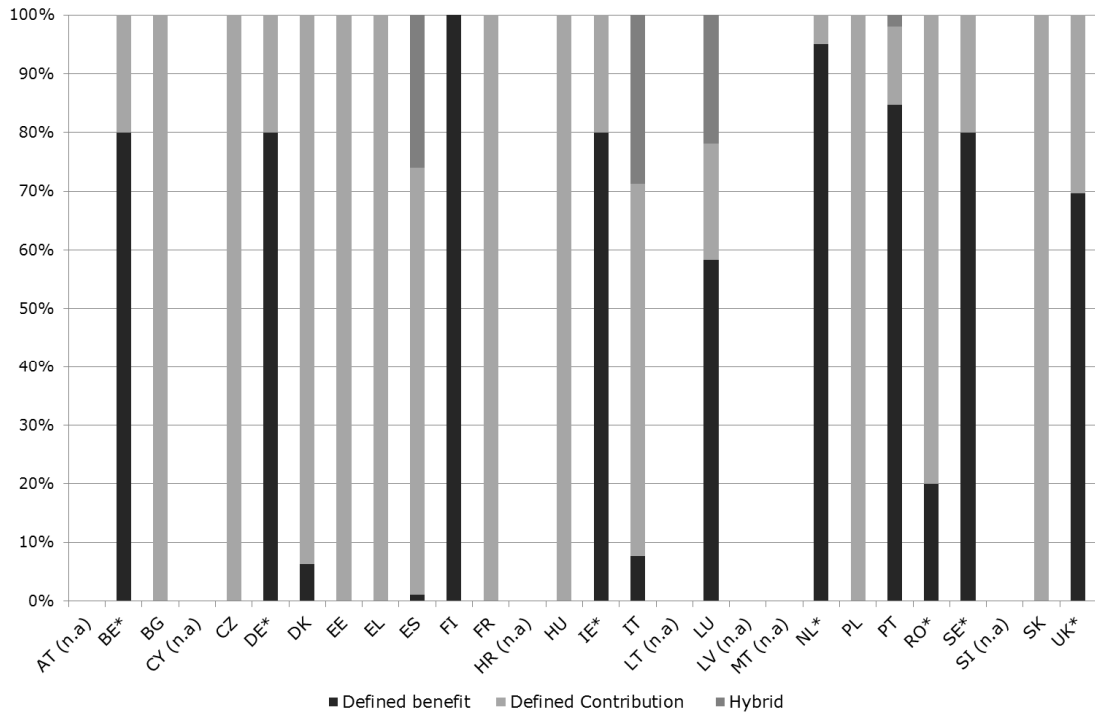
Source: OECD (2013), "Pension Markets in Focus No.10", except those marked (*) which are drawn from information published by the relevant national supervisors or equivalent institutions.

3.1.2   Funding ratio

The funding ratio refers to the relationship between the assets and liabilities held by a PSA. A fully funded PSA has sufficient assets to cover all its pension liabilities. In under-funded PSAs liabilities exceed the current value of its assets. Managing liability risk will be particularly crucial in such under-funded funds, and who are therefore more likely to use derivatives. Data on the funding ratio are less available than other metrics (for Member States where PSAs are mostly or exclusively on a defined contribution basis, this is perhaps unsurprising). The chart below shows that for most Member States, where data are available, pension scheme arrangements are in aggregate fully-funded (or indeed over-funded). The exceptions are the UK, Romania and Ireland.

Figure 3.4: Funding ratios for a sample of Member States, 2012
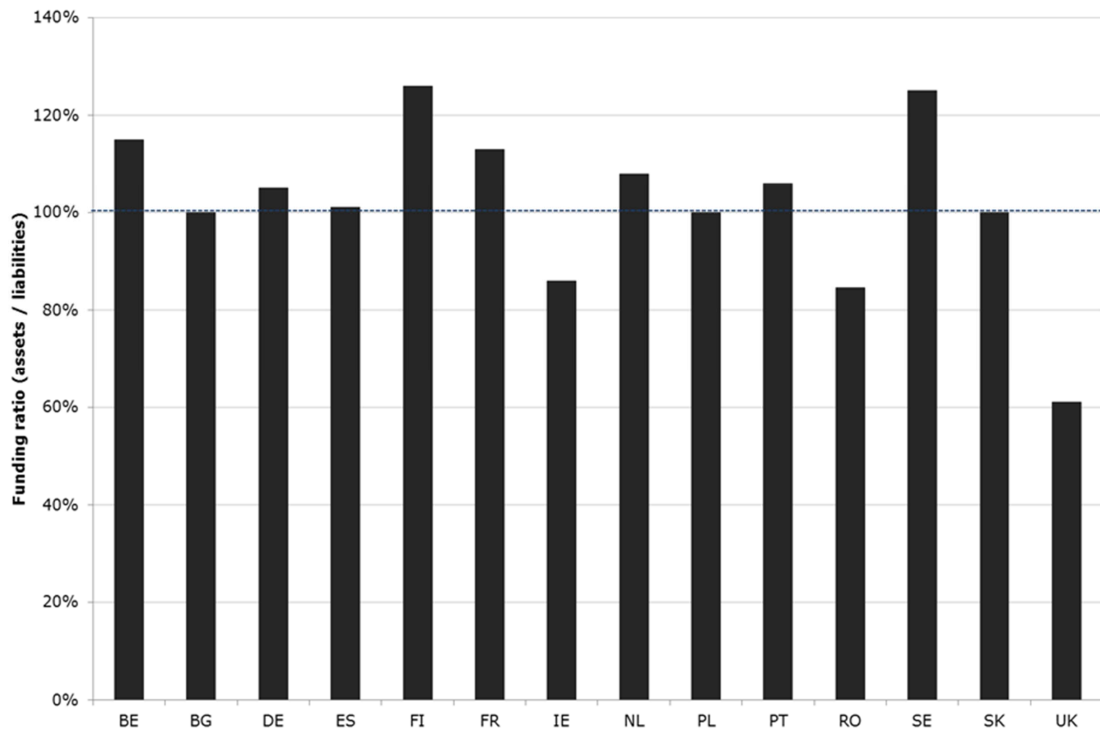
Source: EIOPA (2013) "Quantitative Impact Survey on IORPS" and pensions regulators[8]

3.1.3   Asset allocation

The range of assets in which pension funds invest may also have a bearing on their use of OTC derivatives. Interest-bearing assets such as bonds may provide a natural hedge against elements of interest rate risk. The chart below presents the average allocation across assets for Member States. In the majority of Member States, cash and interest-bearing assets account for at least 40 – 50 per cent of assets.

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8   EIOPA's QIS is based on a sample. We have therefore preferred Member State-wide data, where available. The UK is a particular case: there are two under-funding ratios current for the UK. The Pension Protection Fund's Purple Book references the s.179 ratio of 84 per cent (based on what the PPF would pay-out as statutory compensation) and the full pay-out ratio of 61per cent (based on the actual benefits promised by funds). For our purposes, it is the latter ratio which we consider to be relevant.

Figure 3.5: Asset allocation of pension scheme arrangements, 2011/2012
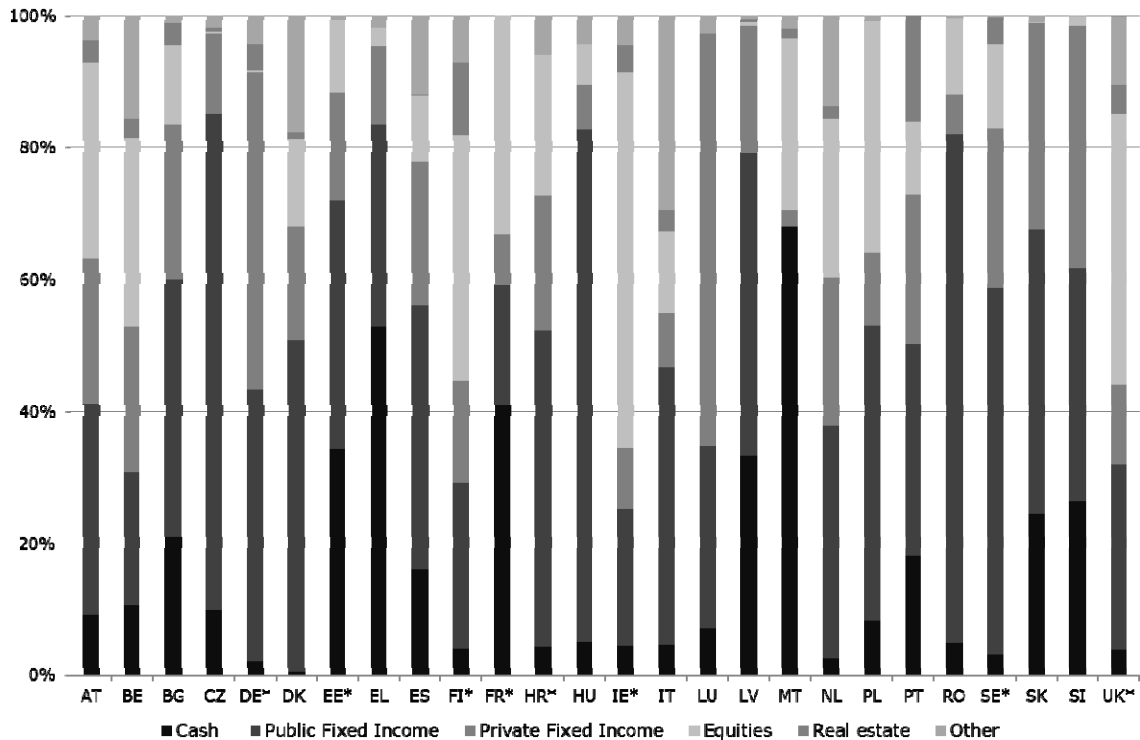
Notes:
1. * denotes an assumed split between public and private fixed income of 70/30.
2. The original data include 'mutual funds' as an asset type rather than as an investment wrapper. We have allocated the value of these mutual funds across other asset classes in proportion to the industry's direct holdings by asset class.
3. The remainder of the assets is allocated to 'other' categories. This include alterantive investments such as hedge funds and private equity, and also — potentially — OTC derivatives at their marked-to-market value.
Source: Source: OECD (2013), "Pension Markets in Focus No.10" and Pensions Europe (2012) "Statistical Survey 2011".

The above chart represents average asset allocations across all pension funds in each Member State. However, the range of assets in which individual pension funds invest will likely vary according to the structure of their liabilities. For example, data from the UK show that even among defined benefit schemes there are structural drivers of differences in asset allocation. The increasing closure of private sector defined benefit schemes has led to a reduction in the holding of equities and an increase in the holding of fixed income assets. This reflects the evolving nature of risks faced by a pension fund that is closed to new entrants (if fully funded, a closed fund's assets could be allocated close to 100 per cent in government bonds). Pension funds are increasing their allocations to index-linked gilts and corporate bonds once schemes close to either new members or to both new members and to future accruals.

A more detailed decomposition of asset allocation is available from a survey conducted by Mercer covering pension funds in 13 EU Member States. The funds surveyed had assets of just over €750 billion.[9] In particular the data show a more detailed

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9   Mercer (2013) "Asset Allocation Survey: European Institutional Marketplace Overview 2013". The asset allocations reported in the Mercer study differ markedly in some cases from the OECD allocations, in particular with regard to the allocation to public

breakdown of asset allocation between different bond categories, including between domestic and non-domestic government bonds.

Figure 3.6: Allocation of bond asset classes, 2013
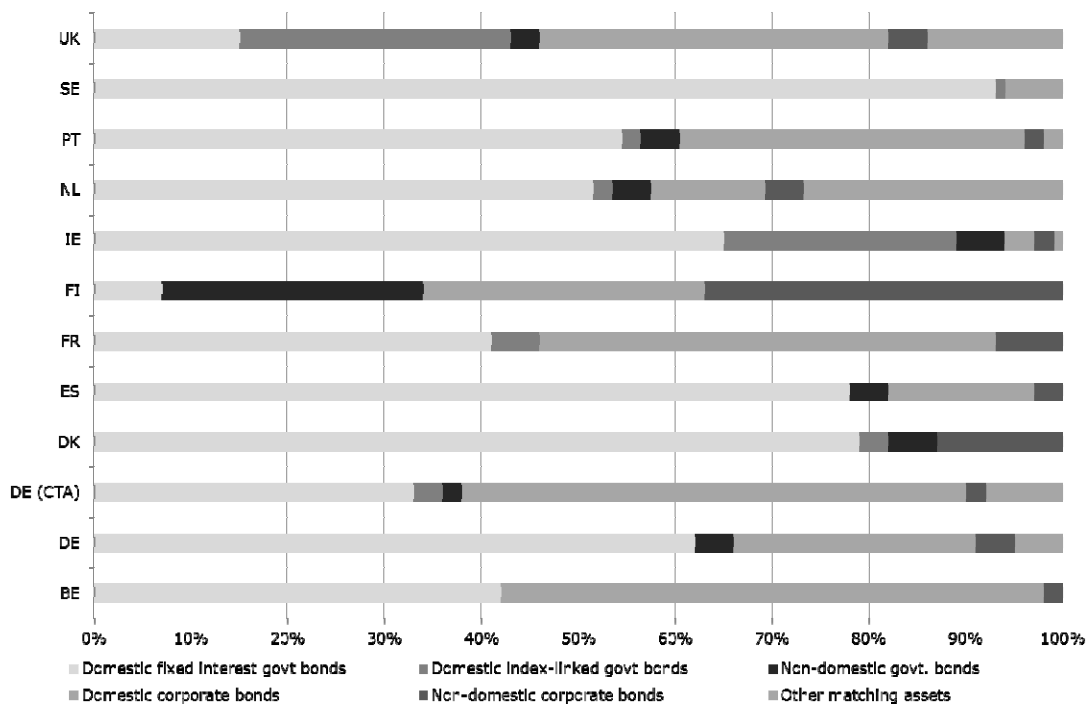
Source: Mercer (2013) "Asset Allocation Survey: European Institutional Marketplace Overview 2013".

As can be seen, domestic government bonds represent a significant share of the invested assets in the majority of countries captured by the survey. The survey represented around 20 per cent of occupational pension assets in the EU.

Asset allocations do change over time, but do not follow a neat secular trend. In addition there are some market and regulatory developments which are not yet determined. For example, the impending Solvency II regulation is anticipated by some market observers to drive a degree of asset reallocation within the portfolios of pension schemes. In particular long-duration corporate bonds may decline in importance with increased weight being attached to asset classes such as infrastructure and residential property. We have not sought to model such effects in the baseline for straightforward reasons: first there is residual uncertainty as to the likelihood and scale of such a shift and second, given our results, it would be unlikely to materially affect the results. The latter point is simply because in our cascade of assets (see 4.4 below) which would be sold to fund an increased cash buffer the model rarely enters the corporate bond layer.

3.1.4   Size of fund

The size of fund may also have a bearing on the extent of its derivative usage. Our fieldwork indicates that, all else being equal, larger funds tend to invest in derivatives to a greater degree than smaller funds. (It should also be borne in mind that the

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and corporate fixed income. The Mercer study represents on average 26 per cent of total occupational pension assets within each country, with three, nine and 15 per cent on the Netherlands, Denmark and the UK being represented respectively.

PSAs may outsource fund management to a specialist fund manager, who will actually be the responsible party for derivatives activity – again, larger asset managers may be more active here than small ones. Nevertheless we understand that the size of the underlying fund is still relevant to the intensity of derivatives usage).

We do not have data that looks directly at either (i) the distribution of PSAs by assets, or (ii) the joint distribution of PSAs managing their own assets and also of asset managers. We therefore consider an alternative way of unpicking the size distribution of PSAs, which will enable us to understand the intensity of derivative usage more fully.

We consider it a reasonable assumption that pension assets held will have a broadly proportional relationship to the number of members. (There will, of course, be exceptions to this. The most obvious would be where small PSAs are for the benefit of the most highly paid executives and workers.) The chart below illustrates the distribution of funds in terms of the number of members.

Figure 3.7: Distribution of pension funds by number of members
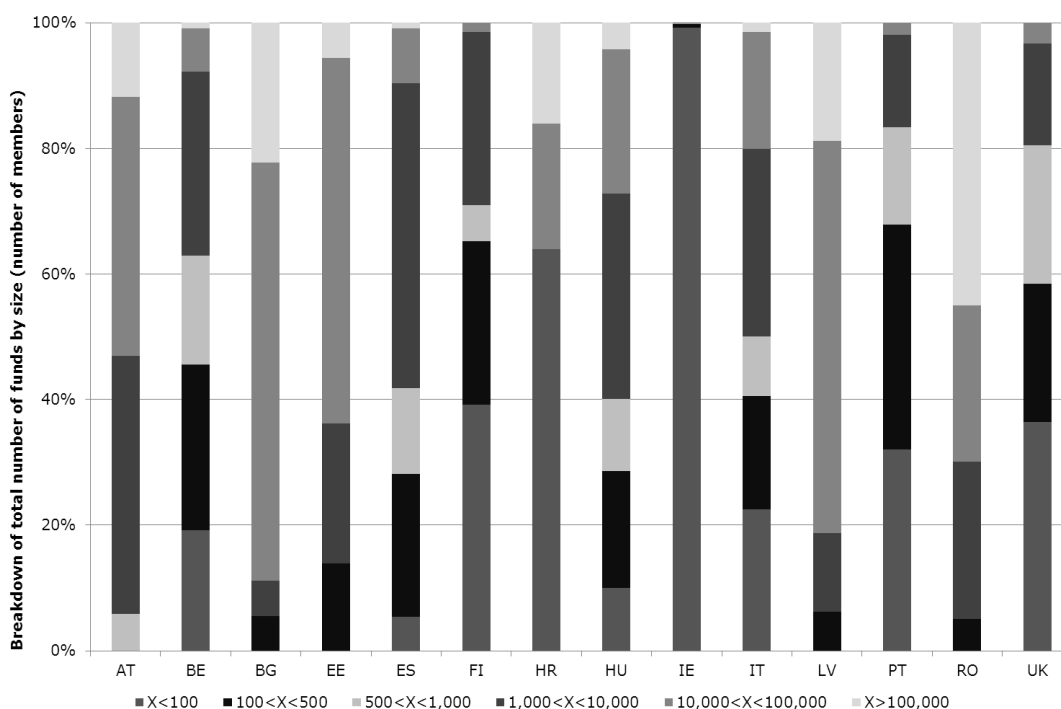
Source: PensionsEurope (2012) "Statistical Survey 2011".

We have then used these data to estimate the average assets under management (AUM) per PSA member in each Member State and then used this to approximate the average fund size in terms of AUM within each size band displayed above.

We set an indicative threshold of €50 million AUM above which a fund would be considered 'large' for the purposes of derivative use intensity (described further in section 3.3.2 below). The chart below presents the results of this analysis.

Figure 3.8: Large and small funds as a proportion of aggregate AUM
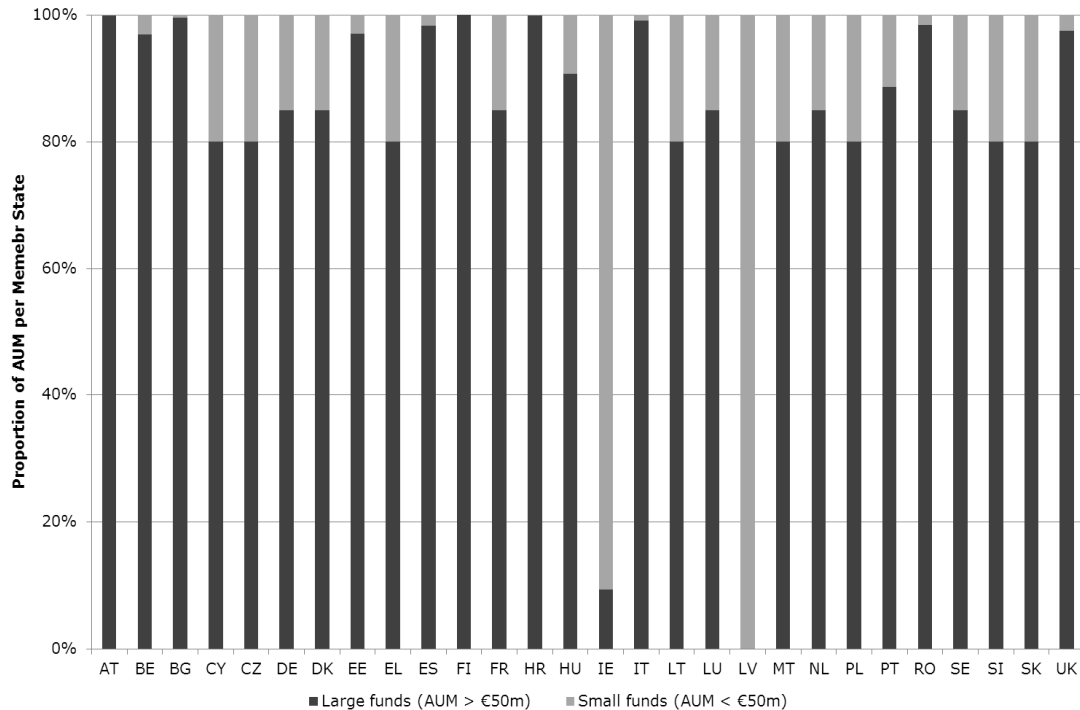
Source: OECD 2013 and Europe Economics analysis.

3.2   Approach to our fieldwork

Our fieldwork comprised of two strands:

- In-depth interviews with PSAs and other market participants from a sub-section of Member States where the impacts of EMIR's central clearing obligation would be expected to be greatest.

- Broad data collection across EU Member States through a focused survey. This sought to understand the level of OTC derivative usage by PSAs across Member States and the drivers thereof.

Our in-depth fieldwork sought to gather information from the industry about the costs and impacts of central clearing under EMIR (focusing on the requirement to post cash variation margins), and about the viability of a number of solutions to the posting of non-cash collateral. We consulted PSAs, clearing members, custodian banks, clearing houses and central banks. We also collected portfolio data from funds to construct representative portfolios with which to model the impacts of the removal of the exemption.

We focused on those Member States where the impact of central clearing would be greatest, namely Member States with large pension industries that engage extensively in OTC derivative use and those Member States that had expressed to the European Commission interest in relation this issue. Based on the industry data and the initial feedback from trade associations, we narrowed the selection for our in-depth fieldwork

to the UK, the Netherlands and Denmark. The broad data collection strand included approaches to all associations of pension funds within the EU.[10]

3.3 Findings from our fieldwork

Pension funds providing details of their asset allocations and derivatives portfolios (including those funds interviewed as part of the in-depth fieldwork) account for around €1.1 trillion in AUM, approximately 20 per cent of total occupational pension AUM across the EU.[11] Survey responses account for just below 70 per cent of AUM in the Czech Republic, nearly 60 per cent of AUM in the Netherlands and just over 20 per cent of AUM in the UK. Other Member States represented in the survey are Austria, Germany, Denmark, Italy, Greece, and Portugal. Funds from the EFTA (Norway and Switzerland) also participated.

The low (or even non-existent) response rate from some EU Member States is likely to be in part reflective of the low relevance of the EMIR clearing obligation and exemption to PSAs across the EU. Feedback from the relevant trade associations in Member States from which we received no responses often indicated that OTC derivative usage by PSAs was considered to be low or negligible — or simply unknown. As can be observed from the industry data, in many other Member States the pensions industry is entirely defined contribution (implying little need to hedge long-term liabilities), or is of low importance as a share of GDP.

Reponses to our survey represent a significant share of the parts of the pension industry we expect to be most affected. For example, the survey responses account for about 35 per cent of defined benefit AUM across the EU28.

3.3.1 Asset allocation

The allocation of assets among the PSAs in our sample is broadly similar to the average allocation at the Member State level. Cash holdings generally account for less than 10 per cent of assets. Government bonds are the largest asset class in many Member States, broadly confirming the detailed distributional data from the Mercer survey described above.

The figure below presents the weighted average allocation (by AUM) within each Member State represented in the fieldwork.

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10 All associations across the EU 28 were contacted, and we engaged with associations about the level of derivative usage from AT, HR, CZ, DK, EE, FR, EL, IE, LV, LU, MT, NL, PT, RO, SK, and UK.

11 This figure includes the AUM of some large fund managers.

Figure 3.9: Weighted average asset allocation across Member States in survey
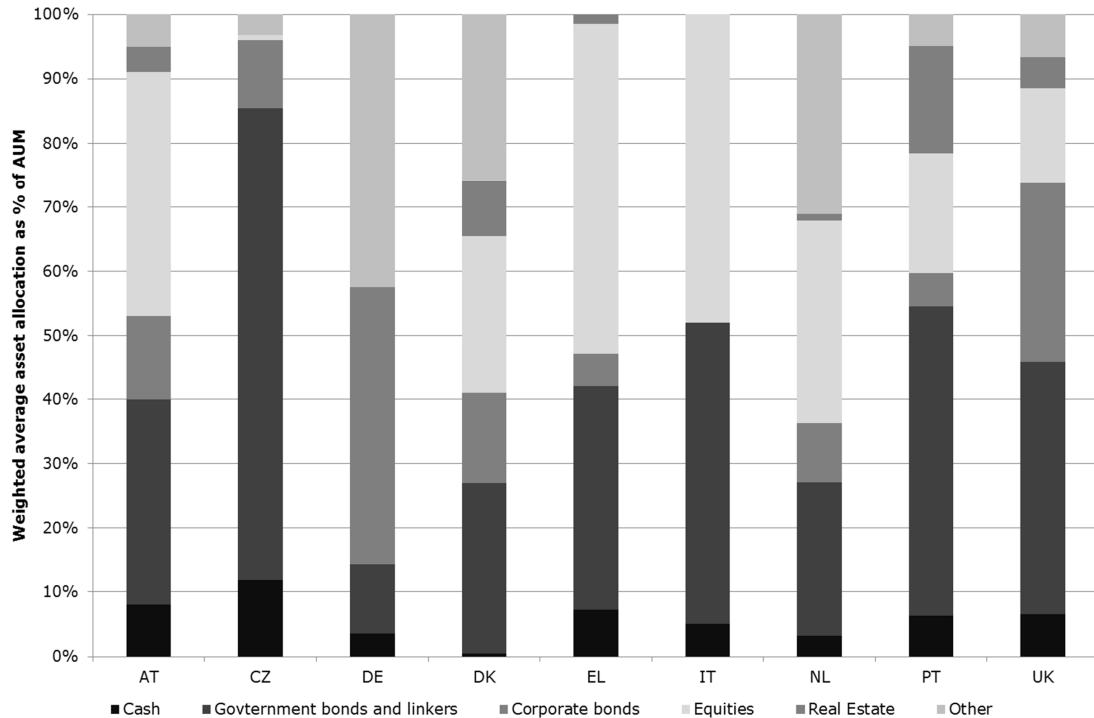
Source: Europe Economics Focused Survey 2013.

3.3.2   Intensity of derivative usage

Our fieldwork provides insight into derivative usage by PSAs not available in public statistics. Interest rate swaps (including swaptions)[12] were the most commonly used instrument, followed by FX forwards, and inflation swaps.

For example, the level of interest rate swaps as a proportion of non-interest-bearing assets (e.g. excluding government and corporate bonds) is an approximate way of assessing the total level of hedging of interest rate risk. The weighted average notional value of interest rate swaps as a proportion of non-interest bearing AUM was over 100 per cent in the Netherlands, around 14 per cent in the UK, 27 per cent in Germany and around 50 per cent in the Czech Republic.[13] (If assessed against liabilities the UK figure would increase.)

We used metrics such as the sensitivity of the derivatives portfolios to changes in interest and inflation rates (e.g. DV01[14], IE01[15]), relative to AUM as a way of indexing

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12 Swaptions are options to enter into a swap transaction. Since they typically refer to options on interest rate swaps we group them together.

13 The results for the Czech Republic are influenced by two of the larger funds having the majority of their assets (over 70 per cent) invested in government bonds. Comparing the countries on the basis of interest rate swap notional values as a proportion of total AUM, the Czech Republic is lower than most at around 4 per cent.

14 DV01 of an instrument is the sensitivity of the value of the instrument to a one basis point (or 0.01 per cent) increase in the relevant interest rate; that is the euro or sterling change (in this context) in the value of the instrument caused by a one basis point increase in the relevant interest rate.

the intensity of overall derivative usage. This work indicates that Member States with the most intense usage are the UK and the Netherlands, with the occasional high-use fund present elsewhere, e.g. in Denmark. Indeed a report on liability-driven investment (LDI) notes that "the use of derivatives seems to be particularly widespread in Denmark, the United Kingdom and the Netherlands".[16] Pension funds in Sweden and, to a lesser extent, Germany are also identified in this study as being more intensive in their derivative usage.

The data are not sufficient to draw out clear *trends* in derivative usage. Nevertheless our fieldwork indicates that derivative usage in the UK has seen growth over the past decade, albeit that has largely stalled since the credit crunch. This growth has been fostered by increased adoption of LDI strategies, particularly in the UK. At least some of the UK participants in our fieldwork expect a return to growth in the medium term.

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15 IE01 of an instrument is the sensitivity of the value of the instrument to a one basis point (or 0.01 per cent) increase in the relevant inflation rate; that is the euro or sterling change (in this context) in the value of the instrument caused by a one basis point increase in the relevant inflation rate.

16 EDHEC-Risk Institute (2014), "Dynamic Liability-Driven Investing Strategies: The Emergence of a New Investment Paradigm for Pension Funds? A survey of the LDI practices for pension funds".

4. Modelling Approach

4.1 Introduction

Our analysis considers three phases of the situation in the absence of technical solutions. We look at the situation prior to EMIR, the situation under EMIR with the exemption, and the situation under EMIR where central clearing is required.

- **Phase 1: Baseline costs of bilateral collateralisation prior to EMIR**. In this phase we calculate the costs to PSAs of current bilateral collateralisation arrangements for OTC derivatives under the existing credit support agreements. This represents the costs to PSAs prior to EMIR.

- **Phase 2.1: Costs of bilateral collateralisation arrangements under EMIR with the exemption.** In this phase we calculate the expected costs of PSAs complying with bilateral VM requirements on the basis of the draft regulatory technical standards for OTC-derivatives not cleared by CCP under EMIR (Draft RTS).[17] In this phase PSAs can access the clearing exemption but their OTC derivative contracts are required to be collateralised bilaterally.

- **Phase 2.2: Costs under EMIR with no exemption and no solutions.** In this phase we estimate the expected costs to PSAs of complying with current CCP cash VM requirements for OTC derivatives subject to central clearing. This phase represents the 'counterfactual' to the technical solutions, i.e. the situation under EMIR once the clearing exemption has ended but in the absence of any solutions for the posting of non-cash collateral. In order to assess the impact of possible technical solutions to the posting of non-cash collateral, an understanding is required of the costs of the situation in the absence of any such solutions. This phase also includes the costs of bilateral collateralisation associated with OTC derivatives contracts that are not eligible for central clearing.

This section describes our methodologies used to calculate the costs of the different phases of our assessment.

4.1.1 Incremental impacts

The concern about central clearing for PSAs centres on CCPs' requirement for cash VM, and the need for PSAs to maintain a cash buffer in order to respond to CCP VM calls, which would lead to high opportunity costs for PSAs. This requirement for cash variation margin is not specifically required under EMIR, the text of which allows a relatively broad set of assets to be used as variation margin. Nevertheless, CCPs restrict their offerings to cash VM for various operational and risk reasons, which we describe fully in Section 6.

The clearing obligation is already set in EMIR and our analysis does not examine the costs or benefits to PSAs of central clearing as a whole, but focuses on the costs associated with collateralisation.

The costs calculated in Phase 1 represent the costs of collateralisation prior to EMIR. This reflects what happens currently in the absence of any regulation. Phase 1 therefore provides a baseline situation against which to measure the costs associated with collateralisation under EMIR.

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[17] http://www.eba.europa.eu/documents/10180/655149/JC+CP+2014+03+%28CP+on+risk+mitigation+for+OTC+derivati ves%29.pdf

The costs under Phase 2.1 represent the costs of bilateral collateralisation under EMIR but with an exemption, i.e. PSAs do not undertake central clearing.

Phase 2.2 represents the costs of bilateral collateralisation and clearing under EMIR in the absence of technical solutions. If we consider that the clearing obligation under EMIR is set, then Phase 2 represents the baseline situation against which to measure the costs and benefits of the technical solutions.

The incremental costs of EMIR *with* the exemption are therefore the costs of Phase 2.1 less the costs of Phase 1. The incremental costs of EMIR *without* an exemption are the costs of Phase 2.2 less the costs of Phase 1. The incremental costs and benefits of the technical solutions are therefore the costs of the solutions less the costs of Phase 2.2.

4.1.2   Direct and opportunity costs

We model two categories of costs to PSAs: direct costs and opportunity costs.

- Direct costs are the upfront costs associated with posting and managing collateral calls, such as managing Credit Support Annexes (CSAs) and relationships with clearing members, and transferring/receiving assets to and from counterparties. Given the scope of our work we focus on the costs associated with administering collateral rather than the wider costs of trading and/or clearing OTC derivatives. Data on the direct costs were gathered through our fieldwork.

- Opportunity costs relate to the foregone yield due to holding cash instead of other assets to be ready to pay cash VM under the central clearing obligation. These costs only apply to Phase 2.2 as the need to hold cash is the result of the central clearing obligation and CCPs' requirement for cash VM. We do not consider there to be opportunity costs associated with asset allocation for VM under bilateral arrangements, as PSAs optimise their collateral arrangements in the CSAs they have and this is part of the usual cost of derivative trading not influenced by regulation. We describe how we assessed the opportunity costs in more detail below.

4.2   Building blocks for the modelling

Before modelling the direct and opportunity costs associated with collateralisation, we developed the following building blocks:

- Development of representative portfolios.

- Calculation of VM requirements for representative portfolios.

- Estimation of derivative usage across the EU industry.

4.2.1   Development of representative portfolios

The first step was the creation of three representative derivatives portfolios drawing on real portfolio data obtained from funds through our fieldwork. These are made to stand for the whole universe of portfolios. This is obviously a significant simplification — however we note that the risks faced (such as interest rates, inflation and longevity) have a high degree of commonality across all pension funds. For example, we would expect all pension funds will seek to protect themselves against *rising* interest rates. Therefore this approach is more reasonable here than would be the case if considering a more heterogeneous group (e.g. corporates).

These representative portfolios – two representing UK funds, one for LDI funds and one for non-LDI funds and one representing a Eurozone[18] fund – are used as the basis for the European industry.

The separation of UK PSAs into non-LDI funds and LDI funds is driven by differences in their utilisation of assets, which results in differences in the VM call they face. Additionally, differences in the intensity utilisation between these two types of funds affects the scaling factor described later. Forty per cent of total AUM (about £750 billion) is allocated to LDI funds.

The Eurozone portfolio acts as the proxy for non-euro pension assets. This is a realistic assumption: in the case of Denmark, for example, hedging activity is often in euro-denominated assets in order to access the greater liquidity in those markets.

The representative portfolios reflect the derivative exposure of typical high derivative-use funds. The derivatives held in the three portfolios are interest rate swaps (IRS) and inflation swaps. In addition to simplifying our modelling, these are the two derivatives that are both likely to be centrally cleared (albeit inflation swaps are not expected to be clearable until late in 2014) and are commonly used by PSAs for hedging. The duration and currency of the IRS typically used by PSAs are already clearable. (Perhaps 85–90 per cent of IRS are in the top four currencies — $, €, £ and ¥. These are clearable by more than one CCP, and at least one CCP clears IRS denominated in around 10–12 additional currencies.)

As noted IRS and Inflation swaps are the main constituents of PSAs' OTC derivative portfolios, particularly of the longer-dated instruments. Some PSAs will use FX, equity and CDS instruments. The first two are not foreseen to be imminently clearable. CDS are clearable across a relatively wide pool of instruments. However our fieldwork indicates that these are used by relatively few PSAs, and in limited quantities. We therefore excluded these from the representative portfolios.[19]

PSAs will seek to hedge liabilities not assets. As we have noted at 3.1.2 above there can be significant discrepancies between the two. In the Eurozone portfolio assets are nearly equivalent to the liabilities (indeed, it is taken to be over-funded, with a funding ratio of 108 per cent: the portfolio drew on Dutch-derived data, and this is the average funding ratio in the Netherlands). In contrast, the UK portfolios assume a degree of under-funding. The funding ratio in each UK portfolio is set at 61 per cent (i.e. assets are 61 per cent of liabilities): this is for simplicity, being in line with the average for the UK pension industry.

The three portfolios are shown below, beginning with the UK portfolios. The non-LDI portfolio is composed as follows:

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18 Based on portfolio data obtained from Dutch funds.

19 Of thirty portfolios of pension funds actively using OTC derivatives, just four had CDS exposure — and of these four just one had significant CDS coverage. No fund outside the UK or Netherlands providing us with data had CDS exposure.

Table 4.1: Representative UK (£ Sterling) non-LDI portfolio asset allocation

Asset	Market value (£m)	%
Money market instruments (cash)	39.6	4.0%
Short-term Government Bonds (UK)	-	0.0%
Government Bonds	185.2	18.5%
Corporate Bonds	119.6	12.0%
Equity	502.2	50.2%
Other long-term investments	93.6	9.4%
Value of derivatives	59.8	6.0%
Total AUM	**£1,000**	

Source: Bourse Consult.

Table 4.2: Representative UK (£ Sterling) non-LDI portfolio derivative usage (as % of AUM)

Time bucket	DV01	IE01
≤1 yr	-0.00001%	0.00001%
≤3 yr	-0.00036%	0.00044%
≤5 yr	-0.00016%	0.00035%
≤10 yr	-0.00234%	0.00180%
≤20yr	-0.01355%	0.00573%
≤30yr	-0.01771%	0.00938%
≤40 yr	-0.00938%	0.00521%
≤50 yr	-0.00573%	0.00417%
Total	**-0.04924%**	**0.02709%**

Source: Bourse Consult.

Turning to the UK LDI portfolio:

Table 4.3: Representative UK (£ Sterling) LDI portfolio asset allocation

Asset	Market value (£m)	%
Money market instruments (cash)	42.3	4.2%
Short-term Government Bonds (UK)	10.8	1.1%
Government Bonds	423.6	42.4%
Corporate Bonds	120.9	12.1%
Equity	220.6	22.1%
Other long-term investments	75.7	7.6%
Value of derivatives	106.2	10.6%
Total AUM	**£1,000**	

Source: Bourse Consult.

Table 4.4: Representative UK (£ Sterling) LDI portfolio derivative usage (as % of AUM)

Time bucket	DV01	IE01
≤1 yr	-0.00001%	0.00001%
≤3 yr	-0.00038%	0.00046%
≤5 yr	-0.00016%	0.00037%
≤10 yr	-0.00136%	0.00187%
≤20yr	-0.01465%	0.00922%
≤30yr	-0.03038%	0.01628%
≤40 yr	-0.01411%	0.00977%
≤50 yr	-0.01139%	0.00787%
Total	**-0.07244%**	**0.04585%**

Source: Bourse Consult.

The third portfolio is:

Table 4.5: Representative Eurozone portfolio asset allocation

Assets	Market value (€m)	%
Money market instruments (cash)	21.6	2.2%
Short-term Government Bonds	-	0.0%
Government Bonds (DE, FR and NL)	327.9	32.8%
Corporate Bonds	193.1	19.3%
Equity	219.3	21.9%
Other long-term investments	149.2	14.9%
Value of derivatives	89.0	8.9%
Total AUM	**€1,000**	

Source: Bourse Consult analysis.

Table 4.6: Representative Eurozone portfolio derivative usage (as % of AUM)

Time bucket	DV01	IE01
≤1 yr	0.00097%	0.00000%
≤5 yr	-0.00091%	0.00000%
≤10 yr	-0.00445%	0.00055%
≤20yr	-0.01779%	0.00737%
≤30yr	-0.02041%	0.01060%
≤40 yr	-0.01158%	0.00085%
≤50 yr	-0.00536%	0.00012%
Total	**-0.05953%**	**0.01950%**

Source: Bourse Consult analysis.

4.2.1   Calculation of VM requirements

Variation margin represents "the settlement of the running profit/loss of a derivative and … [is] … a transfer of resources from one party to another".[20] It is effectively a risk reset. It reduces the counterparty risk to that covered by the IM, being a payment

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20 Ibid, page 8.

from the party that has moved out of the money since the last reset (normally the previous day) to the party which has moved into the money. Portfolios are usually revalued at the end of each trading day (although revaluation may occur intraday if price movements are unusually sharp).

The VM requirements for a fund will depend on the make-up of its derivative portfolio and on changes in market conditions. The amount of VM for a specific fund's portfolio of derivatives would remain the same regardless of who makes the call (i.e. a bilateral counterparty or a CCP) although the frequency of the call may differ. Under the new arrangements both bilateral and centrally cleared derivative portfolios will be subject to daily margining.[21]

A PSA (or the asset manager acting on its behalf) needs to estimate the likely scale of VM calls that it might be subject to over the life of the derivative transactions which it enters into. This is not a trivial exercise as it will depend on the movement (or co-movement) of variables in the future that, in fact, the fund is seeking to hedge against. Our approach incorporated a mimetic exercise in order to estimate the quantum of assets that a fund would consider appropriate to hold against potential VM calls.

We model the VM requirements for the three portfolios in a scenario in which only IRS are cleared, and then in a scenario in which IRS and inflation swaps are cleared and capable of being netted (e.g. by being cleared at a single CCP). Due to the potential netting of IRS and inflation swap exposure under the latter case, the VM requirements are typically lower than under the scenario where only IRS are clearable.[22] However, in certain cases clearing of both IRS and inflation swaps may lead to higher VM requirements where there is a contemporaneous VM call for both the IRS and inflation swap. (Whilst these instruments are negatively correlated, this correlation is far from perfect).

In a centrally cleared world (where it is assumed that only cash VM is accepted) funds will need to make a decision about the appropriate level of "cash buffer" to hold against VM calls. If VM calls exceed the buffer then assets would need to be realised into cash either through outright sale or a repo transaction. This would need to be effected in a timely manner. VM will normally be calculated and notified at the end of the trading day for payment the following morning. However if an intra-day calculation is made, payment could be required by the end of that day. The lower the buffer, the more frequent the recourse to such transactions. In certain circumstances — such as in a crisis where interest rate expectations have increased sharply — such transactions may be difficult to achieve, at least at normal pricing and possibly at all.

There is no definitive way in which an entity reaches a view on this. To understand the possible choices better we have considered the following situations:

- First we use historical data on interest rate swap and inflation swap changes dating back to the beginning of 2007 to produce a stream of daily mark-to-market changes over a five year period. Whilst no one would deny that this period includes times of severe economic stress and even market dislocation it may not include the extreme levels of interest rate and inflation moves which PSAs feel that they should plan for. Therefore we also model mark-to-market changes under three stress scenarios.

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21 Ibid, page 9 and EMIR article 41.1.

22 The relationship between interest rates and inflation is much studied. In the empirical literature, for example, Barr and Campbell (1996) investigated UK nominal and inflation-linked government bonds. They found a strong negative correlation between expected inflation and changes in real rates over short horizons, but that this relationship breaks down over longer horizons. This suggests that any netting will be far from perfect, especially since PSAs tend towards longer-dated instruments.

- The of these scenarios uses forecasts of interest rate and inflation movements drawn from the 'adverse' scenario created by the US Federal Reserve.[23] This — helpfully from our perspective — decomposes shocks across a wide set of instruments relevant to this study. (The US Federal Reserve has also published a 'severely adverse' scenario which is broadly speaking twice as bad as the adverse one. We do not include the detailed results of this scenario in this study).

- One stress scenario uses inputs from the EU-wide stress test scenarios outlined by the European Banking Authority (EBA). These data were, of course, designed for a different purpose and the parameters do not include the impact of the shocks on longer-dated instruments (e.g. 40 year IRS). We have interpolated these based upon the scale of the shocks on shorter-dated instruments.

- The final stress scenario assumes a 100bps parallel move to the historical interest rate curve. From our fieldwork this appears to be a common heuristic within the pension industry.

We have then modelled the mark-to-market changes implied by these scenarios on the value of the two representative portfolios. The results – presented as a percentage of assets under management for each portfolio – are the basis for our modelling to determine the opportunity costs of holding cash to cover VM calls.

4.2.2   Derivative usage across the EU industry

The data gathered on the direct costs of collateral management, and our estimates of VM requirements from the representative portfolios, are based on funds and portfolios with a particular asset allocation and (generally speaking, high) intensity of derivative use.

In order to enable the extrapolation of our cost models to the EU industry as a whole we must develop an understanding of the intensity of derivative usage of funds in other Member States, and calculate scaling factors to adjust the results of our models accordingly.

Derivative use intensity

As noted, data on derivative usage across Member States are very limited. The results of our focussed survey enable us to classify responding Member States in terms of the intensity of derivative use, either through data on derivative usage or through feedback from trade associations about the general level.

To classify the remaining Member States we use data on a range of factors that, as described in section 3.1 above, are likely to influence the intensity of a fund's derivatives usage. These are:

- Whether the pension industry is defined benefit or defined contribution. Derivative usage is likely to be significantly lower among defined contribution schemes compared with defined benefit schemes. Defined contribution schemes do not need to hedge against risks associated with large, long-term liabilities in the same way as defined benefit schemes and the risks associated with the final pay-out under the former schemes are in general borne by the pensioners rather than the fund.

- Whether the pension industry is under-or over-funded. Managing liability risk will be more crucial for under-funded schemes, and it is likely that derivatives form part of this management.

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23 US Federal Reserve 2014 stress test parameters: 2014 CCAR Severely Adverse Market Shocks Data; 2014 CCAR Adverse Market Shocks Data.

- Whether there are regulatory incentives towards hedging. For example, UK DB pension plans can get regulatory relief by holding assets with pay-outs that mirror the behaviour of their liabilities (provided that they can demonstrate the effectiveness of the risk transfer).[24]

- Whether the fund is large or small. Our fieldwork confirmed the assumption that large funds are significantly more likely to use derivatives than small funds. Very large funds may have their own derivative operations in-house; others are likely to use the services of an asset manager. For the purposes of this analysis we classify as "small" individual funds with AUM less than €50 million.

Combining this information with that from the focused survey, we create four fund categories within each Member State:

- Large defined contribution.

- Small defined contribution.

- Large defined benefit.

- Small defined benefit.

Each category is informed by the proportion of AUM within each Member State that is represented by large/small funds; and defined benefit/defined contribution funds. The table below presents this information.

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24 BIS, August 2013, "Longevity risk transfer markets: market structure, growth drivers and impediments, and potential risks".

Table 4.7: Characteristics of Member States

Member State	Defined benefit as % AUM	Defined contribution as % AUM	Large as % AUM	Small as % AUM
AT	0.0%	100.0%	99.9%	0.1%
BE	80.0%	20.0%	96.8%	3.2%
BG	0.0%	100.0%	99.6%	0.4%
CY	0.0%	100.0%	80.0%	20.0%
CZ	0.0%	100.0%	80.0%	20.0%
DE	80.0%	20.0%	85.0%	15.0%
DK	6.3%	93.7%	85.0%	15.0%
EE	0.0%	100.0%	97.0%	3.0%
EL	0.0%	100.0%	80.0%	20.0%
ES	14.0%	86.0%	98.3%	1.7%
FI	100.0%	0.0%	100.0%	0.0%
FR	0.0%	100.0%	85.0%	15.0%
HR	0.0%	100.0%	99.9%	0.1%
HU	0.0%	100.0%	90.7%	9.3%
IE	80.0%	20.0%	9.3%	90.7%
IT	22.1%	77.9%	99.1%	0.9%
LT	0.0%	100.0%	80.0%	20.0%
LU	69.2%	30.8%	85.0%	15.0%
LV	0.0%	100.0%	0.0%	100.0%
MT	0.0%	100.0%	80.0%	20.0%
NL	95.0%	5.0%	85.0%	15.0%
PL	0.0%	100.0%	80.0%	20.0%
PT	85.7%	14.3%	88.6%	11.4%
RO	20.0%	80.0%	98.4%	1.6%
SE	80.0%	20.0%	85.0%	15.0%
SI	0.0%	100.0%	80.0%	20.0%
SK	0.0%	100.0%	80.0%	20.0%
UK[25]	69.6%	30.4%	97.4%	2.6%

Source: Europe Economics analysis.

We then assign the fund categories within each Member State one of the following derivative use intensity score:

- Ultra high.

- High.

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25   Aggregating both the LDI and non-LDI elements.

- Medium.

- Low.

- Ultra low.

If sufficient information is available from the focused survey or other sources, we used this to assign a derivative use score. For the remaining Member States we have assumed that derivative usage is no higher than 'medium'. The table below sets out our methodology used to assign the remaining scores:

Table 4.8: Methodology to assign derivative use intensity scores

Category	Derivative use intensity score
Defined benefit, Large	Medium
Defined benefit, Small	Low
Defined contribution, Large	Low
Defined contribution, Small	Ultra low

Scaling factors

The representative portfolios described above were designed to represent funds with a 'high' derivative use. For the purposes of comparing different intensities of use we have scaled from the relevant 'high' use portfolio in accordance with the intensity scores. The values for the rest of the derivative use scores are modelled according to the scaling factors presented below. These draw upon our fieldwork.

Table 4.9: Scaling factors for derivative use intensity

Derivative use intensity score	Scaling factors
Ultra high	122%
High	100%
Medium	56%
Low	22%
Ultra low	11%

Provided that the composition of a fund's portfolio of derivatives is in line with those of the representative portfolios then this linearity should hold without need for further adjustment. As we have noted already there is significant commonality between the risks faced. This does not necessarily mean that the derivative portfolios will be equally common at different levels of derivative use intensity (e.g. a fund less reliant on derivatives might only use them for risks of a very specific duration). However we note that this issue is greatest at lower levels of intensity, and these represent at most 20 per cent of the estimated total use.

We apply these scaling factors to the AUM represented by the four fund categories in each Member State to arrive at a blended scaling factor as a percentage of AUM for that country's pension industry. The scaling factors applied to defined benefit funds is further adjusted to reflect the average funding ratio within each Member State relative to the representative portfolio — this is important because it is the liabilities ultimately that a fund is seeking to hedge.

These scaling factors are applied to the results of our direct cost and opportunity cost models to extrapolate the results up to the EU-level.

Table 4.10: Final scaling factors for each Member State

Member State	Final scaling factor
AT	22.21%
BE	45.64%
BG	22.17%
CY	20.00%
CZ	46.67%
DE	86.72%
DK	93.80%
EE	21.89%
EL	20.00%
ES	26.91%
FI	47.62%
FR	20.56%
HR	22.21%
HU	21.19%
IE	61.18%
IT	29.96%
LT	20.00%
LU	43.61%
LV	11.11%
MT	20.00%
NL	99.67%
PL	20.00%
PT	48.14%
RO	23.27%
SE	75.55%
SI	20.00%
SK	48.89%
UK (non-LDI)	101.33%
UK (LDI)	85.46%

Source: Europe Economics and Bourse Consult analysis.

4.3   Direct cost model

The direct cost model calculates the expected direct costs to PSAs of administering VM under the three phases:

▪ Bilateral collateralisation prior to EMIR (Phase 1).

▪ Bilateral collateralisation under EMIR with the exemption (for the same universe of OTC derivatives as above, but subject to daily margining under the Draft RTS – Phase 2.1).

▪ Costs of meeting cash VM requirements (central clearing) under EMIR with no exemption plus the costs of bilateral collateralisation for non-clearable derivative contracts (Phase 2.2).

For each phase, costs are estimated in respect of the existing portfolio and trading volume of PSAs for the year 2012. We use data gathered from the fieldwork for a sample of funds on the costs currently incurred in meeting bilateral VM requirements and on the foreseen costs under EMIR. Our direct cost estimates focus on the costs of administering collateral, rather than on the total costs of managing derivative contracts or of central clearing.

The Draft RTS may impact the costs of administering collateral for bilateral OTC derivatives under EMIR. To date, these regulations state that VM must:

- Cover the full mark-to-market exposure.

- Be paid in the form of liquid assets, which will hold their value in times of financial distress (taking haircuts into account). There is also a restriction that no more than 50 per cent of the value of collateral put up from an entity can come from a single (or group of closely related) Sovereign, regional authority or PSE issuer.[26]

- Be exchanged daily.

These margining requirements are only applicable to new contracts and will be phased in over time.

4.3.1 Drivers of costs

Direct costs of administering bilateral collateral under current arrangements

Collateral management is resource intensive, and the direct costs of meeting collateral requirements consist largely of staff and systems costs. For current bilateral arrangements (i.e. under existing CSAs) these costs include:

- Managing CSAs and collateral lines.

- Deciding on which assets to move through the system as collateral.

- Arranging for the transfer of assets.

In the sample funds on which our costs are based, settlement is T+1 around 90 per cent of the time. Daily settlement is therefore required, and collateral moves need to be agreed daily with other parties. This is unlikely to be the case across the industry: respondents to the BIS/IOSCO OTC Margin Requirement Quantitative Impact Survey (QIS) posted VM for bilateral OTC derivative contracts on average around every 2 days.[27]

The above would apply to CSAs which specify cash or bonds as acceptable collateral. Where CSAs also specify that only cash is to be used as VM, costs could include, for example, money market operations to raise cash.

The costs associated with meeting collateral requirements under existing CSAs are largely operational, particularly when non-cash assets make up the majority of collateral transfers. These operations can be outsourced, or if undertaken in-house this by 'back office' staff.

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26 There are also other limits on the share of collateral that is made up of securitisations, convertible bonds, equities and units in UCITS.

27 Basel Committee on Banking Supervision and the International Organization of Securities Commissions, "Margin requirements for non-centrally cleared derivatives: Second consultative document", February 2013. The QIS was conducted in 2012.

Direct costs of administering bilateral collateral under EMIR RTS

The 'unit' costs of administering collateral for bilateral arrangements under EMIR will be broadly similar to the costs under current arrangements, with some changes resulting from the Draft RTS. In the case that PSAs are able to access the clearing exemption, all their OTC derivative contracts would be subject to these costs of bilateral clearing. In the case of no exemption, only those OTC derivative contracts *not* eligible for central clearing would be bilaterally collateralised, which would imply a significant reduction in the volume of bilateral OTC derivative contracts and thus a reduction in absolute costs of bilateral collateralisation in the long term compared with the current situation.[28] In the medium term, existing bilateral contracts will still need to be serviced regardless of whether the derivatives are eligible for central clearing, and therefore the bilateral collateralisation costs under EMIR with no exemption are relatively similar to the bilateral collateralisation costs with an exemption.

To the extent that daily margining is a new requirement for funds under EMIR, this may increase the complexity of bilateral collateral management and thus require additional resources to manage the additional VM calls. We anticipate this additional cost would be small given the relative frequency of current bilateral VM calls as indicated by the BIS/IOSCO QIS.

The restrictions imposed by the EMIR RTS on the proportion of collateral in a single asset class could pose some indirect costs on PSAs. For example, CSAs might need to be re-written to take into account of any implications of the collateral restriction. In extreme cases, some funds might need to re-allocate their assets available for collateral.

Direct costs of administering cash VM under central clearing

Meeting cash VM requirements for CCPs in the context of central clearing under EMIR (i.e. in a situation with no exemption) will be a different matter. On the one hand, posting cash as VM is operationally simpler than posting securities — these processes can be systematised to a greater degree, with fewer operational challenges. In addition, under central clearing, funds would be able to benefit from netting arrangements with fewer clearing members and thus be exposed to fewer transactions and margin calls (assuming that under current bilateral arrangements they holds CSAs with a broad range of counterparties). These changes imply that collateral management is a less resource-intense process under central clearing compared to bilateral arrangements.

On the other hand, more complex decisions will need to be taken with the posting of cash VM. Our modelling assumes that funds would create a cash buffer in preparation for central clearing, and maintain this buffer throughout. Decisions would therefore need to be taken on how much liquidity to hold in the cash buffer, how to raise the cash (e.g. which assets to sell) and how to maintain the buffer. This would entail input from 'front office' staff (and possibly trustees, as liquidity management decisions cannot be outsourced) both as a one-off set up cost and an ongoing cost. A cash buffer held to cover VM calls within a certain degree of confidence would also need to be supplemented occasionally with additional cash when a VM call (or a stream of calls) exceeds the buffer. For this, some additional resource would be required to manage repo transactions.

The costs of collateral management under current bilateral arrangements are driven largely by the number of CSAs and collateral lines that need to be managed. This is in turn related to the volume of bilateral derivatives traded and the intensity of

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28 There would of course be additional cost associated with central clearing in this latter case, which we model in Phase 2.2.

derivative use. The costs of collateral management under central clearing will also be linked to the volume of derivatives traded, scaled to reflect increased operational efficiency and netting capabilities. The volume of OTC derivatives considered under each modelling phase will differ as follows:

- **Bilateral collateralisation under current arrangements.** Here we consider the entire existing OTC derivative portfolio. All OTC derivatives will be subject to bilateral collateral arrangements. Costs are benchmarked directly on the current costs of bilateral collateralisation obtained from our fieldwork.

- **Bilateral collateralisation under EMIR with exemption.** Again we consider the entire existing OTC derivative portfolio across PSAs. All PSA's OTC derivatives will still be bilaterally collateralised. Costs are benchmarked on the costs of the current situation, but adjusted to take into account the impacts of the Draft RTS, namely daily margining.

- **Bilateral collateralisation under EMIR without clearing exemption.** Only those OTC derivatives not eligible for clearing will be subject to bilateral collateralisation arrangements in the long run. In the medium term, however, there will remain bilateral contracts of (now) centrally clearable derivatives that still require management. We term these 'legacy' bilateral contracts.

- **Central clearing under EMIR with no clearing exemption.** We model two scenarios: one in which only IRS are cleared (thus leaving inflation swaps and other derivatives such as FX forwards and CDS in the bilateral space) and one in which both IRS and inflation swaps are centrally cleared. Based upon our fieldwork the latter situation should be in effect before the end of 2014.

Figure 4.1: VM pre- and post-EMIR with no exemption
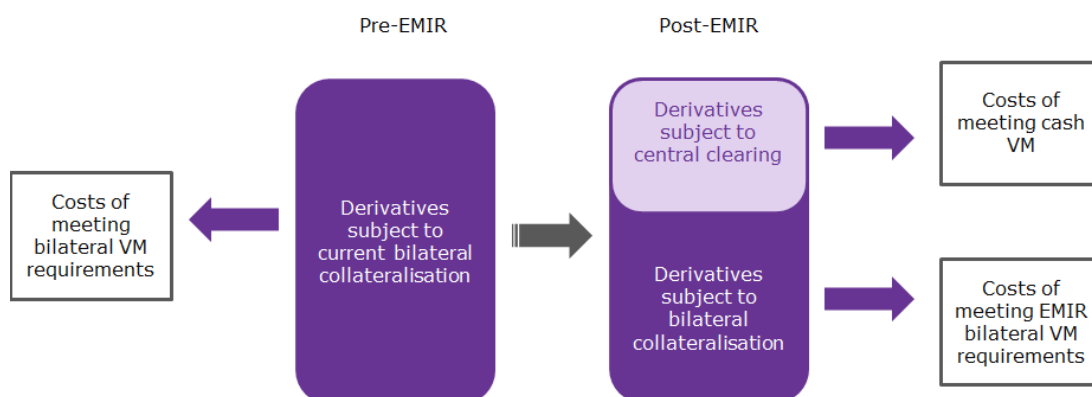
The costs associated with the different volume of derivatives in each phase will not adjust linearly in line with the change in derivative portfolios.

- Under EMIR bilateral arrangements without the exemption (where PSAs will centrally clear all eligible derivative contracts and only those non-eligible contracts will be subject to bilateral arrangement), even though the volume of bilaterally traded derivatives will reduce compared to current bilateral arrangements (as many will migrate from the bilateral space to the centrally cleared space), the number of CSAs will not reduce directly in line with this as there will be a fixed element based on the number of contracts (rather than the size of each). In addition, the CSAs and collateral lines related to existing contracts for now centrally clearable

derivatives would remain and would need to be managed for at least the medium term.

- The draft RTS state that bilateral collateralisation requirements under EMIR must include daily mark-to-market and daily VM calls. Our fieldwork indicates that daily collateral exchange already frequently occurs, and the BIS/IOSCO QIS found that collateral is exchanged on average around every 2 days. The unit costs of bilateral collateral management under EMIR should therefore be only marginally higher compared with the current situation.

- For centrally cleared portfolios under EMIR, PSAs will have to manage collateral movements to and from their clearing members. It is likely that PSAs will have relationships with fewer clearing members than with current bilateral counterparts for a similar volume of derivatives, although would still diversity across a sufficient number of clearing members and CCPs for risk management purposes. The lower 'unit' costs per volume of derivative traded would however be augmented by additional 'front-office' liquidity management costs and some money-market capability.

4.3.2   Modelling methodology

We used the following steps to estimate the direct costs of meeting collateral requirements.

Estimate of the costs under the three phases for the representative portfolios

First, for the sample portfolios we calculated the relationship between derivative usage (expressed as the mark-to-market of all derivatives as a proportion of the AUM in the portfolio) and the number of CSAs and subsequently full-time equivalent employees (FTEs) associated with these portfolios. This represents the resources required under current bilateral collateralisation arrangements (phase 1).

Second, using the same universe of OTC derivatives but adjusting the resources for daily margining, we obtained the costs of phase 2.1 (bilateral collateralisation under EMIR with an exemption).

We then estimated the derivative usage under phase 2.2 (EMIR with no exemption, i.e. central clearing of eligible OTC derivatives and bilateral collateralisation of non-eligible derivatives) using the mark-to-market as a proportion of AUM for the various derivatives included in in central clearing and bilateral collateralisation respectively.

We considered the scenarios where both IRS and inflation swaps are cleared and where IRS only are cleared. We assume that if IRS and inflation swaps are both centrally cleared, the VM paid and received against each would be capable of being netted off. Whilst this need not be the case, it is a reasonable assumption as, at present, one clearing house dominates IRS clearing and it is the same clearing house that is expected to be first in offering clearing of inflation swaps. Indeed in the case when more than one category of derivative is cleared, it will be more efficient to clear them on the same CCP rather than on different CCPs.[29]

Under both scenarios for the bilateral collateralisation element of phase 2.2 we assume that in the medium term the existing CSAs for (now) clearable derivatives will largely remain.

Fourth, by linking the ratio of derivative usage to the number of CSAs we calculated the CSAs required for the bilateral elements of the sample portfolios for phase 2.2. For

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29 Darrell Duffie and Haoxiang Zhu (2010), "Does a Central Clearing Counterparty Reduce Counterparty Risk?"

each scenario (IRS and inflation swaps both cleared and IRS only cleared) we estimated the CSAs relating to non-clearable OTC derivative contracts and the CSAs relating to the legacy of (now) clearable derivatives.[30] We scaled the reduction in CSAs for non-clearable OTC derivatives by only a part of the reduction in derivatives traded to account for the fixed element of CSAs and the uncertainty around the proportion of funds' derivative portfolios that will be subject to clearing. We then linked the number of CSAs to FTEs.

Fifth, we estimated the number of additional FTEs required for the central clearing element of phase 2.2. The requirement for back-office FTEs to manage the new relationships with clearing members and CCPs is benchmarked against the FTEs needed to manage equivalent derivative volumes for current bilateral arrangements, with a scaling reduction to reflect operational and netting efficiencies. We also add additional FTEs to represent the front-office costs of managing cash buffers and liquidity decisions, and resources for small-scale repo transactions.

Finally we used average employment costs of €100,000 for back-office FTEs and €150,000 front-office FTEs to estimate the total resource costs.

The table below presents the data and results of these steps for the sample portfolios, which are classified as very large, high intensity use.

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30 The latter would reduce over time as these legacy contracts reach full term. Given the uncertainty around when this would occur we model the costs in the medium term.

Table 4.11: Resources required for collateral management for the sample portfolios

	Market value of derivatives as % of AUM	Number of FTEs	Cost (€000s)	Notes
Current bilateral	9.10%	20	€ 2,000	All derivatives in the sample portfolios. Less-than-daily margining; small repo facility to represent high-use fund
EMIR bilateral (with exemption)	9.10%	24	€ 2,400	All derivatives in the sample portfolios, subject to draft RTS (daily margining).
EMIR bilateral no exemption (IRS and INFL clearable)	0.2% (bilateral) + 8.9% (legacy clearable)	21.0	€ 2,105	Remaining derivatives in the sample portfolio not eligible for central clearing (FX forwards and swaps, CDSs) PLUS legacy CSAs of now clearable derivatives. Number of new bilateral CSAs for non-clearable derivatives reduced by only 50% of the change in MV to reflect fixed element of CSAs
EMIR bilateral no exemption(INFL not cleared)	0.5% (bilateral) + 8.6% (legacy clearable)	21.2	€ 2,116	Remaining derivatives in the sample portfolio not eligible for central clearing (Inflation swaps, FX forwards and swaps, CDSs) PLUS legacy CSAs of now clearable derivatives. Number of new bilateral CSAs for non-clearable derivatives reduced by only 50% of the change in MV to reflect fixed element of CSAs
EMIR central clearing (IRS and INFL cleared and netted)	9.10%	16	€ 1,800	Additional FTEs to bilateral collateralisation to manage new relationships with clearing members (CMs) and CCPs (efficiency saving of 60% from bilateral situation) and man repo desks
EMIR central clearing (INFL not cleared)	9.40%	16.60	€ 1,868	Additional FTEs to bilateral collateralisation to manage new relationships with CMs and CCPs (efficiency saving of 60% from bilateral situation) and man repo desks

Note: Sample portfolios are defined as large, high intensity use.
Source: Sample portfolios and Europe Economics analysis.

Extrapolate costs to other fund types

These portfolios represent large, 'high' intensity derivative use. Funds with a lower intensity of derivative usage will incur lower collateral management costs as a proportion of their AUM. Using our derivative usage scaling factors described in section 4.2.2 (from Ultra high to Ultra low) we adjust the costs for each phase for each Member State. We do not adjust the costs directly in line with the scaling factors to take account of the fact that there will be a base level of fixed collateral management costs regardless of the derivative use intensity.

We also adjust the costs to include an uplift of 25 per cent for outsourcing. This is applied to the proportion of funds with a Low or Ultra Low intensity score under the assumption that small funds would outsource their collateral management and incur higher unit-costs that those able to do this in-house.

The final outcome of this step is a range of costs, expressed as a cost per €1 billion of AUM, for each type of derivative intensity.

Table 4.12: Total costs of collateral management across different derivative use intensities and phases, as cost per €1 billion AUM

	Ultra High	High	Medium	Low	Ultra Low
Bilateral (current)	7,900	7,100	5,600	6,500	6,000
EMIR bilateral (with exemption)	9,500	8,600	6,700	7,900	7,100
EMIR bilateral (IRS and INFL cleared)	8,400	7,500	5,800	6,900	6,300
EMIR bilateral (INFL not cleared)	8,400	7,600	5,900	6,900	6,300
EMIR central clearing (IRS and INFL cleared)	7,100	6,400	5,000	5,900	5,400
EMIR central clearing (INFL not cleared)	7,400	6,700	5,200	6,100	5,600

We note that the total costs under EMIR will be the sum of the EMIR bilateral costs and the EMIR central clearing costs under either clearing scenario. The table below presents this.

Table 4.13: Total costs of collateral management across different derivative use intensities, pre- and post-EMIR, as cost per €1 billion AUM

	Ultra High	High	Medium	Low	Ultra Low
Bilateral (current)	7,900	7,100	5,600	6,500	6,000
EMIR bilateral (with exemption)	9,500	8,600	6,700	7,900	7,100
EMIR Total (IRS and INFL cleared)	15,500	13,900	10,800	12,800	11,700
EMIR Total (INFL not cleared)	15,800	14,300	11,100	13,000	11,900

Extrapolation to Member State level

As the final step we extrapolate the above costs according to the AUM in each Member State as shared across the different derivative use intensity scores.

The total direct costs are presented alongside those results of the opportunity cost modelling in section 5.

4.4   Opportunity cost model

The opportunity cost model calculates the expected costs to PSAs of complying with current cash VM calls for centrally cleared transactions in the event that the clearing exemption expires and a solution for the posting of non-cash collateral is not found.

4.4.1   Overview of the model

The model estimates the yield loss incurred by PSAs if they were to hold a cash buffer to meet VM calls, as opposed to holding higher-yielding assets.

We assume that PSAs would hold enough cash to cover most VM calls. However there may be instances when the VM call exceeds the cash buffer and PSAs are required to enter into a short-term repo to raise the necessary additional cash. The model therefore also estimates the cost of this "excess VM call". The smaller the cash buffer, the more often a fund would be required to conduct a repo transaction.

The cash buffer would be created prior to the beginning of the central clearing period and thus the opportunity cost from holding cash instead of other assets would extend over the life of the fund.

In creating the cash buffer, we assume that funds ring-fence their existing cash allocation to a certain degree. The rest of the buffer would be made up by selling assets according to a simplified waterfall of assets as follows:

Government bonds → corporate bonds → equities → other long-term assets

This cascade seeks to take into account both the liquidity of the assets and the returns achieved on them (Government bonds have a lower return than corporate bonds, and so on). Our fieldwork indicates that it is at least reasonably realistic, as this would tend to reduce the opportunity cost. One caveat here is the point, as already noted, that bonds can play a hedging role themselves. It follows that holding a lower

proportion of assets in Government bonds (or other interest-bearing instruments) could affect the effectiveness with which the fund's liabilities are hedged.

The opportunity cost is calculated as the difference in return between the asset sold and the return on cash the funds would be able to earn.

A slice of government bonds would also be reserved at the outset to cover initial margin. This indirectly affects the opportunity cost, as it means that the cash buffer is more likely to trip into asset classes other than Government bonds.

The figure below illustrates the logic behind the model.

Figure 4.2: Stylised logic of the opportunity cost model
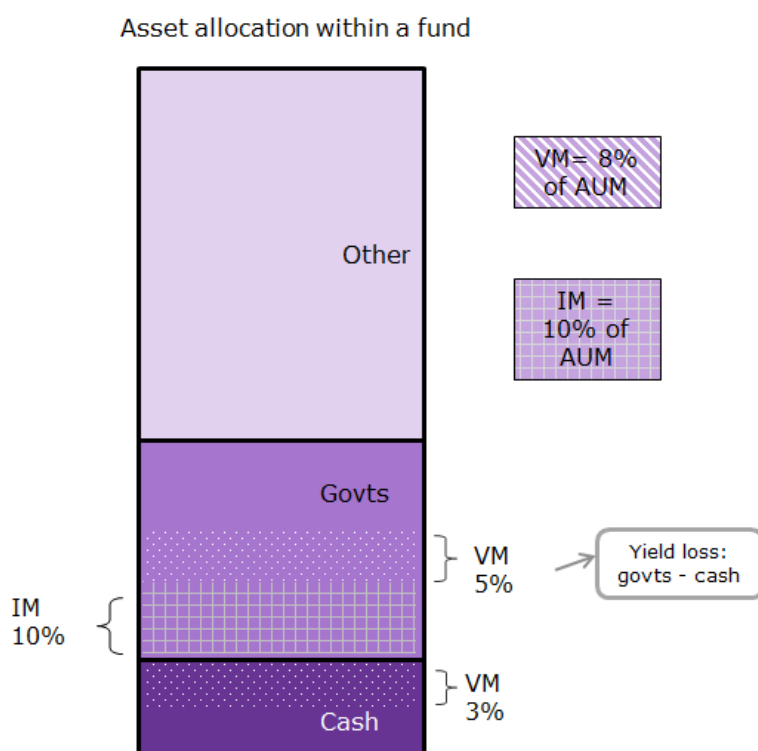
4.4.2   Size of the cash buffer

The model assumes that PSAs will hold a cash buffer to cover a proportion of VM calls with a certain degree of confidence. The size of the cash buffer is informed by aggregate VM calls over a five-day period: taking the simulated VM calls[31] developed in the VM Model (described in section 4.2.1 above) between January 2007 and December 2012, the model considers VM calls over rolling five day periods. The model then creates the cash buffer based on 100 per cent, 90 per cent and 80 percent of the maximum five-day call.

In cases when there are VM calls in excess of the cash buffer we assume a short-term repo transaction would take place to raise the cash for the excess VM call.

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31 VM calls were simulated for sterling and euro portfolios and for both a model incorporating clearable inflation swaps and interest rate swaps and for a model incorporating only clearable interest rate swaps. The euro model was used for every Member State except the United Kingdom.

Under the stress scenarios, the key consideration is the likely frequency of a VM call high enough to breach the stress cash buffer. Stress situations such as those modelled would be very seldom. We therefore estimate an indicative average excess VM call repo cost for 2012 based on the cost of a repo to meet the excess VM call averaged over the likely frequency of such an occurrence (10 years).

4.4.3 Value of assets to be sold to meet cash buffer

Once the required initial cash buffer is set, the model calculates what assets must be sold to obtain it according to the asset cascade described in the previous section. For every Member State the overall asset allocation of the pension industry is identified within the following categories: cash, government bonds, corporate bonds, equities and other assets.[32]

We have assumed that funds will ring-fence a proportion of their existing cash allocation; once the remaining cash is used up for the cash buffer the other assets will be sold in a waterfall of government bonds, corporate bonds, equities and finally other assets. For funds with existing cash allocations less than five per cent of AUM we assume that the entire cash allocation would be ring-fenced, and that the cash buffer would be drawn entirely from the asset waterfall. For funds with an existing cash allocation greater than five per cent, we assume that up to half of the required cash buffer will be drawn from the cash allocation, and the remainder drawn from the asset waterfall. In the more severe scenarios, where half of the desired cash buffer exceeds the initial cash level as a percentage of assets under management, all of the initial cash level would contribute to the cash buffer.

As noted above the model also allows for an indicative slice of government bonds to be ring-fenced for IM (expressed as a proportion of AUM). This increases the likelihood that the waterfall will use up the remaining government bonds and move onto corporate bonds. We assume that the IM slice for the IRS-only representative portfolios is 7 percent, and 11 per cent for IRS and inflation swap portfolios.[33] This IM slice is scaled for each Member State by our derivative use intensity factors to reflect the fact that IM will be a smaller proportion of AUM for lower intensity Member States.

Our model relies on average asset allocations drawn from data aggregated at a Member State level. In any Member State, PSAs will have heterogeneous allocations deviating more or less from their peers. Some PSAs could have very low allocations of, say, Government Bonds compared to the national average. Dependent on the size of the cash buffer, considering only the average could imply that only Government Bonds were sold, whereas *some* funds could be obliged to move further along the cascade. To account for this we allocated a portion of the assets (25%) in each Member State a higher than average allocation of assets at the beginning of the cascade, and another portion a lower than average share (also 25%), with the balance at the average allocation. The changes were calibrated so that the overall level of AUM and the aggregate Member State asset allocation are unaffected.

4.4.4 Opportunity costs

The model calculates the annual opportunity cost from selling each type of asset to increase cash holdings. This is based upon the quantity of an asset sold and the difference in the return of the asset over the return the PSA can receive on cash. The selection of assets used to represent each asset class is outlined in Table 4.14 below.

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32 OECD 2013.

33 We base this indicative IM value on an industry assessment.

Table 4.14: Opportunity cost model inputs

Input	Description	Data sources and adjustments
Initial asset allocation	A breakdown of the average percentage of assets under management held as cash, government bonds, corporate bonds, equity and other assets at a Member State level	OECD (2013), "Pension Markets in Focus No.10"
Assets under management	The value of assets under management for pension funds in each Member State, used to convert the cost of posting cash collateral in percentage terms into a cost in terms of euros.	OECD (2013), "Pension Markets in Focus No.10"
Investment asset returns	The model used investment asset returns calculated using daily data between 1999 and 2013. An average for each calendar day was taken over this period and then compounded to get an annual return	Price data accessed via Bloomberg
Investment assets	*Cash:* EONIA or SONIA for euro and sterling returns respectively (less 30bps as a maintenance charge); *Government bonds:* UK 10 year gilts[34] and German 10 year Bunds; *Corporate bonds:* IBOXX € CRP TR7-10 and IBOXX £ CRP TR 7-10 *Equity:* DAX TR Index and FTSE 100 TR GBP	Bloomberg
Proportion of maximum VM call	A percentage of the maximum VM call over the range of VM calls in each simulation. These are taken at 100, 90 and 80 per cent.	
Scaling factor	A scaling factor applied to reflect the intensity of derivative usage for each Member State, based upon the funding ratio of PSAs, the ratio of defined benefit to defined contribution funds and the size of pension funds.	Europe Economics analysis
Initial margin (IM) slice	A percentage of government bonds which PSAs will not use for the purposes of obtaining cash to post variation margin.	11 per cent for the IRS and inflation swap portfolio; this is then scaled for each MS to reflect the intensity of derivative usage.
Haircuts applied to repo transactions	The asset used in a repo transaction incurs a haircut, to protect against the risk that the value of assets posted exceeds the level of cash received as part of the repo transaction. Riskier assets incur a greater haircut due to the risk that their value will decrease below the level of cash involved in the repo transaction. This cost is relevant to the cases where the cash buffer is not sufficient to cover the required level of VM to be posted. In stress scenarios, an additional haircut is applied.	Fieldwork

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34 We reviewed the period from 1999 through to 2013. It is worth noting that over this period, the yield differential between SONIA and gilts is much more volatile than that between EONIA and bunds. For the UK we focused on the past five-six years, which gives a higher yield loss than if one looked back all the way to 1999, and is also more comparable to that applied for the rest of Europe.

Input	Description	Data sources and adjustments
	We have applied haircuts based upon current market practice and estimates from market participants as to how haircuts would vary between normal and stressed market conditions.	
	For completeness we note that there is ongoing work led by the Financial Stability Board (FSB) on mandatory minimum haircuts. This policy would have the intent of reducing the pro-cyclical effects of haircuts (which can increase significantly in stressed times). The design and parameterisation of any such policy is still to be determined.	
Repo cost	Fixed number of basis points on the size of the repo transaction. This cost is relevant to the cases where the cash buffer is not sufficient to cover the required level of VM to be posted.	Fieldwork

4.4.5   Costs of excess VM call

For those days when the VM call exceeds the cash buffer, we assume PSAs will enter into a short-term (one month) repo of assets to raise the additional cash. A haircut is applied to the required level of assets which must be posted as part of a repo operation, this varies depending upon the asset (from 2.7 per cent for Government bonds up to 6.4 per cent for other assets in the normal scenario and from 2.7 per cent for Government bonds up to 15 per cent for other assets in the stress scenarios). The costs of the repo consist of the charge levied by the counterparty (which increases in line with the perceived riskiness of the asset subject to the repo trade) and an overnight opportunity cost which is the difference in the return of the asset over cash on that day. Under the historic scenario the cost of a repo is between 13bps for government bonds up to 19bps for other assets. The cost increases to between 25 and 38bps under the stress scenarios.

As described above, to arrive at the cost of excess VM calls for the 2012 portfolios under the historic scenario we calculate the individual repo costs for each time the VM calls exceed the cash buffer. Under the stress scenarios we estimate an indicative annual repo cost by dividing the cost of an excess repo by the frequency with which this is likely to occur (20 years).

4.4.6   Scaling of the final costs

The opportunity costs and excess VM call costs are expressed as a proportion of AUM for each Member State, and then scaled up based upon the total level of assets under management for that Member State via the intermediate steps described above). The simulated VM calls as a proportion of AUM are taken for the representative portfolios which are classified as 'high' derivative use intensity. In order to reflect the fact that the intensity of derivative usage will vary across – and within – Member States, we scale the final opportunity costs by the blended scaling factors described in section 4.2.2 above.

The costs of meeting cash VM requirements are extrapolated over 20, 30 and 40 years to represent the impact of the cash buffer on the typical pensioner.

5. Results of Phase 1 and Phase 2 Modelling

In this chapter we present the results of the modelling exercises described in Chapter 4. These results represent the costs to PSAs of administering collateral under different phases, and cover:

▪ Direct costs of administering collateral.

▪ Opportunity costs of holding cash to meet cash VM calls.

Phase 1 represents the baseline costs of bilateral collateralisation prior to EMIR. Only direct costs are included in Phase 1. We do not consider there to be opportunity costs associated with VM under bilateral arrangements, as PSAs optimise their collateral arrangements in the CSAs they have and this is part of the usual cost of derivative trading not influenced by regulation.

Phases 2.1 and 2.2 represent the costs of collateralisation under EMIR. Phase 2.1 covers the expected costs to PSAs of complying with bilateral variation margin requirements in the case of an exemption from the clearing obligation – as with Phase 1 only direct costs are included in Phase 2.1. Both direct and opportunity costs are included in Phase 2.2, which represents the costs to PSAs of complying with current CCP cash VM requirements.

For each phase we estimate the costs to PSAs for the year 2012 using representative eligible portfolios and trading volumes for 2012.

5.1   Costs of Phase 1

The direct annual costs of administering collateral under current bilateral arrangements across the EU28 are summarised in the table below. The total costs across the EU28 are just under €44 million for 2012.

These costs are based on our sample funds as described in Chapter 4 and scaled across the EU to reflect different fund sizes and intensities of derivative usage. The costs are driven by the number of CSAs and volume of derivative usage rather than the value of VM exchanged. They assume that VM collateralisation does not generally take place daily (but more frequently than weekly), and that CSAs can stipulate a mix of cash and non-cash assets as suitable VM collateral.

Table 5.1: Direct costs of administering collateral under current bilateral arrangements across the EU28, 2012

Member State	Direct cost (€000s)
AT	132
BE	332
BG	21
CY	0
CZ	61
DE	1,788
DK	3,329
EE	12
EL	0.6
ES	1,143
FI	690
FR	1,044
HR	46
HU	20
IE	538
IT	643
LT	1.9
LU	5.4
LV	2.3
MT	3.7
NL	6,652
PL	435
PT	78
RO	19
SE	1,525
SI	15
SK	39
UK	25,336
Total	**43,913**

Source: Europe Economics and Bourse Consult analysis.

5.2   Costs of Phase 2.1

The expected direct annual costs of bilateral collateralisation under EMIR with the exemption across the EU28 are summarised in the table below. The total expected costs across the EU28 are approximately €52 million.

These costs are based on existing portfolios and trading volumes for 2012. The increase in costs from current bilateral arrangements is driven by the move to daily margining which would entail a slight increase in the resources needed to administer collateral under CSAs.

Table 5.2: Expected direct costs of administering collateral under EMIR bilateral arrangements across the EU28, 2012

Member States	Direct costs (€000s)
AT	159
BE	436
BG	25
CY	0
CZ	73
DE	2,304
DK	4,015
EE	14
EL	0.7
ES	1,399
FI	895
FR	1,415
HR	56
HU	24
IE	669
IT	786
LT	2.3
LU	6.8
LV	2.8
MT	4.5
NL	8,622
PL	522
PT	101
RO	20
SE	2,038
SI	18
SK	47
UK	28,496
Total	**52,151**

Source: Europe Economics and Bourse Consult analysis.

5.3   Direct costs of Phase 2.2

Phase 2.2 includes the expected direct annual costs to PSAs of administering cash VM for clearable OTC derivative contracts under EMIR once the exemption has expired; and the direct costs of managing bilateral collateralisation for non-clearing-eligible OTC derivative contracts and the remaining 'legacy' bilateral contracts of (now) clearable derivatives.

These costs are presented in the table below. We present the costs under two clearing scenarios: the first where both IRS and inflation swaps are clearable, and the second where only IRS are clearable.

The total costs across the EU28 are approximately €85 million in the first scenario and €87 million in the second. These include the direct costs of posting collateral to CCPs

for clearing-eligible derivative (around €40 million where both IRS and inflation are clearable and €41 million where only IRS are clearable) and the direct costs of bilateral collateralisation for the remaining non-clearing-eligible contracts and the legacy contracts for (now) clearable derivatives (approximately €45 million and €46 million respectively).

The slightly higher costs in the scenario where only IRS are cleared reflect the fact that cash VM calls from IRS and inflation swaps would not be netted off at the clearing member level and the assumption that this would result in more frequent VM calls.

These costs are based on the assumption that a similar volume of IRS and inflation swaps currently represented by the 2012 portfolios would be centrally cleared. Costs are driven by the relationships that funds would need to manage with clearing members which, although related to derivative volumes, would be subject to efficiency savings. Additional costs to cover liquidity management decisions and repo transactions are included.

Table 5.3: Expected direct costs of administering CCP cash VM and remaining bilateral VM under EMIR with no exemption across the EU28, 2012

Member State	IRS and Inflation clearable Direct costs (€000s)	Only IRS clearable Direct costs (€000s)
AT	259	264
BE	710	724
BG	40	41
CY	0	0
CZ	120	122
DE	3,749	3,825
DK	6,533	6,666
EE	23	23
EL	1.1	1.1
ES	2,277	2,323
FI	1,456	1,485
FR	2,302	2,349
HR	91	92
HU	39	40
IE	1,088	1,110
IT	1,278	1,304
LT	3.7	3.8
LU	11	11
LV	4.6	4.7
MT	7.2	7.4
NL	14,028	14,313
PL	849	866
PT	164	168
RO	33	34
SE	3,317	3,384
SI	28	29
SK	77	78
UK	46,365	47,307
Total	**84,852**	**86,576**

Source: Europe Economics and Bourse Consult analysis.

5.4 Direct costs of pre- and post-EMIR collateral administration

The table below summarises the total direct costs across the EU28 for all phases.

Table 5.4: Total annual costs of collateral management under all phases

Phase	Total Direct Costs EU28
Current Bilateral Arrangements	43,459
Bilateral EMIR (with exemption)	52,151
Total EMIR with no exemption (IRS and INFL cleared)	84,852
Total EMIR with no exemption (only IRS cleared)	86,576

This cost increase, whilst not wholly trivial, is of significantly less importance than the potential opportunity cost calculation to which we now turn.

5.5   Opportunity costs of Phase 2.2

In addition to direct costs, the expected costs to PSAs of complying with current CCP cash VM requirements include the opportunity costs of holding a cash buffer at the expense of higher yielding assets.

The opportunity costs will vary according to different scenarios.   We consider two clearing scenarios – the first where only IRS are clearable, and the second where both IRS and inflation swaps are clearable.

For each clearing scenario we have modelled the opportunity costs under different levels of market stress which PSAs might take into consideration when setting up the cash buffer to cover possible VM calls.   These various market stress scenarios are developed from:

- Historic interest rate and inflation moves, where the cumulative five-day move was considered.

- A simulated 100bps increase in historic interest rate moves. The 100bps shock only reflects a shift in interest rates and the results are not duplicated for the case where both inflation and IRS are cleared.[35]

- Interest rate and inflation moves from the Federal Reserve's "adverse stress scenario".[36]

- Interest rate and inflation moves from the EBA's macroeconomic scenario for the 2014 stress test.[37]

In the Appendix detailing the full modelling results we present for each scenario:

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35 We examined the historic government bond yields from Germany, the Netherlands and the UK using data dated back to 1980, 1986 and 1984 respectively, and accessed from Eurostat. This analysis identifies that relatively rapid 100+ bps movements have been experienced previously, albeit infrequently (being very infrequent in the Netherlands, less infrequent in the UK). Whilst interest rates have typically been less volatile since the mid-1990s than before this should not be construed as a sign that greater volatility will not be a feature of the future.

36 US Federal Reserve 2014 stress test parameters: 2014 CCAR Severely Adverse Market Shocks Data; 2014 CCAR Adverse Market Shocks Data.

37 https://www.eba.europa.eu/-/eba-publishes-common-methodology-and-scenario-for-2014-eu-banks-stress-test

- The total VM requirement to be held as a cash buffer by PSAs in each Member State.

- The opportunity cost to PSAs of holding the cash buffer over one year.

- The cost to PSAs of conducting repo over one year to cover the excess VM calls.

- The total combined opportunity and repo cost to PSAs over one year.

The results are presented for three different levels of cash buffer representing 100 per cent, 90 per cent and 80 per cent of the maximum VM call. Whilst our model has considered this range of possible approaches the actual level of the cash buffer that pension funds would adopt is uncertain and will depend in part on market conditions at the time and on how conservative pension funds choose to be.

Our fieldwork has indicated the 100bps move as a commonly cited reference point. We believe funds would be unlikely to consider anything below the historic VM calls. We therefore consider this to be a reasonable estimate for expected costs. Below we focus largely upon the 100 bps shock. We include the impacts of the other simulations in Appendix 2.

The table below presents the cash buffer implied by PSAs preparing for a 100 bps shock.

Table 5.5 Total cash VM requirement to be held under the IRS clearable-100bps scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	267	241	214
BE	1,799	1,619	1,439
BG	41	37	33
CY	0.09	0.09	0.08
CZ	302	272	242
DE	14,540	13,086	11,632
DK	26,926	24,233	21,541
EE	23	21	19
EL	1.02	0.92	0.82
ES	2,889	2,600	2,311
FI	4,438	3,994	3,551
FR	2,234	2,011	1,787
HR	94	84	75
HU	39	35	31
IE	2,932	2,639	2,346
IT	1,814	1,633	1,451
LT	3.52	3.17	2.81
LU	23	21	19
LV	2.6	2.34	2.08
MT	6.87	6.18	5.5
NL	59,777	53,800	47,822
PL	805	725	644
PT	410	369	328
RO	34	31	27
SE	12,863	11,577	10,291
SI	27	24	22
SK	198	179	159
UK	122,901	110,611	98,321
Total	255,393	229,854	204,315

Source: Europe Economics and Bourse Consult analysis.

The table below presents the total costs to PSAs across the EU28 if they held a cash buffer based around coping with a 100 bps shock.

For those countries with a relatively high initial cash holding, the additional cost of conducting larger and more frequent "emergency" repo operations as the cash buffer's size decreases could outweigh the saving from a reduced opportunity cost. However typically in our model the opportunity cost change outweighs substantially the repo cost, i.e. at face value the lowest possible cost would appear to be at the lower cash buffer – but this does not mean this approach would be adopted, due to concerns over the ability to repo at the levels implied. We return to this point at 5.7.3 below.

Table 5.6 Annual total cost (opportunity cost and emergency repo costs) under IRS clearable-100bp scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,703	1,540	1,376
BE	11,454	10,356	9,257
BG	264	238	213
CY	0.6	0.54	0.49
CZ	1,922	1,738	1,554
DE	185,188	167,048	148,908
DK	342,951	309,358	275,764
EE	149	135	120
EL	6.52	5.89	5.27
ES	18,401	16,636	14,871
FI	56,530	50,993	45,455
FR	14,229	12,864	11,499
HR	1,193	1,076	959
HU	305	281	258
IE	37,345	33,687	30,029
IT	23,104	20,841	18,578
LT	22	20	18
LU	149	135	120
LV	17	15	13
MT	148	124	103
NL	761,372	686,793	612,213
PL	5,129	4,637	4,145
PT	2,611	2,360	2,110
RO	518	476	433
SE	163,839	147,791	131,742
SI	172	156	139
SK	1,263	1,142	1,021
UK	1,173,383	1,059,236	945,089
Total	**2,803,369**	**2,529,680**	**2,255,994**

Source: Europe Economics and Bourse Consult analysis.

PSAs in the UK and Netherlands are those most affected in absolute terms (and also in relative terms, compared to total AUM).

5.6   Total costs of complying with cash VM under EMIR

The total expected costs to PSAs of complying with VM collateral requirements under EMIR will be the sum of the direct costs of complying with bilateral VM requirements based on the Draft RTS for non-clearable derivatives; the direct costs of complying with CCP cash VM requirements for clearable OTC derivatives; the opportunity costs of holding sufficient cash to meet current CCP cash VM requirements; and any costs associated with meeting any shortfall between the cash buffer and extreme VM calls.

The opportunity costs will differ according to the size at which PSAs set the cash buffer. The tables below present the total direct and opportunity costs across the EU pensions industry under the two approaches and across different cash buffer levels. Interest rate swaps are already clearable across a wide range of products. Inflation swaps are not yet clearable — however our fieldwork indicates that at least one clearing house is already seeking approval for various inflation swap products from its regulator. Although the set of inflation swap products to be approved is not yet set, we understand that it should be broad enough to be of substantial benefit to those PSAs using inflation swap products. The timing of the approval of inflation swaps for clearing is not yet certain but we expect inflation swaps to join interest rate swaps as being clearable by the end of this year (i.e. 2014).

Table 5.7: Total expected annual costs to EU pension industry in IRS only clearable scenario, €millions

	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
100bps scenario	2,890	2,616	2,343

Table 5.8: Total expected annual costs to EU pension industry in IRS and inflation swap clearable scenario, €millions

	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
100bps scenario	2,888	2,615	2,341

Total costs under the 100bps scenario are very similar across the two clearing cases. This is due to the fact that this scenario does not adjust the margin on the inflation swaps (i.e. in effect it assumes that there is no correlation between these two variables at the point that the 100 bps increase occurs). This is a strong assumption.

5.7   Wider impacts on PSAs of complying with cash VM under EMIR

Section 5.5 above shows that the costs to PSAs of complying with current CCP cash variation margin requirements in the absence of the exemption and any technical solutions will be significant. The biggest cost element is the yield drag arising from holding a cash buffer instead of higher-yielding assets. The total expected annual costs to the total pension industry under the scenario where both IRS and inflation swaps are clearable would range from €1.3 billion if PSAs referenced the size of their cash buffer to historic VM calls to €2.9 billion if they referenced their cash buffers to VM calls under a 100bps increase in interest rates.

In response to the significant costs, PSAs face a trade-off. On the one hand PSAs could choose to retain their current level and structure of hedging and incur these opportunity costs. These costs in the form of foregone yields would most likely be passed onto pensioners in the form of reduced retirement benefits, particularly for funds which are under-funded and whose sponsors cannot guarantee to meet the gap.

On the other hand PSAs could try and reduce the extent of these costs by changing their derivative usage through different hedging or investment strategies.

Our fieldwork indicates a degree of behavioural change from PSAs: smaller, less sophisticated funds would stop hedging using OTC derivatives if it became too costly

or complex. This reaction, however, is only partly driven by the costs of maintaining a cash buffer – the general increase in complexity and cost arising due to central clearing would have a significant impact on funds' decisions.

5.7.1 Changes in derivative usage

By changing their use of OTC derivatives PSAs could reduce the VM requirements from CCPs for centrally cleared OTC derivatives and thus hold a smaller cash buffer and incur lower costs. PSAs could move towards hedging their long-term liabilities using derivatives associated with lower VM calls, such as short-dated or exchange-traded derivatives. Whilst a number of funds have suggested they would explore the use of alternative derivatives to offset the costs of clearing, there is concern throughout the industry that this would have consequences of less efficient hedging and reductions in innovative hedging solutions. OTC derivative contracts, by their bespoke nature, can be tailored to perfectly match the specific risks of a fund. Exchange traded derivatives would be more standardised and would not exactly match the risks being hedged – as with short-dated derivatives these would not match pension funds' liabilities which are of long maturities and need to be inflation-linked. The industry's view is that exchange traded derivatives are not yet available at desired liquidity levels.

A move to short-dated derivatives is seen as particularly sub-optimal as, in addition to the risk mismatch, it would involve extensive roll risk and would introduce significantly more operational risk as it would require much more active management of positions to ensure that the relevant duration profile was correctly matched.

The mismatch resulting from the use of alternative derivatives is particularly relevant for inflation risks. Given the seasonality of inflation (e.g. low in June, high in April, with as much as a 120bps range — at least in "normal" inflationary times) it is very important to link the swap to the month to which the benefit pay-out is uplifted. In the bilateral world it is possible to trade a bespoke swap linked to the exact month needed. If swaps are to be standardised then the market needs to decide on one (or a few) months to link these to as there would not be enough volume/liquidity to have different swap products linked to every month. Moving to standardised swaps could thus result in a mismatch for many hedges.

Funds may also decide to hedge their liability risks using alternative assets rather than derivatives. For example, interest-bearing assets like government bonds are a natural hedge against interest rate risk. As with other alternatives to OTC derivatives, the use of other assets would most likely result in less efficient hedging.

5.7.2 Changes in investment strategies

It is likely that some funds across the industry would maintain a similar use of OTC derivatives and incur the costs of foregone yields. Indeed, part of the pension fund industry views stopping or limiting hedging as the worst outcome for PSAs, and that all alternative solutions should be explored, even incurring the additional costs of maintaining cash for VM.

PSAs may seek to boost yields to offset the opportunity costs by investing in an asset portfolio that includes more high-yielding, (generally illiquid) assets. A drawback of this strategy would be that sudden changes in the economic environment would make it difficult to turn these assets into liquid cash. Some pension funds in the US have chosen to make up for the lost yield by selling index credit default swaps (CDSs), replacing the lost credit exposure without upfront payments. However, the volatility of long rate duration is usually significantly higher than that of credit spreads, so the risk of large, volatile margin calls on cleared index CDSs is lower. In addition, a rising-rate environment normally indicates the economy is fragile – under those circumstances,

the likelihood is that credit spreads will narrow, reducing margins for the CDS positions.

Another possible change would be to insulate the portfolio by trading payer swaptions (which cover interest rate risk). This would protect the firm in the short end if interest rates rose. If rates rise, the fund would receive collateral on the swaption positions and can then post it out on its duration hedges. But this strategy depends on the cash collateral being received on the uncleared swaptions – if the counterparty has the ability to post bonds under its bilateral agreement, the strategy would not work.

5.7.3   Reliance on the repo market

Many in the PSA industry see raising cash for VM from the repo market as preferable to reducing hedging activity or incurring significant costs of holding cash buffers. In particular, responses to our fieldwork view reducing hedging activity as very undesirable. Views were split between not cease hedging activity or else only reducing it if the costs of clearing were "excessive" and no solution were found ("excessive" was not defined by participants in the fieldwork –– this views may have some equivalence).

There are, however, concerns about the capacity of the repo market to meet the needs of the pension funds, particularly in extremis.

The European repo and reverse repo market had in aggregate about €5.5 trillion outstanding at the end of 2013.[38] This is substantially below its peak size, but shows significant recovery from the market's low in 2008. About two-thirds of this total was denominated in euros, and a further 10 per cent in sterling. Government securities were the most used asset as collateral, representing 38.5 per cent of the total outstanding (about €2.1 trillion).   The directional size of the market would therefore be about €1 trillion.

In the UK, outstanding gilt repo transactions stood at about £300 billion at November 2013 (i.e. about €360 billion), with about £100 billion of this outstanding with non-banks. Reverse repo (i.e. the other side of the transaction) showing similar figures. These data are higher than that implied by the ICMA survey where sterling trades are about 10–11 per cent of overall total repo transactions. There are various possible explanations for this: ICMA is a survey, and so may be missing some material data, sterling repo may be particularly prominent in Government securities, or there could be a decline in activity between the end of November and the year end.

Even taking both datasets at face value, this implies that the repo market in European Government bonds would be at least €700 billion in outstanding transactions (and likely higher).

The size of the market at any one time is less clear. About twenty per cent of the repo transactions in the ICMA survey were overnight trades (this is across all asset classes), i.e. on average 20 per cent of the outstanding value is being transacted daily. ICMA's data are analysed by maturity (overnight, two days to one week, one week to one month, and so on).   If it is assumed that the trades within a particular maturity are equally distributed across the number of trading days within then the stock data within the ICMA survey can be used to identify — in broad terms — the flow of repo transactions. Our analysis indicates that about 25 per cent of the outstanding transaction value is being traded on an average trading day. This would imply that about £75 billion of gilt repos are being transacted on an average day.

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38 International Capital Market Association: European repo market survey, Number 26 - conducted December 2013. This measures
     the stock of outstanding transactions, not the flow during the year.

Our fieldwork indicated that UK LDI schemes are currently using the repo market to increase their exposure to gilts. This is either to raise cash for liquidity management or for return enhancement purposes, so achieving a degree of leverage.[39] One estimate was that as much as £80 billion in outstanding gilt repo was with LDI schemes — this would be about 80 per cent of the UK gilt repos outstanding with non-banks (or over a quarter of the total). This means that there is currently a base level of repo already committed to the pension sector, although this is largely influenced by the current price differential between swaps and gilts, which may not extend into the future. Nevertheless if we reverse the logic above, £80 billion outstanding would involve about £20 billion transacted on any given day (from the £75 billion total).

The remaining £55bn in gilt repo might be assumed by PSAs to be available to them, but this would be a very strong assumption. Whilst PSAs might further assume some fraction of other asset classes providing additional market liquidity it is worth recalling that the repo market for government bonds is about double that for rest, and the gilt repo market is also much more resilient in stressed situations. There will be other players with needs, so even if there is a price war to secure repo, PSAs are not guaranteed to be able to win it on economic terms. It looks unlikely that PSAs would be able to assume more than £20bn from repo would be available to contribute towards collateral needs, and perhaps less than this.

This would not be equally available to all participants. The larger asset managers have dedicated repo teams and well-established market connections: in the event of demand outstripping supply, these would be able to service their own needs whilst smaller funds and asset managers would not.

This means that larger funds would be able to operate with a lower cash buffer than smaller players — this would represent an important advantage of scale.

As already indicated above, the equivalent data point for euro-denominated Government bonds is less apparent but would be at least €170 billion if we apply the preceding assumptions. The proportion of this related to German bunds is not evident, but is likely to be substantial.

A similar analysis (relying in large part on mapping across UK market assumptions) indicates that as much as €350 billion available on any given day in the rest of Europe. There is typically less experience in repo, although the industry is bigger. They would face significant operational issues. Capacity may be two-three times larger than in UK gilt repo.

Our modelling indicates that the aggregate VM call for a 100 basis point move would be €204–255 billion for European PSAs. Of this, €98–123 billion (£82–103 billion) would relate to UK PSAs, and predominantly be linked to sterling assets, and €106–130 billion would relate to euro (and perhaps other currency) assets.

It can be seen that the total VM requirement for such a move would exceed the apparent daily capacity of the UK gilt repo markets and would likely exceed the relevant parts of the European government bond repo market — i.e. primarily that in German bunds.

Capacity exists in other (less creditworthy) asset classes and some of this might be attracted to higher grade repo transactions. Given that such an event would be coincident with market stress, this is perhaps not unlikely but would still likely have pricing implications. We additionally note that pension funds are far from the only participants in repo (the Bank of England data suggesting that banks account about

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39 Policy Framework for Addressing Shadow Banking Risks in Securities Lending and Repos – FSB – August 2013 - http://www.financialstabilityboard.org/publications/r_130829b.pdf

two-thirds of activity, at least for gilt repo, although some of this may be undertaken on behalf of non-bank counterparties) the aggregate demand in such a scenario would likely overwhelm the market if that demand was coordinated and time compressed (as, indeed, it would be expected to be).

In addition there is some uncertainty in some Member States (e.g. the Netherlands) about whether PSAs are allowed to use repos. Under Dutch pension law (Article 136) there is a general prohibition against pension funds taking out loans — however it is possible for temporary liquidity needs within the remit of clear guidance of the responsible pension fund board. We understand that the Dutch regulator accepts that the regulations needed to be clarified in this respect.

There is also widespread concern about the capacity and resilience of the repo market (we discuss the capacity of the repo market in detail at Section 6.3.4).

In any event using the repo market to fund VM calls would imply elements of counterparty credit risk, liquidity risk and roll risk. Since repos are fully collateralised they present a significantly lower counterparty credit risk than uncleared swaps but this can be a factor if the repo counterparty is holding the collateral on behalf of the PSA. A number of funds have started monitoring the risk level in repo markets and the possibility that they might be forced to let go of repos at short notice and implement alternative hedging strategies, e.g. through the use of long-dated gilts to meet this new requirement. The main issue remains that these long dated assets are a less precise hedge for duration risk than OTC swaps.

Uncertainty over the scale of costs of meeting cash VM requirements is a likely driver of the wide range in opinions among the industry.

We now consider the impacts on retirement incomes if the opportunity costs were to be borne by pension funds.

5.8   Conclusions - impact on retirement incomes

To the extent that PSAs pass these total costs on to pensioners, these would represent a € for € reduction in retirement incomes. Whilst it is possible that — where relevant — corporates and other sponsors of PSAs could make good any shortfall by increasing their contributions to the funds, our fieldwork does not indicate that this is a likely outcome. It would, anyway, only substitute a reduction in pensioner incomes with a reduction in corporate profits.

The annual total costs as a percentage of PSAs' AUM would represent the annual reduction in investment returns. Compounding over the span of pensioners' contributions provides the cumulated effect. The table below presents the cumulated percentage reduction in retirement incomes under a low assumption (20 years), medium assumption (30 years) and a high assumption (40 years). The table below considers the costs associated with a cash buffer set at the maximum calculated VM call under the 100bps move simulation by Member State, and – by way of comparison – the EU28 cost for the others.

The impact on retirement incomes would be significant – up to 3.1 per cent in the Netherlands and 2.3 per cent in the UK in the 100bps scenario. The key driver of opportunity cost is the difference in the return between cash and higher yielding assets (in particular government bonds). At present these spreads are relatively low; if the spreads should widen then we could expect a much more significant impact on retirement incomes.

This could also arise if PSAs chose to fund the cash buffer from assets other than government bonds. PSAs could decide to maintain a minimum proportion of their investable assets as government bonds, with the result that more higher-yielding

assets would be sold to fund the cash buffer. As a crude example, if PSAs determined that at least 25 per cent of AUM should remain in government bonds then a strict interpretation of this "rule" would have a significant impact in some countries (in this example, the UK would be very affected as the average fund has holdings of government bonds only a little above this level now) as the yield differential between cash and (say) corporate bonds is much higher than that between cash and government bonds. Similarly, if PSAs focused on an alternative metric – such as the stressed simulations – the impact would again deepen.

Table 5.9: Indicative cumulated reduction in retirement incomes over 20, 30 and 40 years

	20 years	**30 years**	**40 years**
AT	0.19%	0.29%	0.39%
BE	0.37%	0.55%	0.74%
BG	0.19%	0.29%	0.39%
CY	0.18%	0.27%	0.35%
CZ	0.38%	0.57%	0.75%
DE	1.35%	2.03%	2.72%
DK	1.46%	2.20%	2.94%
EE	0.19%	0.29%	0.38%
EL	0.18%	0.27%	0.35%
ES	0.23%	0.34%	0.46%
FI	0.74%	1.12%	1.49%
FR	0.18%	0.27%	0.36%
HR	0.36%	0.55%	0.73%
HU	0.22%	0.34%	0.45%
IE	0.96%	1.44%	1.93%
IT	0.48%	0.72%	0.96%
LT	0.18%	0.27%	0.35%
LU	0.36%	0.53%	0.71%
LV	0.11%	0.16%	0.22%
MT	0.54%	0.81%	1.09%
NL	1.55%	2.33%	3.13%
PL	0.18%	0.27%	0.35%
PT	0.39%	0.58%	0.78%
RO	0.45%	0.68%	0.90%
SE	1.18%	1.77%	2.36%
SI	0.18%	0.27%	0.35%
SK	0.39%	0.59%	0.79%
UK	1.09%	1.64%	2.19%
EU 28	**1.11%**	**1.67%**	**2.24%**
EU28 impact (historic)	0.63%	0.95%	1.26%
EU28 impact (EBA)	1.62%	2.43%	3.26%
EU28 impact (US Fed Adverse)	1.82%	2.73%	3.66%

Source: Europe Economics and Bourse Consult analysis.

6. Technical Solutions for the Posting of Non-Cash Collateral to CCPs

PSAs are concerned that a requirement to post cash VM at CCPs will necessitate a substantive reallocation of assets towards cash. Since cash is relatively low-yielding this would result in a drag on investment returns. The previous chapters in this study have illustrated the impact of this. We now examine seven potential technical solutions of this problem for PSAs.

The solutions provide potential mechanisms for the posting of non-cash collateral to CCPs to meet VM requirements. For each, we describe the solution, along with the associated benefits, costs, risks and challenges associated with it in order to provide a view of its viability. We then provide a comparative analysis and conclusion as to the viability of the solutions.

However, before beginning this examination, we first describe the existing CCP clearing arrangements for OTC derivatives contracts in order to assist the reader to better understand the discussion which follows on each technical solution.

6.1 CCP clearing arrangements for OTC derivatives contracts

The following is a description of a typical OTC CCP clearing arrangement which is not intended to be exhaustive but to be illustrative of the main characteristics of CCP clearing which are relevant to this study. Individual CCPs will differ in the specifics and detail of their services.

Figure 6.1: Timeline of illustrative OTC clearing arrangement
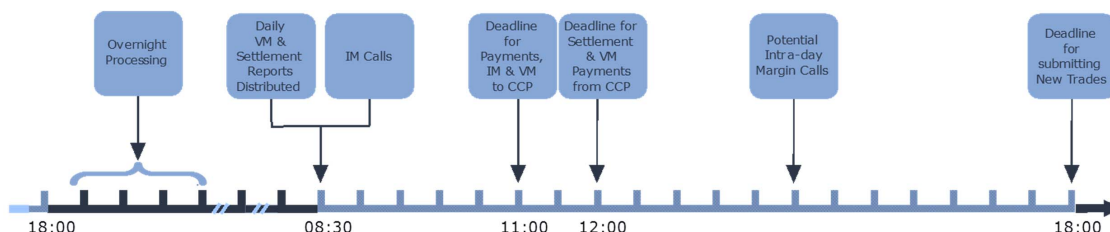
CCP risk management cycle

The CCP operates to a regular daily timetable, represented in the diagram above, in which it accepts trades for clearing, calculates risk, demands margin and settles margin transfers and due payments.

Trade input

During the business day new trades are confirmed and submitted to the CCP either through its own confirmation system or a third party system.

Account structures

Trades novated by the CCP are held in position accounts in the name of the relevant CM. Trades relating to a client of the CM are segregated, in a client account, from those relating to the CM as a trading principal which are recorded in a "house" account. Traditionally CMs have co-mingled the positions of all their clients in a single "omnibus" client account but now all CCPs offer, in addition to omnibus accounts, individual client accounts which allow the client, in the event of its CM defaulting, to transfer its position to another CM or to recover the value of the account directly from the CCP.

Figure 6.2: Account structures
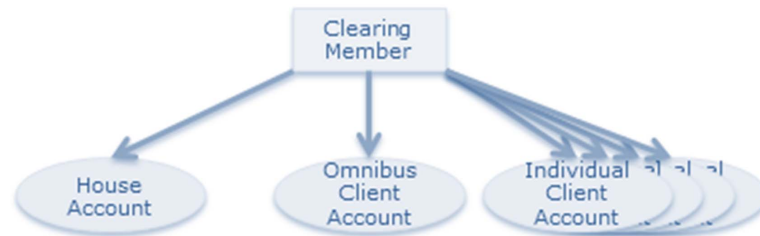
Each client of the CM chooses whether its positions should be held in the CM's omnibus client account or an individual account designated with the name of the client.

Overnight processing

After the end of the business day the CCP calculates the amount of IM and VM it now requires to cover the risk of each CM's portfolio, taking into account the trades which have been accepted and novated during the day. More and more CCPs are now providing real time or periodic information to CMs, so they can see in advance the direction and amount of VM and the likelihood of any IM calls the next day.

Each CM will perform its own overnight calculations to determine the amount of collateral it will require from each individual client to cover the positions which are being cleared by the CCP. Irrespective of whether the client's positions are held in an omnibus[40] or individual account, the margin amounts that they will have to provide to their CM are calculated individually. As far as possible the CM will use the same margin model as the CCP for these calculations and, in order to facilitate this, the CCP will provide all CMs each day with a copy of the variable data - e.g. interest rate curves - it has used in the model.

Margin calculation

The CCP requires IM to be covered by collateral, either in the form of cash or securities. CCP's require VM to be paid and received in cash.

Notification of VM obligations and IM calls

Some CCPs provide CMs with these calculations soon after trade acceptance, others overnight. However, before business opens each morning, every CM will know its obligations for VM payments (or receipts) and any calls to increase the collateral cover for IM.

Posting of collateral

If the CM intends to meet its IM obligation by posting securities or cash in a different currency to the sub-portfolio, the value of collateral required by the CCP will be a certain percentage greater than the amount of IM calculated. This is to cover the risk of the collateral losing value before it could be liquidated in the event of a default. The percentage is related to the historic volatility of the security or the relevant FX rate and is termed the "haircut".

Most CMs - particularly those posting non-cash collateral - prefer not to fine tune the amount of collateral covering their IM obligation on a daily basis - this would incur bank or custodian transaction fees. Instead they provide more than is required in order to cover potential future increases in IM without posting additional collateral.

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40 An omnibus account is where the positions of all or several clients of a CM are co-mingled and treated as a single portfolio by the CCP for risk management purposes.

CCPs usually assist by advising the CMs on the current value of the collateral held and how it relates to the IM requirement (some do this real time). They also inform CMs when the level of collateral "headroom" is becoming small (e.g. an alert may be issued if the IM amount reaches 90% of the value of the collateral held).

In order to post collateral to cover its client's portfolios a CM needs to receive collateral from its clients in time for it to be able to meet the CCP's deadline for receiving the collateral. If the client wishes to post non-cash IM collateral the transfer will have to have been arranged well before the final IM calculations are made because of the inherent delays in securities settlement which are discussed below.

Payments of IM and VM to the CCP

An actual call being made for IM usually has to be settled by the CM in cash (due to the time it can take to transfer securities). This cash could later be substituted by securities. VM has to be provided in cash. There is a strict cut off time for such payments. If a payment is delayed the CM is technically in default to the CCP, which has serious consequences.

Payments of IM and VM from the CCP

CCPs usually make payments of VM only after the receipt of the VM from the paying-in CMs. CMs who have an excess of IM at the CCP can make a request anytime for return of that excess.

Intra-day margin calls

All CCPs reserve the right to make intra-day margin calls in the event of market or other events which negatively changes the value of the collateral held or the value of the derivative contracts. Both IM and VM calls can be made (and even payments out of VM). All such calls have to be met with cash within a short timeframe (and, in all cases, by the end of the day).

Posting of securities as margin

Securities, of the kind acceptable to CCPs as collateral, usually have a fixed settlement cycle. For example, for UK government gilts, settlement is on a T+1 basis. German government bonds normally settle on a T+3 basis, but T+1 settlement is possible. This means that it is impossible to use securities to meet a margin call within the timeframes required by the CCP if the transfer is arranged at the time the margin reports are received. Therefore the securities transfer either has to have been arranged on a previous day or the margin call is met in cash and subsequently replaced by securities. Therefore the CM has to ensure it has enough cash to meet any likely calls. If could, of course, use securities to raise cash but, again, due to the time it takes to settle bond trades, it cannot rely on this method to meet the margin calls.

6.2   The examined solutions

In the sections that follow we examine seven potential solutions for the posting of VM by PSAs to CCPs, namely:

- Collateral transformation by clearing members (CMs).

- Collateral transformation by CCPs.

- Direct acceptance of non-cash assets with pass through to receivers of VM.

- Acceptance of non-cash assets with security interest passed through to receivers of VM.

- Quad-party collateral for VM security interest.

- Agency stock lending.

- Secured lending by cash-rich corporations.

PSA's do not use Prime Brokers. The reason they evolved was purely to support the needs of Hedge Funds and more latterly professional trading firms that require exchange clearing and leverage. Hedge Funds use the leverage of the Prime Broker to amplify the specific investments they make to obtain a multiplier effect on the asset return, which also has a similar effect on the risk profile if naked or not properly hedged.

PSA's investments tend to be fully paid for and therefore they do not want to place their entire portfolio under a security interest where the Prime Broker has the ability to lift collateral from the account as required to assist in funding any leverage they have extended. Prime Brokers in the main offer products based off of Equities, as Fixed Income instruments have evolved to transactional level financing via Repo instead of portfolio level financing via Prime Brokers and blanket rehypothecation.

The way in which each solution would operate is described and the solutions are assessed in terms of the costs, benefits and risks to the main participants.

6.3   Collateral transformation by CMs

6.3.1   Description of the solution

In section 5.5 above, we model the opportunity cost for PSAs if they were to keep a cash buffer to meet potential cash VM calls for up to 100% of the historical maximum 5 day requirement and use repo to cover any VM requirement that cannot be met by this cash buffer. In this section, we look at the implications of PSAs maintaining a much smaller cash buffer and using CM repo to meet virtually all of their VM requirements, so that assets would not need to be sold to maintain a suitable cash buffer.

This solution is a continuation of a service already offered to PSAs by CMs and, in some cases, by the asset manager of the PSA. However, such a service can also be provided to PSAs independently of their CMs by a 3rd party bank.

Operationally a PSA would make arrangements for a reverse repo facility in which the CM would guarantee to provide cash up to a specified limit. The securities needed as collateral for this facility could either be provided to the lender in advance of the repo being executed or provided as necessary to meet the need for cash - this would depend upon how the PSA wishes to manage its assets and the terms it has negotiated with the CM.

When the PSA was subject to a VM call from its CM and did not have the necessary cash to meet it, a repo transaction would be triggered. When the cash was no longer needed, or if there was a VM credit in conjunction with the repo coming to an end, the assets used as collateral could be returned to the PSA or continue to be held by the CM, depending on the terms of the arrangement.

Such repos as described above could be either bi-party, in which the PSA provides the collateral directly to the CM or tri-party, where the assets are lodged with a custodian and the custodian acts as agent for the PSA in collateral selection, payment and settlement with the CM, and custody and management during the life of the repo transaction. This Tri-party repo arrangement, thusly removes a lot of operational effort and risk from the PSA. Custodians typically charge 1–3 basis points for such a service over and above their normal custody fees. Several custodians operating in

Europe are looking at enhancing their tri-party repo offerings and such solutions may well become more popular if this solution becomes more common.

Figure 6.3: Collateral transformation by CMs

6.3.2   Benefits of the solution

The key benefit of this solution is that it is closely aligned to existing practices in the industry. The CMs and other cash providers are very well experienced in providing this type of service and it would require only a small amount of adjustment in the industry.

6.3.3   Costs of the solution

The direct costs of using the repo market to meet VM needs will clearly have an impact on returns. These impacts result from:

- An increased use of repo compared to PSAs current operations. PSAs (or their investment managers) would need to invest in the necessary treasury operations and risk management infrastructure and staff to manage this activity. This would mean costs in additional staff, systems and management time. At an investment manager this could involve setting up a repo desk to service multiple PSAs, as well as having more staff to manage each PSA as the PSAs will have to make decisions about what and when collateral can be made available. This would expand existing treasury operations, perhaps significantly, and could, in some cases, necessitate the set-up of a treasury department from scratch.

  The treasury function would manage:

  – Forecasting of the PSA's need to provide repo collateral ahead of the VM calls.

  – The transfer of collateral to the repo provider ahead of the actual need for VM cash, since this can take up to three days, depending on the securities concerned.

  – Execution of the repo transactions to meet actual VM calls.

- Some investment opportunity cost. If the PSA had the necessary committed repo facility in place with the CM and had provided sufficient collateral in advance, then there would be no need for it to maintain a cash buffer. However, in practice, there will still be occasions when there is an unforeseen need to access cash quickly and the CM would require that there is a sufficient cash buffer to cover any short term liquidity shortage. This cash would earn less than invested securities and so would be a drag on investment returns. This need for a cash buffer to cover short term unforeseen VM needs is common to all the solutions examined.

- A committed repo facility would incur a fee for the duration of the facility. For example, currently a 180 day facility for UK gilt repos would between 40-100bps. A similar euro repo facility could cost up to 200bps.

- The costs of the repos themselves (which would be in addition to the cost of a repo facility). As an example, currently UK gilt repo rates vary from 2-5bps over base rate for overnight s to 3-25bps for 3month repos. Euro rates ore from 5-10bps for overnight repos to 25-50bps for 3 month repos.

6.3.4 Risks of the solution

Capacity of the repo market

The key risk is whether the repo market could actually handle the additional volume of business that covering the aggregated VM obligations of the PSAs in cash on a daily basis would entail. This is both at a trading and at an operational level. Several commentators have pointed out that some major players in the repo market are expecting to withdraw from or reduce their involvement in what is viewed as a low margin business and one which is likely to become less attractive if some of the regulatory changes under discussion are implemented (see below).

We have described at 5.7.3 our estimate that the European government bond repo market is at least €0.7 trillion and the UK gilt repo market is about £300 billion.

The size of the market at any one time is less clear. Our analysis indicates that about 25 per cent of the outstanding transaction value is being traded on an average trading day. This would imply that about £75 billion of gilt repos are being transacted on an average day. As indicated above, the equivalent data point for euro-denominated Government bonds is less apparent but would be at least €170 billion if we apply the preceding assumptions. The proportion of this related to German bunds is not known, but is likely to be substantial.

Our modelling indicates that the aggregate VM call for a 100 basis point move would be €204–255 billion for European PSAs. Of this, €98–123 billion (£82–103 billion) would relate to UK PSAs, and predominantly be linked to sterling assets, and €106–130 billion would relate to euro (and perhaps other currency) assets.

It can be seen that the total VM requirement for such a move would exceed the apparent daily capacity of the UK gilt repo markets and would likely exceed the relevant parts of the European government bond repo market — i.e. primarily that in German bunds.

Capacity exists in other (less creditworthy) asset classes and some of this might be attracted to higher grade repo transactions. Given that such an event would be coincident with market stress, this is perhaps not unlikely but would still likely have pricing implications. We additionally note that pension funds are far from the only participants in repo (the Bank of England data suggesting that banks account about two-thirds of activity, at least for gilt repo, although some of this may be undertaken on behalf of non-bank counterparties) the aggregate demand in such a scenario would likely overwhelm the market if that demand was coordinated and time compressed (as, indeed, it would be expected to be).

The regulatory treatment of repo transactions under Basel III[41] is expected to have a negative impact on the repo market. The limitation on netting (when specific conditions are met), and an add-on for credit risk mean banks will have to hold more capital to support their repo businesses, which could lead to a reduction in banks' appetite to offer repo services and a shrinkage of the repo market, and almost certainly an increase in costs for their clients.

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41 *Basel III leverage ratio framework and disclosure requirements - January 2014 -* http://www.bis.org/publ/bcbs270.pdf

In addition a Financial Transaction Tax (FTT) would also have a severely negative impact on repo if such transactions were subject to such a tax. A rate of 10 basis points could either kill the market (as margins are already small), especially at the short end, or else cause a significant reduction in its scale.

Finally, an introduction of mandatory haircuts for repos, which has been proposed by the Financial Stability Board[42] (with the objective of reducing pro-cyclicality), could also have an unintended impact on repo market capacity. Haircuts for government euro bond or UK gilt repos currently range from 0.5% to 2%, depending on the term of the repo. The scale of mandatory haircuts are far from being determined, although we note that the current FSB proposals have haircuts dependent on, and increasing with, the maturity of the collateral securities. This may have particular consequences for PSAs: we have already noted that these generally have significant holdings in longer-dated government securities and these are likely candidates for repo collateral.

At the time of writing it is not possible to predict the quantitative impact of these regulatory changes since the regulations are not yet finalised and therefore the banks' response is not predictable. However, it is likely that the volume of repos done bilaterally between banks and investing institutions will reduce. A part of the current bilateral repo volume involves a bank executing back-to-back repos between two clients in order to transfer cash to one and collateral securities to the other – e.g. between a corporate treasurer and an investing institution. It is possible that, if the bank decided not to continue with this type of business, at least some of it could evolve into direct secured lending between the two buy-side parties as discussed later in section 6.9.

Obtaining sufficient repo lines to PSAs

One major issue for PSAs is that the provision of repo is not guaranteed. Banks are increasingly reluctant to provide long-term and large size commitments. This is because the commitment would still consume balance sheet and regulatory capital even if the line is not drawn upon. The view from the market is that it might be possible for some large PSA clients to obtain some level of commitment, if it is part of a suite of services the bank provides — but even this would only be at a price that covers the associated balance sheet charges.

If a bank decides to reduce the resources it is willing to allocate to repo business it is likely that the offer of repo lines would be prioritised to their larger clients who buy other services from the bank, hence there is a risk that smaller clients will not have the option to raise secured long dated cash through repo to fund their VM requirements.

Counterparty credit risk

As discussed in section 5.7.3, the principal counterparty credit risk of a repo is largely covered by the fact that all repos are fully collateralised. Remaining counterparty credit risk can be mitigated by using a wider range of counterparties for repo or by using cleared repo arrangements. The latter are currently offered by LCH.Clearnet and Eurex.

Such cleared repo arrangements are not currently open to PSAs directly. LCH.Clearnet has not yet finalised any plans to change that but Eurex is actively working on a service designed to address the PSAs need to use securities in order to meet the cash VM calls required by Eurex Clearing.

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42 Policy Framework for Addressing Shadow Banking Risks in Securities Lending and Repos – FSB – August 2013 -
    http://www.financialstabilityboard.org/publications/r_130829b.pdf

Our understanding is that the Eurex scheme would, if it comes to fruition, allow a limited range of buy and hold investors (which would include PSAs and insurance companies) to be accepted as principals in its GC Pooling cleared repo service. PSAs would execute repos through the service and the cash raised by the repo could be posted to the CCP to meet VM calls. The repos themselves would be cleared through the CCP and therefore the PSA would face the counterparty credit risk of the Eurex CCP. Adding another class of clearing participant raises the question of what default fund would be used by the CCP in the, albeit unlikely, event of the default of a PSA participant and how it would be funded — the trust document of many PSAs may prohibit direct contributions into a default fund. Whether the cost of the service would be acceptable to PSAs is also an open question.

Cleared repo in general, is expected to be more expensive than bilateral repo. Whether that will be the case in future will depend on whether the cost that the banks put on the balance sheet capacity which would be consumed by bilateral repo would be less than the transaction, margin and operations costs if the repo was cleared. This is not yet evident.

Matching the maturity of a repo with the duration of the VM

Repo solutions currently cannot match the maturity of the repo with the possible duration of the VM. Most cleared OTC derivatives contracts are very long dated while repo transactions at the extreme go out for one year (perhaps two years exceptionally), which means there will be continual and significant roll risk and associated transactional costs.

Range of securities that would be accepted

Only high grade securities would be acceptable for such repo, such as government debt and supranational paper. There could be shortages of these during stressed market conditions.

Ensuring liquidity provision in both good and distressed markets

This VM funding requirement needed by PSAs would grow significantly if interest rates rise rapidly (when, due to the directional nature of their hedging, most PSAs would be pushed out of the money). This sudden demand for repo services could impose prohibitive costs or even overwhelm the market completely (i.e. demand would exceed supply).

The latter instance would, of course, mean that margin calls could not be met if repo were the only source of funding available to PSAs at the time. In the case of a bilateral OTC contract the counterparty could choose to postpone a VM payment and absorb the risk or cover the risk in some other way. This discretion is not open to a CCP in the case of clearing OTC derivatives. If a PSA failed to raise the cash required to meet a VM call for a cleared contract and its CM was not able to provide emergency funding (either from its own resources or, in extremis, from its central bank) to fill the gap the CM would be called into default by the CCP and all its positions – not only those of the PSA in question – would be taken over by the CCP.

A single PSA getting into such difficulties would be unlikely to bring down a CM. However, our view is that the repo market would not be able to cope with the aggregate demand from PSAs seeking to fund in full cash VM calls due to a severe interest rate movement (say 100bps) and PSAs would, as a result, not have access to funding needed to meet VM calls if they all chose to rely on the repo market, whilst remaining fully invested. Potentially (as suggested above) this could lead to the default of the PSA's CM, and consequently this is a source of systemic risk. It also means that the PSAs need to seek other ways to manage this contingent liquidity risk.

There is also an operational dimension. A period of volatile interest rates would probably mean that the rollover period would significantly reduce (even down to daily) as liquidity in all but the shortest term repo markets dry up. There may also be changes to the type of collateral accepted for repo (i.e. a move to even higher quality assets) and the size of haircuts would increase. All of this would mean PSAs, investment managers, custodians and CMs exchanging a large number of securities and large amounts of cash each day. The infrastructure and operations of these entities is built around normal levels of transaction numbers. The system currently has low levels of straight-through processing (STP) and relies on staff managing the workload and not making mistakes — this means it may lack the flexibility to cope with such stressed events. This translates through to a potentially significant increase in operational risk.

Ensuring the return of assets to PSAs that meet the same characteristics as those posted

Depending on the type of repo and agreements in place, there is a challenge around the re-use of the collateral.

If PSAs provide bonds for repo purposes, the cash provider can re-use them so there is a risk that the PSAs may not get back from the lender the same securities that they sold. There could be a shortage of the particular securities in the market at the time that they need to be returned, for instance. This could be obviated by having the repo agreement disallow the reuse of the securities. However, not allowing re-use would impact the price of the repo and the availability of repo capacity.

6.4   Collateral transformation by CCPs

6.4.1   Description of the solution

In this solution, instead of providing a CCP with cash to meet a VM call, the CM of the PSA would provide the CCP with high quality assets such as government bonds. The CCP would then use these assets to enter into a repo transaction with either:

a) a central bank; or

b) the marketplace, i.e. the commercial banks; or

c) the marketplace, with the central bank providing liquidity in times of stress -in order to generate the necessary cash to post as VM.

Figure 6.4: Collateral transformation by CCPs

The CCP arranging a repo with a sell-side bank would have many of the characteristics of the collateral transformation by CMs solution. If the repo transaction were done with a central bank there would be some differences, however.

The big advantage of the CCP being able to repo securities with a central bank would be that the bank has the ability to create liquidity and the CCP could therefore have

confidence that liquidity would be available in adverse market conditions. They could not have the same confidence if they were only able to do repos with commercial banks.

It is unlikely that an arrangement in which the central bank is the only provider of liquidity for repo would be acceptable to a central bank therefore this discussion assumes a solution whereby the CCP expects to use the commercial banks in 'normal' conditions and only uses the central bank in adverse market scenarios.

The key consideration then is whether central banks will be prepared to offer such a service to the CCPs in their jurisdiction. Currently most CCPs do not have routine access to central banks. Eurex and LCH.Clearnet SA are the main European exceptions with special banking licences, although these only have access to intra-day credit which is not suitable for the repo transactions. For repo they would need at least overnight facilities.

It is now clear that at least some central banks are planning to provide such facilities. The Bank of England Governor, Mark Carney made a speech in June 2014[43] in which he said:

"We all know that real markets can seize up in crises of confidence, threatening financial stability and the wider economy. Just as there will be times when central banks must backstop the banking system, there are also times when they should backstop core markets in a way that supports their contribution to the real economy but doesn't encourage excessive risk taking. That …… is why I can announce that, in the coming year, the Bank will widen access to our facilities to include the largest broker-dealers regulated in the UK and to those central counterparties authorised to operate in UK markets."

This follows a speech in October 2013[44] where he said that the bank was extending the range of collateral it accepted and the length of lending facilities it offered as well as reducing the cost of its facilities.

Whilst the practical detail of these announcements is still to emerge we view them as very significant to the way repo markets in the UK, and potentially across the EU if replicated by central banks elsewhere, will operate in the future. It has the potential to improve liquidity in interbank repo markets at times of stress. It could even, at least in theory, provide a foundation for CCPs to offer repo, as a principal, directly to their participants. Both would serve to reduce the risk of PSAs not being able to raise cash for variation margin when markets are stressed.

However, despite these developments there is still a question as to whether CCPs could be equipped to offer such a service or would even want to. When we interviewed CCPs during this study, albeit before the Bank of England announcements were made, they all indicated that they had very significant reservations about providing such a service, with the view that it would add to their risk profile (perhaps to an unacceptable degree). Reasons cited were:

- The competence of the CCP to become a repo market principal. They do not have, and may not wish to invest in, the necessary trading and treasury management capability (i.e. CMs and banks are best placed to offer such a service, as indeed they do now).

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43 Mark Carney: Speech at Lord Mayor's Banquet, London, 12th June 2014 –

http://www.bankofengland.co.uk/publications/Documents/speeches/2014/speech736.pdf

44 Mark Carney: Speech as part of the Financial Times 125th anniversary celebrations, London, 24th October 2013 -

http://www.bankofengland.co.uk/publications/Pages/speeches/2013/690.aspx

- The extra concentration of risk in the system that would be created by such arrangements.

- The offering of such a service would put the CCP in direct competition with one of the business lines of its membership.

That said, several CCPs interviewed indicated that, if another CCP offered such a service and did it well then they would be forced to respond due the competitive advantage conferred on the first CCP to offer this service.

These reservations were shared by other participants. The primary concern was the potentially destabilising effect during the default of a CCP participant of the CCP having to unwind repo transactions, in which it was a principal, at the same time as liquidating or transferring the defaulter's OTC derivatives contract portfolio. Currently CMs have confidence that they understand the CCP's default procedures and risk management policies sufficiently to understand the potential impact on the CCP of a default and to assess the counterparty risk of the CCP. The need to unwind a portion of the repo book in which the CCP was itself a principal would add a further dimension to this assessment. It would increase the counterparty risk and naturally there would be uncertainty about how large the increase in risk would be.

Overall the reaction of the CMs to this solution ranged from lukewarm to complete rejection of the concept (including giving up membership of a CCP if it tried to offer this service). On the other hand, if such a service existed, at least some CMs indicated that they would consider using it, especially if their clients wished them to, provided it was clear that the CCP had properly covered the increased risks.

Even though CCPs may choose not to offer repos as a principal to participants it does not mean that CCPs can do nothing to improve the functioning of the repo market. As mentioned in section 6.3.4, Eurex is looking to enhance its existing GC Pooling service (in which it acts as service provider) to allow PSAs to act as principals in it, reducing the counterparty risk that would result from increased repo activity.

Other CCPs are also looking at assisting the repo market and are at different stages of planning but, again, only on a service provider basis. LCH.Clearnet's RepoClear service does not currently offer client clearing[45] however Michael Davie, CEO of LCH.Clearnet, speaking in May 2014, discussed the possibility of giving PSAs direct access to its repo clearing service and said that LCH.Clearnet was discussing with the industry how this could work in practice.

6.4.2   Benefits of the solution

The fundamental assumption of this solution is that the CCP's central bank would offer liquidity in times of stress. Consequently the main risk of the changes being imposed by EMIR, as perceived by PSAs (liquidity risk), would be eliminated.

6.4.3   Costs of the solution

Due to the minimal amount of work undertaken by CCPs, CBs and others on this solution it is difficult to quantify the costs. If the CCPs undertook this role as a cost recovery service to the industry then it could potentially be cheaper than collateral transformation by CMs, but there really is not enough information available at this stage to determine that.

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45 LCH.Clearnet's SwapClear service does offer client clearing, but the two services have separate sets of rules and rule changes involve consultation with the respective groups of current users.

6.4.4   Risks of the solution

The following are the key risks and issues impacting on this solution.

Change in the risk profile of CCPs

In order to offer such services, CCPs would have to develop new management, operational and risk management capabilities which they do not currently have. Default procedures would have to change significantly and they would need to take into consideration the VM funding side of clearing in addition to the current risks they manage. This means that they would be increasing their risk profile and become even more systemically critical than they currently are. Such an increase in their risk profile is likely to be a major concern to regulators. Any such change in default procedures would be subject to regulatory approval, which may well not be given.

The actual access CCPs have to central bank repo facilities in order to ensure liquidity in both good and distressed markets

Currently no CCPs have such access. As mentioned above, two have intra-day liquidity facilities but we are not aware of any more extensive arrangements being discussed between central banks and CCPs. The key to making this solution work would be to ensure that the CCP has unrestricted access to liquidity against high quality collateral, as large volumes of VM cash may need to be available at times of market stress when interest rate volatility may be high.

If a central bank were to provide a CCP with an unlimited liquidity facility it is likely that the terms and limitations of access to the CCP services which were supported by the facility would need to be very specifically and narrowly drawn – e.g. restricted to the funding of VM related to client clearing of relatively low-risk investors, such as PSAs.

However, in a distressed market situation, PSAs may prefer to obtain funding from their existing (non-CCP) counterparties, who could assess them on their commercial value and specific credit risk, meaning that they might access the necessary liquidity at more competitive prices than with a CCP where all clients are treated equally.

Also, in times of market stress, it is likely that the average repo term available would shorten significantly. This would put greater demands on all the players in the system - PSAs, investment managers, CMs, CCPs and the central banks.

Matching the maturity of a repo with the duration of the VM

If such a solution was adopted then it could benefit from long term repo facilities being provided by the CCP but would, of course, increase the risk to the CCP if corresponding terms could not be sourced on the other side. Such long term facilities are not a feature of the existing repo market.

Range of securities that would be accepted

In order for this solution to operate it would, as for collateral transformation by CMs described above, be essential for PSAs to have enough high quality assets (government debt or supranational paper) to be used for such a repo service. As indicated above, there probably is enough high quality collateral available generally and our fieldwork suggests that PSAs are holding significant quantities of high quality collateral.

The CCP would be likely to specify a general collateral[46] basket of securities any mixture of which would be eligible as collateral for such a service as this. This would

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46   General collateral or GC is the range of assets that are accepted, at any particular moment, as collateral in the repo market by the majority of market intermediaries and at a very similar repo rate.

mirror the collateralisation approach of central banks when providing liquidity to credit institutions.

Ensuring the return of assets to PSAs that meet the same characteristics as those posted

A consequence of a collateral pooling approach would be that PSAs would not be guaranteed to receive back the exact securities they originally posted. The acceptability to PSAs of this would depend on the collateral basket specified by the CCP and the investment and asset management policies of the PSA. However, the loss of control over assets could be an issue in some Member States. For example, under Danish regulations pension funds must keep an asset register, and therefore require the exact assets put up for VM to be returned to them.

The acceptance by central banks of unlimited amounts of repo exposure over long periods at a fixed price

A difference between this solution and collateral transformation by CMs is that it would involve the central banks potentially providing funding for the duration of a market disruption for a specific part of the financial market community. There is precedent for this, as such long term funding by central banks to commercial banks was crucial to the efforts to resolve the recent financial crisis. However, if a central bank-backed repo service was only offered to PSAs there could be opposition from other financial market participants (or the request for an extension of such facilities to themselves). Also, the provision of such funding does not come without cost to the central banks, and such support would probably be construed as a subsidy from the tax-payer to the PSAs. This could make it politically difficult to implement.

Differential access of CCPs to central bank liquidity

The provision of central bank liquidity to PSAs would, in itself, be unprecedented. Also, there is a very real risk that this arrangement could give rise to competitive distortions in the market unless all relevant CCPs had similar access to central bank liquidity resources. If only one or a few of the CCPs could provide such a solution, it would distort the market, potentially disadvantaging other CCPs.

6.5 Direct acceptance of non-cash assets with pass through to receivers of VM

6.5.1 Description of solution

The fundamental proposition of this solution would be that CCPs would allow participants to post and receive variation margin in either cash or securities. Our working assumption is that the securities which the CCP deemed eligible to be used for this purpose would be government bonds with high credit ratings. A PSA which had elected to pay and receive VM in securities would, on being notified of a variation margin call by the CCP via its clearing member, instruct its custodian to transfer securities to the value required by the CCP into the name of the CCP. When a PSA which had elected to pay and receive in securities was due to receive VM the CCP would be instructed by the CM to transfer securities into the name of the PSA at its custodian. The basic flow would therefore be as shown in the following diagram:

Figure 6.5: Direct acceptance of non-cash assets
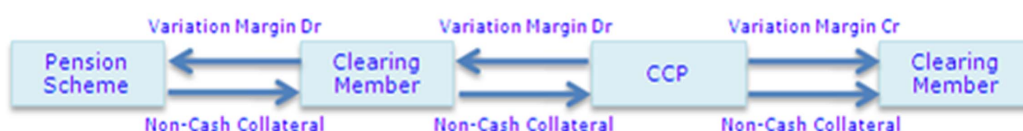
There are two potential variants on this basic concept:

a) The securities could be passed through to the VM receiver with the right for the receiver to reuse the securities and hence to be able to realise their value.

b) The securities could be passed to the receiver with a contractual requirement to return them should the receiver become a payer of VM, so that they can be returned to the PSA that originally posted them if and when the original poster became a receiver of VM. The legal form of this could be as title transfer to the VM receiver or as a pledge which would be in place until the expiry of the contract or some predetermined earlier date at which time a title transfer would be triggered.

Consequences of uncertainty over collateral form

Under existing bilateral CSAs it is common for the parties to be able to pay VM in either cash or securities but the industry has increasingly recognised that the valuation of the swap has to be related to the nature of the collateral and that, if there is uncertainty about the collateral which will be received, there will be uncertainty about the valuation of the swap.

In the case of bilaterally settled contracts there is the possibility for the parties to negotiate how the swap should be valued in order to take account of the variability of collateral allowed under the CSA. In a multilateral clearing situation, where, once the trade has been novated, the direct connection between the trading parties is broken, there is no possibility for this type of negotiation and the valuation method has to be standardised.

Even for bilaterally settled contracts there has been a significant move towards reducing valuation uncertainty with the introduction in June 2013 of the ISDA Standard Credit Support Annex (SCSA)[47] in which only cash, in the same currency as the swap, is eligible for VM. Whilst the original ISDA CSA can still be used the SCSA is a demonstration of the direction in which the industry is moving.

We conclude, therefore, that the market would not accept a cleared contract where the form in which VM was to be received was uncertain and a contract in which non-cash VM was the only option would also be unacceptable to a large portion of the market. Consequently, for this solution to be acceptable to the market, a CCP would have to offer for clearing two parallel sets of products with the same fundamental economic terms – one for which VM would be paid and received in cash and the other for which it would be posted and received in specified eligible securities. This is for the following reasons:

- Most counterparties require cash collateral to contribute to the funding of the swap and related hedges.

- If the parties to the swap were uncertain whether they would receive cash or securities as VM it would mean that the valuation of the swap would be less certain and the spread for the product would widen. This is discussed further in section 6.6.

- It is not feasible in a multilateral clearing service for the CCP to offer a product which allows participants the option of choosing the form in which they post and receive VM. This is also discussed further in 6.6.

There would be a significant difference in the conceptual basis of VM between the cash and non-cash VM products. VM payments and receipts for the cash products would be treated as a settlement and the receiver would be able to use the cash as it saw fit –

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47 http://www.fpml.org/wgroup/scsawg/First-Draft-Annotated-SCSA.pdf

conceptually similar to the way VM is treated in futures markets and in current OTC clearing services. Securities received as VM for the non-cash products would be considered as collateral which the receiver had a duty to preserve and return over the course of the contract – conceptually similar to the way VM is treated for bilaterally settled OTC derivatives contracts.

In order to reduce pricing uncertainty, the specifications of cleared contracts with non-cash VM would need to allow a much narrower range of acceptable collateral than that currently seen with OTC CSAs. This would reduce market liquidity.

Securities posted as VM would not be subject to a haircut. If a haircut were applied it would protect the receiver of VM against a fall in the value of the securities during the settlement cycle but it would be a consistent additional cost to payers of VM and windfall income to the VM receiver in the event that the market price did not fall during settlement or, indeed, rose.

6.5.2   Benefits of the solution

This solution is attractive prima facie because it would allow securities held in the PSA's investment portfolio to be posted as VM without them having to be liquidated and the PSA thereby losing investment return. Unlike the solutions described in 6.3 and 6.4, it does not rely on cash liquidity being available from other parties and therefore would be more robust during stressed markets, when liquidity may be tight.

6.5.3   Costs of the solution

The consequences of the CCP offering parallel sets of cash and non-cash contracts would be:

- Separate market prices for the parallel sets of cash and non-cash contracts to reflect:

  - the impact on counterparty bank's swap funding of the different collateral;

  - the different reference rates used for valuing the swaps;

  - the lower liquidity of securities compared to cash; and

  - the credit risk of the securities and the uncertainty in assessing the risk for receivers of VM, since they cannot predict exactly what security they will receive.

- Less liquidity in each contract with the probability of wider trading spreads.

- Less flexibility in porting or liquidating the positions of a defaulting participant.

Operational costs related specifically to the use of securities for VM would be:

- The costs of modifications to CCP, CM, Custodian, asset manager and PSA systems. Systems would need functionality added to do the following:

  - The CCP's system would, in the case of variation (b) described in section 6.5.1 need to maintain a trace of the specific securities received as VM, the CM they were received from and the CM they were paid out to.

  - The CM's, PSA's and custodian's systems would, in the case of variation (b) have to record securities received as VM in a segregated way so that those same securities can be used to satisfy future repayments of VM.

- On expiry of a contract the CCP's, CM's, PSA's and custodian's systems would have to record the fact that securities received as VM against the expiring contract no longer need to be held against possible VM repayment.

- The CCP's, CM's and PSA's systems would have to account for differences between the value of the securities posted and the VM value called for and to process the settlement of the differences in cash.

- The CCP's, CM's and PSA's systems would have to account for income earned on the securities posted and received as VM. In the case of variant (b), if the securities were received under pledge the income would have to be paid to the originator of the securities, via the CCP and respective CMs.

These would run into many millions of euros for the industry as a whole.

- Direct custodian and Central Securities Depositary (CSD) fees related to movements of securities to and from the CCP.

- Increased back office staff costs for asset managers, CMs and CCPs to handle the additional operational complexity.

- A level of over-collateralisation created by participants wanting to reduce the number of securities movements and therefore leaving collateral with the CCP until a headroom threshold has been attained. This would be a particular concern in the case of some CCPs such as CME Clearing where excess collateral is included in the default waterfall. Currently there is no concept of excess VM under current clearing models and this would therefore require further legal work on segregation and default rules.

6.5.4 Risks of the solution

Acceptability to in-the-money counterparties of VM paid in non-cash assets

For the reasons discussed in 6.5.1 above we would expect that choice over the form of collateral posted and received would be provided by having two distinct contracts forms available for trading. Therefore non-cash VM would be acceptable to the in-the-money counterparty since they had chosen to trade a specifically non-cash VM contract.

However, this solution has a number of serious disadvantages:

- A two tiered market would make trade reporting confusing as prices would be weighted in some cases by the VM terms and therefore create noise in market transparency.

- It would result in a divergence of pricing between the cash and non-cash VM contracts which in turn would lead to the non-cash contract being used by a minority of market participants and therefore having low liquidity.

- Since there would almost certainly be a range of securities eligible for VM it would be difficult to value the non-cash VM swap.

- It would be operationally complex and create practical difficulties due to the short term nature of VM – both the need to meet VM obligations at short notice and the two-way variability of VM.

- Passing securities through to the receiver of VM would not meet some PSAs' requirement to keep control of their assets.

Our view is that these issues are so serious that it would make the solution unusable by the majority of the market. This view was borne out by our fieldwork. All the clearing members and CCPs which commented on this solution were negative to it. Of the PSA fund managers interviewed all the UK firms said that they had concerns that their fiduciary duty to maintain control of the assets would be difficult to satisfy with this solution. Some Dutch firms, however, said that they would prefer to pass bonds as VM.

Scope for the return of assets to PSAs that meet the same characteristics as those posted

Initial margin will be returned to participants by the CCP at the expiry of the contract to which the IM relates. Variation Margin, however, has different characteristics. It reflects the increase or decrease in the value of the contract since trade date and is payable or receivable each day depending on the contract's value on that day, the extent to which the contract is in or out of the money compared to its initial value and the aggregate amount of VM paid or received to date. VM will not be repaid on expiry of the contract as it is a settlement payment, although a counterparty which has received VM in relation to a particular contract may, at any point during the life of the contract find that it has to pay VM because the contract's value moves against it.

A PSA therefore could not expect to have returned to it all the VM it posted against a particular swap. We can, however, examine whether it would be possible, as and when VM is repaid, for it to be in the securities originally posted. In order to achieve this, the cleared contract would need to be similar to variant (b), outlined in 6.5.1 above. This has some important differences to variant (a):

- A receiver of VM would be required to hold on to the collateral so that it could be returned in the event that the receiver becomes a payer of VM. The receiver would therefore not be able to use the VM to fund the swap.

- If a receiver of VM was later required to pay VM the volume of securities required to cover the VM call would be calculated at the price of the securities on the call date. This means that, even if the original VM payer received back the same securities it could have effectively made a gain or loss on them because of the difference in the market price of the securities when it paid VM to the price when it received VM.

- In order for the trace between VM payer and receiver to be maintained as far as possible the VM payments calculated by the CCP for a particular participant would have to be made gross to and from the CCP rather than inward payments being netted with receipts as would be conventional for cash VM derivatives.

If it was acceptable to PSAs to receive back VM securities "with the same characteristics" as those it originally posted rather than the exact same securities variant (a) described in 6.5.1 could go some way to satisfying the requirement. The CCP would specify a general collateral basket of securities any of which would be eligible to be posted as VM. This would involve consultation with PSAs and their counterparties to determine a group of securities with sufficiently similar characteristics that the PSAs would be comfortable posting and receiving any of them without the variability of collateral having an impact on the valuation of the swap. There is, of course the possibility that PSAs would not be able to agree or that they agreed on such a narrow set of securities that the bundle would not meet the CCP's liquidity risk or concentration risk policies.

Our understanding is that no CCP currently has the systems capable of managing securities collateral used for a VM arrangement in which it is paid out to in-the-money counterparties. Indeed, we have no evidence that they have put much thought into

the cost of developing such systems. However, we have set out some of the additional functionality which we consider would be required in section 6.5.3

Measurement and monitoring of the value of non-cash assets by CCPs

The type of non-cash assets which CCPs would accept as collateral is likely to be highly rated and liquid government bonds for which real time prices are available. It is quite possible that this would be a subset of the securities eligible as collateral under existing CSAs precisely because the CCP needs to be confident in the liquidity and valuation of the collateral.

The CCP should, therefore, be able to maintain a real time view of the current value of the collateral it is passing to and from participants (the CCP would already have to do this because it would hold similar securities as IM).

Operational issues

Participants posting non-cash VM would have to be able to transfer the securities into the name of the CCP on the same day as the collateral call is made. However, this would be difficult to achieve in practice since most CSD settlement systems work on too long a settlement cycle. If the PSA were to hold its securities with a custodian with which the CCP also has an account the transfer could then be internalised within the custodian and not be subject to the settlement timetables of external CSDs, but PSAs may not want to choose their custodians on this basis. However, they may need to for this model to work.

One further difficulty is that securities can only be exchanged in transferable units. In the case of bonds these units can be quite large. Since the VM amounts payable or receivable will be calculated by the CCP in monetary values the CCP would need to set a market convention for how these values are to be converted into the deliverable quantity of whatever security the VM payer chooses to post. This would inevitably result in rounding differences which, depending on the securities involved, could be considerable.

These rounding differences would have to be accounted for and cash adjustments made between the CCP and the clearing members and would need to be covered by changes to the CCP's rules.

If the solution conformed to variant (b), outlined in section 6.5.1 above, and the securities were moved to the VM receiver under a pledge, any interest payments received on the securities would be due to the beneficial owner, i.e. the original VM poster, under current conventions relating to pledged collateral. This would cause considerable operational complications:

- Firstly the CCP would have to monitor coupon events on all the securities eligible for VM and demand payments from VM receivers and pay it out to VM posters on coupon dates.

- Secondly it would distort the economic impact of the contract since interest would be paid to the original VM poster and yet the securities may never be returned.

The question of how coupon payments would be treated under this solution would therefore need legal determination in order for the idea to be developed further.

6.6 Acceptance of non-cash assets with security interest passed through to receivers of VM

6.6.1 Description of solution

In this solution the CCP would allow participants to post variation margin in securities. In order to meet a variation margin call the PSA would instruct its custodian to transfer securities to the account of the CCP. Unlike the solution described in 6.5 above, the CCP, instead of passing on the securities to the counterparties due to receive VM, would create a security interest over the posted securities, in favour of the VM receiver.

Figure 6.6: Acceptance of securities with security interest passed through

Since the receiver of VM only receives value for the security interest in the event of a default, this solution is less a way of managing VM, more a fundamental alternative to VM. The overall purpose of a derivatives contract with daily mark to market and cash settlement between those out of the money and those in the money is that it resets the risk between the participants and the CCP to that of the close-out risk in the event of default of one of the participants. The solution described here could, perhaps, better be described as a "variable IM" model in which out-of-the-money parties are required to post additional collateral on top of the initial level of IM but the collateral remains within the CCP's ambit in normal operation even though some of it is earmarked to in-the-money parties. This contract form is not unknown but it does have a different economic content to the current norm in the OTC swaps market. As mentioned earlier, the economic impact of a cash settled VM contract is to erase on a daily basis the counterparty exposure arising from market moves: in the case of a variable IM contract, a security interest or a claim on a security would not erase but merely mitigate the counterparty risk of the daily exposure and expose the receiver to the market risk and credit risk related to the value of the claim. In the event of default, the recipient of the claim would be subject to a loss (or a gain) and to the uncertainty of the value of his claim until its liquidation. This additional risk borne would imply that contracts in which VM is not cash settled should be priced differently and be more expensive than regular cash settled ones.

Many of the issues outlined in the discussion in section 6.5 above result from the fact that the value of the securities used for collateral have a varying relationship to the cash flows in the underlying swap. Those issues would consequently also affect this solution. We assume that a contract with security interest passed through would also have to be offered in addition to, and not in replacement of, a parallel contract with cash VM.

The securities posted by VM payers would be subject to a haircut, set by the CCP, to cover the market risk relating to the securities the security interest held for the VM receiver would be over the same volume of securities as was posted by the VM payer.

6.6.2   Benefits of the solution

Similarly to the model described in section 6.5, this solution is also attractive because it would allow securities held in the PSA's investment portfolio to be used, in this case to cover the variable IM, without them having to be liquidated and the PSA thereby losing investment return. Again, unlike the solutions described in sections 6.3 and 6.4, it does not rely on cash liquidity being available from other parties and therefore would be more robust during stressed markets, when liquidity may be tight.

6.6.3   Costs of the solution

Legal risk

A crucial open question at present is whether the security interest would have a consistent legal basis across the EU. The complexities and differences in the law on security interests in the different member state jurisdictions would make the concept very uncertain in a default situation, which is exactly when it needs to work predictably.

One CCP said that it was interested in the concept and it was being investigated but that they had not yet addressed the legal aspects and they had doubts about the solution working in practice.

Overall, the great majority of CMs expressed the view that this option was not feasible. Two PSAs said that they would prefer this option as long as the assets were held at their custodian with the CCP having a charge over them - this would be similar to the quad-party model discussed in section 6.8 below. One PSA fund manager said that, if technically feasible, this would be their preferred option but recognised the probability that the market would be bifurcated (see discussion below), with two different swap prices, and the likelihood of over-collateralisation might also make this solution problematic.

Counterparty appetite to accept a cash claim on the CCP instead of an immediate receipt of cash

As discussed in section 6.5, our view is that many market participants would not accept a claim instead of actual cash since the cash collateral is an important element in funding the swap. As far as this solution is concerned we have therefore also concluded that, if a product with security interest as receivable VM were to be offered, it would have to be in addition to, not replacing, the conventional cash VM product. Hence this solution would have many of the same consequences as that involving securities pass through, such as:

▪ Separate market prices for the parallel sets of cash VM and non-cash VM contracts.

▪ Less liquidity in each contract with a possibility of wider trading spreads.

▪ Less flexibility in porting or liquidating the positions of a defaulting participant.

Operational costs

PSAs would face custody and settlement costs related to the posting of VM securities to the CCP. There may also be some inefficiency as a result of over-collateralisation created by posters of VM wanting to reduce the number of securities movements.

CCP reuse of the posted securities

Unlike the solution in described in section 6.5, the CCP would not need to reuse the posted securities. However, it would need to be able to create a charge over the securities in order to pass on the security interest to the receiver of VM. The securities posted by givers of VM would have to be unencumbered and the PSA would

have to allow a security interest, to the benefit of any receivers of VM the CCP should choose, to be created over them. Most PSAs have rigorous policies to ensure that they maintain proper control of their assets, particularly when they outsource some of their responsibilities to fund managers and/or custodians. This solution would require some PSAs to alter their asset management policies in order to allow a security interest to be created over assets posted as VM. It would also require CCPs to take new powers in their risk management and treasury policies and their participation agreements. We would expect these issues to be solvable.

Application of 'haircuts' on the value of the collateral

Haircuts on the securities posted by VM givers would be set by the CCP and the same haircuts would, in effect, be applied to the value of the security interest passed on to VM receivers. The CCP would need to determine the haircut by taking into account the additional risks associated with dealing with securities collateral and the securities interest held by VM receivers in the event of default.

The respective policy of the CCP would be published to participants and be open to scrutiny by its regulator.

6.7 Quad-party collateral for VM security interest

6.7.1 Description of solution

This solution is a variation on the one described in section 6.6. It would allow the PSA to use securities for VM without transforming them into cash, the collateral being provided in the form of a securities interest. The PSA would outsource its collateral management to a custodian in an arrangement formalised between the four parties involved - the PSA, the CM, the CCP and the Custodian.

Figure 6.7: Quad-party collateral for VM security interest
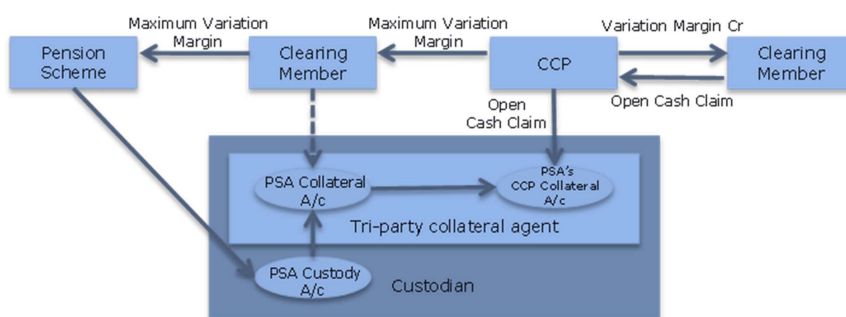
The PSA would transfer securities to be used for collateral into an account to be controlled under the quad party agreement. It would be a segregated account in the name of the PSA. On receiving a VM call from the CCP the CM would instruct the Custodian to move the required value of securities from the PSA's account into a collateral account in the name of the CCP. The CCP would then allocate the collateral received from VM payers to VM receivers by recording a security interest over the securities held to its name by the Custodian in favour of each VM receiver.

The solution would build on existing tri-party collateral management services and would be similar in most respects to quad-party collateral services already proposed by some custodians to meet the needs some buy-side firms have for segregation of their assets from their service banks.

6.7.2   Benefits of the solution

This solution has similar benefits to the solutions described in sections 6.5 and 6.6 in not requiring PSAs to liquidate securities to meet VM calls. In addition, as the collateral is not being passed to the CCP via the CM it would be possible for the CCP to obtain value against the security interest in the event of the default of the CM without it being delayed by the liquidator of the CM.

6.7.3   Costs of the solution

Swap pricing

The market costs of there being parallel sets of cash and non-cash contracts would be similar to those for solutions described in sections 6.5 and 6.6.

Operational efficiency

The solution could build on efficient existing tri-party collateral systems. It would not involve the frequent movement of securities or cash between systems and it would lend itself to STP integration with the CMs' and CCPs' systems. However, we would expect the current collateral management systems of custodians to require some development in order to provide a quad-party service.

Costs of the solution

There would be service charges - both annual charges and per transaction fees - to be borne by the PSA but it is difficult at this point to estimate what these would be.

6.7.4   Risks of the solution

Many of the characteristics of the previous solution would also apply here:

- It is a "variable IM" concept rather than a daily settled VM concept.

- Counterparty credit risk against the CCP could build up significantly over the life of the contract.

- It would probably result in a split market between a cash VM contract and a non-cash contract.

- The legal treatment of securities interests varies across the EU.

- CCP-determined haircuts would apply.

- The PSA trustees would have to agree to a certain portion of the portfolio being under the control of the quad-party arrangement.

The general view of the firms interviewed was that, because the nature of the security interests over the collateral securities is complex, this solution would present too many legal difficulties in a default situation.

Discussion amongst participants of this option as a potential solution to the challenges of buy-side clearing seems to have diminished recently, having been largely overtaken by the individual segregation opportunities offered by CMs.

6.8   Agency stock lending

6.8.1   Description of solution

This solution is not a way of posting non-cash collateral but another form of transformation in which a PSA raises the necessary cash for meeting VM calls. Stock

lending is similar to repo but, in this case, the PSA would lend securities from its portfolio (mediated by an agent) to other market players who actually have a need for that security (such as to meet a delivery obligation where they are short of the stock, due to operational difficulties or deliberate short selling). Collateral is taken by the PSA to ensure the return of the assets lent and, if this collateral is taken in the form of cash, that cash could be used for VM purposes.

Although banks could arrange the stock loans, they would be acting as agents and the repos would, therefore, not be on their balance sheets.

As a component of their investment strategy, stock lending is already used by many PSAs as a way of enhancing portfolio returns. However, as the ability to lend depends on the needs of other players to cover short trading positions and on the state of the market, stock lending cannot be viewed as a consistent source of funding and certainly not a complete solution to the problem.

Figure 6.8: Agency stock lending

A PSA could, however, adopt a strategy of being more active in the stock lending market and using any cash raised to reduce the amount that is needed to be raised by other means. In this way it may be able to reduce the extra cash requirement which comes with mandatory clearing.

6.8.2 Benefits of the solution

This solution is a continuation and enhancement of an existing common practice. PSAs are very familiar with it, the supporting legal agreements are mature and well understood and custodians have established infrastructure to support it. It, thus, does not require any new systems, legal work or operational procedures. The loans also generate income from the borrower and therefore enhance investment returns.

6.8.3 Costs of the solution

PSAs do not pay directly to use such a service but are, in fact, paid a fee by the borrower. However, most loans are mediated through the PSA's asset manager and an agent who together charge up to 40 per cent of the income received from the borrower.

6.8.4 Risks with the solution

Availability of sufficient liquidity

The key issue is that the stock lending market can give little certainty of the amount of cash that can be raised. Whether counterparties actually want to borrow stock (and it is usually primarily equities) and for what duration (and most loans are of short duration) is outside the control of the PSAs. In times of market stress, when short selling may actually be banned for some security types and other market participants also have liquidity squeezes, the market may dry up completely. Finally, the volume of stock lending tends to be very seasonal, varying with the dividend seasons of European markets.

Some interviewees commented that the stock lending market is actually becoming less attractive than it was. Reasons cited were the possible introduction of a Financial Transaction Tax on such transactions and counterparty risk issues. The former is outside the scope of this report. The latter, however, could clearly be helped by

increased use of cleared stock lending services, such as those currently offered by Eurex and SIX. Such arrangements are not heavily used yet, but may eventually become attractive to the whole industry as securities lending falls into in the same category as OTC derivatives and repo in terms of capital requirements. From a regulatory perspective, therefore, a CCP cleared solution would have the same impact on the capital requirements for securities lending transactions as it does on repos.

6.9   Secured lending by cash-rich corporations

6.9.1   Description of solution

During the course of the study a further potential solution was identified - the possibility that non-traditional sources of cash could be tapped to help provide liquidity for VM payments by well capitalised OTC derivatives parties such as PSAs. In particular many large corporate entities presently have very significant cash reserves and some have become concerned about depositing their cash, without security, with the banking sector. If the need of cash-rich corporates to lend securely could be brought together with the need of PSAs to have a source of cash to allow them to pay VM without liquidating securities there could be a solution which is attractive to both.

We believe that at least one of the organisations interviewed has put considerable thought into how such a service could be arranged but there are not yet indications that it would definitely be launched.

Figure 6.9: Secured lending by corporations
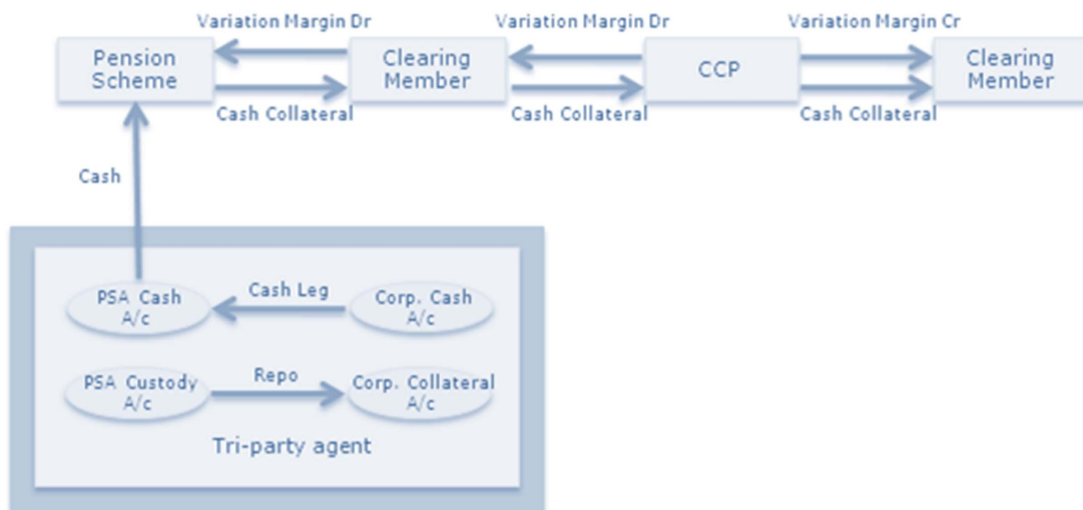
The solution would involve essentially a repo mechanism with a PSA repo-ing securities and receiving cash from the corporate entity as collateral against the repurchase. The service would be operated by a third party or parties. The main characteristics of the arrangement would be as follows:

- The service would be similar to tri-party repo facilities currently offered by custodian banks and ICSDs such as Euroclear and Clearstream.

- The corporate entity and the PSA would be the principals to the repo contract.

- The service operator would hold securities and cash accounts for the participants and would administer the cash and securities flows related to each repo contract on behalf of the principals.

- Corporate entities and PSAs would be direct participants in the service.

- Although banks could arrange the repo deals they would be acting as agents and the repos would therefore not be on their balance sheets.

- The service operator could define standardised repos for particular bundles of eligible securities, which would maximise liquidity and the ease with which repos could be arranged and which would allow securities to be substituted during the life of the repo. It could also administer the repo-ing of specific securities, which would ensure that the PSA received back the original security on the return date.

- In order to ensure that repos could be executed with immediate effect the securities involved would need to be held within the service. This in turn would mean that, for it to be efficient the service would need to have a critical mass of lenders and PSAs.

- In order to be able to draw on cash held across the globe the operational hours of the service would need to be extensive.

Operational efficiency

This solution would be based on existing tri-party models which, once the tri-party agreement is in place, allow for transactions to be administered through their lifetime by the service provider with little effort from the counterparties.

6.9.2   Benefits of the solution

The primary benefit of this solution would be that it provides for a new source of cash to be brought into the system, potentially alleviating the liquidity squeeze that a reduction in traditional repo activity may cause (particularly in times of stress).

It would also offer benefits to corporations which want to lend to highly creditworthy counterparties; want to spread risk by having a broader group of borrowers; or want to lend to borrowers other than credit institutions.

6.9.3   Costs of the solution

It is difficult to forecast the cost of a service when it is at the stage of a broad concept. In general we would expect it to be competitive with the cost to a PSA of a conventional tri-party repo.

It is likely that some new systems infrastructure would need to be developed and legal and regulatory work would be required to establish the service. Therefore the service provider would incur up-front costs which would need to be recovered during the operation of the service.

6.9.4   Risks with the solution

Service Provider

One of the prime issues would be how to bring together a sufficiently large community of lenders and PSAs to make the liquidity available sufficiently attractive and the service cost efficient. This "critical mass" challenge is the crux of many new financial market initiatives but in this case it has an additional dimension. The central participants - corporates and PSAs - are clients of the banks. Setting up an infrastructure service in which the principals are bank clients could be seen as disintermediation, which has traditionally been viewed negatively by banks.

In order to keep the repo transactions off bank balance sheets the service really needs to be operated through a CSD-like body and the major International CSDs would be

the natural providers of this service. Euroclear Bank, for example, already allows corporates to be participants but only as liquidity providers. However, PSAs are not eligible to be participants. A group of banks effectively control Euroclear's participation criteria and moves in the past to change the criteria to include investing institutions have not been successful. Even if PSA participation were limited to tri-party repo services this could be seen by the bank participants to be the start of a slippery slope to broader scale disintermediation. If regulators thought it was desirable for PSAs to have direct access in order to secure liquidity and reduce systemic risk, they could, conceivably, force the issue but this seems unlikely.

One custodian bank (BNY Mellon) already operates a CSD in Belgium which provides securities issuing services and has ambitions to provide services for investors. The London Stock Exchange Group will establish a new CSD in Luxembourg during 2014 and JP Morgan has announced that it will use it as part of its international collateral management service. It is unlikely, however, that this solution would reach critical mass if the service were operated by a single bank. In order to get wide usage the customers of multiple banks would need to participate.

A neutral CSD, with open access for corporates and PSAs located in a wide range of countries, could be the appropriate vehicle to operate the service. This could, conceivably, be provided by the LSE's Luxembourg venture provided it has sufficiently open membership criteria and could attract multiple banks to support it. A CSD owned by a consortium of banks could also be a possibility.

Form of contract

We have described this solution as a vehicle for facilitating repos but that would not have to be the form of the contract between the parties. It would be possible to use a similar structure for handling secured loans between corporates and PSAs. A secured loan transaction may be more acceptable than a repo for some participants because:

- Some corporates may not be familiar with repos and not have the administrative resources to deal with them.

- The loan terms could be more flexible, making it possible to repay the loan when the PSA chooses rather than having to specify a repo return date.

Availability of sufficient liquidity

The motivation for the cash-rich corporations is seeking additional return on their cash. This suggests several issues. Firstly, the cash is on balance sheets because of a lack of suitably attractive investment opportunities and has not been returned to investors due to a mix of faith in future opportunities and perhaps also the associated tax effects of returning cash to investors. These motivations may not be maintained indefinitely.

Secondly, the demand from PSAs is likely to be volatile – if the cash-rich corporations have the appetite for the additional treasury management implied by that, it would be priced into the offering.

Therefore this solution would have to be seen as a potential additional source of VM cash for PSAs not the complete solution to their needs.

One potential benefit of this solution, though, is that corporates and other cash rich bodies may not be so negatively impacted by adverse market conditions as CMs which have many other market activities to fund. Therefore, they may actually be a more stable source of funds in these circumstances.

Additional sources of cash

CCPs themselves hold significant quantities of cash - principally IM - which they have to invest. If CCPs were able to reverse repo this cash to PSAs it could provide an additional source of liquidity.

However, under the EMIR Technical Standards CCPs have restrictions on where they can invest cash. On the face of it these appear to allow CCPs only to deposit cash with banks with a low credit risk. We understand that CCPs have been seeking clarification on this restriction and some believe that the legislation may permit lending by CCPs to PSAs. This may need to be the subject of future clarification by regulators. If CCPs were allowed to reverse repo cash to PSAs it would not only provide a further source of liquidity for the PSAs but it would also provide CCPs with an opportunity to lend, with good quality collateral, to a more diversified range of counterparties and hence to reduce their concentration risk.

Interestingly, one CCP told us that, in their experience, in times of market stress when VM calls are likely to be higher, the proportion of margin that they collect which is in cash rises.

6.10 Summary of analysis of technical solutions

All of the models described above are theoretically possible but most have technical, cost, risk, market impact and practicality issues which would have to be resolved before they before they could be available to PSAs to meet their VM needs.

Below we summarise the key benefits, costs, risks and market capacity of each potential solution. In order to compare the solutions, we have assessed and charted the impact each solution would have on the following factors:

- Market Capacity (i.e. the ability of the market to provide the necessary VM, both in normal market conditions and in times of stress).

- Impact on Investment Performance (i.e. the direct investment returns of the PSAs).

- Impact on Swap Market (i.e. market liquidity and pricing).

- Legal & regulatory complexity and risk.

- Operational Cost (in normal market conditions).

- Operational complexity and risk (in normal market conditions).

- Investment required (in people, systems, legal work, etc.).

- Counterparty Risk.

The radar charts below represent our assessment of these factors. The more positive the assessment the further the plotted point is from the centre of the chart.

6.10.1   Collateral transformation by CMs
Benefits of the solution

- It is close to current market practice. Most CMs are able to offer repo facilities to their clients and many PSAs and their investment managers already use repos.

- Most PSAs hold high quality bonds which would be readily acceptable collateral for repo transactions.

- The PSA would also retain its exposure to the securities it repos, thereby meeting one of their key objectives.

- The solution uses existing legal and regulatory structures and would not require new ground to be broken in this area.

- It would not have any impact on the pricing of the cleared swaps.

Costs and risk factors

- PSAs and their investment managers would need to develop their treasury and risk management capabilities in order to deal with larger volumes of repos and the short operational deadlines by which VM must be posted. For this some additional system support may be required.

- PSAs would pay the transaction costs of the repos.

- If PSAs required a repo facility guaranteeing a certain level of capacity from its CM there would be an ongoing cost for it.

- The interest paid on the repo cash would be an additional operational cost.

- For CMs this should be a revenue earning service but the profit margin for this business is expected to be squeezed by an increase in their cost of regulatory capital.

- It would not be possible to match the maturity of the repo with the duration of the VM requirement. The PSA would therefore incur continuing roll costs and attendant risk.

Capacity of the solution

- In normal market conditions we would expect the market to have sufficient euro and sterling repo capacity to meet the needs of the European PSAs.

- In a severely stressed market the total PSA VM requirement would exceed the apparent daily capacity of the UK gilt repo market and would probably exceed the relevant parts of the euro government bond repo market.

- In the event of an imminent CM default caused by a PSA not being able to obtain sufficient repo liquidity to meet its VM call we consider it likely that the respective central bank would step in to provide short term liquidity to bridge the crisis, but this would not be a prior commitment.

- Market capacity may reduce as banks reduce their involvement in response to capital adequacy regulatory changes.

Figure 6.10: Summary of collateral transformation by CMs
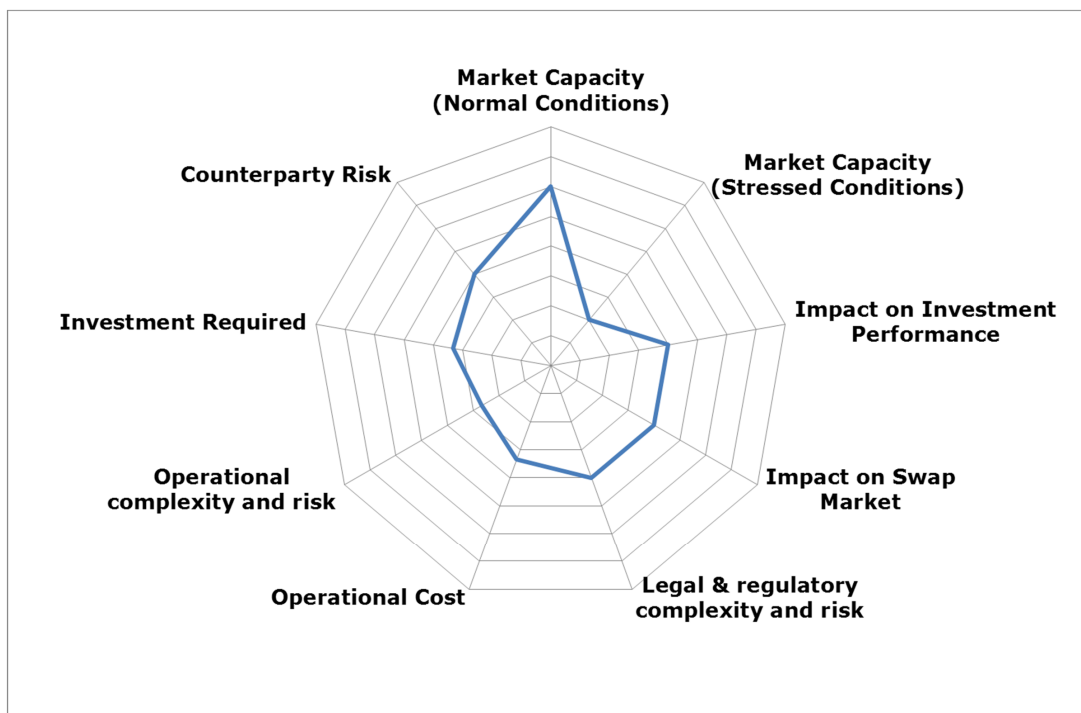
6.10.2   Collateral transformation by CCPs

Benefits of the solution

- Access to central bank liquidity would remove the possibility of a shortage of repo capacity at times of market stress leading to a PSA not being able to fund its VM call and causing the default of its CM.

- The service would be available to all PSA client clearing participants of the CCP.

- The PSA would retain its exposure to the securities it repos.

Crucial assumption on which this solution depends

- That the CCP would have access to overnight central bank liquidity to fund its repo book in the event that it was not able to obtain it from commercial banks. While at least one central bank is probably going to provide CCPs with some form of access to its lending facilities, the terms and conditions to be applied have yet to emerge and we cannot, therefore, judge whether it will adequately fit the needs of this solution.

Costs and risk factors

- CCPs would be entering into a line of business which is out of character. They would become a trading participant in the repo markets. The CCP would be taking on new and additional risk. This would affect the assessment their CMs make of them as a counterparty credit risk.

- The CCP would need to invest in the development of the service involving new contractual arrangements, new rules, system changes and regulatory clearance. The CCP would also need to develop new trading and risk management capabilities to cover the operation of the repo business.

- PSAs and their investment managers would need to develop their treasury and risk management capabilities and infrastructure in a similar way to the Collateral transformation by CMs solution.

- PSAs would be less likely to receive back exactly the same securities on maturity of the repo since the service would specify a general collateral basket.

- PSAs would pay the transaction costs of the repos. These would be likely to be a higher than those of the Collateral transformation by CMs solution since the CCP's costs would need to be covered and a tri-party repo service would probably be involved.

- The interest paid on the repo cash would be an additional operational cost.

Capacity of the solution

- In normal market conditions would be similar to Collateral transformation by CMs.

- In stressed markets it would continue to meet the requirements of PSAs since it could call on central bank liquidity.

Figure 6.11: Summary of collateral transformation by CCPs
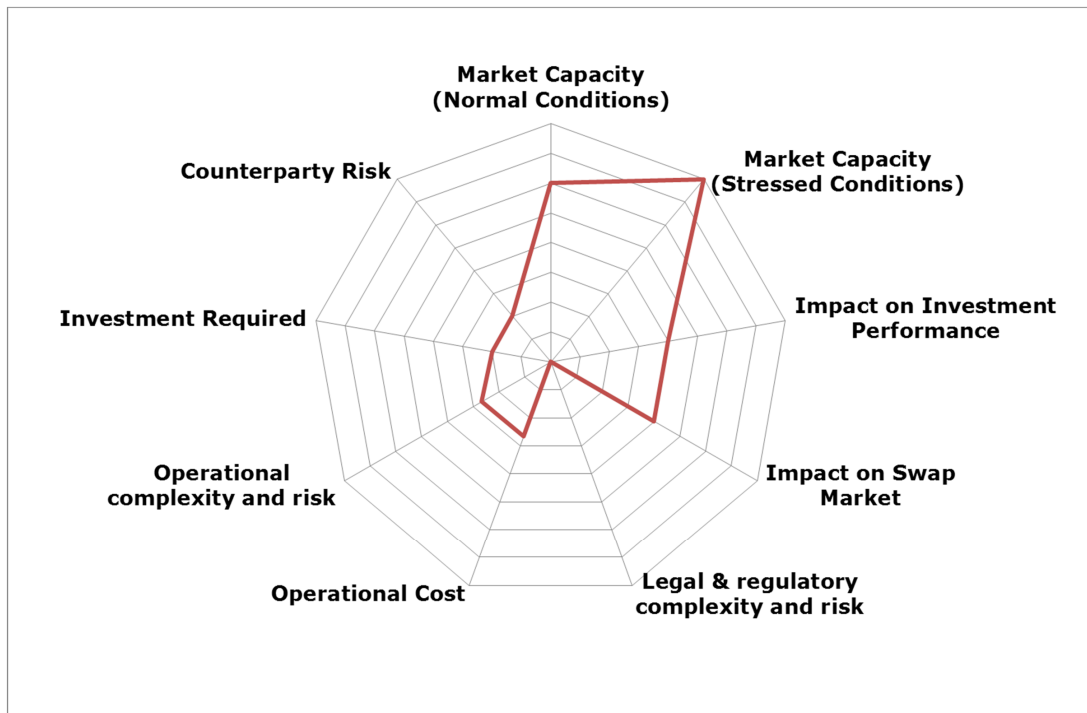
6.10.3 Acceptance of non-cash assets with pass through to receivers of VM

Benefits of the solution

- It would allow securities held in the PSA's investment portfolio to be posted as VM without them having to be liquidated.

- The variation of the solution described in section 6.3.1(b) would ensure that the PSA posting securities as VM would receive back securities that it had previously posted should it become a VM receiver.

Costs and risk factors

- Contracts with securities VM would have to be priced differently to those with cash VM. This would result in a bifurcation of the market for any particular OTC derivatives contract, split liquidity and worse pricing for the non-cash product. That would impair the PSA's investment return.

- There would be significant legal issues to resolve relating amongst others to: the legal form of the transfer of VM securities; the point at which the ownership of the securities is transferred; the segregation of over collateralised assets and the rights to income deriving from the securities.

- PSAs would have to hold securities they wish to use for VM in a custodian or CSD in which the CCP also has an account and which could process a same day transfer to the CCP's account before the deadline for posting VM.

- PSAs would pay custodian and CSD fees related to the movements of securities to and from the CCP.

- CCPs, CMs, PSAs custodians and asset managers would need to keep track of securities which had been used for VM which may need to be repaid. There would need to be a considerable systems investment to support this.

- Systems and operational procedures would also have to be able to manage and account for the rounding differences resulting from the securities having minimum transferrable units.

- There would be increased staff and management costs for PSAs, asset managers, CMs and CCPs to handle the additional operational complexity.

Capacity of the solution

- In both normal conditions and in times of market stress the solution should perform satisfactorily.

Figure 6.12: Summary of pass-through of non-cash assets

6.10.4 Acceptance of securities with security interest passed through to receivers of VM

Benefits of the solution

- It would allow securities held in the PSA's investment portfolio to be posted as VM without them having to be liquidated.

- Since this is not a conventional VM arrangement and VM is not passed through to receivers, it would ensure that the PSA posting securities as VM would receive back, by the maturity date of the OTC derivatives contract, the securities that it had previously posted.

Costs and risk factors

- Contracts operating to this model would have to be priced differently to those with cash VM. This would result in a bifurcation of the market for any particular OTC derivatives contract, split liquidity and worse pricing for the non-cash product. That would impair the PSA's investment return.

- The complexities and differences in the law on security interests in the different member state jurisdictions would make the concept very uncertain in a default situation, which is exactly when it needs to work predictably.

- PSAs would be subject to additional custodian and CSD costs related to moving securities to and from the CCP.

- PSAs would have to modify their asset management policies to allow a security interest to be created over the securities they post to the CCP.

- CCPs would have to invest in determining the legal basis for the contracts using this model so as to minimise legal risk during a CM default. They would have to obtain regulatory clearance for it and to modify their systems so as to be able to account for the security interests and to manage defaults where this type of contact was involved.

- CMs would probably also have to modify their systems in order to handle this model of contract.

Capacity of the solution

- In both normal conditions and in times of market stress the solution should perform satisfactorily.

Figure 6.13: Summary of pass-through of security interest
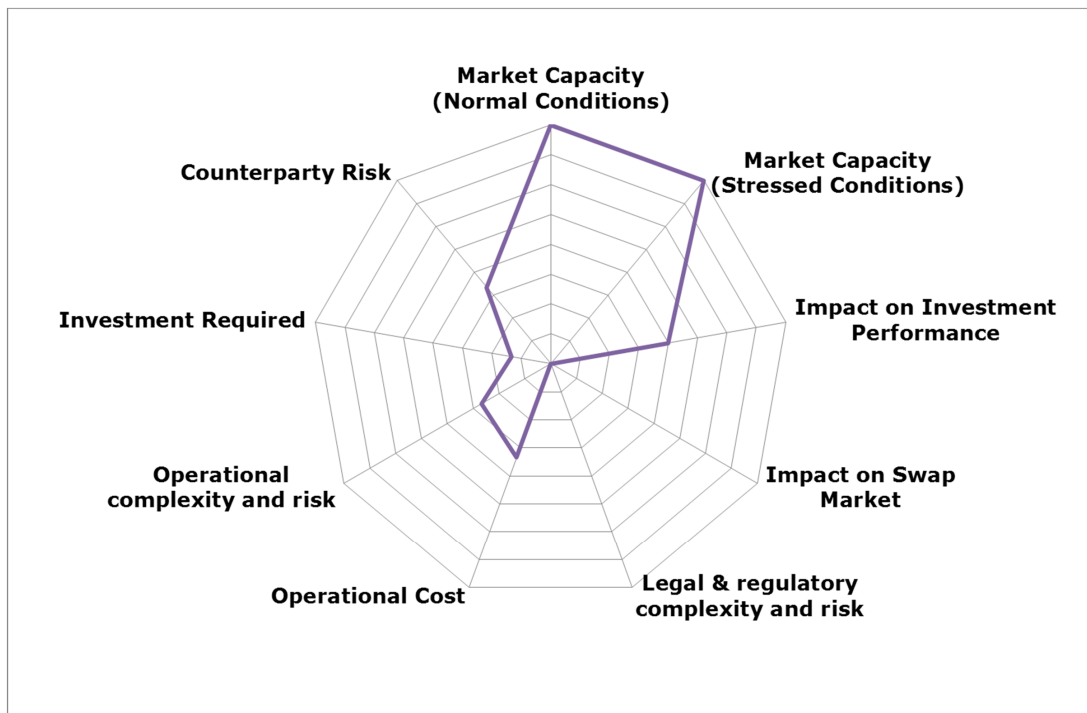
6.10.5   Quad-party collateral for VM security interest

Benefits of the solution

- It would allow securities held in the PSA's investment portfolio to be posted as VM without them having to be liquidated.

- Since this is not a conventional VM arrangement and VM is not passed through to receivers, it would ensure that the PSA posting securities as VM would receive back, by the maturity date of the OTC derivatives contract, the securities that it had previously posted.

Costs and risk factors

- Contracts operating to this model would have to be priced differently to those with cash VM. This would result in a bifurcation of the market for any particular OTC derivatives contract, split liquidity and worse pricing for the non-cash product. That would impair the PSA's investment return.

- The complexities and differences in the law on security interests in the different member state jurisdictions would make the concept very uncertain in a default situation.

- PSAs would have to keep the securities they intended to use for VM with a custodian which operated this service for the CCP concerned.

- PSAs would be subject to additional custodian and CSD costs related to moving securities to and from the CCP. These would be likely to be higher than the costs of the solution described in 6.4.1.

- PSAs would have to modify their asset management policies to allow a security interest to be created over the securities they post to the CCP.

- CCPs would have to invest in determining the legal basis for the contracts using this model so as to minimise legal risk during a CM default. They would have to obtain regulatory clearance for it and to modify their systems so as to be able to account for the security interests and to manage defaults where this type of contact was involved.

- The custodian operating the quad party service would have to invest in the systems to manage it.

- CMs would probably also have to modify their systems in order to handle this model of contract.

Capacity of the solution

- In both normal conditions and in times of market stress the solution should perform satisfactorily.

Figure 6.14: Summary of quad-party collateral
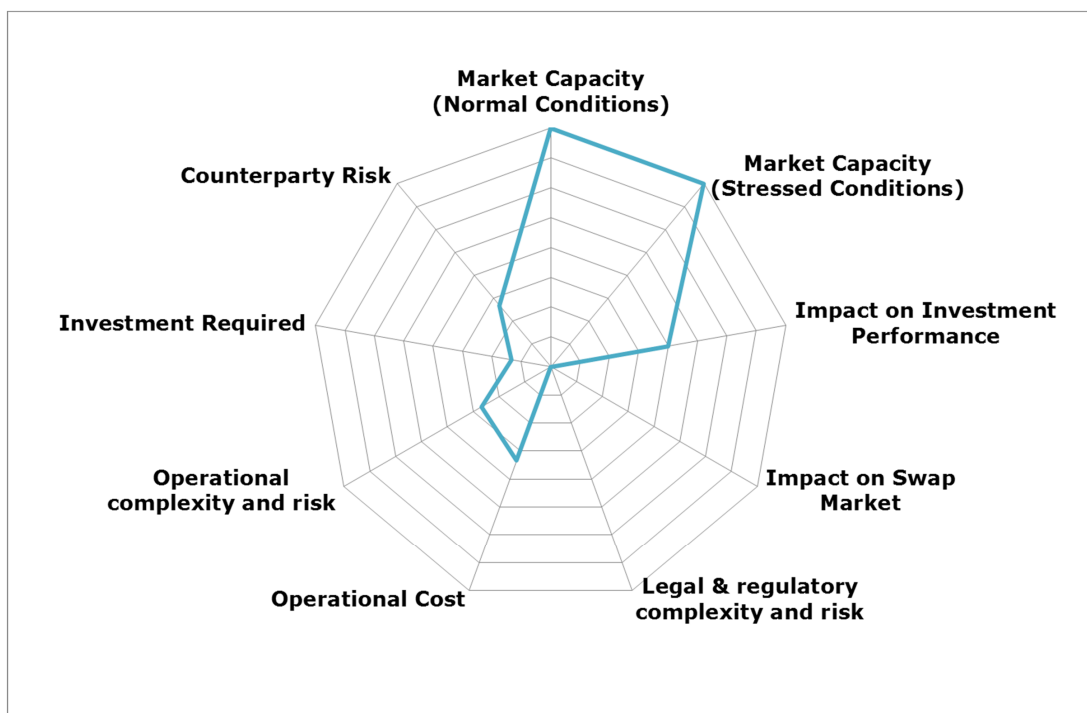
6.10.6   Agency stock lending

Benefits of the solution

- It follows current market practice. Most CMs are able to offer repo facilities to their clients and many PSAs and their investment managers already use repos.

- The PSA would also retain its exposure to the securities it lends, thereby meeting one of their key objectives.

- Stock lending can enhance investment returns.

- The solution uses existing legal and regulatory structures and would not require new ground to be broken in this area.

- It would not have any impact on the pricing of the cleared swaps.

Costs and risk factors

- PSAs would not pay directly to use such a service but would, in fact, be paid a rate of return by the borrower. However, since this solution assumes the loans would be mediated through an agent - often the custodian of the PSA they would incur fees.

Capacity of the solution

- The capacity available to a PSA would depend on the level of demand from borrowers of stock at the time for the securities the PSA holds in its portfolio. This demand tends to be seasonal, being related to dividend dates. Capacity can therefore not be relied upon.

- In times of market stress, when short selling may actually be banned for some security types and other market participants may also have liquidity squeezes, the market may dry up completely.

Figure 6.15: Summary of agency stock lending
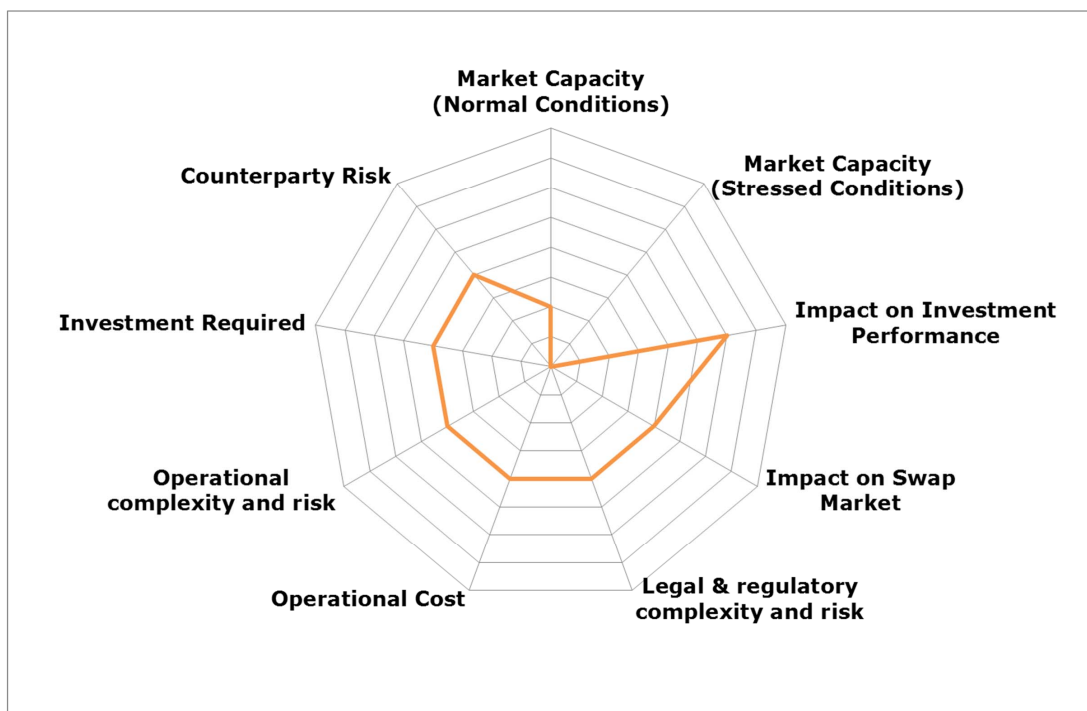
6.10.7   Secured lending by cash-rich corporations

Benefits of the solution

- It provides for a new source of cash to be available to PSAs, potentially alleviating the liquidity squeeze that a reduction in traditional repo activity may cause.

- Corporate lenders would have ready access to a class of very creditworthy borrowers.

- Although banks could arrange the repo deals they would be acting as agents and the repos would therefore not be on their balance sheets.

Costs and risk factors

- In order to be effective the service would need a critical mass of lenders and borrowers and preferably global reach so that it could draw on cash held around the world. Current infrastructure providers may not be able to achieve this. Any one custodian may not have a sufficiently wide customer base to make it effective. The ICSDs should be good candidates to offer this type of service but have restrictions on PSAs being able to directly participate in their services.

- PSAs would need the securities they intended to repo to provide VM cash to be held by the custodian or CSD operating the service.

- It is likely that some new systems infrastructure would need to be developed and legal and regulatory work would be required to establish the service.

- Probably both parties to the transactions would be charged a fee for the services. We would expect it to be competitive with the cost to a PSA of a conventional tri-party repo.

Capacity of the solution

- The capacity of the solution would depend on the number of lenders which decide to participate and the total volume of cash they decide to lend through the service. Therefore this would have to be seen as a potential additional source of VM cash for PSAs not the complete solution to their needs.

- In times of market stress corporates and other cash rich bodies may not be so negatively impacted by adverse market conditions as CMs which have many other market activities to fund and therefore they may be a more stable source of funds.

Potential variant of the solution

- It would be possible to use a similar structure for handling secured loans between corporates and PSAs in addition to repos. A secured loan transaction may be more acceptable than a repo for some participants because corporates may be more familiar with secured loans than repos and the loan terms could be more flexible, making it possible to repay the loan when the PSA chooses rather than having to specify a repo return date.

Figure 6.16: Summary of secured lending by cash-rich corporations
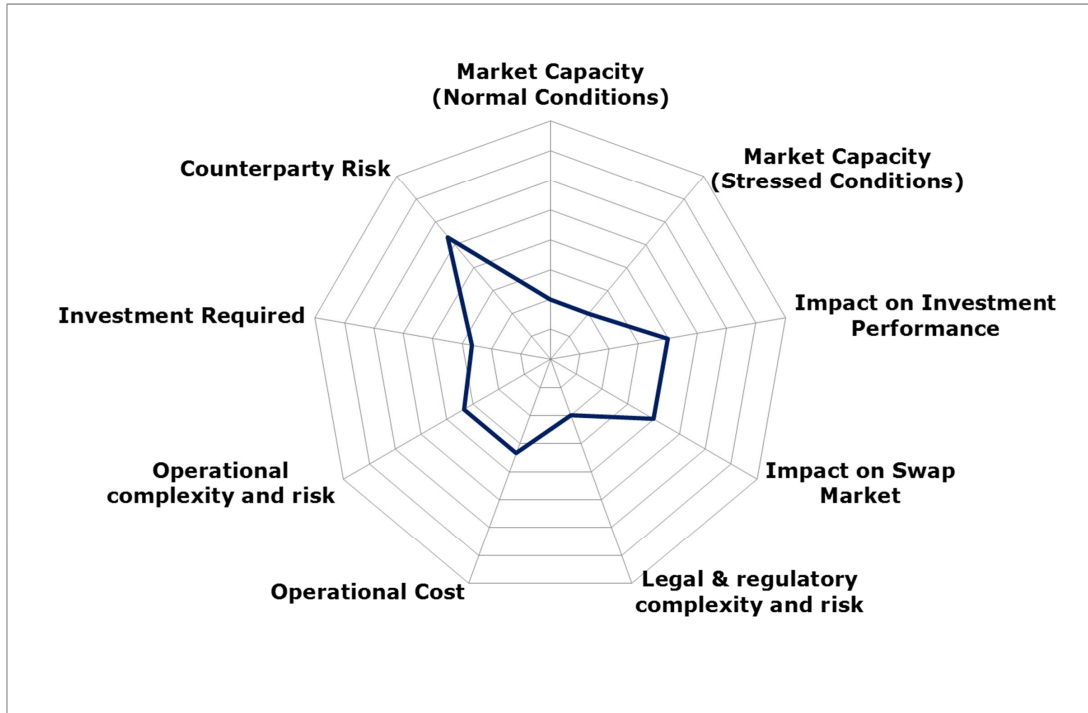
6.11 Conclusions on the relative merits of the technical solutions

It is clear that, despite many industry players being very aware of the negative impacts of mandatory clearing on PSAs none of the models assessed stands out as the obvious solution to the issue. Perhaps partly for this reason, there is currently little hard evidence that the industry is investing in innovative solutions to the core problem. This is due in part to the whole clearing industry having been preoccupied in making sure they themselves can meet the impacts of EMIR and other regulatory changes introduced over the last few years, combined with a general assumption that the exemption to PSAs from mandatory clearing will be extended. It can certainly be said with confidence, at this stage, *"that the necessary effort to develop appropriate technical solutions has not been made and that the adverse effect of centrally clearing derivative contracts on the retirement benefits of future pensioners remain unchanged"[48]*.

The table below summarises our assessment of each of the solutions in terms of its impact on the cost and risk factors we have discussed above. Against each factor in the table we have assessed the relative appeal of each of the solutions.

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48 See EMIR 85(2).

Table 6.1: Summary of assessment of impact on cost and risk factors

	Collateral trans-formation by CMs	Collateral trans-formation by CCPs	Direct pass-through of non-cash assets to receivers of VM	Security interest in non-cash assets passed through to receivers of VM	Quad-party collateral for VM security interest	Agency stock lending	Secured lending by cash-rich corpora-tions
Impact on Investment Performance	yellow	yellow	yellow	yellow	yellow	light green	yellow
Impact on Swap Market	yellow	yellow	red	red	red	yellow	yellow
Legal & regulatory complexity and risk	yellow	red	red	red	red	yellow	orange
Operational Cost							
PSAs	orange	red	red	orange	orange	yellow	orange
CCPs	red	red	red	yellow	yellow	yellow	yellow
CMs	yellow	light green	red	yellow	yellow	yellow	yellow
Operational complexity and risk							
PSAs	orange	orange	red	orange	orange	yellow	orange
CCPs	yellow	red	orange	yellow	yellow	yellow	yellow
CMs	orange	light green	yellow	yellow	yellow	yellow	yellow
Investment Required							
PSAs (inc. custodians)	orange	orange	orange	orange	orange	yellow	red
CCPs	yellow	red	red	red	red	yellow	yellow
CMs	yellow	yellow	red	orange	orange	yellow	yellow
Counterparty Risk							
PSAs	yellow	yellow	yellow	orange	yellow	yellow	light green
CCPs	yellow	orange	yellow	yellow	yellow	yellow	yellow
CMs	yellow	red	yellow	yellow	yellow	yellow	light green

Key: Relative Appeal
Best (dark green)
(light green)
(yellow)
(orange)
Worst (red)

The table below summarises our assessment of the capacity of the solutions – i.e. the extent to which each solution would meet the full requirement of the PSAs in both normal and stressed market conditions.

Table 6.2: Summary of assessment of capacity of the solutions

	Collateral trans-formation by CMs	Collateral trans-formation by CCPs	Direct pass-through of non-cash assets to receivers of VM	Security interest in non-cash assets passed through to receivers of VM	Quad-party collateral for VM security interest	Agency stock lending	Secured lending by cash-rich corpora-tions
Market Capacity (Normal Conditions)	light green	light green	green	green	green	orange	orange
Market Capacity (Stressed Conditions)	orange	green	green	green	green	red	orange

Key: Capacity to meet PSAs VM requirement
Would fully meet requirement ▇ (green)
▇ (light green)
▇ (yellow)
▇ (orange)
Would meet a small part of requirement ▇ (red)

Three of the solutions – Direct acceptance of non-cash assets with pass-through to receivers of VM, Acceptance of non-cash assets with security interest passed through to receivers of VM and Quad-party collateral for VM security interest – would allow PSAs to use securities to cover VM calls, without having to transform them into cash. However, all of them have significant drawbacks. All of them would entail non-cash VM contracts being offered as separate product lines to cash VM products. The resulting low liquidity of the non-cash VM products would mean that they would trade at wider spreads. In addition we consider direct acceptance of non-cash assets with pass-through to receivers of VM to involve so much operational complexity as to rule it out.

The two solutions involving security interest would be easier to implement technically but differences in the law on security interests in the different member state jurisdictions would mean they have higher legal risk. Even if the legal uncertainty could be resolved, we would expect that the split of liquidity between cash and non-cash products would be enough to prevent the non-cash products from gaining traction.

Two of the solutions – Collateral transformation by CMs and Agency stock lending – are already available to PSAs. Questions about their applicability revolve around the capacity of the market to meet the full needs of the European PSAs, whether that capacity may reduce as a result of changes in capital adequacy regulation and whether capacity would hold up in times of market stress.

Agency stock lending can be attractive to PSAs - because it can enhance investment returns - in the event that there is demand from borrowers at the time the PSA needs to raise VM cash. However, since this cannot be relied on, stock lending can at best form a small part of the solution to the PSAs need for VM cash.

Collateral transformation by CCPs appears to be an attractive solution, particularly in times of stressed markets. However, there are two main challenges. First, whether the conditions under which central banks would be prepared to offer liquidity to CCPs would, in practice, be compatible with the solution. Second, the lack of appetite amongst CCPs to take on and manage the resulting increased risk (and even with a

changed appetite by CCPs it would be subject to regulatory approval) and likely concern about the ability of CCPs to maintain current levels of systemic security.

Secured lending from cash-rich corporations is an interesting concept and could allow PSAs to tap into an additional pool of cash to which they currently have limited access. For it to be a significant part of the solution PSAs need custodians or CSDs would have to invest in creating a service with sufficient scale and ease of use. In addition, the cash is on balance sheets because of a lack of suitably attractive investment opportunities and has not been returned to investors due to a mix of faith in future opportunities and perhaps also the associated tax effects of returning cash to investors. These motivations may not be maintained indefinitely

The only substantial solution with any expectation of traction at present is collateral transformation by CMs. A PSA's appetite for reliance on this solution will depend on how the cost of repo (both at business-as-usual and at stressed repo rates and haircuts) compares to the opportunity cost of maintaining a larger cash buffer instead. Critically, it will also depend on its view of the capacity of the repo market to satisfy its likely needs. As indicated in section 6 above, there are serious concerns that the repo market, as presently constructed, could not meet the liquidity demands of the PSAs in times of stress.

It therefore follows that UK PSAs as a group would not be able to rely fully on the gilt repo market in the UK, and most likely other PSAs would not be able to rely on euro government bond repo markets in the rest of Europe. Whilst the repo of other assets could increase the potential capacity available these other repo markets are much more susceptible to losses of liquidity in a crisis situation. As such, reliance upon them is not likely to be seen as a prudent approach.

Therefore, absent any change in the size of the repo market or very substantial progress on some other technical solution (with the sourcing of liquidity from cash-rich corporations being the most promising), PSAs would need to create a cash buffer to cover the shortfall over and above the capacity that they judge the repo market would be likely to be able to provide.

7. Appendix 1: Risk Management of OTC Derivative Contracts

This explanation is provided to assist readers with some of the concepts discussed in this paper.

The trading of an OTC derivative contract creates obligations between the parties for what can be a very long period of time (up to 50 years). Changes to the values of the variables underlying the contract during this period (e.g. interest rates in the case of interest rate swap contracts) result in changes in the value of the derivative contract, resulting in turn in one party making a profit on the contract and the other making a loss. Under EMIR, every OTC contract now needs to be valued at least once per day (known as marking-to-market)[49]. Once the contract is marked-to-market, the profit or loss of each of the parties to the contract can be calculated.

Rather than allowing the profit and loss to build up, and running the risk that the losing counterparty will not be able to pay when the loss is settled, regular action is taken to manage this risk. The methods used have some differences depending upon whether the contract is settled bilaterally between the trading parties or they submit the contract to a CCP for clearing.

Bilateral settlement

OTC derivatives contracts which are to be bilaterally settled are covered by an ISDA Master Agreement, agreed between the trading parties. Almost all Master Agreements include a CSA which governs how the credit risk is to be covered for all OTC trades done between the parties. The CSA requires that the entire portfolio of trades covered by the Master Agreement is marked-to-market to arrive at a single net valuation for the portfolio. The valuation is carried out by the Valuation Agent specified in the CSA, which in most cases of OTC derivatives contracts between a PSA and a bank, will be the bank or its nominated agent. The Valuation Agent calculates the portfolio value and the change in the value since the last valuation and notifies both parties of the results.

Figure 7.1: Role of Valuation Agent

Collateral in the form of Variation Margin can then be required by the gainer from the loser to protect the former in the event that the loser is not able to pay the difference at the subsequent payments. The process is not automatic, however. The party entitled to receive VM must notify the other party that a transfer of VM is required and CSAs can specify a threshold amount below which a transfer is not required.

This process basically avoids any build-up of uncollateralised losses. Hence at any point in time the party for whom the bilateral portfolio has a positive value is holding

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49 EMIR clause 11.2 refers.

collateral equivalent to that value and at each valuation the amount of collateral is adjusted.

Figure 7.2: Calculation of daily variation margin

Who pays and who receives is determined by whether this calculation is positive or negative.

Traditionally CSAs have allowed variation margin to be provided in the form of securities, or in cash. In order to cover the risk of securities transferred as VM changing in value, each security eligible for VM under the CSA has an associated "valuation percentage" by which the value of securities transferred must exceed the calculated figure of VM due. There is, however, a trend towards bilateral VM being paid in cash rather than securities (though no regulation mandates this).

VM does not, however, cover all the risks the parties face in relation to the bilateral portfolio. In the event of the default of one of the parties the other party would probably have to replace the portfolio with an equivalent, traded with one or more new counterparties. The potential costs of the replacement are not covered by the bilateral transfer of VM. In the past, this risk was either accepted by the parties or managed by tools such as position limits. However, EMIR now requires these risks, once they get beyond a certain threshold, to be managed through the taking of initial margin (IM). This is margin taken to cover the potential loss which would be incurred in the event of the default of counterparty.

CCP clearing

With CCP clearing the relationships between the parties to a particular contract are different to those for bilateral settlement. In general buy-side organisations, such as PSAs, will not be direct participants of a CCP. Any contract they wish to be cleared must go through a clearing member (CM) of the CCP. This CM could be the firm that arranged the trade, or was the counterparty of the trade, but it does not have to be.

Figure 7.3: CCP clearing
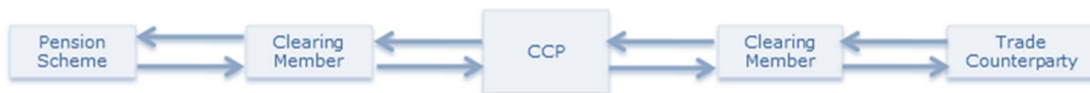
The CM becomes the party to the trade as far as the CCP is concerned and, once the trade has been matched (i.e. both parties have formally agreed on the details of the trade) and has been received by the CCP, it is then 'novated'. Novation means that the CCP breaks the original trade into two trades - the buying CM becomes the buyer to the CCP and the selling CM becomes the seller to the CCP. The CCP therefore becomes the buyer to every seller and the seller to every buyer. This results in the CCP having a completely flat position, as for every buy it makes, it makes an identical sell.

Figure 7.4: Novation
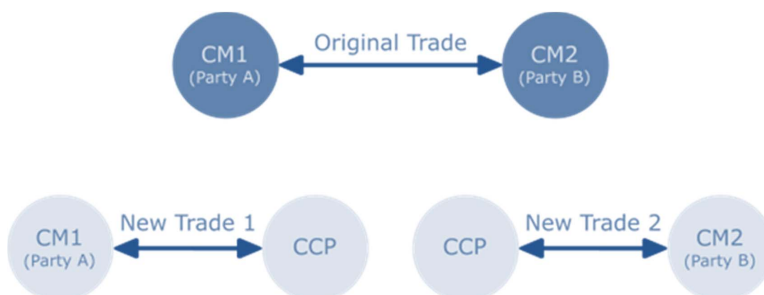
Novation breaks the relationship between the parties to the original trade and, from the point of novation onwards, the CCP's systems and processes make no reference to a connection between New Trade 1 and New Trade 2. The CCP applies its risk management processes to the portfolio of trades it holds against each of its counterparties, i.e. against each CM. This results in important differences compared to bilateral settlement:

- Each CM's portfolio includes trades done originally with multiple counterparties, hence CCP clearing is sometimes referred to as "multilateral".

- Each CM's portfolio contains trades in multiple products, including those not traded OTC.

- The CCP will split the total portfolio by product in order to calculate its exposure to each CM although, where products are closely correlated, they may be grouped together in order to take account of the correlation in the exposure calculations.

As with bilateral contracts under EMIR, a CCP marks-to-market all CM portfolios on at least a daily basis, and calculates the variation margin due to the CCP and the variation margin that the CCP has to pay out.

CCPs differ in their treatment of the market risk from that employed in bilaterally settled contracts. Instead of collateralising the differences in market value as described above for bilaterally settled contracts, CCPs actually crystallise the profits and losses, resulting in the VM actually being a settlement payment from the loser to the gainer. This is the reason that CCPs only accept VM in cash and pay out the same in cash, cash being the most negotiable instrument.

The CM is responsible for paying the VM to the CCP and it, in turn, collects the same from the PSA or other counterparty. Operationally, most CCPs undertake the mark-to-market and variation margin calculations overnight and make the resulting cash exchanges between themselves and the CMs the next morning.

A CCP is not a risk taking organisation. Therefore, it seeks to remove as much risk as possible. It does this by also taking IM to cover the risk of the CM defaulting[50].

IM is calculated at the end of each day (but can be more often in periods of volatility) and calls to top up any IM are made to CMs.

Summary of margin taken by a CPP:

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[50] If a CM defaults, the clearing house aims to crystallise any losses as soon as possible, usually by closing out the derivative positions of the defaulting CM or transferring them to another CM. However, it can take time to do this and the price may move against the clearing house, especially in a default which happens at a time of increased market volatility. In such a case, the value of the positions may have moved a long way since the last mark-to-market and settlement of the related variation margin. Initial margin is taken to cover any such potential losses, in at least the vast majority of envisaged scenarios.

- VM is the daily profit and loss on a derivative contract since the last mark-to-market and is exchanged daily in cash.

- IM is an amount to cover the risk of having to close out or transfer a defaulting CMs position. It is recalculated at least daily and any shortfalls have to be made up immediately. IM can be provided in the form of cash or securities (the latter subject to haircuts).

Differences between bilateral and CCP clearing for the purposes of this study

Under EMIR, the risk management for both bilateral and CCP cleared contracts requires the taking of both IM and VM. The key difference is that, for bilateral contracts, the VM provided is actually collateral to protect the gainer from the potential loss of profits accumulated under the contract whereas, for CCP cleared contracts, the VM is actually settlement of the profits gained on the contract. Another way of looking at it is that profits gained on a contract are paid out daily in the CCP environment (in the form of VM), but are accumulated in the bilateral environment until the next payment date, with the risk of loss of the profits being covered by VM.

8. Appendix 2: Detailed Modelling Results

8.1.1   Regulatory regime

The tables below presents the derivative usage regimes used to calculate the scaling factors to account for differing intensity of derivative usage across the EU28. This feeds directly into the VM modelling results. These regimes were developed based on information received from our fieldwork and industry data where available. Where no information was available (those Member States marked with an asterisk in the table) have assumed that derivative usage is no higher than 'medium', and assigned scores scoring to the following methodology.

Table 8.1: Methodology to assign derivative use intensity scores

Category	Derivative use intensity score
Defined contribution, Large	Low
Defined contribution benefit, Small	Ultra low
Defined benefit, Large	Medium
Defined benefit, Small	Low

Table 8.2: Derivative usage intensity scores

Member State	Derv usage Large DC	Derv usage Small DC	Derv usage Large DB	Derv usage Small DB
AT*	Low	Ultra Low	Medium	Low
BE*	Low	Ultra Low	Medium	Low
BG*	Low	Ultra Low	Medium	Low
CY*	Low	Ultra Low	Medium	Low
CZ	Medium	Ultra Low	N/A	N/A
DE	Medium	Low	High	Medium
DK	High	Medium	High	Medium
EE	Low	Ultra Low	N/A	N/A
EL	Low	Ultra Low	N/A	N/A
ES*	Low	Ultra Low	Medium	Low
FI*	Low	Ultra Low	Medium	Low
FR*	Low	Ultra Low	Medium	Low
HR*	Low	Ultra Low	Medium	Low
HU*	Low	Ultra Low	Medium	Low
IE	Medium	Ultra Low	High	Medium
IT	Low	Ultra Low	Medium	Low
LT*	Low	Ultra Low	Medium	Low
LU*	Low	Ultra Low	Medium	Low
LV*	Low	Ultra Low	Medium	Low
MT*	Low	Ultra Low	Medium	Low
NL	High	Medium	High	High
PL	Low	Ultra Low	Medium	Low
PT	Low	Ultra Low	Medium	Low
RO	Low	Ultra Low	Medium	Low
SE	Medium	Low	High	Medium
SI*	Low	Ultra Low	Medium	Low
SK	Medium	Low	N/A	N/A
UK - LDI	Medium	Low	Ultra high	High
UK - non-LDI	Medium	Low	High	Medium

Note: N/A applies where Member States have no AUM in defined benefit.
* indicates those Member States where we used default as set out at Table 8.1

8.1.2 Historic scenario

The amount of cash that PSAs across the EU28 would need to hold to meet VM requirements is presented in the table below. This represents a proportion of the maximum VM collateral need based upon the simulations run, being: 100 per cent, 90 per cent and 80 per cent of the maximum five-day VM call from 2007 to 2012.

At the 100 per cent cash buffer there is significant variation in the size of the cash buffer, from €730,000 for Greece to €37 billion for the UK when only IRS is clearable. This variation reflects differences in the intensity of derivative use and the size of the pension industry in each Member State.

Table 8.3 Total cash VM requirement to be held under the IRS clearable-historic scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	190	171	152
BE	1,280	1,152	1,024
BG	29	27	24
CY	0.07	0.06	0.05
CZ	215	193	172
DE	10,349	9,314	8,280
DK	19,166	17,250	15,333
EE	17	15	13
EL	0.73	0.66	0.58
ES	2,057	1,851	1,645
FI	3,159	2,843	2,527
FR	1,590	1,431	1,272
HR	67	60	53
HU	28	25	22
IE	2,087	1,878	1,670
IT	1,291	1,162	1,033
LT	2.5	2.25	2.
LU	17	15	13
LV	1.85	1.67	1.48
MT	4.89	4.4	3.91
NL	42,550	38,295	34,040
PL	573	516	459
PT	292	263	233
RO	24	22	19
SE	9,156	8,241	7,325
SI	19	17	15
SK	141	127	113
UK	37,160	33,444	29,728
Total	131,469	118,322	105,175

Source: Europe Economics and Bourse Consult analysis.

When inflation clearing is incorporated into the model, the cash buffer for the majority of Member States falls. Inflation shocks typically provide some offset for interest rate shocks, which enables some netting of daily VM calls by the CCP. This in turn translates into a lower cash buffer requirement. The exception is the UK, where the cash buffer requirement increases where inflation and interest rates are both clearable. The UK on average makes a greater use of inflation swaps and thus the netting of VM calls during clearing is not sufficient to offset the increase in VM resulting from clearing inflation as well as interest rate.

Table 8.4 Total cash VM requirement to be held under the IRS and inflation clearable-historic scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	180	162	144
BE	1,212	1,090	969
BG	28	25	22
CY	0.06	0.06	0.05
CZ	203	183	163
DE	9,795	8,815	7,836
DK	18,139	16,325	14,511
EE	16	14	13
EL	0.69	0.62	0.55
ES	1,946	1,752	1,557
FI	2,990	2,691	2,392
FR	1,505	1,355	1,204
HR	63	57	50
HU	26	24	21
IE	1,975	1,778	1,580
IT	1,222	1,100	978
LT	2.37	2.13	1.9
LU	16	14	13
LV	1.75	1.58	1.4
MT	4.63	4.16	3.7
NL	40,270	36,243	32,216
PL	543	488	434
PT	276	249	221
RO	23	21	18
SE	8,666	7,799	6,933
SI	18	16	15
SK	134	120	107
UK	47,814	43,033	38,252
Total	137,069	123,362	109,655

Source: Europe Economics and Bourse Consult analysis.

The table below presents the annual (2012) opportunity cost across the EU of holding this amount of cash. As can be seen the opportunity costs vary significantly across the EU28, from just over €4,500 in Greece to over €500 million in the Netherlands. The costs represent between around 0.01 and 0.05 per cent of total AUM. The weighted average opportunity cost across Member States is around 0.03 per cent of AUM.

The opportunity costs to PSAs across Member States of holding this amount of cash depends on a number of factors, such as how much cash they already have and can use to create the cash buffer; what assets they need to sell to create the remainder of the buffer; the foregone yield on these assets; and the yield that can be made on the cash held. For example, despite the NL having only a slightly higher aggregate cash buffer requirement than the UK, Dutch PSAs would incur a much greater overall

opportunity cost due largely to the higher average return on SONIA compared with EONIA.

Table 8.5: Annual opportunity cost of holding cash buffer under IRS clearable-historic scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,212	1,091	970
BE	8,153	7,338	6,522
BG	188	169	150
CY	0.43	0.39	0.34
CZ	1,368	1,232	1,095
DE	131,818	118,637	105,455
DK	244,116	219,704	195,292
EE	106	95	85
EL	4.64	4.18	3.71
ES	13,098	11,788	10,478
FI	40,239	36,215	32,191
FR	10,128	9,115	8,102
HR	849	764	679
HU	234	216	199
IE	26,582	23,924	21,266
IT	16,446	14,801	13,157
LT	16	14	13
LU	106	96	85
LV	12	11	9.43
MT	91	82	73
NL	541,951	487,756	433,561
PL	3,651	3,285	2,920
PT	1,858	1,672	1,487
RO	393	362	331
SE	116,622	104,960	93,298
SI	123	110	98
SK	899	809	719
UK	354,784	319,305	283,827
Total	1,515,048	1,363,558	1,212,067

Source: Europe Economics and Bourse Consult analysis.

The ability to clear inflation swaps and the scope of netting between these and IRS reduces the size of the cash buffer, with a resulting smaller opportunity cost, for all Member States except the UK. The UK's opportunity cost of holding a cash buffer under the combined scenario is greater than under the scenario where only IRS are clearable.

Table 8.6: Annual opportunity cost of holding cash buffer under IRS and inflation clearable-historic scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,147	1,032	918
BE	7,716	6,945	6,173
BG	178	160	142
CY	0.41	0.36	0.32
CZ	1,295	1,166	1,036
DE	124,754	112,279	99,803
DK	231,033	207,930	184,827
EE	100	90	80
EL	4.39	3.95	3.51
ES	12,396	11,156	9,917
FI	38,082	34,274	30,466
FR	9,585	8,627	7,668
HR	804	723	643
HU	224	208	191
IE	25,158	22,642	20,126
IT	15,564	14,008	12,452
LT	15	14	12
LU	100	90	80
LV	11	10	8.92
MT	86	78	69
NL	512,908	461,617	410,326
PL	3,455	3,109	2,764
PT	1,759	1,583	1,407
RO	377	347	318
SE	110,372	99,335	88,298
SI	116	104	93
SK	851	766	681
UK	456,501	410,851	365,201
Total	1,554,594	1,399,149	1,243,704

Source: Europe Economics and Bourse Consult analysis.

Since more cash is held as the buffer size increases, the opportunity cost of the cash buffer will always increase with it, whereas any costs associated with conducting repo operations when there is a shortfall in the cash buffer will decrease as the cash buffer increases.

At the cash buffer levels analysed here, in the historic simulation there is no additional cost incurred by conducting repo operations to meet excess VM requirements, i.e. the cash buffer is always sufficient. This result arises because the maximum five-day VM call over the 2007 to 2012 period is sufficiently greater than the maximum five-day VM call for the year of analysis, i.e. 2012. This result reflects the relative stability of interest rates over 2012 compared with the initial financial crisis and the subsequent Eurozone crisis.

Since there are no requirements for repo operations, the total cost over one year is unchanged relative to the opportunity cost of holding an additional cash buffer.

8.1.3   100bps scenario

Here we assume that in forming the cash buffer PSAs would consider the highest five-day VM call over the past five years as well as the expected VM call in the event of a 100bps move in interest rates. This change would be right across the curve. Again we analyse three different levels of cash buffer.

For Member States other than the UK, the size of cash buffer required under this model is 140 per cent of the cash buffer under the normal scenario. In the UK the increase is far more substantial, at 330 per cent.

Table 8.7 Total cash VM requirement to be held under the IRS clearable-100bps scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	267	241	214
BE	1,799	1,619	1,439
BG	41	37	33
CY	0.09	0.09	0.08
CZ	302	272	242
DE	14,540	13,086	11,632
DK	26,926	24,233	21,541
EE	23	21	19
EL	1.02	0.92	0.82
ES	2,889	2,600	2,311
FI	4,438	3,994	3,551
FR	2,234	2,011	1,787
HR	94	84	75
HU	39	35	31
IE	2,932	2,639	2,346
IT	1,814	1,633	1,451
LT	3.52	3.17	2.81
LU	23	21	19
LV	2.6	2.34	2.08
MT	6.87	6.18	5.5
NL	59,777	53,800	47,822
PL	805	725	644
PT	410	369	328
RO	34	31	27
SE	12,863	11,577	10,291
SI	27	24	22
SK	198	179	159
UK	122,901	110,611	98,321
Total	255,393	229,854	204,315

Source: Europe Economics and Bourse Consult analysis.

Due to the nature of the model, except when a marginal increase in the cash buffer results in PSAs within a Member State selling assets with a higher excess return, the change in the opportunity cost is linear to the change in the cash buffer.

Table 8.8: Annual opportunity cost of holding cash buffer under IRS clearable - 100bp scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,703	1,533	1,362
BE	11,454	10,309	9,163
BG	264	237	211
CY	0.6	0.54	0.48
CZ	1,922	1,730	1,538
DE	185,188	166,669	148,150
DK	342,951	308,656	274,361
EE	149	134	119
EL	6.52	5.87	5.22
ES	18,401	16,560	14,720
FI	56,530	50,877	45,224
FR	14,229	12,806	11,383
HR	1,193	1,074	955
HU	305	280	256
IE	37,345	33,610	29,876
IT	23,104	20,794	18,483
LT	22	20	18
LU	149	134	119
LV	17	15	13
MT	148	124	103
NL	761,372	685,235	609,098
PL	5,129	4,616	4,103
PT	2,611	2,349	2,088
RO	518	475	431
SE	163,839	147,455	131,071
SI	172	155	138
SK	1,263	1,137	1,011
UK	1,173,383	1,056,045	938,707
Total	2,803,369	2,523,037	2,242,708

Source: Europe Economics and Bourse Consult analysis.

In this scenario, the simulated VM calls for 2012 are supplemented by the excess VM call when considering the requirements for repo operations to cover any excess VM calls that exceed the cash buffer. As a result, other than in the case where 100 per cent of the VM call is held as the cash buffer, there are some costs of conducting repo operations for all Member States. These are presented in Table 8.9 below.

Since the size of required repos increases with a lower cash buffer, the costs are decreasing with the level of the cash buffer. The model assumes that the stress scenario only happens once every twenty years, and thus we report an average cost for 2012.

Table 8.9 Annual cost of repo under IRS clearable - 100bp scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	0.00	6.97	14
BE	0.00	47	94
BG	0.00	1.08	2.16
CY	0.00	0.00	0.00
CZ	0.00	7.87	16
DE	0.00	379	758
DK	0.00	702	1,403
EE	0.00	0.61	1.22
EL	0.00	0.03	0.05
ES	0.00	75	151
FI	0.00	116	231
FR	0.00	58	116
HR	0.00	2.44	4.88
HU	0.00	1.01	2.02
IE	0.00	76	153
IT	0.00	47	95
LT	0.00	0.09	0.18
LU	0.00	0.61	1.22
LV	0.00	0.07	0.14
MT	0.00	0.31	0.61
NL	0.00	1,558	3,115
PL	0.00	21	42
PT	0.00	11	21
RO	0.00	0.89	1.77
SE	0.00	335	670
SI	0.00	0.7	1.41
SK	0.00	5.17	10
UK	0.00	3,191	6,382
Total	0.00	6,643	13,287

Source: Europe Economics and Bourse Consult analysis.

The table below presents the total costs to PSAs across the EU28. For funds with a relatively high initial cash holding, the additional cost of conducting larger repo operations as the cash buffer decreases could outweigh the saving from a reduced opportunity cost. However typically in our model the opportunity cost change outweighs substantially the repo cost, i.e. at face value the lowest possible cost would appear to be at the lower cash buffer – but this does not mean this approach would be adopted, e.g. if there are concerns over the ability to repo in the levels implied.

Table 8.10 Annual total cost (opportunity cost and repo cost) under IRS clearable - 100bp scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,703	1,540	1,376
BE	11,454	10,356	9,257
BG	264	238	213
CY	0.6	0.54	0.49
CZ	1,922	1,738	1,554
DE	185,188	167,048	148,908
DK	342,951	309,358	275,764
EE	149	135	120
EL	6.52	5.89	5.27
ES	18,401	16,636	14,871
FI	56,530	50,993	45,455
FR	14,229	12,864	11,499
HR	1,193	1,076	959
HU	305	281	258
IE	37,345	33,687	30,029
IT	23,104	20,841	18,578
LT	22	20	18
LU	149	135	120
LV	17	15	13
MT	148	124	103
NL	761,372	686,793	612,213
PL	5,129	4,637	4,145
PT	2,611	2,360	2,110
RO	518	476	433
SE	163,839	147,791	131,742
SI	172	156	139
SK	1,263	1,142	1,021
UK	1,173,383	1,059,236	945,089
Total	2,803,369	2,529,680	2,255,994

Source: Europe Economics and Bourse Consult analysis.

8.1.4   EBA stress scenario

Costs here mimic the situation where PSAs used as a reference point the impact of the parameters contained within the EBA's adverse stress tests.

The total cash VM requirement to be held under a stress scenario where IRS only is cleared ranges from €235 billion to €294 billion across the EU28. This increases to a range of €301 billion to €377 billion where both IRS and inflation swaps are clearable.

Table 8.11 Total cash VM requirement to be held under the IRS clearable-EBA adverse stress scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	308	278	247
BE	2,074	1,867	1,660
BG	48	43	38
CY	0.11	0.1	0.09
CZ	348	313	279
DE	16,770	15,093	13,416
DK	31,056	27,950	24,844
EE	27	24	22
EL	1.18	1.06	0.94
ES	3,332	2,999	2,666
FI	5,119	4,607	4,095
FR	2,577	2,319	2,062
HR	108	97	86
HU	45	40	36
IE	3,382	3,044	2,705
IT	2,092	1,883	1,674
LT	4.06	3.65	3.24
LU	27	24	22
LV	3	2.7	2.4
MT	7.92	7.13	6.34
NL	68,945	62,051	55,156
PL	929	836	743
PT	473	426	378
RO	39	35	31
SE	14,836	13,353	11,869
SI	31	28	25
SK	229	206	183
UK	141,464	127,318	113,171
Total	294,276	264,848	235,421

Source: Europe Economics and Bourse Consult analysis.

Table 8.12 Total cash VM requirement to be held under the IRS and inflation clearable-EBA adverse stress scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	370	333	296
BE	2,487	2,238	1,990
BG	57	51	46
CY	0.13	0.12	0.1
CZ	417	376	334
DE	20,104	18,094	16,083
DK	37,231	33,508	29,785
EE	32	29	26
EL	1.42	1.27	1.13
ES	3,995	3,596	3,196
FI	6,137	5,523	4,910
FR	3,089	2,780	2,471
HR	130	117	104
HU	54	48	43
IE	4,054	3,649	3,243
IT	2,508	2,257	2,007
LT	4.86	4.38	3.89
LU	32	29	26
LV	3.6	3.24	2.88
MT	9.5	8.55	7.6
NL	82,655	74,390	66,124
PL	1,114	1,002	891
PT	567	510	453
RO	47	42	38
SE	17,787	16,008	14,229
SI	37	34	30
SK	274	247	219
UK	193,432	174,089	154,746
Total	376,631	338,968	301,305

Source: Europe Economics and Bourse Consult analysis.

The tables below present the annual opportunity costs of holding different proportions of the total VM cash buffer. Costs across the EU28 range from €2.6 billion to €3.2 billion for the IRS-only scenario, and between €3.3 billion and €4.1 billion for the inflation and IRS scenario.

Table 8.13: Annual opportunity cost of holding cash buffer under IRS clearable-EBA adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,964	1,768	1,571
BE	13,211	11,890	10,569
BG	304	274	243
CY	0.69	0.62	0.56
CZ	2,217	1,996	1,774
DE	213,590	192,231	170,872
DK	395,549	355,994	316,439
EE	172	155	138
EL	7.52	6.77	6.02
ES	21,223	19,100	16,978
FI	65,200	58,680	52,160
FR	16,411	14,770	13,129
HR	1,376	1,239	1,101
HU	343	314	286
IE	43,072	38,765	34,458
IT	26,648	23,983	21,318
LT	26	23	21
LU	172	155	138
LV	19	17	15
MT	186	158	130
NL	878,142	790,328	702,514
PL	5,915	5,324	4,732
PT	3,011	2,710	2,409
RO	584	534	484
SE	188,967	170,070	151,174
SI	199	179	159
SK	1,457	1,311	1,166
UK	1,350,611	1,215,550	1,080,489
Total	3,230,576	2,907,523	2,584,470

Source: Europe Economics and Bourse Consult analysis.

Table 8.14: Annual opportunity cost of holding cash buffer under IRS and inflation clearable-EBA adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	2,355	2,119	1,884
BE	15,838	14,254	12,670
BG	364	328	291
CY	0.83	0.75	0.67
CZ	2,658	2,392	2,127
DE	256,063	230,457	204,850
DK	474,204	426,784	379,364
EE	206	185	165
EL	9.02	8.11	7.21
ES	25,443	22,898	20,354
FI	78,165	70,348	62,532
FR	19,674	17,707	15,739
HR	1,650	1,485	1,320
HU	400	365	331
IE	51,637	46,474	41,310
IT	31,947	28,752	25,557
LT	31	28	25
LU	206	186	165
LV	23	21	18
MT	242	208	174
NL	1,052,763	947,487	842,210
PL	7,091	6,382	5,673
PT	3,610	3,249	2,888
RO	684	624	564
SE	226,544	203,889	181,235
SI	238	214	190
SK	1,747	1,572	1,398
UK	1,846,767	1,662,090	1,477,413
Total	4,100,558	3,690,507	3,280,456

Source: Europe Economics and Bourse Consult analysis.

Table 8.15 Annual cost of repo under IRS clearable-EBA adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	0.00	8.04	16
BE	0.00	54	108
BG	0.00	1.24	2.49
CY	0.00	0.00	0.01
CZ	0.00	9.07	18
DE	0.00	437	874
DK	0.00	809	1,618
EE	0.00	0.7	1.41
EL	0.00	0.03	0.06
ES	0.00	87	174
FI	0.00	133	267
FR	0.00	67	134
HR	0.00	2.82	5.63
HU	0.00	1.17	2.33
IE	0.00	88	176
IT	0.00	55	109
LT	0.00	0.11	0.21
LU	0.00	0.7	1.41
LV	0.00	0.08	0.16
MT	0.00	0.35	0.71
NL	0.00	1,796	3,593
PL	0.00	24	48
PT	0.00	12	25
RO	0.00	1.02	2.04
SE	0.00	387	773
SI	0.00	0.81	1.62
SK	0.00	5.96	12
UK	0.00	3,673	7,346
Total	0.00	7,655	15,310

Source: Europe Economics and Bourse Consult analysis.

Table 8.16 Annual cost of repo under IRS and inflation clearable-EBA adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	0.00	9.63	19
BE	0.00	65	130
BG	0.00	1.49	2.98
CY	0.00	0.00	0.01
CZ	0.00	11	22
DE	0.00	524	1,048
DK	0.00	970	1,940
EE	0.00	0.84	1.69
EL	0.00	0.04	0.07
ES	0.00	104	208
FI	0.00	160	320
FR	0.00	80	161
HR	0.00	3.38	6.75
HU	0.00	1.4	2.8
IE	0.00	106	211
IT	0.00	65	131
LT	0.00	0.13	0.25
LU	0.00	0.84	1.69
LV	0.00	0.09	0.19
MT	0.00	0.43	0.85
NL	0.00	2,154	4,307
PL	0.00	29	58
PT	0.00	15	30
RO	0.00	1.23	2.45
SE	0.00	463	927
SI	0.00	0.97	1.95
SK	0.00	7.15	14
UK	0.00	5,022	10,045
Total	0.00	9,796	19,592

Source: Europe Economics and Bourse Consult analysis.

The most significant driver of the total costs over one year, shown in the table below, is the opportunity cost of holding additional cash.

Once again, whilst the cost may be minimised at the 80 per cent buffer, concerns over the repo market does not mean this (or, indeed, an even lower cash buffer) would be adopted.

Table 8.17 Annual total cost (opportunity cost and repo cost) under IRS clearable-EBA adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	1,964	1,776	1,587
BE	13,211	11,944	10,677
BG	304	275	246
CY	0.69	0.63	0.56
CZ	2,217	2,005	1,792
DE	213,590	192,668	171,746
DK	395,549	356,803	318,057
EE	172	155	139
EL	7.52	6.8	6.08
ES	21,223	19,187	17,152
FI	65,200	58,813	52,427
FR	16,411	14,837	13,263
HR	1,376	1,241	1,107
HU	343	316	288
IE	43,072	38,853	34,634
IT	26,648	24,037	21,427
LT	26	23	21
LU	172	155	139
LV	19	17	15
MT	186	158	130
NL	878,142	792,124	706,106
PL	5,915	5,348	4,780
PT	3,011	2,722	2,433
RO	584	535	486
SE	188,967	170,457	151,947
SI	199	179	160
SK	1,457	1,317	1,178
UK	1,350,611	1,219,223	1,087,835
Total	3,230,576	2,915,178	2,599,780

Source: Europe Economics and Bourse Consult analysis.

Table 8.18 Annual total cost (opportunity cost and repo cost) under IRS and inflation clearable-EBA adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	2,355	2,129	1,903
BE	15,838	14,319	12,800
BG	364	329	294
CY	0.83	0.75	0.67
CZ	2,658	2,403	2,148
DE	256,063	230,980	205,898
DK	474,204	427,754	381,304
EE	206	186	167
EL	9.02	8.15	7.29
ES	25,443	23,003	20,562
FI	78,165	70,508	62,852
FR	19,674	17,787	15,900
HR	1,650	1,488	1,327
HU	400	367	334
IE	51,637	46,579	41,521
IT	31,947	28,817	25,688
LT	31	28	25
LU	206	186	167
LV	23	21	19
MT	242	208	175
NL	1,052,763	949,640	846,517
PL	7,091	6,411	5,731
PT	3,610	3,263	2,917
RO	684	625	566
SE	226,544	204,353	182,162
SI	238	215	192
SK	1,747	1,579	1,412
UK	1,846,767	1,667,113	1,487,458
Total	4,100,558	3,700,303	3,300,048

Source: Europe Economics and Bourse Consult analysis.

8.1.5   Adverse stress scenario

Costs here mimic the situation where PSAs used as a reference point the impact of the parameters contained within the Federal Reserve's adverse stress tests. These are somewhat akin to a crisis laid upon a crisis – i.e. very unlikely events.

Since the cash buffer is directly proportional to the size of the maximum VM call, the cash buffer held by all Member States other than the UK is 2.6 times greater than in the normal scenario for the IRS model. In the case of the UK, this multiple increases to 6.8.

Table 8.19 Total cash VM requirement to be held under the IRS clearable-adverse stress scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	499	449	399
BE	3,358	3,022	2,686
BG	77	70	62
CY	0.18	0.16	0.14
CZ	564	507	451
DE	27,142	24,428	21,714
DK	50,265	45,239	40,212
EE	44	39	35
EL	1.91	1.72	1.53
ES	5,394	4,854	4,315
FI	8,285	7,457	6,628
FR	4,171	3,754	3,337
HR	175	157	140
HU	72	65	58
IE	5,474	4,926	4,379
IT	3,386	3,048	2,709
LT	6.56	5.91	5.25
LU	44	39	35
LV	4.85	4.37	3.88
MT	13	12	10
NL	111,592	100,433	89,274
PL	1,503	1,353	1,203
PT	765	689	612
RO	63	57	51
SE	24,013	21,612	19,211
SI	50	45	40
SK	370	333	296
UK	254,282	228,854	203,425
Total	501,616	451,455	401,293

Source: Europe Economics and Bourse Consult analysis.

The VM requirement for the UK is higher under the IRS-only case in the FED stress scenario. This is different to the other simulations (i.e. historic data and the EBA stress scenario) in which the VM requirement for the UK is greater when both IRS and inflation swaps are clearable. This is because inflation for the UK is assumed to increase under the Fed adverse scenario, while it decreases in the EBA scenario and during the worst 5-day period in the historic scenario.

Table 8.20 Total cash VM requirement to be held under the IRS and inflation clearable-adverse stress scenario, €millions

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	438	394	350
BE	2,945	2,651	2,356
BG	68	61	54
CY	0.15	0.14	0.12
CZ	494	445	395
DE	23,808	21,427	19,046
DK	44,090	39,681	35,272
EE	38	34	31
EL	1.68	1.51	1.34
ES	4,731	4,258	3,785
FI	7,267	6,541	5,814
FR	3,658	3,293	2,927
HR	153	138	123
HU	64	57	51
IE	4,801	4,321	3,841
IT	2,970	2,673	2,376
LT	5.76	5.18	4.61
LU	38	34	31
LV	4.26	3.83	3.41
MT	11	10	9.
NL	97,882	88,094	78,306
PL	1,319	1,187	1,055
PT	671	604	537
RO	56	50	45
SE	21,063	18,957	16,851
SI	44	40	35
SK	325	292	260
UK	203,313	182,982	162,651
Total	420,261	378,235	336,209

Source: Europe Economics and Bourse Consult analysis.

In line with the increased cash buffer requirements under this scenario, there is an increased opportunity cost of holding cash. This is typically of the same magnitude, except in cases where the cash buffer eats sufficiently into the initial cash holding that there is a requirement to sell a higher than proportional level of assets to meet the desired cash buffer.

Table 8.21: Annual opportunity cost of holding cash buffer under IRS clearable-adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	3,179	2,861	2,543
BE	21,382	19,244	17,106
BG	492	443	394
CY	1.12	1.01	0.9
CZ	3,589	3,230	2,871
DE	345,707	311,137	276,566
DK	640,218	576,196	512,174
EE	278	250	223
EL	12	11	9.74
ES	34,350	30,915	27,480
FI	105,530	94,977	84,424
FR	26,562	23,906	21,249
HR	2,228	2,005	1,782
HU	562	473	427
IE	69,715	62,743	55,772
IT	43,131	38,818	34,505
LT	42	38	33
LU	278	250	223
LV	31	28	25
MT	359	314	269
NL	1,421,322	1,279,190	1,137,058
PL	9,574	8,617	7,659
PT	4,873	4,386	3,899
RO	893	813	732
SE	305,854	275,268	244,683
SI	321	289	257
SK	2,358	2,123	1,887
UK	2,427,721	2,184,949	1,942,177
Total	5,470,563	4,923,473	4,376,426

Source: Europe Economics and Bourse Consult analysis.

Table 8.22: Annual opportunity cost of holding cash buffer under IRS and inflation clearable-adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	2,788	2,510	2,231
BE	18,755	16,880	15,004
BG	431	388	345
CY	0.99	0.89	0.79
CZ	3,148	2,833	2,518
DE	303,234	272,911	242,588
DK	561,562	505,406	449,249
EE	244	220	195
EL	11	9.61	8.54
ES	30,130	27,117	24,104
FI	92,564	83,308	74,052
FR	23,298	20,969	18,639
HR	1,954	1,758	1,563
HU	463	422	382
IE	61,150	55,035	48,920
IT	37,832	34,049	30,265
LT	37	33	29
LU	244	220	195
LV	27	24	22
MT	304	264	224
NL	1,246,702	1,122,031	997,361
PL	8,398	7,558	6,718
PT	4,275	3,847	3,420
RO	794	723	652
SE	268,277	241,449	214,622
SI	282	254	225
SK	2,069	1,862	1,655
UK	1,941,107	1,746,997	1,552,886
Total	4,610,080	4,149,077	3,688,074

Source: Europe Economics and Bourse Consult analysis.

As with all the stress scenarios, there is a requirement to conduct repos when the cash buffer is less than 100 per cent of the expected maximum VM call. The cost across the IRS clearing model and the model where both IRS and inflation are cleared is similar across both models for most Member States. However in the case of the UK, there is a significantly greater cost associated with conducting repo operations when inflation is not cleared.

Table 8.23 Annual cost of repo under IRS clearable-adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call of maximum calculated VM call	80% of maximum calculated VM call
AT	0.00	13	26
BE	0.00	87	175
BG	0.00	2.01	4.03
CY	0.00	0.00	0.01
CZ	0.00	15	29
DE	0.00	707	1,414
DK	0.00	1,310	2,619
EE	0.00	1.14	2.28
EL	0.00	0.05	0.1
ES	0.00	141	281
FI	0.00	216	432
FR	0.00	109	217
HR	0.00	4.56	9.11
HU	0.00	1.89	3.77
IE	0.00	143	285
IT	0.00	88	176
LT	0.00	0.17	0.34
LU	0.00	1.14	2.28
LV	0.00	0.13	0.25
MT	0.00	0.57	1.15
NL	0.00	2,908	5,815
PL	0.00	39	78
PT	0.00	20	40
RO	0.00	1.65	3.31
SE	0.00	626	1,251
SI	0.00	1.31	2.63
SK	0.00	9.65	19
UK	0.00	6,602	13,205
Total	0.00	13,047	26,094

Source: Europe Economics and Bourse Consult analysis.

Table 8.24 Annual cost of repo under IRS and inflation clearable-adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	0.00	11	23
BE	0.00	77	153
BG	0.00	1.77	3.53
CY	0.00	0.00	0.01
CZ	0.00	13	26
DE	0.00	620	1,241
DK	0.00	1,149	2,298
EE	0.00	1.	2.
EL	0.00	0.04	0.09
ES	0.00	123	247
FI	0.00	189	379
FR	0.00	95	191
HR	0.00	4.	7.99
HU	0.00	1.66	3.31
IE	0.00	125	250
IT	0.00	77	155
LT	0.00	0.15	0.3
LU	0.00	1.	2.
LV	0.00	0.11	0.22
MT	0.00	0.5	1.01
NL	0.00	2,550	5,101
PL	0.00	34	69
PT	0.00	17	35
RO	0.00	1.45	2.9
SE	0.00	549	1,098
SI	0.00	1.15	2.31
SK	0.00	8.46	17
UK	0.00	5,279	10,558
Total	0.00	10,932	21,864

Source: Europe Economics and Bourse Consult analysis.

The most significant driver of the total costs over one year, presented in the table below, is the opportunity cost of holding additional cash.

Once again, whilst the cost may be minimised at the 80 per cent buffer, concerns over the repo market does not mean this (or, indeed, an even lower cash buffer) would be adopted.

Table 8.25 Annual total cost (opportunity cost and repo cost) under IRS clearable-adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	3,179	2,874	2,569
BE	21,382	19,332	17,281
BG	492	445	398
CY	1.12	1.02	0.91
CZ	3,589	3,245	2,900
DE	345,707	311,844	277,980
DK	640,218	577,506	514,793
EE	278	252	225
EL	12	11	9.84
ES	34,350	31,055	27,761
FI	105,530	95,192	84,855
FR	26,562	24,014	21,467
HR	2,228	2,009	1,791
HU	562	475	431
IE	69,715	62,886	56,057
IT	43,131	38,906	34,681
LT	42	38	34
LU	278	252	225
LV	31	28	25
MT	359	315	270
NL	1,421,322	1,282,098	1,142,873
PL	9,574	8,656	7,737
PT	4,873	4,406	3,939
RO	893	814	735
SE	305,854	275,894	245,934
SI	321	291	260
SK	2,358	2,132	1,906
UK	2,427,721	2,191,552	1,955,382
Total	5,470,563	4,936,520	4,402,520

Source: Europe Economics and Bourse Consult analysis.

Table 8.26 Annual total cost (opportunity cost and repo cost) under IRS and inflation clearable-adverse stress scenario, €000s

Member State	100% of maximum calculated VM call	90% of maximum calculated VM call	80% of maximum calculated VM call
AT	2,788	2,521	2,254
BE	18,755	16,957	15,158
BG	431	390	349
CY	0.99	0.89	0.8
CZ	3,148	2,846	2,544
DE	303,234	273,531	243,828
DK	561,562	506,554	451,547
EE	244	221	197
EL	11	9.65	8.63
ES	30,130	27,240	24,350
FI	92,564	83,497	74,430
FR	23,298	21,064	18,829
HR	1,954	1,762	1,571
HU	463	424	385
IE	61,150	55,160	49,170
IT	37,832	34,126	30,420
LT	37	33	30
LU	244	221	197
LV	27	25	22
MT	304	264	225
NL	1,246,702	1,124,582	1,002,462
PL	8,398	7,592	6,787
PT	4,275	3,865	3,455
RO	794	725	655
SE	268,277	241,998	215,719
SI	282	255	228
SK	2,069	1,870	1,672
UK	1,941,107	1,752,276	1,563,444
Total	4,610,080	4,160,009	3,709,938

Source: Europe Economics and Bourse Consult analysis.