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## MERGING SCHEMES: AN ECONOMIC ANALYSIS OF DEFINED BENEFIT PENSION SCHEME MERGER CRITERIA

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### ABSTRACT

The conditions under which pension schemes merge is an important issue which has been under-researched. Mergers can affect the strength of the sponsor's covenant and the balance of power between the trustees and the sponsor, as well as the deficit or the surplus of the receiving scheme and its funding ratio. This paper sets out two financial criteria to be met by any pension scheme merger: no profit or loss on merging with another scheme; and no dilution of the funding ratio. After defining a merger basis for valuing the assets and liabilities, and allowing for adjustments to the funding ratio via side receipts and payments; it is shown that, whether or not these criteria are met, depends on the state of the financial markets.

### KEYWORDS

Defined Benefits; Mergers; Takeovers; Side Payments; Side Receipts

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### 1. INTRODUCTION

It is increasingly recognised that, when taking over, merging with, or selling a company, careful consideration needs to be given to the pension schemes of the companies concerned. For example, in 2004 the takeover bids for WH Smith by Permira, and for Marks & Spencer by Philip Green foundered on problems concerning the pension schemes, as did the bids by Duke Street Capital for Uniq, the Apax and Time Warner bid for ITV, and the bid for Beale in 2005. The Santander Central Hispano bid for Abbey National in 2004 only succeeded after it agreed to inject €950 million into the Abbey National pension scheme. A recent survey by Jones *et al.* (2005) found that 69% of private equity houses have abandoned a deal due to pensions issues.

Since pension schemes can involve very large amounts of money, and the value of the liabilities may be many times greater than the value of the

employer, dealing with the pension schemes can be an important aspect of the merger terms. Surprisingly, the effects of pension schemes on company mergers or takeovers has only recently assumed importance, and little attention has previously been given to this matter by researchers.

This paper addresses the problem of setting the terms under which two defined benefit schemes merge. There are a number of reasons for the merger of defined benefit pension schemes:

- a merger between two companies, followed shortly afterwards by the merger of their pension schemes;
- one company takes over another (and then merges the pension schemes);
- two schemes, previously run by the same employer, are combined;
- a group of employees, all working for the same employer, is transferred from one company pension scheme to another (Strictly this is a bulk transfer, but the economic principles are similar.); and
- a scheme merger may result from a company either joining a multi-employer scheme, or transferring an additional group of employees into a multi-employer scheme. In 2005 the National Association of Pension Funds was urging small schemes to form multi-employer schemes.

Throughout this paper, merger refers to any situation where two defined benefit pension schemes pool their assets and liabilities without any ring fencing or special sections, and active members of the transferring scheme receive past service credits. This paper does not consider the administrative difficulties of merging schemes and the problems of replicating the benefit structures of both sets of pensioners and deferred pensioners within a single scheme; nor does this paper address the question of choosing a strike date on which the assets and liabilities are valued. The one-off transaction costs, as well as any long-run cost savings generated by merging schemes, are not considered.

There is considerable scope for variation in the terms under which two schemes merge, and the objective adopted here is to devise conditions under which: (a) the value of the assets and liabilities of the transferring scheme are in balance, i.e. there is no profit or loss on taking over another scheme; and (b) there is no transfer of value from the members of one scheme to those of another, i.e. the merger does not involve a cross-subsidy. If there is a substantial difference in size between the two schemes, any loss or cross-subsidy to or from the large scheme on the merger may be trivial, and its trustees may be prepared to overlook such matters.

There are many complicated legal restrictions on the operation of pension schemes in most countries, and these rules are subject to constant revision. The purpose of this paper is to address the fundamental economic issues of

profit or loss and cross-subsidy, and the circumstances in which such effects can be avoided. In this context, the underlying legal framework is not considered in any depth, and some proposals may require legal changes in some countries. Recent legislation in the United Kingdom has facilitated the economic approach adopted in this paper.

For expositional simplicity, let firms *A* and *B* merge to form firm *C*, and let scheme *A* (the receiving scheme) be the pension scheme to which all of the members of pension scheme *B* (the transferring scheme) transfer, to create the merged scheme, called scheme *C*. The problem is to specify the conditions under which the merger is acceptable to the trustees of both schemes *A* and *B*.

The merger criteria considered here will tend to be enforced because the trustees of scheme *B* may either refuse to agree to the scheme merger, or trigger a winding-up of their scheme if the receipts from a wind-up (including any share of the surplus on scheme *B* attributable to its members) exceed the benefits of becoming a member of scheme *C*. If the trust deed and rules do not give them the power to initiate a winding-up, the trustees can make representations to the Pensions Regulator for the scheme to be wound up. From 11 June 2003, the liabilities on such a wind-up have been valued on a full buy-out basis (including the administrative costs of the wind-up). Similarly, if an employer withdraws from a multi-employer scheme after 1 September 2005, a full buy out basis must be used to value the liabilities (the Pensions Regulator, 2005). Alternatively, rather than merge with scheme *A*, the trustees of scheme *B* may consider using the assets of their scheme to buy out the scheme liabilities; e.g. by the purchase of annuities and deferred annuities from an insurance company (see Chapman & Jagelman, 1980, 1982); or they may continue as a closed scheme. Conversely, the trustees of scheme *A* may be unwilling to receive scheme *B* if this leads to the members of scheme *A* becoming worse off.

After explaining the zero profit and no dilution criteria in Section 2, this paper argues that a merger can affect the balance of power between the trustees and the sponsor, and the strength of the sponsor's covenant. A merger basis for valuing the assets and liabilities of the merging schemes is then defined in Section 3.1. After introducing side receipts and payments to adjust each scheme's funding ratio in Section 3.2, the feasible regions for a merger which meets one or both of the criteria are derived in Section 4. It is concluded in Section 4.3 that simultaneously meeting the two merger criteria requires that both schemes *A* and *B* are at least fully funded. Since scheme funding levels vary with the state of the financial markets, whether two or more schemes can reach a merger agreement depends on the financial markets. Delay may mean that funding levels rise, and a merger which did not meet the criteria specified in this paper becomes possible. Conversely, it is possible that, while the merger criteria are currently met, this will cease to be the case if there is delay.

## 2. ALTERNATIVE VIEWS ON ACCEPTABLE TERMS FOR A MERGER

There are two distinct views on setting acceptable merger terms for defined benefit pension schemes, and these are outlined in this section.

2.1 *Zero Profit or Loss*

The first view is that, at the time of the merger, the assets and liabilities of scheme *B* should be in balance, leading to no profit or loss on the transfer. Members of schemes *A* and *B* are deemed to have no interest in the size of their scheme surplus, because: (a) they have no claim on any surplus (although this depends on the scheme rules); and (b) the extent of any over-funding is irrelevant as, following GN16, the security of the pensions promise needs not to be considered when devising merger terms. The trustees of scheme *B* will not wish to transfer a surplus, while the trustees of scheme *A* will not wish to take on a deficit; and this leads to the requirement that the assets transferred from scheme *B* to scheme *A* should exactly cover the liabilities.

2.2 *Zero Dilution of the Funding Ratio*

The criterion of no actuarial profit on scheme *B* does not rule out a cross subsidy from scheme *A* to scheme *B*. This will occur if scheme *A* has a surplus, which is diluted on merging with a less well funded scheme. If scheme *A* is in deficit, while scheme *B* is not, the merger will lead to a cross subsidy from scheme *B* to scheme *A*. This view recognises that members of the two pension schemes are interested in the surplus per member because: (a) they are concerned about the margin of safety between the pensions promised and the funding available, i.e. the funding ratio (scheme members benefit from the entire margin of safety); and/or (b) they have a legal claim on part or all of the scheme surplus, or a reasonable expectation of sharing the surplus. In which case the situation changes substantially. Members of both schemes *A* and *B* will wish to preserve or improve their initial funding ratio. If the schemes have different funding ratios on the merger valuation basis (explained in Section 3), side payments or receipts are required to produce adjusted funding ratios for schemes *A* and *B* which are equal, so preventing any cross-subsidy or dilution.

Hammond (1962) supports the aim of preventing dilution when pension schemes are merged. He suggests four possible responses to different funding ratios:

- (a) Accept such differences if the acquired scheme is small, or if the difference in funding ratios is small.
- (b) Keep schemes *A* and *B* separate until such time as their funding ratios are equal.
- (c) Earmark or ring-fence the money paid in by scheme *B*, while all the assets of scheme *C* are managed as a single pension fund.

- (d) The priority order on a wind-up of scheme *C* specifies different treatments for the former members of schemes *A* and *B*. This would require the scheme to be sectionalised, which implies point (c).

### 2.3 Other Criteria

The trustees of schemes *A* and *B* will also be concerned about the strength of the covenant of scheme *C*'s sponsor, the balance of powers as between the trustees and the sponsor of scheme *C*, and the potential for 'flooding' — whereby the increase in membership of the receiving scheme enables the sponsor to eliminate a surplus more quickly by a contribution holiday (see Greenstreet, 2002).

#### *Sponsor's Covenant*

It is likely that the sponsors of schemes *A* and *B* have covenants of different strengths. It is also quite possible that the strength of the covenant of the sponsor of scheme *C* (i.e. the merged company) differs from that of schemes *A* and *B*. If firm *A* issues a lot of debt to finance the purchase of firm *B*, it is possible that the strength of the covenant of firm *C* is inferior to that of both firms *A* and *B*. Alternatively, the merger of firms *A* and *B* may generate considerable synergies, so that the strength of the covenant of firm *C* is superior to that of both firms *A* and *B*. It is also possible that the merger leads to a strengthening of the sponsor's covenant for the members of scheme *B*, and a weakening of the covenant for the members of scheme *A*; and vice versa.

The trustees of schemes *A* and *B* will presumably accept a merger in which the strength of their sponsor's covenant is increased, or remains unchanged. There are various ways in which the merger can be structured to strengthen the covenant of scheme *C*:

- (a) The covenant of firm *C* can be strengthened by reducing the firm's debt-equity ratio. For example, if the merger is financed using largely new equity capital, the covenant of firm *C* may be stronger than that of firm *A* (and firm *B*).
- (b) The sponsor of scheme *C* can offer a high priority on company liquidation to the pension scheme by making it a secured creditor. For example, in November 2002 Intelek gave its pension scheme a charge of £2.4 million on the United States assets of its subsidiary; while in October 2003 ICI announced setting up a subsidiary owning £250 million of ICI debtors. The ICI pension scheme was the only creditor of this subsidiary.
- (c) A group company, or other entity can provide a guarantee to the scheme.
- (d) A financial institution may issue a letter of credit or bank guarantee to the scheme.
- (e) The trustees of scheme *C* may be given enhanced powers, e.g. the power to set the contribution rate; or the rules governing the allocation of a surplus on wind-up may be changed.
- (f) A wide range of business decisions can influence the strength of the

- sponsor's covenant, e.g. signing a long-term contract to supply goods or services, selling a failing subsidiary, moving into a profitable new market.
- (g) The sponsor can undertake a covenant under which it agrees not to increase its debt level beyond some specified maximum, which will limit any future deterioration in its debt-equity ratio.
  - (h) Concerns about the sponsor's covenant are linked to the scheme's funding ratio, and the injection of a large sum of money into scheme *C* will reduce any concerns about the sponsor's covenant. The sponsor can issue debt, and inject the proceeds into the pension scheme. In June 2003 General Motors issued \$10 billion of bonds for injection into its pension scheme, while in March 2004 Marks & Spencer borrowed £400 million for injection into its pension scheme. This action increases the solvency of the pension scheme, but weakens the sponsor's covenant by increasing its debt-equity ratio. Injecting funds into the pension scheme before or after the merger is considered further in Section 3.2.

#### *Balance of power*

There may also be concern about differences in the balance of power as between the trustees and the sponsor of the transferring and receiving schemes. These differences can form part of the merger negotiations, and it may be possible to find an outcome acceptable to all parties.

#### *Flooding*

The potential for flooding exists whenever scheme *C* has a surplus, and the powers of the sponsor are sufficient to introduce a contribution holiday. It can be prevented by increasing the powers of the trustees of scheme *C* in setting the contribution rate.

The balance of power between the trustees and sponsor and the potential for flooding can be addressed as part of the rules governing the operation of scheme *C*. Provided the sponsor is not liquidated or the scheme wound up, the strength of their covenant does not directly alter the amount of money available to pay or improve benefits; although it does affect the risk of default on the pensions promise. Taken together, it will be shown below that the zero profit and dilution criteria require both schemes *A* and *B* to be fully funded at the time of the merger. Therefore the strength of the sponsor's covenant is likely to be of secondary importance, behind dilution and the profit or loss on the merger. While it would be possible to model a risk-return trade-off between the strength of the covenant and the funding ratio, it is not considered further in this paper.

### 3. VALUING SCHEMES AND ADJUSTING THE FUNDING RATIOS

#### 3.1 *Merger Basis*

A key feature of the problem is the actuarial assumptions used to value

the assets and liabilities transferred from scheme *B*, which is termed ‘the merger basis’. Since the aim is to rule out economic profits or losses and cross-subsidies, the liabilities should be valued using an unbiased forecast of their current economic value. Therefore, the valuation basis should not be unduly strong or weak, while the chosen funding method (e.g. the projected unit) should be economically appropriate. The same financial assumptions should be used for schemes *A* and *B*; as the money will be invested in a pooled manner by scheme *C*. Hammond (1962) recommends the use of the same funding method for both schemes. The demographic assumptions may differ because the two groups of members may have different longevity, ill-health, withdrawal rates, etc., which are expected to be maintained in the future. Although different, these demographic assumptions should be of equal strength, relative to the circumstances of each scheme’s membership. Scheme *A* will want the use of a strong actuarial basis to value scheme *B*’s liabilities, while scheme *B* will want a weak actuarial basis. Negotiation should produce an agreed set of actuarial assumptions and a funding method which approximates to the merger basis.

The merger agreement may make allowance for a surplus or deficit on the pension schemes of the companies concerned. A takeover bid may include the condition that the target company makes good any deficit on its pension scheme (see Chapman & Jagelman, 1980, 1982). Alternatively, the bidder can reduce its offer by the amount of any pension deficit, and inject this money into scheme *B* immediately after the takeover. If scheme *B* is in surplus, and this surplus is to be included in the merged pension scheme, the value of the takeover bid can be increased (see Chapman & Jagelman, 1980; Hammond, 1962). Alternatively, Chapman & Jagelman (1980) suggest that a surplus on scheme *B* might be allowed for by giving the former members of scheme *B* a higher priority in the event of a winding-up of scheme *C* (which requires the scheme to be sectionalised). Similarly, Greenstreet (2002) mentions altering the priority order on a wind-up, but argues that such provisions are hard to operate, and that the statutory provisions cannot be overridden.

### 3.2 *Side Receipts and Payments*

There are a number of ways in which the funding ratio of a scheme can be increased or decreased, and these will be termed side receipts and side payments respectively. Side receipts effectively increase the funding ratio of a scheme, and may take the form of:

- (a) a capital sum injected into the scheme by the sponsor immediately before the merger;
- (b) an agreement for the sponsor to make a payment with the requisite present value into scheme *C*, paid in instalments over a number of years; and
- (c) an agreement to pay a higher employer’s contribution rate than otherwise, for a specified period, to scheme *C*, in respect of the former members of one of the merged schemes.

A scheme funding ratio can effectively be reduced by side payments, which may take the form of:

- (a) a lower employer's contribution rate to scheme *C* than otherwise, for a specified period, in respect of the former members of one of the merged schemes; and
- (b) an increase in the accrued benefits for scheme members immediately before the merger.

In practice, there may be upper limits on the magnitude of side receipts, as the employer may be unable to inject very large sums into its pension scheme. If the sponsor of scheme *B* is wholly owned by a parent company, this parent will receive the proceeds of the sale of its subsidiary, and these can be injected into scheme *B* to remove a deficit computed on the merger basis. However, if the sponsor of scheme *B* is not a subsidiary of another company, the proceeds of the acquisition will go to its shareholders, and may be unavailable for rectifying any deficit in scheme *B*. There is also a limit on the extent to which the contribution rate can be reduced (e.g. a contribution holiday). The upper bound on side payments will probably be large, e.g. a contribution holiday for many years; while the upper bound on side receipts will probably be smaller.

#### 4. DERIVATION OF FEASIBLE REGIONS

This section develops simple mathematical models which specify the initial conditions for which either one or both of the merger criteria are met. Let the market values of the assets of schemes *A* and *B* at time *t* be  $A_{At}$  and  $A_{Bt}$ , while the values of the liabilities (valued using the merger basis) at time *t* are  $L_{At}$  and  $L_{Bt}$ . Let the present value of any side payments which reduce the funding ratio be  $A_{At}P_A$  and  $A_{Bt}P_B$ , where  $P_A$  and  $P_B$  are assumed to be constant over time. Similarly denote the present value of any increases in the funding ratio (side receipts) by  $A_{At}R_A$  and  $A_{Bt}R_B$ , where  $R_A$  and  $R_B$  are also assumed to be constant over time.

A major influence on the current value of a scheme's assets and liabilities (and hence its funding ratio) is the current state of the financial markets. While this relationship is complex, for simplicity it is assumed that the funding ratio before side payments and receipts at time *t* ( $FR_t$ ), for both schemes, is a positive linear function of some measure of the state of the financial markets at time *t* (denoted  $M_t$ ).

The value of scheme assets increases as investment returns rise, while the value of scheme liabilities increases as interest rates fall. Let  $FR$  be a linear function of the value of the market portfolio ( $V_M$ ), interest rates ( $r$ ) and the values of other assets ( $Y$ ) such as property, commodities, private equity, etc. (For simplicity, changes in the actuarial assumptions are not considered.)



Thus  $FR = a + bV_M + cr + dY$ . For the simplicity of a one-factor model, it is assumed that there are linear relationships between the various factors determining  $FR$ . For example:  $r = e + fV_M$ ; and  $Y = g + hV_M$ . Therefore  $FR = \alpha + \beta M$ , where  $\alpha = a + ec + dg$ ,  $\beta = b + cf + dh$ , and  $M$  is the state of the financial markets as measured by the value of the market portfolio  $V_M$ . The values of  $\alpha$  and  $\beta$  reflect the actual asset allocation and maturity of the scheme concerned. If, as assumed, there is a constant relationship between the value of scheme assets and interest rates (e.g. an all gilt portfolio, when  $\alpha = a$  and  $\beta = c$ ) the major factors determining  $FR$  can be collapsed into a single factor ( $M$ ):

$$FR_{At} \equiv A_{At}/L_{At} = \alpha_A + \beta_A M_t \tag{1a}$$

$$FR_{Bt} \equiv A_{Bt}/L_{Bt} = \alpha_B + \beta_B M_t. \tag{1b}$$

The funding ratios can be adjusted by side payments and receipts up to some maximum amounts. Letting the maximum values of  $P$  and  $R$  be denoted by  $P^*$  and  $R^*$  respectively, the maximum and minimum adjusted funding ratios at time  $t$  ( $AFR_t$ ) for schemes  $A$  and  $B$  are:

$$\text{Min } AFR_{At} = (1 + P_A^*)FR_{At} = (1 + P_A^*)(\alpha_A + \beta_A M_t) \tag{2a}$$

$$\text{Min } AFR_{Bt} = (1 + P_B^*)FR_{Bt} = (1 + P_B^*)(\alpha_B + \beta_B M_t) \tag{2b}$$

$$\text{Max } AFR_{At} = (1 - R_A^*)FR_{At} = (1 - R_A^*)(\alpha_A + \beta_A M_t) \tag{2c}$$

$$\text{Max } AFR_{Bt} = (1 - R_B^*)FR_{Bt} = (1 - R_B^*)(\alpha_B + \beta_B M_t). \tag{2d}$$

The conditions required by the two different views of an acceptable merger will now be considered.

#### 4.1 Zero Profit or Loss

The first criterion requires that the transfer of the members of scheme  $B$  to scheme  $A$  to form scheme  $C$  does not involve an actuarial profit or loss; in which case the adjusted funding ratio of scheme  $B$  immediately before the merger must be 100%. For the trustees of scheme  $B$  to agree to the merger, scheme  $A$  is required to have a funding ratio of 100% or better. Using the previous notation, this can be stated as:

$$A_{Bt} + A_{Bt}R_B = L_{Bt} + A_{Bt}P_B \quad \text{or} \quad A_{Bt}(1 + R_B - P_B)/L_{Bt} = 100\% \tag{3a}$$

$$A_{At} + A_{At}R_A \geq L_{At} + A_{At}P_A \quad \text{or} \quad A_{At}(1 + R_A - P_A)/L_{At} \geq 100\% \tag{3b}$$

where  $P_A, R_A, P_B, R_B \geq 0, P_B \leq P_B^*, R_B \leq R_B^*, P_A \leq P_A^*$  and  $R_A \leq R_A^*$ .

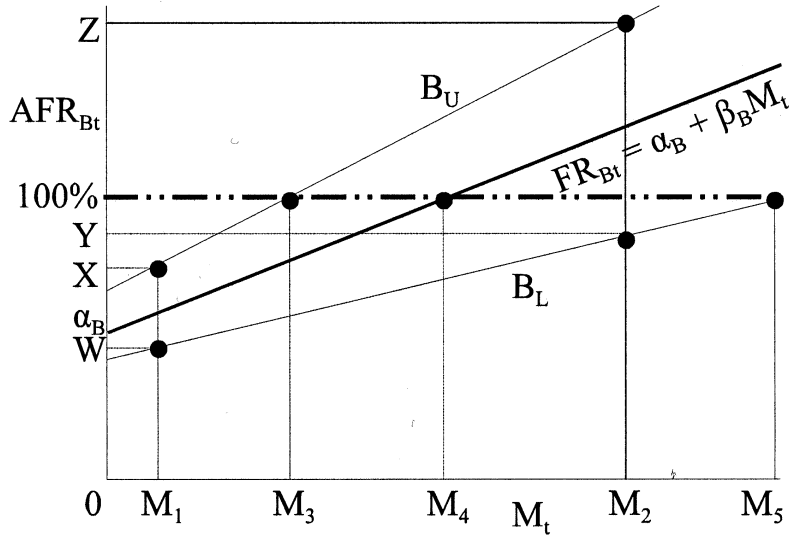


Figure 1. Zero profit or loss — scheme B

Either side payments or side receipts may be required to adjust the funding ratio of scheme B so that equation (3a) is met. Provided that the required side receipts and payments are within the permitted bounds,  $AFR_{Bt}$  can be made equal to 100%. Figure 1 shows the relationship between market conditions and the adjusted funding ratio.

The line  $FR_{Bt} = \alpha_B + \beta_B M_t$  gives the relationship between market conditions and the unadjusted funding ratio. This funding ratio can then be adjusted upwards or downwards by side payments or receipts, until the maximum payment or receipt is reached (i.e. the lines  $B_U$  and  $B_L$  show the result of the maximum receipts and payments, respectively). Above the 100% funding ratio line side payments are required, and below this line side receipts are indicated. For example, if the market conditions are  $M_1$ , then an  $AFR_{Bt}$  of between  $W$  and  $X$  can be achieved; while if the market conditions are  $M_2$ , an  $AFR_{Bt}$  of anywhere between  $Y$  and  $Z$  can be achieved. More generally, for each value of  $M_t$ , an  $AFR_{Bt}$  between the  $B_U$  and  $B_L$  lines can be attained. Depending on the values of  $P_B^*$ ,  $R_B^*$  and  $M_t$  (as well as  $\alpha_B$  and  $\beta_B$ ), it may be possible to achieve an adjusted funding ratio of 100% for scheme B. Figure 1 shows that the 100% line intersects the  $B_U$  line when the market level is  $M_3$ , while it intersects the  $B_L$  line when the market level is  $M_5$ . For values of  $M_t$  between  $M_3$  and  $M_5$ , an adjusted funding ratio of 100% for scheme B can be achieved. Over the range  $M_3$  to  $M_4$ , there will be side receipts to increase

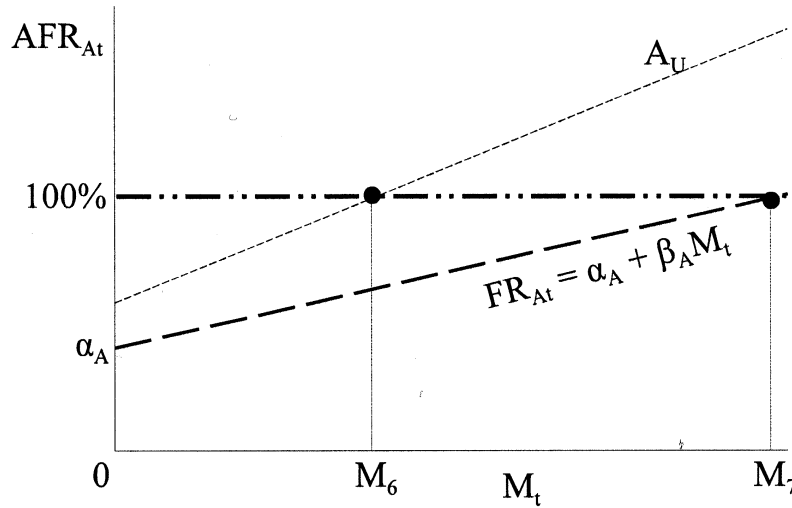


Figure 2. Zero profit or loss — scheme A

the initial funding ratio to 100%, while from  $M_4$  to  $M_5$  there will be side payments to reduce the initial funding ratio to 100%.

As well as moving the funding ratio for scheme B to 100%, the funding ratio of scheme A must be at least 100%, as set out in inequality (3b). This is analysed in Figure 2. The line  $A_U$  represents the highest funding ratio which can be reached for scheme A by side receipts. For values of  $M_t \geq M_6$ , the adjusted funding ratio of scheme A can be made at least 100% by side receipts. For values of  $M_t$  above  $M_7$ , the unadjusted funding ratio of scheme A will be above 100%, and side receipts are not required.

The salient features of Figures 1 and 2 are combined in Figure 3 (assuming that  $M_6 > M_3$ ), which shows that the scheme B funding ratio can be adjusted to 100% for values of  $M_5 > M_t > M_3$ ; while the scheme A funding ratio can be adjusted to 100% or above for values of  $M_t > M_6$ . Therefore, in this case, in order for the ‘no actuarial profit or loss’ condition to be met for both schemes, it is required that  $M_5 > M_t > M_6$ . If this condition is not met, it is impossible to devise a zero profit or loss merger.

Alternatively, if  $M_3 > M_6$ , equation (3) can be met in the circumstances shown in Figure 4, leading to two alternative conditions for no actuarial profit or loss:

Figure 3  $M_5 > M_t > M_6 > M_3$  (4a)

Figure 4  $M_5 > M_t > M_3 > M_6$ . (4b)

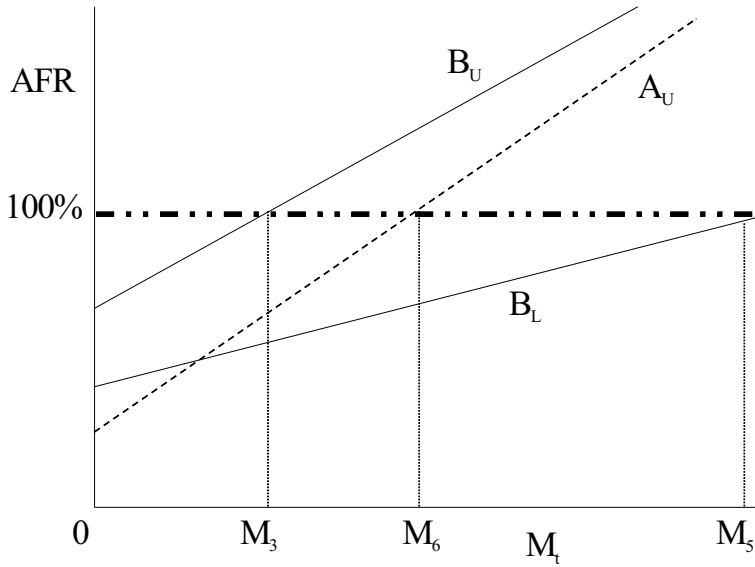


Figure 3. Zero profit or loss — schemes *A* and *B* (1)

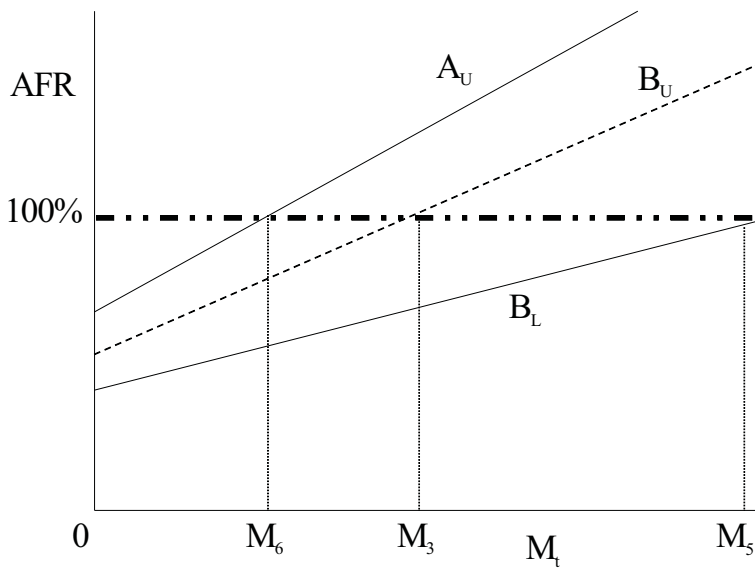


Figure 4. Zero profit or loss — schemes *A* and *B* (2)

Inequality (4) reveals that the ability to negotiate a scheme merger without an actuarial profit or loss depends on the level of the market variable  $M_t$ . Thus, the timing of a merger may be crucial. In practice, it is quite likely that inequality (4) is met, because the funding ratios of pension schemes usually tend to cluster around 100%, and so  $M_4 \approx M_6 \approx M_t$ ; which implies that  $M_5 > M_t > (M_3, M_6)$ . In which case it is possible to ensure zero actuarial profit or loss on a scheme merger.

4.2 Zero Dilution of the Funding Ratio

For the moment, the objective of no actuarial profit or loss on the merger will be dropped. The criterion that neither scheme should have its initial funding ratio diluted requires that the adjusted funding ratios of schemes A and B immediately before the merger are equal, and this can be stated as:

$$A_{At}(1 + R_A - P_A)/L_{At} = A_{Bt}(1 + R_B - P_B)/L_{Bt} \tag{5}$$

where  $P_A, P_B, R_A, R_B \geq 0, P_A \leq P_A^*, P_B \leq P_B^*, R_A \leq R_A^*,$  and  $R_B \leq R_B^*$ .

By side payments and receipts, it may be possible to equate the adjusted funding ratios of schemes A and B. There are various situations in which equation (5) can be met, and these are shown in Figures 5, 6, 7 and 8.

Figure 5 presents a possible relationship between  $M_t$  and  $FR_t$  for both

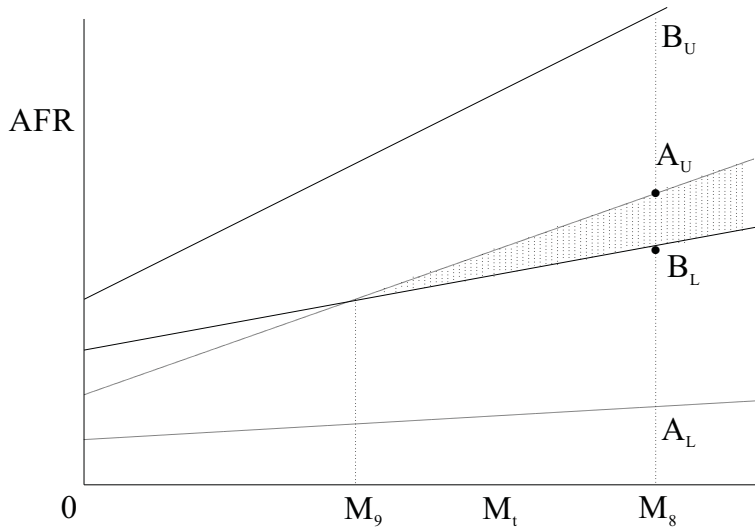


Figure 5. Zero dilution of the funding ratio (1)

schemes *A* and *B*. It also shows the maximum extent to which these funding ratios can be adjusted by side payments and receipts. The lines labelled  $A_U$  and  $B_U$  represent the maximum values of the *AFR* for schemes *A* and *B* respectively, while the lines labelled  $A_L$  and  $B_L$  show the minimum *AFR* values. When the level of the market is  $M_8$ , the *FR* of scheme *A* can be adjusted to be anywhere between  $A_L$  and  $A_U$ , while the *FR* of scheme *B* can be adjusted to be anywhere between  $B_U$  and  $B_L$ . Therefore, the *FR* of both schemes can be equalised by adjusting them to some common value between  $A_U$  and  $B_L$ . In this case, the funding ratio of scheme *B* is reduced by side payments, while the funding ratio of scheme *A* is increased by side receipts. The common *AFR* will be decided by negotiation. Given the situation shown in Figure 5, equation (5) is met if  $M_t > M_9$ , the point of intersection between  $A_U$  and  $B_L$ . Three other situations in which equation (5) can be met appear in Figures 6, 7 and 8.

The four possible conditions for meeting equation (5) are:

$$\text{Figure 5} \quad M_t > M_9 \quad (6a)$$

$$\text{Figure 6} \quad M_{10} > M_t > M_9 \quad (6b)$$

$$\text{Figure 7} \quad M_t > 0 \quad (6c)$$

$$\text{Figure 8} \quad M_{11} > M_t > 0. \quad (6d)$$

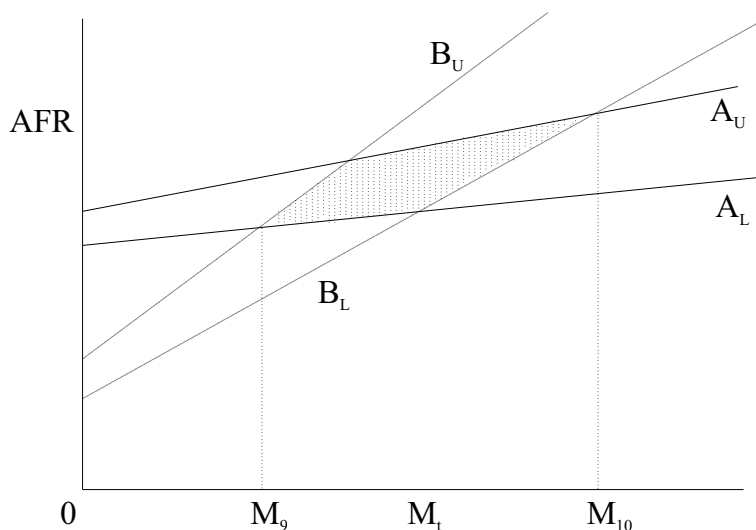


Figure 6. Zero dilution of the funding ratio (2)

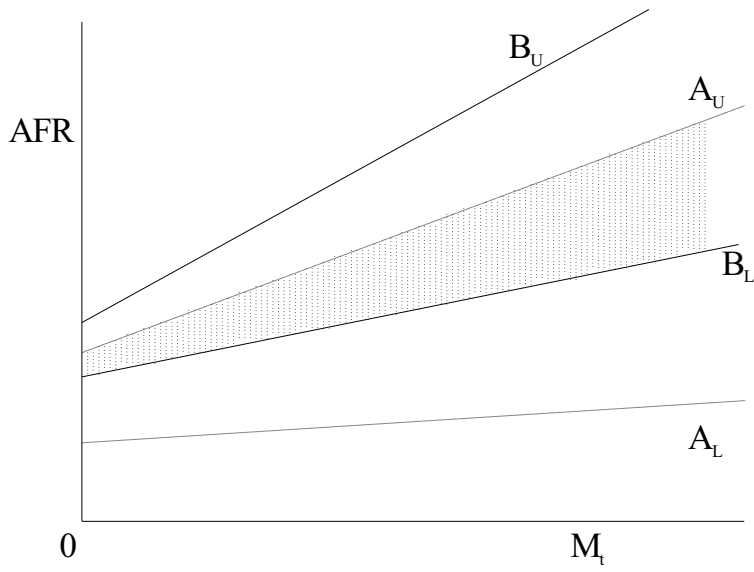


Figure 7. Zero dilution of the funding ratio (3)

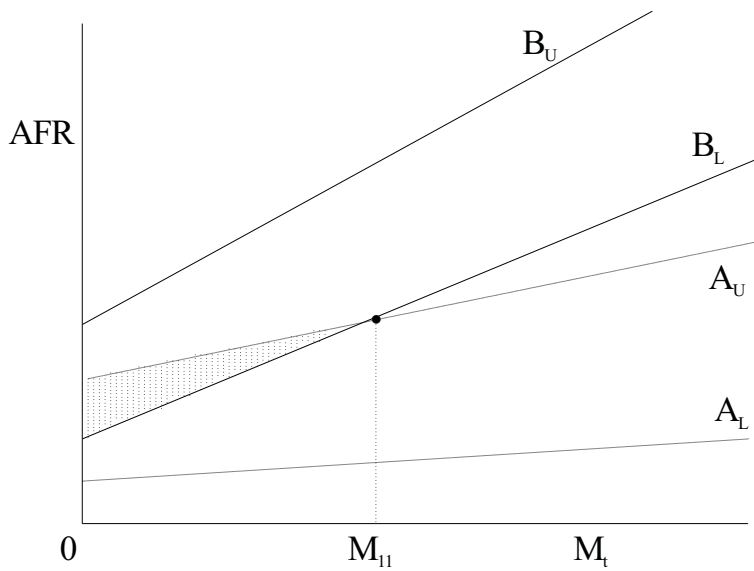


Figure 8. Zero dilution of the funding ratio (4)

It is possible that the *AFRs* do not intersect at any level of  $M_t$ , and a zero dilution merger is impossible for any level of  $M$ . If a two-factor model is used, in which equities and interest rates move differently, a solution may be possible. The two schemes will usually have different values of  $\alpha$  and  $\beta$  due to differences in asset allocation and scheme maturity. The effects of this on finding a solution which meets equation (5) are varied, as illustrated in Figures 3 to 8, and may or may not facilitate finding a solution. Equation (5) is more likely to be met when the upper bounds on side payments and receipts are large. It was previously argued that the funding ratios of both schemes will tend to be in the vicinity of 100%. Therefore the funding ratios of schemes *A* and *B* will be fairly similar, and tend to rise and fall together as the market changes. In consequence, there is a reasonable prospect that side receipts and payments will enable a dilution-free outcome, although this cannot be guaranteed.

#### 4.3 Zero Profit or Loss and Zero Dilution

Depending on whether the objective is ‘zero profit or loss’, or ‘zero dilution’, the merger terms may differ, and a merger which is acceptable under one approach may be unacceptable under the other. This raises the question of the conditions which are required before both merger criteria can be met simultaneously. The combined condition that the adjusted funding ratios are both equal to 100% is:

$$A_{At}(1 + R_A - P_A)/L_{At} = A_{Bt}(1 + R_B - P_B)/L_{Bt} = 100\% \quad (7)$$

where  $P_A, P_B, R_A, R_B \geq 0$ ,  $P_A \leq P_A^*$ ,  $P_B \leq P_B^*$ ,  $R_A \leq R_A^*$  and  $R_B \leq R_B^*$ .

Equation (7) requires that inequalities (4) and (6) are met simultaneously. Since there are two situations when inequality (4) can be met, and four situations when inequality (6) can be satisfied; there are eight ways of simultaneously meeting both inequalities. Using the situations depicted in Figures 3 and 5 as an example, the combined position is shown in Figure 9.

Only the zero profit or loss condition is affected by the position of the 100% funding horizontal line. In Figure 9 this line can rise to infinity, or fall to point *Z*, and both merger criteria continue to be met. However, if this line drops below point *Z*, neither merger condition is met. The shaded regions in Figures 5 to 8 represent the combination of values of the funding ratio and  $M_t$  for which both the zero profit and the no dilution criteria are met. These shaded regions show that often both criteria can be met for a very wide range of positions of the 100% line. The only exception is the diamond shape in Figure 6. This suggests that, in practice, it may often be possible to meet both merger criteria simultaneously.



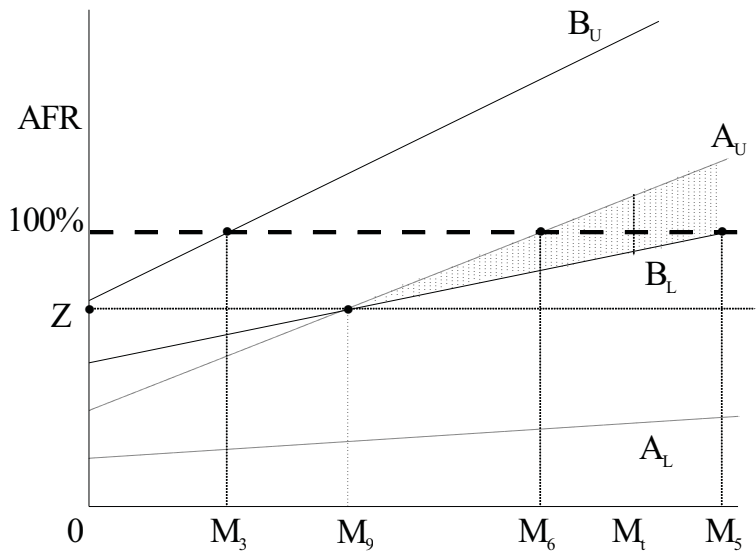


Figure 9. Zero profit or loss and zero dilution of the funding ratio (Figures 3 and 5)

### 5. CONCLUSIONS

The conditions under which two pension schemes merge is an under-researched question which has recently assumed increased importance. Two criteria have been proposed for judging scheme mergers: no actuarial profit or loss; and no dilution of the funding ratio. The strength of the sponsor's covenant, the balance of power between trustees and sponsor and the potential for flooding are also of importance, but were not included as additional criteria. If the two merger criteria are met, both merging schemes will be well funded and the covenant will be of secondary importance; while flooding and the balance of powers are independent of the two merger criteria.

The merger basis for use by actuaries in valuing the two schemes was defined, and the use of side receipts and payments to remove the profit or loss and dilution effect explained. Various circumstances under which there is no profit or loss and no dilution were then presented. It was argued that fully funded pension schemes should generally be able to satisfy one or other of these conditions, although simultaneously meeting both is more challenging. Whether or not it is possible to meet the merger criteria depends on the current state of the financial markets, amongst other things, and it

may be sensible to delay merging pension schemes until market conditions are more favourable, or to strike while the iron is hot if the merger criteria are currently met.

The model presented in this paper can be developed in a number of directions. First, the single financial market factor could be divided into two or more factors (e.g. equity returns and gilt returns). This would create  $n$  dimensional diagrams, and give more ways in which both merger criteria can be satisfied simultaneously. Second, the strength of the employer's covenant could be introduced as a third merger criterion. Third, an empirical investigation could be conducted into the extent to which the merger criteria can be met in reality.

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