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The bonus pool, mark to market and free cash flow: Producer surplus and its vesting in the financial markets

by

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Abstract

Proposals from G20 or national regulators that seek to limit or govern bonuses in the banking finance industry in the interests of systemic stability need to be grounded in the financial economics of producer surplus and its distribution. In this respect, existing treatments of economic agency in justifying large bonus awards are content to accept accounting P&L numbers as a basis for the managerial bonus pool. We argue that managerial bonuses and shareholder dividends should be treated more symmetrically, and constrained by free cash flow criteria that capture producer surplus created by genuine managerial ability. Priority rules should apply, such that fair market value is a compensation for shareholder risk bearing and not a source of managerial surplus. The use of free cash flow conversion ratios neutralises the free option problem that has become a social irritant in public bailouts.

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1. Introduction

Over the course of the international credit crisis, public perceptions of managerial reward structures progressed from a social irritant to a major systemic liability. The former arose from the wealth (in some cases of dynastic proportions) accruing to those who simply managed, rather than created *de novo* as entrepreneurs; or from the lifestyles enjoyed by their more numerous younger compatriots in major financial centres[1]. The systemic aspect was an ex post attribution of financial collapses to perverse incentives created by managerial bonus structures.

Of the two, it was the bonus structures that have received primary attention from policymakers charged with restoring confidence to the financial system. The G20 measures of September 2009 proposed to limit hiring guarantees to just one year; a vesting rule to distribute bonus payouts over three years, with share rather than cash components; a clawback in the case of subsequent poor performance; and a number of other more cosmetic reporting requirements. To some extent, these reflected prior recommendations by a number of national and international regulatory supervisors, such as the UK Financial Services Authority (FSA) and the Bank for International Settlements (BIS). With the exception of the Netherlands, which has moved to cap bonuses at 100% of salary, no regulatory agency has attempted to put limits on the total rewards, though the US does place a limitation on the cash component. But as the financial system recovers from the crisis, much the same stories are emerging, of large bonus guarantees to hire or retain traders in fields such as commodity trading or shipping, or of resurgent P&L based bonus pools in the trading of asset backed securities and credit default swaps as prices recover from past (unpenalised) failures. The free option social irritant will evidently remain, though only time will tell whether the systemic threat remains.

Bonuses are, of course, an element of manager or trader compensation structures. The general issue of managerial compensation had by the time of the credit crunch been the subject of an extensive academic literature, with seminal contributions such as Jensen and Meckling (1976), Jensen (1986), Jensen and Murphy (1990) helping to set the stage; Murphy

[1] In 2006 the top 250 managers at UBS earned an average bonus of USD 1m; see http://news.hereisthecity.com/news/business_news/6493.cntns. The 2008-9 bonus pool for Salomons is a reported USD 4.6 billion (*BBC News*, 16 July 2009). Goldman Sachs has so far (as of Sept. 30 2009) set aside $16.7bn to cover pay and bonuses for 2009, an average payout of $700,000 per worker. JP Morgan is reportedly also awash (*Guardian* 14 October 2009). Bailed out UK banks are claiming *force majeure*; if they do not pay large bonuses, staff will migrate.

(1999), Carpenter and Yermack (1999), and Balsam (2002) provide useful reviews. The academic contributions can generally be organised into two strands, the first seeking explanations in terms of agency theory as above, and the second in terms of power relationships between the company board and its managers, with supporting bit players, notably remuneration consultants. The straight agency view holds that a bonus system is necessary to align employee behaviour with risk seeking appetites of shareholders. Thus if the firm's value function is convex, then the managerial risk profiles should be encouraged to reflect this, with a disincentive to hedge (Smith and Stultz (1985), Kim et al (2007)). Signalling is also a motivation, with newly hired employees willing to signal confidence in their own abilities by accepting a variable success-related component in the form of bonus. With respect to the competing power based view, Bebchuk and Cohen (2003), and Bebchuk & Fried (2003, 2004) have argued that managerial rent seeking results from influence relationships that are themselves part of the agency problem; so that in the last analysis, it is simply extended agency that is the problem. The net result, on this view, is a decoupling of pay from performance (e.g. Tosi et al (2000)).

There is no reason to think that the finance industry is immune from general agency effects, just as for any industrial sector. Thus substantial trader bonuses might be justified in the context of a bank or investment bank with a mixed portfolio of financial activities, e.g. retail and wholesale, that encompasses a spectrum of risk from the low or moderate to the high. The optimal shareholder risk profile might then call for encouraging its wholesale traders to undertake more risks, with aggressive bonus seeking as the incentive to do so. Taking this together with talent scarcity might be quite sufficient to think that quantitative limits on bonuses could actually detract from shareholder value, provided that the systemic risk can be satisfactorily limited. But in the specific context of the finance industry, it is probably fair to say that the remedial policy measures thus far mooted have been informed less by the general economics of agency than by the politics of appeasement and accommodation; the social irritation element, in other words. Restoring the balance requires not only reference to the general theory of economic agency or power relationships, but also to the specifics of the particular industrial context.

The present paper adds to the overall story by considering just what it is that shareholders and their agents are seeking to divide between themselves, even prior to the agency problems that cover its distribution; namely, the bonus pool from which bonuses, dividends or debt interest are to be paid. It is in this sense a paper about measurement, though acknowledging that agency considerations must inform the very basis for measurement. The

distinctive feature is that we consider the microstructure of value generation and whether measurement processes are optimally adapted, or on the other hand, create perverse incentives that should be corrected. The specific context of the paper is the banking and finance industry[2] and the systemic fallout, with reference to credit trading in particular. The issues to be raised deal with the management accounting and underlying economics of the bonus base, i.e. the pool of apparent value on the basis of which trader bonuses are determined for the current year. Is straight accounting profit an economically justified basis for a bonus pool, as is common practice, or should its elements be separated out or differentially weighted in the division of rewards as between shareholders and managers or traders? In turn, this entails two further decision criteria.

(a) The first concerns the treatment of mark to market (MtM) based rewards. In principle, MtM gains for the current period refer to the present value of a series of future premium type flows over and above fair market at the future time points until instrument maturity. So should MtM value gains for the present period enter into the bonus pool in their entirety; or should they be distributed in some way across the future periods? In other words, what sort of principles should given the extent to which MtM gains are factored into current period bonuses?

(b) The second decision criterion governs priority rules for risk bearing as between shareholders and managers. If nothing more than a fair market return is received, should managers be rewarded with a bonus, or on the other hand, should the entire amount be passed through to shareholders as a reward for bearing risk?

It goes almost without saying that aspect (a) has generated so much social resentment and recrimination. If a positive MtM gain this year collapses to an instrument or portfolio of zero value next year, why should traders have been rewarded with high bonuses in the meantime; and would it not be fair to claw the lot back (especially if a public bailout has been required)? The problem is simply that MtM gains have not been crystallised or realised into a year by year cash flow basis. If this is not done, there is an inherent asymmetry between the way that traders and shareholders are rewarded; the resulting free option serves to ratchet manager value well beyond firm value[3]. In standard corporate finance, shareholders are

[2] It is common knowledge that the finance industry in general is at the forefront not only of executive pay but also of pay further down the line. Kaplan and Rauh (2009) is a comparative empirical study.

[3] The dislocation between firm value and manager rewards has been graphic over the period 2006-9. Firm (share) value has not yet fully recovered. But managers have had huge bonus rewards for two of those years with no penalty for the interim loss of value; the free option aspect.

rewarded as part of the free cash flow to owners, the other claimants being debt holders, who are also stakeholders in all this. Mark to market elements, on the other hand, are not cash flow, and should be reduced to such a dimension before distribution to any claimants, including managers and traders. The present paper proposes free cash flow conversion ratios as a systemic way of accomplishing this. Because the conversion ratios have a history, reflecting past failures as well as current successes, they can inoculate against the free option problem that has become such a social irritant in the wake of public bailouts.

Aspect (b) is perhaps less visible to the public at large, but came to a head with the origination and trading of credit default swaps (CDS). Although the instruments date from much earlier, huge volumes of CDS were being written and traded between 2002 and 2006. In turn, this generated a bonus pool of correspondingly large dimensions. But arguably it should have done so only to the extent that it reflected the generation of value superior to fair market value, due (one would hope) to superior trading talent.

Consider the current premium (the 'carry', or loosely the 'coupon') on a fairly priced CDS, usually paid quarterly to the credit protection seller[4]. Apart from any required trading margin, a CDS is a zero capital instrument: I receive a fixed premium (the carry) in exchange for taking on your default risk. The going market rate for the premium can be viewed as the market's required compensation for bearing the risk of a default or downgrade on the reference entity; in effect a normal return on the implicit shareholder capital needed to back the swap's risk. The fair market premium itself should therefore be reserved in its entirety for shareholders as compensation for risk bearing.

In turn, this means that priority rules should obtain in who gets what among the firm's stakeholders. To the extent that this was not observed prior to the crunch, the incentive was for traders to simply run out and buy as many CDS as they could put on the books, subject only to their personal trading limits, and share in the resulting inflow of premiums. Exactly the same incentive arose in respect of special purpose vehicles; their unit holders wore the risk, the originators reaped the reward.

In addition to their integral role in the credit meltdown, credit default swaps are an ideal instrument to exposit the measurement and distribution priority aspects referred to above, and this will be extensively done in what follows. However, the conclusions and remedies are more general, at least in so far as they relate to the finance industry. They apply to wholesale

[4] The word 'carry' is often used in the industry to refer to the cumulative premiums paid up to the current point. The 'carry return' would then be the current premium.

trading of any instrument and in some aspects to retail activities as well, especially when these generate mark to market value.

The scheme of the paper is as follows. Section 2 contains brief review of remuneration practices in the banking and finance industry, as they existed up to (and arguably after) the credit crisis. CDS trading is used extensively as an expositional vehicle throughout the paper, and the basics are also reviewed at this point, including cash flow and MtM pricing conventions. Section 3 explores the theory of producer surplus based free cash flow as a basis for the bonus pool in its relationship to MtM and premium or coupon income. Remedies proposed in section 4 include the use of cash flow conversion ratios in capturing the revealed quality of measured profit and loss. Section 5 offers some concluding remarks.

2. Incentive structures and financial trading

As one would expect, there is mutual reinforcement between remuneration practices and employee behaviour in the finance industry. This section reviews some of these linkages and the incentives they induce on the part of employees, in particular those at the trading desk, though extending to the managers who supervise them. The conventions and practices described below, based on personal experience and participant responses, are generally those of the European markets, prior to 2008, though mention is made where US conventions differ. Further material relates to MtM formulas for subsequent use, using the CDS trading as the template for doing so.

2.1 Lobster pie, and how it is shared

Remuneration in all its aspects is conditioned by accounting profit (P&L), which in the case of financial trading spans both coupon type cash flow and mark to market value gains and losses. In the basic model, the bonus pool is determined by the simple sum of cash flow income and mark to market gains; simple sums of this kind are widely used in reporting overall firm profit or loss, even by central banks[5]. In some institutions there may be a degree of differentiation between realised and unrealised profits depending also on the type of activity involved; section 3.3 returns to this issue.

Inside a trading division, this year's remuneration is conditioned by performance relative to budget, again at all levels: personal, desk, and division. The budget is set each year

[5] A very recent example is the huge profit (relative to capitalisation) reported for the June year 2008-9 by the Reserve Bank of NZ. Much of this was due to MtM gains e.g. for its bond portfolio. This – and doubtless a bit of arm wrestling – appears to have encouraged it to pay a dividend of $630m to its shareholder, the NZ Government. The senior executives, on the other hand, decided to forego a salary rise for the coming year, though no information was released on bonuses, past or future.

based on the previous year's performance (75-90%) and on future expectations. At the trading desk level, the bonus consists of a trading bonus (linked both to personal and desk performance) and a more universal component linked to performance of the bank as whole; the latter is typically a smaller proportion of the trader bonus. In addition, there are special bonuses such are retention bonus or guaranteed bonuses, the latter as an inducement to join. In the German markets (Frankfurt), the median trader would typically expect 4-8% of the year's above-budget P&L, conditional also on the desk's performance, with a variable income component at 1.5-2 times the fixed. It could be higher if the team or individual members were thought to be poachable by competitors: a decent bonus might lead yet undecided team leaders or traders to put their CV's (and print-outs of their P&L) back into the drawer.

The type of activity is important. For example, a trader gaining solely by brokerage rather than risk positions might be rewarded with 0.5% of the P&L; so the trader could make €40million profit and would get a variable payment of €200k for it. By way of contrast, a hedge fund manager, extensively taking risk, could easily end up with 10% of the profit as bonus. The distinction between realised and unrealised profits also makes an appearance in this connection: a trading book with a short holding period is supposed to have more realised profits, on the basis that 'you're paid for trading, not waiting to trade'. An investment book involving buy and hold positions will have more unrealised profits. The bonus basis will be adapted correspondingly.

General remuneration culture is also cognate. The link between personal and firm wide budget is not necessarily monotonic; a good trader would expect a personal P&L based performance related bonus even if the bank as a whole made a loss. Bonus awards are also differentiated in favour of activity areas that senior managers wish to encourage, at the expense of areas deemed less strategic in current market circumstances. Other markets appear to be more generous with bonus payments than Frankfurt (graphically depicted by Ishikawa (2009) for the UK and US). Even post the crisis, US banks are reportedly offering guarantees of up to $1m for seasoned commodity and shipping traders.

Turning to seniority, there has been a top-down approach for compensation, from department budget to team budget to traders', all relative to performance. The more senior the position, the higher the bonus, in relative as well as absolute terms. In this respect, the distribution of the bonus pool can be likened to a dinner buffet: the first in line grab most of the lobster. A representative progression in US investment banking would be: junior 60%:40% (fixed versus bonus); senior 40%:60%; and high senior 20%:80%.

Intra-year results create their own incentives. As earlier suggested, traders are mobile, especially where they have been dissatisfied with their bonuses in the previous year, either in absolute amount or relative to their peers. For the first six months of the new trading year they will take higher risk positions in order to create a real option to move. If these are substantially in the money, that information will find its way via the headhunter to a potential new employer, with a generous guarantee for joining up, plus an undertaking to buy out any commitments to the previous employer. If, on the other hand, the first six months turn out to be disappointing the trader loses little in staying. If the loss exceeds the trader's limit, he or she remains on paid gardening duty, and can start afresh the following year. There is also an incentive to realise end of year losses in order to create a lower budget base for potential profits in the following year; balance sheet adjustments of this kind were often followed at the divisional level.

2.2 CDS trading

The simplest form of CDS is a buy and hold position in which an institution would sell credit protection on a reference entity in exchange for quarterly fixed payment, the CDS premium (called also the 'carry'). This can be done either with individual credit names, or with index baskets such as those on Itraxx. It was this sort of activity that became popular with fund managers seeking to enhance their returns at a time when ambient interest rates were dropping. Special purpose vehicles took money from the general public, invested it in unexciting but safe government bonds to provide the collateral for any default payouts, and enjoyed the yield enhancement provided by the CDS premiums. The willingness of the public to provide the funding base for CDS, together with monoline insurers, provided the underpinning for the explosion of subprime credit via structured investment vehicles (Bowden and Lorimer (2009)).

Turning to the specific context of professional credit trading, trader rewards might depend upon the type of trading activity and the extent to which this is subject to institutional position constraints or directives. Quasi arbitrage provided one such motive. In theory, a CDS can always be arbitraged against an underlying asset swap on the corresponding physical bond. This entails a purchase of the cash bond, financing the purchase in the repo market at a floating rate, which can then be swapped to a fixed rate obligation. In practice, however, there is a spread between the CDS and the corresponding physical; the CDS basis is defined as the difference between the CDs premium and the asset swap spread. The CDS basis itself becomes an object for trader position taking, e.g. whether it will likely mean revert. As CDS

trading developed, upfront premium payments became popular for new issues. However, traditional running spreads were more responsive to developing information about reference credit, generating higher changes in MtM value. There are many variants on CDS trades[6]. As in all forms of financial trading, private information is vital in the CDS context, e.g. about impending large loan issues, though front running on the part of sponsoring syndicates is frowned upon. The trader may in addition face management directions, or else constraints related to the institution's other activities. This might include replication trades in response to the bank's position in the corresponding physicals.

There is a difference of emphasis between the loan or investment book and the trading book, both of which can engage in CDS related activities. The former will often hold more illiquid positions as a hedge against their physical loans, while the trading book will concentrate on more liquid contracts, to facilitate closing out at any time, and will tend to concentrate on the MtM value of the future coupon stream. In this respect, the most liquid contract is typically the 5 year maturity (20 quarters). At the end of each quarter, the traders will roll down, which means an offsetting 19 period swap followed by a new 5 year swap, in order to obtain a constant maturity position in the CDS The rates on either or both the 5 year renewal or the 19 quarter offset are set by agreement with the broker or exchange so as to make the price value per basis point (PVBP) with respect to the ambient market 5 year rate the same. This sort of facility is also used to hedge a loan book where the latter is constrained to be of constant duration or maturity.

2.3 Mark to market formulas

The MtM value of a pre-existing CDS at a given historical premium can theoretically be established in terms on an offsetting swap at current market rates with maturity equal to the remaining maturity of the original swap. The PV of the premium difference then gives us the current value of the swap, more or less as that of an annuity each quarterly payment of which is the difference between the original and offsetting swap premiums. However, this is not quite the same as valuing a straight annuity to maturity, since a reference credit event could occur before the maturity date. The premium differences that make up each quarterly annuity payment therefore have to be weighted by the survival probability to that date and then discounted back by the risk free rate. Schematically,

[6] Rajan and Roy (2007) is a good source, as are investment bank publications such as the JP Morgan/Risk *JPM Guide to Credit Derivatives,* or the Merrill Lynch *Credit Derivatives Handbook*, vols1,2. More general treatments of credit pricing include Duffie and Singleton (2003), Bomfim (2005) and Loeffler and Posch (2007).

(1) $$MtM = \sum_{\tau} \Delta x \times SP_{\tau} \times DF_{\tau} ,$$

where Δx is the premium difference payment or gain, SP_τ is the survival probability to time τ, and DF_τ is the discount factor to time τ, reflecting the pricing of survival risk. Note that formulas such as (1) refer to market to market gains or losses, the sense in which MtM will be used throughout.

A convenient sensitivity formula runs in terms of the price value of a basis point movement in the current CDS premium. For a CDS with time T left to run, this can be approximated as

(2) $$PVBP(x_T) = \frac{1 - \left(1 + \rho_T + \frac{x_T}{LGD}\right)^{-T}}{\rho_T + \frac{x_T}{LGD}}$$

where:

x_T is the current market CDS premium with duration T;

ρ_T is the risk-free interest rate from 0 to T;

LGD is the loss-given-default, taken as 1- Recovery Rate.

Usually the market trades CDS with an implied recovery rate of 40%, so LGD is typically 60%. Note that given the LGD the probability of default is implicit in the current spread x_T.

The general effect of the MtM formulas is to adjust the premium gain or loss for each future period by a stochastic discount factor reflecting the probability of an adverse credit event prior to or during that period, together with the expected loss if such an event does take place.

3. Reward elements and their beneficial ownership

This section explores the sharing of P&L between stakeholders in the firm, in particular as between shareholders and employees. A prior question is whether P&L is itself the right basis for a bonus pool. As earlier indicated, it contains both cash flow and MtM elements, so that whereas shareholders are primarily[7] rewarded on a free cash flow basis, managers and traders are typically rewarded on a MtM basis in addition. This is not to say that dividends are not partly determined by value gains as MtM. One would indeed expect that a bank that had

[7] To be sure, shareholders can gain from MtM via expectations of future free cash flow reflected in the value of their shares. More perceptive shareholders can realise such gains by selling the shares, leaving the new owner with the risk of adverse MtM.

experienced huge MtM gains over the year would feel that much more generous about distributing dividends, even if free cash flow is the ultimate constraint. But a further constraint is their degree of confidence in doing so, knowing that MtM gains can evaporate next year. The net effect of the asymmetry between dividends and bonuses is to force shareholders into the position of underwriting the risk inherent in managerial bonus payouts based on MtM.

The discussion that follows looks in turn at both P&L elements, namely premium and MtM, in the context of CDS trading.

3.1 Producer surplus as a basis for the bonus pool

To provide a convenient expository framework, consider a CDS that is held to maturity. As earlier indicated, this is by no means always done, especially in a trading environment; thus we also consider the case where the position is closed out after just the first period. But it does point up some of the central conceptual issues as to who should get what. Figure 1 depicts the progression of fair market premiums in an idealised CDS over its life (taken as 5 periods); $x_{t/\tau}$ is the fair market premium for a swap at real time t with τ periods left to run. The diagram is drawn under the maintained assumption that no underlying credit event occurs, and that other pricing factors, such as per period default probabilities, loss given default, and interest rates, likewise stay constant; so this is pure time value.

The shaded areas in figure 1 can be taken as proxies for MtM gains from period to period. The total shaded area can be viewed as analogous to classical producer surplus, for at each subsequent period the firm is getting x_0 but would have settled for something less under fair market value. The area marked as ~MtM_1 represents the annuity gain over period 1, i.e. the difference between the initial premium x_0 and the market premium for the offsetting swap at time 1 as they would then accrue from period 2 onwards. However, as formula (1) shows, the successive annuity elements have then to be discounted back, so the shaded area as such is an overestimate (section 4.4 makes the formal correction). The elements marked c_1, c_2, c_3 refer to coupon elements of producer surplus at a given real time, in this case time $t = 3$. Thus $x_0 = x_{0/5} = x_{3/2} + c_1 + c_2 + c_3$.

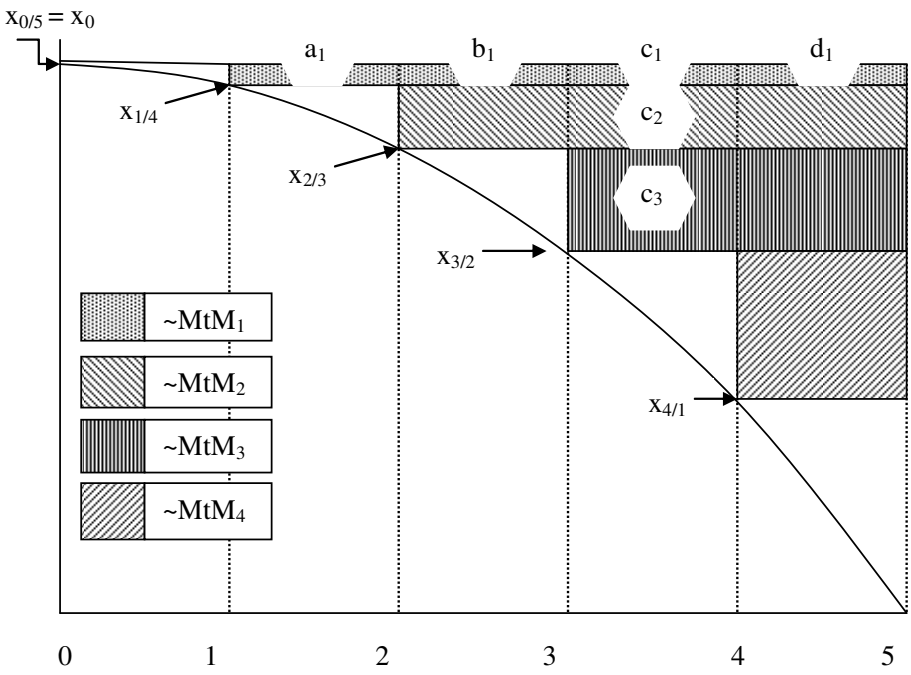

Figure 1: CDS premium and value progression

3.2 Premiums and priority

In figure 1, the fair market premiums are marked in as $x_{t/\tau}$ such that t refers to real time and τ to maturity time. Loosely, one could refer to the fair market premiums each quarter as coupons, even if the analogy with ordinary bonds is imprecise, for at inception CDS are zero capital instruments. However, it could be held that they are equivalent to coupons received on an underlying contingent shareholder capital, namely that required to compensate for a credit downgrade on the reference entity.

Now the flow of fair market coupons $x_{t/\tau}$ are counted as part of P& L and therefore of the managerial bonus pool. Should this be the case? Arguably, no. They are there to precisely balance the market value of the risk of an underlying credit event, and therefore of the contingent payout for which the shareholders would be liable. In this respect, they are analogous to a normal rate of return on the shareholder capital that might be called on to meet the reference entity risk. To put it differently, any trader could place as many fairly priced CDS on the books as is consistent with his or her trading limit, without any added value from his or her own human capital.

One could argue that a better case – as to a bonus pool – could be made for any excess of the coupons currently received over the fair market value. In the case illustrated this is in fact happening from the end of period 1 onwards. Thus it could be that the trader has

exhibited enough insight to realise that there is nothing in fact going to happen with the underlying reference entity, so that at time $t = 0$ the market has mispriced the swap. Or it could just be luck. Either way, the bank has benefited with above market value, which is a suitable basis for employee reward. This contrasts with fair market value, which is a recompense for fairly priced risk. Thus in the case illustrated, traders and managers should score no bonuses over period 1. At the end of period 3 any bonus pool based on cash flow premiums over the period should be confined to the supernumerary elements of the coupon, marked in as $c_1 + c_2 + c_3$.

In other words, priority rules should obtain. If shareholders are to bear risk, then they get first call on the rewards. If the latter are no more than fair market value, then shareholders need not share the cash flows with the managerial bonus pool.

3.3 Mark to market and the bonus pool

In the situation illustrated with figure 1, the trader would be rewarded with a share of MtM_1, the gain in value over the period. Likewise in period 2, MTM_2 would enter the bonus pool, and so on. The problem is that absent any closing out of the swap, these could subsequently be lost if the swap premium went back the other way and premiums subsequently increased. This is more or less what happened in the crunch; bonuses had been awarded on huge increases in P&L arising from market to market gains that turned around to massive losses.

Notice also the double dipping where a bonus pool based on P&L incorporates both coupon cash flow and mark to market. The annual bonus pool for period 3 will implicitly include elements c_1 and c_2, because these are part of the coupon for that period. But elements c_1, c_2 have already been implicitly rewarded over periods 1 and 2 as part of MtM_1 and MtM_2 respectively; the period 3 contribution to the annuity difference as in formula (1).

In all cases, bonuses should be based on realised P&L. Suppose, for instance, that the trader had decided to close out the position after period 1. Referring to figure 1, the realised gain would then be proxied (i.e. apart from discounting) by the sum $a_1 + b_1 + c_1 + d_1$. This would then become a base for the bonus pool, either as the entire discounted sum after period 1, or else period by period under vesting rules.

Even in existing practice, the quality of the P&L, i.e. the relation between realized and unrealized P&L, can be a determinant of the bonus payment. This varies also as between trading books and investment books, since the latter have a larger proportion of unrealized P&L. But even in such cases, the unrealized P&L is not fully excluded when determining the bonus payment, being used as a 'soft factor' to differentiate between traders with similar

performance. The effect of this might well be to reward herd behavior at the ultimate expense of shareholders.

3.4 Adverse incentives

As one might expect, there is a trade off between premium and MtM constituent of the P&L based holding period return. As the trader continues to hold the swap, the carry element (i.e. the original premium) increasingly compensates for the risk of a credit event such as a default. If the trader's bonus is linked to both components (the original premium and the MtM gain or loss), then typically the carry progressively outweighs the expected loss entailed in a default. Having the gross carry (x_0) as a bonus contribution would tempt the trader to hold the swap longer than might otherwise be optimal, in terms of the risk to the bank. Appendix A traces this effect in more detail.

Linking bonus to MtM has some further hazards. As earlier mentioned, employees thinking of jumping ship will try to create a real option by putting on riskier positions with a possibility of very high MtM gains. In doing so, they are virtually creating their own personal value in terms of the implied premiums on the real options thus created. To the extent that the (as yet unrealised) MtM can evaporate or become negative, the real option value is a deadweight loss to their current employer, who has in effect written the option.

4. Performance measurement and cash flow conversion ratios

The expository vehicle of section 3 is in some respects limited in its domain of applicability; traders, for example, would more usually seek to maintain a constant maturity profile in search both of period to period value leverage and of maintaining the most liquid contract. But it does point up some of the contradictions and misplaced incentives that characterised bonus systems prior to the credit crunch, and it provides a framework within which to assess the regulatory reforms that have thus far been mooted.

In this respect, proposed clawback and vesting rules address one particular aspect, namely the transient nature of MtM and the inadvisability of awarding bonus payments that fully reflect unrealised MtM gains at the time that they first accrue. However, they do not address the central issue of just what should count for the bonus pool, and whether premium (the full carry or coupon) and MtM should figure on an equal footing. Thus clawback could apply because a trader has shown poor subsequent performance, even if the prior results of his superior performance have been firmly locked in, i.e. is not exposed to subsequent MtM adversity. A clawback of this rather penal kind could actually impede a successful trader from taking any further risk.

4.1 The bonus basis and free cash flow equivalence

The most general problem with the G20 and similar rules reforms thus far proposed is that they have insufficient regard to the principles that should govern the sharing of financial value, and hence the basis for the bonus pool itself. A more systematic approach would be to put bonus payment on just the same footing as dividend payments by converting the annual bonus pool into a free cash flow equivalent. Reconsidering figure 1, the bonus for period 3 would be based on the sum $c_1 + c_2 + c_3$ representing the free cash flow component this period that has been due to the employee's superior performance. A rule of this kind is automatically a vesting rule in respect of earlier MtM gains, for c_1 has arisen out of MtM_1 and c_2 out of MtM_2; but both are realised cash flows.

A more stringent regime would be to sunset each MtM component to the reporting period where it first arose. Applying this rule to figure 1 means that over period 3 the marginal coupon value c_3 would be rewarded, but not the elements c_1 and c_2, on the grounds that these contributions had already been sufficiently rewarded in the preceding periods. An argument along similar lines is implicit in the carry versus MtM trade off mentioned in section 3.4 and Appendix A.

The point being made is of general applicability. What goes into the bonus pool should reflect more lasting economic value rather than transient accounting numbers. A bonus pool based on locked in producer surplus solves the problem of vesting. The clawback issue hardly arises, or if it does, only as a remedy for irresponsible subsequent behaviour, rather like victim restitution or compensation. Basing the bonus awards on free cash flow and producer surplus means that employees are being treated symmetrically with shareholders, rather than leaving shareholders bearing alone the burden of deals that subsequently turn bad. It creates an incentive for employees to look for deals that will create lasting value down the track and a motivation to see things through rather than, as now, jump ship brandishing this year's MtM based P&L printout.

Bonus awards over a given accounting period should ideally also take into account the existence and scale of open positions at closing. A large open position with MtM gains could be penalised in the context of a trading book, less so for an investment book; this might also vary according to the counterparty. The penalty might be formalised in terms of a value at risk (VaR) discount applied to realised gains. The degree of bonus penalty for open positions could diminish in the light of experience with the employee, effectively as a learning algorithm for the probability that he or she will deliver on currently unrealised MtM gains.

Similar structures might apply to people leaving the bank in the course of the year, who might otherwise be tempted to leave the bank to carry the can for subsequent losses.

4.*2 Performance measurement*

More systematic use of the free cash flow equivalence should also be reflected in employee performance measurement. Performance measures have a wider domain of reference than just internal bonus awards; they also encompass retention, promotion and recruitment decisions, the latter extending to headhunter evaluations as to which of a number of alternative candidates should be put forward to a prospective employer. What is need in such respects is a more formal framework for taking into account the quality of a given P&L number, to be presented along with the gross figure itself.

A suitable metric for the purpose can be based on the extent to which MtM gains have been converted into realised cash flows. Continuing with the CDS analogy illustrated with figure 1, suppose the evaluation is to be carried out as of period 3. Let r be a suitable cost of capital, supposed constant from period to period. The ratio:

$$\gamma_{1/3} = (a_1 + \frac{b_1}{1+r} + \frac{c_1}{(1+r)^2}) / (a_1 + \frac{b_1}{1+r} + \frac{c_1}{(1+r)^2} + \frac{d_1}{(1+r)^2})$$

$$= (a_1(1+r)^2 + b_1(1+r) + c_1) / (a_1(1+r)^2 + b_1(1+r) + c_1 + \frac{d_1}{1+r})$$

can be taken to represent the fraction of period 1 MtM that has been realised as of the chosen evaluation time, period 3. The two equivalent versions correspond to whether the numerator and denominator are measured as of period 2 value or period 3 value. Since the evaluation is to be carried out ex post as of period 3, the latter is more appropriate.

Similarly,

$$\gamma_{2/3} = (b_2 + \frac{c_2}{(1+r)}) / (b_2 + \frac{c_2}{(1+r)^2} + \frac{d_2}{(1+r)^2}) = (b_2(1+r) + c_2) / (b_2(1+r) + c_2 + \frac{d_2}{1+r}) \text{ is}$$

the realised fraction of period 2 MtM as of time 3, and

$$\gamma_{3/3} = \frac{c_3}{(c_3 + \frac{d_3}{1+r})} = \frac{c_3(1+r)}{c_3(1+r) + d_3}$$

is the realised fraction of period 3 MtM.

To find a single number to represent the overall position performance as of time 3, one weights the individual period fractions $\gamma_{i/3}$ by the sum of their denominators, representing the total managerial surplus to date 3; analogous to the shaded areas above and to the left of time point 3. The resulting number will be referred to as the (cash flow) conversion ratio.

A trader wanting to jump ship should be required by the head hunter to present his or her conversion ratio along with the gross P&L printout. Because the conversion ratio incorporates a history, it would provide a measure of protection against the free option aspect so apparent in proposals to reward traders of bailed out companies with bonuses based on mark to market recoveries.

5. Concluding remarks

The remedies suggested in this paper take a more structured view of the origination and distribution of value than do current G20 and other regulator proposals. The latter certainly have their merits, notably in vesting bonus awards over a period of years, even if the mechanism to do so is ad hoc. However, there has in our view been insufficient attention to what can be called the microstructure of the bonus pool. In this respect, a sharper division should be drawn between fair market and surplus elements of P&L, together with better guidance as to the principles governing who gets what of either. Fair market coupons or premiums are an actual or implicit normal return on shareholder capital and should be treated as such, rather than as some form of supernumerary gain to be shared with employees as bonus.

A similar degree of detail should govern the extent to which mark to market gains should be crystallised before they are paid out. Converting these to free cash flow equivalents would restore symmetry with dividends to shareholders. Distributing MtM gains over a longer period of realised free cash flow also encourages employees to take a longer term view of the merits of any position, if not of their own personal employment horizon with the bank. Likewise, 'clawback' and similar dis-incentivising recovery provisions become less necessary.

Bonus share issues are widely used, especially in regimes that seek to limit the cash component of P&L based managerial rewards. Two remarks could be made in this connection. The first is that earlier raised in connection with priority rules for sharing, namely that P&L originating in fair market pricing should not generally qualify, for these do not raise the market value of the firm. An exception might be where the firm's market share of the trade in such instruments has been materially enhanced, with demonstrable future profit generating capabilities. The second point is that to award 'free' bonus shares at current market prices does dilute the beneficial interest of the existing shareholders. If the MtM subsequently evaporates, it is they who carry more of the burden of the fall in price. That is why bonus awards based on this period's MtM have to be tied to free cash flows realised at

designated future dates. Vesting rules should specify how this is to be accomplished. In other words, bonus shares awarded this period against MtM gains are more a statement of intent; promises that when the gains are actually realised the shares will be handed over. The proposed cash flow conversion ratios provide an informational basis to guide such decisions.

Finally, it is worth reiterating that none of the above should be taken to limit managerial bonus or other reward elements as to the actual sums paid. Big money will always be paid for exceptional talent, and if quantitative limits are imposed by regulation, there will always be ways to circumvent them. As the traditional theory of agency points out, bonus and other contingent reward systems do have economic efficiency benefits in aligning employee risk appetites with those of shareholder, and in signalling managerial ability or trading talent. And as directors of bailed out UK banks have recently pointed out, declining to pay bonuses could result in the loss of capable staff.

The starting point in all such cases is to ensure that bonus awards are soundly based in economic theory. Appreciating that existing P&L based bonus pool schemes short change shareholders, leaving them to pay out managers on transient future value, provides a better starting point for consensual regulatory reform, one more firmly grounded in economic theory as well as common equity. The use of realised cash flow conversion ratios would serve to highlight both the quality of P&L and the necessity to adjust for past failures, removing the free managerial bonus option that has become so apparent in the subsequent history of public bailouts. That would go some way to resolve the social irritation.

Appendix A: Incentives created by rewarding the gross carry

The exposition that follows enlarges on the remarks of section 3.4 concerning the incentives created by trader reward systems where the gross premium enters each period into the bonus pool. The argument is intended to show that the construction underlying the CDS favours (a) taking risks rather than protecting against defaults; (b) holding on to risky positions even as market conditions worsen; and (c) buying into high risks because the gross carry outweighs possible MtM losses.

Notation generally follows that of sections 3 and 4, except that the fair value of the CDS is written as $x_{t,T}$ at real time $t = 0,1, \ldots T$; where T is the maturity in quarters. If the swap is put on the books at time t = 0, then the premium earned thereafter is $x_{0,T} = x_0$, constant, as distinct from the fair market $x_{t,T}$. The face value of the swap is denoted *N* dollars, euros etc.

In market terminology, 'carry' refers to the cumulative premium earned (paid) by selling (holding) the CDS protection, i.e. $x_{0,T}\ N\ t$. Thus the carry is zero at the beginning of the contract and increases each quarter by $\frac{1}{4}Nx_{0,T}$ The term 'carry return', in contrast, refers to the P&L due to the current premium and the mark-to-market of the position. Thus the mark-to-market (MtM) of a CDS is $\left(x_{0,T} - x_{t,T}\right)\ N\ PVBP\left(x_{t,T}\right)$ as seen from a risk long point-of-view. For a risk short position, the MtM is multiplied by -1. The accrued carry up to time *t* is given as $x_{0,T}\ N\ t$, and the profit and loss is the sum of MtM and carry:

$$\text{P\&L} = \left(x_{0,T} - x_{t,T}\right)\ N\ PVBP\left(x_{t,T}\right)\ + x_{0,T}\ N\ t.$$

Note that the first part of the P&L, the MtM, is unrealized profit, whereas the second part, the carry, is realized profit assuming the counterparty survives the underlying's default in order to pay the accrued carry.

Now consider the following example, abstracting from the bid-ask spread for demonstration purposes:

t	$x_{t,T}$	$x_{t,T+1/4}$	Roll
0	**100bps**	102bps	Up: +2bps
¼	98bps	**100bps**	**Down: -2bps**
	MtM= 100-98= -2bps		

Here the market's perception of the credit quality does not change over the quarter. The on-the run contract (bold) at time zero is worth 100bps, the contract with a quarter more maturity is worth 102bps. After three months, the longer contract becomes the on-the run contract. The MtM loss for a risk long position is 100-98 = - 2 bps, whereas the roll-down 'gain' is 2 bps. However, the carry for one quarter risk-long is 25 bps. Thus the over-all P&L is 23 bps positive. Thus the carry outweighs the MtM loss in the position. In fact, any spread change of less than 5% leaves the trader with a positive P&L. After three quarters holding period, this number increases to 17%.

Although this illustration is quite simple, there are incentives for perverse behaviour for a CDS trader. Because trading books are typically monitored by their P&L and VaR, risk becomes 'cheaper' with increasing time since the initial trade. One might conjecture that the holding period of a trading book's position is limited by risk management. However, the maximal holding period is often 90days and furthermore the process of rolling is technically a new position. Thus the holding period does not impose a strong restriction for the trader, but rather increases the number of trades (and the aggregate notional volume of the market).

So what is the optimal strategy from a trader's perspective, supposing that the goal is to maximize the P&L as this maximizes the remuneration prospects? Examining the expected value of a CDS reveals an inherent bias to take risky positions rather than seeking protection. The expected value of the CDS over one year is simply the weighted sum of the carry possible earned and the nominal to be paid to the protection buyer in the case of default. The weights are the probability of default (PD) and the survival probability respectively; also relevant is the loss given default (LGD). Assuming constant PD and LGD, the expectation over T years is given by:

$$E^T(CDS)\times N = x_{t,T}\,(1-PD)^T - PD(1-PD)^{T-1}\,LGD.$$

Thus the CDS has a positive expected value only if

$$x_{t,T} > LGD\times PD\,/(1-PD).$$

The term PD × LGD is called the expected loss (EL) in cents per dollar (euro, etc.). Thus if the ratio of the EL and the survival probability is less than the spread, then taking risk is rational from a one-years point of view. As the survival probability is close to one for investment grade names, this means a CDS risk long position is only profitable if the spread is higher than the expected loss. As an example, consider a PD of 0.24% which is the historical

average for a BBB rating and a LGD of 80%, then for any spread larger than 19bps the expected value of the CDS is positive.

Now consider the following rearrangement of the above formulas. The implied PD of a CDS contract with duration T and spread $x_{t,T}$ can be approximated by $PD = x_{t,T}/LGD$. It follows that:

$$E(CDS) > 0 \Leftrightarrow PD^i LGD^i > PD \; LGD \; /(1 - PD).$$

So if the expected loss implied by the current spread is larger than the (true and unknown) expected loss, divided by the survival probability (taken as 1 for brevity), then the CDS is profitable. In other words, the higher the market price for risk compared to the fundamental value, the more profitable is the CDS risk in the short term. However, the cumulative expected return of the CDS includes $(T-1)x_{0,T}$ as carry earned for each year the underlying reference entity did not default. This leads to a break even condition:

$$x_{t,T} > \frac{LGD}{1-PD} - (T-1)x_{0T} .$$

In turn, this means that the longer the expected survival of the underlying credit, the lower is the profitable CDS spread.

Using relative value trades, e.g. by trading the CDS term structure curve, one could construct carry-positive positions with less risk than outright trading. In practice, however, a trading book is monitored by common risk measures (e.g. VaR). Each trader has a certain amount of risk available to trade on. But if the P&L goal has been reached without using a large proportion of the assigned risk, next year's risk reallocation might leave the trader with fewer opportunities. The trader's personal risk limit will be decreased if he or she made profit without taking risk, for senior managers will assume that more profit can be made by attributing more risk to those desks that made profit using their full risk limit capacity.

References

Balsam, S. (2002) *An introduction to executive compensation,* San Diego: Elsevier Academic Press.

Bebchuk, L.A. and A. Cohen (2003) The costs and payoffs of executive compensation, Research Paper, Harvard Law School and NBER.

Bebchuk, L.A. and J.M. Fried(2003) Executive compensation as an agency problem, *Journal of Economic Perspectives,* 17(3), 71-92.

Bebchuk, L.A. and J.E. Fried (2004) *Pay without performance: The unfulfilled promise of executive compensation*, Boston, Mass.: MIT.

Bomfim, A. N. (2005) *Understanding credit derivatives and related instruments*, San Diego: Elsevier Academic Press.

Bowden, R. and D. Lorimer (2009) Credit securitisation, information, and system stability, working paper, Kiwicap Research; http://www.wellesley.org.nz/papers_public.asp

Duffie, D. and K. J. Singleton (2003) *Credit risk: Pricing, measurement, and management*, New Jersey: Princeton University Press.

Carpenter, J. and D. Yermack (1999) *Executive compensation and shareholder value: Theory and evidence*, Boston, Mass.: Kluwer Academic.

Ishikawa, T. (2009) *How I caused the credit crunch*, London: Icon Books.

Jensen, M. and W. Meckling (1976) Theory of the firm: Managerial behavior, agency costs, and ownership structure, *Journal of Financial Economics* 3, 305-360.

Jensen, M. (1986) Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review,* 76, 323-329

Jensen, M. and K. Murphy (1990) Performance pay and top management incentives, *Journal of Political Economy*, 98, 225-263.

Kaplan, S.N. and J. Rauh, (2009) Wall Street and Main Street: What contributes to the rise in the highest incomes?, *Review of Financial Studies*, forthcoming.

Loeffler, G. and Posch, P.N. (2007) *Credit risk modelling using Excel and VBA*, Chichester UK: Wiley.

Murphy, K. J. (1999) Executive compensation, in Ashenfelter O.,Card, D (eds) *Handbook of Labor Economics*, Vol. 1. Amsterdam: Elsevier Science.

Rajan, A., G. McDermott and R. Roy (2007) *The structured credit handbook*, New Jersey: Wiley.

Smith, C. W. and R.M. Stulz (1985) The determinants of firms' hedging policies, *Journal of Financial and Quantitative Analysis* 48, 391-405.

Tosi, H.L., S. Werner, J.P Katz, and L.R. Gomez-Mejia (2000) How much does performance matter? A meta-analysis of CEO pay studies, *Journal of Management*, 26 (2), 301-339.