



Special Stock Option Watch

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This fifth issue of the ZEW Stock Option Watch deals particularly with the behaviour of employee stock option holders. In the first article (Sautner and Weber) the reasons for (and rationality of) an early exercise of employee stock options is analysed. The second article (Hodder and Jackwerth) develops a new valuation model for employee stock options which takes the risk-taking behaviour of managers into account. Fischer then

investigates, in the third article, shareholder-management conflicts in mutuals (“Genossenschaftsbanken”). In the fourth article Soumaré analyses the investment in employer shares as part of 401 (K) pension plans.

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Rational or Irrational Behaviour: How Employees Exercise Stock Options

Employee stock option plans are widely used. Developments in recent years have shown that stock options are not only granted to top executives but also and increasingly to employees at lower hierarchy levels in firms. By 2002, for example, more than 90 percent of all stock options in the United States were given to employees below the five top executives (see Hall and Murphy). Apart from a few exceptions, most companies listed in the DAX 30 and in the EuroStoxx 50 now offer stock option plans which provide considerable option value to a large number of employees at many different hierarchy levels.

Only little research about exercise behaviour

Stock options give employees the right to purchase shares of company stock during a pre-specified time period (the exercise period) at a pre-specified price (the strike price). The exact timing when these options are exercised lies in the discretion of each individual em-

ployee. Despite the economic importance of stock option programs, there still exists very little research about the actual exercise behaviour of option recipients. This is largely due to a lack of publicly available exercise data. Understanding individuals' exercise behaviour is of great relevance for various reasons. It is, for example, important for the design of new and powerful option plans. Moreover, firms can use information on their employees' actual option exercise activity to reduce the accounting costs of stock option plans in the context of the new US-GAAP (SFAS 123) and IFRS (IFRS 2) accounting rules.

Early exercise can be rational

First of all, the question arises whether economic theory does make any predictions and recommendations about the exercise behaviour of employees. Generally speaking, it is never optimal to exercise traditionally traded call options prior to maturity as it would imply an immediate loss of a significant proportion

of the option's value (the so-called time value). However, it turns out that this basic argument has to be modified in the context of employee stock options.

Employees are usually inherently underdiversified because they have invested a significant fraction of their total wealth as human capital in the company. Moreover, they often invest some of their private money in shares of company stock and/or hold claims from pension funds (especially in the US) that often also put money in stocks of the employing firm leading to an even worse total wealth diversification. Furthermore, legal constraints regularly prohibit transactions executed by managers with the goal to hedge against the risks inherent in stock options and company stocks.

The US researchers Lambert, Larcker and Verrecchia have shown that employees therefore value their stock options significantly less than expected and predicted by standard option-pricing models (like the Black-Scholes model). Their calculations show that employees value their stock option somewhere be-

tween 20 and 60 percent below the theoretical Black-Scholes values. The value placed on an option by an employee is decreasing in the percentage of his total wealth that is invested in company stocks

share price increases will be followed by periods in which prices will fall again (belief in “mean reversion”). Since stock options would lose substantial value if prices drop, employees exercise their



and decreasing in his risk aversion (higher risk aversion leading to lower values). From the perspective of a poorly diversified and risk-averse employee, it can therefore be rational to exercise stock options prior to maturity to invest the proceedings in alternative and better diversified assets. These considerations explain (at least partially) why almost all empirical studies on the exercise behaviour of employees find that options are exercised very early and much before expiration.

Exercise behaviour is influenced by psychological factors

One of the most extensive empirical studies in the field has been undertaken by the economists Heath, Huddart and Lang who have investigated the exercise behaviour of 50,000 employees at seven companies. In their study they found that the exercise behaviour of individuals is significantly influenced by psychological variables not included in the theories mentioned above.

They demonstrate, for example, that exercise activity increases if the employing company's share price has gone up in value in the recent past (one month period). They explain this finding with the belief of individuals that periods of

options in the aftermath of short-term price rallies to avoid these losses. Moreover, Heath, Huddart and Lang show that the exercise activity (number of exercises per week) approximately doubles whenever the company share price exceeds its one-year high.

Exercise behaviour of managers

We ourselves have studied the exercise behaviour of managers participating in a stock option plan run by a large German MDAX company. We obtained information on all plan participants indicating how many options each option recipients actually exercised and at what point in time he did that. We also received information on what individuals actually did with the stocks acquired in the stock option programme. Moreover, we were able to directly ask each individual about his or her attitudes towards risk, investments in company stock, personal characteristics (age, education, grade level in the company, etc.) and various other variables using a questionnaire.

Consistent with the existing literature, we found that employees tend to exercise the vast majority of their options very early and in a few large transactions. Almost all acquired stocks (85 percent) were directly sold after the exercise

decision. Surprisingly, we found that individuals who exercised their options immediately (i.e. immediately after the vesting period has expired) were neither significantly more risk averse, nor had a significantly larger proportion of their total assets invested in company stock (compared to the individuals that exercised at later points in time). However, we also found that early exercisers had, on average, a significantly lower total wealth implying that they have fewer financial means to diversify their total wealth. From an economic point of view it might therefore make perfect sense for this group of employees to exercise the stock options at an early point in time.

We also used our survey to extract stock market expectations of the option receiving managers (the highest and lowest levels of the DAX, the EuroStoxx 50 and price of company stock which they consider unlikely to be under- or outperformed by the end of the year). Based on these individual forecasts, we found that individuals that immediately exercised their options tended to expect much lower stock market fluctuations compared to the individuals that exercised later. Our results therefore suggest that individuals' exercise decisions seem to be influenced by variables not considered in existing studies (expected stock price fluctuations).

Zacharias Sautner and Martin Weber

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Why Employee Stock Options Could Be Worth Much More To The Manager

The academic discussion of the value of employee stock options has focused for a long time on the reduced value of the employee stock option to the employee. This low value is typically attributed to market incompleteness, as the employee cannot hedge the option perfectly. However, in a recent working paper, Hodder and Jackwerth (2004) argue that employee stock options are much more valuable once we take into consideration that managers (and possibly some lower level employees, too) can actually influence the risk taking of the firm. What we find is that the manager will optimally take on risks in order to increase the value of his employee stock options.

The Black-Scholes model

Historically, the valuation of employee stock options started out with the Black-Scholes model which has served as the workhorse of option pricing for a long time. Early authors suggested incorporating simple adjustments to the Black-Scholes formula, such as accounting for the vesting period, forfeiture, and taxes, in order to adapt the model to the intricacies of employee stock options. Nonetheless, the resulting models still hinged upon the key assumption that the manager is able to fully hedge the option position by continuously and costlessly trading in the underlying stock and the bond. It was quickly realised, however, that managers are typically severely restricted in trading their own company's stock. In particular, they are often prohibited from shorting their own company's shares.

As a result, subsequent papers take into consideration the market incompleteness, due to the lack of perfect hedging, from the perspective of the manager, and explicitly specify the utility function of the manager. Typically, a power utility function with risk aversion coefficient of around 2 to 3 is assumed. These models then proceed to finding



the certainty equivalent value (CEV) of the employee stock option. The CEV is the exact amount of money which needs to be added to the initial wealth of the manager, in order to give the manager the same utility that he would have had through the possession of the employee stock option. So far, the assumptions are quite defensible.

Managers' ability to influence firm risk-taking

Most of the existing literature completely ignores the ability of a manager to influence firm risk-taking. The few papers that allow some control stipulate that the manager will determine the balance between risky and riskless investments only once and then hold this proportion constant until the terminal date. Even those authors often realise that this assumption is somewhat counter-intuitive since managers are supposed to adjust risk through time as market conditions and firm values change. After all, one important reason for granting employee stock options to begin with is to induce the manager to take risks in line with what shareholders deem as appropriate risk levels.

Hodder and Jackwerth (2004) address this issue by setting up a discrete time model of dynamic risk-taking where the manager can choose the optimal risk-taking over time and in accordance with the current firm value. Furthermore, the manager will choose risk levels as a function of the distance to some lower barrier at (and below) which he will be fired for poor performance. We document in this more realistic setting that managers follow very rich optimal risk-taking strategies with widely varying risk levels across time and firm value. For example, they increase risk along the lower barrier, when there is little hope of rescuing the firm otherwise, while they will reduce risk taking some distance above the lower boundary, as they can still hope for gradual improvement in that situation. Even more importantly, the manager will want to increase the risk of the firm if he holds employee stock options which are somewhat out-of-the-money, in order to have the chance of finishing in-the-money with his employee stock options.

An important implication of such managerial risk-taking is that it significantly increases the potential value of employee stock options. The literature often estimated the CEV value of employee stock

options to be only half of the equivalent Black-Scholes value, whereas we come to the conclusion that the value of an optimally controlled employee stock option can exceed, and in certain cases double, the Black-Scholes value. A further implication is that early exercise is less desirable the more control the manager has: if control can be used to increase the value of the employee stock option through optimal risk-taking, then the manager is

much more reluctant to early exercising and giving up this control.

Dynamic risk-taking

The more realistic modelling of dynamic risk-taking by managers changes our assessment of the certainty equivalent values of employee stock options. Namely, it can significantly increase the CEV value of employee stock options and

should therefore be taken into account when considering employee stock option grants and their valuation.

Jim Hodder and Jens Jackwerth

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Controlling Agency Costs in Mutual Financial Intermediaries (Part 1)

This article is the first of a series of two about shareholder-management (S-M) conflict in mutual financial intermediaries. This is a somewhat exotic and often overlooked issue that affects large chunks of the economy, particularly in countries where mutuals play an important role, be this the United States (with over 75 million members in credit unions alone) or Europe where mutuals are often the dominating banking by the number of clients or even asset share. In this first article we focus on the formulation of the problem and briefly look at more classical (motivational) mechanisms to control agency conflicts in mutuals.¹ In the article that will follow we evaluate empirical evidences and approach the less studied and more interesting coordination approach, based on organizational governance mechanisms.

Reducing agency conflicts by awarding stock options to managers

In a stock company, agency conflicts and the dead weight they imply, increase with separation between ownership (residual claimants) and control (management). In widely held stock firms, one effective conflict reduction mechanism is to award stock options to man-

agers. They align interests of shareholders and holders of the option (management). In theory they are more efficient than to distribute the underlying shares.

Their power derives from two factors: First, high sensitivity of option returns to small variations in the value of the underlying asset. Thus stock options improve the reward (option return) to cost (effort) ratio over shareholding. Second, and more importantly, how information is processed. Although stock options are just one form of compensation to induce virtuous incentives – hence motivational mechanisms – in S-M relations, they have one advantage over devices providing monetary rewards based on bureaucratically verified ex-post results. The collection of information to assess those results ... is left to the market. Thus Hayek's (1945) effective and low-cost information gathering mechanism to assess quality of results through decentralized price setting, substitutes for less effective and higher cost bureaucratic mechanisms.

Thus, stock banks are endowed with means to efficiently control S-M conflicts for every level of ownership diffusion. In closely held firms, effective control by shareholders limits the scope of the conflict. In widely held firms stock options

may be used to limit the impact of S-M conflicts. In financial cooperatives (FC) stock options are, alas, of no use. In a co-op, shares are not traded in the market and are reimbursable – by the co-op itself – at face value. Thus, writing options on co-op shares is not possible. Not surprisingly, dead weights due to management-shareholder/members conflicts in cooperative enterprises can take, literally, catastrophic dimensions. This conflict can, and does, kill many FC, arguably more so than in stock enterprises. FC could, and do, reach for other weapons suggested by principal-agent contract theory that require costly state verification through bureaucratic means. But is that all?

The answer is no, FC use with success devices that reinforce – often more efficiently – motivational mechanisms. They control S-M conflicts through institutional design. These mechanisms do not address directly the utility function of the individual. Instead, they rely on modifications of the organisation of production to control for the severity of the agency conflict. Hence, we call them coordination mechanisms.

The nature of the problem has been synthesized quite clearly by Hart and Moore ([12], pp 45): “An individual

¹ The term “mutuals” is used in the traditional sense to represent institutions which are controlled by the users of the service. This includes primarily cooperatives/credit unions but also mutual savings banks. Under the latter are included institutions such as the U.S. mutual Savings and Loans, the German Sparkassen and the Spanish Cajas to mention a few.

member of a cooperative cannot buy up the votes of his colleagues, because unbundling votes from membership is not permitted. Nor is a member permitted to acquire power by buying up lots of membership places for his own use. Hence it is difficult for an individual to exert pressure on management, except through the democratic process, which we know suffers from severe free-rider problems. In the cooperative, then, **management may be more entrenched than they would be in a public corporation.**" (emphasis added)

While S-M is a conflict considered of significance in the public corporation and stock banks, it is crucial in the life of a mutual bank. In the context of financial cooperatives (FC) and mutual savings banks it was studied taking two theoretical approaches. The earliest works made use of "expense preference" theory. Examples are Akella and Greenbaum (A&G, [1988]) and Keating and Keating ([1992] and [1975]). The second, and later, approach borrows modelling tools from the theory of principal agent relations under information asymmetry. These works are more sparse and a late phenomena. Of interest are Fama and Jensen [1983], Rasmusen [1988] and, more recently, Emmons and Schmidt [1999].

The expense preference approach

Using the expense preference theory of Williamson [1963] A&G focus on the influence of ownership on managerial expense preferences. In this approach, managers' utility maximisation includes preferences for certain types of expenditures, such as staff and offices, that distort resource allocation. Imperfect monitoring of managers, accompanied by imperfections in the capital and labour markets and poor regulation and supervision (R&S) facilitate expense preference behaviour and "sub-goal" pursuit by managers. The decision on use of inputs is based on a joint optimisation problem, and the solution is not cost minimisation. The result of modelling the mutual in this fashion is that output and staff are above cost-minimising levels.

Other inputs may be above or below the cost-minimising level, depending on the relative strength of scale and substitution effect.

The agency theoretic approach: "motivational" mechanisms

Fama and Jensen [1983] (F&J) developed an analysis of agency costs based on the nature of residual claims. They investigate: (i) open corporations; (ii) closed corporations; and (iii) financial

banks, in mutuals managers don't face the threat of concentration (hostile takeovers) given the one-man/one-vote rule. In addition, taking a United States perspective, the author points out that management compensation in credit unions is subject to regulatory ceiling. This causes inefficiencies since managers in mutual banks will have lower incentives to increase income. Comparatively, management compensation in stock banks is more aggressive to encourage managers to increasing the



mutuals and non-profit firms with unusual residual claims. While the two first types of organisations exhibit symmetric advantages and limits in terms of controlling management entrenchment, the third type presents specific agency problems. They suggest that in mutuals the redemption used by residual claimants/customers mechanism regulates intensity of S-M conflicts. In fact, F&J are the only to argue that management entrenchment will be less in mutuals since each shareholder can return his claim at a determined price depriving manager of control over assets.

More formally Rasmusen [1988] also compares management efficiency in mutual and stock banks. He argues that managers of mutual banks have a greater control over the institutions than in stock banks. While the ownership is uniformly distributed in both types of

bank's income. Therefore, managers of mutual banks will be less diversified, have low motivation to increase performance and will be more risk averse than managers of stock banks.

Conflict of interest between manager and sponsor

Emmons and Schmidt (E&S, [1999]) take a formal approach modeling occupational credit unions (CU) in the United States using the costly-state verification paradigm of Townsend [1979]. The problem they solve is one of conflict of interests between the manager and the sponsor with respect to the manager's consumption on the job ("shirking"). E&S assume that CU cover costs with subsidies from the sponsor, who is thus the de facto residual claimant to the institution.² The sponsor can observe the

2 This extreme – and outside of the United States unrealistic – assumption turns out not to be a major obstacle in the application of the model to less restrictive conditions outside of the United States. Thus many of the results can be transposed easily by reading "board of directors" instead of "sponsor."

manager's shirking but must wait for a government regulator to be able to prove it. An inspection occurs if (and only if) the CU encounters financial distress. This modeling approach constitutes a significant step forward in modelling mutuals and one that moves the theory closer to the day-to-day reality of the governance and supervision of mutual intermediaries.

E&S address the problem of a motivational efficient wage compensation schedule. The sponsor maximises an expected payoff which is a function of the benefit the sponsor receives from (risk-free and risky) loans made to members of the CU, the premium the sponsor pays the manager to prevent shirking, the reservation wage that must be paid to the manager so that he participates in the game, the sponsor's cost of inspection and the value to the sponsor of loans to the members. Several interesting results obtain from the first order conditions, including the optimal probability of inspection. To note: i) as verification costs increase, the optimal wage (premium over reservation wage) will also increase; ii) the larger the utility of shirking, the larger will be the optimal wage premium required to avoid it; iii) the optimal wage premium will be negatively

related to the probability of failure. The solutions have eminent intuitive appeal, rejoining traditional approaches to use motivational wage mechanisms to align incentives and the use of costly bureaucratic means of ex-post verification. However, as for most of the results obtained from principal-agent contract theory literature, translating equilibrium conditions to a realistic pay schedule is far from obvious.

In the follow-up article we review some studies that provide empirical support to these theories. We then move to consider a completely different set of tools, which we call coordination mechanisms that are used successfully to control S-M conflict in mutuals.

Klaus P. Fischer, Ph.D.

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401(K) Pension Plans Investment in Employer Shares

Despite high diversification costs, a considerable number of defined contribution pension plans have large holdings of the shares of the company they work for. This research proposes an incentive model to examine the voluntary optimal company shareholdings of the worker.

Pension plans: defined benefit and defined contribution

In essence, pension plans are vehicles that provide post employment income for workers. They typically take two

broad forms, defined benefit (DB) and defined contribution (DC). The DB plan is the traditional plan and consists of a promise to pay workers a predefined amount, based on their years of service and their wage history. Employers contribute to an investment pool that is used to fulfill the promised benefits. Any shortfall in investment income relative to promised payments is the responsibility of the employer. Hence, risk is largely born by the employer and accordingly the employer has control of the investment decision.

Over the last decades, DC pension plans have gradually replaced DB pension plans as shown in the table on page VII. This shift has taken place despite the fact that most DB plans in the U.S. are guaranteed by the "Pension Benefit Guaranty Corporation" (PBGC), DC plans are not.

Research focus on DC pension plans

Although interesting, the management of DB plans is not the subject of the current research. This research focuses

on DC plans. Here, the worker and his employer contribute to a fund that belongs to the worker. The retirement income is the outcome of returns to this specific investment portfolio. These funds were originally created as means of profit sharing. The employer matches any contributions from workers according to a predetermined formula. The contributions from the employer can be in cash or shares. The post employment income fluctuates with the investment returns of the plan so that, in contrast to the DB plan, the risk rests with workers. Accordingly, investment decisions are mainly made by workers.

The empirical literature has widely documented many special features inherent to DC plans assets allocations. In fact, according to Benartzi (2001), a third of the assets in large DC plans are invested in the stock of the firm that employs the worker, so called company stock. A quarter of workers' discretionary contributions are invested in company stock. The table on page VIII exhibits the percentage of company share in some major DC pension plans.

This allocation runs contrary to standard investment advice. In this research, we propose a voluntary investment-incentive model to explain how the optimal company's shareholdings by the worker can be part of the overall compensation package.

Plan design influences assets allocation in company stock

Moreover, Mitchell and Utkus (2002) report that workers invest more in company stock when the company has experienced a price run up, and they rate the firm's stock as less risky than identical individual stocks. Benartzi and Thaler (2001) find that workers follow the so-called "1/n naive diversification strategy", by dividing their contributions evenly across the funds offered in the plan, treating company shares as one investment category even though it is far less than 1/n of the market. And, when the employer's contributions are automatically directed to company stock, employees invest more of their own contributions in company stock, perhaps because they interpret the allocation of the employer's contributions as implicit

investment advice. Overall, according to Liang and Weisbenner (2002) it seems that the plan design (number of investment alternatives, employer match in

investors who held company stock in their 401(k) accounts were opposed to legislative efforts to restrict the amount of company stock in defined contribution

Aspects of U.S. Private Sector Pension Plans: 1985-2004

A. Number of Pension Plans

| Year | Total | DB Plans | DC Plans |
|-------------------|---------|----------|----------|
| 1985 | 632,135 | 170,172 | 462,963 |
| 1990 | 712,308 | 113,062 | 599,245 |
| 1995 | 693,404 | 69,492 | 623,912 |
| 1998 | 730,031 | 56,405 | 673,626 |
| 2001 ^e | 758,000 | 51,000 | 707,000 |

B. Number of Active Pension Plan Participants (000)

| Year | Total | DB Plans | DC Plans |
|-------------------|--------|----------|----------|
| 1985 | 62,268 | 29,024 | 33,244 |
| 1990 | 61,831 | 26,344 | 35,488 |
| 1995 | 66,193 | 23,531 | 42,662 |
| 1998 | 73,328 | 22,994 | 50,335 |
| 2001 ^e | 78,000 | 22,500 | 55,500 |

C. Pension Plan Assets (\$ millions)

| Year | Total | DB Plans | DC Plans |
|-------------------|-----------|-----------|-----------|
| 1985 | 1,252,739 | 826,117 | 426,622 |
| 1990 | 1,674,139 | 961,904 | 712,236 |
| 1995 | 2,723,735 | 1,402,079 | 1,321,657 |
| 1998 | 4,021,849 | 1,936,600 | 2,085,250 |
| 2001 ^e | 4,000,000 | 1,900,000 | 2,100,000 |

Source: Reproduced from Mitchell & Utkus (2002, Table 1, p.36)

company stock) has a strong influence on DC plans assets allocation in company stock.

Many people believe that the holding of company shares by workers is imposed to them by their company management. This is not the case. Despite the lack of diversification suffers by workers, through their large holding of company shares, the majority of company shares in DC plans are voluntarily held by employees. While the "Employee Retirement Income Security Act" (ERISA) of 1974 restricts the investment of DB plans in stock or real estate of the employer to 10 percent of total assets, DC plans are exempted from this rule. Erickson (2002) reports that "in a February 2002 poll of 1000 individuals conducted by Putnam Investments, 57 percent of

plans; only 20 percent favoured such restrictions." It is likely that some workers would oppose restrictions on the amount of company stock in DC plans. In Huberman and Sengmueller (2004), it is quoted that "for instance Motorola eliminated its policy limiting its employees' investment in Motorola stock to 25 percent of their contributions after employees' complaints".

The apparently puzzling investment behaviour by plan participants has drawn a greater level of academic interest in the characteristics and structure of DC plans. Unfortunately, these works depict workers as naive or irrational investors who follow the lead of senior managers. Choi et al. (2001) have even qualified workers as followers of "the path of least resistance", and Huberman

Percentage allocation of retirement plans assets in company stocks in 2001

| Company name | % company stock holding | Company name | % company stock holding |
|----------------------|-------------------------|----------------|-------------------------|
| Procter & Gamble | 94.7 | Williams | 75.0 |
| Sherwin-Williams | 91.6 | Mc Donald's | 74.3 |
| Abbott Laboratories | 90.2 | Home Depot | 72.0 |
| Pfizer | 85.5 | McKesson HBOC | 72.0 |
| BB&T | 81.7 | Marsh&McLennan | 72.0 |
| Anheuser-Bush | 81.6 | Duke Energy | 71.3 |
| Coca-Cola | 81.5 | Textron | 70.0 |
| General Electric | 77.4 | Kroger | 65.3 |
| Texas Instrument | 75.7 | Target | 64.0 |
| Willian Wrigley, Jr. | 75.6 | Enron | 62.0 |

Source: Reproduced from Purcell (2002, Table 1, p.4) (from DC Plan Investing, Institute of Management and Administration, NY).

and Sengmueller (2004) have suggested the existence of a corporate culture.

Optimal portfolio allocation of workers' DC pensions

Our research examines the optimal portfolio allocation of worker's DC pension wealth using a voluntary investment-incentive model. The economic rationale of the model is that workers hold company stock to benefit from their ability to adjust effort. Indeed, since workers have the ability to influence the productivity of the firm, by holding shares of the company, they receive part of the profit which will go to other investors otherwise.

The basic economic forces at work in our model are otherwise similar to those found in the standard principal/agent literature. However, this research departs from this literature by assuming that workers are responsible for deciding how to invest their defined contribution pension plans' assets. Moreover, we argue that, when they have the ability to

affect the productivity of the firm, workers will invest in company stock and benefit from the rent of their own efforts.

Issouf Soumaré, Ph.D.

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