Acquisition bid price: Is there an optimal cash-equity payment mix?

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Abstract:

This paper looks at the combination of cash and share payment in takeovers, particularly in analyzing the condition of its optimal mix setting. This problem develops in a context of asymmetry of information for the buyer has lower information on the target firm than the sellers. But the bidder has superior information on the true economic value of his own shares. In fact, a double asymmetry of information develops between both parties. The setup of the paper is to design the optimal payment mix considering payment with shares as insurance for the buyer against a risk in information, although at the same time new shares will entail dilution. That cash-shares mix is an element of the process which helps disclosing pieces of private information on the economic perspectives of the newly merged firms.

We show that a payment scheme mixing cash and shares explains itself outside a pure strategic game aiming at discouraging competitors. The setting of common conditions of payment is part of the takeover transaction process. The optimal means of payment will be directly influenced by the correlation between the expected acquisition gains at the target and at the acquiring firm levels. This correlation will characterize strategies spanning from pure diversification of economic activities to business integration.

A process of negotiation does not mean equally and symmetrically shared information, but that biases are limited. Exaggeration biases exist and are part of communication policy from one party to the other. That communication policy gains importance in a situation of negotiation of the means of payment or when the terms of payment are publicly revised in a mixed takeover offer. It also appeared that the final takeover price should be sensitive to the design of the scheme of payment.

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Mergers and acquisitions transactions may appear as similar if the payment is made either by cash or by issuing new shares. The bidder can pay the shares of the target firm by cash or what is equivalent by issuing new debt to pay. When it occurs, payment by shares is done by issuing new shares. Even if the purchase of existing shares in the market can be done, that solution is not common. The takeover's means of payment can be, at first glance, seen as equivalent if we consider that the delivered shares can be negotiated in a liquid market. At his individual level, a given shareholder of the target can easily sell the shares and get cash. This argument is not valid on the whole level of the acquiring firm because of the dilution resulting from the issue of new shares. If the two means of payment were equivalent, a mixed payment with cash and shares would be redundant. In fact, we have recently assisted to massive takeover bids with mixed payment scheme, i.e. a fixed amount of cash and a fixed amount of shares of the bidder exchanged for one share of the target. For instance, in may 2003, the French Crédit Agricole issued a public offer giving 148,24 euros and 4 of his own shares to get 5 shares of the Crédit Lyonnais, another French bank. Subsidiarily, if one shareholder had preferred a "pure cash offer" or a "pure share" offer, the Crédit Agricole proposed either 56€ per share of the Crédit Lyonnais, or 17 of his shares for each 10 shares of the Crédit Lyonnais. If the individual choice of the mean of payment of a shareholder seemed free, it was not true on the global level for the buyer who limited the possibilities of pure cash or pure share payments to a global limit of 66.18% in cash and 33.82% in shares paid by the Crédit Agricole. This clause shows that the mix of payment is important to the buyer and that an optimal percentage scheme of payment should exist in the setting of his offer. The public takeover made the French pharmaceutical firm Sanofi on the Swiss Aventis in 2004 had similar mixed payment features : 5 newly issued shares of Sanofi and 69€ in cash were

proposed for exchange of 6 Aventis shares[1]. Fearing a possible competition by a third party, Sanofi modified its first mixed payment offer, increasing its cash part. The new structure of payment was 29% in cash and 71% in shares. This offer was largely accepted by the target's shareholders. It appears clearly that the balance between cash and shares was one key variable of the offer and of the economic decision.[2].

Mixed payment schemes have an increasing importance in mergers and acquisitions, particularly looking at offers on large firms. Goergen and Renneboog (2002) analyzed public takeover bids in Europe during the 1990s. Considering a sample of 156 offers, 93 were pure cash, 37 pure shares and 18 mixed payment.[3]. Among the later, the average part of the cash payment was globally 45.9%. Faccio and Masulis (2004) considered a larger sample of 3667 mergers or acquisition of European firms. The number of mixed payment operations is only 11.3% of them (with an average proportion of 57% in cash and 43% in shares). However the size of a mixed payment takeover offer was 5 times higher than the size of a standard pure cash offer. Lesieur (2004) identified a sample of 334 takeover offers in Europe through the 2000-2003 period[4]. Mixed payment offers represented 8.7% of the total number of operations, but 27.9% of their cumulated value. The optimal balance between means of payment appears as an element of the economic calculus in large operations. Recalling that most of them are non hostile, the question of the optimal mode of payment arises independently of a the

[1] Subsidiarily a pure exchange of 35 Sanofi shares vs. 34 Aventis shares and a pure cash payment scheme of 60,43€ per Aventis share were also proposed. However, these two offers were contractually limited to a global payment of the acquisition using 81% in share and 19% in cash. A contractual mechanism of limitation of the demand by the target shareholders was explicitly organized.

[2] Other recent operations can be mentioned as examples. The mixed payment offer by the Canadian firm Alcan on the French Pechiney in october 2003, or the mixed payment offer of France Télécom on his partially owned subsidiary Wanadoo in 2004 show the balanced proportion between cash and share payment. For the later the weights were 55% in cash and 45% in shares. In 2006, the offer of Mittal on Arcelor can also be mentioned as an example.

[3] Median value of the offer : 575 millions $. Over the 156 offers, 55 were mergers, 40 acquisitions and 40 hostile.

[4] It was numbered 206 pure cash payment, , 65 pure shares payment and 29 mixed payment. Source : Bloomberg, see: research paper, Prism, Université Paris I. Sorbonne.

existence of a competition between bidders and is not linked with the success or not of a competitive offer.

This paper looks at mixed means of payment, particularly in analyzing the condition of its optimal setting by a buyer. First, the target shareholders and the buyer's shareholders should integrate the dilution effect ensuing from the issuance of new shares in the takeover payment. This problem develops in a context of asymmetry of information for the buyer has lower information on the target firm than the sellers. But the bidder has superior information on the true economic value of his own shares. He can be prone to propose share payment when they are overvalued in the market. That signaling hypothesis has initially been outlined by Hansen (1987) who refers to a double asymmetry of information between both parties. In that framework, the payment with shares can be viewed as an insurance for the buyer against a risk in information. The setup of the paper is to design the optimal mixed payment scheme in the process of a non competitive and non hostile takeover. The success of the takeover offer is considered as known by both parties. This paper aims at determining the percentage of cash-shares payment. That percentage as an element of the negotiation process helps disclosing pieces of private information on the economic perspectives of the merged firms. A first section will show that this question has not been really considered in the previous literature. A second section will set the model and solve the optimal payment structure in a context of identical and shared common information between the buyer and the seller. The third section introduces asymmetries of information from the buyer and the target shareholders. A final conclusion will then follow.

1 – Review of the literature

At first, the question of the optimal weighting between cash and shares payments in takeover can be seen as a special case of the more general question of financing the firm's investments. Partial payment in cash expresses the existence of financial constraints. The pecking order theory (Myers et Majluf, 1984) explains that investments are first financed by internal cash-flows, then by debt and ultimately by issuing new equity. A mixed payment scheme in a takeover offer can follow that logic. The idea of « investment regime » (Harford, 1999) can also explain why such a mix of financing exists. Some firms follow a policy of progressive accumulation of cash-flow to finance investment expenditures which are foreseen in a long term view, symmetrically, other firms will use issuing new equity to balance a deficient internal cash-flow. Takeovers are large and strategic operations. Sometimes firms may have planned them for a long time, or others may react shortly facing a specific opportunity and they use their current liquidity to finance their offer, completing it with others resources. Following Hartford, shareholders' interest of the buying firm is not always privileged in this last situation.

The mean of payment can also be seen as a signal to the market. A first set of studies consider it as a signal when the offer is still uncertain. A payment in cash is considered as dissuasive in the negotiation process and discouraging competition by other potential buyers. The strategic role of the mean of payment in public takeover has been analyzed by Fishman (1989) who considers that a pure cash offer is dissuasive and signals good quality target firms. However, his model leads to all cash or all shares payment. Eckbo, Giammarino and Heinkel (1989) refer explicitly to mixed cash-shares payment. They were the first to highlight that the weighting between these two means of payment will reveal to others parties the respective quality of competitive buyers. Berkovitch and Narayanan (1990) introduced in the analysis the sharing of the synergy gains between the buyer and the target firm's shareholders. The

seller's appropriation of the synergy gains is linked to the difference of information between the two parties. Cornu and Isakov (2000) developed their analysis in the framework of a competitive offer between two acquiring firms. The risk, when the first set a price offer and a mean of payment, is to trigger a counter-offer by the other firm. To disclose information on his strategy, the first can use a signal through an announced pure cash payment or a pure share payment. The authors do not consider mixed payment, but refer to two sources of information asymmetry. The target firm knows its own economic value and the buyer knows the size of the synergy gains. The expected future value of the target firm for the buyer V_T is different of its initial true economic value and includes the future synergy gains. The forecasts of the two competing buyers about future are however supposed to be the same[5]. The more they spend money to get insight in the target firm, the more their forecast of its future value is fair and accurate. Buyers share the same distribution of forecasts of the future value. Shareholders and managers of the target firm also ignore the true future value V_T. If they knew it, they would demand an at least equivalent price. An impossibility of takeover will then occur because the buyer will loose at that price (Grosman et Hart, 1980). The two parties are risk averse and it is supposed, in the Cornu and Isakov' model, that the target firm's shareholders prefer a cash payment. A Bayesian equilibrium converging to a solution is shown to exist. Pure cash offers are dissuasive because they reveal a buyer with a strong will to acquire the target firm. As a consequence, counter-proposals may easily develop into situations of initial takeover offers with only shares payment.

The theoretical model of Cornu and Isakov is confirmed using a sample of UK data. Considering 86 British offers in the years 1995-96, the authors counted 61 cash offers, 24

[5] This hypothesis is binding because the two competitors are in fact nearly similar for *Vt* gives the same value to the synergy gains and the scale economies. We cannot have one competitor following a strategy of diversification and the other following a strategy of economic integration because the expected gains are assumed to be the same.

shares offers and only one with debt. Empirically, it is shown that the probability of getting a counter-offer is lower with pure cash initial offers. Other empirical tests look at the possibility of a competition occurring in the takeover process. The idea behind it is that more competitiveness will entail lower positive abnormal returns of the buyer's shareholders (see, Schwert, 1996).

However, as a matter of fact, 90% of mergers and acquisitions are non hostile and means of payment are diversified. We have then to analyze the characteristics of the payment scheme in a context of a known success of the takeover. The means of payment disclose a signal on the future economic perspectives of the two merged firms.

In a 100% shares payment, the buyer's shareholders are diluted with the issue of new stocks. It can also be considered as a signal of overvalued stock price in the market as suggested by the pecking order theory of financing. Then, the price of the stock of the new merged firms should then decrease (Myers and Majluf, 1987, Hansen, 1987). Chang and Mais (2000) highlighted that risky firms' managers will prefer financing a takeover with the issue of new stocks in order to limit the debt leverage and to decrease their own risk. If the bidder seeks to avoid overpaying the target firm because he does not get all inside information, he will choose a mixed payment. It will allow sharing the risk due to an information asymmetry between the buyer and the seller. The acquirer has imperfect information on the target firm or knows it through possibly biased information delivered by the seller. Conversely, the seller does not know the gains of synergy.

A 100% cash offer is a good signal: the buyer has enough and reliable information on the target. He does not need to insure himself against overvaluation by imposing a shares

payment. Payment in cash is similar to financing the takeover with new debt. It can be preferred by large corporations in financing a takeover because it is easier to implement and does not need the prior agreement of the shareholders when financing through the issue of new shares. Cash financing is also preferred by managers when they own a significant part of the capital directly or implicitly through stock options (Stulz, 1988). It allows buying a target whose ownership is concentrated because new important block holders may unbalance the controlling ownership of the buyer if an important new player comes in the control game (Chang and Mais, 2000).

This last point introduces corporate governance in the analysis of the means of payment in public or private takeover offers. Faccio and Masulis (2004) took into account the means of payment. For them, payment in cash, which is considered as equivalent as issuing debt, does not modify the control of a dominant shareholder of the acquiring firm. But keeping his control entails a higher financial risk and is possibly limited by indebtedness constraints. Conversely, payment by shares can easily modify the structure of ownership and control, particularly in European firms where dominant shareholders are common (Harris et Raviv, 1988). Faccio and Masulis explain mixed payment in takeover by the structure of control and power. Their empirical tests support the idea of a preference for a cash payment when a large shareholder owning 20 to 60% of the capital of the buyer exists.

Previous analyses do not explicitly consider the very specific situation of a public takeover with a double information asymmetry between an acquiring and a target company. Hansen (1987) was the first to mention that each one has private information on his own value. He underlines the importance of the relative size of the two firms. The part of capital the bidder wants to get (beyond that giving control) is an adjustment variable. That fraction reveals

private information about the buyer's real value. If the means of payment disclose private signals to other parties, it will in return also influence the process of negotiation. Chang (1998) extended the idea that an exchange of information can help to solve the double information asymmetry (« double lemons effect »). He introduced a prior holding in the target's capital (« toehold ») as a mean to reduce the buyer's asymmetry of information. The last has then a better inside knowledge of the target, especially if he holds an important part of capital (Goldman and Qian, 2004). Target's shareholders, if they accept to be paid with shares, will show they trust the positive perspective of creation of value following acquisition. An empirical study by Megginson and al. (2004) on the long term performances resulting from mergers confirms that analysis and shows that a cash-payment is a trustworthy signal on the future creation of value.

Asymmetries of information and the signaling role of the means of payment were studied within several empirical works. Very often this literature tries to identify abnormal returns in holding acquirer's stocks when the offer is made public. The conclusions are not always converging. Travlos (1987) highlighted negative abnormal returns for takeover paid with shares in the United States. Results were similar for Bellamy and Lewin (1992) in Australia. But looking only to pure cash takeovers in the two last studies, abnormal returns are close to zero. Payment in cash, other things put aside, gives positive information on the value of the target company and on the future gains resulting from the acquisition. A payment by issuing shares may signal the buyer's shareholders that their stock price is overvalued and/or they need some self-insurance over the value of the target. A dilution effect is also important in shares payment schemes because, other things equal, the controlling group in the buyer's capital (and globally the prior shareholders) will have lower ownership after the takeover. A controlling shareholder will only accept dilution if there exists large opportunities of creation

of value and gains. The implicit costs ensuing from lower private benefits of control will advantage payment in cash rather than payment in shares. This hypothesis was successfully tested by Amihud, Lev and Travlos (1990). Control and appropriation of the rent are also important for the groups of managers and major shareholders of the target firm. They have private information on its situation and perspectives. Looking only at takeover on privately held firms, abnormal positive returns for the buyer's shareholders are more common and stronger in cash bids than with payment in shares. This fact compares to the already positive signaling effect of cash bids in public offers. In private firms, shareholders have a stronger negotiation power, so managers of the acquirer should deliver more information on the future value of their firm. The acceptance of a payment with shares by the target's shareholder means favorable perspectives of future profits. Chang (1998) analyzes the different means of payment between public and private takeovers. Specifically, private takeovers using shares payment are linked with important and positive abnormal returns in the USA. Fuller et al. (2002) also analyze the offers comparing publicly listed and private target firms. Considering a sample of 3135 acquisitions in the United States, buyer's abnormal returns are on the average negative by -1% for public offers and positive of more than 2% for private offers. The importance of the mean of payment appears clearly in the analysis because considering listed targets, the abnormal returns (both cash and mixed payments) are non significant, but they are significantly negative for shares payments. When the targets are private subsidiaries or private firms, stock abnormal returns are significant and positive whatever the means of payment. Da Silva Rosa, Limmack and Woodliff (2003) made an event study of 210 public and private offers in Australia. Contrary to previous studies, they found that buyer's shareholders of private takeover with shares payment do not enjoy any positive returns. Empirically, the offers are often cash bids, what is explained by the argument that a lower competition in private takeover allows to capture a higher part of the economic rent of control of the target

firm. Cash payment is used to lower the competition degree of the takeover. Goergen and Renneboog (2002) with a sample of 156 public European offers also evidenced the role of the means of payment. Cash offers will entail larger positive abnormal returns for the target (+10%) than payment with shares (+6%). Conversely, looking at the acquiring firm, the stock market reacts positively to a cash payment, what means that his shareholders do consider a negative signal linked to the issuance of eventually overvalued shares.

The question remains how to set a scheme of payment in a situation of double information asymmetry between risk-averse buyers and sellers. It has not been extensively analyzed in the literature, except in the process of a takeover with several competitors. Here, we will assume that the success of the takeover is known at a globally agreed price. The means of payment are nevertheless to be set. A payment with shares is a guarantee against a possible valuation mistake of the target. It permits to split between parties, on the one hand, the future gains ensuing from the acquisition and, on the other, the risks. The buyer can imagine other ways to guarantee his purchased value of the target firm : he can ask the buyer to guarantee a limited value to the liabilities. In case of hidden or possible losses, all or part of them are reimbursed by the seller (see, Pop, 2003). By transforming them into shareholders of the new merged firm, the acquirer makes the seller participate to the risk and to the uncertainties on the value of the acquired firm and the future gains. A partial payment in shares is a self insured policy when facing an information asymmetry on the target firm. This last is merged or, if not, its profits are consolidated within the financial reports and results of the buyer. The target's shareholders paid with shares will receive a part of the uncertain future profits or losses ensuing from the acquisition. A payment with shares introduces an equity dilution of the former shareholders of the buyer. We look only at dilution of capital, and will not consider the possible dilution in control of a dominant group of shareholders of the acquiring firm (cf.

Hansen, 1987). This aspect has been already studied in the literature with regard to the financing decision using debt. The controlling group will then privilege takeover payment in cash (through the issuance of debt). Here, we focus on the dilution of futures profits and gains which will be shared with newly associated shareholders. A payment with cash will entail two certainties : a fixed and riskless price for the sellers, and a total and certain appropriation of the future expected profits by the acquirer.

The paper wants to analyze the weighting of the means of payment proposed by the bidder. This variable characterizes the takeover conditions. It has to be set optimally considering the information level of the acquirer. But, we will take into account the double asymmetry of information situation and the necessary equilibrium implicit in the agreement of the offer. The target's shareholders are not passive. They also have a preferred scheme of payment, even if it is not formally made explicit at the beginning of the process. The mix of payment can appear in the process, for instance, through counter-offers. The idea is that the weighting of the means of payment will reveal private information. The offer price has to be taken into account in the analysis. If the choice of means of payment has value, it can interact with the final price. Even if the takeover is certain, the sharing of the synergy gains may be influenced by the balance between cash and shares. In such a situation, the takeover price agreed between the buyers and the sellers will be influenced by the means of payment.

2 – Situation of symmetric information

We consider a non hostile offer. The transaction value of the target firm is set. The transaction is agreed, but the means of payment has yet to be determined. We set the following variables:

$\tilde{A}$: uncertain value of the net assets of the target firm after the acquisition

A_D : acquisition price for the target firm (D for « deal »)

$\tilde{S}$: uncertain future value of the acquiring firm after the takeover

S_0 : value of the acquiring firm set at transaction/offer

k : percentage of the offer paid with cash; total cash payment is $k.A_D$

α : ratio of value between the two firms set for the acquisition, $\alpha.S_0=A_D$

c : fraction of the acquisition and synergy gains captured by the sellers

$\tilde{\varepsilon}_A$: total gains (or losses) of acquisition by the buyer on the assets A. A tilde indicates an uncertain variable, without tilde is the expected value of the gains

σ_A : standard deviation of the acquisition gains on the A assets

$\tilde{\varepsilon}_S$: economic acquisition gains of the buyer on his assets S and synergy gains after merging. Without tilde is the expected value of gains.

σ_S : standard deviation of the acquisition and synergy gains on the assets S

The seller and the buyer agree on the acquisition price. It is paid partly in cash and in shares of the acquiring firm :

$$A_D=k.\ A_D + (1-k).\alpha.S_0. \qquad (1)$$

The future value of the firm A's assets has an expected value $A_0+\varepsilon_A$ and a standard deviation σ_A. We consider the certainty equivalent wealth of risk-averse investors with a risk aversion coefficient μ. The buyers and the sellers have the same risk aversion. Both fell uncertain with the value of the assets of the other party. We first look at the situation of no information risk and symmetric information. It will then after be enlarged by introducing a double information asymmetry for the sellers and the buyers.

The value of the acquirer after the takeover will depend on the random value of the target's assets, $\tilde{A}$. These are merged with S after the acquisition. We introduce a supplementary uncertainty for the target' shareholders who receive shares from the acquirer S. The economic future profit for the initiator will depend on gains resulting at the S level from the acquisition of A. This gain ε_S covers possible economies of scale and gains of synergy which are not known by the target's shareholders. We suppose that ε_S is positive. The total acquisition gain resulting from the takeover is $(\varepsilon_A+\varepsilon_S)$, the sum of the gain extracted from A's assets and those created by S in the management of the new merged firms. These two random variables are not independent. When the acquisition leads to a diversified group, the two process of value creation are poorly correlated. When merging occurs in the same economic activity, or looks for economies of scale, the correlation ρ between ε_A and ε_S may be important and positive. The new economic value of the merged firm after acquisition is $(S_0 + A_0 + \varepsilon_A + \varepsilon_S)$.

The global value of the consolidated firm has to take into account the negative cash flow resulting from the cash payment :

$$S_0+(A_0+\varepsilon_A+\varepsilon_S)-k.\ A_D \qquad (2)$$

The transaction price, A_D, includes a sharing of the expected gain as expected both by the buyer and the seller, no matter where it comes from the A's or the S's assets. The transaction price is :

$$A_D=A_0+\ c.(\varepsilon_A\ +\ \varepsilon_S) \qquad (3)$$

with A_0, value of the target before takeover.

The minimum condition to participate to the game and to accept is $A_D > A_0 + (\varepsilon_A + \varepsilon_S)$, what means a positive value of c (if $\varepsilon_A + \varepsilon_S > 0$). At least, the sellers want to capture a part of the acquisition profit/synergy gains. The term $(1-c).(\varepsilon_A + \varepsilon_S)$ represents the remaining part of the acquisition gains on the assets A which profits the buyer. A situation where $c<1$, if $(\varepsilon_A+\varepsilon_S) <0$, may occur ; it corresponds to the selling of A's assets with probable future important losses and the seller accepts to bear a part of the loss.

Following the issue of new stocks to pay the target firm' shareholders, the equity capital is (see relation (1)):

$$S_0.[1+(1-k)\alpha]$$

Former acquirer' shareholders are diluted in the new equity capital structure of the firm. Their share decreased by a coefficient $1/[1+(1-k).\alpha]$. New shareholders coming from the target firm will own a fraction $(1-k).\alpha.S_0$ of the capital of the merged group. Their participation in the new ownership structure is (via the transaction exchange ratio of values, α) increasing with A_D, transaction price of the target (and also with c, the captured fraction of acquisition gains).

$$\alpha = \frac{A_D}{S_0} = \frac{A_0 + c.(\varepsilon_A + \varepsilon_S)}{S_0}$$

2.1 Situation of the acquiring firm

The expected profit for the buyer (i.e. the acquiring firm's former shareholders) come from the gross acquisition profit to be shared over his whole (prior and new) shareholders. This gross profit equals the increase of the net equity value of the firm. Considering the economic value after merging (see equation (2)), we get :

$$\pi = [S_0+(A_0+\varepsilon_A+\varepsilon_S)-k.A_D] - S_0[1+(1-k)\alpha]$$

Replacing with (1) and (3), we check that the buyer' gross profit is equivalent to the non captured part of the acquisition gains :

$$\tilde{\pi} = (1-c).(\varepsilon_A + \varepsilon_B)$$

The acquisition profit of the buyer and the synergy gains go to its shareholders. Among them are the target's former shareholders paid with the issue of new shares. We have to look at the net wealth of the prior takeover shareholders because they ex ante decide to launch the operation. The buyer's expected profit weighted by his part in the new equity capital is :

$$\tilde{\pi}_b = \frac{(1-c).(\tilde{\varepsilon}_A + \tilde{\varepsilon}_S)}{1+(1-k).\alpha} \qquad (4)$$

The net profit is the uncaptured part of acquisition gains corrected by a dilution factor. The expected profit, $E(\varepsilon_{A+}\ \varepsilon_S)$, should at least be positive, otherwise the buyer will not bid. This condition allows a first remark : when the buyer is low-sized, (i.e. high α) compared to the size of the target firm, he is pushed to pay in cash (k=1) to avoid dilution and to preserve his expected part of the gains.

The certainty equivalent (EC) is obtained assuming an exponential utility function with risk aversion μ. The buyer's EC is, after dilution :

$$EC_b = \frac{(1-c).(\varepsilon_A + \varepsilon_S)}{[1+(1-k)\alpha]} - \tfrac{1}{2}\mu.\frac{(1-c)^2}{[1+(1-k)\alpha]^2}.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S) \qquad (5)$$

In order to design the optimal payment in cash, we derive (5) in relation to k :

$$\frac{dEC_b}{dk} = \text{sgn}\left[\frac{\alpha(1-c)}{[1+(1-k)\alpha]^2}\left(\varepsilon_A - \mu.(1-c).(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S)\frac{1}{[1+(1-k)\alpha]}\right)\right]$$

At optimality, equalizing to zero, we get :

$$k_b^* = 1 + \frac{1}{\alpha} - \frac{(1-c).\mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S)}{\alpha.(\varepsilon_A + \varepsilon_S)} \qquad (6)$$

The more important the risk in the acquisition gain is, the lower the part of the payment in cash will be ($dk/d\sigma_{A,S}<0$). It corresponds to an insurance behavior from the buyer. We also see that $dk_b^*/d\rho<0$ assuming realistic values for c. The buyer pays less (more) in cash if the correlation is high (low). Replacing α, makes explicit the relative size effect of the two firms S_0/A_0.

$$k_b^* = 1 + \frac{S_0}{A_0 + c.(\varepsilon_A + \varepsilon_S)}\left(1 - \frac{(1-c).\mu.(\sigma_A^2 + \sigma_S^2 + 2\rho.\sigma_A\sigma_S}{(\varepsilon_A + \varepsilon_S)}\right) \qquad (6')$$

The k_b* value is upward limited by 1. We draw the condition to give a negative or null value to the second term of the right hand side of equation (6') :

$$(\varepsilon_A + \varepsilon_S) \leq (1-c).\mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S) \qquad \text{(C1)}$$

Condition (C1) means that a risk on the value of the future acquisition gains combined with a risk aversion, leads to mixed schemes of payment (k<1) corresponding to an insurance motivation by the buyer. Conversely, when the risk is low or the expected profit ε is high, the optimal payment is a pure cash payment (k=1). The condition (C1) reveals the existence of the question of the means of payment for the buyer. If that condition is not satisfied the pure cash payment is optimal and is the only one to consider. The limit condition (C1) is then assumed verified.

The importance of the relative size effect is analyzed by the derivative of k* with regard to α. It is positive due to the limit condition (C1). :

$$\frac{dk_b^*}{d\alpha} = \left(-\frac{1}{\alpha^2}\right).\left(1 - \frac{(1-c).\mu.(\sigma_A^2 + \sigma_S^2 + 2.\rho\sigma_A\sigma_S)}{(\varepsilon_A + \varepsilon_S)}\right) \geq 0 \qquad (7)$$

The conclusion follows : the higher the size of the target is, the higher the cash percentage in the payment will be. Conversely, for small target firms, the payment with shares is more important. The relative size effect introduces a fear of dilution which, other things remaining equal, will limit a share payment and encourage a cash payment.

We have to question whether the optimal cash payment is a systematically increasing function of the expected profit by the buyer on the assets A of the target firm. The effect of the acquisition gain is measured by the derivative of k^* with regard to ε :

$$\frac{dk_b^*}{d(\varepsilon_A+\varepsilon_S)} = -\frac{c.S_0}{(A_0+c.(\varepsilon_A+\varepsilon_S))^2}$$
$$+(1-c).\mu.(\sigma_A^2+\sigma_S^2+2\rho\sigma_A\sigma_S).S_0\left(\frac{(A_0+2c(\varepsilon_A+\varepsilon_S))}{(A_0+2c(\varepsilon_A+\varepsilon_S))^2.(\varepsilon_A+\varepsilon_S)^2}\right) \qquad (8)$$
$$=\mathrm{sgn}\left[-c.(\varepsilon_A+\varepsilon_S)^2+(1-c).\mu.(\sigma_A^2+\sigma_S^2+2\rho\sigma_A\sigma_S).(A_0+2c(\varepsilon_A+\varepsilon_S))\right]$$

This derivative makes sense only if k is not meaningless, i.e. if condition (C1) is valid. If we add (C1) into (8), we get a lower value of the sign of the derivative which is $(A_0+c.(\varepsilon_{A+}\ \varepsilon_S))$ and gives an always positive lower value. Therefore, the sign of $dk_b/d(\varepsilon_{A+}\ \varepsilon_S)$ is positive : the part of the cash payment is increasing with the acquisition gain. The buyer pays more in cash if the future perspectives of value creation are high, this corresponds to a lower need to be insured with a sharing of the risk with the seller.

The structure of payment depends on the splitting of the gains. The equation (6') highlights that the sign of dk_b/dc is undetermined. We get :

$$\frac{dk_b^*}{dc} = -\frac{(d\alpha/dc)}{\alpha^2}+\frac{\mu.\sigma_A^2}{\alpha.\varepsilon_A}-\frac{(d\alpha/dc).\varepsilon_A.(1-c)\mu.\sigma_A^2}{(\alpha.\varepsilon_A)^2} \qquad (9)$$

XXXXXX????

The transaction exchange ratio α depends on c (see (6')) with $d\alpha/dc$ >0. The sign of (9) is undetermined. So, we cannot draw a simple relation between the sharing of the acquisition gain (in fact the acquisition price offer) and the means of payment. In the ultimate phase of the process of negotiation, an increase of the offer price (which means a higher c) may

involve a revision of the part of the cash payment. The most important is that, in non hostile situations, a relation exists: it means that the offer price proposed by the buyer and presented as acceptable by both parties will depend on the scheme of payment. This highlights the existence of a process leading to an accepted transaction price.

The optimal sharing of the acquisition gain is also identified by deriving (5) with relation to *c*. We get a relation similar to (6). It exists for the buyer an infinite number of optimal solutions describing a curve in the two dimensions plan (*k*,*c*), keeping in mind that α itself is a function of *c*:

$$1-c^* = \frac{(\varepsilon_A + \varepsilon_S)\left[1+(1-k^*).\alpha(c^*)\right]}{\mu.(\sigma_A^2 + \sigma_S^2 + 2.\rho.\sigma_A\sigma_S)} \qquad (6)$$

The more important the future profit is, the more the buyer wants to retain a large part of it. Particularly, we see that it is not optimal for the buyer to retain all the acquisition gain ($c^*=0$), what could have appeared as an intuitive optimal solution for him. The buyer has interest in sharing the gain, what increases the sellers' risk exposure through a payment with shares and, consequently, limits his own risk exposure.

2.2 Situation of the target's shareholders

The sellers anticipate a supplementary profit resulting from the payment with shares. Their certain profit is in the transaction price offer A_D. But compared with a pure payment in cash, they receive a part of the wealth of the acquiring firm after merging. They should take into account dilution, but also potential profit or losses on the issued shares received for payment. These new shares are bought on the basis of a value $(1-k).\alpha.S_0$ (see equation (1)).

The value of their share of capital after merging is equal to their percentage of capital *(1-k)α / [1+(1-k)α]*, multiplied by the value of the merged firm after acquisition., *(S_0+A_0+ε_A+ε_S -k.A_D)*.

The target's shareholders sell a firm of which value before takeover is A_0. They receive shares and cash on the basis of a transaction price which includes a part of the potential acquisition gains. Their net profit is partly captured in the transaction price and partly linked with capital gain or loss in a mixed payment scheme, as seen in equation (10).

$$\tilde{\pi}_s = k.A_D + \frac{(1-k)\alpha.(S_0 + A_0 + \tilde{\varepsilon}_A + \tilde{\varepsilon}_S - k.A_D)}{1+(1-k).\alpha} - A_0$$

Replacing in the previous formula :

$$\tilde{\pi}_s = \frac{(1-k)\alpha(1-c).(\tilde{\varepsilon}_A + \tilde{\varepsilon}_S)}{1+(1-k).\alpha} + c.(\tilde{\varepsilon}_A + \tilde{\varepsilon}_S) \qquad (10)$$

We calculate the equivalent certainty for a risk averse seller :

$$EC_s = \left(\frac{(1-k)\alpha(1-c).(\varepsilon_A + \varepsilon_S)}{1+(1-k).\alpha} + c.(\varepsilon_A + \varepsilon_S)\right) - \tfrac{1}{2}\mu.\left(\frac{(1-k)\alpha(1-c)}{1+(1-k).\alpha} + c\right)^2 (\sigma_A^2 + \sigma_S^2 + 2.\rho\sigma_A\sigma_S)$$

$$\frac{dEC_s}{dk} = \left(\frac{-\alpha.(1-c)}{[1+(1-k)\alpha]^2}\right)\left(+(\varepsilon_A + \varepsilon_S) - \mu(\sigma_A^2 + \sigma_S^2 + 2.\rho.\sigma_A\sigma_S).\left(\frac{(1-k)\alpha(1-c)}{[1+(1-k)\alpha]} + c\right)\right)$$

$$= \text{sgn}\left[-(\varepsilon_A + \varepsilon_S) + \mu(\sigma_A^2 + \sigma_S^2 + 2.\rho\sigma_A\sigma_S)\left(\frac{(1-k)\alpha(1-c)}{[1+(1-k)\alpha]} + c\right)\right]$$

Setting the derivative to zero to get the optimal payment structure :

$$k_s^* = 1 + \frac{(\varepsilon_A + \varepsilon_S) - c.\mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S)}{\alpha.\left(\varepsilon_A + \varepsilon_S - \mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S)\right)} \qquad (11)$$

A partial payment with shares only appears if $k_s^*<1$, what implies :

$$\left(\varepsilon_A + \varepsilon_S - \mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S).c\right)\left(\alpha(\varepsilon_A + \varepsilon_S - \mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S))\right) < 0 \qquad \text{(C2).}$$

If that condition is not satisfied, the seller is not interested in receiving shares but only cash. The (C2) condition is equivalent to :

$$\left(\mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S).c\right) < (\varepsilon_A + \varepsilon_S) < \left(\mu.(\sigma_A^2 + \sigma_S^2 + 2\rho\sigma_A\sigma_S)\right)$$

It means that a mixed payment scheme will only be accepted by the sellers if the expected profit lies between two limits. If the future perspectives (ε_{A+} ε_S) lead to losses, we easily find a preference for a 100% payment in cash. For high expected gains, exceeding the required risk premium, the seller will also prefer a cash payment. Between the two a mixed cash-shares payment is attractive. The derivative dk_s^*/dc from (11) has the same sign as :

$$\frac{dk_s^*}{dc} = \text{sgn}\left[\frac{-\mu.(\sigma_A^2 + \sigma_S^2 + 2.\rho\sigma_A\sigma_S)}{(\varepsilon_A + \varepsilon_S - \mu.(\sigma_A^2 + \sigma_S^2 + 2.\rho\sigma_A\sigma_S)}\right] \qquad (12)$$

In case of a risk lower than the expected profit ($\mu.(\sigma_A^{2+}\sigma_S^2+2\rho\sigma_A\sigma_S)<(\varepsilon_{A+}$ $\varepsilon_S)$), the seller will accept a trade-off between a higher (lower) cash payment and a lower (higher) transaction price (i.e. a lower/higher part of the expected acquisition gain). In case of very small perspectives of gain, the sellers will try to capture a large part of it and will seek a cash payment. We see that *k* and *c* interact from the sellers' point of view because the partial derivative is not null (except for risk neutral seller).

If we want to design the condition for a joint equilibrium for the buyer and the seller, we should get $k^*_b=k^*_s$, at least for admissible limits to k^* (i.e. $k<1$). It involves that conditions (C1) and (C2) are both verified and means that the percentage of captured gain c must be lower or equal to 0.50. The definition of a joint equilibrium involves a common solution for the two equations (6) and (11), each of it describing a curve in the (c,k) plan. Nothing will insure that the solution $k_s^* = k_b^*$ will be acceptable, i.e. between 0 and 1. An obvious solution appears for c=1 which means the total capture of the acquisition gain by the seller[6]. We see here that a joint equilibrium does not give any advantage to the buyer who will not launch a takeover in that situation. We find here the well-known conclusion of Grosman and Hart (1980). In order to restore the economic interest of a takeover, we have to consider ignored factors such as information asymmetries.

3 – Information asymmetries and the process of negotiation

3.1 Uncertainty and asymmetry both from the target and the acquiring firms

The seller may give biased information on the future acquisition gain resulting from his assets (or what is similar, the buyer receives noisy information on the acquisition gain). This bias is represented by the variable i_A. If its average value is positive, the overestimation corresponds to manipulated and exaggerated information or to the hiding of losses. A situation with a negative i_A is also possible : it corresponds to a buyer who underestimates the profitability of

[6] This result comes from the hypothesis of an identical risk aversion of the seller and the buyer. If we have supposedly different values for the risk aversion, a joint equilibrium with a mixed payment could be set.

A's assets (or exaggerate the future losses). The seller knows the exact distribution of the acquisition gain on his assets. His information is better on that point:

$$\tilde{\varepsilon}_{A,b} = \tilde{\varepsilon}_A + \tilde{i}_A$$

The noise term has an expected value i_A et a standard deviation σ_{iA}. The buyer knows that he is exposed to a specific information risk regarding A's assets. From his point of view, the two information and economic risks are independent, so : $\sigma^2_{A,b} = \sigma^2_A + \sigma^2_{iA}$ [7].

The value of the acquiring company is also uncertain. The firm *S*'s assets (those of A put aside) will generate future acquisition gains which will benefit the previous *A*'s shareholders, now *S*' new shareholders through a share payment. The combination of *A*'s and *S*'s assets through acquisition will create synergies or crossed effects of which estimation is uncertain, but the managers (and then shareholders) of *S* have better information. The random variable ε_S represents the acquisition and synergy gains specific to S. We introduce the possibility for the buyer to influence the target's shareholders by manipulating information on the future perspectives of economic gain resulting from the acquisition. For instance, a public notice of large synergy gains may increase the perceived value of the acquiring firm and the part of payment with shares[8]. The bidder perceives the acquisition gain distribution with a noise combined with the true economic distribution which is only known by the seller. Symmetrically, the later has lower information on the future synergy gains and perceives them with an uncertain bias.

$$\tilde{\varepsilon}_{S,s} = \tilde{\varepsilon}_S + \tilde{i}_S$$

[7] Similarly, we have $cov(\varepsilon_{A,b}, \varepsilon_S) = cov(\varepsilon_A, \varepsilon_S)$ or equivalently $cov(i_A, \varepsilon_S)=0$.

[8] A simplified model is possible with only one information asymmetry in favour of the seller if the acquiring firm is listed on a perfectly efficient market. In case of an envisaged acquisition, the gains of acquisition and synergies are known in the market. So, the variable ε_S is known identified by the shareholders of the target. The only asymmetry benefits to the seller who can, for instance, hides some losses. The same argument of efficiency applies also to a listed target firm. In fact, the analysis here considers a bilateral process of negotiation not known by the market.

The process of transaction develops on non homogeneous information set and leads to different calculus. The acquisition is done at the transaction price $A_D=k.\ A_D\ +(1-k)\alpha S_0$. The common exchange ratio between A's and S's assets is differently viewed from each party because each one casts his own perspectives of profits (and consequently his view of the captured part of the gains) :

$$\begin{aligned} A_D &= A_0 + c_b.(\varepsilon_{A,b} + \varepsilon_S) = A_0 + c_b.(\varepsilon_A + \varepsilon_S + i_A) \\ A_D &= A_0 + c_s.(\varepsilon_A + \varepsilon_{S,s}) = A_0 + c_s.(\varepsilon_A + \varepsilon_S + i_S) \end{aligned} \qquad (13)$$

For positive bias, c_b is lower than c_s. The exchange ratio α is always A_D/S_0, but the transaction price is affected by the average value of the information bias for each party.

3.1.1 Situation of the acquirer's shareholders

The buyer's expected profit is :

$$\pi_b = \frac{(1-c_b).(\tilde{\varepsilon}_{A,b} + \tilde{\varepsilon}_S)}{1+(1-k).\alpha}$$

His optimal payment scheme is :

$$k_b^* = 1 + \frac{1}{\alpha} - \frac{(1-c_b).\mu.(\sigma_{A,b}^2 + \sigma_S^2 + 2\rho\sigma_{A,b}\sigma_S)}{\alpha.(\varepsilon_{A,b} + \varepsilon_S)} \qquad (14)$$

The correlation coefficient ρ indicates the possible synergies ensuing an acquisition with a possible decrease in economic risk (ρ<1) which is equivalent to a creation of value. The correlation allows to define the economic goal of the acquisition : diversification (low ρ coefficient) or at contrary vertical or horizontal integration (positive and high ρ). From (14),

we see that $dk_b^*/d\rho<0$. For correlated activities (high and positive ρ), the optimal part of cash payment is lower for the bidder. We supposed independence between the information noise, i_A, and de ε_A. This assumption means that, at the target firm level, the size of the information bias is not linked with the existence of gains (or losses). This is questionable since, for instance, we can imagine that a seller can be pushed to issue optimistically exaggerated information as far as he fears possible losses after the acquisition. We then get:

$$k_b^* = 1 + \frac{1}{\alpha} - \frac{(1-c_b).\mu.(\sigma_A^2 + \sigma_S^2 + \sigma_{iA}^2 + 2\rho(\sigma_A^2 + \sigma_{iA}^2)^{1/2}.\sigma_S)}{\alpha.(\varepsilon_A + \varepsilon_S + i_A)} \qquad (15)$$

with the following condition to get a value of k_b lower or equal to one :

$$(\varepsilon_A + \varepsilon_S + i_A) \le (1-c_b).\mu.(\sigma_A^2 + \sigma_S^2 + \sigma_{iA}^2 + 2\rho(\sigma_A^2 + \sigma_{iA}^2)^{1/2}.\sigma_S) \qquad (C1')$$

Considering equation (15), we see that $dk_b/di_A>0$ [9]. An optimistic bias from the seller ($i_A>0$) means a higher proportion of cash. The buyer can be manipulated by a seller who wants, for instance, to be more paid in cash. Such behavior cannot be endless. We will suppose that a too high bias (and a too high expected value of the future gain) as perceived by the buyer, will cast an increasing doubt for him. The information of the target is then seen as fuzzy and not trustworthy ($di_A/d\sigma_{iA}^2>0$). Conversely, reliable information expresses the true economic distribution of the acquisition gains, no noise is added to it ($i_A=0$, $\sigma_{iA}^2=0$). That model of trustworthiness introduces a self-limitation to information manipulation; otherwise the bias would be unlimited. Looking at (16), we get $dk^*/d\sigma_{iA}^2<0$. Taking delivery by the buyer of noisy information entails two contradictory effects : a positive bias leads him to pay more in cash, but at the same time a balancing effect will limit that trend with a larger perceived risk

[9] The proof obtains similarly as for relation (8), considering i instead of ε.

(see last term of RHS of (15)). The buyer protects himself by paying the takeover with more shares to transfer some of the risk to the seller.

Under an assumption of binomial distribution of the information bias i_A, equation (15) changes (see annex, equation A1). Figures 1 and 2 show how the optimal payment schemes change between 0% to 100% in cash according to the initial relative size A_0/S_0 of the target compared to the acquirer and, on the one hand, the size of the information bias (see graphic 1), and, on the other hand, the correlation (see graphic 2).

INSERT graphic 1

INSERT graphic 2

We may draw a testable proposition from the previous developments : Public takeovers on positively correlated target firms, or pursuing integration strategies, should offer a lower payment in shares. Conversely, a strategy of diversifying activities will correspond to offers with a higher proportion of cash.

Similarly with equation (9), we get dk_b^*/dc_b with an undetermined sign. This derivative combines different terms of different signs[10] :

$$\frac{dk_b^*}{dc_b} =$$

$$-\frac{(d\alpha/dc_b)}{\alpha^2}+\frac{\mu.(\sigma_A^2+\sigma_S^2+\sigma_{iA}^2+2\rho\sigma_A\sigma_S)}{\alpha.(\varepsilon_A+\varepsilon_S+i_A)}-\frac{(d\alpha/dc_b).\varepsilon_A.(1-c)\mu.(\sigma_A^2+\sigma_S^2+\sigma_{iA}^2+2\rho\sigma_A\sigma_S)}{(\alpha.(\varepsilon_A+\varepsilon_S+i_A))^2}$$

[10] We have $d\alpha/dc$ positive.

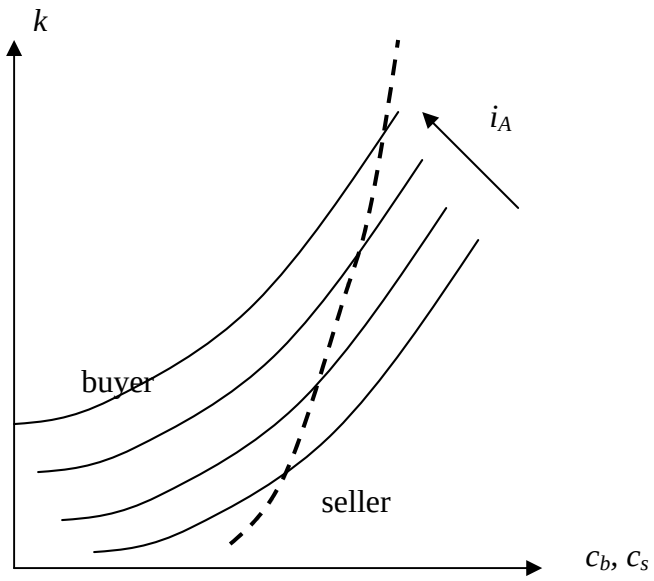
For not trivial sets of values, that derivative is different from zero. It means that the choice of a scheme of payment will influence the previously negotiated transaction price. The derivative of k_b with regard to the information bias from the seller is obtained from (15) reminding that the exchange ratio α will also depend on i_A for the buyer. From the latter's point of view, the transaction price is $A_D=A_0+S_0+c_b(\varepsilon_A+\varepsilon_S+i_A)$.

$$\frac{dk}{di_A} = -\frac{c.S_0}{(A_0+c.i_A)^2} + (1-c).\mu.(\sigma_A^2+\sigma_S^2+\sigma_{iA}^2+2\rho(\sigma_A^2+\sigma_{iA}^2)^{1/2}.\sigma_S).S_0\left(\frac{(A_0+2c.i_A)}{(A_0+2c.i_A)^2.i_A{}^2}\right)$$
$$= \mathrm{sgn}\left[-c.i_A{}^2+(1-c).\mu.(\sigma_A^2+\sigma_S^2+\sigma_{iA}^2+2\rho(\sigma_A^2+\sigma_{iA}^2)^{1/2}.\sigma_S).(A_0+2c.i_A)\right]$$

(16)

Condition (C1') gives that a lower value of (16) is always positive, so we get $dk_b*/di_A>0$. We verify using (15) that $dk_b*/\sigma_{iA}<0$. The information bias issued by the seller modifies the equilibrium locus of optimal solution for the buyer ($c*$,$k*$). A positive bias moves the buyer's equilibrium curves upward. Consequently, the crossing point with the seller's curve moves toward higher values of the percentage of cash payment.

The information and communication policy of the seller aims at issuing an optimistic bias to move higher the transaction price, more precisely to increase the captured part of the total acquisition gain and to get paid in cash (see graphic 3).



Graphic 3 Situation of the buyer with information asymmetry

The bias issued by the seller can eventually be negative. That means that the target's shareholders may get advantages in delivering prudent information on the perspectives of profit of the firm to get an optimal payment corresponding to their view of the economic perspectives of the merged firm. The elements playing toward an optimism bias issued by the buyer are : expected economic losses at the buyer's level, an high target economic risk and a negative correlation. Conversely, a negative information bias may occur with expected economic gains, low economic risk and strong correlation between activities. We remark that the perspectives of important gains will limit the incentive to manipulate information from the seller, conversely, losses may favor optimistic biases.

3.1.2 Situation of the seller

The seller is exposed to an uncertain value on the shares he gets as payment. We assume independence between the information noise from the buyer, i_S, and his synergy profit ε_S (so $cov(i_S, \varepsilon_S)=0$).

$$k_s^* = 1 + \frac{(\varepsilon_A + \varepsilon_S + i_S) - c_s.\mu.(\sigma_A^2 + \sigma_S^2 + \sigma_{iS}^2 + 2\rho\sigma_A(\sigma_S^2 + \sigma_{iS}^2)^{1/2})}{\alpha\left(\varepsilon_A + \varepsilon_S + i_S - \mu.(\sigma_A^2 + \sigma_S^2 + \sigma_{iS}^2 + 2\rho\sigma_A(\sigma_S^2 + \sigma_{iS}^2)^{1/2})\right)} \qquad (17)$$

The previous formula is slightly modified if we assume that the information bias i_S follows a binomial distribution (see Annex, equation A4). Graphics 4 and 5 will illustrate the optimal means of payment for the seller according the size of the information bias he is exposed to by the buyer about his own value (graphic 4) and according the correlation between activities (graphic 5).

INSERT graphic 4

INSERT graphic 5

The derivative versus c of the optimal cash payment for the seller has the same sign as :

$$\frac{dk_s^*}{dc} = \mathrm{sgn}\left[\frac{-\mu.(\sigma_A^2 + \sigma_S^2 + \sigma_{iS}^2 + 2\rho\sigma_A(\sigma_S^2 + \sigma_{iS}^2)^{1/2})}{\alpha\left(\varepsilon_A + \varepsilon_S + i_S - \mu.(\sigma_A^2 + \sigma_S^2 + \sigma_{iS}^2 + 2\rho\sigma_A(\sigma_S^2 + \sigma_{iS}^2)^{1/2})\right)}\right] \qquad (18)$$

It is of undetermined sign. In the two dimensional plan (c,k), the two optimal curves of the seller and the buyer do not have the same slope. They cross at least in one common equilibrium point. More precisely, equations (15) and (17) define two families of curves depending on respectively i_A and i_S.

At joint equilibrium, a 3 equations set with 3 variables may determine the values of k^*, c_b and c_s (equations (13), (15) et (17))[11]. The solution does not depend on the relative size of the two firms, but directly on the biases i_A and i_S and on the information uncertainty linked to it. The existence of a bias may allow to satisfy the two conditions (C1) et (C2) modified to take into account the captured part of the acquisition gain considered differently from the buyer's or the seller's points of view.

3.2 Information policy

The existence of better informed agents and possible manipulation of information introduces a two way asymmetry. That reciprocal game may lead to a better equilibrium situation for the players. We saw that, for exogenous values of the economic uncertainty of the future gains σ_A et σ_S, the initial takeover offer may lead to a common negotiated price A_D, but to different preferences as regard to the payment structures ($k_s \neq k_b$). The convergence toward a commonly accepted scheme of payment is reached by lowering one party's information bias or by increasing the other party's information bias. We should however introduce in the policy the cost associated with a possible decrease in trustworthiness (i.e. higher σ^2_i with higher bias i). An incentive to disclose better quality information thus appears with a lower bias and a lower perceived risk. A change in the information set in the process of negotiation which results in a lower percentage of cash payment means that a better quality and trustful forecast of future gains has been disclosed to the other party. It is what could happen in the negotiation process of a non hostile takeover before the terms of the takeover are made public. It could also happen when the bidder revises the payment structure. It can also occur implicitly without

[11] The two equations (13) are equivalent to : $c_b(\varepsilon_A + \varepsilon_S + i_A) = c_s.(\varepsilon_A + \varepsilon_S + i_S)$

formal negotiation process. If a buyer modifies the terms of payment with a lower proportion in cash, it underlines a trend of exaggeration about the future synergy and acquisition gains. This analysis leads to test the hypothesis of an increasing flow of information linked with the modification of the mix of payment during takeover negotiations. An active communication policy with new perspectives, business plans or public notices are ways to help the convergence of the condition of the takeover, particularly the means of payment between sellers and buyers.

The previous developments have to be mitigated with the existence of self-regulation in these information policies from both sides. Rational economic agents are aware that they are exposed to asymmetries of information and they forecast the risk due to information. Any piece of information is weighted by a specific uncertainty due to its issuer behavior and which cumulates with the economic uncertainty of the future expected gains. That information noise is analyzed in terms of trustworthiness for the one who receives information. We should take into account that trustworthiness is endogenous and depends on the level of the economic gains announced by one party. A rational equilibrium exists and comes from the fact that exaggeration makes information poorly credible. Information risk is perceived similarly as the economic risk by the agent who receives information. He tries to cover himself against that risk globally. One possibility, as highlighted above, is to associate the seller by paying him more largely with shares, making him exposed to losses coming from his own exaggerated information. Reciprocal mechanisms of self regulation may limit the behavior of the buyer. Market efficiency, disclosure rules and the existence of powerful regulation authorities will force a listed acquirer to deliver trustable forecasts of the futures gains. The pressure of independent financial analysts, if we assume they effectively play their role of expertise, can lead to the delivery of uncertain but unbiased forecasts on the future gains resulting from a

takeover. Such a situation may be an improvement globally for investors, and particularly for the target's shareholders, but paradoxically the acquiring firm appears as informationally dominated vis-à-vis a target firm which is not listed. Capital gains of the targets are then easier to dissimulate and strategies of exaggeration are possible.

The previous analysis leads to some hypothesis that can be empirically tested :

- The modification of the payment structure during the process of a takeover comes with a flow of new information about the economic perspectives of the operation ;
- The flow of information comes from the party who revises the scheme of payment and/or the price, practically, in formal procedures, it comes from the acquirer ;
- A rise of the cash proportion will convey positive forecasts of acquisition gain for the buyer ;
- Conversely, a rise of the proportion in shares will go with less favorable perspectives coming from the seller or more trustable ones coming from the buyer.

Conclusion

During takeover offers, a mixed payment weighting cash and shares explains itself outside a pure strategic game aiming at discouraging competitors. The design of an optimal mixed payment scheme expresses the risk aversion of the buyer and the seller who both face a double risk. If the buyer questions the economic value of the acquired assets, the seller who is partly paid with shares also questions the future gains of synergy. The setting of an optimal weighting of means of payment appears as a way to answer the problem. For the buyer, paying with newly issued shares allows to insure himself against the information risk and the

uncertainty on the real economic value of the target's assets. But at the same time issuing shares will dilute the acquirer's former shareholders. The seller also suffers from information asymmetry and can be given biased perspectives about the future of the acquisition. The setting of common conditions of payment is part of the transaction process. It can be explicit in the negotiation period between the buyer and the seller of a non hostile takeover. The optimal setting of a mixed cash-shares payment may disclose information to third parties who will observe the public mixed weighting. The optimal means of payment will be directly influenced by the correlation between the expected acquisition gains at the target and at the acquiring firm levels. This correlation will characterize strategies spanning from pure diversification of economic activities, if it is low, to business integration, if it is high. Globally, a diversification strategy should imply a takeover offer with a greater emphasis on cash payment than on the share payment.

A takeover is a contract. If it is successfully agreed, it means that the seller's optimal preferences of payment have been taken into account. The convergence to a commonly accepted scheme of payment means that a process of information exchange occurred successfully in the sense that the noisy future acquisition gains reciprocally communicated to the other party in the negotiation process between the buyer and the seller became at last compatible. It does not mean equally and symmetrically shared information, but that biases are limited. Exaggeration biases exist and are part of communication policy from one party to the other. But limitless biases will lead to systematically extreme solutions of pure cash or pure share payments. A self regulation mechanism of trustworthiness will limit information risk for the party who receives information. If bias and exaggeration increase the fuzziness of information linked to the future economic value, the buyer (seller) will try to cover that risk and will propose a payment with more shares (cash). The communication policy seems to gain

more importance in situation of negotiation of the means of payment or when the terms of payment are publicly revised in a mixed takeover offer. It also appeared that the final takeover price should be sensitive to the design of the scheme of payment. Means of payment mix conveys information and manages information risk; its setting has value and will marginally modify the transaction price offer. The previous findings open ways to empirically testable propositions.

Annex - Binomial model

The bias i_A and the uncertainty around it allows the seller to react in the negotiation process and to lead the buyer to propose an optimal payment mix k^* according his objectives. Manipulating i is however complex because the seller ignores the consequences of the information bias he casts in term of his own trustworthiness σ_i. We suppose that σ_i is endogenous and is a function of the average size of the information bias as perceived by the recipient *:* the higher the acquisition gains as announced by the target firm is, the more it is doubtful for the acquiring firm. A binomial model makes explicit the link between that expected value and its variances. We here suppose that i_A follows a binomial distribution with a probability *p*, which is the probability that an information bias exists on the gains resulting the acquisition at the target firm's level. The bidder has a (*1-p*) probability to use the true economic information on the acquisition gain with no information, i.e. enjoying symmetric information with the seller. The bias on the acquisition gain, if it exists, is $\bar{i}$. A strictly symmetrical information bias i_S may exist in the other way, issued by the acquirer to the seller about the future synergy gains :

$E(i_A) = p_A.\bar{i}_A$ $\qquad\qquad$ $\sigma_{iA}^2 = p_A(1-p_A).\bar{i}_A^2$

$E(i_S) = p_S.\bar{i}_S$ $\sigma_{iS}^2 = p_S(1-p_A).\bar{i}_S^2$

The previous expressions show that the variance in information risk is positively related to the size of the expected bias. The optimal payment scheme considered from the buyer's point of view is :

$$k_b^* = 1 + \frac{1}{\alpha} - \frac{(1-c_b).\mu.(\sigma_A^2 + \sigma_S^2 + p_A(1-p_A).\bar{i}_A^2 + 2\rho(\sigma_A^2 + p_A(1-p_A).\bar{i}_A^2)^{1/2}.\sigma_S)}{\alpha.(\varepsilon_A + \varepsilon_S + p_A\bar{i}_A)} \qquad \text{(A1)}$$

The value of the derivative of k_b in relation to i_A is :

$$\frac{dk_b^*}{d\bar{i}_A} = -\frac{S_0.p_A.c}{(A_0 + c.(\varepsilon_A + \varepsilon_S + i_A))^2}$$
$$-\left[\frac{S_0}{(A_0 + c.(\varepsilon_A + \varepsilon_S + i_A))}.\frac{(1-c).\mu.f'(i_A).D - p_A.N}{(\varepsilon_A + \varepsilon_S + i_A)^2} - \frac{S_0.p_A.c}{(A_0 + c.(\varepsilon_A + \varepsilon_S + i_A))^2}.\frac{N}{D}\right]$$

If we call respectively N and D the numerator and the denominator of the last term on the right hand side of (A1) and if we set : $f(i_A) = p_A(1-p_A).\bar{i}_A^2 + 2\rho(\sigma_A^2 + p_A(1-p_A).\bar{i}_A^2)^{1/2}.\sigma_S$. We have :

$$f'(i_A) = \bar{i}_A\left(2.p_A(1-p_A) + 2\rho.\sigma_S(p_A(1-p_A))(\sigma_A^2 + p_A(1-p_A).\bar{i}_A^2)^{-(1/2)}\right) \qquad \text{(A2)}$$

We get :

$$\frac{dk_b^*}{d\bar{i}_A} = -\frac{S_0.p_A.c}{(A_0 + c.(\varepsilon_A + \varepsilon_S + i_A))^2}.\left[1 - \frac{N}{D}\right] - \left[\frac{S_0}{(A_0 + c.(\varepsilon_A + \varepsilon_S + i_A))}.\frac{(1-c).\mu.f'(i_A).D - p_A.N}{(\varepsilon_A + \varepsilon_S + i_A)^2}\right]$$
(A3)

The first term in the RHS of (A3) is positive because N/D is above 1 (following the condition (C1')). The second RHS depends on the sign of :

$$\text{sgn}\left[-(1-c)\mu.f'(.).D + p_A.N\right]$$

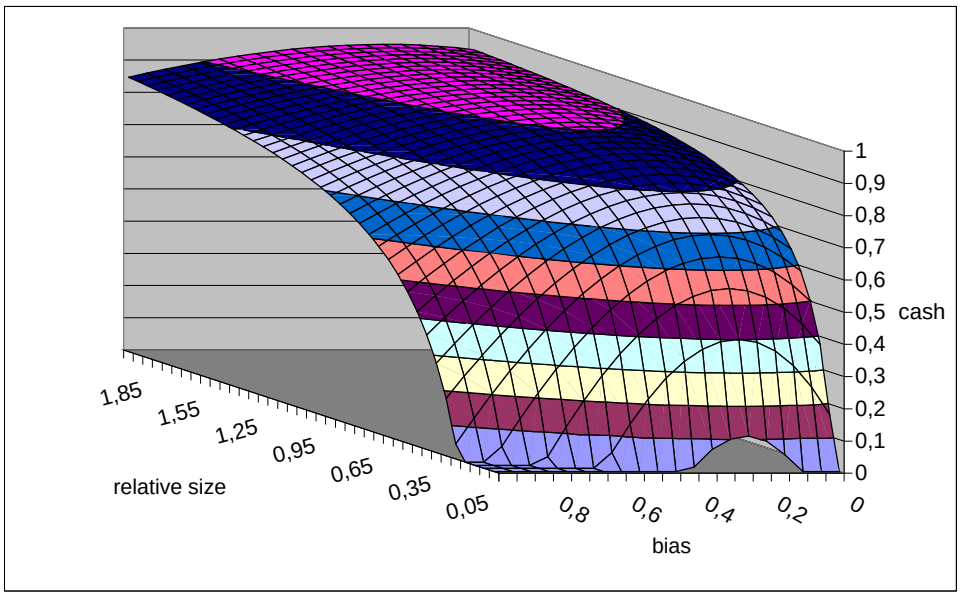
The only term which may play to give a negative sign to the dk_b^*/di_A derivative is $f'(i_A)$. If $f'(i_A)>0$, that term has a negative influence. Looking at (A2), for positive correlation, $f'(i_A)$ has the same sign and magnitude as the bias $\bar{i}_A$. Then for large enough exaggeration bias, the derivative turns negative and then the acquirer covers its valuation risk of the target assets by paying more in shares and less in cash.

Conversely if $f'(i_A)$ is negative, which means a negative pessimistic bias, all terms in (A3) formula are positive. Then the bias encourages a cash payment. The condition $f'(i_A)<0$ is sufficient. A negative correlation such that $\rho < -\frac{(\sigma_A^2 + p_A(1-p_A).\bar{i}_A^2)^{1/2}}{\sigma_S}$ is also enough to give a negative $f'(.)$. The derivative dk_b^*/di_A is of positive value. The buyer has to take into account positive news from undervalued gains and/or better diversification gains by capturing them and by increasing the cash payment to the seller.

In most cases, the sign of dk_b^*/di_A following (A3) is undetermined. The parameters of the communication policy are then important to influence the value k* in the wished way.

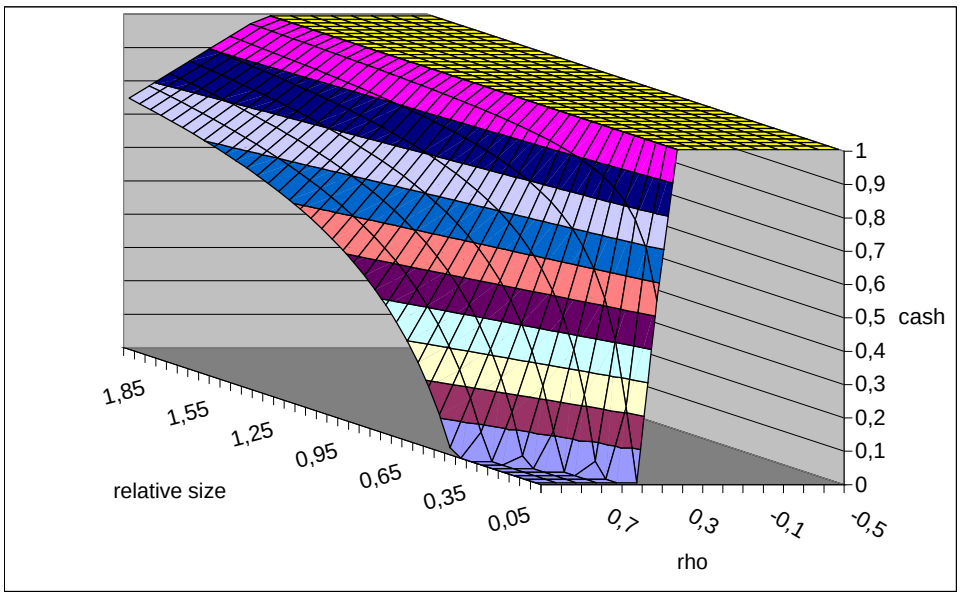
Considering the optimal payment from the target's point underlines the influence of the perceived bias i_S in the information from the buyer. We get :

$$k_s^* = 1 + \frac{(\varepsilon_A + \varepsilon_S + p_S\bar{i}_S) - c_s.\mu.(\sigma_A^2 + \sigma_S^2 + p_S(1-p_S).\bar{i}_S^2 + 2\rho\sigma_A.(\sigma_S^2 + p_S(1-p_S).\bar{i}_S^2)^{1/2})}{\alpha\left(\varepsilon_A + \varepsilon_S + p_S\bar{i}_S - \mu.\left(\sigma_A^2 + \sigma_S^2 + p_S(1-p_S).\bar{i}_S^2 + 2\rho\sigma_A.(\sigma_S^2 + p_S(1-p_S).\bar{i}_S^2)^{1/2}\right)\right)} \qquad \text{(A4)}$$



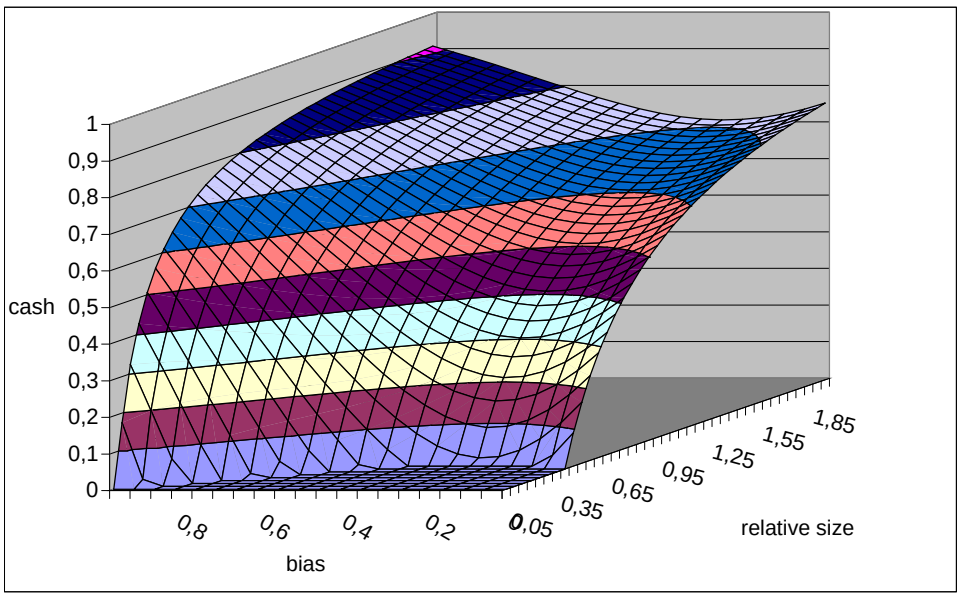
Graphic 1 - Optimal cash payment for the buyer (for different positive exaggeration bias from the seller)

(relative size : ratio of the initial target asset size compared to the acquiring firm size, A_0/S_0, varying from 5% to 200% of the acquirer's initial value, S_0 ; bias : size of the exaggeration bias on the acquisition gain in the target's assets varying from 0% to 100% of the average true economic acquisition gain ε_A ; parameter values in equation (A1) : S_0=10, ρ :0,5, μ=4, $\varepsilon_A=\varepsilon_S$=1, $\sigma_A=\sigma_S$=1, c=0,25, p=0,5)



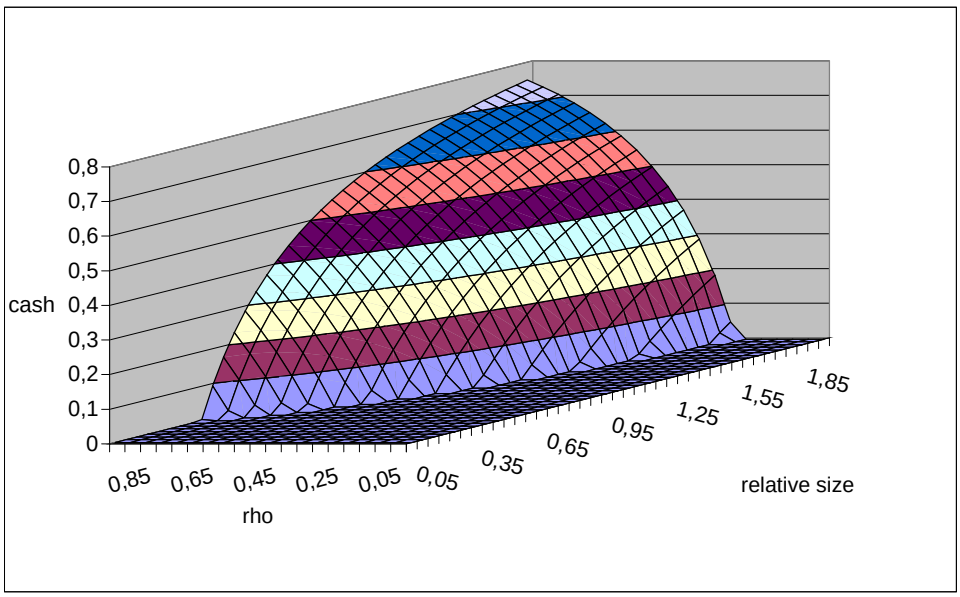
Graphic 2 - Optimal cash payment for the buyer (for different correlation values)

(see legend figure 1 ; rho : correlation coefficient between the uncertain economic acquisition gains ε_A and ε_S varying from -0,5 to +1 ; parameters in equation (A1) : S_0=10, i_A=0,5, μ=4, ε_A=ε_S=1, σ_A=σ_S=1, c=0,25, p=0,5)



Graphic 4 - Optimal cash payment for the seller (for different positive exaggeration bias from the seller)

(see legend figure 1 ; bias : size of the exaggeration bias on the acquisition/synergy gains in the acquirer's assets varying from 5% to 100% of the average true economic acquisition gain ε_S ; parameter values in equation (A4) : S_0=10, ρ :0,5, μ=4, ε_A=ε_S=1, σ_A=σ_S=0,5, c=0,25, p=0,5)



Graphic 5 - Optimal cash payment for the seller (for different correlation values)

(see legend figure 1 ; rho : correlation coefficient between the uncertain economic acquisition gains ε_A and ε_S varying from 0,05 to +1 ; parameter values in equation (A4) : i_S :0,5, μ=4, ε_A=ε_S=1, σ_A=σ_S=0,5, c=0,25, p=0,5)

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