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Mergers and Acquisitions in a Union – Oligopoly model: *How Do Unions Affect M&A Decisions?*[*]

Abstract

The purpose of the present thesis is to explore and analyze the possible effects that a merger (or an acquisition) might have on wages and employment in an *a la Cournot* duopolistic industrial sector with monopoly trade unions and the existence of technological asymmetries between the two firms. Given the fact that a possible merger (or acquisition) is about to take place we investigate the changes that occur in wages (determined by the unions) and in employment (determined by firms) and try to extract the incentives for merger. The results are being compared with a competitive model with exogenously determined wages.

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CONTEXT page

1. Introduction

Investigating mergers and acquisitions and their effects on a market has always been interesting especially during the last two decades. Because of the fact that Industrial Organization is quite a new concept in economics, many topics which require investigation come ashore and reveal new topics for research. From 1980's, especially, the concept of mergers and acquisitions has risen since then there has been an increasing interest for the analysis of such matters with the help of econometric methods (***empirical approach***) and later on by using latest microeconomic tools and game theory(***microeconomic approach***). Especially the last one has contributed greatly to the analysis of mergers and their effects on wages and employment as basically a merger (or an acquisition) is nothing more but a game between players who through bilateral bargaining have to determine the proper incentives[1] in order to reach an agreement.

In order now to be more specific on this area we must first determine what is a merger or an acquisition. ***Merger*** is the integration of two or more firms that belong in the an industrial sector and from their integration results a new consolidated firm. Of course it should not be neglected that in order to be successful a merger requires the consensus of both parts. In the other hand ***Acquisition*** is the "*take – over*" of a firm by another firm in which the *biding* firm pays to the *acquired* firm the amount of profits that this firm had before the acquisition. In contrast to a merger, the acquisition doesn't necessarily require the consensus of both parts and that an acquisition may occur each time only between two firms. In general mergers and acquisitions may occur either in domestic industries or in international ones and their main aim is to grow faster and in more costless method. In a way we can think mergers as an alternative strategy - against direct investments for the firm's growth and empowerment of competitiveness. As regards, now, to the form of a merger, that can take different forms of integration. Those are: ***horizontal M&A*** (M&A between firms, which products are substitute), ***vertical M&A*** (M&A between firms, which products are complementary) and ***conglomerate M&A*** (M&A between firms which products are unrelated). In the present paper we focus our attention more to the first form rather than the others. From the various forms of external growth the most common ones are the mergers between two or more firms which are characterized as mergers with or

[1]The fundamental incentive of a merger is that each share of the profits that result after the merger must be greater than the profits that each participant makes before the merger.

without management agreement of the merging firm (or the acquired firm) – in this case we have a hostile take-over. This can be achieved by concentrating the superiority of the acquired firm's shares (commonly through stock market). In addition to the above forms we also have, nowadays, the appearance of a new form of integration, called, ***the Leveraged Buyouts*** (***LBO***) which refers to mergers that occur via the consensus of the Board of Directors and with the bank, of each firm.

Returning, now, back to the analysis of the incentives for mergers we confront early 1960's neoclassical theories such as *Manne* (1965) who supports that a profit-maximizing management is seeking towards the maximization of shareholders wealth, thing that can be achieved by a merger (or an acquisition), if and only if, post merger reorganization leads to synergies[2] and profitability enhancement. Moving forward we face new ideas on the theory of mergers such of *Scherer* (1980) who supports that there are four reasons for which the owners of a firm would follow a merger. Those are:

1. The need of compiling sufficient economic recourses for investments as well as capable management in an attempt to secure the future of the firm.
2. The lack of succession by the owners of many firms
3. Legislation and, particularly, taxation policy, which through government re-forming, urge firm owners to merge.
4. Medium or small sized firms, due to their weakness to expand in other markets, tend to follow merger with bigger firms in order to get the means to expand in other markets.

All these consist the proper incentives which lead to a forming of a profitable merger. In the other hand we have the buyers or the receivers of the possible integration, whose motives can be divided in the following categories:

1. The increase of market power; the merger between two firm in a duopoly may well lead to the forming of a monopoly.
2. Reduction of advertising costs; even if market shares doesn't increase, a merger will certainly lead to a reduction of advertising cost – especially in the case of horizontal mergers (homogeneous products).
3. Increase in the productivity through synergies; due to joint production the merged entity may exploit possible scale effects of production.

[2] Synergies can be succeeded through increased market power, economies of scale and scope, etc.

4. The industrial profits after the merger are expected to be higher than the profits prior to the merger; this is due to the fact that pre – merger profits refer to an oligopolistic competition while the post – merger profits refer to a reduced competition. In some cases (i.e. duopoly) the profits are reaching the monopoly level.

Given all the above mentioned about incentives it is interesting to introduce to the analysis other parameters and factors that may implicate on the incentives. In the present paper we will use the notion of upstream market which we will assume that consist of trade unions each of one is organized at firm level.

Although M&A is an area of broad research in the last two decades, the relative literature on the effects of M&A on wages and employment is quite few. Most papers are concerned with the determination of the proper incentives for M&A and its profitability in the downstream market. The most classic ones is that of *Salant et al.* (1983) who show that in a Cournot oligopoly with homogeneous goods, linear demand and constant marginal costs, a merger is unprofitable unless the merging coalition consists of more than 80 per cent of all firms in the industry. Of course other studies show that the relaxation of some assumptions may lead to a more general outcome, that of a profitable merger. Such paper is the *Deneckere* and *Davinson* (1985) who now try a more microeconomic aspect on the topic of M&A. They show that in an oligopolistic sector with differentiated goods, a merger is always profitable. The progress since then is quite interesting especially with the paper of *Horn* and *Wolinsky* (1988) who study how the organization of upstream market affects the incentives for merger in the downstream market plus the nature of products (complements or substitutes)[3]. Their model consists of a duopolistic market in which each of the firms is locked in a bilateral monopoly with its supplier (a firm or a union) and a merger is about to take place. They investigate the profitability of this merger which can also occur between the suppliers. The most interesting fact about this paper is that the wages are determined endogenously through efficient bargaining between the supplier and the firm. They finally conclude that a merger is profitable when the products are substitutes. *Perry* and *Porter* (1985)[4] challenged the view that a merged

[3] Another important assumption is that labour is the only factor of production thus the production function is formulated as $Q_i = l_i$.

[4] Similar studies are those of *Farrell* and *Shapiro* (1990) and *McAfee* and *Williams* (1992). *Fridolfsson* and *Stennek* (2002) also introduce the assumption that a merger in oligopoly can lower marginal cost.

firm is no larger than any of the constituent firms. In their study they adapt the existence of some crucial assets that are in limited supply in order to capture the notion that some firms are larger than others in a homogeneous product industry. This assumption implies rising marginal cost of output production and internal cost savings from mergers which could make a merger profitable. Another addition to the concept of unionization and M&A is that of strategic delegation i.e. the unions and the firms are using delegates in the bargaining process followed after the merger, which is used in the paper of *González-Maestre* and *López-Cuñat* (1999). They show that the incentive for merger, under delegation, is increased compared to the without delegation case.

Interesting is also the paper of *Barcena-Ruiz* and *Begona-Garzon* (2000) whose paper is basically an extension to the paper of *Horn* and *Wolinsky*. They investigate the profitability of a merger in a duopolistic market each of one firm is producing goods that are related to each other. There also exist two trade unions in which all the employees of each firm are organized. The merger between the two firms is a possible outcome as well as between the unions too. Through a four - stage game they find that when the products are substitutes the firms proceed to a horizontal merger where they keep both brands whereas the unions merge independently of the degree of differentiation between the products. In the other hand if the products are complements the merger is vertical and they concentrate all the production while the unions merge if $C < -0.5$, where C expresses the relatedness between the two products. The more specific study for the relation between wages, employment and M&A comes with the paper of *Lommerud*, *Straume* and *Søgard* (2000) who investigate merger profitability in unionized oligopoly in an *a la Cournot* and *Bertrand* competition and with differentiated products. There exist trade unions that may organized in two different ways: plant – specific and firm – specific[5]. They find that if unions are plant – specific the merger is profitable while if they are firm – specific results are reversed. An also interesting outcome of this paper is that when the unions are plant – specific the merger tends to be more profitable due to the significant reduction in wages, set by the unions. This is due to intra – union rivalry that makes the unions to lower their wages in order to achieve a more competitive

[5] Recently *Lommerud*, *Straume* and *Søgard* in the paper "Downstream merger with upstream market power" (2003) analyze the same features only this time they formulate their model in a more general approach and they also extend to the profitability of international mergers and introduce a third type of union organization: industry - specific. The results are the same with the above mentioned paper.

place in the labour market. Interesting feature is also the fact that there exist a free – rider problem by the outsider firm which can benefit by the merger effects.

These are the most interesting papers in the related literature about wages, employment and M&A and their interaction. The results are quite interesting and intuitive with the mainstream theory of Industrial Organization and provide ground for further and deeper research in this field. The present paper tries to follow that path of logic by introducing other parameters such as technology efficiency and scale economies. Our paper is focused on the implications that a merger or an acquisition might have on wages and employment in an asymmetric duopolistic industrial sector. By making the assumption of different technology used by the two firms we manage to get quite interesting outcomes and somehow different to the mainstream results from the so far published papers. Our contribution with this paper is an alternative approach to the until now matter of M&A and their implications on wages and employment. This approach has been made by the introduction of a Cobb – Douglas production function in the mathematical analysis and the assumption of different marginal efficiencies between the two firms. We find that a merger between the firms results in lower wage rates and reduced labour demand, post – merger, and by taking two alternative cases of merger we determine which is the more prevailing in the equilibrium. To be more specific we divide two cases of merging; the case where the two firms merge and keep both plants operational and the case where the merger dictates the shut – down of the inefficient plant[6]. As far as the relative literature concerned the former case is always appears to be non – existing or not optimal behaviour to extend that in most cases the optimal strategy, post – merger, for the merged firm, is to shut – down the inefficient plant[7]. In this paper we find out that if there exist trade unions that have all the power to set wages in the two plants the optimal strategy, post – merger, for the consolidated firm is to keep both plants operational. In the following analysis it is also included the case of an acquisition which is an alternative type of integration between two firms as well as a competitive model in which we assume that the wages are determined exogenously and for more

[6] Consequently in the former case the unions remain as are, while in the latter case the union of the closing plant doesn't exists any more.

[7] A recent paper by *Cabolis*, *Manasakis* and *Petrakis* (2006) investigate the effects that M&A may have on R&D investments in an oligopolistic market with three firms. The optimal outcome of the merging between the two firms of the sector is the shutting – down of the inefficient plant. In any case this is optimal as far as concerns the firm without the pressure forced by the wage setting by the union – this doesn't' included in the above paper.

simplicity we will assume that they approach the competitive wage (or reservation wage). This is included because we want to investigate how the profitability of a merger (or acquisition) is being affected by the behaviour of the unions.

2. The preliminaries

The merger before happening must firstly be decided by the two merging parts. The consensus of both parts gives the "*OK*" to proceed in a merger (or in a case of acquisition the bidder firm has decided to proceed to the take – over) and of course the unions do not intervene in this choice. After the merger (or acquisition) that has been decided, the merging parts have the option to follow two different types of merging which are:

- Merger/Acquisition followed by keeping both plants operational
- Merger/Acquisition followed by the shutting – down of the inefficient plant.

In any case the possible incentives are being examined and the merging coalition decides the type of integration. In the other hand, now, the unions after a possible merger and given its type, must decide which policy of wage setting will they follow (this due to the fact that we assume that the unions are organized as monopoly unions[8] and therefore have all the power to set wages in a single stage of the merging game). The possible strategies of wage setting that the unions have to choose between are two:

- Independently determine the wage to be paid at the plant level.
- Collectively determine a single wage paid to any employee of the consolidated firm (working at any of its plants)[9]

To put it in simple words, they may choose either to set wages independently or collectively at plant level. This is only happens as long as the merged firm is working with both plants operational in opposition to the other case where the closing of the inefficient plant automatically shuts down one of the unions also. In this case, of course, the second option of wage setting is necessarily realized.

What happens in the pre - merger stage is also important feature here in order to justify the actions taken by the merging firm post - merger. A tricking assumption that

[8] Monopoly union is a special case of a right – to – manage model of bargaining between firm and union in which the union has the power to set wages while the firm sets employment.

[9] In the present analysis the option of union collusion is not analyzed. Of course this would be also the union's wage setting policy after the shutting down of the inefficient plant.

we could well make here is to suppose the existence of a minimum sectoral wage regime. In a regime of a minimum sectoral wage there exists a single wage in the industrial sector with which all the firms has to follow at least. This means that each firm is forced to set a minimum wage equal to the minimum sectoral wage determined by a constituted wage and labor institution often called *MSWI* (*Minimum Sectoral Wage Institution*). This interesting notion is being examined in the paper of *Petrakis* and *Vlassis* (2003) as they explore the endogenous emergence of wage bargaining institutions in a union – oligopoly framework. With relation to the notion of merger the above paper says that when the firms act independently, the efficient one has the incentive to determine a single minimum wage (possibly higher than the already existing one) choice with which the unions also agree. So what happens now is the phenomenon known as *business - stealing through a single wage* which results in the loss for the inefficient firm. But this may not happen if after a merger we do not have the shutting – down of the inefficient plant. Instead in this case the merged firm will act as a monopolist with two plants operational case which dictates the setting of two wages. All those happen when the market has the option to constitute a minimum sectoral wage regime with which all the firms of the sector have to follow.

If, now, we assume that the constitution of a minimum sectoral wage in the market isn't available then we assume that the efficient firm has (possibly) the incentive to persuade the inefficient firm to follow a merger either:

- With two wages and both plants operational
- With a single wage paid at the consolidated firm level and the shutting – down of the inefficient plant.

3. Describing the market

3.1 Downstream Market

As we have already mentioned above the downstream market consists of two asymmetric firms which they compete each other with respect to quantities produced. We assume that firm 1 is the inefficient firm producing quantity 1 while firm 2 is the efficient firm producing quantity 2. The asymmetry refers to different marginal efficiency per unit of labor and it is represented by the parameter k_i (for $i= 1, 2$) whereas the production function of each firm is a *Cobb – Douglas* production function like:

$$q_i = \sqrt{2k_i l_i} \qquad (1)$$

Where, k_i (for i= *1, 2*) is $k_1 = 1$ and $k_2 = k > 1$. Here we will assume that *1<k<5/3* because despite the fact that firm 2 is the efficient one we want both firms to able to produce in the market and for that there are technological asymmetries but there are not sufficiently high[10]. As far as the market is concerned, now, we assume that the two products produced, 1 and 2 are homogeneous and they are being traded in the market according to the following linear demand function:

$$P = a - bQ \qquad \text{Where,} \quad Q = q_1 + q_2 \qquad (2)$$

Of course here despite the existing technological asymmetries the price is unilateral for both firms as they operate in an oligopolistic competitive sector. In the other hand the quantities produced are different as the efficient firm is more capable of producing larger quantity of product 2 while the inefficient one produces less. Another important feature here is the fact that the production function is exhibiting decreasing returns to scale as the marginal cost is increasing.

3.2 Upstream Market

Turning to the upstream market we have two monopoly unions which means that they posses all the power to set wages. The monopoly union is a special case of a right – to – manage model of bargaining and according to *Petrakis* and *Vlassis* (2000) the right – to – manage bargaining is the equilibrium outcome if the union's bargaining power is sufficiently high[11]. Here we assume that both unions have enough power to set wages in order to justify the use of monopoly unions. Each union sets wage at plant level in order to maximize the so – called *Stone – Geary* utility function:

$$U_i = (w_i - w_0)^f (l_i)^{1-f} \qquad (3)$$

Where, the parameter $f \in (0, 0.6)$ [12] captures the relative importance of wages and employment to the unions. The reservation wage w_0 is equal to wage that could be

[10] This assumption is used by *Petrakis* and *Vlassis* (2003) to express that $k_2 \geq k_1$ but $k_2 < 5/3$ meaning that technological asymmetries aren't so excessive that only the efficient firm survives in the market.

[11] *Lommerud*, *Straume* and *Søgard* (2003) also suggest that which bargaining game will emerge as the equilibrium outcome depends on the characteristics of the industry in question. In addition *Espinosa* and *Rhee* (1989) find that efficient bargaining may emerge as an equilibrium outcome in infinitely repeated games.

[12] Although the set of values is limited it is necessary in order to have solution in the following model as in worst case scenario we could have had multiplicity of equilibrium but here for values of *f>0.6* we get negative wages which is unacceptable.

earned in the competitive sector of the market[13]. From an early look we can see that for $f \to 0$ the unions tend to care more about employment while for $f \to 0.6$ unions tend to care more about wages and as we will see later on, this result is confirmed meaning that as *f* increases the wage also increases. Another important note that we have to make here is that the structure of the upstream market is assumed to be exogenously given. For that we assume that the unions are organized at plant level.

3.3 The Game

Since a merger is a long – term commitment, it is then natural to assume that the candidates for merger would take into account the unions' response to a downstream merger and for that reason we let the decision of whether to merge or not, be taken at the first stage of the game. So in conclusion the merging game will be formulated in the following stages:

Stage 1: Firms 1 and 2 decide to merge or not and which type of merger will they follow.
Stage 2: Given the type of merger the unions choose the strategic wage setting and set wages at plant level.
Stage 3: (Merged) firm(s) set(s) employment given the wage structure (at each plant)

Solving the above game by backwards induction we find:

1. $A = [\{F_1, F_2 \to F_m\}, \{U_1, U_2 \to w_1, w_2\}]$, *merger type - 1*
2. $B = [\{F_1, F_2 \to F_m\}, \{U_2 \to w_2\}]$, *merger type - 2*
3. $C = [\{F_1, F_2 \neq F_{M/m}\}, \{U_1, U_2 \to w_1, w_2\}]$, *no merger*

At 1st stage we have the determination of the incentives for merger by the firms which they eventually choose one of the two alternative types of integration they will follow. At 2nd stage after the possible merger has been occurred the unions set wages which mainly depend upon the type of integration. Finally at the 3rd stage of the game the merged firm, given the strategic wage setting of the unions, sets the employment (either on two plants or on one plant – depending on the type of integration).

[13] We can also assume here that the sector is relatively small to the aggregate market and so the impact of the unions' actions on the aggregate price index is negligible and thus unions only care about nominal wage rates. (From *Petrakis* and *Vlassis* (2003))

4. The model

4.1 Pre – Merger/Acquisition Game

To begin with we will see first what happens in **pre – merger/ game** where, Firm 1 and Firm2 set q_1 and q_2 respectively (given exp. (1)) in order to maximize

$$\pi_1 = (a - b(q_1 + q_2))q_1 - \frac{1}{2}w_1 q_1^2 \quad (4)$$

$$\pi_2 = (a - b(q_1 + q_2))q_2 - \frac{1}{2k}w_2 q_2^2 \quad (5)$$

From first order conditions we get for q_1 and q_2 respectively

$$q_1 = \frac{a(bk + w_2)}{3b^2k + w_1w_2 + 2b(kw_1 + w_2)} \quad (6)$$

$$q_2 = \frac{ak(b + w_1)}{3b^2k + w_1w_2 + 2b(kw_1 + w_2)} \quad (7)$$

In the other hand we have the unions which set the wages according to maximize

$$U_1 = (w_1 - w_0)^f (\frac{q_1^2}{2})^{1-f} \quad (8)$$

$$U_2 = (w_2 - w_0)^f (\frac{q_2^2}{2k})^{1-f} \quad (9)$$

Taking the logarithm of (6) and (7) and solving the system of *f.o.c* we get

$$w_1^c = -\frac{((2bk + w_0)(b(-2 + 4f) + w_0 - fw_0) + n)}{(-2 + 3f)(2bk + w_0)} \quad (10)$$

$$w_2^c = -\frac{((2b + w_0)(2b(-1 + 2f)k + w_0 - fw_0) + n)}{(-2 + 3f)(2b + w_0)} \quad (11)$$

So by replacing (10) and (11) in (6) and (7) respectively we get

$$q_1^c = -\frac{a(-2 + 3f)((2b + w_0)(bfk + w_0 - fw_0) + n)}{2(-1 + f)(2b + w_0)(b^2(-2 + f)k + 2b(-1 + f)(1 + k)w_0 + (-1 + f)w_0^2 - n} \quad (12)$$

$$q_2^c = -\frac{a(-2 + 3f)k((2bk + w_0)(bf + w_0 - fw_0) + n)}{2(-1 + f)(2bk + w_0)(b^2(-2 + f)k + 2b(-1 + f)(1 + k)w_0 + (-1 + f)w_0^2 - n} \quad (13)$$

Where,

$$n = \sqrt{(2b + w_0)(2bk + w_0)(b^2(4 + f(-10 + 7f))k + 2b(-1 + f)^2(1 + k)w_0 + (-1 + f)^2 w_0^2}$$

Finally replacing expressions (12) and (13) into (4) and (5) we get

$$\pi_1^c = (a - b(q_1^c + q_2^c))q_1^c - \frac{1}{2}w_1^c q_{1,c}^2$$

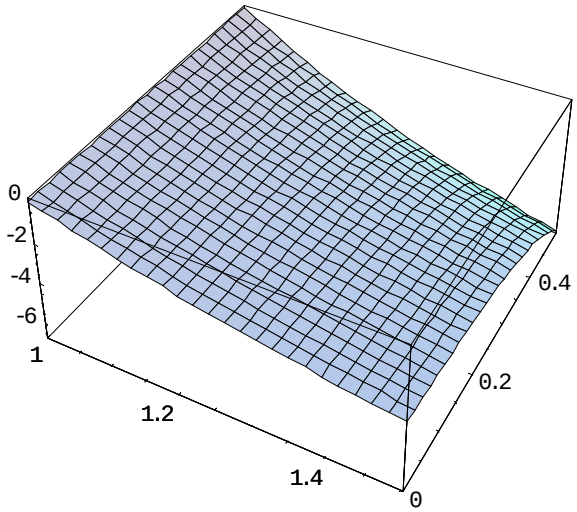
$$\pi_2^c = (a - b(q_1^c + q_2^c))q_2^c - \frac{1}{2k} w_2^c q_{2,c}^2$$

The above expressions represent the optimal values that each firm employs in order to maximize profits. From a quick look we can see that $w_2^c > w_1^c$ for $k > 1$ and $w_0 > 0$ which means that the efficient firm's wage rate is higher than that of the inefficient one when we have a duopolistic industrial sector with completely decentralized union wage setting regime. So that concludes as

Lemma 1 *Under completely decentralized union wage setting efficient firm's wage rate is higher than that of the inefficient one e.g.* $w_2^c > w_1^c$ *for* $k > 1$ and $w_0 > 0$.

Proof For $k > 1$ and $w_0 > 0$ from (10) and (11) we have that $w_2^c > w_1^c$ when $2b(-1+k)((-1+2f)(2b+w_0)(2bk+w_0)+n) > 0 \Leftrightarrow$ Normalizing by $b = 1$ and $w_0 = 10$ we get $2(-1+k)(24(-1+2f)(5+k)+n) > 0$ this holds for $k > 1$ and $f \in (0, 0.6)$.

Other concluding remarks that we may have here could be also the fact that $q_1^c < q_2^c$ as firm 2 posses better technology than firm 2. In addition the unit cost for firm 2 is lower than the unit cost for firm1 and consequently the profit of firm1 is lower than the profits of firm 2. This means that $w_1 > w_2 / k$ again for $k > 1$ and $w_0 > 0$



(Figure 1)

The above figure (Figure 1) shows exactly that suggestion that due to better marginal efficiency for firm 2 we have lower unit cost for that firm. The suggestion is reversed for the firm1 as it posses lower marginal efficiency which results into higher unit cost.

Both these conclude that $\pi_2^c > \pi_1^c$ which is a justified result given the difference in the technology used by both firms.

4.2 Post – Merger Game (Case 1)

Firm 1 and Firm 2 merge and keep both plants operational and consequently produce q_1 and q_2 respectively (given exp. (1)) in order to maximize

$$\pi_M = (a - b(q_1 + q_2))(q_1 + q_2) - \frac{1}{2} w_1 q_1^2 - \frac{1}{2k} w_2 q_2^2 \quad (14)$$

From first order conditions we get for q_1 and q_2 respectively

$$q_1 = \frac{a w_1}{2b w_1 + 2b w_2 + w_1 w_2} \quad (15)$$

$$q_2 = \frac{a k w_1}{2bk w_1 + 2b w_2 + w_1 w_2} \quad (16)$$

In the other hand we have the unions which set the wages according to maximize

$$U_1 = (w_1 - w_0)^f \left(\frac{q_1^2}{2}\right)^{1-f} \quad (17)$$

$$U_2 = (w_2 - w_0)^f \left(\frac{q_2^2}{2k}\right)^{1-f} \quad (18)$$

Taking the logarithm of (17) and (18) and solving the system of *f.o.c* we get

$$w_1^M = -\frac{((2bk + w_0)(b(-2 + 4f) + w_0 - f w_0) + s}{(-2 + 3f)(2bk + w_0)} \quad (19)$$

$$w_2^M = -\frac{((2b + w_0)(2b(-1 + 2f)k + w_0 - f w_0) + s}{(-2 + 3f)(2b + w_0)} \quad (20)$$

Where,

$$s = \sqrt{(2b + w_0)(2bk + w_0)(4b^2(1 - 2f)^2 k + 2b(-1 + f)^2(1 + k) w_0 + (-1 + f)^2 w_0^2}$$

By replacing expressions (19) and (20) into (15) and (16) we get

$$q_1^M = \frac{(a(-2 + 3f)((2b + w_0)(2b(-1 + 2f)k + w_0 - f w_0) + s))}{(2(-1 + f)(2b + w_0)(4b^2(-1 + 2f)k - 2b(-1 + f)(1 + k) w_0 - (-1 + f) w_0^2 + s))} \quad (21)$$

$$q_2^M = \frac{(a(-2 + 3f)k((2bk + w_0)(b(-2 + 4f) + w_0 - f w_0) + s))}{(2(-1 + f)(2bk + w_0)(4b^2(-1 + 2f)k - 2b(-1 + f)(1 + k) w_0 - (-1 + f) w_0^2 + s))} \quad (22)$$

Finally replacing expressions (21) and (22) into (14) we get

$$\pi_M = (a - b(q_1^M + q_2^M))(q_1^M + q_2^M) - \frac{1}{2} w_1^M q_{1,M}^2 - \frac{1}{2k} w_2^M q_{2,M}^2$$

In order now to distribute the profits among the 2 firms we will assume the existence of an exogenous profit share rule with which we get

$\pi_1^M = (B\%)\pi^M$ and $\pi_2^M = ((1-B)\%)\pi^M$

This means that firm 1 gets *B%* of the merger total profits and firm 2 gets *(1-B) %* of the total profits. Investigating again the new wages rates set by the unions we see that $w_2^M > w_1^M$ and also that $w_2^M < w_2^C$ and $w_1^M < w_1^C$. This could be attributed to the existence of fierce intra - union rivalry which compresses the wage rates down. This assumption is justified as there is a possibility for the merged firm to switch production between the two operating plants and thus make the unions to compete with each other in order to preserve their utility on a certain threshold level. So that concludes as follows

Lemma 2 *Under merging type – 1, and completely decentralized wage setting, the wages rates are lower than in pre – merger status quo, e.g.* $w_1^M < w_1^C$, $w_2^M < w_2^C$. *Also the efficient firm's wage rate is higher than that of the inefficient one e.g.* $w_2^M > w_1^M$ *for* $k > 1$ and $w_0 > 0$.

Proof For $k > 1$ and $w_0 > 0$ from (19) and (20) we have that $w_1^M < w_1^C$ when

$-((2bk + w_0)(b(-2 + 4f) + w_0 - fw_0) + n) + ((2bk + w_0)(b(-2 + 4f) + w_0 - fw_0) + s) < 0$

$\Leftrightarrow$ $s - n < 0$ which is true for:

$$s = \sqrt{(2b + w_0)(2bk + w_0)(4b^2(1-2f)^2 k + 2b(-1+f)^2(1+k)w_0 + (-1+f)^2 w_0^2}$$

And

$$n = \sqrt{(2b + w_0)(2bk + w_0)(b^2(4 + f(-10 + 7f))k + 2b(-1+f)^2(1+k)w_0 + (-1+f)^2 w_0^2}$$

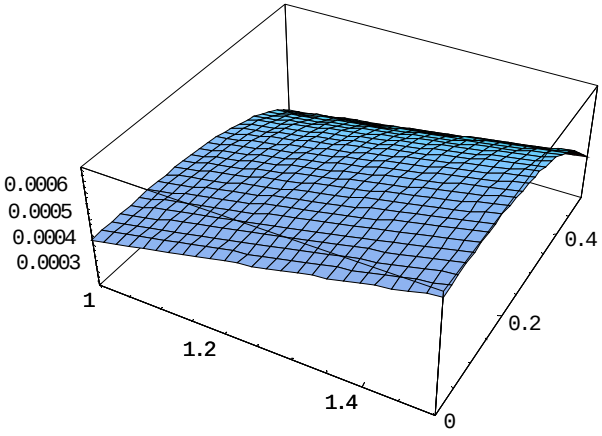
Through *mathematica* simplifying the above expression by $b = 1$ and $w_0 = 10$ we get

$12.09\sqrt{4.4(1-2f)^2 + 142.(-1+f)^2} - 12.09\sqrt{142.(-1+f)^2 + 1.1(4 + f(-10 + 7f))} < 0$

this holds for $k > 1$ and $f \in (0, 0.6)$. The proof for $w_2^M < w_2^C$ is also the same.

Again other concluding remarks that we may have here could be also the fact that $q_1^M < q_2^M$ as firm 2 posses better technology than firm 1. Another important feature here is also the fact that the total merger profits are larger than the pre-merger profits as now the wage rates are lower that in pre – merger status quo and the employment

in both plants is also reduced compared to the pre – merger state. What has happened here is that in pre – merger state we had a duopoly but still a competitive sector. While now after the merger we have the formulation of a monopoly with reduced output, wage rates and employment. This is expressed in the following figure



(Figure 2)

Figure 2 shows the relationship between the profits both before and after the merger with both plants operational. We see that for $f \in (0, 0.6)$ and $k > 1$ the profits of merger are larger than those achieved in the duopoly, pre – merger, i.e. $\pi_M > \pi_1^c + \pi_2^c$ which can be translated as the monopoly profits are always larger than the profits of an oligopoly sector. We see that the difference is not much of significance but it is enough to urge the firms to follow a merger. Last but not least is the fact that after the merger we have a decrease in the demand for labor i.e. $l_i^M < l_i^c$ mostly due transformation of the duopoly into a monopoly sector[14].

4.3 Post – Merger Game (Case 2)

Firm 1 and Firm 2 merge and shut – down the inefficient plant 1 and consequently produce q_2 (given exp. (1)) in order to maximize

$$\pi_m = (a - bq_2)q_2 - \frac{1}{2k} w_2 q_2^2 \qquad (21)$$

From first order conditions we get for q_2 as follows

$$q_2 = \frac{ak}{2bk + w_2} \qquad (22)$$

[14] Another reason according to *Lommerud*, *Straume* and *Søgard* (2003) is the firm coordination of production that occurs after the merger in order to internalize any possible negative effects that the merger might have

In the other hand we have the union of the efficient plant which sets the wage according to maximize

$$U_2 = (w_2 - w_0)^f \left(\frac{q_2^2}{2k}\right)^{1-f} \quad (23)$$

Taking the logarithm of (23) solving the *f.o.c* we get

$$w_2^m = -\frac{2(bfk + w_0 - fw_0)}{-2+3f} \quad (24)$$

By replacing expression (24) into (22) we get

$$q_2^m = \frac{a(-2+3f)k}{2(-1+f)(2bk+w_0)} \quad (25)$$

Finally replacing expression (25) into (21) we get

$$\pi_m = (a - bq_2^m)q_2^m - \frac{1}{2k} w_2^m q_{2,m}^2$$

In order now to distribute the profits among the 2 firms we will again assume the existence of an exogenous profit share rule (similar to case 1) with which we get

$\pi_1^m = (C\%)\pi_m$ and $\pi_2^m = ((1-C)\%)\pi_m$

This means that firm 1 gets *C%* of the merger total profits and firm 2 gets *(1-C) %* of the total profits. Turning the attention to the wage rate we can see from expressions (24) and (11) that when we have merging type – 2 we get $w_2^m > w_2^c$. This is due to the fact that with the remaining of one plant in operation the existing union monopolizes the upstream market (the centralization of the upstream market is higher) which gives the union the power to set a wage rate even higher than in the pre – merger status quo. So that concludes as follows

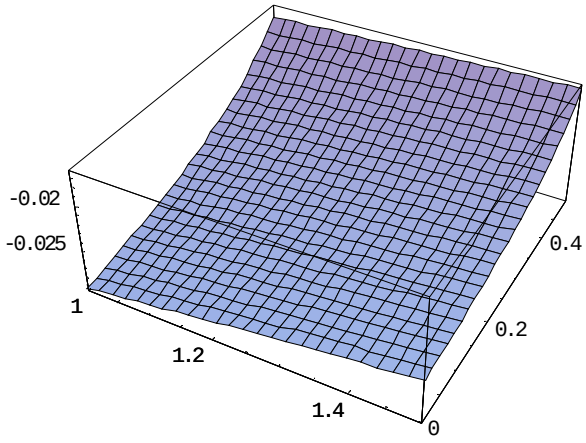
Lemma 3 *Under merging type – 2 the wage rate is higher than in pre – merger status quo, e.g.* $w_2^m > w_2^c$ *for* $k > 1$ *and* $w_0 > 0$.

Proof For $k > 1$ and $w_0 > 0$ from (24) and (11) we have that $w_2^m > w_2^c$ and by simplifying by $b = 1$ and $w_0 = 10$ we get for $w_2^m - w_2^c > 0$;

$$\frac{-12(5+k)+12f(5+k)+\sqrt{6}\sqrt{(5+k)(120(-1+f)^2+(24+f(-50+27f))k)}}{6(-2+3f)} > 0$$

This is true for all $f \in (0,0.6)$ and $1 < k < 5/3$. Another proof here may well be a plot of the above expression for certain values of *f* and *k* which will give positive results.

For this type of merger now we have that $q_1^m > q_2^c$. This can be explained mostly because the shutting down of the inefficient plant compels the merged firm to increase output produced and as a result, a respectively increase in employment. From the part of the unions this increase of employment, combined to the organization of the upstream market (as a monopoly)[15] results, finally, to a relative loss in the total merger profits. Another important feature here is also the fact that the total merger profits are lower than the pre – merger profits. This result is quite interesting as in the conventional literature[16] (as we have already mentioned above) a monopoly with an efficient plant has by default higher payoffs for the firm compared to the oligopoly case. This is expressed in following figure



(Figure 3)

Figure 3 shows the relationship between the profits both before and after the merger with only the efficient plant operational. We see that for $f \in (0, 0.6)$ and $k > 1$ the profits of merger are lower than those achieved in the duopoly, pre – merger, i.e. $\pi_m < \pi_1^c + \pi_2^c$ which can be translated as: the monopoly profits with only one plant operational are lower than the profits of an oligopoly sector. We see that the difference is not much of significance but it is enough to urge the firms not follow a merger combined with the shutting down of the inefficient plant. Last but not least is the fact that after the merger we have an increase in the demand for labor i.e. $l_i^m > l_i^c$ mostly due transformation of the duopoly upstream market into a monopoly market in which the closing the one plant dictates the increase of employment used.

[15] This result is also mentioned in the paper of *Horn* and *Wolinsky* (1988) who find that a monopoly supplier is more profitable when the downstream products are homogeneous.
[16] To give an example of that, *Lommerud*, *Straume* and *Søgard* (2003) mention in their paper that when we have homogeneous products the merged firm will produce only at the low – cost plant.

4.4 Post – Acquisition Game (Case1)

Turning our attention to another type of firm integration, we investigate the type of acquisition. Again, similar to the merger case, we distinguish between two possible cases of acquisition: with *both plants operational* and *only one plant operational*. Here we will see the first one.

Firm 2 acquires Firm 1 by paying it a bidding price equal to the maximum gross profits that firm 1 was achieving at pre – acquisition state. The new firm keeps both plants operational and consequently produces q_1 and q_2 respectively (given exp. (1)) in order to maximize

$$\pi_{AC} = (a - b(q_1 + q_2))(q_1 + q_2) - \frac{1}{2} w_1 q_1^2 - \frac{1}{2k} w_2 q_2^2 - (a - b(q_1^c + q_2^c))q_1^c \qquad (25)$$

From first order conditions we get for q_1 and q_2 respectively

$$q_1 = \frac{a w_2}{2bkw_1 + 2bw_2 + w_1 w_2} \qquad (26)$$

$$q_2 = \frac{akw_1}{2bkw_1 + 2bw_2 + w_1 w_2} \qquad (27)$$

In the other hand we have the unions which set the wages according to maximize

$$U_1 = (w_1 - w_0)^f \left(\frac{q_1^2}{2}\right)^{1-f} \qquad (28)$$

$$U_2 = (w_2 - w_0)^f \left(\frac{q_2^2}{2k}\right)^{1-f} \qquad (29)$$

Taking the logarithm of (28) and (29) and solving the system of *f.o.c* we get

$$w_1^{AC} = -\frac{(2bk + w_0)((2b(-1+2f) + w_0 - f w_0) + s)}{(-2+3f)(2bk + w_0)} \qquad (30)$$

$$w_2^{AC} = -\frac{(2b + w_0)((2b(-1+2f)k + w_0 - f w_0) + s)}{(-2+3f)(2b + w_0)} \qquad (31)$$

Where,

$$s = \sqrt{(2b + w_0)(2bk + w_0)(4b^2(1-2f)^2 k + 2b(-1+f)^2(1+k)w_0 + (-1+f)^2 w_0^2}$$

By replacing expressions (30) and (31) into (26) and (27) we get

$$q_1^{AC} = \frac{(a(-2+3f)((2b + w_0)(2b(-1+2f)k + w_0 - f w_0) + s))}{(2(-1+f)(2b + w_0)(4b^2(-1+2f)k - 2b(-1+f)(1+k)w_0 - (-1+f)w_0^2 + s))} \qquad (32)$$

$$q_2^{AC} = \frac{(a(-2+3f)k((2bk + w_0)(b(-2+4f) + w_0 - f w_0) + s))}{(2(-1+f)(2bk + w_0)(4b^2(-1+2f)k - 2b(-1+f)(1+k)w_0 - (-1+f)w_0^2 + s))} \qquad (33)$$

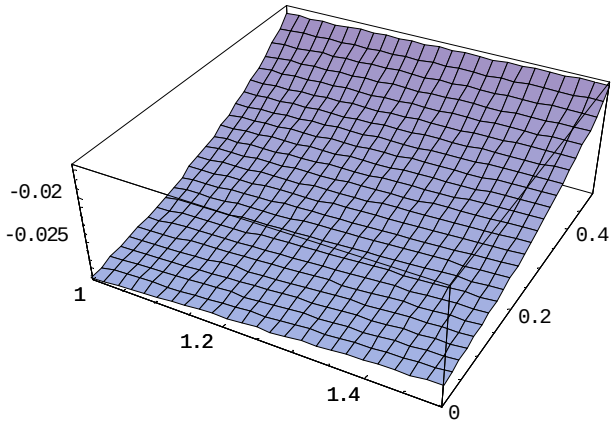
Finally replacing expressions (32) and (33) into (25) we get

$$\pi_{AC} = (a - b(q_1^{AC} + q_2^{AC}))(q_1^{AC} + q_2^{AC}) - \frac{1}{2} w_1^{AC} q_{1,AC}^2 - \frac{1}{2k} w_2^{AC} q_{2,AC}^2 - (a - b(q_1^c + q_2^c))q_1^c$$

Of course here because the integration between the firms is acquisition as we said earlier the above profits π_{AC} will go to the bidding firm (firm 2 in our case) and the acquired firm will receive as a buying price the maximum gross profits that achieved in duopoly i.e. $\pi_g^c = (a - b(q_1^c + q_2^c))q_1^c$. This means that firm 1 is always in favour of the prospect of accepting an acquisition by firm 2 while firm 2, in order to proceed to the take – over, must make bigger profits than those in the duopoly case. As far as the wage rates concerned, what we have here, are results similar to the merging type 1 as the acquisition is nothing more but the merger profits reduced by the amount of optimal gross profits of firm1 (achieved in duopoly). This means that $w_2^{AC} > w_1^{AC}$ and also that $w_2^{AC} < w_2^c$ and $w_1^{AC} < w_1^c$. So that concludes as follows

Lemma 4 *Under acquisition type – 1, and completely decentralized wage setting, the wage rates are lower than in pre – merger status quo, e.g.* $w_2^{AC} < w_2^c$, $w_1^{AC} < w_1^c$ *for* $k > 0$ *and* $w_0 > 0$. **[Proof** See proof page 13 – ***Lemma 2*****]**

Other concluding remarks that we have here are also that $q_1^{AC} < q_2^{AC}$ as firm 2 posses better technology than firm 1.Turning the attention to the profits side we see that the total acquisition profits are lower than the corresponding total profits of the bidding firm in duopoly. This is expressed in following figure



(Figure 4)

Figure 4 shows the relation between the profits achieved in duopoly and the profits achieved from an acquisition. We can clearly see that their difference is a negative one (for all $f \in (0,0.6)$ and $k \in (1,1.6)$) which means that the profits in the new state are lower that those of the previous state. This is due to the fact that the acquisition profits are $\pi_{AC} = \pi_2^M - \pi_{2,c}^g$ i.e. the merger profits reduced by the amount of optimal gross profits of firm1 (achieved in duopoly). Again similar to the merger type - 1 we have reduced output and consequently reduced employment $l_{1,2}^{AC} < l_{1,2}^c$ mostly due transformation of the duopoly into a monopoly sector.

4.5 Post – Acquisition Game (Case 2)

Firm 2 acquires Firm 1 and the new firm shuts – down the inefficient plant after the acquisition and consequently produces q_2 (given exp. (1)) in order to maximize

$$\pi_{ac} = (a - bq_2)q_2 - \frac{1}{2k} w_2 q_2^2 - (a - b(q_1^c + q_2^c))q_2^c \qquad (34)$$

From first order conditions we get for q_2 as follows

$$q_2 = \frac{ak}{2bk + w_2} \qquad (35)$$

In the other hand we have the union of the efficient plant which set the wage according to maximize

$$U_2 = (w_2 - w_0)^f \left(\frac{q_2^2}{2k}\right)^{1-f} \qquad (36)$$

Taking the logarithm of (36) solving the *f.o.c* we get

$$w_2^{ac} = -\frac{2(bfk + w_0 - fw_0)}{-2 + 3f} \qquad (37)$$

By replacing expression (37) into (36) we get

$$q_2^{ac} = \frac{a(-2 + 3f)k}{2(-1 + f)(2bk + w_0)} \qquad (38)$$

Finally replacing expression (25) into (21) we get

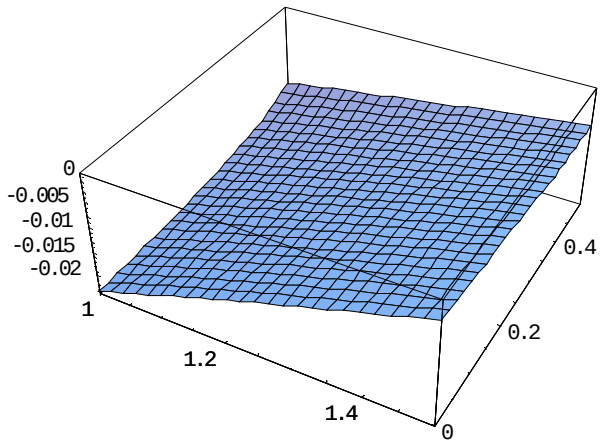
$$\pi_{ac} = (a - bq_2^{ac})q_2^{ac} - \frac{1}{2k} w_2^{ac} q_{2,ac}^2 - (a - b(q_1^c + q_2^c))q_2^c$$

That concludes the maximizing process of acquisition type – 2. Investigating further the wage rates we can easily see, again, that the results are resemble to those of merging type – 2, only here we do not have a distribution of profits among the firms.

Turning the attention to the wage rate we can see from expressions (37) and (11) that when we have acquisition type – 2 we get $w_2^{ac} > w_2^c$. Again this is due to the fact that with the remaining of one plant in operation the existing union monopolizes the upstream market (the centralization of the upstream market is higher). So that concludes as follows

Lemma 5 *Under acquisition type – 2, the wage rate is higher than in pre – merger status quo, e.g.* $w_2^{ac} > w_2^c$ *for* $k > 0$ *and* $w_0 > 0$. **[Proof** See page 15 – ***Lemma 3***]

Similar to merging type – 2 again here we get that $q_2^{ac} > q_2^c$. This can be explained mostly because the shutting down of the inefficient plant compels the merged firm to increase output produced and as a result a respectively increase in employment $l_2^{ac} > l_2^c$ as now the new firm faces higher wage rate. All these in combination lead to a relative decrease in profits which now are even lower, compared to the merging type – 2, as they are less by the amount of the total gross profits of the acquired firm (achieved in duopoly). This is expressed in the following figure



(Figure 5)

Figure 5 shows the optimal values of acquisition profits type – 2 for all $f \in (0,0.6)$ and $k \in (1,1.6)$. We can see that for all that values the profits are totally negative which makes the acquisition type – 2 a strongly unadvisable strategy for firm integration. This result is quite justified as the profits are now reduced by the amount of gross profit that firm1 achieved in duopoly. Basically we have $\pi_{ac} = \pi_2^m - \pi_{2,c}^g$ and we have already seen that profits of merger type – 2 are lower than profits in duopoly.

5. Incentives for Merger/Acquisition

Having examined the model extensively and having found the types of interaction between upstream and downstream market we move forward to the determination of the proper incentives for merger (or acquisition). In this section we investigate the profitability of each type of integration and study how viable is each type.

5.1 Incentives for merger

As we already know from the related literature the profitability of a merger is always a certain fact. But what really happens when we have asymmetry and two alternative type of merging is not quite obvious. In order to make things more clearly we will assume the existence of an exogenous rule for profits shares[17] so as to determine the proper incentives of each type of merging. This rule is as follows

Merger Type 1

$\pi_1^c < (B\%)\pi_M \; And \; \pi_2^c < ((1-B)\%)\pi_M$

Merger Type 2

$\pi_1^c < (C\%)\pi_m \; And \; \pi_2^c < ((1-C)\%)\pi_m$

Given the rule and using ***Lemma 2, 3*** along with the following equations we get

$$\pi_1^c = (a - b(q_1^c + q_2^c))q_1^c - \frac{1}{2} w_1^c q_{1,c}^2$$

$$\pi_2^c = (a - b(q_1^c + q_2^c))q_2^c - \frac{1}{2k} w_2^c q_{2,c}^2$$

$$\pi_M = (a - b(q_1^M + q_2^M))(q_1^M + q_2^M) - \frac{1}{2} w_1^M q_{1,M}^2 - \frac{1}{2k} w_2^M q_{2,M}^2$$

$$\pi_m = (a - bq_2^m)q_2^m - \frac{1}{2k} w_2^m q_{2,m}^2$$

Proposition 1 *with firm – specific unions, a merger may be profitable, for both participants, as long as both plants remain operational, e.g.* $\pi_M > \pi_1^c + \pi_2^c$.

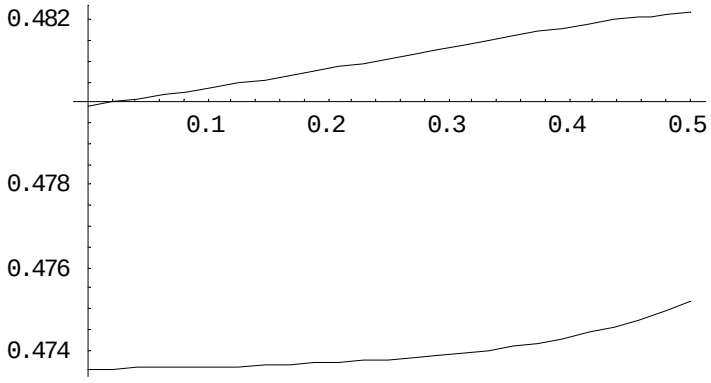
By using also the rule we get the optimal shares for the two firms in order to have both the incentive to merge. So profit shares will be distributed as follows

[17] *Cabolis*, *Manasakis* and *Petrakis* (2006) are using this rule to investigate the profitability of a merger with relation to *R&D* investments.

$$\pi_1^M = (B\%)[(a - b(q_1^M + q_2^M))(q_1^M + q_2^M) - \frac{1}{2} w_1^M q_{1,M}^2 - \frac{1}{2k} w_2^M q_{2,M}^2]$$

$$\pi_2^M = ((1-B)\%)[(a - b(q_1^M + q_2^M))(q_1^M + q_2^M) - \frac{1}{2} w_1^M q_{1,M}^2 - \frac{1}{2k} w_2^M q_{2,M}^2]$$

Through mathematical programs we have found the values of *B* as



(Figure 6)

From figure 6 we see that for $B > 0.474$ the merger is profitable for firm 1 while for $B < 0.482$ the merger is profitable for firm 2. Thus the merger type - 1 is profitable for both participants for $0.474 < B < 0.482$. In this space there exists an optimal combination of *B* for which the merger type – 1 is profitable for both firms. Again this results as well as ***Lemma 2*** are quite interesting results as they are somehow different to the related literature which dictates as optimal strategy for a profitable merger the shutting down of the inefficient plant[18]. So there are incentives for merger type – 1.

Proposition 2 *with firm – specific unions, a merger is never profitable, for both participants, if the merger is followed by the shutting down of the inefficient plant, e.g.* $\pi_1^c + \pi_2^c > \pi_m$

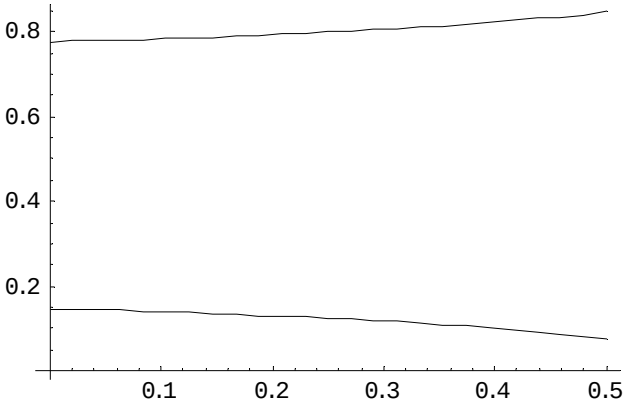
By using also the rule we get the optimal shares for the two firms in order to have both the incentive to merge. So profit shares will be distributed as follows

$$\pi_1^m = (B\%)[(a - bq_2^m)q_2^m - \frac{1}{2k} w_2^m q_{2,m}^2]$$

$$\pi_2^m = ((1-B)\%)[(a - bq_2^m)q_2^m - \frac{1}{2k} w_2^m q_{2,m}^2]$$

Through mathematical programs we have found the values of *B* as

[18] In cases of that we have technological asymmetries and homogeneous products.



(Figure 7)

From figure 7 we see that for $C > 0.85$ the merger is profitable for firm1 while for $C < 0.25$ the merger is profitable for firm 2. Obviously we cannot have a combination of values of C for which the firms would agree to merge. After all, remember ***Lemma 3*** and figure 3 through which we have that $\pi_m < \pi_1^c + \pi_2^c$ which means that either way merger type – 2 is never profitable. So there are not incentives for merger type – 2.

5.2 Incentives for acquisition

In contrast to the cases of merger for acquisition there is no need for distribution of profits. As we have already said in an acquisition the bidding firm pays to the acquired firm the amount of gross profits that the firm was achieving in duopoly. So, then, the profits for the bidder firm would be the profits of acquisition and the profits for the target firm would be the price paid by the bidding firm. So given this acquisition contract and ***Lemma 4, 5*** and from the equations below we get

$$\pi_1^c = (a - b(q_1^c + q_2^c))q_1^c - \frac{1}{2}w_1^c q_{1,c}^2$$

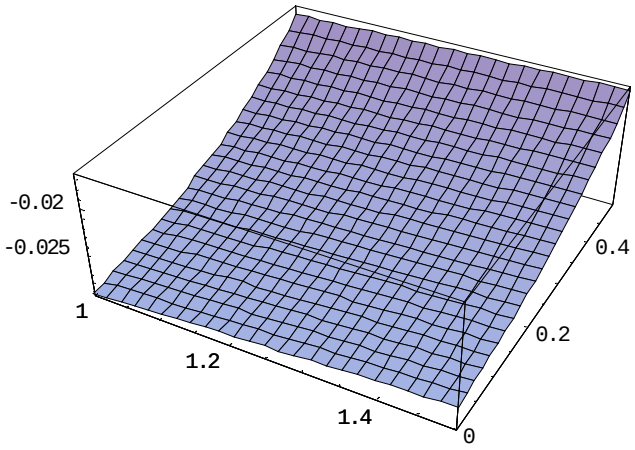
$$\pi_2^c = (a - b(q_1^c + q_2^c))q_2^c - \frac{1}{2k}w_2^c q_{2,c}^2$$

$$\pi_{AC} = (a - b(q_1^{AC} + q_2^{AC}))(q_1^{AC} + q_2^{AC}) - \frac{1}{2}w_1^{AC} q_{1,AC}^2 - \frac{1}{2k}w_2^{AC} q_{2,AC}^2 - (a - b(q_1^c + q_2^c))q_1^c$$

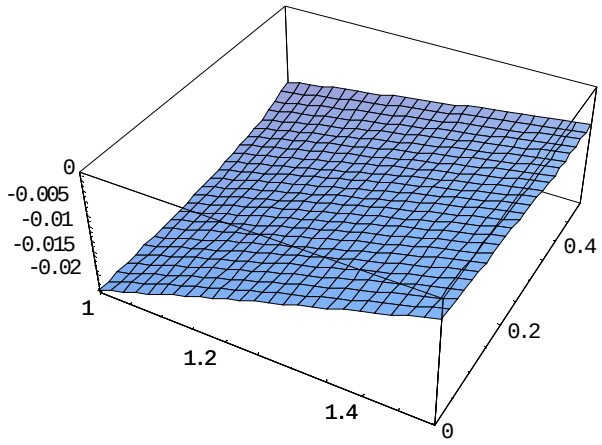
$$\pi_{ac} = (a - bq_2^{ac})q_2^{ac} - \frac{1}{2k}w_2^{ac} q_{2,ac}^2 - (a - b(q_1^c + q_2^c))q_2^c$$

Proposition 3 *with firm – specific, unions, an acquisition is always non – profitable, for both cases; both plants operational, efficient plant operational e.g.* $\pi_{AC} < \pi_2^c$ *and* $\pi_{ac} < \pi_2^c$.

Again let's remember figures 4 and 5 from sections 4.4 and 4.5. We get that



From this figure we get that $\pi_{AC} < \pi_2^c$ which means that for all $f \in (0,0.5)$ and $k \in (1,1.6)$ firm2 has no incentive for acquisition type - 1. Similar for acquisition type – 2 we get that



From this figure we get that $\pi_{ac} < \pi_2^c$ which means, again, that for all $f \in (0,0.5)$ and $k \in (1,1.6)$ firm2 has no incentive for acquisition type – 2.

6. Game solution

So as concluding remarks here we may say that when the two firms have to choose between two methods of integration (merger vs. acquisition) they always choose the method of merger as the more profitable type of integration. The incentives for merger are stronger than those of non – merger or acquisition and thus a merger will eventually be the most prevailing type of integration. This means that we will have as an optimal solution the merging of the two firms and the forming of a monopoly market. More specifically the merger will be type – 1; with both plants

operational. We see that this strategy from the part of the consolidated firm is optimal as it gives the advantage that *with both plants operational and with the option of shifting production between the plants an intra – union rivalry emerges compressing the wage rates down and making the incentives for merger even stronger*.

As we have proven through ***Lemma 2*** this intra – union rivalry can sometimes be either fierce or weak. Either way, even with a slightly decrease in wage rates; it will make the merger profitable. So returning back to the game we find that the *Nash* equilibrium will be: *merger with both plants operational*. So

$$A^* = [\{F_1, F_2 \rightarrow F_m\}, \{U_1, U_2 \rightarrow w_1, w_2\}]$$

In the equilibrium of the game we will get

$$w_1^M < w_1^c;\ w_2^M < w_2^c;\ w_1^M < w_2^M$$

$$q_2^M > q_1^M;\ \pi_M > \pi_1^c + \pi_2^c$$

All these say that with merging type – 1 an intra union rivalry occurs which further lowers the wage rates and thus, makes the merger incentives stronger. The distribution of profits among the two firms will be as

$$0.474 < B < 0.482,\ f \in (0,0.5) \text{ and } k \in (1,1.6)$$

This means that firm 1 gets over the 47.4% of the total merger profits and firm 2 gets over 51% of the total merger profits.

7. Empirical consistency

Although the results are quite interesting they must have at least some empirical approval. If these results are proven to consistent with the so far empirical literature then we can accept and back our model and its results. In this section we will review the most representative papers on mergers and acquisitions which deal these matters with more econometric and empirical analysis. As we have already said M&A constitute a great research topic in Financial Economics and Industrial Economics (empirical and theoretical literature). But most of this work is focused more on matters such as: merger motives, merger profitability and antitrust law enforcement. The interaction between M&A and wages – employment has not emerged significant research yet.

The empirical literature begins with the paper of *Hendricks* (1976) who investigates the effects of M&A - but only on wages. The sample consists of 701 firms which had joined conglomerate M&A during 1970-1971 in the U.S.A. where

she takes the employee wages as a function of industry concentration, degree of product differentiation, union density and pre merger level of employment for all the firms joined a M&A. The results are: positive relation with the first three and negative with the forth.

Another important paper is that of *Brown* and *Medoff* (1988) who estimate the effects of M&A on employment (monthly data) and wages (quarterly data) in a sample of 30.252 plants in the State of Michigan in the U.S.A. from 1978 to 1984. The results are: 9% increase in employment and 9% decrease in wages for plant which had ownership change, 5% reduction on employment and 5% increase in wages for plants which had sold part of their assets and finally 2% increase in employment and 4% reduction on wages for plants which had joined M&A. of course this paper makes no use of different types of integration supports that these results are contradict to the related literature.

By using the different types of integration *Peoples Jr.* (1989) investigates the effects of alternative M&A types (horizontal, vertical, conglomerate), industry characteristics (concentration, productivity, unemployment, unions density), as well as employees characteristics (level of education, age, marital status, specialization in the production process) in a sample of 11.911 employees in the year 1980 in the U.S.A. The findings are quite interesting as the effects of M&A, horizontal and vertical cause 6% increase in wages and conglomerate 8% decrease.

In the same line of reasoning lies, also, the paper of *McGuckin, Nguyen* and *Reznek* (1995) who use data taken from manufacturing industry for period 1977 – 87. They find that for plant level data M&A increase wages and employment while the results are reversed for firm level data. For plant closing results suggest that plants with new owners are more likely to survive.

Interesting is also the paper of *Lichtenberg* and *Siegel* (1992) who by using data from 19.000 units of production in the USA for period 1974 – 1982 investigate the effects of M&A on employment and wages. An interesting feature is the distinction between employees; *black collar* and *blue collar*. The former has 16%decrease in employment and 6% in wages while the latter has 4% decrease in employment and 2% in wages.

What we have seen so far, is most papers suggesting that M&A contribute positively to wage and employment enhancement. But it is also interesting the fact that all these papers where based on a particular economy of world, the US economy.

Thus these results may be fundamental for the US firms but this is not necessary the same for the European economies. Many studies from the related literature have shown that US economies respond better to shocks than the European economies (in fact it has proved that UK is the slowest). In addition we must not neglect the fact that always USA has lower unemployment rates that those of Europe. The following papers incorporate those features in their analysis.

Conyon et al (2000) make use of data for take – over in the UK for 1983 - 1996 concerning 721 mergers. They find that M&A have negative effects on employment and wages at about 7.5% of the pre – merger level.

Gugler and *Yurtoglou* (2003) they use a sample 200.480 mergers during the period 1981 – 1998 for the US and EURO economies. They find that M&A affect labour market (due to increasing adjustment costs) and it is more possible to lead to a reduction in the labour demand mostly because EURO companies are unable to restructure these effects. They find also that labour is decreased following a merger by 2.9% in general. Specifically in UK it is 12.4% while in Continental Europe is 7.9%.

Again *Conyon* et al (2002) in a sample of 460 M&A in the U.K. from 1989 to 1994, make a distinction between these cases, where the acquirer was a domestic company from those in which the acquirer was a foreign company. For the first set of cases, it is estimated a 14% productivity enhancement and 3.5% wage increase. For the second set of cases, productivity is unaffected and wages decrease 2%.

Finally we have *Girma* and *Gorg* (2003) who are using data from 340 mergers (239 for the electronics sector and 121 for the nutrition sector) in UK for the period 1980 – 1993. They find that the rate of change in employment is decreasing for the electronics sector while there is no significant change in the nutrition sector.

And with these, we conclude the review of the empirical literature. As we can see, the so far research is quite controversial. This, on the other hand, is justified as the economies around the world do not resemble in structure and in capabilities. Thus it is quite natural to get different results. However, it is important to notice that both directions are based on simplified assumptions and that both have theoretical foundations, so they are not totally the appropriate ones for the estimation of the effects of mergers and acquisitions an employment and wages. Both directions ignore the role of the product's industry structure, the labour's market structure and the interaction between them, as well. Moreover the impact of M&A on wages –

employment, in last resort, depends on many factor, one of them is the type of integration (horizontal, vertical etc.) which is many times considered as input information. For that both results may be occur in different countries around the world. And of course a crucial addition to all these would be the interaction between the two entities (firms and unions) which at the same time constitute the market.

8. Conclusions - Extensions

This present paper tried to follow that path of reasoning, as described above, adding various assumptions such as alternative merging strategies, technological asymmetries and profit distribution rules. Doing we managed to came up with quite interesting results that somehow contradict with the related literature. More specifically we investigated two alternative merging strategies and we found that the incentives for merger exist when the two firms merge and keep both plants operational. This is due to intra – union rivalry that emerges after the integration between the two operating plants and compresses the wage rates down and making the merger profitable. Interestingly we found out that the incentives for merger do not exist when the firms merge and decide to shut – down the inefficient plant. This due to the reorganization of the upstream market into a powerful monopoly in which the wage rate increases and the post - merger payoffs are reducing. This result is the same for the acquisition case meaning that in a technologically asymmetric sector an acquisition is never profitable for one of the two participants as, always the acquisition profits are equal to merger profits reduced by the price that the bidder pays to the target. So as a final conclusion of this thesis is that M&A reduce wages and employment and enhance firm profitability while the unions make incentives for merger stronger when they compete with each other on wages and employment between the two plants.

Before closing this paper it is important to mention that a competitive model with exogenous wages was analysed also in order to compare with our model. From that we found that $\pi_1^c + \pi_2^c < \pi_M$ and that the most prevailing type of integration is merger type – 1. So typically the unions have no impact on wage structure among the plants but interestingly we found out that they have big effect on the payoffs that the firms receive after the merger. More specific we found out that in the competitive model the firms receive 45% and 55% of the total profit while in our model when the unions

decide the wage structure among the plants the payoffs are 47% and 53% of the total. As we can see the profit shares change when the unions enter in the model and the wage rates are determined endogenous. Thus the unions do affect M&A profitability.

Apart, now, from our current analysis the present model can also be worked with more assumption and other approaches. One possible extension of the model could well be the addition of another assumption, that of union cooperation. As we have already seen *Horn* and *Wolinsky* (1988) found that merger between the unions is profitable and by that way they gain a better bargaining position. It is therefore interesting to examine whether these results still hold if applied in the model and if we have cooperation instead of merger. Another extension could be also that of applying an efficient bargaining model rather than a monopoly model and then investigate the interaction between unions and firms. *Lommerud, Straume* and *Søgard* (2000) investigate that possibility with three firm, three unions and differentiated products and find that even with efficient bargaining the result is reduced wage rates. Finally another important extension could be the use of *Bertrand* competition instead of *Cournot* and see how the prices change after a merger or an acquisition.

APPENDIX

Pre – Merger

3rd Stage

Pr1=(a-b(q1+q2))q1-(w1/2)(q1^2)

Pr2=(a-b(q1+q2))q2-(w2/(2k))(q2^2)

Solve[{D[Pr1,q1]==0,D[Pr2,q2]==0},{q1,q2}]

$$\left\{\left\{q1 \to -\frac{-a\,b\,k-a\,w2}{3\,b^2\,k+2\,b\,k\,w1+2\,b\,w2+w1\,w2},\ q2 \to \frac{k\,(a\,b+a\,w1)}{3\,b^2\,k+2\,b\,k\,w1+2\,b\,w2+w1\,w2}\right\}\right\}$$

2nd Stage

U1=((w1-w0)^f)((q1^2)/2)^(1-f)

U2=((w2-w0)^f)((q2^2)/(2k))^(1-f)

Solve[{foc1==0,foc2==0},{w1,w2}]

$$w1 = -\frac{((2\,b\,k+w0)\ (b\,(-2+4\,f)+w0-f\,w0)+n)}{(-2+3\,f)\ (2\,b\,k+w0)}$$

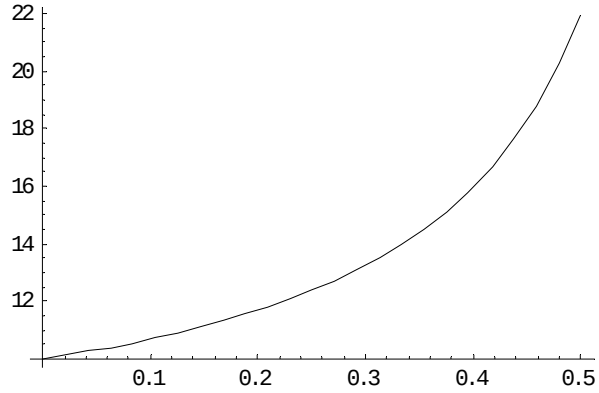
$$w2 = -\frac{((2\,b+w0)\ (2\,b\,(-1+2\,f)\,k+w0-f\,w0)+n)}{(-2+3\,f)\ (2\,b+w0)}$$

Profits

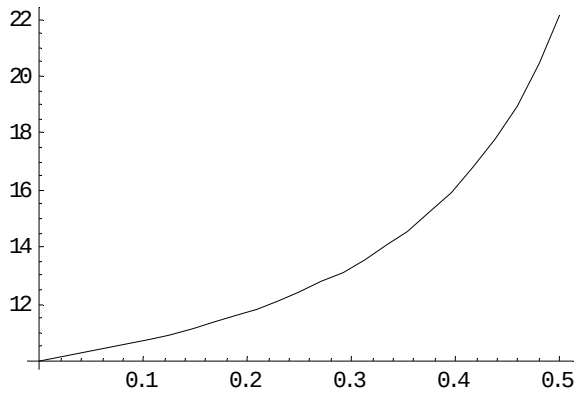
$$\begin{aligned}
Pr1 = \Big(& a^2\,(-2+3\,f)\\
&\Big(8\,b^5\,(-4+f\,(10+(-8+f)\,f))\,k^3+4\,b^4\,k^2\,(-4\,(5+2\,k)+f\,(56+18\,k+f\,(-55-13\,k+2\,f\,(9+k))))\,w0-4\,(-1+f)^2\,w0^3\\
&\Big(-(-1+f)\,w0^2+\sqrt{(2\,b+w0)\ (2\,b\,k+w0)\ (b^2\,(4+f\,(-10+7\,f))\,k+2\,b\,(-1+f)^2\,(1+k)\,w0+(-1+f)^2\,w0^2)}\Big)+\\
&2\,b^3\,k\Big((f\,(94+f\,(-95+33\,f))+f\,(104+f\,(-92+27\,f))\,k+(-2+f)^2\,(-1+f)\,k^2-8\,(4+5\,k))\,w0^2-\\
&2\,(2+f\,(-3+2\,f))\,k\sqrt{(2\,b+w0)\ (2\,b\,k+w0)\ (b^2\,(4+f\,(-10+7\,f))\,k+2\,b\,(-1+f)^2\,(1+k)\,w0+(-1+f)^2\,w0^2)}\Big)+\\
&b^2\,w0\Big((-1+f)\ (16\,(-1+f)^2+(64+f\,(-118+57\,f))\,k+(-2+f)\ (-10+9\,f)\,k^2)\,w0^2-k\,(16-26\,f+11\,f^2+\\
&(-2+f)^2\,k)\sqrt{(2\,b+w0)\ (2\,b\,k+w0)\ (b^2\,(4+f\,(-10+7\,f))\,k+2\,b\,(-1+f)^2\,(1+k)\,w0+(-1+f)^2\,w0^2)}\Big)+\\
&4\,b\,(-1+f)\,w0^2\Big((-1+f)\ (-4+4\,f-4\,k+3\,f\,k)\,w0^2+(2\,(1+k)-f\,(2+k))\\
&\sqrt{(2\,b+w0)\ (2\,b\,k+w0)\ (b^2\,(4+f\,(-10+7\,f))\,k+2\,b\,(-1+f)^2\,(1+k)\,w0+(-1+f)^2\,w0^2)}\Big)\Big)\Big)\Big/\\
&\Big(8\,(-1+f)^2\,(2\,b+w0)\ (2\,b\,k+w0)\Big(b^2\,(-2+f)\,k+2\,b\,(-1+f)\ (1+k)\,w0+(-1+f)\,w0^2-\\
&\sqrt{(2\,b+w0)\ (2\,b\,k+w0)\ (b^2\,(4+f\,(-10+7\,f))\,k+2\,b\,(-1+f)^2\,(1+k)\,w0+(-1+f)^2\,w0^2)}\Big)^2\Big)
\end{aligned}$$

$$
\begin{aligned}
Pr2 = \Big(& a^2 (-2+3f) k \\
& \Big(8b^5 (-4+f(10+(-8+f)f)) k^2 + 4b^4 k (-4(2+5k) + f(18+56k+f(-13-55k+2f(1+9k)))) w0 - 4(-1+f)^2 w0^3 \\
& \Big(-(-1+f) w0^2 + \sqrt{(2b+w0)(2bk+w0)(b^2(4+f(-10+7f))k+2b(-1+f)^2(1+k)w0+(-1+f)^2 w0^2)} \Big) + \\
& 2b^3 \Big(((-2+f)^2(-1+f) + (-40+f(104+f(-92+27f)))k + (-1+f)(32+f(-62+33f))k^2) w0^2 - \\
& 2(2+f(-3+2f))k \sqrt{(2b+w0)(2bk+w0)(b^2(4+f(-10+7f))k+2b(-1+f)^2(1+k)w0+(-1+f)^2 w0^2)} \Big) + \\
& 4b(-1+f) w0^2 \Big((-1+f)(-4+3f+4(-1+f)k) w0^2 - (-2+f+2(-1+f)k) \\
& \sqrt{(2b+w0)(2bk+w0)(b^2(4+f(-10+7f))k+2b(-1+f)^2(1+k)w0+(-1+f)^2 w0^2)} \Big) + b^2 w0 \\
& \Big((-1+f)(20+f(-28+9f)+64k+f(-118+57f)k+16(-1+f)^2 k^2) w0^2 - ((-2+f)^2+(16+f(-26+11f))k) \\
& \sqrt{(2b+w0)(2bk+w0)(b^2(4+f(-10+7f))k+2b(-1+f)^2(1+k)w0+(-1+f)^2 w0^2)} \Big) \Big) \Big) \Big/ \\
& \Big(8(-1+f)^2 (2b+w0)(2bk+w0) \Big(b^2(-2+f)k + 2b(-1+f)(1+k)w0 + (-1+f)w0^2 - \\
& \sqrt{(2b+w0)(2bk+w0)(b^2(4+f(-10+7f))k+2b(-1+f)^2(1+k)w0+(-1+f)^2 w0^2)} \Big)^2 \Big)
\end{aligned}
$$

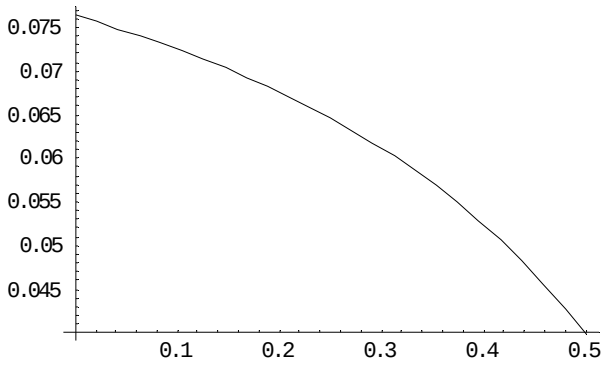
W1=Plot[{w1},{f,0,0.5}]



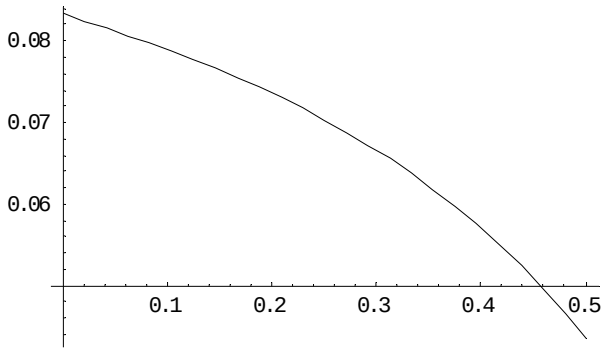
W2=Plot[w2,{f,0,0.5}]



```
Q1=Plot[{q1},{f,0,0.5}]
```




```
Q2=Plot[{q2},{f,0,0.5}]
```



Post – Merger Case 1

3rd Stage

PM=(a-b(q1+q2))(q1+q2)-(w1/2)(q1^2)-(w2/(2k))(q2^2)

Solve[{D[PM,q1]==0,D[PM,q2]==0},{q1,q2}]

$$\left\{\left\{q1 \to \frac{a\,w2}{2\,b\,k\,w1 + 2\,b\,w2 + w1\,w2},\ q2 \to \frac{a\,k\,w1}{2\,b\,k\,w1 + 2\,b\,w2 + w1\,w2}\right\}\right\}$$

2nd Stage

U1=((w1-w0)^f)((q1^2)/2)^(1-f)

Solve[{foc1==0,foc2==0},{w1,w2}]

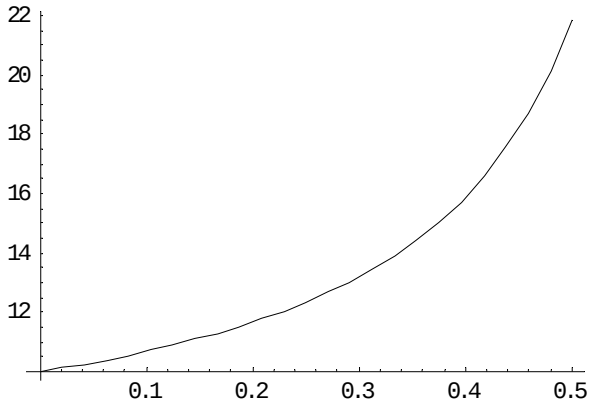
$$w1 = -\frac{((2\,b\,k + w0)\,(b\,(-2 + 4\,f) + w0 - f\,w0) + s)}{(-2 + 3\,f)\,(2\,b\,k + w0)}$$

$$w2 = -\frac{((2\,b + w0)\,(2\,b\,(-1 + 2\,f)\,k + w0 - f\,w0) + s)}{(-2 + 3\,f)\,(2\,b + w0)}$$

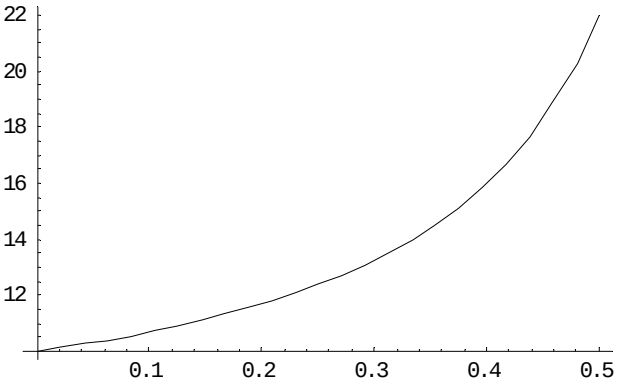
Profits

$$PM=\left(a^2\left(4b^3(-3+4f)k(1+k)+2b^2(-3+2f(2+k))(1+2k)-k(8+3k))w0+\right.\right.$$
$$(-1+f)w0^3+w0\sqrt{(2b+w0)(2bk+w0)(4b^2(1-2f)^2k+2b(-1+f)^2(1+k)w0+(-1+f)^2w0^2)}+$$
$$\left.\left.b(1+k)\left((-5+6f)w0^2+\sqrt{(2b+w0)(2bk+w0)(4b^2(1-2f)^2k+2b(-1+f)^2(1+k)w0+(-1+f)^2w0^2)}\right)\right)\right)\Big/$$
$$(4b(-1+f)(2b+w0)(2bk+w0)(2b(1+k)+w0))$$

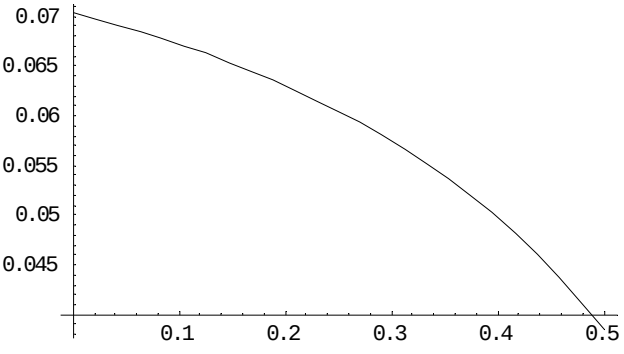
```
W1=Plot[{w1},{f,0,0.5}]
```



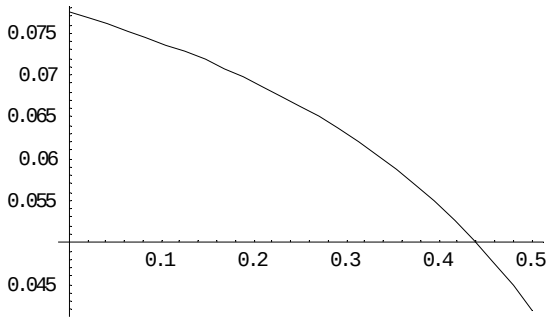

```
W2=Plot[{w2},{f,0,0.5}]
```




```
Q1=Plot[{q1},{f,0,0.5}]
```



Q2=Plot[{q2},{f,0,0.5}]



Post – Merger Case 2

3rd Stage

Pm=(a-(b)q2)q2-(w2/(2k))(q2^2)

Solve[D[Pm,q2]==0,q2]

$$\left\{\left\{q2 \to \frac{a\ k}{2\ b\ k + w2}\right\}\right\}$$

2nd Stage

U=((w2-w0)^f)((q2^2)/(2k))^(1-f)

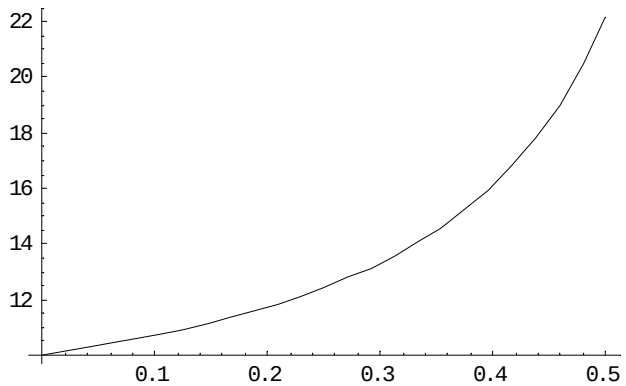
Solve[foc==0,w2]

$$w2 = -\frac{2\ (b\ f\ k + w0 - f\ w0)}{-2 + 3\ f}$$

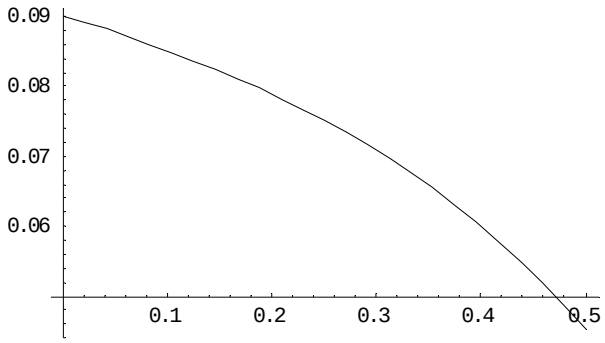
Profits

$$Pm = \frac{a^2\ (-2 + 3\ f)\ k}{4\ (-1 + f)\ (2\ b\ k + w0)}$$

W2=Plot[{w2},{f,0,0.5}]



```
Q2=Plot[{q2},{f,0,0.5}]
```



Competitive Model

Pre - Merger

$$q1 = -\frac{-a\,b\,k - a\,w0}{3\,b^2\,k + 2\,b\,w0 + 2\,b\,k\,w0 + w0^2}$$

$$q2 = \frac{k\,(a\,b + a\,w0)}{3\,b^2\,k + 2\,b\,w0 + 2\,b\,k\,w0 + w0^2}$$

$$Pr1 = \frac{a^2\,(2\,b + w0)\,(b\,k + w0)^2}{2\,(3\,b^2\,k + 2\,b\,(1 + k)\,w0 + w0^2)^2}$$

$$Pr2 = \frac{a^2\,k\,(b + w0)^2\,(2\,b\,k + w0)}{2\,(3\,b^2\,k + 2\,b\,(1 + k)\,w0 + w0^2)^2}$$

Post – Merger Case 1

$$q1 = \frac{a}{2\,b + 2\,b\,k + w0}$$

$$q2 = \frac{a\,k}{2\,b + 2\,b\,k + w0}$$

$$PM = \frac{a^2\,(1 + k)}{4\,b\,(1 + k) + 2\,w0}$$

Post – Merger Case 2

$$q2 = \frac{a\,k}{2\,b\,k + w0}$$

$$PM = \frac{a^2\,k}{4\,b\,k + 2\,w0}$$

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