CESifo Working Papers
www.cesifo.org/wp

Horizontal Merger under Strategic Tax Policy

Chih-Chen Liu
Arijit Mukherjee
Leonard F.S.Wang

CESIFO WORKING PAPER NO. 4996
CATEGORY 11: INDUSTRIAL ORGANISATION
SEPTEMBER 2014

CESifo *Working Paper No. 4996*

Horizontal Merger under Strategic Tax Policy

Abstract

We show that the presence of a strategic tax policy increases the incentive for a horizontal merger compared to the situation with no tax policy. Thus, we point towards a new factor, viz., strategic tax policy, for increasing the incentive for a horizontal merger that has been ignored in the existing literature. In contrast to the usual belief, we also show that a horizontal merger may benefit the consumers and the society.

JEL-Code: L130, D430.

Keywords: merger, tax policy, social welfare.

Chih-Chen Liu
Department of Applied Economics
National University of Kaohsiung
Nan-Tzu, Kaohsiung 811 / Taiwan
ccliu@nuk.edu.tw

*Arijit Mukherjee**
Nottingham University Business School
Jubilee Campus, Wollaton Road
United Kingdom – Nottingham, NG8 1BB
arijit.mukherjee@nottingham.ac.uk

Leonard F.S.Wang
Department of Applied Economics
National University of Kaohsiung
Nan-Tzu, Kaohsiung 811 / Taiwan
lfswang@gmail.com

*corresponding author

September 2014

Horizontal merger under strategic tax policy

1. Introduction

It is believed that, in the absence of significant synergic benefits, the firms' gains from horizontal mergers come at the expense of the consumers (Farrell and Shapiro, 1990), and create concerns for the antitrust authorities. However, this view generally ignores non-production activities of the firms such as innovation (Jacquemin and Slade, 1989). The Schumpeterian view suggests that merger creates positive effects on innovation and welfare by increasing product market concentration (Schumpeter, 1943). In a recent paper with no innovation, Davidson and Mukherjee (2007) show that merger may not affect consumers but increase social welfare for any synergic benefit in the presence of firm-entry. While synergic benefit, innovation and firm-entry are considered to be important factors for creating positive welfare effects of horizontal mergers, an important factor, viz., strategic tax policies, went unnoticed.

It is well known that, in an imperfectly competitive product market, a government may use tax policies to improve its welfare by reducing the distortion created by imperfectly competitive product market (see, Myles 1996, Hamilton 1999). However, it is interesting to note that, while analyzing the implications of horizontal mergers in oligopolistic markets, the existing literature did not pay due attention to government policies such as tax/subsidy policies. We take up this issue in this paper.

More specifically, we show the implications of strategic tax/subsidy policies on the incentive for horizontal merger, consumer surplus and social welfare. To show the implications of the tax/subsidy policies, we assume away other factors, such as cost synergy, innovation and firm-entry, which increase the incentive for a merger and tend to increase consumer surplus and social welfare following a merger.

Using a model similar to Salant *et al.* (1983), we show that, in the presence of strategic tax/subsidy policies, the effects of mergers on profits, consumer surplus and social welfare depend on the marginal social cost of public funds. Following Neary and Leahy (2004), we consider the situations where the marginal social cost of public funds is greater than one (e.g., due to distributional considerations) and where it is less than one (e.g., where the government maximizes a political support function[1] which is a weighted average of welfare and political contributions that is equal to consumer surplus and profit).

We show that the presence of a strategic tax/subsidy policy increases the incentive for merger compared to the situation with no government policy. However, a merger decreases (increases) consumer surplus and social welfare if the marginal social cost of public funds is greater (less) than one.

Our paper points towards a new factor, i.e., strategic tax/subsidy policy, for

[1] See Grossman and Helpman (1994) where the government maximizes a political support function.

increasing the profitability of horizontal merger, thus complementing the previous works such as Perry and Porter (1985), Long and Vousden (1995), Kabiraj and Mukherjee (2001) and Davidson and Mukherjee (2007) showing the role of cost synergy, international trade cost, Stackelberg leader and firm-entry, respectively, in increasing the incentive for merger. Further, in contrast to Schumpeter (1943), Farrell and Shapiro (1990) and Davidson and Mukherjee (2007), we show that merger may benefit the consumers and increase social welfare even if there is no innovation, cost synergy and firm-entry.

The remainder of the paper is organized as follows. Section 2 considers a model of horizontal merger like Salant *et al.* (1983) with no tax/subsidy policy. Section 3 shows the implications of tax/subsidy policy on the incentive for merger and the effects of merger on consumers and social welfare. Section 4 concludes.

2. Horizontal merger without government policy

In this section, we consider a model similar to Salant *et al.* (1983). Assume that there are n symmetric firms producing homogeneous goods at a constant marginal production cost $c > 0$ and competing like Cournot oligopolists. Assume that the inverse market demand function is $P(Q) = a - Q$, where P denotes price, Q is the total output and $a > c$.

We consider the following game in this section. Conditional on merger or no merger, the firms determine outputs like Cournot oligopolists and the profits are realized. We solve the game through backward induction.

2.1. No merger

If the firms compete non-cooperatively, i.e., there is no merger, the *i*th firm's profit is $\pi_i = (P-c)q_i$, $i = 1, \dots, n$. Given the demand function, consumer surplus is $CS = \frac{Q^2}{2}$, which is positively related to the total output. Social welfare is the sum of profits and consumer surplus, i.e., $SW = \sum_{i=1}^{n} \pi_i + CS$.

Standard calculation gives $q_i^{NM} = \frac{a-c}{n+1}$, $Q^{NM} = \frac{n(a-c)}{n+1}$, $\pi_i^{NM} = \left(\frac{a-c}{n+1}\right)^2$ and $SW^{NM} = \frac{n(2+n)(a-c)^2}{2(n+1)^2}$, where $i = 1, \dots, n$.

2.2. Merger

Now consider merger of *m* firms, where $1 < m \le n$. While $m = 1$ is equivalent to the case of no merger, $m = n$ implies an industry-wide merger. If a merger occurs, the merged firms, called insiders, would behave like a single firm and choose output to maximize the profit of the merged firm. We call the non-merged firms as outsiders. Hence, there are *m* insiders and $(n-m) = k$ outsiders. After merger, the number of symmetric firms in the market reduces from n to $(n-m+1) = (k+1)$. The equilibrium values after merger are $q_i^M = \frac{a-c}{n-m+2}$, $Q^M = \frac{(n-m+1)(a-c)}{n-m+2}$,

$\pi^M = \left(\frac{a-c}{n-m+2}\right)^2$ and $SW^M = \frac{(n-m+1)(n-m+3)(a-c)^2}{2(n-m+2)^2}$, where $i = 1, 2, ..., n-m+1$.

2.3. Comparison

It is immediate from the above equilibrium values that the profit of an outsider is higher under merger compared with no merger, since $\pi^M > \pi^{NM}$.

Merger is profitable to the insiders if their total profits are higher under merger than under no merger. By comparing the total profits of the insiders under no merger and under merger, we find that a merger of m firms is profitable, i.e., $\pi^M - m\pi^{NM} = \frac{(\mathrm{m}-1)[\mathrm{m}-(k+1)^2](a-c)^2}{(\mathrm{m}+\mathrm{k}+1)^2(k+2)^2} > 0$ if $m > (k+1)^2$.

By comparing the total output and social welfare under no merger and under merger, we find that both total output (and therefore, consumer surplus, since it is positively related to the total output) and social welfare are lower under merger compared to no merger, since $Q^M - Q^{NM} = -\frac{(m-1)(a-c)}{(n+1)(n-m+2)} < 0$ and $SW^M - SW^{NM} = -\frac{(m-1)(2n-m+3)(a-c)^2}{2(n+1)^2(n-m+2)^2} < 0$.

The following proposition summarizes the above results, which follow from Salant *et al.* (1983).

Proposition 1:*If there is a merger of m firms in an industry with n firms producing like Cournot oligopolists, the merger is profitable if* $m > (k+1)^2$, *where* $k = (n-m)$.

The merger benefits the outsiders, and reduces consumer surplus and social welfare.

Although a merger benefits the insiders by internalizing competition among them, it creates a positive externality on the outsiders by increasing the outsiders' residual demands, which, in turn, increases the outsiders' outputs. Hence, a merger in a Cournot oligopoly is not profitable unless a sufficiently large number of firms merge.

3. Horizontal merger with government policy

Now we introduce strategic tax policy in the model described in Section 2. We consider the following game in this section. Conditional on merger or no merger, the government determines the welfare maximizing per-unit tax, t (subsidy if t is negative) at stage 1. At stage 2, the firms determine outputs like Cournot oligopolists and the profits are realized. We solve the game through backward induction.

3.1. No merger

If the firms compete non-cooperatively, i.e., there is no merger, each firm's profit is $\pi_i = (P - c - t)q_i$, $i = 1, \dots, n$. Social welfare is the sum of the firms' profits, the consumer surplus and the tax revenue/subsidy payment weighted by the marginal social cost of the public funds, λ, i.e., $SW = \sum_{i=1}^{n} \pi_i + CS + \lambda t Q$. As mentioned in the introduction, marginal social cost of public funds can be greater than one (e.g., due to distributional considerations) or less than one (e.g., where the government maximizes a political support function which is a weighted average of welfare and political contributions that is equal to consumer surplus and profit) (Neary and Leahy, 2004).

Given the tax/subsidy rate, *t*, the equilibrium output and profit of each firm is respectively $q^{NMP} = \frac{a-c-t}{n+1}$ and $\pi^{NMP} = \left(\frac{a-c-t}{n+1}\right)^2$. The total output and social welfare is respectively $Q^{NMP} = \frac{n(a-c-t)}{n+1}$ and $SW^{NMP} = \frac{n(a-c-t)[(n+2)(a-c-t)+2(n+1)t\lambda]}{2(n+1)^2}$.

The government maximizes SW^{NMP} to determine *t*, which gives the equilibrium tax/subsidy rate as $t^{NMP} = \frac{(a-c)[(n+1)\lambda-n-2]}{2(n+1)\lambda-n-2}$. The second-order condition for welfare maximization requires $[2(n+1)\lambda-n-2]>0$, which is assumed to hold. We get that $t^{NMP} > (<) 0$ for $\lambda > (<) \frac{n+2}{n+1}$.

Using t^{NMP}, we get that $q_i^{NMP} = \frac{(a-c)\lambda}{2(n+1)\lambda-n-2}$, $\pi_i^{NMP} = \left[\frac{(a-c)\lambda}{2(n+1)\lambda-n-2}\right]^2$, $Q^{NMP} = \frac{\mathrm{n}(a-c)\lambda}{2(n+1)\lambda-n-2}$ and $SW^{NMP} = \frac{\mathrm{n}(a-c)^2\lambda^2}{2[2(n+1)\lambda-n-2]}$. The positive equilibrium price implies $\lambda > \frac{(n+2)a}{(n+2)a+cn}$, which is assumed to hold and satisfies $[2(n+1)\lambda-n-2]>0$. Since $\frac{(\mathrm{n}+2)\mathrm{a}}{(n+2)a+cn} < \frac{n+2}{n+1}$, we get that $t^{NMP} < 0$ (i.e., the government gives a subsidy) for $\frac{(n+2)a}{(n+2)a+cn} < \lambda < \frac{n+2}{n+1}$ and $t^{NMP} > 0$ (i.e., the government charges a tax) for $\lambda > \frac{n+2}{n+1}$.

3.2. Merger

If there is a merger of m firms, where $1 < m \leq n$, the number of active firms reduces from n to $(n - m + 1) = (k + 1)$ and the ith firm's profit is $\pi_i = (P - c - t)q_i$, $i = 1, \dots, n - m + 1$ and social welfare is $SW = \sum_{i=1}^{n-m+1} \pi_i + CS + \lambda t Q$.

The equilibrium values under merger can be found by replacing n by $(n-m+1)$ in the equilibrium values of subsection 3.1. Hence, we get that $t^{MP} = \frac{(a-c)[(n-m+2)\lambda - n + m - 3]}{2(n-m+2)\lambda - n + m - 3}$, $q_i^{MP} = \frac{(a-c)\lambda}{2(n-m+2)\lambda - n + m - 3}$, $\pi_i^{MP} = \left[\frac{(a-c)\lambda}{2(n-m+2)\lambda - n + m - 3}\right]^2$, $Q^{MP} = \frac{(\mathrm{n-m+1})(a-c)\lambda}{2(n-m+2)\lambda - n + m - 3}$ and $SW^{MP} = \frac{(\mathrm{n-m+1})(a-c)^2\lambda^2}{2[2(n-m+2)\lambda - n + m - 3]}$. The second-order condition for welfare maximization requires $[2(n-m+2)\lambda - n + m - 3] > 0$, which is assumed to hold. We get that $t^{MP} > (<) 0$ for $\lambda > (<) \frac{n-m+3}{n-m+2}$.

The positive equilibrium price implies $\lambda > \frac{(n-m+3)a}{(n-m+3)a + c(n-m+1)}$, which is assumed to hold and satisfies $[2(n-m+2)\lambda - n + m - 3] > 0$. Since $\frac{(\mathrm{n-m+3})\,\mathrm{a}}{(n-m+3)a + c(n-m+1)} < \frac{n-m+3}{n-m+2}$, we get that $t^{MP} < 0$ (i.e., the government gives a subsidy) for $\frac{(\mathrm{n-m+3})\,\mathrm{a}}{(n-m+3)a + c(n-m+1)} < \lambda < \frac{n-m+3}{n-m+2}$ and $t^{MP} > 0$ (i.e., the government charges a tax) for $\lambda > \frac{n-m+3}{n-m+2}$.

Given that $\frac{n+2}{n+1} < \frac{n-m+3}{n-m+2}$, it is immediate from t^{NMP} and t^{MP} that the values of λ for which the government imposes a tax are higher under merger compared to no merger, implying that the possibility of taxation is lower under merger compared to no merger. We also find that $(t^{MP} - t^{NMP}) = \frac{[n - m(4 - m + 3n) + 1](a - c)\lambda}{[(2\lambda - 1)(n - m + 1)^2 + 2\{(n - m + 1)\lambda - (n + 1)\}][2 + \text{n} - 2(1 + \text{n})\lambda]} < 0$, suggesting that if the government imposes a subsidy (tax) before merger, it imposes a higher subsidy rate (a lower tax rate) after the merger. The reduction in competition following a merger increases the government's incentive for reducing the distortion due to oligopoly, thus increasing the government's incentive for subsidization or decreasing its incentive for taxation.

We consider in the following analysis that the equilibrium prices are positive under both no merger and merger, which happens for $\frac{(n - m + 3)a}{(n - m + 3)a + c(n - m + 1)} < \lambda$.

3.3. Comparison

Now we determine the condition for a profitable merger in the presence of a strategic tax policy. A merger of *m* firms is profitable in the presence of a strategic tax policy if $\pi^{MP} > m\pi^{NMP}$, which happens for $m > \left(k + 1 - \frac{1}{2\lambda - 1}\right)^2$. Since $\frac{1}{2} < \frac{(n - m + 3)a}{(n - m + 3)a + c(n - m + 1)} < \lambda$, we have $(2\lambda - 1) > 0$, and we get the following proposition immediately from the above discussion.

Proposition 2: *Consider strategic tax policy in an industry with n firms where the* *firms compete like Cournot oligopolists. If* $\frac{(n-m+3)a}{(n-m+3)a+c(n-m+1)} < \lambda$*, so that the equilibrium prices are always positive under both no merger and merger, a merger of* m *firms,* $1 < m \leq n$*, is profitable if* $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$*, where* $k = (n-m)$.

Proposition 1 shows that a merger of *m* firms is profitable for $m > (k+1)^2$, while Proposition 2 shows that a merger of m firms is profitable for $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$. The comparison of these conditions shows that the number of insiders required for a profitable merger is smaller in the presence of a strategic tax policy compared to no tax policy. In other words, the possibility of a profitable horizontal merger is higher in the presence of a strategic tax policy compared to no strategic tax policy, as considered in Salant *et al.* (1983). Thus, Proposition 2 points towards a new factor, viz., the strategic tax/subsidy policy, for increasing the incentive for a profitable merger in a Cournot oligopoly that has been ignored in the literature.

Now we see the effects of the merger on total outputs and social welfare. Assume that $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$ holds, so that a merger of *m* firms in an *n*-firm Cournot oligopoly is profitable in the presence of a strategic tax policy. If the firms merge, the total output is $Q^{MP} = \frac{(\mathrm{n}-\mathrm{m}+1)(a-c)\lambda}{2(n-m+2)\lambda-n+m-3}$. However, if the firms do not merge, the total output is $Q^{NMP} = \frac{n(a-c)\lambda}{2(n+1)\lambda - n - 2}$. We get that $Q^{MP} > (<) Q^{NMP}$ for $\lambda < (>) 1$. Since we are considering that $\frac{(n-m+3)a}{(n-m+3)a + c(n-m+1)} < \lambda$ and $\frac{(n-m+3)a}{(n-m+3)a + c(n-m+1)} < 1$, a profitable merger in the presence of a strategic tax policy increases (decreases) the total output and therefore, benefits (hurts) the consumers if $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$ holds for $\lambda \in \left(\frac{(n-m+3)a}{(n-m+3)a + c(n-m+1)}, 1\right)$ $(1 < \lambda)$.[2] For a given tax/subsidy rate, a merger reduces the total output compared to no merger and makes the consumers worse off under merger compared to no merger. However, a merger reduces the tax rate or increases the subsidy rate, which tends to make the consumers better off under merger compared to no merger. If λ is less than one, so that the government's incentive for subsidization increases significantly following a merger, the later effect dominates the former effect and a merger benefits the consumers compared to no merger.

Now compare social welfare under merger and no merger. Assume that $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$. If merger occurs, social welfare is $SW^{MP} = \frac{(n-m+1)(a-c)^2\lambda^2}{2[2(n-m+2)\lambda - n + m - 3]}$. However, if merger does not occur, social welfare is $SW^{NMP} = \frac{n(a-c)^2\lambda^2}{2[2(n+1)\lambda - n - 2]}$. We find that $SW^{MP} > (<) SW^{NMP}$ for

[2] For example, since $\left(k+1-\frac{1}{2\lambda-1}\right)^2$ increases with λ, a profitable merger of m firms makes the consumers better off under merger compared to no merger for any $\lambda \in \left(\frac{(n-m+3)a}{(n-m+3)a+c(n-m+1)}, 1\right)$ if $m > \left(k+1-\frac{1}{2-1}\right)^2 = k^2$.

$\lambda < (>) 1$. Hence, like the comparison for consumer surplus, a profitable merger increases social welfare compared to no merger if $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$ holds for $\lambda \in \left(\frac{(n-m+3)a}{(n-m+3)a+c(n-m+1)}, 1\right)$. However, if $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$ holds for $1 < \lambda$, a profitable merger reduces social welfare compared to no merger. The reason for this result is similar to the one discussed above for consumer surplus.

The above discussion is summarized in the following proposition.

Proposition 3: *In the presence of a strategic tax policy, a profitable horizontal merger of m firms in a n-firm Cournot oligopoly makes the consumers and the society better off (worse off) under merger compared to no merger if* $m > \left(k+1-\frac{1}{2\lambda-1}\right)^2$ *holds for* $\lambda \in \left(\frac{(n-m+3)a}{(n-m+3)a+c(n-m+1)}, 1\right)$ *(*$1 < \lambda$*), where* $k = (n-m)$.

4. Conclusion

We show the effects of a strategic tax policy on the incentive for a merger in a Cournot oligopoly. We show that the incentive for a merger is higher under strategic tax policy compared to no strategic policy. Thus, we point towards a new factor, viz., strategic tax policy, for increasing the incentive for a merger that has been ignored in the literature. We also show that a merger benefits the consumers and the society in the presence of a strategic tax policy if the marginal social cost of the public funds is less than one.

References

Davidson, C. and Mukherjee, A. (2007). Horizontal mergers with free Entry. *International Journal of Industrial Organization*, 25, 157-172.

Farrell, J. and Shapiro, C. (1990). Horizontal mergers: an equilibrium analysis. *American Economic Review* 88, 107-126.

Grossman, G.M. and Helpman, E. (1994). Protection for sale. *American Economic Review*, 84, 833-850.

Jacquemin, A. and Slade, M.E. (1989). Cartels, collusion and horizontal merger. In R. Schmalensee and R. Willing (Eds.), *Handbook of Industrial Organization*, North-Holland, Amsterdam.

Kabiraj, T. and Mukherjee, A. (2001). Bilateral merger: a note on Salant-Switzer-Reynolds model. *Journal of Quantitative Economics (Old Series)*, 17, 82-88.

Leahy, D. and Montagna, C. (2001). Strategic trade policy with heterogeneous costs. *Bulletin of Economic Research*, 53, 177-182.

Long, N.V. and Vousden, V. (1995). The effects of trade liberalization on cost reducing horizontal mergers. *Review of International Economics*, 3, 141-55.

Neary, J.P. and Leahy, D. (2004). Revenue-constrained strategic trade and industrial policy. *Economics Letters*, 82, 409-414.

Perry, M. and Porter, R. (1985). Oligopoly and the incentive for horizontal merger. *American Economic Review* 75, 219-227.

Salant, S.W., Switzer, S. and Reynolds, R.J. (1983). Losses from horizontal merger: the effects of an exogenous change in industry structure on Cournot-Nash equilibrium. *Quarterly Journal of Economics*, 98, 185-199.

Schumpeter, J.A. (1943). *Capitalism, socialism and democracy*. London, Unwin University Books.