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Public Firm in Mixed Oligopolistic Structure: A Theoretical Exposition

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Abstract

The logic for state monopoly of public utilities arises from increasing returns to scale and the concern that private business in these areas results in monopolistic exploitation of consumers. The state monopoly however is fraught with the danger of production inefficiency. In this backdrop, the market form of mixed oligopoly is contemplated in markets like health, education, electricity, gas, telecommunications etc, where public and private sector coexists. The private firms maximize profit but the public firm maximizes social welfare.

Despite this theoretical exposition, it is often observed that public firms fail to make contributions according to their potentiality. The public firm in an industry with rapid change in technology can perform inefficiently due to decision making delay, adherence to social obligation. The policy makers must rise to these occasions then survival of public firms will be smooth. The option of public private partnership also derives affirmative results for the society and the particular industry per se.

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Introduction

After the Second World War, the World witnessed the development of consensus in favour of active involvement of Government in the economic activities of a country. Accordingly, in many countries in the world, a large public sector came into being. In India also under the philosophy of mixed economy, public sector was assigned the commanding heights of the economy.

It was however subsequently realized that public sector suffered from several deficiencies. Experiences across the world suggest that the state monopoly may be fraught with the danger of production inefficiency. According to Locke and Dupatti (2010) the most public enterprises are characterized by a very low economic efficiency due to the lack of competition in the field covered by public enterprises (absence of any incentive elements), thus for establishment of proper competition within the public sector, it is necessary to introduce adequate regulative institutions (independent bodies) for specific monopolized fields of activities in which public enterprises are active.

Many public sector firms of different countries suffered from huge losses. We can refer to Siberian industries -NIS (Oil Industry of Serbia), EPS (Power Energy of Serbia). In that background privatization of public sector firms and opening up of sectors, hitherto reserved for public sector for private firm was contemplated. This led to the emergence of mixed oligopoly in many sectors. An oligopolistic market form where public and private sector coexist is known as mixed oligopoly. But the problem of production inefficiency in the public sector has still been observed due to incentive problems and has thus failed to make contributions according to their potentiality.

This problem can, according to many economists and policy makers, be somewhat mitigated with public private partnership. Public private partnership can also help dealing with the problem of large accumulation of public debt. In fact the idea of public private partnership originated when the public debt grew rapidly in many countries in the 1970s and 1980s resulting in macroeconomic dislocation. The Latin American debt crisis that hit many countries in the Latin American region during the 1960s and 1970s are probably the best supportive evidence of how public debt can destabilize any economy.

Many countries across continents have resorted to PPP. The countries which have largely set up PPP include both developing and developed countries, for example, Australia, Canada, China, India, Japan, Philippines, Puerto Rico, Russia, United Kingdom, United States etc. PPP models are growingly becoming popular in developing countries like Brazil and India. Traditionally the PPPs were sought for infrastructural projects. However, over the years the scope of PPPs has increased and is still increasing. Thus along with the traditional sector like infrastructure, PPPs are being advocated as a policy measure for non-traditional sectors like health services, provision of certain public goods including water, development of various products etc.

In India, PPPs have been used in transport and road, metro rail, civil aviation, power and even in agriculture[5]. Many Indian states like Andhra Pradesh, Karnataka, Kerala, West Bengal, Orissa, Punjab Himachal Pradesh etc. have chosen PPP for transport sector and infrastructure development. On the other hand, Pondicherry has resorted to PPP for setting up Special Economic Zones (SEZ), Tamil Nadu identified priority sectors for PPP as water supply and sewerage, computer literacy in schools along with road and infrastructure development. Jharkhand has involved PPP in mines and mineral industry, power generation and distribution, sericulture etc. as well. Policy analysts also suggest scopes for PPP in education, health, dairy sector etc. PPP in social sector is also on the rise for implementation of various Central Government Schemes related to health and family welfare, environment and forests, rural development, water supply and even poverty alleviation[6].

In economic literature we find supportive models where mixed oligopoly market outcome is shown to be more efficient than pure oligopoly. As discussed in the literature, private players are profit maximisers, whereas public firms are social welfare maximizing in nature in the long run. However, they have to bear the social obligations for which inefficiency may creep in. To meet public interests, State owned firms may take those production decisions, which are not compatible with profit making. Lax supervision and decision making dilemma also bring in inefficiency. So there must be a mechanism that addresses the issue of incompatibility between social obligation and profit making on the issue of public auditing and delay in decision making.

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[5] In Maharashtra the National Horticultural Mission was launched during 2005-06for the holistic development of horticulture through adoption of an integrated approach duly ensuring backward and forward linkages including marketing (Iqbal (2012)).
[6] Iqbal (2012).

The Paper is organized as follows. The following section discusses the existing literature. The next section sketches two analytical models, one of a mixed oligopoly and the other of mixed oligopoly involving public private partnership (PPP). The penultimate section is for observations. The section concludes.

Literature Review

The earliest exposition of mixed oligopoly and existence of government firm in oligopoly is by Merrill and Schneider (1966). De Fraja and Delbono (1989) contribute another important paper that focuses on alternative strategies of a public enterprise in Oligopoly. Cremer, Marchand and Thisse, (1989) discuss the role of public firm as an instrument of regulation.

Only a few very recent papers look at the issue of Cournot and Bertrand in the context of mixed oligopoly. Ghosh and Mitra (2010) compare Cournot with Bertrand competition in a mixed oligopoly with differentiated good and finds reversal of the results that Bertrand competition yields lower prices as well as profit and higher consumer surplus. According to this paper, for substitute goods, the public firm's output is higher and the private firm's output lower under Cournot competition, compared to the Bertrand competition. Choi (2012) considers the case where public firm is less efficient than the private firm, an assumption we hold in our model. Choi's paper develops a two stage game model and shows that for substitute goods adoption of price competition or quantity price competition depends on degree of efficiency gap. All these models consider differentiated goods market.

Delbono et al. (1996), using a model similar to Grilo (1994), introduce the possibility that the market might be uncovered (implying that a mixed duopoly cannot reach the social optimum). It is also shown that the presence of the public firm in the market decreases quality differences and increases market coverage and welfare. The author uses Motta's (1994) rendition of the model in Sutton (1991), with fixed quality-dependent costs. The author shows that mixed oligopoly may be the least expensive. The objective of model discussed by Lutz and Pezzino (2010) is to study the social desirability of a mixed duopoly with vertical product differentiation in a model like à la Mussa and Rosen (1978) when firms face fixed quality-dependent costs and the market is uncovered. Teresa, Zsuzsanna and Isabelle (2007) consider the challenges and opportunities for

improvement of public sector firms. Christensen (2015) shows that public sector firms are like a hybrid and create ripple effects between the market and the hierarchy that hindered the marketisation.

The first major work on public private partnership (PPP) comes from Hart (2003). From a theoretical point of view Hart (2003) distinguishes between PPP and public procurement which suggests that the essential difference between the two lies in the fact that building and operating stages are bundled in the PPP. Hart (2003) was subsequently followed by many who discuss several aspects of PPP. We are mentioning a few important ones among them. Bennett and Iossa (2006) discuss "alternative institutional arrangements for building and managing facilities for public services including the use of Private Finance Initiatives (PFIs)". Grimsey and Lewis (2007) elaborate on the trends in governments to look increasingly for private financing of public services across the world. Martimort and Pouyet (2008) analyse whether the two tasks of building and managing socially useful infrastructure for providing public services should be bundled or not. Engel, Fischer and Galetovic (2013) discuss the merit of the implementation of PPP contract through competitive auction and elaborate on the allocation of risk under optimum contract. Iossa and Martimort (2015) analyse the main issues of incentives in case of PPPs and discuss how the optimal contracts should be shaped in such contexts.
All these works analyse PPP as a monopolistic structure. Our paper is an addition in this extant literature where PPP can coexist with an oligopolistic market structure. This paper uses two simple theoretical models about public firm.

The Model

This section considers two alternative theoretical possibilities mixed oligopoly framework. The first one involves a simple mixed oligopoly framework, while the second one considers the presence of public private partnership in a mixed oligopoly framework.

Mixed Oligopoly

The world has witnessed full or partial privatization of many erstwhile public sector enterprises from 1970's. China introduced its privatization policy in 1978, The UK government started a privatization drive from 1979, and similar policies were subsequently followed in East Europe,

South America and other Asian countries, including India. We present below a simple model to derive some results of mixed oligopoly.

There are two firms in this model – private (X) and public (Y) with production levels x and y. The basic assumption is that in the long run the private firm maximizes profit but the public firm maximizes social welfare which is the sum of consumers' surplus and the total profit of the firms. We will impose two restrictions.

The first one is regarding efficiency of the public firm. It is perceived that the public firm is less efficient and less consumer-friendly by the consumers and therefore has a lower demand. This is captured by assuming that maximum reservation price for the private firm is 1 and for the public firm $\lambda < 1$.

Thus the demand functions for the private firm and the public firm for two different market segments are respectively.

$$p_{pvt} = p_x = 1 - x - y ....(1) \text{ for private firm}$$
$$p_{pub} = p_y = \lambda - x - y ....(2) \text{ for public firm}$$
$$\lambda < 1.$$

We have also the restriction that $\lambda < x + y$.

The second constraint is regarding technology adoption ability of the public firm. We argue that for new technology adoption, public firm has a higher cost on account of inefficiency.[7] For simplicity we assume that the private firm has zero average and marginal cost and for the public firm this average and marginal cost is $c > 0$. We assume further that the firms are engaged in Cournot competition with their respective objectives, demand and cost structures and with no capacity limit.

The profit function of the private firm is

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[7]Inefficiency should not always be taken in a pejorative sense. A part of the inefficiency may be a legacy of the inefficiencies of its past monopoly. But higher cost may be due to better adherence to regulatory norms compared to private firms. BSNL scores higher than the private firms in terms of transparency but that imposes a burden on BSNL. See Datta & Chatterjee (2012).

$$\pi_x = x - x^2 - xy$$

$$W_y = \lambda y - xy - y^2 - cy + x - x^2 - xy + \frac{(x+y)^2}{2}$$

The private firm maximizes this profit taking y as given.

The public firm wants to maximize social welfare taking x as given

From the necessary maximizing conditions, we get the following equilibrium values.

$$x^* = 1 - \lambda + c \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

$$y^* = 2\lambda - 2c - 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4)$$

$$p_x^* = 1 - (1 - \lambda + c) - (2\lambda - 2c - 1) = 1 - \lambda + c \dots\dots\dots(5)$$

$$p_y^* = \lambda - (1 - \lambda + c) - (2\lambda - 2c - 1) = c \dots\dots\dots\dots(6)$$

The above result shows that if the public firm has no disadvantage with regard to demand and cost, i.e. if $c = 0$ and $\lambda = 1$ there is no need for private firm from the point of view of economic efficiency. Both firms in that case charge the competitive price c = 0. The public firm can ensure Pareto efficiency by following social welfare maximization principle (Lange, 1938). But as the post Second World War experiences have shown in many countries, higher cost resulting from legacy of the past is a reality and taking this into account the governments of various countries have taken recourse to privatization. This also shows that even if the public firm charges lower price, still the private firm may produce more, given that

$$\frac{2}{3} > \lambda - c \dots\dots\dots\dots\dots\dots\dots(7)$$

The above result shows that with privatization and entry of new private firms in the fray, the public sector firm may find it more and more difficult to survive in the market, unless adequate cost management is exercised and adequate support is provided for its social obligation.

Problem of public firm arises as it is a politico economic organisation. As state is involved, political involvement comes in the management of public sector. By politics here we mean the fight over the distribution of the national pie. Allocation of resources also becomes political in the sense that they are linked to the distribution of income. In this construct, public sector firm does not remain pure

business entity. The word "corporatisation" is commonly used now for explaining the stature of the state owned firm is not at all a reality rather rhetoric.

Political aspect enters into managerial decisions (for providing free services, services at subsidised price, assurance of job security) and threatens the efficiency. Private corporate sector is answerable to shareholders, whereas in case of public sector principal of the organisation is general public and the management (representative of government is agent). The political nature of public firm makes them amenable to public audit where every expenditure should be audited elaborately and the management is publicly answerable. This exposes the public firm to type one or type two error. Honest decision maker may be punished, if auditing is tight. This deters decision making and delays performance.

Mixed Oligopoly Involving Public Private Partnership

Most of the existing literature consider a PPP as a monopoly where the public and the private sector join hands. But the case of a mixed oligopoly, where the public sector collaborates with any private firm or firms and some purely private firms also remain in the market is a situation not explored in the existing literature. Here is a simple model to address this issue.

There are $n > 1$ firms in the market playing Cournot game. The marginal cost of each firm is constant and for ith firm it is $c_i > 0$. The inverse demand function is given by $a - bQ$, where Q is the industry output. Note that $Q = \sum_{i=1}^{n} q_i$, where q_i is the output produced by ith firm. Obviously $a \gg c_i$ for all $i \in \{1, \cdots, n\}$. This is a model of complete information.

No PPP

Suppose no firm is collaborating with the Government. Then it is just a case of simple oligopoly with n firms. The profit function of the ith firm is

$$\Pi_i^{NP} = (a - bQ)q_i - cq_i - L$$

where $L > 0$ is the licensing fee.

The reaction function of the ith firm is

$$\frac{(a - c_i)}{b} = 2q_i + \sum_{j \neq i} q_j$$

8

There are n reaction functions with n unknowns. Solving them we get the equilibrium output of the ith firm as

$$q_i^{NP} = \frac{a - nc_i + \sum\limits_{j \neq i} c_j}{b(n+1)}$$

So equilibrium profit of the ith firm is (gross profit is bq_i^2 as usual)

$$\Pi_i^{NP} = \frac{1}{b}\left[\frac{a - nc_i + \sum\limits_{j \neq i} c_j}{n+1}\right]^2 - L$$

Equilibrium industry output is

$$Q^{NP} = \frac{na - \sum\limits_{i=1}^{n} c_i}{b(n+1)}$$

Then equilibrium price is

$$P^{NP} = \frac{a + \sum\limits_{i=1}^{n} c_i}{n+1}$$

PPP

Suppose only one firm is having partnership with the government. Let it is the pth firm. The profit function of the pth firm is then

$$\Pi_p^P = (1-\delta)\left[(a - bQ)q_p - (c_p - \theta)q_p\right]$$

where δ is the fraction of profit that the firm must pay to the government and since it is a PPP government also shares some cost of production validating the presence of θ.

Analyzing the same way we have the following :

- The output of the ith firm not under PPP is $q_i^P = \dfrac{a - nc_i + \sum_{j \neq i} c_j - \theta}{b(n+1)}$.

- The profit of the ith firm not under PPP is $\Pi_i^P = \dfrac{1}{b}\left[\dfrac{a - nc_i + \sum_{j \neq i} c_j - \theta}{n+1}\right]^2 - L$.

- The output of the p th firm is $q_p^P = \dfrac{a - nc_p + \sum_{j \neq p} c_j + n\theta}{b(n+1)}$.

- The profit of the p th firm is $\Pi_p^P = (1-\delta)\dfrac{1}{b}\left[\dfrac{a - nc_i + \sum_{j \neq i} c_j + n\theta}{n+1}\right]^2$.

- The industry output is $Q^P = \dfrac{na - \sum_{i=1}^{n} c_i + \theta}{b(n+1)}$.

- Equilibrium price is $P^P = \dfrac{a + \sum_{i=1}^{n} c_i - \theta}{n+1}$.

Comparison between No PPP and PPP

First we note that the industry output is larger in PPP (and the therefore the price is lower). So social welfare will increase under PPP if the social welfare is defined as $CS + PS + GS$.

Some observations

- it must be the case that $\Pi_i^P > 0$ for i th firm, otherwise the firm will shutdown. If there was identical firm to begin with this implies that without the above condition there will be monopoly in the market after PPP.

- $\Pi_i^P > 0$ implies $\Pi_i^{NP} > 0$, so if i th firm survives after her rival enters in PPP, then it must be the case that without PPP this firm must get positive profit.

- A firm will enter in PPP iff $\Pi_p^P \geq \Pi_p^{NP}$. This itself is a parametric condition for successful PPP.

- If Government wants to increase the social welfare without incuring budget deficit then $\frac{\delta}{1-\delta}\Pi_p^P + (n-1)L \geq \theta q_p^P$ must hold.

- If Government wants to increase the social welfare but at the same time wants revenue no less than the revenue in No PPP situation, then $\frac{\delta}{1-\delta}\Pi_p^P \geq \theta q_p^P + L$ must hold.

Conclusion

The choice problem of a public sector firm is subject to additional constraints, vis a vis private firms. Profit maximisation without constraint always produces better result than constrained maximisation. State owned firm cannot charge a high price, so as to maximise profit. The social welfare

maximisation obligation restricts the profit. This is known as the problem of multiple objectives and sub optimal performance. Our theoretical exposition has captured this aspect.

In recent years the concern of public–private partnerships has increased widely following the diversification of actors that collaborate with foreign investors, and the growing use of partnerships to allow local participation in environmental and developmental policies in general (Forsyth ,2005). Rather than simply seeking to provide badly needed infrastructure at the cheapest cost to the state, such new approaches to partnerships may also occur with bottom of administration and general public, and may be designed to allow greater participation of all non-state actors in shaping development policy (e.g. Plummer, 2002). Further scope of research in this direction lies in exploring the prospects for public private partnerships under asymmetric information framework where the governments do not have enough information about the potential firms who are candidates for the partnership and have to choose the most efficient firm from this set.

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