Partial Privatization, Managerial Incentives
and Bank Competition

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Abstract

We consider a mixed duopoly where a state-owned bank competes with a private bank in collecting deposits. Prior to this competition the government decides on optimal privatization of the public bank, and the private bank decides on managerial incentives. The government is a welfare maximizer, but also profit oriented. Because of profit orientation the government internalizes the strategic effects of public ownership on the private bank’s profit, and implements privatization to a certain extent. But the private bank’s managerial incentives induce even greater privatization and transfer of profit from the public to the private bank with unchanged social welfare.

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1 Introduction

Profit consideration has recently led to divestment or privatization of many state-owned banks in developing and transition economies. At the same time, entry of private and foreign banks has remained a subject of state control. In fact, state presence is a common feature in banking systems all over the world. See Barth et al (2001) for evidence on EU countries, Sherif et al (2003) for transition economies and Shirai (2002) for China and India. There is also evidence that firms in emerging economies offer managerial incentives. It is, therefore, reasonable to expect that the banking industry in many economies (especially emerging) resembles mixed oligopoly with strategic interactions among banks occurring at many dimensions. We study such interactions between one partially public bank and one private bank by allowing the former to choose the degree of public ownership and the latter managerial incentive prior to engaging in deposit competition.

We assume that government is a social welfare maximizer, but is also somewhat profit oriented. This profit orientation forces the government to privatize the public bank to some extent, even if there is no other bank in the market. The presence of another bank makes the government internalize some of the strategic effects that state ownership, howsoever partial, might have on the other bank’s profit. On its part, the private bank can counter the competitiveness of the public bank by offering revenue-linked incentives to its manager. The combination of managerial incentives and profit orientation will cause even greater privatization of the public bank. As a consequence, a particular type of mixed duopoly emerges in which privatization is always partial and the private bank always departs from (pure) profit maximization.

More interestingly, in this mixed duopoly the government’s profit orientation determines a certain level of industry profit, and the private bank’s managerial incentives determine the distribution of profits leaving the social welfare unchanged. This pure redistributive role of managerial incentives is possible only in a mixed duopoly, and this has not been identified earlier in the literature.

In the context of banking Purroy and Salas (2000) studied competition between a profit maximizing private bank and a savings institution. Their savings institution exhibits ‘expense preference behavior’, i.e. utility maximization where utility is a weighted average of profit and workers’ wage-bill. They show that the private bank can partly restore the asymmetry created by the savings institution’s utility function by offering managerial incentives. However their results cannot be generalized to public banks and the question of privatization cannot be addressed. Our model tries to fill this gap.

There are many papers that have studied mixed duopoly, but partial privatization concerns only a few (such as Fershtman, 1990; Matsumura, 1998). Even fewer papers have studied mixed duopoly in the banking context (except Purroy and Salas, 2000; Saha and Sensarma, 2004). But there is a large literature on managerial incentives following the seminal work of Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987). We integrate these two literatures with the objective of simultaneously determining optimal privatization and managerial incentives.

The paper is organized as follows. Section 2 sets out the basic model and section 3 discusses optimal privatization and managerial incentives. Some concluding remarks are offered in Section 4.
2 The Model

We consider a two-stage game between a partially public and a fully private bank. In the first stage, the government decides on the share of public ownership in the partially public bank, while the private bank decides on managerial incentives. In the second stage the two banks engage in deposit competition.\footnote{When interest rate is regulated, as in many developing economies, banks tend to compete more in deposit.} Profits are subsequently realized.

The public bank is indexed 0, and the private bank indexed 1. Depositors earn interest rate $r$ by the following rule

$$r = b(D_0 + D_1), \quad b > 0.$$  

On the revenue side, both banks face a constant rate of return $R$ on each unit of investment made out of these deposits.\footnote{This is a simplification. Results do not change if $R$ varies inversely with $D$. We can also allow for a statutory reserve ratio, in which case $R$ is to be taken as an average rate of return, averaged over the reserve deposit and investible deposit.} Fixed $R$ can be justified by assuming that money markets and loan markets are competitive, where banks are price takers, though they can have market power in raising deposits. The public bank is jointly owned by the government and a private partner, and the choice of the volume of deposit is made by the bank’s board of management consisting of a government representative and the private partner. If the private partner had full ownership, it would have maximized $\pi_0 = (R - r)D_0$ by choosing $D_0$ as

$$D_0 = \frac{R - bD_1}{2b}. \quad (1)$$

Denote this hypothetical reaction function as $\hat{R}_F_0$. On the other hand,
if the bank was under full state ownership, the government representative in
the public bank would maximize social welfare, which is defined as the sum
of depositor surplus ($DS$) and bank profit, and given by $SW = DS + \sum_{i=1}^{1} \pi_i$, where $DS = rD - \int_{0}^{D} bzdz = rD - \frac{bD^2}{2} = \frac{bD^2}{2}$, or $SW = (R - \frac{bD}{2})D$, where $D = D_0 + D_1$. The government representative would maximize $SW$ by choosing $D_0$ as

$$D_0 = \frac{R - bD_1}{b},$$

(2)

which would have been its reaction function. We denote it as $\tilde{RF}_0$.

However, there must be a balance between the profit maximizing objective
of the private partner and the social welfare objective of the government
representative. This can be modeled in a number of ways. We take the
approach suggested by Fershtman (1990) in which the public bank’s deposit
choice is given by a weighted reaction function, where weights are applied
on the two extreme reaction functions - fully public (2) and fully private (1),
and the weights directly correspond to their respective shares of ownership.
Thus, the reaction function of the public bank is

$$RF_0 = \theta \tilde{RF}_0 + (1 - \theta) \tilde{RF}_0,$$

where $\theta (\theta \in [0, 1])$ is the degree of public ownership.\(^4\) This can be rewritten
as

$$D_0 = \frac{(1 + \theta)(R - bD_1)}{2b}. \quad (3)$$

\(^4\)While the ownership exceeds 50 percent is very important, it cannot be denied that
any change in $\theta$ will have some effect on the bank behavior.
It is noteworthy that Fershtman (1990) did not provide an objective function of the partly nationalized firm leaving it an open issue.\(^5\) However, first Saha and Sensarma (2003) and then Kumar and Saha (2008) have suggested two alternative objective functions that can support Fershtman’s reaction function.\(^6\) Either can be used as a justification in the present context.

While the public bank’s deposit choice is specified in the above manner, it may be preceded by a decision of how much to divest or privatize, and this decision lies at a higher level of government, whose concern is to maximize social welfare and possibly at the same time ensure solvency of the public bank. Thus, the government chooses \(\theta\) to maximize a modified social welfare function which places a higher weight on profit. The modified social welfare function is denoted as \(V = DS + \beta(\pi_0 + \pi_1)\) which can be rewritten as \(V = SW + (\beta - 1)(\pi_0 + \pi_1)\). With \(\beta > 1\), the government demonstrates its profit orientation by placing an additional positive weight on profit in its social welfare objective. Note that the government’s objective function differs from the objective of the government representative in the public bank’s management board. However, this difference is only in terms of the profit orientation.

The private bank, though technologically identical to its public counterpart, may hire a manager and offer her incentives to boost its profit. Following the strategic delegation literature (see Vickers, 1985; Fershtman and Judd, 1987; Skilvas, 1987), we assume a linear incentive scheme which may

\(^5\)Fershtman (1990, pp. 327) cites Bos and Peters (1989) for a detailed discussion on the objective function of a partly nationalized firm. But the issue was, nevertheless, unsettled.

\(^6\)Saha and Sensarma (2003) showed that if the government representative wanted to maximize the depositor surplus for the public bank’s depositors, then Nash bargaining between him and the private partner would result in this reaction function. Kumar and Saha (2008) show that if the objective function of a public firm of mixed ownership is given by a weighted average of SW and profit, but the weights are non-linear in their ownership in a certain way, then also the above reaction function emerges.
reward (or penalize) the manager for generating revenue beyond the standard profit maximizing level. Formally, the manager is instructed to choose $D_1$ to maximize

$$M = (1 - \rho)\pi_1 + \rho RD_1.$$ 

Depending on the owner’s preference, $\rho$ can take a wide range of values. The standard case of profit maximization is given by $\rho = 0$. But if $\rho > 0$, the manager is encouraged to pursue sales more than profit. Conversely, $\rho < 0$ implies that the manager will be encouraged to pursue profit more than sales.

The manager maximizes the above objective function and her choice of $D_1$ gives the private bank’s deposit reaction function

$$D_1 = \frac{R - (1 - \rho)bD_0}{2b(1 - \rho)}. \quad (4)$$

The reaction curves of the two banks as given by (3) and (4) are shown in figure 1. Two thick curves, denoted as $RF_0$ and $RF_1$ are drawn with the assumption that $\theta \in (0, 1)$ and $\rho \in (0, \frac{1}{2})$. The downward slopes indicate that the deposits are strategic substitutes. If the private bank chooses zero deposit, the public bank will choose its monopoly deposit as $\frac{(1+\theta)R}{2b}$, and similarly, if the public bank chooses zero deposit the private bank’s manager will choose $D_1 = \frac{R}{2b(1-\rho)}$. Conversely, if the private bank chooses $D_1 = \frac{R}{b}$, the public bank will simply close down, and similarly, the public bank’s choice of $D_0 = \frac{R}{b(1-\rho)}$ will force the private bank to close down. Thus, the monopoly and entry-deterring levels of deposits of each bank can be defined in the usual way as quantity setting firms’ outputs are defined. The equilibrium deposits
are given by point $M$ comprising of $D_0^*$ and $D_1^*$, which we obtain as
\[
D_0 = \frac{R(1 + \theta)(1 - 2\rho)}{b(3 - \theta)(1 - \rho)},
\]
\[
D_1 = \frac{R[[(1 - \theta) + \rho(1 + \theta)]}{b(3 - \theta)(1 - \rho)}.
\] (5)

It is clear that we must have $\rho < \frac{1}{2}$ for $D_0$ to be positive. If indeed it were the case that $\rho \geq \frac{1}{2}$, the public firm would be forced to close down, and the private bank would mobilize $D_1 = \frac{R}{b}$; however its profit will fall to zero, which also suggests that the private bank will never set $\rho > \frac{1}{2}$. This extreme situation is described by the two dashed reaction curves. On the other extreme, if $\theta = 0$ and both banks were profit-maximizers (i.e. $\rho = 0$) we would have a pure (or equivalently private) duopoly. Both reaction curves would then shift inward and we have the Cournot Deposits as $D_0 = D_1 = \frac{R}{b}$. This is given by point $N$ at the intersection of two thinner reaction curves. Since point $M$ lies North-East of point $N$, it is clear that the mixed duopoly generates much greater individual and aggregate deposits than the private duopoly.

As can be seen from (5), managerial incentive of the private bank and privatization of the public bank will both favor the private bank, and hurt the public bank in terms of their deposit choice. Formally, $\frac{\partial D_0}{\partial \rho} < 0$, $\frac{\partial D_0}{\partial \theta} > 0$, $\frac{\partial D_1}{\partial \rho} > 0$, $\frac{\partial D_1}{\partial \theta} < 0$, if $\rho < \frac{1}{2}$.

Finally, if the private bank had set $\rho < 0$, its output would fall against any given $\theta$, because its reaction function would shift inward starting from the situation of profit maximization. Consequently, its deposit would fall below the pure duopoly level. However, such a scenario is never profitable for the private bank. Therefore, we will not consider $\rho < 0$. Henceforth, our attention will be restricted to $\rho \in [0, \frac{1}{2}]$. 8
3 Optimal privatization and managerial incentives

We now move to the first stage of the game and analyze the strategic interactions in terms of managerial incentives and privatization. For this we need to derive the private banks’s profit and the government’s modified social welfare from the second stage equilibrium. Utilizing (5) we get

\[ V = \frac{R^2[2 - \rho(1 + \theta)][2 - \rho(1 + \theta) + \beta(1 - \theta)(1 - 2\rho)]}{b(1 - \rho)^2(3 - \theta)^2}, \] (6)

\[ \pi_0 = \frac{R^2(1 - \theta^2)(1 - 2\rho)^2}{b(1 - \rho)^2(3 - \theta)^2}, \] (7)

\[ \pi_1 = \frac{R^2(1 - \theta)(1 - 2\rho)[(1 - \theta) + \rho(1 + \theta)]}{b(1 - \rho)^2(3 - \theta)^2}. \] (8)

A crucial point to note is that both for \( \pi_1 > 0 \) and \( \pi_1 > 0 \) it is necessary that \( \theta < 1 \). Without some privatization two banks cannot operate. Further, in the pure duopoly case, i.e. when \( \theta = \rho = 0 \), each bank earns \( \pi = \frac{R^2}{9b} \).

The government and the private bank determine their respective choice variables, viz. \( \theta \) and \( \rho \), simultaneously. The private bank’s owner chooses \( \rho \) by maximizing (8) as follows

\[ \rho(\theta) = \frac{1 + \theta}{5 + \theta}. \] (9)

This is the private bank’s ‘incentive reaction function’, which is upward sloping in \( \theta \) (see figure 2). Starting from a situation of complete nationalization, as the public bank increases divestment (i.e. reduces \( \theta \)), \( D_0 \) fall, \( D_1 \) rises
(assuming $\rho < \frac{1}{2}$), the private bank then reduces its aggressiveness by cutting down on its sales incentives (or incentives to mobilize deposit). Alternatively stated, in a situation of pure duopoly, the private bank can enjoy its highest profit by setting $\rho = 1/5$. Now if the government gets some stake in the rival bank, the private bank will experience a loss in profit. To make up for the lost profit, it will then raise its revenue incentive above $1/5$. Thus, greater the $\theta$, greater is $\rho$. Thus, managerial incentive is strategic complement to nationalization, or strategic substitute to privatization (which is measured by $(1 - \theta)$).

To solve for the public bank’s response, we maximize $V$ with respect to $\theta$. This gives us

$$\theta = \frac{2 - \beta - \rho(1 + \beta)}{\beta - \rho(3\beta - 1)}.$$ 

Notably, if $\beta = 1$, optimal $\theta$ is $1$ regardless of $\rho$.

Several points are noteworthy. First, given $\rho < \frac{1}{2}$ and $\beta > 1$, government’s choice of privatization is partial. That is, $\theta \in (0, 1)$. Second, when $\rho = 0$, the resulting privatization is still partial, $0 < \theta < 1$. This is because, the government is now concerned about profit, and driving depositor surplus to its maximum by setting $\theta = 1$ involves inflicting loss on both banks. Given $\beta > 1$ that cannot be optimal. Third, from the government’s point of view nationalization (privatization) and managerial incentives are strategic substitutes (complements), as $\theta'(\rho) < 0$. This is exactly opposite of the perspective the private bank has. This is where mixed duopoly is crucially different from pure duopoly. As the government is not only concerned about private bank’s profit, but also values the industry profit relatively more than depositor surplus, it internalizes some of the negative effects on profit that would follow from aggressive deposit mobilization by both banks. So when the private bank is expected to increase its deposit incentives (thus induce greater ag-
gression by its manager in the second stage), the public bank divests its ownership to reduce the public bank’s aggression, in order to contain the overall level of deposit mobilization. Thus, the government accommodates the private bank’s aggression through privatization.

We derive the Nash equilibrium from the intersection of the two reaction functions, i.e. the nationalization reaction function of the public bank and the incentive reaction function of the private bank. Equilibrium $\theta$ and $\rho$ are given as follows

$$\theta^* = \frac{3 - 2\beta}{2\beta - 1},$$
$$\rho^* = \frac{1}{4\beta - 1}. \quad (10)$$

The solution is graphically shown in figure 2. In order to ensure an interior solution we need to assume that vertical intercept of the nationalization reaction function is greater than that of the incentive reaction function. This gives an upward limit on $\beta$, i.e. $\beta < \frac{3}{2}$. Beyond this level of $\beta$, the government becomes too profit oriented and hence would prefer to fully privatize the public bank. Therefore, for $\beta \in (1, \frac{3}{2})$, (10) gives the equilibrium solution of $\theta$ and $\rho$.

Insert Figure 2 here

We can contrast this solution with two situations. First, if there were no private banks at all, what would be the optimal privatization? This can be determined by considering that if $D_1 = 0$ optimal $D_0$ would be $\frac{(1+\theta)R}{2b}$ yielding $V^M = \frac{R^2}{2b} (1 + \theta)[(1 + \theta + 2\beta(1 - \theta)]$ and maximizing $v^M$ one obtains the optimal $\theta$ as $\frac{1}{2\beta - 1}$. This optimal privatization depends only on $\beta$. If
however, $\beta = 1$, $\theta^* = 1$, i.e. divestment under monopoly is optimal only if there is profit concern. Second, if the government had no additional concern for profit (i.e. if $\beta = 1$) its reaction curve would be vertical at $\theta = 1$ and the only Nash equilibrium is then $\rho = \frac{1}{3}$ and $\theta = 1$. This gives rise to a strange situation. Both firms make zero profit, and yet mobilize strictly positive deposits. At $\rho = 1/3$ we can see from figure 1 both $D_0 > 0, D_1 > 0$, though the private bank remains aggressive in the deposit competition, its aggressiveness hardly pays off. But this is also not a situation where the private bank’s best response is to exit. Thus, both banks will be stuck in a state of insolvency.

The mixed duopoly literature generally highlights the aggressiveness of public ownership and how it can force private firms to suffer loss and even exit; but what has not been considered at all is the potential response of the private firms. By using sales-oriented managerial incentives the private firms can prevent their exit from the industry, albeit earning only zero profit. So the managerial incentive can be seen as a survival strategy of private firms in the face of complete nationalization. In this environment, therefore, the government can make the mixed duopoly solvent by having some additional concern for profit. Of course, an immediate implication of the profit concern is that the government will be forced to internalize some of the strategic effects of managerial incentives, and therefore will divest more. We now summarize our main result.

**Proposition 1** *If the government is profit oriented, (i.e. $\beta > 1$), the Nash equilibrium is characterized by the public bank being partially privatized and the private bank offering managerial incentives. Compared to the ‘no managerial incentives’ case, privatization will be greater. With an increase in $\beta$, equilibrium $\theta$ and $\rho$ fall.*
While we have already discussed the equilibrium responses, here we consider the effect of an increase in $\beta$. A rise in the profit orientation of the government leads to greater privatization, and lower managerial incentives. Here the $\theta$ reaction curve shifts to the right, and the $\rho$ reaction curve remains unaffected. Hence equilibrium $\theta$ and $\rho$ decline. Thus, a higher profit orientation of the government induces both banks to move towards profit maximization behavior, and reduce their competitiveness.

Finally we check the social welfare implications of partial privatization and managerial incentives. Recall that $SW = (R - \frac{bD^2}{2})D$, where $D$ is the total deposit. It can be easily seen that $SW$ is an increasing function of $D$ as long as $R > bD$ (which holds in equilibrium). Hence higher $D$ would mean higher social welfare. Therefore comparing social welfares in two situations boils down to comparing total deposits. From the second stage equilibrium deposits as given in (5) we derive the total deposit as

$$D = \frac{R[2 - \rho(1 + \theta)]}{b(1 - \rho)(3 - \theta)}. \quad (11)$$

Next we substitute the equilibrium values of $\theta$ and $\rho$ from (10) in (11) and obtain the equilibrium value of $D$ which is

$$D^* = \frac{R\beta}{b(2\beta - 1)}.$$

We would like to compare $D^*$ with two situations: (i) pure duopoly without managerial incentives, and (ii) mixed duopoly without managerial incentives. In the first case, total deposit is $D = \frac{2R}{3\rho}$ which is obtained by substituting $\rho = \theta = 0$ in (11). Since $\beta > 1$, $D^* > \frac{2R}{3\rho}$. That is, social welfare is higher in the mixed duopoly as compared with the case of a private duopoly without managerial incentives. In the second case, we find the equilibrium industry
deposit without managerial incentive. This is obtained by substituting \( \theta = \frac{2 - \beta}{\beta} \) (which is the optimal value of \( \theta \) when \( \rho = 0 \)) in (11). This yields 
\[
D = \frac{R\beta b}{b(2\beta - 1)} = D^*.
\] Therefore, social welfare in the mixed duopoly with managerial incentives is same as that in a mixed duopoly without managerial incentives. Since \( D \) is same in both situations, depositor surplus is also same and therefore the industry profit is also unchanged. But we know from (7) that the public bank’s profit will fall with an increase in \( \rho \). Then it must be the case that with managerial incentives the public bank’s profit has fallen and the private bank’s profit has risen, by exactly the same amount. Thus, the managerial incentive is playing a merely redistributive role with no effect on efficiency, which is entirely determined by the government’s profit orientation.

We believe, this is a new insight into managerial incentives. In a pure duopoly managerial incentives (offered by two private banks) lead to mutual over-production, which generates higher social welfare, but lowers industry profit. In a mixed duopoly with endogenous privatization, the government internalizes the strategic effects on the private bank and thus softens the intensity of deposit competition by privatizing appropriately. The extent of privatization will however depend on the extent of profit orientation. If, for instance, the government is not at all profit oriented (\( \beta = 1 \)), industry profit will be zero; but with managerial incentives the private firm will still be able to induce a redistribution of deposits with however no profit to redistribute. But if \( \beta > 1 \), the government’s concern for industry profit will be greater and its optimal privatization in the absence of managerial incentive will ensure an industry profit of \( \pi = \frac{R^2\beta(\beta - 1)}{b(2\beta - 1)} \). If now the private bank offers managerial incentives, the government will further divest, so that the industry profit and social welfare remain unchanged, but the private bank’s profit rises at the
expense of the public bank’s and this redistribution of profit will take place via a redistribution of deposits. The following proposition summarizes our finding on social welfare.

**Proposition 2** Social welfare in a mixed duopoly with equilibrium privatization and managerial incentives is higher than that in a private duopoly without managerial incentives; but it is same as that in a mixed duopoly without managerial incentives. Thus in a mixed duopoly, managerial incentives become merely redistributive having no efficiency effect.

4 Conclusion

This paper explores optimal partial privatization and managerial incentives in the framework of a ‘mixed oligopoly’ involving a partly divested public bank. We show that if the government is profit oriented, then the public bank has to be partially privatized, and in response the private bank will offer revenue-linked incentives to its manager. But privatization will be greater than in the case where the private bank does not offer managerial incentives. Thus, managerial incentives and partial privatization appear to be integral features of mixed duopoly. Moreover, profit orientation and managerial incentives appear to be playing two distinct roles. Profit orientation determines the industry profit and managerial incentives determine its distribution between the two banks. This merely redistributive role of managerial incentive seems to be possible only in a mixed duopoly.
References


Figure 1: Deposit reaction functions of public and private banks

\[
R/R_F = \frac{R}{2b(1-\rho)}
\]

\[
R/R_F = \frac{R}{2b}
\]

\[
R/R_F = \frac{(1+\theta)R}{2b}
\]

\[
R/R_F = \frac{R}{b}
\]
Figure 2: Equilibrium privatization and managerial incentives