# THE OPTIMAL TIMING OF PRIVATIZATION: THEORY AND AN APPLICATION TO THE CASE OF TAIWAN

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## ABSTRACT

Privatization has been studied primarily from the standpoint of the post-privatization performance of state-owned firms (SOEs) or of various ways of valuing and privatizing them, but little attention has been paid to the timing of privatization. In this paper we develop theoretical model to consider a situation where the government has the option to delay a planned privatization in the expectation that exogenous events may make the firm more valuable to outside investors sometime in the future. In addition to considering the theoretical aspects of the problem, we apply our model to Taiwan's privatization program to add to the understanding the role of option value in Taiwan's privatization program.

## INTRODUCTION

Governments intent on privatizing state-owned enterprises (SOEs) face a timing problem. Delay in privatization may be accompanied by an increase in the market value of profit-making SOEs over their value at the inception of the privatization program. The government, by waiting, may be able to privatize the firms under more favorable market conditions. For example, the market values of all firms may rise due to cyclical influences or the prices of firms in some sectors may increase due to exogenous shocks caused by developments in technology, foreign prices, etc.. Alternatively, the government may believe that future prices of SOE's may be higher due to the evolution and maturation of the capital market, which can reduce the effects of thinness and thus make it easier to float larger share issues without unduly reducing the price of the shares being sold. Thus, a key, but largely unexamined, issue for government privatization programs is the timing of privatizations of individual firms. In this paper we develop a model that formalizes the government's timing problem using the concept of real options, and we also discuss the model in the light of Taiwanese experience.

By way of motivation for this paper, we note that Taiwan's privatization program has experienced a number of roadblocks, including low initial private offering (IPO) prices for firms being privatized, opposition from legislators due to their perception that SOEs were being under priced, and lack of market enthusiasm for the offerings of the privatization program. These roadblocks resulted in the delay of several IPOs of SOEs, which caused shortfalls in government revenue that forced the government to adjust its budget to match the reduced revenue or to issue government debt to cover the revenue shortfall. The budget changes also resulted in the reduction of government capital expenditures, because such reductions entailed lower political costs than would have resulted from changes in the level of government employment, and these reductions in government investment had an adverse effect on the island economy's long-term economic growth. Increased government debt also increased the borrowing cost for the private sector due to the crowding out effect in the local bond market, which discouraged the private sector's capital investments.

From a decision science perspective, privatization can be viewed as a strategic decision to divest

state-owned assets. The traditional static approach to the decision problem applies cost-benefit analysis, which states that if the net present value (NPV) of the benefits is greater than the NPV of the costs of the strategic decision, then the decision should be carried out immediately. This static approach, however, ignores three important characteristics of the dynamic strategic decision making problem: uncertainty, irreversibility, and flexibility. In this paper we present a model that seeks to encompass these three characters into the decision making process. The primary technique used in this more realistic analysis is called real options analysis (ROA).

## TIMING DECISION

We develop a model of privatization where the government can sell SOEs through IPOs that place the firms' shares in the hands of private investors. We assume that such sales are irreversible, either because the government is unable to spend funds on reprivatization or because it does not want to discourage private investors by reversing its privatization decisions. The government is able to choose which firms to privatize, but it can delay their privatization for some period of time during which market sentiments or exogenous factors can have a significant effect on the value that investors place on the SOEs being privatized. The government faces uncertainty about capital market conditions, demand shocks and technological shocks, and this uncertainty adds a stochastic element to the trend of the firm's value. Because the IPO is irreversible, the government's only choice variable is when to take the firm public. This can occur either immediately at the inception of the privatization program or at some later time.
For undertaking the IPO, the government incurs some direct costs and underwriting fees. The net proceeds to the government from the IPO are defined as $\Omega(\pi_t)$, where

$$\Omega(\pi_t) = \frac{\pi_t}{\delta^m}(1-\lambda) - C$$

The underwriter receives the fraction $\lambda$ of the issue proceeds and $0 < \lambda < 1$. C is the government's fixed direct expense. The value to the government from the sale of the firm consists of the cash flow from the dividends and the proceeds of IPO. The value is defined as

$$F(\pi_t) = \mathrm{E}\left[\int_t^{t+T(\pi^*)} \alpha\pi_s e^{-\beta^p(s-t)} ds + e^{-\beta^p T(\pi^*)}\Omega(\pi^*) \mid \pi_t\right]$$

If the government sells the firm immediately, $T(\pi^*)$=0, where T is the time of privatization and $\pi$ the firm's profit. The value from selling the SOE would be the government's net proceeds from the IPO. That is,

$$F(\pi^*) = \Omega(\pi^*).$$

Then, we have the critical profit level as

$$\pi^* = \frac{C}{\left(\frac{1-\lambda}{\delta^m} - \frac{1}{\delta^p}\right)}$$

If the government waits before privatizing the firm, then $T(\pi^*) > dt > 0$. We have the critical profit level as

$$\pi^{T^*} = \left(\frac{\beta^p}{\delta^p}\right)\left(\frac{C}{\left(\frac{1-\lambda}{\delta^m} - \frac{1}{\delta^p}\right)}\right) = \frac{\beta^p}{\delta^p}\pi^*$$

## EMPIRICS OF PRIVATIZATION IN TAIWAN

In this section we use the model developed above to examine the privatization strategy followed by the Taiwan government in the 1990s in the privatization of a number of large state-owned firms. In many cases, waiting to privatize appeared to be the proper strategy given the values of the relevant parameters.

## CONCLUSION

We analyze the timing of SOEs by treating the privatization through public share offerings as a real option. The government can decide at any date to take SOEs public, but, by doing so it exercises the timing option. Investors value the privatized firm using publicly observed market prices of firms from the same industry. In an efficient market all public information is encompassed in the market prices of similar firms. Performance measures are observable financial and operating variables. The proceeds from an IPO and, therefore, its value to the government depend on market conditions. Over time, the set of public information evolves randomly. This will in turn lead to a stochastic path for the valuation of the privatized SOE. The uncertainty over the future value makes the timing option valuable because the government can wait for improved market conditions before undertaking an IPO. However, the relative inefficiency of SOEs causes the potential market value of the SOEs to decline over time. It is the effect of these two factors the optimal timing of privatization that is investigated in this paper.