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Optimal policy for attracting FDI: Investment cost subsidy versus tax rate reduction☆

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ABSTRACT

This paper examines and compares two policies (investment cost subsidy and tax rate reduction) for the host government to attract FDI. Taking into consideration the firm's indifferent FDI option value between the two policies, the government trades off the immediate and certain lump-sum cost of the subsidy against the future random flow of tax rate reduction. We demonstrate that the optimal policy for attracting FDI depends on the growth rate and the volatility of the profit as well as the discount rate. There exists a critical level in each of the three parameters. The tax rate reduction (or investment cost subsidy) is preferable when the growth rate and the volatility of the profit is higher (or lower), and when the discount rate is lower (or higher). These results are consistent with the empirical findings, which found that governments are more likely to adopt tax rate reduction for firms with high risk and high return.

1. Introduction

Recently, foreign direct investment (FDI) is increasing with the improvement of globalization. FDI has a significant and positive effect on economic growth (see Kim, 1998). For example, FDI can reduce unemployment, increase government revenues by tax collections, reduce imports and/or increase exports, help with technology transfer, and develop local entrepreneurship. Therefore, governments have incentives to attract FDI. There are two most common methods to attract FDI (see Bond & Samuelson, 1986): investment cost subsidy and tax rate reduction.

There is a stream of theoretical literature on the effect of subsidy and tax rate on FDI. See Pennings (2000, 2005), Yu, Chang, and Fan (2007), Danielova and Sarkar (2011), Sarkar (2012), Kijima and Tian (2013), Barbosa, Carvalho, and Pereira (2016), Di Corato (2016), among others.[1] Pennings (2000) showed that with a zero-cost combination (i.e., the value of the government's tax collections is exactly offset by the subsidy it provides), the investment threshold is a decreasing function of the tax rate. Thus, a higher tax rate (but with a correspondingly higher subsidy) will accelerate investment. In other words, the government is better off with a full investment subsidy and a high tax rate. However, in real life, it is rarely observed that governments provide a full investment subsidy.

Yu et al. (2007) found that for a give investment threshold, the expected present value of investment subsidy is smaller than that of

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[1] Compared analysis on optimal policy for attracting FDI from the host government's perspective, there is another stream of literature on choice between horizontal (market-seeking) and vertical (efficiency seeking) FDI as well as choice between exporting and FDI from the firm's perspective. For example, Aizenman and Marion (2004) compared the merits of horizontal versus vertical FDI in the presence of supply and demand uncertainties.

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tax rate reduction. In other words, the government should always adopt investment cost subsidy rather than tax rate reduction to accelerate FDI. However, in fact, there are many governments provide tax rate reduction and/or investment subsidy (see Hansson & Stuart, 1989).

Sarkar (2012) argued that when the government uses a different discount rate from firms, which is assumed to be an increasing function of the tax rate, it might be possible to get an internal optimum, i.e., a positive tax rate and a fractional subsidy. With a wide range of parameter values for numerical examples, the optimal tax rate is generally in the range of 33%− 36%. However, the assumption that the discount rate used by the government is an increasing function of the tax rate seems ad hoc. Also, the optimal tax rate is too high as a result after tax rate reduction.

While the literature above examined how to induce immediate investment through investment thresholds, the objectives of both the foreign firm and the host government are not to speed up FDI but to maximize their profits from FDI. Moreover, as pointed out by Haaparanta (1996), Oman (1999), Morisset and Pirnia (2000), in reality, there exists competition between governments of different countries in attracting FDI. If the policy that the firm prefers is not consistent with the one that the government prefers, the government should take into consideration the firm's indifferent value between the two policies. Therefore, it is necessary to take into consideration the strategic interaction between the foreign firm and the host government through value functions.

In this paper, we provide an analytical framework to explicitly compare the effectiveness of the investment subsidy and tax rate reduction for attracting FDI through value functions. The main questions are as follows: (i) Which policy is more effective in attracting FDI, investment subsidy or tax rate reduction? (ii) Do the results depend on different circumstances? To answer these questions, it is necessary to consider the trade-off between the immediate and certain lump-sum cost of the subsidy and the future random flow of tax rate reduction for the government to choose the policy to attract FDI.

The main contribution of this paper is to analyze the optimal policy for the host government to attract FDI, keeping the same FDI option value of the foreign firm. In contrast to the literature, we demonstrate that the optimal policy for attracting FDI depends on the growth rate and the volatility of the profit as well as the discount rate. When the growth rate and the volatility of the project are higher (or lower), and when the discount rate is lower (or higher), the tax rate reduction (or investment cost subsidy) is preferable. Our model implications are consistent with the empirical evidence literature that documented that governments are more likely to provide tax rate reduction to firms with R&D and innovation activities and firms in high-tech industries, which are considered to have high risk and high return.

The remainder of this paper is organized as follows. Section 2 describes the model's setup. Section 3 briefly reviews the benchmark case, i.e., the investment timing problem in the standard real options framework. Section 4, which is the main part of the paper, examines the effectiveness of investment cost subsidy and tax rate reduction via indifferent option value and compare the results with the analysis via indifferent FDI timing. Model predictions and implications are discussed in Section 5. Section 6 concludes.

2. Model setup

The model is set in a continuous-time risk-neutral framework. We suppose that a foreign firm owns a privileged right to undertake a project in a host country with an irreversible investment cost I and generate an EBIT X, which is given by the following geometric Brownian motion:

$$\mathrm{d}X_t = \mu X_t \mathrm{d}t + \sigma X_t \mathrm{d}z_t, \quad X_0 = x > 0, \tag{1}$$

where μ and $\sigma > 0$ are constants and $(z_t)_{t\geq 0}$ denotes a standard Brownian motion under risk-neutral measure $\mathbb{P}$. Let $r > 0$ denote the discount rate. We assume $r > \mu$ for convergence. Whenever the EBIT X hits the FDI threshold from below, the foreign firm exercises the FDI option by paying the fixed investment cost I. After engaging in FDI, at each instant, the foreign firm receive a cash flow $(1-\tau)X_t$, where τ is the tax rate.

The host government compares the effectiveness of the two policies (investment cost subsidy and tax rate reduction) to attract FDI. If the government decides to provide an investment cost subsidy, then the investment cost is reduced from I to $sI (s \in (0,1)$. If the government decides to provide a tax rate reduction, then the tax rate is reduced from τ to $\tau'(<\tau)$.

3. Benchmark case

Let the FDI time be T. The firm's FDI option value is

$$\begin{aligned} F(x) &= \mathbb{E}\left[\int_{T^i}^{\infty} e^{-r\left(t-T^i\right)}(1-\tau)X_t \mathrm{d}t - e^{-rT^i} I\right] \\ &= \left(\frac{x}{X_T}\right)^{\beta}\left(\frac{1-\tau}{r-\mu}X_T - I\right), \end{aligned} \tag{2}$$

where