

Interactions between capacity expansion options and performance-sensitive debt*

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Abstract

We consider a decision-theoretic setting where a firm decides on capacity expansion—specifically, on when and by how much to expand its production capacity. In contrast to the canonical model of the option to expand, we allow for an endogenous choice of the investment lump. The firm’s operating strategy consists of selecting a time of investment, namely a stopping time, as well as choosing the extra capacity lump added to its existing stock. This firm is not all equity-financed, but is partly financed by a novel type of debt instruments theorized and coined performance-sensitive debt (PSD) by Manso, Strulovici, and Tchisty (2010). Debt financing induces here the possibility for shareholders—to which benefits the management decides—to default on their debt obligations in the spirit of Leland (1994). We investigate the interactions between the performance-sensitive coupon and the firm’s capacity expansion strategy as well as the extent to which PSD can mitigate the underinvestment problem on both the timing and the size of the investment.

We revisit the classical real option problem accounting for additional features. Specifically we consider a decision-theoretic setting where a firm decide on capacity expansion—specifically, on when and by how much to expand its production capacity. Following the terminology in Trigeorgis (1996), this situation is analogous to the exercising of an option to expand capacity (which implies a choice of an investment time); yet, in contrast to the canonical model, we allow for an endogenous choice of the investment lump. The firm’s operating strategy consists of selecting a time of investment, namely a stopping time, as well as choosing the extra capacity lump added to its existing stock. This firm is not all equity-financed, but is partly financed by a novel type of debt instruments theorized and coined *performance-sensitive debt* (PSD) by Manso et al. (2010). Within the literature on debt financing, there are basically two streams depending on whether defaulting is part of the firm’s strategy. Debt financing induces here the possibility for shareholders—to which benefits the management decides—to default on their debt obligations in the spirit of Leland (1994). Our intent is to investigate the impact of a debt-overhang on both the timing and the size of the investment. While it is well known that debt will induce under-investment (Myers, 1977; Hennessy, 2004), the combined effect on debt on the exercise strategy of an expansion option is understudied; here the strategy is twofold, including a choice of investment time and production scale.

In this manuscript, we study the interplay between capital-budgeting decisions and a firm’s debt structure via performance-sensitive debt. This mix of decisions complicates considerably the mathematical treatment of the real option problem. An interesting question is whether the (linear) performance-sensitive debt instrument mitigate some of the welfare losses induced by debt (namely the debt overhang). Assuming managers’s incentives are perfectly aligned with those of shareholders, will they pick an investment policy closer to first best (i.e. to the unlevered case)? Will the gain in terms of less under-investment compensate for the expected higher probability of bankruptcy due to PSD? In particular, will the model give an interior solution for the optimal sensitivity of debt (as well as the optimal leverage)?