

# Capital Structure, Product Market Dynamics, and the Boundaries of the Firm<sup>\*</sup>

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## Abstract

We study how interactions between financing and investment decisions can shape firm boundaries in innovative markets. In particular, we model new product market opportunities as growth options and ask whether they are best operated inside large incumbent firms (integration) or in separate, specialized firms (non-integration). Using a theoretical model in which value-maximizing corporate investment and financing decisions are jointly determined, we show that integration best protects assets in place value, while non-integration best protects the value of the growth option and maximizes financial flexibility. These forces drive different organizational forms depending on firm and product market characteristics. We also show that alliances organized as licensing agreements or revenue sharing contracts sometimes better balance the different sources of value, and thus may dominate more traditional forms of organization.

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*Capital Structure, Product Market Dynamics, and the Boundaries of the Firm*

*By Dirk Hackbarth, Richmond Mathews, and David Robinson*

Financial economists have long understood that the presence of pre-existing debt financing can cause managers to make suboptimal investment decisions when they act in the interests of existing shareholders. At the same time, a vast literature in industrial organization and the economics of organizations has explored how firm boundaries are important for determining which types of firms exploit new product market opportunities. In the paper titled *Capital Structure, Product Market Dynamics, and the Boundaries of the Firm*, we examine how debt financing and resulting investment distortions interact with the dynamics of product markets to determine the optimal organization of innovative projects.

Consider recent developments in the automotive industry. Most auto companies use significant debt financing because of their sizeable assets in place, but must also respond dynamically to changing product market opportunities. Over the past several years, automakers have had to determine whether and how they will respond to the rise in demand for electric vehicles. Should they produce new electric vehicles themselves, help fund start-up firms with separate control rights over electric vehicle production, or form alliances or joint ventures? Currently a wide range of organizational forms is observed, with, for example, major automakers GM and Nissan introducing their own mass produced electric vehicles aimed at the lower end of the market, stand-alone firms Tesla and Fisker independently developing and marketing higher-end electric luxury and sports cars, and Toyota forming an alliance with Tesla to co-produce electric cars under the Toyota brand name.

To help explain some of these patterns, we build a theoretical model in which a set of assets in place and a related new opportunity modeled as a real option must be organized and financed. Both corporate activities are operated subject to substantial

uncertainty about the size and timing of future cash flows. For example, a company like Starbucks has thousands of stores all over the world, which represent assets in place with uncertain future cash flows. It also has real options to open many new stores in China and India, as well as the ability to introduce new products within its existing stores, all of which also entail risky future cash flows.

We first derive valuations under two competing organizational forms, reflecting the fact that the new opportunity can be organized inside an existing firm holding the assets in place (innovation by a large or “integrated” firm) or can be organized as a separate firm controlling the option but without assets in place (innovation by a small “non-integrated” firm). In the Starbucks example, a new opportunity can be expansion into a new geographic area, or it may be diversification into fresh fruit juices. In both examples, the new opportunity can be exploited either by expanding the existing organization or by creating a separate organization with its own stores.

In an Integrated design, the debt associated with financing assets in place delays exercise of the option due to “debt overhang,” i.e., the tendency of managers to delay investment in positive NPV projects when much of the benefit will accrue to debtholders rather than equityholders. This inefficiency naturally pushes the innovative activity out of the large firm in order to minimize investment distortions while also maximizing capital structure flexibility. Several realistic features of product markets work against this tendency, however, and the optimal organization of innovative activities is ultimately determined by balancing the investment and financing benefits of non-integration against factors that favor developing the innovative project inside the large firm.

The first such factor is cannibalization. Because the new opportunity is related to the assets in place, exercising the option naturally involves cannibalizing some of the profits associated with the assets in place. In general, the large, integrated firm will take the

cannibalization costs into account in its decision of when to exercise the option, but the small, stand-alone firm will not. Thus, there can be important product market externalities associated with having a non-integrated firm undertake the new activity. As cannibalization increases, this tends to push the optimal organizational design towards innovation in the large firm. Returning to the automotive example, the decisions of GM, Nissan, and Toyota to enter the electric car market undermines some of the potential revenues in the conventional car market (i.e., causes cannibalization), which they will take into account in the timing of new electric car introductions. Similarly, in the Starbucks example the introduction of fresh fruit juices could cannibalize coffee sales to some extent.

The second key factor is obsolescence risk. This embodies the idea that the new project can potentially be preempted by competing firms. Thus, the option can jump to being worthless if a competitor innovates first. This alternative type of innovation by a third party can also adversely affect the value of assets in place. In the automotive example, there are several, young fringe companies, which pose such a threat to existing, old firms in the industry. These newcomers either convert cars into electrical vehicles (e.g., Advanced Mechanical Products) or try to design new electric vehicles from scratch (e.g., Aptera Motors). In the Starbucks example, other coffee companies may expand into a new market first, or stand-alone fresh fruit juice stores may enter first and obtain a first mover advantage.

While the cannibalization effect is straightforward, the effect of obsolescence risk and the aforementioned cash flow risk on the optimal organizational design is not. An increase in cash flow risk tends to make non-integration more likely. This is in line with existing conventional wisdom that smaller firms tend to be more innovative in riskier markets. However, an increase in obsolescence risk instead tends to make integration more likely. This difference is driven by the fact that the two types of risk have opposite effects on the optimal exercise time for the option. Cash flow risk increases option

value and makes it optimal to delay exercise, while obsolescence risk speeds up exercise to avoid preemption. Because the value of assets in place is more sensitive to cannibalization concerns when it is likely to happen in the near future, it turns out that protecting assets in place value by choosing integration is more important when exercise occurs earlier, i.e., when cash flow risk is low or obsolescence risk is high.

The result that non-integration is more likely when obsolescence risk is lower may seem somewhat counter-intuitive, as many argue that small firms are better able to respond in highly dynamic markets. This may be true, but our results indicate that when the source of high uncertainty is the risk of obsolescence due to preemptive innovation by third parties, a small innovator's behavior may impose excessive costs on incumbent firms, so that it could be optimal for them to be absorbed by existing players in the market despite the negative impact on their own value. The resulting empirical implication is then that major innovative advances are more likely to arise within specialized, small firms when the ideas are so novel that obsolescence is unlikely, but ideas that are more aggressively contested by competing innovators might be more often incubated within existing firms.

Returning to the automotive example, our predictions are borne out in the patterns we observe in that industry. Higher-end electric cars aimed at luxury buyers, which likely have higher cash flow risk (their demand is more sensitive to external macroeconomic factors) but lower obsolescence risk (luxury cars are less "commoditized") are currently more likely to be produced by smaller, more specialized producers such as Tesla and Fisker. Lower-end cars, with relatively lower cash flow risk and higher obsolescence risk, and which are also more likely to cannibalize the companies' existing traditional offerings, are being produced by major integrated firms.

We also explore how optimal organizational design responds to changes in the corporate tax rate, the magnitude of bankruptcy costs, and the relative size of the

growth option. Our analysis shows that non-integration is more likely to be optimal the greater is the corporate tax rate or the smaller is the level of bankruptcy costs. As the tax rate is higher or bankruptcy costs are lower, the importance of debt overhang and financial flexibility are magnified. This leads to non-integration since capital structure decisions can then be made independently. We also show that non-integration is more likely to be optimal the larger is the relative magnitude of the growth option. When the growth option is larger relative to assets in place, the negative effects of debt overhang and financial inflexibility are magnified, which leads to non-integration in order to preserve option value.

Finally, we investigate how hybrid organizational forms, such as alliances, could fit into our framework. In particular, starting from our non-integrated case, we investigate the effect of an alliance that takes the form of a licensing or revenue sharing contract. This is modeled as a proportion of the cash flows from the innovative project following exercise that is promised to the large firm. Because the small firm still bears the full cost of exercise, this has the effect of causing the small firm to exercise the option later, closer to the time that is optimal to protect the value of assets in place. Since the firms choose the licensing fraction ex ante to maximize their joint profits, the added flexibility of this contract can be quite valuable, such that the alliance form often dominates both non-integration and integration. Such an alliance exists between Toyota and Tesla in electric vehicle production, with Toyota retaining the rights to introduce resulting new electric cars under the Toyota brand name while Tesla achieves access to parts, production, and engineering expertise to use in marketing cars under its own brand name. Intuitively, separating the two firms removes debt overhang from the decision of when to introduce Tesla branded electric cars and increases financial flexibility, while the licensing contract ameliorates the resulting problem of sub-optimal joint profit maximization in the exercise decision because Toyota's share of the profits from future electric car production help optimize the timing of new product introductions.

Our results should prove useful for future research on whether successful exploitation of new product market opportunities occurs inside or outside existing incumbent firms across different types of markets, as well as investigations of the role and structuring of alliances. We also believe our paper has immediate practical relevance. Corporate Boards and CEOs can apply our model's predictions while formulating their innovation strategies. Management consultants and advisory firms can use our theoretical framework as a basis for analyzing and assessing value propositions for their clients.

Our full paper can be accessed at: <http://ssrn.com/abstract=1767483>.