Enterprise Risk Management and Capital Budgeting Under Dependent Risks: An Integrated Framework

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Risks: An Integrated Framework

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Executive Summary

Risk management and capital budgeting are two critical components of the corporate decision process. They often need to be considered jointly at the corporate level because of their natural interaction through the dependent risk exposures and other synergetic relationships within an intricate corporate structure in a dynamic business environment. This paper develops an integrated framework that aligns these two important corporate strategies across business divisions to optimize the streamlined enterprise strategic goal in a multiperiod setting. The proposed integrated framework can serve as a practical guideline for corporate executives to optimally coordinate capital budgeting and risk management at the enterprise level.

1. **Introduction**

Risk management and capital budgeting are critical components of the dynamic corporate decision process. In practice, they often need to be considered jointly as they are naturally connected by the dependent risk exposures and a variety of other synergetic relationships within an intricate corporate structure.

In much of the current literature, the subjects of capital budgeting and risk management have been studied in separate fashions, resulting in a simplified setup neglecting the joint impact of these two business components. Meanwhile, traditional corporate risk management literature addresses risks within silos, ignoring possible risk dependencies and, hence, their collective contribution to overall corporate performance.

Without an efficiently integrated decision process, corporations could be misled to suboptimal investment and risk management decisions, leading to a permanent loss of the firm value.

These concerns give rise to the development of enterprise risk management (ERM) (see COSO 2004; Ai et al. 2010), for which the most important goal and challenge is to fully encompass risk management into overall corporate decisionmaking.

2. Contribution

Following the spirit of the pioneering work by Froot et al. (1993) and Froot and Stein (1998) where corporate risk management is necessitated by capital market frictions and where capital budgeting and risk management functions become connected, we propose in this paper an integrated framework that allows corporations to design optimal investment and risk management strategies jointly and endogenously under dependent risks in a multiperiod setting.

This paper builds upon and contributes to several strands of literature. First, we contribute to the corporate risk management (e.g., Froot et al. 1993; Froot and Stein 1998) and ERM literature (see Ai et al. 2010; COSO 2004) by operationalizing the concepts of ERM and incorporating risk management into corporate decisionmaking. Second, we contribute to the capital budgeting literature by studying optimal capital budgeting in a multidivisional firm with dependent risk exposures. Finally, we also make technical contributions to the decision analysis literature by further developing the decision tools provided in Gustafsson and Salo (2005) and Wang and Dyer (2012) to handle the more managerially relevant problem of capital budgeting and enterprise risk management.

3. **The Integrated ERM and Capital Budgeting Framework**

Our integrated enterprise risk management and capital budgeting framework considers a multidivisional corporation with a multiperiod capital budgeting horizon. The framework is formulated by solving the optimization problem of corporate decisionmakers, where the top executives allocate capital to projects in different divisions in light of dependent risks within and across business divisions and determine corporate risk management strategies simultaneously.

We model risk dependency with copulas and construct the optimization problem via the intuitive and visual interface of a decision tree. Using only information of marginal distributions and correlations, this copula-based approach allows multiple dependent uncertainties with arbitrary marginal distributions to be represented in a decision tree with a sequence of conditional probability distributions.

The expected future project cash flows depend on the corporate states of nature driven by multiple sources of risks across different business divisions and time periods. The corporate executives then make dynamic decisions for the project's portfolio contingent on the realized uncertainties and their previous decisions. In addition to incorporating dependency and allowing for "natural hedges" among risks and divisions, the proposed integrated framework also considers explicit risk management implementations including hedging and other commonly used risk management strategies, e.g., (re)insurance and risk control. This framework can be easily adapted and internalized by corporate executives to obtain optimal solutions in an integrated decisionmaking process.

4. A Case Illustration for a Financial Services Conglomerate

Many financial services companies have expanded and consolidated their businesses to achieve economies of scope and to maintain competitiveness. These different lines of business entail interrelated risk exposures implicating an integrated risk management and capital budgeting process on the corporate level.

We present a hypothetical example of such a financial services company to illustrate our integrated framework. The case study shows that the optimal performance target would be reduced significantly if we ignore the risk dependencies and, forgoing appropriate hedging strategies, would further reduce the optimal value with or without the dependence modeling. We also examine the robustness of the optimal decisions to the correlation estimates. The sensitivity analysis results suggest that the optimal decisions are robust to assessment errors.

5. Conclusion

In this paper, we propose an integrated ERM and capital budgeting framework under dependent risks in a multidivision, multiproject and multiperiod environment. We formulate the model as an optimization problem of the corporate decisionmakers and construct the model via a decision-tree interface. As business divisions are intrinsically connected by a set of dependent risk exposures, the integrated framework promotes efficiency in both types of corporate decisions.

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