



Dynamic risk management[☆]



Adriano A. Rampini^{a,*}, Amir Sufi^b, S. Viswanathan^a

^a Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC 27708, USA

^b University of Chicago, Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL 60637, USA

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ABSTRACT

Both financing and risk management involve promises to pay that need to be collateralized, resulting in a financing versus risk management trade-off. We study this trade-off in a dynamic model of commodity price risk management and show that risk management is limited and that more financially constrained firms hedge less or not at all. We show that these predictions are consistent with the evidence using panel data for fuel price risk management by airlines. More constrained airlines hedge less both in the cross section and within airlines over time. Risk management drops substantially as airlines approach distress and recovers only slowly after airlines enter distress.

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1. Introduction

What determines the extent to which firms engage in risk management? A central insight from the theoretical literature is that firms engage in risk management because financing constraints render them effectively risk averse (see Froot, Scharfstein, and Stein, 1993). This insight has motivated a large number of empirical papers. However, the empirical findings do not support the prediction that

firms more likely to face financial constraints, such as small firms, are more likely to manage risk. The main robust pattern that emerges from this literature is that small firms engage in less risk management, leading Stulz (1996) to conclude that “[t]he actual corporate use of derivatives, however, does not seem to correspond closely to the theory” (page 8).

In this study, we challenge the notion that financial constraints and risk management should be positively correlated theoretically and empirically. We provide a model that predicts that commodity price risk management should be lower and even absent for firms that are more financially constrained. The basic theoretical insight is that collateral constraints link the availability of financing and risk management. More specifically, if firms must have sufficient collateral to cover both future payments to financiers and future payments to hedging counterparties, a trade-off emerges between financing and risk management. Commodity price risk management shifts net worth across states, and firms are effectively risk averse about net worth. When net worth is low and the marginal value of internal resources is high, firms optimally choose to use their limited net worth to finance investment, or downsize less, at the expense of hedging. Consistent with our model,

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* Corresponding author. Tel.: +1 919 660 7797; fax: +1 919 660 8038.

E-mail address: rampini@duke.edu (A.A. Rampini).

American Airlines, for example, notes in its 2009 10-K Securities and Exchange Commission (SEC) filing that “[a] deterioration of the Company’s financial position could negatively affect the Company’s ability to hedge fuel in the future.”

We explicitly consider input price hedging—for example, fuel price hedging by airlines—in a dynamic neoclassical model wherein firms require capital and an input to produce output next period. Input spot prices are stochastic, and the firm can purchase inputs in the spot market or contract to purchase the input in a state-contingent way in advance. Such a promise to purchase a specific quantity of inputs in some state next period at a prespecified price that exceeds the spot price needs to be collateralized. These promises as well as the promises to repay loans count against collateral constraints, resulting in a trade-off between financing and risk management. High input prices result in low cash flows and, hence, low net worth. Collateral constraints render the firm effectively risk averse in net worth, providing a rationale for input price risk management. Importantly, firm value is concave in net worth and, because input price hedging shifts net worth across states, the firm could hedge input prices, even though the profit function is convex in spot prices, as is standard in neoclassical production theory and unlike in the ad hoc approach often used in the literature. Collateral constraints imply a basic trade-off between financing and commodity price risk management similar to the one identified by Rampini and Viswanathan (2010, 2013) in the context of productivity risk. This trade-off implies that when firms’ current net worth is sufficiently low, the financing needs for investment override the hedging concerns. Firms pledge as much as possible to finance investment, or be forced to downsize less, leaving no room for risk management.

We examine the empirical predictions of the model by analyzing jet fuel price hedging by US airlines. This empirical setting is ideal for a number of reasons. First, jet fuel expenses represent a very large component of total operating expenses for airlines. On average, they are about 20% in our sample. Airlines regularly state in their financial disclosures that the cost of jet fuel is a major input cost and a key source of cash flow risk. Further, a number of financial instruments allow airlines to hedge jet fuel price risk. In addition, most airlines disclose the fraction of next year’s expected fuel expenses that they have hedged in their 10-K SEC filings, which gives us unusually detailed panel data on risk management at both the extensive and intensive margin in contrast to most of the previous literature. Finally, by focusing on the airline industry as an empirical laboratory, we hold constant other characteristics of the economic environment that might vary across industries.

The discussion of fuel hedging by airlines in their 10-K SEC filings reveals a very close connection between collateral considerations and risk management. For example, Southwest Airlines in its 2010 10-K SEC filing explicitly states that its jet fuel price hedges are collateralized with owned aircraft, which is exactly the mechanism linking collateral, financing, and hedging in our model. This tight link between collateral requirements and risk management decisions is largely ignored in the extant literature on risk management.

Our empirical analysis is based on hand collected data on jet fuel price hedging from 10-K SEC filings. Our data set covers 23 US airlines from 1996 through 2009 for a total sample of 270 airline-year observations. We supplement the hedging data with information from Capital IQ and Standard and Poor’s (S&P) Compustat. The panel structure of the data allows us to exploit both cross-sectional and within-airline variation to assess the correlation between measures of net worth and risk management, whereas most previous studies cannot separately exploit within-firm variation in part because many of them use cross-sectional data or data with a limited time series dimension only and in part because they largely rely on dummy variables for derivatives use that have only limited within-firm variation.

We first show that almost no airline hedges 100% of its jet fuel price risk for the next year and that hedging is completely absent for a large number of airlines. Thirty percent of the airline-year observations involve no hedging, and the average hedging is only 20% of expected jet fuel expenses among airlines without fuel pass through agreements.¹

Using several measures of net worth, the empirical counterpart of the key state variable in our model, we then show a very strong positive cross-sectional correlation between net worth and the fraction of next year’s fuel expenses hedged. Using airline averages over the entire sample, that is, cross-sectional variation only, we find that airlines with higher net worth (either in levels or scaled by total assets), higher cash flow, and higher credit ratings hedge more of their expected fuel expenses. In terms of magnitudes, a 1 standard deviation increase in the market value of net worth scaled by the market value of the firm is associated with a 0.5 standard deviation increase in the fraction of next year’s fuel expenses hedged. Because this correlation obtains even when net worth is scaled by assets, it is not simply a reflection of the well-known size pattern in risk management.

The strong positive correlation between measures of net worth and hedging also holds within airlines over time, a dimension that few studies are able to exploit separately. Using airline fixed effects regressions, we show that within-airline variation in measures of net worth are strongly positively correlated with the fraction of fuel expenses hedged. We also use a first difference specification, which is perhaps the most stringent test of the correlation. We find that an increase in net worth from last year to this year for a given airline is associated with an increase in the fraction of next year’s fuel expenses hedged. The magnitude of the correlation is similar across the cross-sectional, fixed effects and first difference specifications. Moreover, we instrument for net worth using operating income, as variation in operating income due to variation in productivity is the main source of idiosyncratic net worth variation in the model. The two stage least squares estimates are qualitatively similar.

¹ A fuel pass through agreement is part of an overall agreement in which a regional airline provides jet service on a code sharing basis on behalf of a major carrier, which is responsible for the scheduling, pricing, and marketing of the route and provides the jet fuel.

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