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A View Inside Corporate Risk Management

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Abstract. Why do firms manage risk? According to various theories, firms hedge to mitigate credit rationing, to alleviate information asymmetry, and to reduce the risk of financial distress. However, empirical support for these theories is mixed. Our paper addresses the "why" by directly asking the managers that make risk management decisions. Our results suggest that personal risk aversion in combination with other executive traits plays a key role in hedging. Our analysis also indicates that risk-averse executives are more likely to rely on (more conservative) fat-tailed distributions to estimate risk exposure. While most theories of risk management ignore the human dimension, our results suggest that managerial traits play an important role.

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Keywords: risk management • hedging • managerial risk aversion • behavioral finance • manager fixed effects • interest rate risk • credit risk • commodity risk • foreign exchange risk

1. Introduction

Why do firms hedge? Various economic theories suggest that firms engage in risk management to mitigate credit rationing (Froot et al. 1993, Holmström and Tirole 2000), to alleviate information asymmetry (DeMarzo and Duffie 1995, Breeden and Viswanathan 2016), and to reduce the risk of financial distress (Smith and Stulz 1985, Stulz 2013). Over the last two decades, these theories have motivated numerous empirical studies; however, there is only mixed evidence that the predictions from these theories explain the practice of risk management. There is evidence that firms are more likely to hedge if they have better investment opportunities, which is consistent with both credit rationing and financial distress motives of risk management (e.g., Nance et al. 1993, Geczy et al. 1997, Gay and Nam 1998, and Graham and Rogers 2002). However, empirical studies also show that small firms hedge less (not more), even though they are arguably more affected by credit rationing (e.g., Mian 1996, and Geczy et al. 1997). The common denominator of this empirical research is the focus on the characteristics of companies.

In this paper, we take a different approach. We focus on the characteristics of the individual managers of the companies that hedge. This human element of risk management motivates the central questions of our paper: Is there a link between an executive's risk aversion and her company's propensity to hedge? Is the relation between risk aversion and risk management affected by the risk manager's personal characteristics, such as age, experience, and education? Does executive compensation interact with risk aversion? Does risk aversion affect how executives assess their firms' risk exposures?

The lack of data on risk aversion and executive characteristics in the context of corporate risk management has presented a major challenge to answering these questions. This type of information is not available in standard archival data sources (such as COMPUSTAT), which only provide data on observed outcomes as recorded in annual reports or other corporate documents. To overcome these limitations, we perform a psychometric test on 681 CFOs from around the world to estimate their degree of risk aversion. At the same time, we gather information about CFOs' compensation, age, experience, and education, and whether their companies engage in risk management.[1] Finally, we collect data on firm demographics, which we use to control for credit rationing, information asymmetry, and financial distress motives for hedging. We use this information to test the key question of our study: Is there a human element in corporate risk management?

For the first time in the literature, we find that more risk-averse managers are more likely to work at firms that engage in risk management. We also show that a firm's propensity to hedge is higher when executives have more of their personal wealth tied to the firm (i.e., among executives compensated with stock and options). Finally, we document that the relation between personal risk aversion and risk management is stronger for younger executives, for executives with

shorter job tenure, and for executives with an MBA or another master's degree, consistent with career concerns and education modifying the effects of risk aversion on hedging.

Our findings are consistent with two theoretical perspectives. In line with agency theory (e.g., Smith and Stulz 1985, and Ross 2004), our results suggest that risk-averse executives hedge to mitigate the effect of their personal exposure to the firm (even if such hedging may not be value maximizing from the perspective of well-diversified shareholders). Our findings also are generally consistent with the prediction from the manager-company matching literature (e.g., Rosen 1982, and Terviö 2008) that firms that hedge prefer to hire risk-averse executives (who plausibly are more willing to embrace and implement the firm's risk management policy.)[2] Under the matching hypothesis, firms optimally engage in risk management to maximize shareholder value and the manager simply acts as an agent to implement the firm's hedging policy.

Overall, our analysis suggests that the "human factor"—executive risk aversion interacting with compensation and personal characteristics related to age, experience, and education—plays a crucial role in corporate risk management decisions.

We also examine how risk management policies are implemented. To manage risk, a manager must first assess risk exposure (e.g., measure the firm's commodity risk exposure). Despite a number of empirical studies on the determinants of hedging, there is scant research on how firms assess risk exposure. Our analysis indicates that risk-averse executives are more likely to rely on (more conservative) fat-tailed distributions to estimate risk exposure.

Tufano (1996) is one of the early empirical studies to consider the role of managerial incentives for risk management. In line with our results, he finds that firms are more likely to hedge if executives own more stock and have a shorter job tenure. However, Tufano does not find strong evidence that executives' age matters for hedging policies. Knopf et al. (2002) find that firms are more likely to hedge if executives' stock and option portfolios are more sensitive to their firms' stock prices. Other studies linking executive compensation to corporate hedging include Graham and Rogers (2002) and, more recently, Chernenko and Faulkender (2011), and Bakke et al. (2016). While these studies make important contributions to our understanding of how executive incentives affect corporate hedging, none of them has a direct measure of managerial risk aversion. Fatemi and Glaum (2000) present one exception. These authors ask German executives how risk averse they are with respect to five different types of risk (stock price risk, interest rate risk, commodity price risk, counterparty risk, and foreign exchange risk). However, they do not explicitly study the relation between risk aversion and corporate hedging, nor do they assess risk aversion with a psychometric test. Our survey instrument allows us to study how managerial risk aversion interacts with compensation policy and personal traits in shaping corporate hedging. Moreover, we use a well-established psychometric test to assess risk aversion rather than simply asking the executives how risk averse they are.

While our survey is well suited to study the human element of risk management, there are limitations with our approach. For instance, it is possible that the sample of respondents is not representative of the underlying population. Similarly, it is possible that some of the survey questions are misunderstood or otherwise produce noisy measures of risk management decisions, firm characteristics, or managerial traits. Finally, we are limited to a single cross-section of firms. As a result, we cannot make causal inference. To alleviate some of these concerns, we consulted with design experts, conducted focus groups, and performed beta tests in an attempt to minimize ambiguity in the questions. Further, we confirm that our sample is generally representative of data from standard archival databases in terms of basic demographics related to size, dividends, profitability, leverage, and cash holdings. In the end, we hope that our findings highlight issues that deserve further investigation, hopefully in settings that allow inference on causality. Methodologically, establishing causality between risk aversion and hedging would probably require the random assignment of risk management executives to firms, something that is not easily attainable in practice. We believe lab experiments might be a natural arena for future investigations.

The paper is organized as follows. The next section provides a review of risk management theories. We describe the survey data in Section 3. Section 4 presents our findings. The final section offers some concluding remarks.

2. Theories of Risk Management: Market Frictions and the Individual Manager

In this section, we provide a brief overview of the theories that guide our empirical analyses. In the absence of capital market frictions, hedging can affect the variability of cash flows but not necessarily their expected value. In this case, risk-neutral firms do not need to hedge because shareholders can hedge on their own without incurring any additional costs. However, in the presence of market frictions, hedging can be beneficial even if firms are risk neutral.

One of the classic motivations for corporate risk management is to mitigate the effects of constraints on the firm's ability to invest: the credit rationing hypothesis of risk management (Froot et al. 1993, Holmström

and Tirole 2000). Hedging mitigates the effect of credit rationing by reducing the volatility of cash flows that can be used to fund investments.[3]

Rampini and Viswanathan (2010, 2013) tie why firms do not hedge to the limited availability of collateral, which could lead financially constrained companies to hedge less than their unconstrained counterparts. In their model, lenders require that financially constrained firms pledge collateral to borrow. Thus, all else equal, we should expect financially constrained firms with low collateral capacity to be less likely to hedge relative to financially constrained companies with high collateral capacity.

Smith and Stulz (1985) consider a world where firms issue debt to create tax shields. In this framework, the authors show that if bankruptcy is costly, hedging can increase the firm's value—even in the absence of credit rationing—because by reducing the volatility of cash flows, hedging effectively reduces the risk that the firm defaults. This line of reasoning represents the financial distress hypothesis of risk management.[4]

DeMarzo and Duffie (1991, 1995), Raposo (1997), and Breeden and Viswanathan (2016) argue that in the presence of information asymmetry, outsiders cannot separate managerial ability from external contingencies (e.g., currency fluctuations). Higher ability managers hedge to signal their type by mitigating the effect of hedgeable risks on firm performance. Lower ability managers do not hedge because risk management is costly.

In sum, the theories discussed in this section focus on the link between market frictions (credit rationing, limited collateral, costly financial distress, and information asymmetry) and corporate hedging. The common assumption in these theories, with the exception of Smith and Stulz (1985), is that executives are aligned with (well-diversified) shareholders, and as such, they act as risk-neutral agents.

In the agency models of risk management (Stulz 1984, Smith and Stulz 1985, Holmström and Ricart i Costa 1986, Lambert et al. 1991, Carpenter 2000, and Ross 2004),[5] executives are risk averse. By relaxing the assumption of risk neutrality, agency models of risk management emphasize the importance of personal risk preferences for hedging. Given that managerial claims to the firm are not easily diversifiable (and underdiversification can be costly),[6] risk-averse managers can reduce the effect of the nondiversifiable risk of their claims by hedging, even when this decision is not value maximizing from the perspective of well-diversified shareholders. (For example, executives in the oil industry could reduce their personal exposure to oil price fluctuations by selling oil price forward contracts as a part of their firm's hedging policy.) In principle, firms could tailor executives' incentives so that managers act in the best interest of well-diversified shareholders. However, firms often do not know the full composition of the executives' personal portfolios and therefore compensate their managers with equity to try to align their interests with the interests of shareholders. Because equity compensation reduces the diversification of the executive's portfolio, the executive might engage in hedging even if doing so is not in the best interest of shareholders.

In the manager–firm matching literature, (Rosen 1982, Lazear 1986; and more recently, Terviö 2008, Gabaix and Landier 2008, Edmans and Gabaix 2011, and Bandiera et al. 2015), firms and managers "select" each other based on corporate needs and policies, managerial characteristics (e.g., risk aversion, talent, experience, or education), and ownership structure. While this literature does not model hedging explicitly, the matching framework implies that firms for which risk management is desirable are more inclined to hire risk-averse executives (who presumably are more willing to embrace these firms' hedging policies). In contrast to the agency models of risk management, in the matching literature, firms optimally hedge to maximize shareholders' value and the managers simply act as an agent to implement firms' policies.

In our survey, we estimate managerial attitudes toward risk using a psychometric-test design that follows Graham et al. (2013). We use these data to test the relation between personal risk aversion and corporate risk management. Importantly, we also gather information on executive compensation and other personal characteristics related to compensation structure, age, experience, and education. This allows us to assess whether the relation between personal risk aversion and corporate risk management is modified by executive compensation and personal characteristics.

3. Data

3.1. The Data Gathering Process

To obtain our data, we contacted members of the Duke-CFO Magazine Global Business Outlook panel, the International Swaps and Derivatives Association (ISDA), and the Global Association of Risk Professionals (GARP). We invited CFOs to take part in the survey via email in the last week of February 2010. Reminder emails were sent throughout March 2010. The survey closed at the end of April 2010. We asked the email recipients to fill out the survey only if they had decision-making authority about risk management. While we cannot rule out that the CEO and other top executives also play an important role in hedging (see, for example, Jagolinzer et al. 2011, and Morse et al. 2016), our survey is designed to ensure that our respondents are among the key decision makers for corporate risk management.

The sample includes nonfinancial companies in North America, Europe, Asia, and other regions

Table 1. Descriptive Statistics

Panel A: Firm characteristics

			North America	Europe	Asia	Other regions	Public	Private
Variables	Mean	Obs.	Mean					
Risk Management	0.50	342	0.45	0.64	0.53	0.60	0.73	0.37
Large	0.28	342	0.31	0.41	0.17	0.10	0.55	0.13
Ratings	0.43	342	0.46	0.45	0.36	0.50	0.63	0.31
Dividend Payer	0.51	342	0.39	0.63	0.69	0.50	0.63	0.43
Investment Prospects (0–100)	65.11	342	67.01	63.88	61.22	63.50	67.16	63.87
Credit Line	0.77	342	0.76	0.79	0.76	0.90	0.81	0.74
Cash Holdings	0.19	342	0.17	0.17	0.26	0.15	0.19	0.19
Profitable	0.77	342	0.71	0.80	0.88	0.70	0.79	0.75
Leverage	0.27	342	0.28	0.31	0.23	0.25	0.29	0.26
Public	0.37	342	0.37	0.36	0.39	0.50	1.00	0.00

Panel B: Regional distribution	Obs. [%]	Panel C: Industry distribution	Obs. [%]		Obs. [%]
North America firms:	192 [56%]	Mining/Basic materials:	27 [8%]	Technology:	28 [8%]
European firms:	55 [16%]	Manufacturing (industrial good):	72 [21%]	Services/Healthcare:	88 [26%]
Asian firms:	82 [24%]	Manufacturing (consumer good):	44 [13%]	Diversified/Other:	51 [15%]
Other region firms:	13 [4%]	Transportation/Utilities/Media:	32 [9%]		

Notes. This table reports summary statistics for the main variables used in the study. The data are from the Corporate Risk Management Survey, which was conducted in the first quarter of 2010. The sample includes nonfinancial firms from around the globe. We focus on the sample of firms we use in our regressions. Descriptive statistics for the full-survey sample are in the appendix (Table A.1). *Risk Management* is an indicator variable for firms that engage in risk management. *Large* is an indicator variable for firms with sales of at least $1 billion. *Ratings* is an indicator variable for firms with a debt rating. *Dividend Payer* is an indicator variable for firms that pay regular dividends. *Investment Prospects* reflects the CFO's rating of the firm's long-term investment and growth opportunities, ranging from 0 (no growth opportunities) to 100 (excellent growth opportunities). *Credit Line* is an indicator variable for firms with a line of credit. *Cash Holdings* is cash holdings and marketable securities as a percentage of total assets. *Profitable* is an indicator variable for firms that reported accounting profits during the previous fiscal year. *Leverage* is the ratio of total debt to total assets. *Public* is an indicator variable for firms listed on a stock exchange. North America Firms are those headquartered either in the United States or Canada. European Firms are those headquartered either in the European Union or other European countries. Asian Firms are those headquartered in an Asian country. Other Region Firms are those headquartered in Australia, New Zealand, Latin America, the Middle East, and Africa.

(including Australia, New Zealand, Latin America, the Middle East, and Africa). In total, we gathered 681 responses (from both public and private companies). Of these, 642 responses are from the Duke-CFO list, from which we obtained a response rate of about 16%.[7] We supplemented these responses with 39 responses from executives with risk management authority from the ISDA and GARP lists. We refer to the survey sample as "CFOs" though some have titles such as treasurer, vice president of finance, or chief risk officer.[8]

Given that the survey is anonymous and we are unable to link it to archival data,[9] such as COMPUSTAT, we ask CFOs about their companies' risk management practices and demographics, including sales, credit ratings, dividend policies, investment prospects, and several other characteristics. We also collect information about risk aversion and other personal traits. We use this information to study the nexus between personal-risk aversion and corporate-risk management decisions.

3.2. Descriptive Statistics

Table 1 reports descriptive statistics for the sample of firms we use in our regressions. About 50% of the companies engage in risk management (*Risk Management* indicator variable), compared to 52% of the firms in the overall survey sample (see Table A.1 in the appendix).[10] Overall, our risk management summary statistics align closely to those reported by previous studies. In a similar survey setting, Bodnar et al. (1998) find that 50% of the firms in their sample hedge. Bartram et al. (2010) find that in a sample of publicly listed firms (two-thirds located in North America), 66% hedge. Our survey shows that 67% of the North American public companies hedge. Table 1 also shows regional variation in risk management practices. Risk management also varies significantly with respect to ownership form: 73% of the public companies engage in risk management compared to 37% of the private companies.

Table 1 also reports some descriptive statistics. About 28% of the firms have revenues above $1 billion (*Large*). There is also some demographic variation

across regions and ownership form. For instance, 17% of the Asian firms are classified as *Large*, compared to 31% and 41% of the North American and European companies, respectively. We also report summary statistics on dividend policy, investment prospects, leverage, and whether the firm has a credit rating.

Table 1 shows that 37% of the firms are public, which indicates that our sample has a good balance of public and private companies. The table also provides information on the distribution of the sample across regions for the firms for which headquarters information is not missing. Fifty-six percent of the firms in the sample are from North America, 16% are from Europe, and 24% are from Asia. The remaining 4% of companies are headquartered in Australia, New Zealand, Latin America, the Middle East, and Africa. We categorize these companies as *Other Region* firms.

Table 1, panel C, provides information on the industry distribution of the sample. Thirty-four percent of the firms are in the manufacturing sector (which includes 13% of firms in consumer goods and 21% in industrial goods), 26% in services/healthcare, followed by 9% in transportation/utility, and 8% in both mining/basic materials and technology. The remaining 15% of firms are either diversified or do not fit in one of the industry categories provided in the survey.

3.3. Is the Sample Representative?

Table 2, panel A, compares our regression sample of public firms (including and excluding North American firms) with the COMPUSTAT Global database universe (which only includes public firms from regions other than North America). This allows us to assess whether our sample characteristics are similar to standard databases used in corporate finance research. There are 244 nonfinancial publicly listed firms in our survey sample, which we compare with a sample of about 22,700 nonfinancial companies in Global COMPUSTAT with a fiscal year ending in May 2010 or the 11 months prior.

The evidence in Table 2, panel A, suggests that our sample is broadly comparable to COMPUSTAT. Focusing on the sample excluding North American firms, we find that about 54% of firms have annual sales of less than $1 billion ("small") in our public sample versus 52% in COMPUSTAT. Our data indicate that about 23% of the survey firms do not pay dividends regularly, relative to 24% of the companies in Global COMPUSTAT.[11] The two samples are quite similar in terms of profitability.

In Table 2, panel B, we compare the private firms in our sample with firms from the Federal Reserve Board's 2003 Survey of Small Business Finance, which includes private firms with less than 500 employees; we also compare to private firms in the COMPUSTAT North America database, which are OTC (over-the-counter) firms and unlisted firms with more than 500 shareholders filing their annual reports with the SEC (e.g., Leuz et al. 2008, and Marosi and Massoud 2007). The 2003 survey is the most recent survey available from the Federal Reserve.

Overall, the evidence in panel B suggests that our private firms are comparable to the private firms in either the Fed Survey or the COMPUSTAT North America database. Our private firms are smaller than the private firms in the COMPUSTAT database. However, they have very similar dividend policies and profitability. About 43% (75%) of the firms in our survey pay dividends (are profitable) compared to 47% (78%) in COMPUSTAT.

In panel B, we also compare our private firms with less than 500 employees to the firms in the Federal Reserve Survey (which by construction includes only firms with less than 500 employees) and the private firms in COMPUSTAT with less than 500 employees. The three samples are very comparable in terms of size. Large firms are only 1% in our survey or the COMPUSTAT sample, similar to the 0% large firms in the Fed Survey. Panel B also shows that our private firms with less than 500 employees are more likely to pay a dividend than their counterparties in the COMPUSTAT database. We do not have dividend information for the firms in the Fed Survey. About 75% of the firms are profitable in both our sample and the Fed Survey sample, while only 52% of the private firms with less than 500 employees are profitable in the COMPUSTAT sample. Median leverage and cash holdings are similar across the three samples, while average leverage is lower for our survey sample compared to either the Fed Survey sample or the COMPUSTAT sample.

Ideally, our respondent sample would also be similar to the universe of firms that were surveyed, to alleviate concerns about response bias. In this case, the bulk of our respondents are CFOs that participate in the quarterly Duke survey of CFOs during 2005 to 2009, firms for which we have some demographic information. We compare four demographic variables (firm size, dividend-paying status, rating status, and rating quality) for our risk management respondents to the firms in the Duke universe that participated in the quarterly CFO survey during 2005 to 2009 (see Table 2, panel C). Our survey firms are very similar in size to the universe: 31% of the risk management firms are large, compared to 26% for the universe. We also find dividend policies and credit ratings to be comparable across the two samples: 39% (46%) of risk management respondents pay dividends (have a credit rating) versus 43% (52%) for the universe. For rated firms, we also find rating quality to be comparable across the two samples: 62% of our sample firms have an investment grade credit rating, compared to 73% in the universe. The numbers are similar but less so for rating quality, with 62% of our sample firms having an investment

Table 2. Representativeness of the Sample: Comparing to COMPUSTAT and Fed's 2003 Survey of Small Businesses Finances

Panel A: Public firms

	Risk management survey					
	Including North America firms		Excluding North America firms		COMPUSTAT global sample	
	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)
Small	58	45	31	54	11,825	52
Large	70	55	26	46	10,915	48
Nondividend Payer	47	37	13	23	2,491	24
Dividend Payer	81	63	44	77	7,887	76
Unprofitable	27	21	9	16	4,540	20
Profitable	101	79	48	84	18,159	80
	Mean	Median	Mean	Median	Mean	Median
Leverage (%)	29	29	30	30	34	19
Cash Holdings (%)	19	15	21	17	17	12

Panel B: Private firms

	Risk management survey				Fed's 2003 survey of small businesses finances		COMPUSTAT			
	Full sample		Firms w/<500 employees		Firms w/<500 employees		All U.S. unlisted firms		U.S. unlisted firms w/ <500 employees	
	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)
Small	186	87	121	99	3,913	100	494	62	323	98
Large	28	13	1	1	0	0	302	38	17	2
Nondividend Payer	122	57	67	55	N.A.	N.A.	422	53	238	73
Dividend Payer	92	43	55	45	N.A.	N.A.	374	47	102	27
Unprofitable	53	25	30	25	994	25	175	22	139	48
Profitable	161	75	92	75	2,982	75	621	78	201	52
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Leverage (%)	23	20	24	20	39	15	35	29	30	19
Cash Holdings (%)	19	10	21	12	24	12	13	5	21	10

Panel C: Risk management survey vs. 2005–2009 CFO surveys (North America samples)

	Risk management survey		2005–2009 CFO surveys	
	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)
Small	132	69	5,637	74
Large	59	31	1,980	26
Nondividend Payer	117	61	245	57
Dividend Payer	74	39	185	43
No Ratings	103	54	1,414	48
Ratings	88	46	1,532	52
Noninvestment Grade	54	32	665	27
Investment Grade	92	62	1,798	73

Notes. This table compares public firms in the Corporate Risk Management Survey global sample with public firms in the COMPUSTAT Global database as of fiscal year ending in May 2010 (panel A), private firms in the Risk Management Survey with private firms in the Federal Reserve Board's 2003 Survey of Small Businesses Finances (Fed Survey) and the COMPUSTAT North America database (OTC firms and unlisted firms with more than 500 shareholders) as of fiscal year ending in May 2010 (panel B), and North America firms in the Risk Management Survey with firms in the 2005–2009 Duke-CFO surveys (panel C). The samples include nonfinancial firms. We restrict the sample to the firms in the full-regression sample in Table 4. Descriptive statistics for the full-survey sample are in the appendix (Table A.1). We report number of observations and percentages based on several firm characteristics. We also report basic descriptive statistics on leverage and cash holdings. Firms are defined as *Small* if their revenues are less than $1 billion, and *Large* otherwise. *Nondividend Payer* firms are firms that do not regularly pay a dividend. *Dividend Payer* firms pay a dividend regularly. *Unprofitable* firms are those that did not report accounting profits during the previous fiscal year. *Profitable* firms are defined as those reporting an accounting profit during the previous fiscal year. *Leverage* is the ratio of total debt to total assets. *Cash Holdings* is the ratio of cash holdings and marketable securities to total assets.

grade credit rating, compared to 73% in the universe. Overall, these findings suggest that the responding firms have a slightly lower rating quality than firms in the universe but do not suggest a significant response bias.[12]

Finally, we note that we find very similar support for the traditional theories of risk management with both our survey sample and a broader sample of nonfinancial firms from COMPUSTAT. Refer to Table A.4 in the appendix and our discussion in Section 4.1.2.

4. Empirical Analysis

4.1. The Human Element of Risk Management

4.1.1. Measuring Risk Aversion. Barsky et al. (1997) assess personal risk aversion with a series of questions involving choices over lifetime income from labor. They ask the subject whether she would switch from her current job to a new job that has a higher expected income but is risky. Barsky et al. (1997) caution that their approach may be impacted by a status quo bias. We follow Graham et al. (2013) and change the question to eliminate this type of bias by asking the CFOs to choose between two "new" jobs:

> Suppose you are the only income earner in your family. Your current income is \$X. Your doctor recommends that you move because of allergies.
>
> Which of the following two job opportunities would you prefer?
>
> (1) 100% chance job pays \$X for life;
>
> (2) 50% chance job pays \$2X for life and 50% chance job pays \$2/3 X for life.
>
> If the CFO chooses (1), then the respondent is asked to answer the following follow-up question:
>
> Which of the following two job opportunities would you prefer?
>
> (3) 100% chance job pays \$X for life;
>
> (4) 50% chance job pays \$2X for life and 50% chance job pays \$4/5 X for life.
>
> If the CFO chooses (2), then the respondent is asked to answer the following follow-up question:
>
> Which of the following two job opportunities would you prefer?
>
> (5) 100% chance job pays \$X for life;
>
> (6) 50% chance job pays \$2X for life and 50% chance job pays \$1/2 X for life.

We categorize the CFOs that picked the sequence (1) and (3) as *Highly Risk Averse*, the CFOs that picked the sequence (1) and (4) as *Moderately Risk Averse*, and the CFOs that picked either the sequence (2) and (5) or (2) and (6) as *Less Risk Averse*. We combine our measures of managerial risk aversion with demographic data related to compensation, age, professional experience, and education.

Table 3 shows that 19% of the CFOs in our sample are *Highly Risk Averse*.[13] Of the remaining group, 17% of the CFOs are *Moderately Risk Averse*, while a sizable 65% are *More Risk Tolerant*. We find very similar patterns across North America, Europe, and Asia. To gain more insights on the composition of more risk tolerant CFOs, we categorize the CFOs that picked the sequence (2) and (5) as *Risk Tolerant* and those that picked the sequence (2) and (6) as *Very Risk Tolerant*. For the overall sample, we find that 32% and 33% of the CFOs are, respectively, risk tolerant and very risk tolerant. Moreover, there are some interesting differences across regions. In North America, risk tolerant executives are 36% compared to 27% of very risk tolerant executives. In Asia (Europe), the percentage of risk tolerant executives is 21% (36%) compared 43% (30%) of very risk tolerant executives. Overall, these findings suggest that a common trait of CFOs around the world is their tolerance of risk, which is more accentuated in Asia. Overall, the CFOs of public and private firms have similar risk tolerance: 33% of the CFOs of public firms are either highly or moderately risk averse, relative to 36% of the CFOs in private firms. However, there are noticeable differences between public and private firms in terms of the composition of the more risk tolerant CFOs. Table 3 shows that 38% and 29% of the CFOs in public firms are, respectively, very risk tolerant and risk tolerant compared to 28% and 35% for private firms.[14]

According to agency theory, a firm's propensity to hedge is higher when executives are more exposed to their firms (e.g., executives compensated with stock and options). Gormley and Matsa (2016) show that younger executives might prefer to "play-it-safe" and adopt risk-reducing corporate policies to minimize agency-related career concerns. As Table 3 shows, CFOs in Europe and Asia are less likely to be compensated with stock and options. They are also younger than executives in North America. CFOs are comparable across regions in terms of years on the job and education. About 20% of the CFOs have been on the job less than four years and more than 60% have an MBA or other master's degree. Executives in public firms are younger and more likely to be compensated with stock and options and have an MBA or other master's degree than executives in private companies but are otherwise comparable in terms of job tenure. In Sections 4.1.2 and 4.2 we assess whether these characteristics impact the relation between risk aversion and hedging.

4.1.2. Risk Aversion and Corporate Risk Management. In this section, we examine the relation between managerial risk aversion on corporate risk management. Motivated by Rosen (1982) and Smith and Stulz (1985), we also study whether executive compensation modifies the relation between risk aversion and risk management. It is not surprising that it has taken over 30 years to directly test these theories given that direct measures of managerial risk aversion are generally unavailable.

Table 3. Risk Aversion and Executive Characteristics

	Full sample		North America	Europe	Asia	Public	Private
Variables	Mean	Obs.	Mean				
Executive traits							
Risk Management	0.50	342	0.45	0.64	0.53	0.73	0.37
Highly Risk Averse	0.19	342	0.19	0.20	0.20	0.14	0.21
Moderately Risk Averse	0.17	342	0.18	0.14	0.16	0.19	0.15
More Risk Tolerant	0.65	342	0.63	0.66	0.64	0.67	0.63
Risk Tolerant	0.32	342	0.36	0.36	0.21	0.29	0.35
Very Risk Tolerant	0.33	342	0.27	0.30	0.43	0.38	0.28
Compensation with Stock and Options	0.37	315	0.46	0.25	0.26	0.70	0.18
Younger than 45	0.32	339	0.28	0.41	0.35	0.41	0.27
Less than 4 *Years on the Job*	0.20	334	0.19	0.23	0.20	0.19	0.20
MBA/Master's Degree	0.64	336	0.65	0.72	0.59	0.72	0.59

Notes. This table reports summary statistics for executive risk aversion and other managerial characteristics. The data are from the Corporate Risk Management Survey in the first quarter of 2010. The sample includes nonfinancial firms from around the globe. We restrict the sample to the firms in the full-regression sample in Table 4. Descriptive statistics for the full-survey sample are in the appendix (Table A.1). *Risk Management* is an indicator variable for firms that engage in risk management. *Highly Risk Averse* is an indicator variable for executives that prefer their current salary to a job that pays twice their current salary with 50% probability or 80% of their current salary with 50% probability. *Moderately Risk Averse* is an indicator variable for executives that prefer their current salary to a job that pays twice their current salary with 50% probability or 66% of their current salary with 50% probability. *More Risk Tolerant* is an indicator variable for executives that prefer a job that pays twice their current salary with 50% probability or 66% of their current salary with 50% probability to their current salary. *Risk Tolerant* is an indicator variable for executives that prefer their current salary to a job that pays twice their current salary with 50% probability or half of their current salary with 50% probability. *Very Risk Tolerant* is an indicator variable for executives that prefer a job that pays twice their current salary with 50% probability or half of their current salary with 50% probability to their current salary. *Compensation w/Stock and Options* is an indicator variable for CFOs with a compensation package that includes stock and options. *Younger than 45* is an indicator variable for CFOs that are younger than 45. *Less than 4 Years on the Job* is an indicator variable for CFOs with less than four years on the job. *MBA/Master's Degree* is an indicator variable for CFOs with an MBA or master's degree. North America Firms are those with the headquarters either in the United States or Canada. European Firms are those with the headquarters either in the European Union or other European countries. Asian Firms are those with the headquarters in an Asian country. *Public* Firm is an indicator variable for publicly listed firms. Private Firm is an indicator variable for firms that are not listed in a public exchange.

We estimate a probit model where the dependent variable is *Risk Management* (an indicator variable for firms engaging in risk management), modeled as a function of control variables and *Highly Risk Averse*. The control variables include *Large*, *Ratings*, *Dividend Payer*, *Investment Prospects*, *Profitable*, *Credit Line*, *Cash Holdings*, *Leverage*, *Public*, and industry and regional dummies (identified based on the industry and regional categories in Table 1).[15] We select our control variables in an attempt to hold constant the effects from other theories and important firm heterogeneity. All of our regressions are estimated with heteroskedasticity-consistent errors clustered by industry.

Columns 1–3 in Table 4 report results for the full sample. In column 1 (specification with industry fixed effects), the coefficient on *Highly Risk Averse* is positive and significant, indicating that firms that engage in risk management are more likely to employ risk averse executives.[16] The marginal effect of 0.10 for high risk aversion implies that risk-averse CFOs are 10% more likely to work at firms that hedge (which is 19.2% [= 0.10/0.52] of the sample average *Risk Management* value of 0.50 from Table 3), relative to their more risk tolerant counterparts. We find very similar effects in column 2 (specification with region fixed effects) and column 3 (specification with industry fixed effects and region fixed effects). This economic effect is comparable to or larger than the marginal effects of most of the control variables in Figure 1. For instance, it is comparable to the marginal effects of 0.09 for Credit *Rating* and 0.08 for credit lines and two times the size of the marginal effect of 0.05 for *Leverage* (which is statistically insignificant).[17] Only *Large*, *Dividend Payer*, and *Public* have bigger marginal effects.

Our findings are consistent with two different theoretical perspectives. In line with agency theory of risk management (e.g., Smith and Stulz 1985), our results suggest that risk-averse executives hedge to mitigate their personal underdiversified exposure to the firm (even if such hedging is not in the best interest of well-diversified shareholders).[18] Our findings are also consistent with a prediction of manager–firm matching theories that firms that engage in risk management prefer to hire risk averse executives (e.g., Rosen 1982, Terviö 2008, and Bandiera et al. 2015), who will act as agents to implement value maximizing corporate policies. We cannot distinguish between these explanations, nor whether they may both be at work, but under

Table 4. Risk Aversion, Executive Compensation, and the Risk Management Decision

	Full sample			Compensation w/Stock and options: Yes			Compensation w/Stock and options: No		
Dep. variable: *Risk Management*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Highly Risk Averse	0.252***	0.256**	0.244***	0.555**	0.553***	0.632***	0.183	0.159	0.142
	(0.096)	(0.125)	(0.087)	(0.251)	(0.173)	(0.245)	(0.185)	(0.194)	(0.147)
[Marginal Effects]	**[0.100]*** **	**[0.101]** **	**[0.097]** **	**[0.201]** **	**[0.205]*** **	**[0.229]*** **	**[0.073]**	**[0.063]**	**[0.057]**
	(0.037)	**(0.049)**	**(0.034)**	**(0.083)**	**(0.058)**	**(0.080)**	**(0.074)**	**(0.077)**	**(0.059)**
Large	0.575***	0.592***	0.605***	0.930***	1.035***	1.160***	0.519***	0.524**	0.519***
	(0.030)	(0.151)	(0.037)	(0.078)	(0.239)	(0.071)	(0.100)	(0.266)	(0.112)
Ratings	0.224**	0.250	0.253***	0.204	0.067	0.321	0.383**	0.392	0.394***
	(0.114)	(0.161)	(0.098)	(0.414)	(0.218)	(0.484)	(0.156)	(0.252)	(0.137)
Dividend Payer	0.291**	0.213*	0.218*	0.645**	0.625*	0.546*	0.096	−0.002	−0.006
	(0.126)	(0.125)	(0.120)	(0.276)	(0.374)	(0.328)	(0.068)	(0.209)	(0.164)
Inv. Prospects	0.176	0.238*	0.194	0.067	0.322*	0.153	0.051	−0.063	−0.060
	(0.272)	(0.128)	(0.254)	(0.473)	(0.189)	(0.442)	(0.224)	(0.270)	(0.198)
Credit Line	0.210***	0.127	0.177***	0.354	0.291	0.250	0.270	0.208	0.290
	(0.031)	(0.167)	(0.030)	(0.426)	(0.186)	(0.498)	(0.195)	(0.358)	(0.266)
Cash Holdings	0.158	0.089	0.067	−0.005	0.009	−0.360	0.378**	0.266	0.397
	(0.242)	(0.576)	(0.299)	(0.868)	(1.058)	(1.308)	(0.173)	(0.762)	(0.248)
Profitable	0.180	0.181	0.155	0.464*	0.157	0.312	0.091	0.139	0.092
	(0.145)	(0.305)	(0.135)	(0.261)	(0.311)	(0.354)	(0.353)	(0.403)	(0.408)
Leverage	0.132	0.081	0.095	0.699	0.637**	0.646	0.040	−0.159	−0.069
	(0.356)	(0.272)	(0.368)	(0.960)	(0.303)	(0.885)	(0.399)	(0.441)	(0.405)
Public	0.605***	0.642***	0.619***	0.344**	0.446	0.238**	0.871***	0.913***	0.899***
	(0.181)	(0.152)	(0.186)	(0.156)	(0.381)	(0.107)	(0.191)	(0.307)	(0.298)
Industry fixed effects	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Region fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Obs.	342	344	340	117	115	114	198	199	196
R^2	0.150	0.160	0.161	0.271	0.258	0.297	0.117	0.129	0.130

Notes. This table reports probit estimation results from the risk management model. The dependent variable is *Risk Management*, which is an indicator variable for firms that engage in risk management. The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

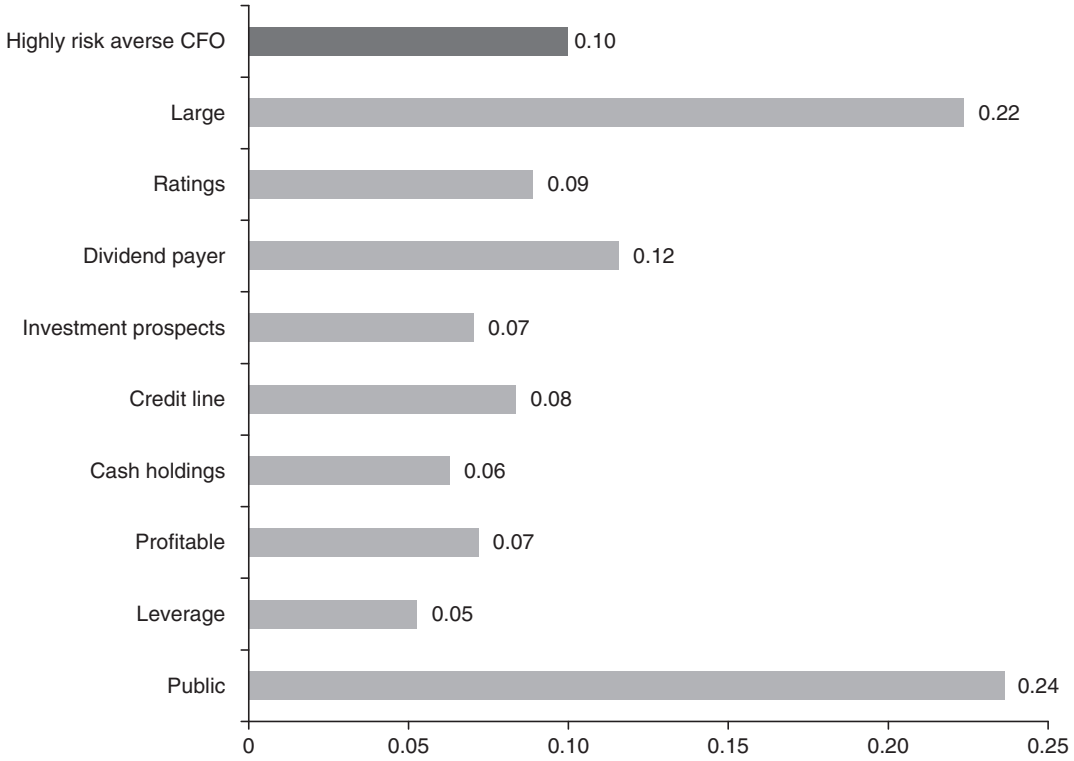
either interpretation our results highlight an important link between corporate risk management and personal risk aversion.

Some control variables in Table 4 stand out. Firms with better investment opportunities are more likely to hedge (although the coefficient is statistically significant only in the specification with region fixed effects—column 2). Consistent with the credit rationing hypothesis (Froot et al. 1993), this suggests that high growth companies hedge to ensure that they have sufficient internal cash flows to finance profitable projects. However, the estimated coefficients on *Large*, *Dividend Payer*, and *Ratings* are positive (and they are all statistically significant with the exception of *Ratings* in column 2). To the extent that large, rated, and dividend paying firms are less financially constrained than their small, unrated, and nondividend paying counterparts,[19] our evidence is inconsistent with one key aspect of the credit rationing hypothesis of risk management.

Froot et al. (1993) and Holmström and Tirole (2000) argue that credit lines can function as a substitute for risk management in mitigating credit rationing. Table 4 shows that credit lines have a positive effect (significant in columns 1 and 3) on a firm's propensity to manage risk in our sample. We also find that cash holdings and profitability have no significant relation to risk management.[20] Overall, we do not find support for the prediction that credit lines, cash holdings, or cash flows (profitability) are substitutes for risk management. Altogether, our findings provide mixed support for the credit rationing hypothesis, similar to findings in previous empirical studies (e.g., Nance et al. 1993, Mian 1996, Gay and Nam 1998, Geczy et al. 1997, Graham and Rogers 2002).

In line with the financial distress hypothesis of Smith and Stulz (1985), we find that firms with higher leverage (firms that might be more susceptible to financial distress) are more likely to hedge. We note, however,

Figure 1. Marginal Effects from Probit Estimation Describing Why Firms Hedge



Notes. This figure reports marginal effects relative to the probit estimation in column 1, Table 4. The data are from our Corporate Risk Management Survey, which was conducted in the first quarter of 2010. The sample includes nonfinancial firms from around the globe.

that the coefficient on leverage is not statistically significant (see also, e.g., Nance et al. 1993).

The evidence in Table 4 can also be considered in the context of a prediction from the information asymmetry models of risk management (De Marzo and Duffie 1995). To the extent that information asymmetry is higher for small (or unrated or nondividend paying) firms, this theory predicts these firms will hedge more than their large firm counterparts. The evidence in Table 4 suggests the opposite. Likewise, Brennan and Subrahmanyam (1995), Easley et al. (1998), and Hong et al. (2000) suggest that information asymmetry is lower for public firms because they are followed by analysts, so we might expect less public firm hedging. In contrast, Table 4 shows that *Public* (our indicator for publicly listed firms) enters our risk-management probit estimation with a significantly positive coefficient. Overall, our results are not consistent with the theories based on information asymmetry. However, we acknowledge that this inference hinges on the viability of our measures of information asymmetry. If, for example, large firms are complex and complexity leads to more information asymmetry, our evidence would be more in line with DeMarzo and Duffie (1995).[21]

We also note that our survey evidence with respect to traditional theories of risk management is similar to evidence based on a broader sample of nonfinancial firms from the COMPUSTAT North America database as of fiscal year ending in May 2010. In fact, we document coefficient estimates for *Large*, *Ratings*, *Dividend Payer*, *Credit Line*, *Profitable*, *Leverage*, and *Public* with the same sign in both the survey sample and the COMPUSTAT sample (although statistical significance is generally higher for the larger COMPUSTAT sample). There are exceptions, however. One is *Investment Prospects*, which is positive in the survey sample, but negative in the COMPUSTAT sample (both statistically insignificant). One possible explanation for this difference is that the two variables are defined differently in the two samples. In the survey sample, we ask executives to rank their firms' growth prospects from 0–100, while in the COMPUSTAT sample we rely on Tobin's q. The other exception is *Cash Holdings*, which is positive but insignificant in the survey sample, and significantly negative in the COMPUSTAT sample. Refer to Table A.4 in the appendix. Overall, the evidence in Table A.4 is remarkably similar to the broader COMPUSTAT sample with respect to traditional determinants of hedging.

Interactions between Risk Aversion and Executive Compensation. Agency theory predicts that the effect of risk aversion on corporate risk management is

stronger if executives have a larger stake of their personal wealth invested in the firm. We start by sorting firms based on whether executives receive stock and options as part of their compensation package. We then reestimate our probit model separately for the two groups (columns 4–9 of Table 4). We find that *Highly Risk Averse* is positive and significant if executives are compensated with stock and options (columns 4–6). The effect is also economically large. For example, in column 4 (specification with industry fixed effects), the marginal effect of 0.201 implies that companies with risk-averse CFOs are 20.1% more likely (or 40% more likely, relative to the sample average *Risk Management* of 0.50) to hedge. We do not find a significant relation between *risk aversion* and risk management among firms in which their CFOs do not receive stock and options as part of their compensation (columns 7–9).

We also find a significantly positive relation between risk aversion and risk management for public firms, but not for private firms. Given that executives of public firms are more likely to receive equity-based compensation, the evidence for public firms further confirms that executives with a less diversified portfolio are more likely to hedge. We note that the compensation results appear to be independent from the public/private firm partition results. For the sample of public firms, we find a significantly positive relation between risk aversion and hedging only when executives are compensated with equity. We are unable to perform a similar analysis for private firms because the number of private firms with equity compensation is too small.

While on average risk aversion does not matter for the executives that do not receive equity as part of their compensation, some of these executives might be worried about their human capital. For example, young executives could be worried about losing their job because they have not yet established a reputation in the labor market. In line with this expectation, we find a significantly positive relation between risk aversion and hedging for young executives who are not compensated with equity.

To the extent that executive stock and options proxy for whether executives have a large stake of their wealth invested in the firm, the evidence in columns 4–6 of Table 4 suggests that highly risk-averse executives with a less diversified personal portfolio are more likely to hedge (as predicted by agency theory).[22] The underlying assumption of our empirical design is that executives compensated with equity face frictions (e.g., execution time or transaction costs) when they try to sell their equity stake on the firm (to rebalance their personal portfolio) that executives compensated with cash do not face (e.g., Kahl et al. 2003). Overall, these findings are also consistent with firms that hedge hiring risk-averse executives (as predicted by the executive firm matching hypothesis). However, we note that our results hold only if the executives are compensated with equity. This suggests that even if matching is an important explanation for our results, it is still necessary for firms to compensate executives with equity to ensure that they have also personal reasons to hedge (as predicted by agency theory). In our view, the evidence in Table 4 suggests that agency theory is the more important explanation for our findings.

Twenty-five U.S. firms in our Corporate Risk Management Survey voluntarily reveal their identities. For these firms, we use Execucomp, 10Ks, and proxy statements to identify the year of hire for the CFO, to investigate whether these firms' hedging policies changed within two years of when the respondent CFO was hired. Following Adams-Bonaimé et al. (2014), we categorize a firm as having a hedging policy firm if either COMPUSTAT'S item *aocidergl*—"Accumulated Other Comprehensive Income—Derivative Unrealized Gain/Loss"—or *cidergl*—"Comprehensive Income—Derivative Gains/Losses"—are greater than zero. We find that five firms out of the 25 changed their hedging practices upon or after the arrival of the respondent CFO. Although the limited number of observations does not allow us to perform any systematic analysis, these findings are consistent with the hiring of a new CFO leading to important changes in a firm's hedging policy in some firms. Fee et al. (2013) document that the turnover of top executives tends to be correlated. We find that in one out of the five survey firms that changed their hedging policy upon or after the arrival of the CFO the CEO also changed. Taken at face value this finding suggests that CFOs (and not necessarily other corporate executives) are responsible for the change in a firm's hedging policy.

4.2. Interactions Between Risk Aversion and Personal Characteristics

To further investigate the link between personal characteristics and corporate hedging, in this section we study the relation between risk aversion and risk management conditional on the age, professional experience, and education of the CFOs. The results are reported in columns 1 to 6, Table 5. We account for industry heterogeneity with industry fixed effects.

We find that *risk aversion* has a significantly positive effect on the risk management propensity of CFOs that are younger than 45 (column 1), but not for the older CFOs (column 2). We also find that *risk aversion* is important for the propensity to hedge among the CFOs with fewer years on the job (column 3), but not for the firms where CFOs have been more than four years on the job (column 4).[23] A young age can be indicative of career concerns because it will take many years for a young person to retire. Similarly, a short tenure

Table 5. Risk Aversion, Executive Characteristics, and the Risk Management Decision

	Younger than 45		*Less than* 4 *Years on the Job*		*MBA/Master's Degree*	
Risk aversion and executive traits	Yes (1)	No (2)	Yes (3)	No (4)	Yes (5)	No (6)
Highly Risk Averse	0.578***	−0.223	1.441***	0.110	0.420***	−0.072
	(0.179)	(0.203)	(0.322)	(0.102)	(0.110)	(0.337)
[Marginal Effects]	**[0.215]*** **	**[−0.083]**	**[0.481]*** **	**[0.044]**	**[0.157]** **	**[−0.027]**
	(0.060)	**(0.074)**	**(0.079)**	**(0.040)**	**(0.038)**	**(0.124)**
Large	0.585***	0.600**	1.613*	0.473**	0.728***	0.111
	(0.072)	(0.243)	(0.964)	(0.213)	(0.030)	(0.333)
Ratings	−0.033	0.995***	0.793***	0.183	0.243***	0.276
	(0.094)	(0.230)	(0.273)	(0.134)	(0.085)	(0.282)
Dividend Payer	0.345***	0.103	0.544*	0.225	0.403***	0.274
	(0.069)	(0.331)	(0.281)	(0.143)	(0.078)	(0.215)
Inv. Prospects	0.131	0.189	−0.826*	0.080	0.008	0.351
	(0.350)	(0.593)	(0.479)	(0.229)	(0.618)	(0.755)
Credit Line	0.181*	0.778***	−0.878***	0.329***	−0.027	0.790*
	(0.104)	(0.288)	(0.294)	(0.099)	(0.173)	(0.442)
Cash Holdings	−0.192	1.698**	−1.159**	0.423	0.067	0.184
	(0.269)	(0.708)	(0.513)	(0.465)	(0.315)	(0.954)
Profitable	0.379**	−0.291**	0.566***	0.151	0.027	0.348
	(0.177)	(0.115)	(0.163)	(0.188)	(0.137)	(0.259)
Leverage	0.268	−0.111	1.331***	0.216	−0.153	0.724*
	(0.290)	(0.552)	(0.459)	(0.445)	(0.379)	(0.403)
Public	0.619***	0.910	−0.551	0.842***	0.423**	1.166***
	(0.210)	(0.669)	(0.446)	(0.198)	(0.213)	(0.233)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	249	90	67	267	215	121
Pseudo-R^2	0.164	0.279	0.307	0.182	0.135	0.311

Notes. This table reports probit estimation results from the risk management model. The dependent variable is *Risk Management*, which is an indicator variable for firms that engage in risk management. The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

can reveal career concerns because being fired in the months immediately after joining a new company is more likely to occur in case of significant underperformance, which will inevitably affect the ability of the executive to find a new job with similar employment conditions. If young age and fewer years on the job are indicative of stronger career concerns, then our results suggest that career concerns increase a CFO's propensity to hedge. Our young-executive findings are in line with Gormley and Matsa (2016).[24]

Overall, our findings are supportive of the prediction from agency theory that executives may hedge in accordance with their own personal characteristics, to reduce their exposure to the firm. The results might also be consistent with a matching hypothesis, however a dynamic matching explanation requires a firm to hire a young CFO so that she implements more hedging, and then fire her (or move her out of the hedging role) as she gets older and her job tenure increases. In our view, this explanation seems less plausible.[25]

We also find that *risk aversion* is important for the propensity to hedge among the CFOs with an MBA or other master's degree (column 5). This finding suggests that more educated executives may be more willing to hedge because they are more likely to have been exposed (e.g., through education) to derivatives (an argument first proposed by Tufano 1996). Thus, education may interact with how personal risk aversion is linked to corporate risk management.

The effects of risk aversion on a firm propensity to hedge are economically large: with marginal effects, respectively, of 21.5% for the sample of young executives, 48.1% for the executives with a shorter tenure, and 15.7% for the executives with an MBA or another master degree. Compared to the marginal effect for risk aversion of 20.1% for the sample of CFOs paid in stocks

and options, these findings suggest that implicit-career incentives related to age and job tenure are of similar or larger economic importance than explicit executive incentives related to compensation.[26]

The coefficient estimate for risk aversion could be biased if we omit control variables correlated with regional or both industry and regional characteristics. To account for this possibility, we reestimate our base models in Tables 5 by adding region fixed effects or both industry fixed effects and region fixed effects. As Table A.5, panel A, in the appendix shows, our region fixed effect results are very similar both in terms of statistical and economic significance to the base estimations in Table 5. For example, for executive younger than 45, the coefficient estimate for highly risk averse is 0.567 (statistically significant at the 1% level) with a marginal effect of 0.212 (also statistically significant at the 1% level) in Table A.5, panel A, compared to 0.536 with a marginal effect of 0.201 in Table 5. We find very similar effects if we control for both industry fixed effects and region fixed effects (Table 5, panel B). Results are also highly comparable in the partitions based on experience and education (Table A.5, panels A and B). Overall, these results mitigate the concern that omitted variables correlated with industry and regional characteristics could bias the coefficient estimate for risk aversion.

Pairwise correlations between compensation and the other executive variables (i.e., age, experience, and education) are low (ranging from −0.05 to +0.05). This mitigates the concern that these four executive variables are capturing similar effects. We also orthogonalize compensation, age, experience, and education with respect to each other using the Gram-Schmidt procedure (Golub and van Loan 1996). We find that all our results in Tables 4 and 5 hold when we use these orthogonalized variables. This further suggests that our executive trait variables are unlikely to capture overlapping effects.

In Tables 4 and 5, we test whether the effect of risk aversion on risk management depends on compensation, age, experience, and education using a split sample approach. We also test these relationships using an interaction approach. In line with the split sample results, Table A.6, panel A, in the appendix shows that the interactions of risk aversion with compensation, age, experience, and education are all positive (and three of them are also statistically significant). In Table A.6, panel B, we also interact all control variables with compensation or one of the other variables (age, experience, and education). This approach gives us the additional flexibility of allowing the coefficients on the control variables to vary depending on compensation, age, experience, and education. In this specification, we find that all interaction variables of interest, including the interaction of compensation with risk aversion, are significantly positively significant.

In Table A.7, we reestimate all the regressions in Tables 4 and 5 adding moderately risk averse and risk tolerant to the regressors. We find that the coefficient on *Highly Risk Averse* is significantly positive and of the same economic magnitude as in Tables 4 and 5, while the coefficients on *Moderately Risk Averse* and *Risk Tolerant* are statistically insignificant. This combined evidence suggests that highly risk-averse executives (but not moderately risk-averse or risk tolerant executives) are more likely to work at firms that engage in risk management. We find that highly risk averse remains significantly positive for the CFOs that are compensated with stock and options, that are younger than 45, for those with less than four years on the job, and for the CFOs with an MBA or another master's degree. Moderately risk averse and risk tolerant are statistically insignificant in these estimations.[27]

In Tables 4 and 5, the dependent variable is an indicator for whether firms "have a formal, documented risk management policy." To investigate whether firms with a formal risk management policy do manage risk at the time of the survey, we check whether these firms use derivatives or other financial instruments. Of the firms that say that they "have a formal, documented risk management policy," 80% indicate that they use derivatives to manage risk (i.e., interest rate, foreign exchange, energy, commodity, credit, and geopolitical risk). If we consider also credit lines and cash holdings—which according to theory (Froot et al. 1993, Holmström and Tirole 2000) firms can use as substitute for derivatives to manage risk—we find that 99% of the firms with a risk management policy use derivatives, credit lines, or cash holdings for risk management. Overall, these findings indicate that nearly all firms with a formal risk management policy use derivatives, credit lines, or cash to manage risk.

Our analysis also shows that only 60% of the firms using derivatives have a formal risk management policy. This suggests that some of the firms in our survey hedge risk on an ad-hoc basis, but do not necessarily have a formal risk management policy. Using this information, we build a new risk management indicator, which is equal to 1 if the firm has a formal risk management program or uses derivatives to hedge (even if it does not have a formal risk management program). We use this variable to reestimate our main models. As Table A.8 in the appendix shows, all our findings (with the exception of the MBA/master's degree partition tests) hold when we use this new dependent variable.

To recap, our analysis suggests that a manager's tolerance for risk is associated with whether their organizations hedge. The evidence also suggests that the channel through which risk attitude affects corporate policies is related to compensation and personal traits of age, experience, and education.

4.3. Risk Aversion, Financing, and Investment Decisions

Our paper thus far has focused on the relation between risk aversion and hedging. Does risk aversion affect other corporate polices? In line with the hedging results, in untabulated regressions we find a negative (but insignificant) relation between risk aversion and leverage. Notably, we find the relation between risk aversion and leverage to be significantly negative for younger executives and for executives with a shorter tenure. We also find a negative (but insignificant) relation between risk aversion and leverage when executives are compensated with equity and for executives with an MBA or another master degree. Overall, our leverage results suggest that risk-averse executives adopt more conservative financing policies if they are more exposed to their firm.[28]

Giambona et al. (2017) analyze information on political risk management for a sample of 88 firms. In particular, they study whether firms "avoid investments in certain countries to deal with political risk" (p. 532). In line with our results, they find that highly risk-averse executives are significantly more likely to avoid investing in risky countries.

Overall, our findings suggest that risk-averse executives adopt more conservatives financing and investment policies.[29]

4.4. Risk Aversion, Risk Exposure, and Fat-Tailed Distributions

To implement a risk management program, an executive must assess outcome risk from a given exposure (e.g., commodity risk exposure). Notably, while there are several studies on why firms hedge, there is little research on how firms assess risk exposure. In our survey, we ask CFOs what distributional assumptions they make to evaluate risk. Given the central thesis of our paper, we explore whether choices related to the assessment of risk are tied to the risk manager's underlying risk aversion.

Following the global financial crisis, there is a consensus among academics and practitioners that financial asset returns are fat tailed and that executives should explicitly take into account extreme events as part of their corporate policies (e.g., Bhansali 2008, and Fabozzi et al. 2011). Researchers, however, still recognize the importance of the Gaussian-based models, which perform well during "normal" market conditions. Therefore, flexible fat-tailed models (e.g., Zumbach 2006), which includes the normal distribution as a special case, are preferred to models with a fixed tail thickness.

In our survey, we asked CFOs to tell us what kind of distributional assumptions they make in assessing risk exposure. We find that 57% of the executives assume that prices are normally distributed. Of the remaining 43% of the respondents, 12% let the historic data determine the shape of some arbitrary distribution, while a sizable 31% assume distributions with fat tails. To our knowledge, our paper is the first to identify such a widespread reliance on fat-tailed distributions in corporate decision making.

We categorize the executives that rely on the normal distribution as least conservative and classify the executives that rely on a distribution determined by historic data as moderately conservative. Assuming the same volatility for the empirical and the normal distributions, the former distribution is more flexible in accounting for potentially large ex ante downside risk. On the other hand, the normal distribution assigns a low probability of extreme downside risk even if such has been experienced in the recent past. As such, assuming a sufficiently long time series, the executives that rely on historic data are likely more conservative than those relying on the normal distribution. Finally, we categorize the executives that assume a fat-tailed distribution as the most conservative. In the fat-tailed distribution, extreme events are not rare (or at least not as rare as in the normal distribution). Hence, executives that rely on fat-tailed distributions likely allow for more frequent and potentially larger downside risk events.[30]

We estimate a probit model where the dependent variable is an indicator equal to 1 if the respondent assumes that prices follow a fat-tailed distribution, and zero otherwise. Table 6, columns 1 and 2 report results from these estimations. We find that *Highly Risk Averse* is significantly correlated (at a 5% level) with the use a conservative, fat-tailed distribution to assess risk. The marginal effect (column 2) indicates that risk-averse executives are 9.1% more likely (compared to less risk-averse executives) to use fat-tailed distributions for their risk management. Alternatively, this finding suggests that firms using more conservative distributions to assess risk are 9.1% more likely to hire risk-averse executives.[31]

To study the link between risk aversion and all three distributional assumptions, we estimate an ordered probit model, where the dependent variable takes the values of 1 for the normal distribution (least conservative), 2 for the historic data distribution (neutral), and 3 for the fat-tailed distribution (most conservative). Column 3 shows that *risk aversion* is positive (and statistically significant at the 1% level) in the ordered probit model. Notably, the marginal effect indicates that risk-averse executives are 7.7% more likely to assess risk exposure through the more conservative fat-tailed distribution (hence allowing for downside risk exposure to be sizable).[32]

In Table 6, we use industry fixed effects to control for industry heterogeneity. We find a very similar relation between risk aversion and distributional assumptions in both the probit and the ordered probit estimations

Table 6. Risk Aversion and Executives' Distribution Assumption to Evaluate Risk Exposure

	Probit Dep. variable: *Fat Tail Distribution* (Yes = 1)		Ordered probit Dep. variable: *Distribution Assumption* (from Normal = 1, Data driven = 2, Fat tails = 3)	
	Raw coefficients (1)	Marginal effects (2)	Raw coefficients (3)	Marginal effects (4)
Highly Risk Averse	0.256**	0.091**	0.217***	
	(0.112)	(0.043)	(0.066)	
[Marginal Effects: Oprobit]				
[Data Driven DSTR == 2]				**[0.009]***
				(0.003)
[Fat-Tailed DSTR == 3]				**[0.077]***
				(0.024)
Large	0.123	0.043	0.063	0.022
	(0.165)	(0.059)	(0.141)	(0.049)
Ratings	0.151	0.052	0.160***	0.055***
	(0.120)	(0.042)	(0.057)	(0.019)
Dividend Payer	0.383**	0.130***	0.266***	0.091***
	(0.159)	(0.051)	(0.086)	(0.029)
Inv. Prospects	0.373*	0.128**	0.066	0.023
	(0.198)	(0.065)	(0.374)	(0.129)
Credit Lines	0.291	0.096	0.031	0.011
	(0.227)	(0.072)	(0.110)	(0.038)
Cash Holdings	0.560*	0.192*	0.305	0.106
	(0.310)	(0.106)	(0.353)	(0.120)
Profitable	−0.283***	−0.101***	−0.096	−0.033
	(0.109)	(0.039)	(0.163)	(0.058)
Leverage	0.065	0.022	−0.029	−0.010
	(0.379)	(0.131)	(0.352)	(0.121)
Public	−0.397***	−0.132***	−0.332*	−0.111*
	(0.131)	(0.040)	(0.188)	(0.060)
Industry-fixed effects	Yes		Yes	
Obs.	256		256	
Pseudo-R^2	0.045		0.027	

Notes. This table reports probit and ordered-probit estimation results from distribution assumption models. The dependent variable in columns 1 and 2 is an indicator equal 1 if CFOs indicate that they rely on a fat-tailed distribution, and zero otherwise. The dependent variable in columns 3 and 4 is an ordinal variable equal to 1 if CFOs indicate that they assume a normal distribution to assess risk exposure, equal to 2 if CFOs rely on a distribution driven by historical data, and equal to 3 if CFOs rely on a fat-tailed distribution. The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

if we control for region fixed effects and both industry fixed effects and region fixed effects (Table A.9).

Overall, this analysis suggests that personal risk aversion is related to the process by which risk is managed, not just whether firms hedge. As for the hedging results, these findings are consistent with two interpretations. According to one interpretation, risk-averse executives make more conservative distributional assumptions in estimating risk exposure. Alternatively, our evidence suggests that firms that assess risk conservatively, with fat-tailed distributions, prefer to hire risk-averse executives.

5. Conclusions

Many theories of risk management predict that companies hedge to mitigate the effects of financial constraints, information asymmetry, or financial distress. In the agency theories of risk management, managerial risk aversion plays a key role in explaining corporate risk management decisions. In addition, manager–firm matching theories predict that firms that engage in risk management prefer to hire risk-averse executives. In the past, it has not been possible to study the link between risk aversion and risk management because managerial risk aversion is not directly observable

from archival data sources. Using a well-established psychometric test, our study directly measures managerial risk aversion to explore the link between specific managers and their companies' risk management policies.

Our analysis suggests that risk-averse executives are more likely to work at firms that engage in risk management. In line with agency theories of risk management, we find that the link between risk aversion and a firm's propensity to hedge is stronger when executives are compensated with stock and options, which presumably leads to less diversified personal equity holdings. We also find that career concerns and education modify the effects of risk aversion. Finally, we find that risk-averse executives are more likely to rely on conservative fat-tailed distributions to estimate risk exposure.

Over the past 25 years, the theoretical and empirical research on hedging has focused on company-wide policies. The company is treated as a monolithic unit and hedging is a result of company characteristics. Our research challenges this approach. While company characteristics are undoubtedly important, we show that the "human element" plays a key role in both the active management of risk and the measurement of the firm's risk exposure.

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Appendix

Table A.1. Descriptive Statistics

Panel A: Firm characteristics								
			North America	Europe	Asia	Other regions	Public	Private
Variables	Mean	Obs.	Mean					
Risk Management	0.52	646	0.44	0.71	0.53	0.54	0.74	0.39
Large	0.31	656	0.35	0.42	0.15	0.24	0.55	0.16
Ratings	0.45	656	0.47	0.50	0.39	0.44	0.64	0.34
Dividend Payer	0.52	656	0.41	0.62	0.69	0.60	0.67	0.43
Investment Prospects (0–100)	65.87	405	68.08	63.91	61.68	66.33	67.05	65.07
Credit Line	0.77	429	0.77	0.76	0.77	0.80	0.83	0.74
Cash Holdings	0.19	388	0.17	0.17	0.26	0.17	0.20	0.19
Profitable	0.78	445	0.72	0.81	0.88	0.80	0.82	0.76
Leverage	0.27	394	0.28	0.29	0.24	0.22	0.29	0.26
Public	0.36	681	0.35	0.43	0.36	0.44	1.00	0.00

Panel B: Regional distribution	
	Obs. [%]
North America firms	344 [53%]
European firms	122 [18%]
Asian firms	164 [25%]
Other region firms	25 [4%]

Notes. This table reports summary statistics for the main variables used in the study. The data are from the Corporate Risk Management Survey, which was conducted in the first quarter of 2010. The sample includes nonfinancial firms from around the globe. *Risk Management* is an indicator variable for firms that engage in risk management. *Large* is an indicator variable for firms with sales of at least $1 billion. *Ratings* is an indicator variable for firms with a debt rating. *Dividend Payer* is an indicator variable for firms that pay regular dividends. *Investment Prospects* reflects the CFO's rating of the firm's long-term investment and growth opportunities, ranging from 0 (no growth opportunities) to 100 (excellent growth opportunities). *Credit Line* is an indicator variable for firms with a line of credit. *Cash Holdings* is cash holdings and marketable securities as a percentage of total assets. *Profitable* is an indicator variable for firms that reported accounting profits during the previous fiscal year. *Leverage* is the ratio of total debt to total assets. *Public* is an indicator variable for firms listed on a stock exchange. North America Firms are those headquartered either in the United States or Canada. European Firms are those headquartered either in the European Union or other European countries. Asian Firms are those headquartered in an Asian country. Other Region Firms are those headquartered in Australia, New Zealand, Latin America, the Middle East, and Africa.

Table A.2. Representativeness of the Sample: Comparing to COMPUSTAT and Fed's 2003 Survey of Small Businesses Finances

Panel A: Public firms

	Risk management survey					
	Including North America firms		Excluding North America firms		COMPUSTAT global sample	
	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)
Small	110	45	63	52	11,825	52
Large	134	55	58	48	10,915	48
Nondividend Payer	80	33	23	29	2,491	24
Dividend Payer	162	67	97	81	7,887	76
Unprofitable	30	18	11	14	4,540	20
Profitable	134	82	68	86	18,159	80
	Mean	Median	Mean	Median	Mean	Median
Leverage (%)	29	28	28	28	34	19
Cash Holdings (%)	20	15	22	16	17	12

Panel B: Private firms

	Risk management survey				Fed's 2003 survey of small businesses finances		COMPUSTAT			
	Full sample		Firms w/<500 employees		Firms w/<500 employees		All U.S. unlisted firms		U.S. unlisted firms w/<500 employees	
	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)
Small	346	84	214	98	3,913	100	494	62	323	98
Large	66	16	4	2	0	0	302	38	17	2
Nondividend Payer	236	57	123	57	N.A.	N.A.	422	53	238	73
Dividend Payer	178	43	93	43	N.A.	N.A.	374	47	102	27
Unprofitable	67	24	41	26	994	25	175	22	139	48
Profitable	214	76	115	74	2,982	75	621	78	201	52
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Leverage (%)	26	20	23	20	39	15	35	29	30	19
Cash Holdings (%)	19	10	21	15	24	12	13	5	21	10

Panel C: Risk management survey vs. 2005–2009 CFO surveys (North America samples)

	Risk management survey		2005–2009 CFO surveys	
	Obs. (N)	Freq. (%)	Obs. (N)	Freq. (%)
Small	222	65	5,637	74
Large	120	35	1,980	26
Nondividend Payer	202	59	245	57
Dividend Payer	140	41	185	43
No Ratings	181	53	1,414	48
Ratings	161	47	1,532	52
Noninvestment Grade	83	32	665	27
Investment Grade	177	68	1,798	73

Notes. This table compares public firms in the Corporate Risk Management Survey global sample with public firms in the COMPUSTAT Global database as of fiscal year ending in May 2010 (panel A), private firms in the Risk Management Survey with private firms in the Federal Reserve Board's 2003 Survey of Small Businesses Finances (Fed Survey) and the COMPUSTAT North America database (OTC firms and unlisted firms with more than 500 shareholders) as of fiscal year ending in May 2010 (panel B), and North America firms in the Risk Management Survey with firms in the 2005–2009 Duke-CFO surveys (panel C). The samples include nonfinancial firms. We report number of observations and percentages based on several firm characteristics. We also report basic descriptive statistics on leverage and cash holdings. Firms are defined as *Small* if their revenues are less than $1 billion, and *Large* otherwise. *Nondividend Payer* firms are firms that do not regularly pay a dividend. *Dividend Payer* firms pay a dividend regularly. *Unprofitable* firms are those that did not report accounting profits during the previous fiscal year. *Profitable* firms are defined as those reporting an accounting profit during the previous fiscal year. *Leverage* is the ratio of total debt to total assets. *Cash Holdings* is the ratio of cash holdings and marketable securities to total assets.

Table A.3. Risk Aversion and Executive Characteristics

	Full sample		North America	Europe	Asia	Public	Private
Variables	Mean	Obs.	Mean				
Executive traits							
Risk Management	0.52	646	0.44	0.71	0.53	0.74	0.39
Highly Risk Averse	0.20	89	0.20	0.20	0.21	0.15	0.23
Moderately Risk Averse	0.17	76	0.19	0.13	0.16	0.17	0.16
More Risk Tolerant	0.63	281	0.61	0.67	0.63	0.68	0.61
Risk Tolerant	0.31	138	0.35	0.32	0.19	0.28	0.33
Very Risk Tolerant	0.32	143	0.26	0.35	0.44	0.40	0.28
Compensation with Stock and Options	0.37	373	0.46	0.24	0.26	0.67	0.20
Younger than 45	0.34	451	0.30	0.44	0.36	0.42	0.29
Less than 4 *Years on the Job*	0.21	446	0.21	0.24	0.19	0.21	0.22
MBA/Master's Degree	0.63	448	0.64	0.68	0.61	0.70	0.59

Notes. This table reports summary statistics for executive risk aversion and other managerial characteristics. The data are from the Corporate Risk Management Survey in the first quarter of 2010. The sample includes nonfinancial firms from around the globe. *Risk Management* is an indicator variable for firms that engage in risk management. *Highly Risk Averse* is an indicator variable for executives that prefer their current salary to a job that pays twice their current salary with 50% probability or 80% of their current salary with 50% probability. *Moderately Risk Averse* is an indicator variable for executives that prefer their current salary to a job that pays twice their current salary with 50% probability or 66% of their current salary with 50% probability. *More Risk Tolerant* is an indicator variable for executives that prefer a job that pays twice their current salary with 50% probability or 66% of their current salary with 50% probability to their current salary. *Risk Tolerant* is an indicator variable for executives that prefer their current salary to a job that pays twice their current salary with 50% probability or half of their current salary with 50% probability. *Very Risk Tolerant* is an indicator variable for executives that prefer a job that pays twice their current salary with 50% probability or half of their current salary with 50% probability to their current salary. *Compensation w/ Stock and Options* is an indicator variable for CFOs with a compensation package that includes stock and options. *Younger than 45* is an indicator variable for CFOs that are younger than 45. *Less than 4 Years on the Job* is an indicator variable for CFOs with less than four years on the job. *MBA/Master's Degree* is an indicator variable for CFOs with an MBA or master's degree. North America Firms are those with the headquarters either in the United States or Canada. European Firms are those with the headquarters either in the European Union or other European countries. Asian Firms are those with the headquarters in an Asian country. *Public* Firm is an indicator variable for publicly listed firms. Private Firm is an indicator variable for firms that are not listed in a public exchange.

Table A.4. The Traditional Determinants of Risk Management: Comparing the Survey Sample to COMPUSTAT

	Survey sample (1)	COMPUSTAT sample (2)
Large	0.571***	0.663***
	(0.034)	(0.072)
Ratings	0.229**	0.410***
	(0.091)	(0.074)
Dividend Payer	0.270**	0.112*
	(0.125)	(0.061)
Inv. Prospects	0.154	−0.039
	(0.226)	(0.032)
Credit Line	0.173***	0.321***
	(0.047)	(0.078)
Cash Holdings	0.098	−1.486***
	(0.249)	(0.206)
Profitable	0.183	0.434***
	(0.138)	(0.090)
Leverage	0.097	0.596***
	(0.363)	(0.112)
Public	0.600***	0.499***
	(0.163)	(0.103)
Industry fixed effects	Yes	Yes
Obs.	340	2,792
Pseudo-R^2	0.146	0.250

Notes. This table reports probit estimation results from the risk management model. In column 1, the data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. The dependent variable is *Risk Management*, which is an indicator variable for firms that engage in risk management. Refer to Table 1 for the definition of the control variables. In column 2, the data are from COMPUSTAT North America database as of fiscal year ending in May 2010. The dependent variable is *Risk Management*, which is an indicator equal to 1 if either COMPUSTAT'S item *aocidergl*—"Accumulated Other Comprehensive Income—Derivative Unrealized Gain/Loss"—or *cidergl*—"Comprehensive Income—Derivative Gains/Losses"—are greater than zero. Inv. Prospects is Tobin's q, defined as the ratio of market value of assets (COMPUSTAT's items at+prcc_f*csho−ceq−txditc) to book assets (COMPUSTAT's item at). *Public* is an indicator equal to 1 for firms listed in the major U.S. stock exchanges (NYSE, NASDAQ, and AMEX) and zero for OTC firms and unlisted firms with more than 500 shareholders. Industries for the COMPUSTAT sample are defined at the one-digit SIC level. The other variables in the COMPUSTAT sample are defined similarly to the variables in the survey sample. For the survey sample, standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A.5. Risk Aversion, Executive Characteristics, and the Risk Management Decision

Panel A: Region fixed effects

	Younger than 45		*Less than* 4 *Years on the Job*		*MBA/Master's Degree*	
	Yes (1)	No (2)	Yes (3)	No (4)	Yes (5)	No (6)
Highly Risk Averse	0.536***	−0.161	1.679***	0.126	0.424**	−0.116
	(0.084)	(0.259)	(0.256)	(0.133)	(0.191)	(0.167)
[Marginal Effects]	**[0.201]****	**[−0.060]**	**[0.537]*****	**[0.050]**	**[0.159]****	**[−0.043]**
	(0.029)	**(0.096)**	**(0.050)**	**(0.052)**	**(0.067)**	**(0.062)**
Large	0.634**	0.519**	2.150***	0.471**	0.728***	0.180
	(0.293)	(0.251)	(0.543)	(0.185)	(0.166)	(0.191)
Ratings	0.012	0.831***	1.165***	0.229	0.302	0.170
	(0.205)	(0.084)	(0.203)	(0.146)	(0.240)	(0.363)
Dividend Payer	0.272***	0.069	0.290	0.178***	0.258	0.150
	(0.102)	(0.079)	(0.555)	(0.065)	(0.220)	(0.658)
Inv. Prospects	0.174	0.208	−2.404**	0.079	0.017	0.482
	(0.248)	(0.486)	(1.170)	(0.235)	(0.252)	(0.333)
Credit Line	0.045	0.561**	−1.318***	0.254	−0.132	0.493
	(0.272)	(0.272)	(0.301)	(0.270)	(0.133)	(0.588)
Cash Holdings	−0.273	1.520***	−0.854	0.351	0.034	0.010
	(0.715)	(0.472)	(1.458)	(0.461)	(0.351)	(1.171)
Profitable	0.375	−0.329*	0.676***	0.171	−0.023	0.294
	(0.331)	(0.197)	(0.168)	(0.323)	(0.275)	(0.241)
Leverage	0.146	−0.006	0.050	0.108	−0.175	0.775
	(0.238)	(0.536)	(1.217)	(0.406)	(0.485)	(0.813)
Public	0.688***	0.625***	−1.029**	0.928***	0.490**	1.189***
	(0.230)	(0.178)	(0.408)	(0.228)	(0.248)	(0.194)
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	251	90	67	269	216	122
Pseudo-R^2	0.163	0.241	0.351	0.184	0.153	0.261

Panel B: Industry fixed effects and region fixed effects

	Younger than 45		*Less than* 4 *Years on the Job*		*MBA/Master's Degree*	
	Yes (1)	No (2)	Yes (3)	No (4)	Yes (5)	No (6)
Highly Risk Averse	0.567***	−0.248	2.670***	0.113	0.398***	−0.064
	(0.151)	(0.207)	(0.967)	(0.098)	(0.097)	(0.293)
[Marginal Effects]	**[0.212]*****	**[−0.093]**	**[0.658]*****	**[0.045]**	**[0.149]*****	**[−0.024]**
	(0.051)	**(0.077)**	**(0.120)**	**(0.039)**	**(0.034)**	**(0.108)**
Large	0.633***	0.474***	3.228***	0.474**	0.784***	0.116
	(0.076)	(0.178)	(0.895)	(0.235)	(0.053)	(0.205)
Ratings	−0.014	1.048***	2.053***	0.195	0.313***	0.275
	(0.077)	(0.174)	(0.591)	(0.119)	(0.084)	(0.258)
Dividend Payer	0.287***	0.170	0.497**	0.175	0.269***	0.242
	(0.079)	(0.354)	(0.211)	(0.130)	(0.067)	(0.258)
Inv. Prospects	0.137	0.001	−3.878***	0.040	−0.019	0.379
	(0.305)	(0.468)	(0.435)	(0.166)	(0.546)	(0.933)
Credit Line	0.121	0.759**	−2.335***	0.326***	−0.131	0.803**
	(0.091)	(0.346)	(0.882)	(0.112)	(0.159)	(0.404)
Cash Holdings	−0.279	1.812***	−2.355***	0.375	−0.048	0.061
	(0.289)	(0.569)	(0.670)	(0.492)	(0.371)	(1.056)

Table A.5. (Continued)

Panel B: Industry fixed effects and region fixed effects						
	Younger than 45		*Less than* 4 *Years on the Job*		*MBA/Master's Degree*	
	Yes (1)	No (2)	Yes (3)	No (4)	Yes (5)	No (6)
Profitable	0.361**	−0.349***	0.679*	0.145	−0.012	0.320
	(0.161)	(0.107)	(0.411)	(0.177)	(0.178)	(0.251)
Leverage	0.244	−0.062	0.876***	0.167	−0.236	0.671*
	(0.315)	(0.617)	(0.274)	(0.428)	(0.296)	(0.395)
Public	0.641***	0.966	−1.606***	0.886***	0.442**	1.174***
	(0.200)	(0.716)	(0.294)	(0.220)	(0.213)	(0.183)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	248	89	67	265	213	121
Pseudo-R^2	0.171	0.292	0.494	0.188	0.158	0.316

Notes. This table reports probit estimation results from the risk management model. The dependent variable is *Risk Management*, which is an indicator variable for firms that engage in risk management. The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by region (panel A) or industry (panel B). These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A.6. Risk Aversion, Executive Characteristics, and Risk Management: Interactive Models

Panel A: Basic interactive model				
Dep. variable: *Risk Management*	(1)	(2)	(3)	(4)
Highly Risk Averse × *Compensation w/Stock and Options* (Yes = 1)	0.242			
	(0.324)			
[Marginal Effects]	**[0.096]**			
	(0.127)			
Highly Risk Averse × *Younger than* 45 (Yes = 1)		0.734**		
		(0.365)		
[Marginal Effects]		**[0.274]****		
		(0.117)		
Highly Risk Averse × *Less than* 4 *Years on the Job* (Yes = 1)			0.695**	
			(0.285)	
[Marginal Effects]			**[0.257]*****	
			(0.092)	
Highly Risk Averse × *MBA/Master's Degree* (Yes = 1)				0.728***
				(0.278)
[Marginal Effects]				**[0.272]*****
				(0.092)
Compensation w/Stock and Options (Yes = 1)	−0.377**			
	(0.177)			
Younger than 45 (Yes = 1)		0.105		
		(0.237)		
Less than 4 *Years on the Job* (Yes = 1)			−0.141	
			(0.243)	
MBA/Master's Degree (Yes = 1)				0.269
				(0.184)
Highly Risk Averse	0.179	−0.216	0.119	−0.251
	(0.118)	(0.200)	(0.125)	(0.227)
Controls	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Obs.	315	339	336	336
R^2	0.152	0.156	0.162	0.180

Table A.6. (Continued)

Panel B: Fully interactive model				
Dep. variable: *Risk Management*	(1)	(2)	(3)	(4)
Highly Risk Averse × *Compensation w/Stock and Options* (Yes = 1)	0.582*			
	(0.350)			
[Marginal Effects]	**[0.222]***			
	(0.120)			
Highly Risk Averse × *Younger than* 45 (Yes = 1)		0.936***		
		(0.199)		
[Marginal Effects]		**[0.336]*****		
		(0.057)		
Highly Risk Averse × *Less than* 4 *Years on the Job* (Yes = 1)			1.667***	
			(0.382)	
[Marginal Effects]			**[0.468]*****	
			(0.052)	
Highly Risk Averse × *MBA/Master's Degree* (Yes = 1)				0.930***
				(0.288)
[Marginal Effects]				**[0.335]*****
				(0.081)
Compensation w/Stock and Options (Yes = 1)	−1.676*			
	(0.937)			
Younger than 45 (Yes = 1)		−1.019***		
		(0.165)		
Less than 4 *Years on the Job* (Yes = 1)			−0.019	
			(0.248)	
MBA/Master's Degree (Yes = 1)				−0.560
				(0.554)
Highly Risk Averse	−0.027	−0.357***	−0.226***	−0.533**
	(0.110)	(0.070)	(0.077)	(0.262)
Controls × *Compensation w/Stock and Options* (Yes = 1)	Yes			
Controls × *Younger than* 45 (Yes = 1)		Yes		
Controls × *Less than* 4 *Years on the Job* (Yes = 1)			Yes	
Controls × *MBA/Master's Degree* (Yes = 1)				Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Obs.	315	339	334	334
R^2	0.109	0.136	0.064	0.110

Notes. This table reports probit estimation results from the risk management model. The dependent variable is *Risk Management*, which is an indicator variable for firms that engage in risk management. The data are from the 2010 Corporate Risk Management Survey. The sample includes nonfinancial firms from around the globe. Controls are the control variables used in the estimations in Table 4. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A.7. Degrees of Risk Aversion, Executive Characteristics, and the Risk Management Decision

	Full Sample	*Compensation w/ Stock and Options*		*Younger than 45*		*Less than* 4 *Years on the Job*		*MBA/Master's Degree*	
Dep. variable: *Risk Management*	(1)	Yes (2)	No (3)	Yes (4)	No (5)	Yes (6)	No (7)	Yes (8)	No (9)
Highly Risk Averse	0.357***	0.695***	0.282	0.668**	0.191	1.549***	0.109	0.475***	0.171
	(0.123)	(0.204)	(0.217)	(0.281)	(0.556)	(0.357)	(0.204)	(0.153)	(0.256)
[Marginal Effects]	**[0.140]*****	**[0.244]*****	**[0.112]**	**[0.244]*****	**[0.073]**	**[0.505]*****	**[0.043]**	**[0.176]*****	**[0.066]**
	(0.047)	**(0.064)**	**(0.086)**	**(0.090)**	**(0.217)**	**(0.081)**	**(0.081)**	**(0.053)**	**(0.100)**
Moderately Risk Averse	0.062	0.424	−0.085	0.225	−0.039	0.074	−0.026	−0.024	0.272
	(0.159)	(0.477)	(0.188)	(0.254)	(0.549)	(0.300)	(0.247)	(0.143)	(0.440)
[Marginal Effects]	**[0.025]**	**[0.156]**	**[−0.033]**	**[0.087]**	**[−0.015]**	**[0.030]**	**[−0.010]**	**[−0.009]**	**[0.106]**
	(0.063)	**(0.162)**	**(0.074)**	**(0.096)**	**(0.205)**	**(0.119)**	**(0.098)**	**(0.056)**	**(0.173)**
Risk Tolerant	0.248	0.248	0.294	0.120	0.950	0.755	0.010	0.166	0.519
	(0.176)	(0.387)	(0.255)	(0.261)	(0.625)	(0.608)	(0.224)	(0.218)	(0.338)

Table A.7. (Continued)

	Full Sample	*Compensation w/ Stock and Options*		*Younger than 45*		*Less than 4 Years on the Job*		*MBA/Master's Degree*	
Dep. variable: *Risk Management*	(1)	Yes (2)	No (3)	Yes (4)	No (5)	Yes (6)	No (7)	Yes (8)	No (9)
[Marginal Effects]	**[0.098]**	**[0.095]**	**[0.117]**	**[0.047]**	**[0.364]**	**[0.287]**	**[0.004]**	**[0.064]**	**[0.200]**
	(0.069)	**(0.145)**	**(0.101)**	**(0.102)**	**(0.328)**	**(0.210)**	**(0.089)**	**(0.083)**	**(0.129)**
Large	0.623***	0.992***	0.596***	0.599***	0.731*	1.570*	0.476**	0.761***	0.206
	(0.022)	(0.117)	(0.052)	(0.059)	(0.416)	(0.917)	(0.218)	(0.045)	(0.232)
Ratings	0.196	0.119	0.342***	−0.039	0.748*	0.709***	0.181	0.211*	0.153
	(0.139)	(0.411)	(0.129)	(0.119)	(0.391)	(0.270)	(0.150)	(0.118)	(0.351)
Dividend Payer	0.300**	0.670**	0.104*	0.352***	0.261	0.676*	0.227*	0.405***	0.205
	(0.122)	(0.282)	(0.054)	(0.065)	(0.261)	(0.371)	(0.134)	(0.079)	(0.663)
Inv. Prospects	0.177	0.090	0.055	0.143	0.453	−0.972***	0.080	−0.008	0.409
	(0.267)	(0.433)	(0.218)	(0.359)	(0.518)	(0.357)	(0.227)	(0.638)	(0.280)
Credit Line	0.201***	0.343	0.281	0.179*	0.332	−0.722***	0.330***	−0.024	0.475
	(0.039)	(0.442)	(0.194)	(0.105)	(0.263)	(0.161)	(0.088)	(0.174)	(0.611)
Cash Holdings	0.139	−0.032	0.359*	−0.195	1.155	−0.772**	0.417	0.062	−0.067
	(0.264)	(0.810)	(0.208)	(0.283)	(0.820)	(0.306)	(0.440)	(0.299)	(1.271)
Profitable	0.159	0.431	0.083	0.369*	−0.387**	0.421*	0.149	−0.006	0.304
	(0.145)	(0.296)	(0.377)	(0.191)	(0.190)	(0.232)	(0.180)	(0.161)	(0.269)
Leverage	0.125	0.637	0.001	0.243	−0.304	1.005**	0.215	−0.168	0.822
	(0.332)	(1.021)	(0.395)	(0.270)	(0.405)	(0.396)	(0.436)	(0.362)	(0.776)
Public	0.581***	0.322	0.878***	0.600***	0.515	−0.546	0.842***	0.404*	1.143***
	(0.175)	(0.203)	(0.175)	(0.229)	(0.480)	(0.464)	(0.182)	(0.215)	(0.171)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	342	117	198	249	89	67	267	215	122
R^2	0.154	0.278	0.125	0.166	0.283	0.331	0.182	0.137	0.280

Notes. This table reports probit estimation results from the risk management model. The dependent variable is *Risk Management*, which is an indicator variable for firms that engage in risk management. The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definitions of *Highly Risk Averse*, *Moderately Risk Averse*, and *Risk Tolerant* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A.8. Risk Aversion, Executive Characteristics, and the Risk Management Decision: Using Alternative Risk Management Measure

	Full Sample	*Compensation w/ Stock and Options*		*Younger than 45*		*Less than 4 Years on the Job*		*MBA/Master's Degree*	
Dep. variable: *Risk Management*	(1)	Yes (2)	No (3)	Yes (4)	No (5)	Yes (6)	No (7)	Yes (8)	No (9)
Highly Risk Averse	0.131*	1.057**	0.061	0.336***	−0.002	1.253***	0.071	0.003	0.231
	(0.075)	(0.441)	(0.132)	(0.120)	(0.207)	(0.122)	(0.093)	(0.076)	(0.156)
[Marginal Effects]	**[0.039]***	**[0.101]*****	**[0.021]**	**[0.088]*****	**[−0.001]**	**[0.243]*****	**[0.021]**	**[0.001]**	**[0.073]**
	(0.022)	**(0.020)**	**(0.045)**	**(0.029)**	**(0.070)**	**(0.042)**	**(0.027)**	**(0.021)**	**(0.048)**
Large	0.639***	0.676***	0.768**	0.637**	0.778***	2.820***	0.480*	0.789***	0.426***
	(0.208)	(0.215)	(0.311)	(0.280)	(0.289)	(0.907)	(0.286)	(0.275)	(0.127)
Ratings	0.220	−0.196	0.436**	−0.083	1.438***	0.611*	0.213	0.313*	0.246
	(0.194)	(0.575)	(0.195)	(0.200)	(0.263)	(0.346)	(0.177)	(0.184)	(0.332)
Dividend Payer	0.417***	1.834***	0.065	0.495***	0.202	0.529**	0.417***	0.446**	0.453***
	(0.050)	(0.221)	(0.160)	(0.103)	(0.227)	(0.256)	(0.093)	(0.189)	(0.136)
Inv. Prospects	−0.061	0.827	−0.431	−0.158	0.172	0.385	−0.374	0.023	−0.509
	(0.261)	(0.685)	(0.298)	(0.290)	(0.595)	(0.760)	(0.280)	(0.484)	(0.387)
Credit Line	0.360*	0.513	0.383***	0.182	0.995***	−0.723	0.542***	0.116	0.539*
	(0.203)	(0.902)	(0.129)	(0.349)	(0.230)	(0.977)	(0.199)	(0.223)	(0.325)
Cash Holdings	0.081	0.583	0.167	−0.113	0.780	−0.335	−0.024	0.235	−0.564**
	(0.385)	(0.951)	(0.483)	(0.629)	(0.511)	(1.235)	(0.549)	(0.589)	(0.255)
Profitable	0.165	0.052	0.200*	0.100	0.810***	0.528	0.176	0.148	0.149
	(0.118)	(0.176)	(0.113)	(0.151)	(0.279)	(0.336)	(0.110)	(0.133)	(0.175)

Table A.8. (Continued)

	Full Sample	*Compensation w/ Stock and Options*		*Younger than 45*		*Less than 4 Years on the Job*		*MBA/Master's Degree*	
Dep. variable: *Risk Management*	(1)	Yes (2)	No (3)	Yes (4)	No (5)	Yes (6)	No (7)	Yes (8)	No (9)
Leverage	0.693**	2.703**	0.463*	1.050***	−0.060	3.453***	0.610	0.517	1.218**
	(0.289)	(1.168)	(0.271)	(0.237)	(0.260)	(1.103)	(0.378)	(0.373)	(0.622)
Public	0.379**	−0.144	0.555*	0.446*	−0.123	−1.083	0.671***	0.179	1.094***
	(0.187)	(0.344)	(0.299)	(0.249)	(0.455)	(0.680)	(0.248)	(0.215)	(0.129)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	342	117	198	249	85	61	267	215	121
R^2	0.144	0.365	0.128	0.138	0.295	0.359	0.176	0.128	0.239

Notes. This table reports probit estimation results from the risk management model. The dependent variable is *Risk Management*, which is equal to 1 if the firm has a formal risk management program or uses derivatives to hedge (even if it does not have a formal risk management program). The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Table A.9. Risk Aversion and Executives' Distribution Assumption to Evaluate Risk Exposure

	Probit Dep. variable: *Fat Tail Distribution* (Yes = 1)		Ordered probit Dep. variable: *Distribution Assumption* (from Normal = 1, Data driven = 2, Fat tails = 3)	
	(1)	(2)	(3)	(4)
Highly Risk Averse	0.311**	0.259**	0.264***	0.206***
	(0.146)	(0.107)	(0.064)	(0.070)
[Marginal Effect: Probit]	**0.111****	**0.092****		
	(0.053)	**(0.041)**		
[Marginal Effects: Oprobit]				
[Data Driven DSTR == 2]			**[0.010]*****	**[0.009]*****
			(0.003)	**(0.003)**
[Fat-Tailed DSTR == 3]			**[0.094]*****	**[0.073]*****
			(0.022)	**(0.024)**
Large	0.125	0.179	−0.003	0.037
	(0.187)	(0.126)	(0.169)	(0.160)
Ratings	0.149***	0.169	0.109***	0.166***
	(0.048)	(0.142)	(0.039)	(0.057)
Dividend Payer	0.330***	0.363**	0.258**	0.271***
	(0.110)	(0.155)	(0.106)	(0.097)
Inv. Prospects	0.417**	0.362	0.058	0.051
	(0.200)	(0.244)	(0.333)	(0.363)
Credit Lines	0.207**	0.253	0.085	0.046
	(0.106)	(0.217)	(0.119)	(0.114)
Cash Holdings	0.449	0.489	0.373	0.333
	(0.450)	(0.315)	(0.331)	(0.381)
Profitable	−0.243**	−0.303***	−0.106	−0.097
	(0.105)	(0.113)	(0.187)	(0.171)
Leverage	0.001	0.087	−0.021	−0.052
	(0.521)	(0.367)	(0.319)	(0.390)
Public	−0.413*	−0.401***	−0.334	−0.316
	(0.215)	(0.152)	(0.214)	(0.192)
Region fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	Yes	No	Yes
Obs.	258	254	258	258
Pseudo-R^2	0.039	0.046	0.019	0.028

Notes. This table reports probit and ordered-probit estimation results from distribution assumption models. The dependent variable in columns 1 and 2 is an indicator equal 1 if CFOs indicate that they rely on a fat-tailed distribution, and zero otherwise. The dependent variable in columns 3 and 4 is an ordinal variable equal to 1 if CFOs indicate that they assume a normal distribution to assess risk exposure, equal to 2 if CFOs rely on a distribution driven by historical data, and equal to 3 if CFOs rely on a fat-tailed distribution. The data are from the Corporate Risk Management Survey first quarter of 2010. The sample includes nonfinancial firms from around the globe. Refer to Table 3 for the definition of *Highly Risk Averse* and Table 1 for the control variables. Standard errors reported in parentheses are estimated with heteroskedasticity-consistent errors clustered by industry. These statistics do not take test multiplicity into account.

***, **, and * indicate statistical significance at the 1%, 5%, and 10% (two-tail) test levels, respectively.

Endnotes

[1] Throughout the study, we use risk management and hedging interchangeably.

[2] This matching perspective is discussed in Bertrand and Schoar (2003), who explain that their managerial style findings are consistent with firms hiring executives whose style match their current policies. Executive-firm matching is also discussed in Graham et al. (2013).

[3] These authors also argue that if companies have access to a credit line, they will be less compelled to rely on hedging as a tool to mitigate credit rationing because they could draw down from the credit facility to cover cash flow shortfalls.

[4] See also Mayers and Smith (1982) and Leland (1998).

[5] Lambert et al. (1991), Carpenter (2000), and Ross (2004) show that even if compensated with stock options, risk-averse executives might have strong incentives to hedge. This occurs if the probability that stock options are in the money is sufficiently high, which renders stock options similar to stocks.

[6] Kahl et al. (2003) estimate that that underdiversification because of selling restrictions can be very costly for executives. Eckbo et al. (2016) find that the personal costs of corporate bankruptcy (in terms of lost employment and reduced wages) can be very large for top executives.

[7] The Duke-CFO group consists of a primary list of 3,624 CFOs (those who as of 2010 had participated in the quarterly Duke-CFO survey in the past five years) and a collection of older email addresses, many of which are obsolete. Five hundred and eight four of the 642 responses from the Duke-CFO list are from the primary list, resulting in a response rate of 16% (= 584/3,624). The full sample results presented in Section 4 also hold on the sample of primary Duke-CFO respondents. The ISDA and GARP lists generated a low response rate because these lists overwhelmingly include junior employees (who do not make risk management decisions and therefore did not fill out the survey).

[8] Other common titles include risk manager, director of finance, director of risk, finance manager, risk controller, risk coordinator, and head of corporate risk management.

[9] As we discuss later, 25 U.S. firms in our survey voluntarily disclose their identities.

[10] The exact wording of the risk management question is the following: "Does your firm have a formal, documented risk management policy?"

[11] For U.S. firms in COMPUSTAT, the percentage of nondividend paying firms is about 70%. For North America firms in our sample, the percentage of nondividend paying firms is 52%.

[12] We reach similar conclusions about representativeness for the full survey sample. Refer to Table A.2 in the appendix.

[13] In a survey completed before the global financial crisis and involving both CEOs and CFOs, Graham et al. (2013) find that a smaller proportion, 10%, of the respondents are highly risk averse. For the general U.S. population, Barsky et al. (1997) find that over 64% of the respondents show low risk tolerance. We use data from COMPUSTAT to check whether hedging was also lower prior to the financial crisis. We find that 39.1% of firms hedge in 2004–2007 compared to 40.7% in 2008–2011. Overall, our analysis suggests that hedging policy did not change significantly in the years of the global financial crisis.

[14] We reach very similar conclusions for the risk profile of the executives in the full sample. Refer to Table A.3.

[15] We follow Demirguc-Kunt and Levine (2001) to separate our firms' headquarters countries into developed economies and emerging countries. All our results hold if we use this indicator for whether the firm is located in a developing economy instead of the regional dummies.

[16] In Graham et al. (2013), older executives are more risk averse. Therefore, we might expect firms with older executives to hedge more. Using the merged ExecuComp-Compustat database, we find firms with older CFOs to hedge more. However, we do not find any significant relation between CEO age and risk management.

[17] We note that one should use caution when interpreting results with p-values higher than 0.01 because of multiple testing (see Harvey et al. 2016, and Harvey 2017).

[18] See Eckbo et al. (2016). Executives are also highly exposed to their firms if they receive stock and options as part of their compensation (something we will investigate in the next section).

[19] Gilchrist and Himmelberg (1995) and Fama and French (2002) argue that small firms are typically young, less well known, and therefore more exposed to credit frictions. The argument that rated companies are less likely to be financially constrained is proposed by Faulkender and Petersen (2006). Related approaches for characterizing financing constraints are used by Gilchrist and Himmelberg (1995) and Almeida et al. (2004), among others. Fazzari et al. (1988) argue that firms are more likely to pay dividends if they are less susceptible to credit rationing.

[20] The literature on liquidity management argues that cash holdings and cash flows are close substitutes for credit lines. See Sufi (2009), Lins et al. (2010), and Campello et al. (2011).

[21] We cannot exclude that some of the variables in Table 4 are insignificant because risk aversion captures some of the traditional motives for hedging. To investigate this issue, we reestimate our hedging model in Table 4, column 1, by adding interaction terms of the insignificant variables with risk aversion. We find the interactions of investment prospects, cash holdings, and profitability with risk aversion to be statistically insignificant. The only exception is the interaction of leverage with risk aversion, which enters the estimation with a significantly negative coefficient. Overall, this analysis confirms that our evidence is consistent with the predictions in some of the theories of risk management, but not with all.

[22] This finding is also consistent with the portfolio choice model of Kahl et al. (2003) that underdiversification is costly and hence risk averse executives hedge to transfer some of the underdiversification costs back to the firm.

[23] Armstrong et al. (2015) find that executives hold more unrestricted equity in their firm if they are less risk averse. This could explain why we do not find a positive relation between risk aversion and hedging for executives with a longer tenure (even though it is reasonable to assume that executives with a longer tenure have accumulated more equity in their firm).

[24] See also Eckbo et al. (2016) who show that the career trajectory and pay of a CEO is severely curtailed if their firm goes bankrupt. This outcome could contribute to younger executives playing it safe and better managing risk.

[25] We are grateful to an anonymous referee for suggesting this argument.

[26] In unreported analysis, we estimate our hedging model for the sample of executives compensated with stock and options conditioning on CFO's age, tenure, and education. Although some of these estimations are based on small samples, these additional tests confirm that implicit-career incentives related to age and job tenure are particularly important for executives compensated with equity.

[27] The large number of possible explanatory variables and interaction variable possibilities creates a multiple testing problem. The reported levels of significance do not correct for multiplicity but we exercise caution in discussing our results (see Harvey 2017).

[28] We do not find any significant evidence that risk-averse executives adopt more conservative cash management policies. While in principle firms could use cash to shield themselves against downsize risk,

cash is also the primary source of collateral for hedging (e.g., International Swaps and Derivatives Association, 2009). As a result, firms that hedge more could in practice have lower cash holdings on their balance sheet because the Financial Accounting Standard (FAS) 133 allows these firms to recognize the cash pledged to derivative counterparties as a receivable and to offset it against the derivative obligations.

[29] Other studies have considered the effect of executive traits on financing and other corporate policies (e.g., Malmendier et al. 2011, Benmelech and Frydman 2015, and Custodio and Metzger 2013), but they do not have a direct measure of executive risk aversion.

[30] Our categorization assumes that volatility is constant across the different distributional assumptions. That is, a normal distribution with a very high volatility might be more conservative than a fat-tailed distribution with a lower level of volatility.

[31] We find no significant effect of risk aversion on the distributional assumption among executives compensated with equity or the executives with a shorter tenure, but there is a significantly positive relation between risk aversion and the distributional assumption among younger executives and those with an MBA or another master degree.

[32] It is possible that only the more sophisticated CFOs are aware that financial events can be fat tailed. If these executives are also the more risk averse, then the evidence in Table 6 would suggest that risk aversion and financial sophistication are related.

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