Managerial Finance

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Received 6 May 2017
Revised 16 October 2017
17 February 2018
Accepted 21 March 2018

Abstract

Purpose – Previous research has documented that high vega CEOs increase R&D investment (Coles *et al.*, 2006) and liquidity (Liu and Mauer, 2011), but provided little clue about how those CEOs get the necessary resources to support those choices. Frankel *et al.* (2016) highlight firms' compensation incentives to manipulate working capital components, the authors use accounts receivable as an example to illustrate. The paper aims to discuss these issues.

Design/methodology/approach – The authors employ sorting, and various regression methods and adjust the Faulkender and Wang (2006) model to test two hypotheses.

Findings – The authors find a negative relation between managerial risk-taking incentives (vega) and accounts receivable and a negative relation between vega and the market value of accounts receivable to shareholders.

Research limitations/implications – The authors do not compare PPE investment, external financing with accounts receivable to figure out whether accounts receivable is better and more efficient to adjust.

Practical implications – The evidence primarily supports the internal allocation hypothesis that high vega managers reduce the accounts receivable investment and that the equity market discounts the value of accounts receivable for high vega firms.

Social implications – Equity holders should consider the internal allocation effect when setting CEO compensation incentives, also they should be cautious when CEOs change their accounts receivable management policy. The equity market discounts the value of accounts receivable for high vega firms.

Originality/value – This study provides important information about the CEO compensation incentives, a new explanation about the formation of accounts receivable management policy, and the market value implication of accounts receivable.

Keywords Managerial incentives, Internal allocation, Accounts receivable

Paper type Research paper

1. Introduction

Equity-based compensation and especially stock options are supposed to encourage managers to adopt risky corporate policies to increase the market value of equity (Jensen and Meckling, 1976), yet the same stock options could also lead to the risk aversion of managers (Lambert *et al.*, 1991; Ross, 2004). Researchers have long been interested in testing whether the managerial compensation programs are better suited to companies' needs and are more effective at creating shareholder value. For example, Coles *et al.* (2006) document that CEOs with higher vega, the sensitivity of CEO wealth to stock volatility, implement riskier investment and financing policies. Liu and Mauer (2011) report a positive relation between vega and corporate cash holdings. On the contrary, Gormley *et al.* (2013) find that high vega CEOs reduce leverage and hold less cash. Recent studies show that firms manipulate earnings and operating cash flows when compensation incentives to do so exist (e.g. Lee, 2011; Gordon *et al.*, 2017). Frankel *et al.* (2016) highlight managers' compensation incentives to

JEL Classification — G30, G32, G34

Managerial Finance
Vol. 44 No. 7, 2018
pp. 865-884

0307-4358
DOI 10.1108/MF-05-2017-0148

manipulate working capital components to achieve their perceived efficiency. Despite the importance of accounts receivable and the substantial increase in equity-based compensation (e.g. Hall and Liebman, 1998; Jensen and Murphy, 1990), few studies the relation between managerial incentives and accounts receivable management policy.

In this paper, we examine how managerial compensation incentives affect accounts receivable management policy for the following reasons. First, investment in accounts receivable represents a significant proportion of a firm's assets. The US corporate sector reported aggregate accounts receivable of $13.0tn at year-end 2011, which is sizable even relative to its annual business receipts of $28.3tn and net income of $1.3tn (Desai *et al.*, 2016). For our sample, the average accounts receivable is 16 percent of US manufacturing corporations' total assets and 15.3 percent of their sales. Second, accounts receivable is deemed a high-risk area of the internal control. Many of the worst corporate scandals since 2000 have involved C-Level executives using receivables to hide the fact that their businesses were not profitable. Third, a firm's accounts receivable management is a critical part of its working capital management and corporate strategy (Sartoris and Hill, 1983; Kieschnick *et al.*, 2013). Managers are motivated by their compensation incentives to manipulate working capital components such as accounts receivable to achieve their perceived efficiency (Frankel *et al.*, 2016).

We extend the research of managerial risk-taking and working capital manipulation to test the relation between managerial incentives and accounts receivable management policy. Our internal allocation hypothesis states that high vega managers reduce their accounts receivable to implement riskier investment and lower working capital. We also examine the implication of our internal allocation hypothesis for a firm's operational efficiency. After merging ExecuComp with both Compustat and CRSP, we build a sample of 26,956 observations for 2,476 unique firms over the period from 1992 to 2014. We find an economically and statistically significant negative relation between vega and accounts receivable, implying that higher vega managers implement lower accounts receivable investment. This evidence supports our internal allocation hypothesis that higher vega managers implement riskier investment and financing policies and manage their operating efficiency by reducing accounts receivable. We employ the Faulkender and Wang (2006) approach to examine how vega influences the marginal value of accounts receivable to shareholders and find that the market value of accounts receivable is a decreasing function of vega. Our finding implies that the equity market discounts the value of accounts receivable for high vega firms.

This paper is related to the risk-taking behavior of high vega CEOs documented by Coles *et al.* (2006) in that we show high vega managers reduce their accounts receivable to support their riskier investment and financing policies. The accounts receivable reduction also explains how high vega managers could increase their liquidity as documented by Liu and Mauer (2011). Moreover, this research is related to Frankel *et al.* (2016) in that we show directly how managerial compensation incentives motivate managers to manipulate their working capital management. It is also related to Hill *et al.* (2012) by showing that the market value of receivables is negatively associated with vega.

The paper proceeds as follows. We develop our hypotheses in Section 2 and describe our data in Section 3. Section 4 contains our results and Section 5 concludes.

2. Hypotheses

Existing work uses both vega and delta to measure managerial compensation incentives and emphasizes the use of CEO compensation incentive characteristics (e.g. Guay, 1999; Core and Guay, 2002; Coles *et al.*, 2006 and Liu and Mauer, 2011). However, the Standard & Poor's ExecuComp data set provides rich data on salary, bonus and total compensation for the top five executives (ranked annually by salary and bonus) including CEOs for firms in

the S&P 500, S&P Midcap 400 and S&P Smallcap 600. We measure managerial compensation incentives using vega and delta at both the top five executives and the CEO levels. In this section, we first present two hypotheses for why vega might influence accounts receivable management policy and then provide the discussion of the likely influence of delta on accounts receivable management policy.

2.1 Vega and accounts receivable

Coles *et al.* (2006) document that higher vega CEOs implement investment and financing policies. Liu and Mauer (2011) report that greater risk-taking of high vega CEOs may cause costly external finance, resulting in higher cash holdings. The above two research papers bring a new question about how high vega managers could increase their R&D investment and liquidity at the same time. Coles *et al.* (2006) imply that high vega CEOs both reduce their PPE (property, plant and equipment) investment and increase their leverage, while Gormley *et al.* (2013) find that high vega CEOs reduce their leverage instead. PPE investment reduction and leverage increase could not be enough to support higher R&D investment demand. Instead, both may cause difficulty in raising external capital and result in increased cost of external funds. In comparison, the reduction of accounts receivable provides a quick and flexible way toward more risk-taking and higher liquidity, given its large size, its easiness to adjust and to manipulate, and its extreme importance to working capital investment. Furthermore, equity-based managerial compensation provides incentives for managers to manipulate their working capital especially accounts receivable when vega is also related to working capital/cash-flow performance measures (Frankel *et al.*, 2016). Frankel *et al.* (2016) emphasize accounts receivable management as an important part of the working capital management, in that relatively small changes in accounts receivable could result in a relatively sizable change in working capital.

Our internal allocation hypothesis states that high vega managers reduce accounts receivable to increase both R&D investment and cash holdings, which results in more risk-taking and better operational efficiency management. Our internal allocation hypothesis predicts a negative relation between accounts receivable and vega:

H1. The relation between accounts receivable and vega is negative.

Accounts receivable has the downward risk when the actual default rate is higher than its estimated level, while it almost has no upward potential to gain a higher return. As such, an efficient compensation structure that aligns the interests of managers and shareholders could limit investment in accounts receivable. Previous literature did not build consensus about the impact of accounts receivable on firm profitability. For example, Juan García-Teruel and Martinez-Solano (2007) state that the more the investment in current assets (including accounts receivable), the lower the profitability obtained. Baños-Caballero *et al.* (2014) suggest that managers should avoid adverse effects on firm performance because of lost sales (possibly caused by the reduction of accounts receivable). Hill *et al.* (2012) suggest that managers should be cautious when minimizing receivables.

To uncover whether the relation between vega and accounts receivable is consistent with shareholder wealth maximization, we investigate whether the market recognizes specific trade credit motives by conditioning receivables on managerial compensation incentives. Higher vega managers implement riskier corporate policies such as more R&D investment, while those managers have less incentive to increase accounts receivable to stimulate sales growth. Given the fact that our sample firms are S&P firms, accounts receivable investment for such explanations as informational asymmetries (Smith, 1987; Biais and Gollier, 1997), bankruptcy (Frank and Maksimovic, 2001; Wilner, 2000), opportunistic behavior (Burkart and Ellingsen, 2004), product quality (Lee and Stowe, 1993; Long *et al.*, 1993) reduces greatly. We expect that the equity market discounts the value of

accounts receivable for high vega firms. Thus, the internal allocation hypothesis further predicts that high vega reduces the market value of accounts receivable:

H2. The market value of accounts receivable decreases with high vega.

2.2 Delta and accounts receivable

Vega and delta tend to be positively correlated, since both are derived from the same stock and options portfolio. As seen in Panel B of Table I, delta/TC is positively related to vega/TC (0.822). While vega measures the risk-taking behavior of managers implied from their incentive compensation portfolio, delta is usually referred as aligning the incentives of managers with the interests of shareholders. Coles *et al.* (2006) suppose that shareholders choose a combination of delta and vega to implement their investment and financial policies. They find that higher delta provides a strong incentive to decrease risk-taking while higher vega offers a strong incentive to increase risk-taking. The effects of delta on policy choices and firm risk are unclear from the previous literature. For example, high delta managers have strong incentive to adopt risk-reducing policies (Lambert *et al.*, 1991; Carpenter, 2000; Ross, 2004). In contrast, increased delta could also provide managerial incentives for managers to implement higher risk projects if those projects could bring higher NPV (John and John, 1993). Both Coles *et al.* (2006) and Liu and Mauer (2011) use delta mainly as a control variable.

Managers should strike a balance between costs and benefits of accounts receivable to establish the optimal accounts receivable management policy. For firms with sound financial flexibility, increasing accounts receivable helps for market share and in sustaining good demand and supply relation and therefore positive stock market response, suggesting a positive relation between delta and accounts receivable. While for financially distressed firms, a restrictive accounts receivable policy will be in the best interests of the high delta firm, which instead predicts a negative relation between delta and accounts receivable. Overall, the effect of delta on the level of accounts receivable can be either positive or negative. Although delta is referred as aligning the incentives of managers with the interests of shareholders, the relation between the market value of accounts receivable and delta is unclear because the relation could be impacted by other important factors such as demand uncertainty, importance of assessing product quality and leverage.

3. Data and descriptive statistics

The Standard & Poor's ExecuComp provides rich data on salary, bonus and total compensation for the top five executives (ranked annually by salary and bonus) of firms in the S&P 500, S&P Midcap 400 and S&P Smallcap 600. We construct our sample from 1992 to 2014. We obtain firm-specific accounting variables from Compustat and stock returns from CRSP. We exclude financial service firms (SIC codes 6000-6999) and utility firms (SIC codes 4900-4999) from our sample. We then eliminate observations missing the required financial data, those having non-positive values for the market value of equity and net assets, as well as with negative sales. Using the change in variables sacrifices the first observation for each firm. The variables are defined as follows:

Accounts receivable: we measure corporate accounts receivable as the ratio of accounts receivable to net assets, where net assets are total assets minus accounts receivable.

Managerial compensation incentives: for a firm-year, vega is the dollar change in the value of executives' option grants and any option holdings for a 0.01 change in the annualized standard deviation of stock returns. Delta is the dollar change in the value of the option or restricted stock grants, shareholdings, and any restricted stock and options holdings for a 1 percent change in the stock price. Managerial compensation incentive measures such as vega and delta are taken from Lalitha Naveen[1]. As stated in Liu and Mauer (2011),

Panel A: descriptive statistics

Variable	Mean	1st quartile	Median	3rd quartile	SD	*n*
Accounts receivable	0.204	0.078	0.153	0.256	0.217	130,010
Vega (in thousands)	62.939	5.608	18.237	53.281	195.188	130,010
Delta (in thousands)	464.705	20.296	58.7	177.067	7646.232	130,010
Vega/TC	0.065	0.019	0.049	0.09	0.062	130,010
Delta/TC	0.132	0.111	0.125	0.145	0.029	130,010
Firm age	24.666	11	20	37	16.221	130,010
CEO age	55.836	51	56	61	7.505	121,681
CEO tenure	7.646	2	5	10	7.377	122,792
Real size	7.392	6.291	7.239	8.359	1.557	130,010
Market to book	1.946	1.14	1.533	2.248	1.305	130,010
Cash flow/Net assets	0.134	0.095	0.135	0.183	0.097	130,010
R&D/sales	0.049	0	0.003	0.051	0.103	130,010
Capex/Net assets	0.068	0.027	0.05	0.088	0.06	130,010
Acquisition activity	0.035	0	0	0.031	0.074	130,010
PQL	0.062	0.053	0.061	0.069	0.012	130,010
Financial distress	0.015	0	0	0	0.121	130,010
Variable cost/Net assets	0.963	0.382	0.727	1.218	0.897	130,010
ROA	0.093	0.052	0.095	0.144	0.099	130,010
Inventory/Net assets	0.15	0.022	0.113	0.223	0.152	130,010
Growth	0.116	−0.024	0.05	0.157	1.977	130,010
Mktshare	0.013	0.001	0.003	0.011	0.027	130,010
SaleVar	0.231	0.083	0.154	0.281	0.245	130,010
Cash/Net assets	0.182	0.032	0.107	0.273	0.196	130,010

Panel B: correlations between accounts receivable, managerial compensation incentives and firm characteristics

Variable	Accounts receivable	Vega	Delta	Vega/TC	Delta/TC
Accounts receivable	1				
Vega	−0.052*	1			
Delta	−0.012*	0.200*	1		
Vega/TC	−0.049*	0.105*	−0.044*	1	
Delta/TC	−0.035*	0.146*	−0.041*	0.822*	1
Firm age	0.011*	0.097*	−0.003	0.177*	0.241*
CEO age	−0.001	0.042*	0.012*	0.007*	0.049*
CEO tenure	0.027*	0.028*	0.050*	−0.110*	−0.086*
Real size	−0.099*	0.301*	0.071*	0.155*	0.262*
Market to book	−0.027*	0.080*	0.059*	−0.203*	−0.134*
Cash flow/Net assets	0.201*	0.040*	0.014*	−0.080*	0.030*
R&D/Sale	−0.116*	0.018*	0.005	0.008*	−0.060*
Capex/Net assets	−0.027*	−0.042*	−0.010*	−0.103*	−0.071*
Acquisition activity	0.055*	−0.002	−0.005	−0.034*	−0.0003
PQL	0.096*	−0.252*	−0.056*	−0.136*	−0.243*
Financial distress	−0.008*	−0.024*	−0.006*	0.022*	−0.033*
Variable cost/Net assets	0.524*	−0.072*	−0.018*	−0.051*	−0.043*
ROA	0.065*	0.073*	0.031*	−0.102*	0.036*
Inventory/Net assets	0.117*	−0.074*	−0.022*	−0.035*	−0.031*
Growth	−0.005	−0.001	0.002	−0.029*	−0.026*
Market share	−0.023*	0.183*	0.026*	0.081*	0.162*
SalesVar	0.376*	−0.073*	−0.013*	−0.062*	−0.130*
Cash/Net assets	−0.006*	−0.011*	0.026*	−0.066*	−0.147*

Notes: Panel A reports descriptive statistics and Panel B reports Pearson correlation coefficients. All variables in dollars (including vega and delta) are inflation-adjusted to 2014 dollars using the Consumer Price Index. *In Panel B denote significance at the 5 percent level. Variable definitions are provided in the Appendix

Table I.
Descriptive statistics and correlations of firm characteristics and managerial compensation incentives

it is appropriate to scale compensation incentives because a CEO might have a relatively large dollar value for vega or delta, which is small relative to her total compensation. Consistent with the previous research, we scale vega and delta by total managerial compensation (TC), where TC in a year includes bonus, restricted stock and option grants, long-term incentive payouts and any other compensation. The Standard & Poor's ExecuComp provides detailed managerial compensation information for the top five executives. We take full advantage of the rich data and use managerial compensation incentive measures at both the top five executives level and the CEO level. We mainly use the top five executives' compensation incentive measures and use CEO compensation incentive measures for robustness check.

Instruments: following Coles *et al.* (2006), Brockman *et al.* (2010) and Liu and Mauer (2011), we use instruments for vega and delta in some of our regression models. The instruments we use include firm age, CEO age and CEO tenure. A firm's age in a sample year is the number of years since the first year that the firm is reported in Compustat. CEO age is the age of the CEO as reported in the ExecuComp database. CEO tenure is the number of years that the current CEO has served in that capacity as reported in the ExecuComp database.

Control variables: the control variables in the accounts receivable regressions are motivated by the variables used in Emery (1984), Bastos and Pindado (2007) and Molina and Preve (2009). Real size is measured by the logarithm of net assets. Market-to-book ratio is computed as the book value of net assets minus the book value of equity plus the market value of equity, all divided by the book value of net assets. Cash flow/net assets is the ratio of earnings after interest, dividends and taxes but before depreciation divided by the book value of net assets. R&D/sales is the ratio of research and development expense to sales. This ratio is set equal to zero when research and development expense is missing. Capex/net assets is the ratio of capital expenditures to the book value of net assets. Acquisition activity is measured by the ratio of expenditures on acquisitions to the book value of net assets. PQL is the product quality-level variable constructed to measure the product quality. Following Bastos and Pindado (2007), we divide all firms into three industries: technical industries (SIC codes between 3400 and 3999), perishable industries (SIC codes between 2000 and 2199), and the remaining firms. We calculate PQL = (30/(1+firm size)) for technical industries, PQL = (0.5/(1+firm size)) for perishable industries, and PQL = (2/(1+firm size)) for the remaining firms. Following Molina and Preve (2009), a firm must satisfy two criteria to be classified as financially distressed: the firm must have difficulty covering interest payments and it must be overleveraged. The first component is having a coverage ratio calculated as operating income before depreciation divided by interest expense less than one for two consecutive years or less than 0.80 in any sample year. Second, a firm is considered overleveraged if its leverage ratio is in the top two deciles of its industry's leverage ratio in a sample year. If a firm meets both conditions in a sample year, then the dummy variable financial distress equals one and zero otherwise. Variable cost/net assets are calculated as the cost of goods sold divided by the book value of net assets. ROA is calculated as earnings before interest and taxes divided by total assets to proxy for supplier's profitability. Inventory/net assets is calculated as inventory divided by the book value of net assets. Growth is the annual percentage change in sales. Mktshare is the ratio of annual firm-level sales to the industry's annual sum of sales. SaleVar is the ratio of the standard deviation of sales to net assets over a rolling five-year period prior to each of the sample years. Firm-year observations are included in the sample for a given year if the firm has at least three observations during the previous five-year period. We also include cash in our control variables and measure corporate cash holdings as the ratio of cash and marketable securities to the book value of net assets.

All variables in dollars are inflation-adjusted to 2014 dollars using the consumer price index. Inflation-adjusted vega and delta and all ratio variables are winsorized at the 1st and 99th percentiles to mitigate the impact of outliers.

We report the descriptive statistics in Panel A of Table I. The average (median) accounts receivable in our sample is 20.4 percent (15.3 percent) of net assets. The top five executives in the sample appear to have nontrivial vega and delta incentives. A 1 percent increase in stock return volatility increases the average (median) top five executives' wealth by about $62,939 ($18,237); and a 1 percent increase in the stock price increases the average (median) top five executives' wealth by about $464,705 ($58,700). Focusing on the means (medians) of vega/TC and delta/TC, the dollar vega and delta incentives represent about 6.5 percent (4.9 percent) and 13.2 percent (12.5 percent) of total annual compensation, respectively.

Panel B of Table I reports Pearson correlation coefficients among those variables. As seen in the panel, accounts receivable is negatively related to vega with a correlation coefficient of −0.052 and is negatively related to vega/TC with a correlation coefficient of −0.049. Both negative correlation coefficients support our *H1* that there is a negative relation between vega and accounts receivable. The correlation between accounts receivable and delta is also significantly negative for both delta and delta/TC. The correlation relation is stronger for vega variables than for delta variables. For example, the correlation between accounts receivable and delta/TC is −0.035 which is lower in absolute value than the correlation between accounts receivable and vega/TC, −0.049. We find that the positive correlation between vega and delta (0.200) becomes much higher when these incentive variables are scaled by total compensation (0.822). This finding is consistent with the fact that vega and delta tend to be positively correlated, since both are derived from the same stock and options portfolio. We also find that instruments for compensation incentives such as firm age, CEO age and CEO tenure have reasonable correlations with vega and delta and their scaled counterparts. One exception is that the correlation between vega/TC and CEO age is close to zero. All those control variables we choose are significantly correlated to our dependent variable, accounts receivable.

We have 26,956 observations for 2,476 unique firms from 1992 to 2014. Table II reports the number of observations in each year. The maximum and the minimum number of observations for a given year are 1,356 and 693 occurring in 2007 and 1992, respectively. The average accounts receivable to sales (net assets) ratio is 16.0 percent (20.8 percent). Column 4 and 7 illustrate a general downward trend in the accounts receivable to total assets ratio. The general trends measured by accounts receivable to sale ratio and accounts receivable to net assets ratio tell the same story. Bates *et al.* (2009) report the average cash-to-assets ratio more than doubles from 10.5 percent in 1980 to 23.2 percent in 2006. The comparison of downward accounts receivable with upward cash holdings seems to imply that firms can reduce their accounts receivable investment to increase their cash holdings.

4. Results

In this section, we examine the extent to which vega induces managers to implement accounts receivable management policy to test both hypotheses. We first report regression results of accounts receivable on managerial compensation incentives in Tables IV and V. We subsequently report regression results that estimate the marginal value of accounts receivable to equity holders in Table VI. In these regressions, we further estimate the effect of managerial compensation incentives on the value of accounts receivable.

4.1 Accounts receivable and managerial compensation incentives

To assess whether accounts receivable is related to vega, we divide those sample firms into quintiles each year according to the average and median vega/TC ratios

Sample year	n	Mean AR/Sales	Mean AR/Assets	Mean AR/Net assets	Median AR/Sales	Median AR/Assets	Median AR/Net assets
1992	693	0.162	0.171	0.236	0.144	0.159	0.190
1993	959	0.167	0.175	0.244	0.149	0.161	0.191
1994	1,021	0.166	0.179	0.251	0.151	0.166	0.200
1995	1,083	0.170	0.182	0.258	0.151	0.167	0.201
1996	1,129	0.170	0.180	0.255	0.152	0.164	0.196
1997	1,196	0.169	0.177	0.251	0.153	0.160	0.191
1998	1,245	0.172	0.172	0.243	0.155	0.155	0.184
1999	1,211	0.177	0.171	0.239	0.163	0.153	0.181
2000	1,150	0.177	0.160	0.220	0.156	0.144	0.169
2001	1,165	0.157	0.143	0.190	0.138	0.122	0.139
2002	1,217	0.159	0.140	0.185	0.143	0.123	0.141
2003	1,289	0.155	0.139	0.183	0.145	0.122	0.139
2004	1,276	0.150	0.143	0.190	0.143	0.128	0.147
2005	1,202	0.149	0.145	0.195	0.146	0.125	0.143
2006	1,254	0.151	0.146	0.196	0.143	0.127	0.146
2007	1,356	0.155	0.144	0.192	0.148	0.126	0.144
2008	1,331	0.140	0.140	0.185	0.130	0.121	0.138
2009	1,291	0.161	0.133	0.172	0.142	0.116	0.131
2010	1,276	0.157	0.136	0.179	0.143	0.119	0.135
2011	1,244	0.144	0.135	0.178	0.137	0.120	0.136
2012	1,210	0.146	0.135	0.178	0.137	0.116	0.131
2013	1,180	0.147	0.133	0.175	0.138	0.117	0.133
2014	978	0.175	0.138	0.181	0.143	0.119	0.135
Observations	26,956	0.160	0.153	0.208	0.146	0.136	0.158
Unique firms	2,476						

Table II.
Time distribution of sample

Notes: This table provides the distribution of the sample across time from 26,956 observations across 2,476 unique companies over the period 1992–2014. Variable definitions are provided in the Appendix

for the top five executives. Table III illustrates the average accounts receivable to net assets ratios by average and median vega/TC quintiles over our sample period.

Take the quintiles by the average vega/TC ratio, for example, we see that industrial firms in the highest average vega/TC quintile (Q5) hold less accounts receivable than their low vega/TC peers, with only three exceptions, i.e. 2001, 2002 and 2003. Overall, the average accounts receivable to net assets ratio drops all the way down from 22.2 percent in the lowest quintile, 21.3 percent in Q2, 20.7 percent in Q3 and 20.2 percent in Q4, to 19.5 percent in the highest quintile. The similar trend is conveyed by the median vega/TC ratio quintiles with an exceptionally increase from 20.6 percent in Q2 to 21.2 percent in Q3.

We test the equality of accounts receivable to net assets ratios among different average vega/TC quintiles. We find overall that the accounts receivable to net assets ratios in low quintiles are greater than those in high quintiles and the relation is statistically significant. As an exception, we find no significant difference in accounts receivable to net assets ratios between Q2 and Q3. The most noteworthy finding is that firms in Q1 hold higher accounts receivable to net assets ratio than those in Q5 with a t-statistics of 5.639 and p-value of 0.000 supporting our discussion that firms in the lowest average vega/TC quintile invest more in the accounts receivable than those in the highest quintile. We find exactly the same pattern when we test the equality of accounts receivable to net assets ratios among different median vega/TC quintiles. For example, we find consistent evidence that firms in the lowest median vega/TC quintile hold higher accounts receivable to net assets ratio than their peers in the highest quintile, with a t-statistics of 6.468 and p-value of 0.000.

Year	Quintiles by average vega/TC ratio					Quintiles by median vega/TC ratio				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
1992	0.276	0.240	0.222	0.231	0.212	0.264	0.223	0.252	0.220	0.221
1993	0.253	0.278	0.253	0.235	0.201	0.244	0.281	0.257	0.231	0.206
1994	0.277	0.285	0.236	0.232	0.227	0.268	0.268	0.257	0.234	0.229
1995	0.299	0.269	0.250	0.246	0.229	0.288	0.264	0.269	0.234	0.238
1996	0.281	0.287	0.229	0.249	0.229	0.287	0.270	0.246	0.248	0.225
1997	0.273	0.246	0.284	0.250	0.201	0.276	0.255	0.270	0.253	0.201
1998	0.264	0.237	0.269	0.238	0.206	0.262	0.246	0.268	0.237	0.200
1999	0.226	0.264	0.235	0.251	0.218	0.239	0.243	0.239	0.254	0.219
2000	0.220	0.221	0.219	0.226	0.212	0.230	0.208	0.227	0.227	0.206
2001	0.171	0.188	0.206	0.204	0.183	0.190	0.162	0.203	0.213	0.184
2002	0.182	0.181	0.184	0.194	0.184	0.178	0.188	0.191	0.189	0.180
2003	0.180	0.182	0.186	0.188	0.180	0.178	0.182	0.176	0.202	0.176
2004	0.188	0.190	0.193	0.184	0.193	0.189	0.190	0.202	0.167	0.200
2005	0.203	0.192	0.197	0.185	0.197	0.209	0.194	0.182	0.193	0.196
2006	0.215	0.193	0.199	0.168	0.207	0.217	0.189	0.198	0.178	0.200
2007	0.214	0.207	0.194	0.159	0.184	0.226	0.199	0.185	0.173	0.177
2008	0.194	0.196	0.179	0.167	0.191	0.213	0.180	0.182	0.159	0.192
2009	0.187	0.162	0.162	0.175	0.172	0.193	0.162	0.159	0.170	0.173
2010	0.197	0.178	0.168	0.172	0.180	0.199	0.165	0.182	0.174	0.176
2011	0.198	0.181	0.168	0.162	0.180	0.207	0.165	0.177	0.164	0.176
2012	0.198	0.174	0.180	0.170	0.169	0.202	0.161	0.194	0.167	0.167
2013	0.195	0.172	0.168	0.174	0.164	0.199	0.167	0.172	0.165	0.170
2014	0.204	0.176	0.180	0.176	0.170	0.201	0.172	0.179	0.181	0.173
Overall	0.222	0.213	0.207	0.202	0.195	0.224	0.206	0.212	0.201	0.195

Notes: This sample includes 26,956 observations across 2,476 unique companies over the period 1992–2014. Variable definitions are provided in the Appendix

Table III. Average accounts receivable to net assets ratios by different vega/TC quintiles

Overall, our sorting results from Table III support the negative relation between accounts receivable and vega:

$$\begin{aligned}\text{Accounts receivable}_{i,t} = {} & \alpha_0 + \alpha_1 \times \text{vega/TC}_{i,t} + \alpha_2 \times \text{delta/TC}_{i,t} + \alpha_3 \times \text{real size}_{i,t} \\ & + \alpha_4 \times \text{market to book}_{i,t} + \alpha_5 \times \text{cash flow/net assets}_{i,t} \\ & + \alpha_6 \times \text{R\&D/sale}_{i,t} + \alpha_7 \times \text{capex/net assets}_{i,t} \\ & + \alpha_8 \times \text{acqusition activity}_{i,t} + \alpha_9 \times \text{PQL}_{i,t} \\ & + \alpha_{10} \times \text{financial distress}_{i,t} + \alpha_{11} \times \text{variable cost/net assets}_{i,t} \\ & + \alpha_{12} \times \text{ROA}_{i,t} + \alpha_{13} \times \text{inventory/net assets}_{i,t} \\ & + \alpha_{14} \times \text{cash/net assets}_{i,t} \\ & + \alpha_{15} \times \text{growth}_{i,t} + \alpha_{16} \times \text{market share}_{i,t} \\ & + \alpha_{17} \times \text{salesVar}_{i,t} + \varepsilon_{i,t}. \end{aligned} \quad (1)$$

Table IV reports regression results of accounts receivable on both managerial compensation incentives measures for the top five executives and controls as specified in Equation (1). All regression models include industry and time effects, i.e. two-digit SIC code dummies and year dummies. Models (1), (3) and (5) include two managerial compensation incentive variables, vega/TC and delta/TC. Models (2), (4) and (6) include only vega/TC.

Models (1) and (2) in Table IV report the contemporaneous relation between accounts receivable and executive compensation incentives. The regression results from both

Table IV.
Regressions of accounts receivable on executive compensation incentives and controls

Independent variable	Contemporaneous incentives (1)	(2)	Lagged incentives (3)	(4)	2SLS (5)	(6)
Vega/TC	−0.062** (0.024)	−0.038** (0.014)	−0.092*** (0.025)	−0.058*** (0.016)	−4.473*** (0.336)	−0.198** (0.065)
Delta/TC	0.068 (0.052)		0.098 (0.058)		9.387*** (0.713)	
Real size	0.004 (0.011)	0.004 (0.011)	−0.018 (0.010)	−0.018 (0.010)	0.008** (0.002)	0.023*** (0.002)
Market to book	0.002 (0.002)	0.002 (0.002)	0.001 (0.002)	0.001 (0.002)	−0.019*** (0.002)	−0.001 (0.0008)
Cash flow/Net assets	0.444*** (0.053)	0.443*** (0.053)	0.281*** (0.049)	0.280*** (0.049)	1.401*** (0.020)	1.234*** (0.012)
R&D/sale	−0.074** (0.023)	−0.073** (0.023)	−0.055* (0.023)	−0.054* (0.023)	0.030** (0.010)	0.029*** (0.007)
Capex/Net assets	0.181*** (0.029)	0.181*** (0.029)	0.041 (0.028)	0.041 (0.028)	−0.463*** (0.016)	−0.394*** (0.012)
Acquisition activity	0.066*** (0.010)	0.066*** (0.010)	0.029** (0.011)	0.029** (0.011)	0.153*** (0.012)	0.236*** (0.008)
PQL	1.365 (1.398)	1.362 (1.397)	0.0931 (1.175)	0.0868 (1.174)	2.675*** (0.240)	3.217*** (0.180)
Financial distress	0.023 (0.017)	0.023 (0.017)	0.009 (0.012)	0.009 (0.012)	0.106*** (0.001)	0.119*** (0.0008)
Variable cost/Net assets	0.130*** (0.008)	0.130*** (0.008)	0.0883*** (0.008)	0.0883*** (0.008)	−1.226*** (0.031)	−0.876*** (0.012)
ROA	−0.273*** (0.050)	−0.272*** (0.050)	−0.232*** (0.045)	−0.229*** (0.045)	−0.086*** (0.005)	−0.096*** (0.004)
Inventory/Net assets	0.152*** (0.031)	0.152*** (0.031)	0.110*** (0.033)	0.110*** (0.033)	0.193*** (0.009)	0.0927*** (0.004)
Cash/Net assets	−0.026 (0.014)	−0.026 (0.014)	−0.020 (0.013)	−0.020 (0.013)	0.0001 (0.0003)	0.0002 (0.0002)
Growth	0.0004 (0.0003)	0.0004 (0.0003)	0.0001 (0.0001)	0.0001 (0.0001)	−0.432*** (0.0363)	−0.163*** (0.0229)
Market share	0.028 (0.218)	0.033 (0.219)	0.202 (0.214)	0.210 (0.215)	0.134*** (0.006)	0.078*** (0.003)
SalesVar	0.021* (0.008)	0.021* (0.008)	0.002 (0.009)	0.001 (0.009)	0.076*** (0.007)	0.024*** (0.004)
Intercept	−0.111 (0.164)	−0.104 (0.164)	0.199 (0.142)	0.210 (0.142)	−1.126*** (0.065)	−0.345*** (0.020)
Number of observations	130,010	130,010	96,355	96,355	121,681	121,681
Adj. R^2	0.863	0.863	0.851	0.851		0.371

Notes: The dependent variable is the ratio of accounts receivable to net assets. All independent variables are defined in the Appendix. Standard errors are in parentheses below parameter estimates. *,**,***Denote significance at the 5, 1, and 0.1 percent levels, respectively

regression models reveal that accounts receivable is negatively related to vega/TC and the relation is significant at 1 percent. In other words, firms that encourage managerial risk-taking reduce their accounts receivable, all else equal. With a coefficient of −0.038, we report that one standard deviation increase of the top five executives' vega/TC leads to 24 basis points decrease of the accounts receivable as a proportion of the net assets. The addition of delta/TC does not change much of the coefficients for those independent variables, but greatly changes the coefficient for vega/TC. As shown in Model (1), the coefficient for delta/TC is not statistically significant, which is consistent with our discussion that the relation between accounts receivable and delta is unclear. The control variables generally have expected signs supporting our internal allocation hypothesis. For example, there is a negative relation between R&D investment and accounts receivable, implying that firms reduce their accounts receivable to support their risk-taking investment. In contrast, the relation between accounts receivable and cash holdings is neither economically nor statistically significant.

To control for the possible endogeneity between accounts receivable and executive compensation incentives, Models (3) and (4) in Table IV report the relation between accounts receivable and lagged executive compensation incentives. The impact for vega/TC on accounts receivable greatly increases from contemporaneous models to lagged models, as evidenced by greater absolute values of coefficients for vega/TC in lagged incentives models. The coefficients are both significant at 1 percent. The relation between accounts receivable and delta/TC is not statistically significant when measured by lagged incentives. Overall, our lagged regression results from Models (3) and (4) are consistent with findings from contemporaneous regression Models (1) and (2) that there is a negative relation between accounts receivable and vega.

While lagging executive incentive measures help to alleviate endogeneity concerns, Models (5) and (6) in Table IV explicitly accounts for the endogeneity problem by using the two-stage least squares (2SLS) estimation method in Liu and Mauer (2011). Specifically, we separately regress vega/TC and delta/TC on all the variables used in Table IV along with instruments including CEO age, CEO tenure and firm age in the first stage. We report in Models (5) and (6) the second-stage regression results in which vega/TC and delta/TC are replaced by their predicted values from their respective first-stage regressions. Models (5) and (6) report much stronger economically significant relation between accounts receivable and vega/TC. The absolute value of the coefficient for vega/TC increases from around 4 percent in Model (2) to around 20 percent in Model (6). The coefficient is again both economically and statistically significant. Model (5) reports 2SLS estimation results with both executive compensation incentive variables included. Both coefficients for vega/TC and delta/TC are absurdly high in Model (5), which is caused by the strong collinearity between predicted values of vega/TC and delta/TC. We cannot conclude whether the significant positive coefficient for delta/TC from Model (5) is caused by spurious regression results.

In summary, we find an economically and statistically negative relation between accounts receivable and vega/TC from regression results in Table IV. Our findings are consistent with the internal allocation hypothesis that higher vega managers reduce their accounts receivable to increase their risk-taking investment such as R&D. We find no consistent evidence supporting a possible relation between accounts receivable and delta/TC.

As a robustness check, we next use the CEOs' instead of all the top five executives' compensation incentive characteristics to test our internal allocation hypothesis. Our CEO sample shrinks to 29,387 observations from the executive sample. We report regression results of accounts receivable on CEO compensation incentive measures in Table V.

Table V reports similar results as in Table IV. The adjusted R^2 values are almost the same for the same regression models, while the absolute values of coefficients for vega/TC greatly increase from Table IV to Table V for both contemporaneous and lagged CEO

Table V.
Regressions of accounts receivable on CEO compensation incentives and controls

	Contemporaneous incentives		Lagged incentives		2SLS	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Vega/TC	−0.097** (0.032)	−0.043* (0.019)	−0.115** (0.036)	−0.065** (0.022)	−5.880*** (1.072)	−0.160* (0.077)
Delta/TC	0.155* (0.066)		0.147 (0.080)		12.93*** (2.409)	
Real size	0.009 (0.011)	0.009 (0.011)	−0.015 (0.010)	−0.012 (0.010)	−0.0005 (0.006)	0.023*** (0.003)
Market to book	0.003 (0.002)	0.003 (0.002)	0.001 (0.002)	0.001 (0.002)	−0.018*** (0.004)	−0.0004 (0.001)
Cash flow/Net assets	0.406*** (0.054)	0.405*** (0.054)	0.256*** (0.051)	0.255*** (0.051)	1.407*** (0.049)	1.226*** (0.024)
R&D/sale	−0.078** (0.024)	−0.076** (0.024)	−0.047 (0.024)	−0.046 (0.024)	−0.021 (0.025)	0.039** (0.015)
Capex/Net assets	0.177*** (0.030)	0.177*** (0.030)	0.036 (0.030)	0.037 (0.030)	−0.414*** (0.032)	−0.390*** (0.021)
Acquisition activity	0.059*** (0.010)	0.059*** (0.010)	0.021 (0.012)	0.022 (0.012)	0.136*** (0.029)	0.234*** (0.015)
PQL	2.103 (1.349)	2.106 (1.348)	0.654 (1.236)	0.656 (1.234)	2.333*** (0.538)	3.145*** (0.347)
Financial distress	0.021 (0.016)	0.020 (0.016)	0.012 (0.014)	0.012 (0.014)	0.108*** (0.003)	0.121*** (0.002)
Variable cost/Net assets	0.128*** (0.007)	0.128*** (0.007)	0.083*** (0.007)	0.084*** (0.007)	−1.328*** (0.093)	−0.869*** (0.025)
ROA	−0.245*** (0.051)	−0.241*** (0.050)	−0.208*** (0.047)	−0.205*** (0.046)	−0.080*** (0.013)	−0.098*** (0.008)
Inventory/Net assets	0.156*** (0.032)	0.155*** (0.032)	0.113*** (0.033)	0.112*** (0.033)	0.214*** (0.026)	0.0895*** (0.008)
Cash/Net assets	−0.029 (0.015)	−0.030* (0.015)	−0.020 (0.015)	−0.021 (0.015)	0.00004 (0.0007)	0.0001 (0.0005)
Growth	0.0003 (0.0003)	0.0003 (0.0003)	0.0001 (0.0001)	0.0001 (0.0001)	−0.466*** (0.094)	−0.126** (0.047)
Market share	−0.003 (0.251)	0.004 (0.252)	0.202 (0.259)	0.209 (0.261)	0.147*** (0.015)	0.079*** (0.005)
SalesVar	0.019* (0.009)	0.018* (0.008)	−0.003 (0.010)	−0.004 (0.010)	0.084*** (0.018)	0.023* (0.009)
Intercept	−0.201 (0.159)	−0.187 (0.160)	0.144 (0.146)	0.158 (0.146)	−1.437*** (0.211)	−0.349*** (0.040)
Number of observations	29,387	29,387	25,248	25,248	27,595	27,595
Adj. R^2	0.862	0.861	0.842	0.842		0.379

Notes: The dependent variable is the ratio of accounts receivable to net assets. All independent variables are defined in the Appendix. Standard errors are in parentheses below parameter estimates. *,**,***Denote significance at the 5, 1, and 0.1 percent levels, respectively

compensation incentive measures. The results comparison between Table IV and Table V is consistent with our knowledge that CEOs have direct control over such corporate policies as the accounts receivable management policy.

In summary, we find strong evidence at both the top five executives and CEO levels supporting the internal allocation hypothesis that high vega industrial firms choose to reduce accounts receivable to support their risk-taking policies.

4.2 Value of accounts receivable and managerial compensation incentives

To figure out whether the market value of accounts receivable increases or decreases with vega/TC and delta/TC, we adjust the Faulkender and Wang (2006) valuation approach to estimate the relation between equity values and accounts receivable. Equation (2) regresses annual excess stock returns on unexpected changes in financial characteristics. Regression estimates yield shareholders' capitalization of changes in these characteristics, so the model resembles a long-term event study. We estimate the following augmented Faulkender and Wang regression to include managerial compensation incentives:

$$\begin{aligned} r_{i,t} - R^{B}_{i,t} = {} & \gamma_0 + \gamma_1 \times \Delta C_{i,t}/\mathrm{MVE}_{i,t-1} + \gamma_2 \times \Delta \mathrm{AR}_{i,t}/\mathrm{MVE}_{i,t-1} + \gamma_3 \times \Delta E_{i,t}/\mathrm{MVE}_{i,t-1} \\ & + \gamma_4 \times \Delta \mathrm{NA}_{i,t}/\mathrm{VE}_{i,t-1} + \gamma_5 \times \Delta \mathrm{R\&D}_{i,t}/\mathrm{MVE}_{i,t-1} + \gamma_6 \times \Delta I_{i,t}/\mathrm{MVE}_{i,t-1} \\ & + \gamma_7 \times \Delta D_{i,t}/\mathrm{MVE}_{i,t-1} + \gamma_8 \times \mathrm{Lev}_{i,t} + \gamma_9 \times \Delta \mathrm{NF}_{i,t}/\mathrm{MVE}_{i,t-1} \\ & + \gamma_{10} \times \mathrm{SaleG}_{i,t} + \gamma_{11} \times \left(\mathrm{vega/TC}\right)_{i,t}/\mathrm{MVE}_{i,t-1} \\ & + \gamma_{12} \times \left(\mathrm{vega/TC}\right)_{i,t} \times \Delta \mathrm{AR}_{i,t}/\mathrm{MVE}_{i,t-1} \\ & + \gamma_{13} \times \left(\mathrm{delta/TC}\right)_{i,t}/\mathrm{MVE}_{i,t-1} \\ & + \gamma_{14} \times \left(\mathrm{delta/TC}\right)_{i,t} \times \Delta \mathrm{AR}_{i,t}/\mathrm{MVE}_{i,t-1} + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where ΔX represents a change in X from year $t-1$ to t.

Our dependent variable is the firm's annual excess stock return defined as firm's annual raw return ($r_{i,t}$) minus the expected return ($R^{B}_{i,t}$). The raw return is equal to the change in market value of equity plus dividends divided by lagged market equity, where these variables are collected from CRSP. Our benchmark returns are taken from Fama and French (1993) size and book-to-market portfolio sorts[2].

We account for changes in profitability, investment and financing policies. We use earnings before extraordinary items (E) to proxy for profitability, research and development expense (R&D) and net assets (NA) to proxy for investment. Our control variables for financial policy include cash (C), interest expense (I), dividends (D), market leverage (L) and net financing (NF). Different from Faulkender and Wang (2006), we include sales growth (SalesG). To show how executive compensation incentives lead to changes in the market value of accounts receivable, we include changes of accounts receivable ratio ($\Delta \mathrm{AR}_{i,t}$), which is defined as the change in accounts receivable scaled by the lagged market value of equity. The coefficient estimates are used to show the additional value to shareholders because of a \$1 increase in the regressors. For example, γ_2 represents the additional value to shareholders for a \$1 increase in the accounts receivable changes.

Our *H2* is about the consequence of high vega managers reducing their accounts receivable. We add more managerial compensation incentives-related regressors into our model. Consistent with models in Tables IV and V, we use the top five executives' compensation incentive ratios for our analysis, vega/TC and delta/TC and CEO compensation incentive variables for robustness check. The coefficients of the incentive variables (γ_{11} and γ_{13}) measure the direct effect of managerial compensation incentives on

excess equity returns. The coefficients of the interactions of the incentive variables with the change in accounts receivable (γ_{12} and γ_{14}) measure the effect of managerial compensation incentives on the value of an additional dollar of accounts receivable. We are most interested in the coefficient on $(\text{vega/TC})_{i,t} \times \Delta\text{AR}_{i,t}/\text{MVE}_{i,t\text{-}1}$, i.e. γ_{12}, which measures the effect of managerial risk-taking incentives on the marginal value of accounts receivable. The coefficient of $(\text{delta/TC})_{i,t} \times \Delta\text{AR}_{i,t}/\text{MVE}_{i,t\text{-}1}$, i.e. γ_{14}, is similarly interpreted, in that it measures the effect of managerial pay-for-performance incentives on the marginal value of accounts receivable. Different from previous literature, we only include changes of cash ratio in the regression.

Panel A in Table VI reports regressions of excess stock returns on executive compensation incentive variables and changes in firm characteristics over the fiscal year based on a sample of 98,949 observations. Regression results reported in our baseline Model (1) show that there is a positive relation between excess stock returns and changes of accounts receivable but the relation is not statistically significant. Model (3) extends Model (1) by including two vega/TC-related variables. The coefficient of $\text{vega/TC}_{i,t}$ is both economically and statistically significant at 1 percent, consistent with Liu and Mauer (2011). We are mostly interested in the interaction term between changes of accounts receivable and vega/TC. We find a direct and marginally significant association between $(\text{vega/TC})_{i,t} \times \Delta\text{AR}_{i,t}/\text{MVE}_{i,t\text{-}1}$ and shareholder wealth. The result of Model (3) in Panel A reports that the coefficient is both economically and statistically significant at 1 percent with a value of −4.410, which indicates that the value of an additional dollar in accounts receivable decreases significantly for firms with high vega/TC. The implication is that the equity market discounts the value of accounts receivable for firms with higher vega. We include delta/TC and the interaction term between delta/TC and accounts receivable changes in Model (2) of Panel A. Consistent with Liu and Mauer (2011), we report that the coefficient for delta/TC is significantly positive in Model (2). However, the association between shareholder wealth and $(\text{delta/TC})_{i,t} \times \Delta\text{AR}_{i,t}/\text{MVE}_{i,t\text{-}1}$ is not statistically significant.

To assess the robustness of our findings, we create executive compensation incentive dummies where vega/TC and delta/TC are equal to one if their respective continuous measures are above their sample medians, and zero otherwise. We substitute those executive compensation incentive dummies for the continuous incentive variables and re-run the same regression models. We report the regression results with those incentive dummy variables in Models (4) and (5) in Panel A of Table VI. The positive signed and significant interaction term between accounts receivable changes and the vega/TC dummy variables from Models (4) and (5) are consistent with those reported in Models (2) and (3). The association between shareholder wealth and two delta/TC dummy-related variables changes to the opposite.

For robustness check, we use CEO compensation incentive variables, i.e. vega/TC and delta/TC for CEOs to repeat the same analysis as in Panel A of Table VI. We report our regression of excess stock returns on CEO compensation incentive variables in Panel B of Table VI. Our sample size decreases from 98,949 to 18,702. With only one exception that in Model (4) of Panel B, we find consistent results regarding the negative relation between excess stock returns and both CEO compensation incentive variables.

In summary, we find strong evidence at both the top five executives and CEO levels supporting the internal allocation hypothesis that high vega reduces the market value of accounts receivable.

5. Conclusions

We examine how managerial compensation incentives influence accounts receivable management policy to test the internal allocation hypothesis, which states that high vega

	Panel A: executive compensation incentives					Panel B: CEO compensation incentives				
	FW model	Continuous incentives		Dummy incentives		FW model	Continuous incentives		Dummy incentives	
Independent variable	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
$\Delta AR_{i,t}$ * Vega/$TC_{i,t}$		−3.449 (2.747)	−4.410* (1.779)	−0.736* (0.225)*	−0.589* (0.232)		−4.949 (4.003)	−5.849* (2.800)	−1.289 (0.824)	−1.020* (0.506)
Vega_$TC_{i,t}$		−1.515*** (0.097)	−1.221*** (0.063)	−0.127*** (0.009)	−0.138*** (0.008)		−1.747*** (0.184)	−1.471*** (0.111)	−0.108*** (0.021)	−0.131*** (0.015)
$\Delta AR_{i,t}$ * Delta/$TC_{i,t}$		−3.076 (7.099)		0.248 (0.284)			−3.112 (7.435)		0.469 (0.764)	
Delta/$TC_{i,t}$		0.804*** (0.177)		−0.019* (0.008)			0.772*(0.348)		−0.042* (0.018)	
$\Delta AR_{i,t}$	0.430 (0.300)	1.038 (1.024)	0.708* (0.336)	0.697 (0.384)	0.725 (0.370)	0.406 (0.333)	1.054 (1.001)	0.718 (0.372)	0.790* (0.389)	0.836* (0.377)
$\Delta C_{i,t}$	0.839*** (0.115)	0.806*** (0.114)	0.808*** (0.115)	0.807*** (0.113)	0.807*** (0.113)	0.693*** (0.127)	0.658*** (0.126)	0.660*** (0.126)	0.659*** (0.126)	0.661*** (0.127)
$\Delta E_{i,t}$	0.623*** (0.098)	0.614*** (0.098)	0.613*** (0.098)	0.616*** (0.098)	0.618*** (0.098)	0.636*** (0.104)	0.627*** (0.104)	0.627*** (0.104)	0.632*** (0.103)	0.633*** (0.104)
$\Delta NA_{i,t}$	−0.145* (0.072)	−0.152* (0.072)	−0.151* (0.072)	−0.146* (0.072)	−0.147* (0.072)	−0.171* (0.083)	−0.179* (0.084)	−0.178* (0.084)	−0.172* (0.082)	−0.173* (0.084)
$\Delta RD_{i,t}$	−1.556 (1.138)	−1.592 (1.133)	−1.597 (1.136)	−1.546 (1.137)	−1.544 (1.138)	−1.731 (1.146)	−1.820 (1.134)	−1.817 (1.138)	−1.719 (1.094)	−1.729 (1.116)
$\Delta I_{i,t}$	−2.930* (1.375)	−2.820* (1.370)	−2.812* (1.370)	−2.822* (1.370)	−2.820* (1.375)	−2.528 (1.495)	−2.456 (1.497)	−2.445 (1.490)	−2.401 (1.479)	−2.406 (1.490)
$\Delta D_{i,t}$	0.490 (0.636)	0.363 (0.635)	0.385 (0.634)	0.482 (0.633)	0.492 (0.635)	0.573 (0.683)	0.403 (0.684)	0.418 (0.684)	0.523 (0.695)	0.531 (0.696)
$L_{i,t}$	−0.642*** (0.086)	−0.535*** (0.089)	−0.547*** (0.087)	−0.561*** (0.088)	−0.557*** (0.087)	−0.685*** (0.097)	−0.573*** (0.101)	−0.583*** (0.099)	−0.614*** (0.104)	−0.608*** (0.100)
$NF_{i,t}$	0.257 (0.169)	0.249 (0.169)	0.249 (0.169)	0.239 (0.168)	0.240 (0.170)	0.309 (0.187)	0.299 (0.187)	0.299 (0.187)	0.281 (0.173)	0.287 (0.184)
$SalesG_{i,t}$	0.153*** (0.035)	0.131*** (0.035)	0.130*** (0.035)	0.127*** (0.035)	0.128*** (0.035)	0.140*** (0.038)	0.118** (0.037)	0.117** (0.037)	0.113** (0.036)	0.116** (0.037)
Intercept	0.195*** (0.028)	0.136*** (0.035)	0.224*** (0.028)	0.224*** (0.029)	0.221*** (0.028)	0.188*** (0.032)	0.112* (0.052)	0.194*** (0.032)	0.202*** (0.033)	0.196*** (0.032)
Number of observations	98,949	98,949	98,949	98,949	98,949	18,702	18,702	18,702	18,702	18,702
Adj. R^2	0.199	0.210	0.209	0.210	0.209	0.118	0.131	0.131	0.130	0.129

Notes: The dependent variable is excess stock returns, $r_{it} - R_{it}^{B}$. All independent variables except for incentives are scaled by the lagged market value of equity. All independent variables are defined in the Appendix. Models 4 and 5 use dummy variable incentives, where incentive dummies are equal to one if their respective continuous measures are above their sample medians and zero otherwise. Standard errors are in parentheses below parameter estimates. *,**,***Denote significance at the 5, 1, and 0.1 percent levels, respectively

Table VI.
The impact of managerial compensation incentives on the value of accounts receivable

managers reduce their accounts receivable to pursue risky policies. We find that accounts receivable is significantly negatively related to vega, which suggests that greater vega encourages greater accounts receivable reduction. This negative relation holds for both the executive and the CEO samples and is robust for different regression models and different managerial incentive measures. This finding shows that higher vega managers reduce their accounts receivable to support greater R&D investment and more cash holdings at the same time. This research is also related to Frankel *et al.* (2016) in that we show directly how managerial compensation incentives motivate managers to manipulate their working capital management. We find no consistent evidence about the relation between accounts receivable and delta.

Using the Faulkender and Wang (2006) and Hill *et al.* (2012) approaches, we examine the relation between the marginal value of accounts receivable changes and vega. We find that the equity market discounts the value of account receivable for high vega firms. This negative relation between the market value of accounts receivable and vega holds for both executive and CEO samples and is robust for different regression models and different managerial incentive measures. Our finding is related to Hill *et al.* (2012) by showing that the market value of receivables is negatively related to vega.

Our research contributes to the finance literature of explaining the existence and use of accounts receivable by testing that the accounts receivable management policy is a result of internal allocation managed by managers. Firms should be very cautious when setting their managerial compensation incentives.

Notes

1. We thank Lalitha Naveen for providing data on managerial compensation data via her website: https://sites.temple.edu/lnaveen/data/
2. Specifically, for each year, we group every firm in our sample into one of 25 size and book-to-market portfolios based on the intersection between size and book-to-market independent sorts. We thank Ken French for providing data on the book-to-market and size portfolio breakpoints and returns via his data library website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

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Further reading

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Appendix

Variable	Definition
Accounts receivable	The ratio of accounts receivable to net assets, where net assets are total assets minus accounts receivable
Acquisition activity	The ratio of expenditures on acquisitions to the book value of net assets
Capex/net assets	The ratio of capital expenditures to the book value of net assets
Cash/Net assets	The ratio of cash and marketable securities to the book value of net assets
Cash flow/net assets	The ratio of earnings after interest, dividends and taxes but before depreciation divided by the book value of net assets
CEO age	The age of the CEO as reporte in the ExecuComp database
CEO tenure	The number of years that the current CEO has served in that capacity as reported in the ExecuComp database
Delta	The change in the value of the option or restricted stock grants in a year, shareholdings, and any accumulated restricted stock and option holdings for a 1 percent change in the stock price
Delta/TC	The ratio of delta to total compensation, where total compensation in a year includes salary, bonus, restricted stock and option grants, long-term incentive payouts and any other compensation
Financial distress	A dummy variable equal to one if a firm meets both conditions in a sample year: 1) is having a coverage ratio calculated as operating income before depreciation divided by interest expense less than one for two consecutive years or less than 0.80 in any sample year; 2) if its leverage ratio is in the top two deciles of its industry's leverage ratio in a sample year, and zero otherwise.
Firm age	The number of years since the first year that the firm is reported in Compustat
Growth	The annual percentage change in sales
Inventory/net assets	Inventory divided by the book value of net assets
Market-to-book ratio	The book value of net assets minus the book value of equity plus the market value of equity, all divided by the book value of net assets
Mktshare	The ratio of annual firm-level sales to the industry's annual sum of sales
PQL	The product quality-level variable constructed to measure the product quality. We calculate PQL = (30/(1+firm size)) for technical industries (SIC codes between 3400 and 3999), PQL = (0.5/(1+firm size)) for perishable industries (SIC codes between 2000 and 2199), and PQL = (2/(1+firm size)) for the remaining firms
Real size	The natural logarithm of net assets
ROA	Earnings before interest and taxes divided by total assets
R&D/sales	The ratio of research and development expense to sales. This ratio is set equal to zero when research and development expense is missing
SaleVar	The ratio of the standard deviation of sales to net assets over a rolling five-year period prior to each of the sample years. Firm-year observations are included in the sample for a given year if the firm has at least three observations during the previous five-year period.
Variable cost/net assets	The cost of goods sold divided by the book value of net assets
Vega	The change in the value of the CEO's option grant in a year and any accumulated option holdings for a 0.01 change in the annualized standard deviation of stock returns
Vega/TC	The ratio of vega to total compensation, where total compensation in a year includes salary, bonus, restricted stock and option grants, long-term incentive payouts and any other compensation
C	Cash and marketable securities
D	Common dividends

(*continued*)

Table AI.
Variable definitions

Variable	Definition
E	Earnings, calculated as earnings before extraordinary items plus interest, deferred tax credits and investment tax credits
I	Interest expense
L	The ratio of long-term debt plus debt in current liabilities to the market value of equity
NA	Net assets, calculated as book value of total assets minus accounts receivable
NF	Net financing is calculated as total equity issuances minus repurchases plus debt issuances minus debt redemption
RD	Research and development expense or zero when missing
$r_{i,t}$	The stock return for firm i during fiscal year t
$r^{B}_{i,t}$	The benchmark return is the return of the Fama and French size and book-to-market portfolio to which stock i belongs at the beginning of fiscal year t
SalesG	Sales growth, calculated as the annual percentage change in sales
AR	Accounts receivable scaled by the lagged market value of equity
ΔX_t	The notion for the one-year change, $X_t - X_{t-1}$, where t (t−1) denotes end of fiscal year t (t−1)

Table AI.

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