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Ingredient hedging and firm value

- A study of agricultural commodity price exposures

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Abstract

Hedging in all respects, is one of the most fundamental tools when it comes to fulfilling the principal aim of corporate finance – maximizing shareholder value. Also the research about how to calculate risk and how to hedge against it has been meticulously assessed in famous research papers that cover almost every detail of risk management. Nonetheless, the missing part in the risk management field seems to be a more practically-oriented and general framework that answers more specific and narrow questions when it comes to such as what types of risks one should hedge and to what extent. This paper assesses the production input price exposure of corporations that use agricultural commodities as inputs in production, something that have yet not been done in previous research. The analysis is performed by comparing the linear relationship between fluctuations in a stock price with fluctuations in the commodity price, for companies that practice commodity hedging and companies that do not. In order to affirm whether or not commodity hedging has a value enhancing effect on equity in addition of having a value-stabilizing effect we use the Tobin's q-statistic as a proxy for firm value and study how it is affected by hedging. In addition, we try to explain why hedging enhances the value by analyzing how it affect the internally generated cash flow that can be used for value-creating activities such as investing in profitable projects. Our findings indicate that hedging companies' stock prices are unaffected by fluctuations in the commodity price and also that these companies are more valuable in terms of the Tobin's q-statistic. Our recommendations for companies exposed to price fluctuations in agricultural commodities are thus to hedge.

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I. INTRODUCTION

Hedging in all respects, is one of the most fundamental tools when it comes to fulfilling the principal aim of corporate finance – maximizing shareholder value. Maximizing shareholder value has several implications whereof the consensus appears to be to maximize the present and future cash flows of the business, something that according to relevant research can be achieved by implementing various types of hedges. Also the research about how to calculate risk and how to hedge against it has been meticulously assessed in famous research papers that cover almost every detail of risk management. Nonetheless, the missing part in the risk management field is a more practically-oriented framework that answers more specific and narrow questions such as what types of risks one should hedge and how much of that risk one should hedge. In addition, the research field of risk management has not yet covered how the various types of hedges impact different industries and sectors. Especially superseded is the management of commodity related risks – probably because it affects different industries in different ways. The management of risks related to foreign exchange rates and to interest rates has in comparison been widely assessed in a manner that is applicable to most industries and sectors.

The purpose of the paper is to assess the production ingredient price exposure of corporations that use agricultural commodities as inputs in production, as it is one of the major industries that yet have not been covered in practical risk management research. In this study we cover for example the sugar price exposure of companies such as Coca-Cola Enterprises and PepsiCo. Particularly interesting with these two very similar companies, is that Coca-Cola Enterprises hedges while PepsiCo do not even though they are exposed to the very same input price, namely the price on sugar. More closely, our study covers the exposure to production ingredient price fluctuations for companies registered under the SIC codes 514 and 515 in the Zephyr database. Companies registered under SIC-code 514 are referred to as wholesale dealing in groceries and related products ("groceries and related products wholesale dealing in"), while SIC-code 515 refers to companies wholesale dealing with farm-product raw materials ("Farm-product raw materials wholesale dealing in"). Exposure will in this context serve as a proxy for sensitivity of the stock price to unanticipated changes in the price of the production ingredients. Moreover, sensitivity to commodity price changes is in the paper measured as the coefficient of the commodity price change in the linear regression of the stock price change (i.e. the change in firm value). As a second step in the study, we assess the impact of hedging on company's cash flows and investment levels. Subsequently we investigate the impact of hedging on firm value by comparing it, using Tobin's Q as a proxy, between companies that hedge and companies that do not hedge. Therefore, in extension we seek to conclude or to get an indication of whether or not hedging, when it comes to agricultural commodities as inputs in production; can be priced in an arbitrage pricing framework.

The analysis is performed by comparing the linear relationship between fluctuations in a company's stock price with fluctuations in the commodity price- first for all companies within our sample one by one and subsequently for the companies that practice commodity hedging altogether with the companies that do not. In order to affirm whether or not commodity hedges have a value-enhancing effect on equity in excess of having a value-stabilizing effect, the procedure used in Allayannis and Weston (2001) has been performed using the so called Tobin's q-statistic as a proxy for firm value. We also expand our research by investigating an eventual reverse causation, i.e. that firms with high Tobin's Q have stronger incentives to hedge than firms with low Tobin's Q, instead of the other way around. If this is true it is hard to make any conclusions regarding whether hedging leads to high values of Tobin's Q or not. In addition, we try to explain why hedging enhances the value by analyzing how hedging affects the internally generated cash flow that can be used for value-creating activities such as investing in profitable projects.

For the sake of delimitation, this particular study focuses on listed American companies found in the deal research database Zephyr. The commodity price is proxied by S&P Goldman Sachs Agricultural and Livestock Commodity Index that includes wheat, red wheat, corn, soybeans, cotton, sugar, coffee, cocoa, live cattle, feeder cattle and lean hogs. In the beginning of our research our sample consisted of 130 companies listed on American stock exchanges, covered by Zephyr and registered under the SIC codes 514 and 515. After further research and screening, 53 companies remained. Several companies were removed from our sample because their hedging activities did not cover the specific commodities included in the commodity composite index. Furthermore, a number of companies were excluded because they, during the period of time studied, altered their hedging strategy. Our sample of 53 firms consequently includes companies that consistently did or did not hedge during the sample period. Our data includes daily stock prices during the period 1th of April 2004 until the 30th of March 2010. In order to determine if the companies practice commodity hedging or not, data from item 7A (Quantitative and qualitative disclosures about market risk) in the 10-K reports was collected. 10 K-reports were available for all companies in the sample. (See part (i) in appendix for an example of an abstract.)

The assumed value-increasing effects of various hedges and its impacts on a corporation's cash flow and stock price have been assessed and debated over the years. One of the most recent articles that validates the findings of Allayannis and Weston (2001) – that hedging results in a higher firm value, is the one that assesses the effect of commodity hedging on firm value among US airline companies (Carter, Rogers and Simkins, 2006). However, this is in complete contrast to the findings by Jin and Jorion (2004) that do not find any relation between firm value and hedging when it comes to oil and gas producers. Similar results were found by Tufano (1998) who studied the impact of hedging on American gold mining firms. More interesting from the standpoint of this paper are perhaps the findings of Gagnon, Lypny and McCurdy (1998) whose research resulted in evidence for the risk-reducing effects of currency hedging strategies.

The framework used in our article and in most of the above mentioned articles, is the framework developed by Froot, Scharfstein and Stein (1993). The framework creates a link between different hedging rationales and the value they may generate. Furthermore, Froot et al discuss the shortcomings in previous literature for not having succeeded in developing practical guidelines regarding risk management by hedging. What is missing in risk management research, as discussed in Froot et al., is a practical assessment of how hedging affects stock price and firm value. We therefore believe that our study fills an empty hole in this area of research as our results have practical implications and answer important questions when it comes to agricultural ingredient hedging. Our findings indicate that investors value hedging activities within firms higher than they value firms where there is a prevailing lack of hedging. This means that investors prefer the smooth stock prices that hedging results in, over the upside and downside risk of stock price movements that a non-hedging company is characterized by, even if these cash flows on average are higher than the average cash flow in a hedging firm.

The paper is organized as follows. Previous research findings are discussed in section II. Hedging theory and its incentives are discoursed in section III. In section IV we discuss our sample of 53 firms, eventual weaknesses in how the data was obtained and the sample selection bias that might be the result of how the data was gathered. This part is then followed by our empirical study of how hedging affects stock price, cash flows and finally, firm value. The empirical study is divided into three parts, where the section V of this paper discourses the effects of hedging on stock price. Section VI covers the effects of hedging on the free cash flows which, as discussed above, is the fundament to understanding why and how hedging affects firm value in a somewhat simplified manner. The empirical analysis is finalized with the assessment of the impact of hedging on firm value, discoursed in section VII. The section that follows, VIII, discusses the results of section V-VII in relation to theory and to previous research. The paper is consummated with our conclusions in section IX. The findings of each empirical sub-study are in addition contrasted to existing theory in each relevant section.

II. HEDGING THEORY AND INCENTIVES

Hedging theory i.e. that hedging smoothes cash flows and enhances value is widely debated. The problem that every firm faces when making decisions regarding hedging strategies is how to tackle and form a solid balance between the uncertainty of future commodity prices and the risk of opportunity loss. One can claim that there are three major risks prevailing in this context of producing firms that are players on the global market. First they face transactional risk, i.e. the uncertainty regarding the interest rate that will affect eventual debt conditions. Secondly they face a translation risk that can be explained as the change in the value of a foreign asset as a consequence to changes in the foreign exchange rate. Finally, producing firms also need to consider the economic exposure risk, known as the risk of a negative impact of fluctuations in commodity prices on the firm's core business (Sooran, 2010). We thus highlight the latter risk that puts firms that use commodities as an ingredient in their core production, in the spotlight. Companies might engage in commodity hedging for several reasons where some of the reasons are induced by external factors. For example, lenders might require that borrowing firms hedge some of their production activities to increase the probability that commodity price fluctuations will not affect the firm's ability to pay interest and amortisement on outstanding debt. Hedging decisions might also be affected when venture capitalists provide firms with capital, who therefore most certainly will base their hedging strategy on the capitalists' risk awareness and wishes (King, Williams, 2003). Also, hedging is in general said to serve as an indicator of managerial ability to investors (DeMarzo and Duffie, 1995).

The main underlying reason why companies choose to hedge their exposure to commodity price fluctuations is to stabilize cash flows (King, Williams, 2003) and to avoid volatility of the cash flows aggravated by the tax regime (Chang, Hong and Kuan, 2005). One can talk about four additional rationales why firms chose to hedge, linked to internal conditions and attitudes within each particular company. First there are managerial motives, namely that managers covered by result-based rewarding systems might find an incentive to hedge to protect their future earnings from steep downturns. This is based on the assumption that managers in general are risk averse and also that it is cheaper to engage in hedging activities within a company than do so as a private person (Froot et al 1993). Empirical research has showed that managers of North American gold mining companies that are in possession of many stocks use risk management, such as hedging tools, to a larger extent than managers with less stocks (Tufano, 1996). Secondly, taxes play a big part on hedging strategies. If taxes are a convex function of earnings, hedging will be optimal for companies. Higher earnings do lead to higher taxes and smoothing earnings can be done through hedging tools. The convexity therefore justifies the hedging activities as a way to minimize tax expenditures. (Smith and Stulz, 1985) Furthermore, hedging might increase debt capacity by smoothing cash flows and keep them from being unmanageably low. The fourth rationale for hedging is capital market imperfections. (Froot et al 1993) According to the Modigliani-Miller theorem, managers should not be able to add value to a firm by hedging if the assumption of a prevailing perfect financial market holds. However, the assumption of a perfect financial market is violated due to prevailing asymmetric information, transaction costs and taxes (Chang, Hong and Kuan, 2006). Hedging tools can therefore be used for speculative objectives where gains and arbitrage opportunities are to be found. Firms speculate by engaging in hedging contracts that are not designed to offset the firm's risk associated with its core business. This increases the firms' risk, instead of reducing it, and is a totally different approach to hedging (Berk and DeMarzo 2007). We have therefore chosen to disregard such activities within firms and we do not treat companies that only hedge for speculative reasons as hedging companies in the further analysis.

The trade-off between uncertainty and opportunity is composed differently from firm to firm. Some companies stay out of hedging tools and hope to be able to encounter a big upside potential that occurs when commodity prices moves in a direction that is in favour for the company's core production, while other firms get involved in hedging activities to lock-in a future profit (King and Williams, 2003). Companies that operate within industries where the core activity is directly linked to the supply and demand for commodities will face volatile earnings because of macroeconomic factors. Such firms will notice how their cash flows and earnings track the appropriate commodities' price movements (Damodaran, 2009). Companies using commodities as inputs in production always need to take macroeconomic factors that per definition are out of their control, into consideration when predicting cash flows and profits. In this case, in addition to business cyclical explanations for price changes, such factors include occurrences that can be characterized as force majeure or economic anomalies. (King, Williams, 2003). When it comes to agricultural commodities such as corn, sugar and wheat, the weather and culture conditions play a big part that is impossible to influence or predict.

Many firms use hedging tools since changes in the price of the raw materials they use as ingredients in production often entail the largest source of risk to their profitability. Such hedges need actions from management in terms of both acquirements of knowledge and hedging long-term contracts or futures contracts. In this paper we study only companies that do not employ natural hedges, which might be the case when firms can carry over increased ingredient prices to their customers through massive increases in the prices of the final products. (Berk, DeMarzo, 2007) Commodity companies are said to be price takers. Regardless of the company's market share, it has to sell the output at the prevailing market price. (Damodaran, 2009) Applying this theory on our sample renders the conclusion that the 53 companies are all price takers, which makes it hard for them to compensate for high commodity input costs by increasing the price of their final goods. These companies might therefore be incentivized to employ agricultural commodity hedges.

III. PREVIOUS LITERATURE

The existing research to be found within this particular area is quite covering. We have in spite of this succeeded with our aim to find a small gap which we strive to fill. The existing work mostly covers the relation between hedging against other risk exposures but commodities, and firm value or stock price. Many researchers within hedging activities keep hedging strategies as the core issue throughout their work and therefore make conclusions about how to ascertain firms' optimal hedging levels given their specific risk exposures. E.g. Peck (1975) and Thompson & Bond (1987) both investigate optimal hedging strategies against commodity risks.

More applicable for our aim of this thesis is the work by Jorion (1990), where he has chosen to examine the exposure and impact of changes in a trade-weighted exchange rate on the stock returns of 287 nonoil U.S. multinational companies. He is basing his implications on what the following linear regression indicates:

$$R_{it} = \beta_{0,i} + \beta_{2,i} R_{st} + \beta_{3,i} R_{mt} + \varepsilon_{i,t}$$

We have chosen to adopt this technical procedure and therefore replace Jorion's $R_{st,}$ that accounts for the exchange rate changes, with the returns in our agricultural commodity index. Apart from that, the framework is the same, since the dependent variable of interest is the firm's stock return and the other independent factor is the market return. Jorion states in his conclusion that the correlation between exchange rate risk exposure and a company's degree of foreign involvement is positive and significant. He does not, which distinguish our article from his even more, examine hedging activities in particular but suggests that currency risk is diversifiable through hedging.

Further we have been inspired by Tufano (1998) who investigates the determinants of the stock price exposure. He chooses to do so among gold mining firms in North America. The main study in this article is therefore made with a different approach than we have, since many factors are taken into consideration when investigating how the effect on the gold beta varies. He starts off by applying the same regression as Jorion developed, namely the multifactor market model (a version of the CAPM). Tufano performs, as a minor part in his work, the regression for each firm in his sample (48 gold mining firms from 1990 through March 1994). This article is though carried on in another angle where Tufano can be able to ascertain a negative impact of the percent hedged on the gold beta. This is in line with our conclusion.

Moreover we adopt the approach of Chang, Hong and Kuan (2005) as they investigate the impact of hedging activities on both stock returns and the proxy Tobin's Q for firm market value, but by using a total different sample (namely 33 Canadian oil and gas companies during 2000-2002). They perform regressions based on monthly data, in line with what we do, but their main contribution to the previous work is their decision to use non-linear regressions and also to take the fraction hedged, based on a notional dollar value of each firm's hedging contracts, into consideration. They state e.g. in their conclusion that stock return in their sample responds to commodity price changes in a non-linear way. They also account for the firms' reserves of physical commodities and therefore ascertain that a higher gas reserve in relation to gas production, given a level of hedging, leads to higher Tobin's Q. These findings are in detail not applicable to our work since our methodology differs in many aspects.

We have been able to adopt both the methodology and framework used in the article by Allayannis and Weston (2001). They do not address the question of how derivatives against commodity price fluctuations affect the firm market value (proxied by Tobin's Q), but instead look at derivatives against foreign currency fluctuations. Thus, we can follow their adopted technique and apply parts of it to our question formulation. They find a positive relation between Tobin's Q and the use of hedging tools, which we also are able to ascertain. Allayannis et al use the same period length as we do, namely six years (1990-1995), but they handle a much bigger sample containing 720 firms (nonfinancial and in the U.S.). They therefore have the advantage of being able to apply a relative big amount of control variables in the linear regression of Tobin's Q, such as dummies controlling for industry effects and industrial diversification. All firms in our sample operate within the same industry and the majority within the same segment, why the adoption of such dummies would not be able to contribute to our findings. Allayannis et al perform a pooled OLS regression using the natural logarithm of Tobin's Q as the dependent variable, thus we have had the possibility to adopt their reasoning to our research.

When it comes to assessing the value-increasing effects of investing in profitable investment projects, the framework developed in Froot et al (1993) has been used and has to a certain extent been extended. In the article, the authors state four different types of rationales for hedging; namely managerial motives, taxes, costs of financial distress and debt capacity, and finally, capital market imperfections and inefficient investment. Another major concept in their article is how capital expenditure, which is essential for the value of the company as the company has to invest to grow, is affected by hedging and how the value of the hedge depends on the stochastic process of available investment projects. Based on limitations in obtainable data and measurement issues we decide to limit the scope of our study to evaluating only the two hedging rationales described in their article that we find most important and relevant for firm value analysis, namely the debt capacity and investment levels, both which can be augmented by increasing the free cash flow. The free cash flow is in turn the most important means to create value and is thus the fundamental to assessing the effects of hedging on firm value. Because the free cash flow can be measured without bias from the 10-K reports we will focus on assessing the impacts of hedging on the free cash flow before we study the impact of hedging on relative firm value, i.e. Tobin's Q. The hedging rationales that stem from managerial motives and the tax benefits, which first were assessed in an article by Smith and Stulz (1985), are not evaluated in detail because of the complexity related to their measurement as opposed to measuring the free cash flow and capital expenditures of the firms in our sample. The results from evaluating the impact of hedging on free cash flow, capital expenditure and relative firm value (Tobin's Q) are hence determined to be enough to get indicative results of how hedging influences important aspects of a firm's value-enhancing activities. To sum up, our approach is thus based on the theoretical framework developed by Froot et al (1993) but is extended in part, by the applications of their framework developed in articles by e.g. Carter et al (2003).

IV. SAMPLE

i. Description

Our data consists of daily stock prices for 53 American publicly held companies found in the database Zephyr under SIC codes 514 and 515. These companies are categorized into hedging and non-hedging companies based on whether or not agricultural commodity risk hedging is undertaken. This means that companies that hedge against foreign exchange rate changes and interest rate changes, but do not hedge their commodity risks, are categorized as non-hedging firms. These companies are hereafter referred to as "non-hedging companies", even though they may hedge other types of risks. The broad selection of available hedging tools and their qualities are out of the scope and relevance for this thesis, even though it is of importance to keep in mind that the choice of hedging strategies within a firm can be more or less effective, which in turn can lead to different levels of impact on factors such as firm value. In addition some of the firms in our sample have chosen to hedge a bigger fraction of their commodity exposure than others, something we do not consider either. The implication of this is discussed more thoroughly in the section VII.

For each of the 53 companies we have gathered annual accounting data, from the year 2000 to 2009, such as book value of assets, shareholders' equity, net debt, free cash flow, capital expenditures and earnings in addition to the market capitalization value of each firm as of 8th of April 2010. However, in the cross-sectional regressions run in section V and VI, data from 2004 and onwards is used in order to make the implications of the study up to date. For different reasons there were missing data for some of the companies during the period from 2000 up until 2004, most certainly the reason for that is that some of the firms were not listed then. We were able to obtain the annual accounting data for all chosen companies from the start of 2004. Thus our selected data that creates our sample starts in that year since we then had a comprehensive set of values for all firms and dates. For the time-series regression run in section V, daily data from the 1st of April 2005 to the 30th of March 2010 is used to calculate monthly average returns.

The commodity price is proxied by the S&P Goldman Sachs Agricultural and Livestock Commodity Index which is a composite index that includes wheat, red wheat, corn, soybeans, cotton, sugar, coffee, cocoa, live cattle, feeder cattle and lean hogs. The rationale for using a composite index is that the majority of the firms in our sample hedges against price fluctuations in several agricultural commodities. For example, the chicken processor Pilgrim's Pride Corp hedges against the commodity risk that stems from fluctuations in the price of both corn and soybean. If we were to measure the exposure to only one of these commodities, we risk weaker results because the complete agricultural commodity risk is not measured. Moreover, because agricultural commodities tend to be highly correlated, using a composite average rather than a single commodity makes sense.

Stock prices along with commodity prices and inflation data were obtained from DataStream, while the accounting data was retrieved from FactSet and Compustat depending on in what database the respective firms were covered. Important to note is that some companies lack accounting data for certain years. Those observations have been excluded from the cross-sectional regressions even though observations from the same companies but for other years have been included in the regression sample. However, as our sample is large in our cross-sectional regressions (n=258) and only a few of the observations are excluded, this does not have any critical implications for the results.

ii. Sample selection issues

As previously mentioned, the list of American publicly held companies was retrieved from the deal database Zephyr. This implies that the list of companies only includes companies that have been involved in mergers and acquisitions, something that might lead to sample selection bias if their involvement in mergers and acquisitions meant diversifying the operations, thus decreasing the sensitivity towards the prices of certain agricultural commodities or in worst case towards commodities in general. This should mean that the effect of derivative hedges is increasingly prevalent for the average company on the market than what our results indicate. However, since the commodity price used in the regressions in fact is proxied by a composite commodity index this bias is to an extent overcome. Also, we believe that mergers and acquisitions between entities with substantially differing operations are somewhat unusual. This could mean that the risk of a prevailing case where the sensitivity toward commodity price per se has decreased for a firm in our sample is small. Thus, we do not judge the sample selection bias to be of significant importance for the implications of our findings.

V. IMPACT OF COMMODITY PRICES ON FIRM STOCK PRICE

i. Empirical models

The study is commenced by assessing the impact of commodity return on stock return and how hedging companies compared to non-hedging companies are affected by changes in commodity price. According to theory, hedging should protect shareholders from unexpected losses (and also prevent the potential for unexpected gains, i.e. the upside risk). In other words, hedging should smooth stock returns (Chang et al 2005). Investors do to a great extent obtain shares in a company to take advantage of the company's core business expertise. (Sooran, 2010). Previous research show how stock returns are used as a measure of firm value (Jorion, 1990) which is something we have decided to take to a further level later on in this thesis. For example, Tufano (1998) examines the determinants of stock price exposure in the gold mining industry in North America. As a part of his work, he regress the daily returns on stocks for the companies within the sample on the daily return on the CRSP NYSE/AMEX/Nasdaq index and on the return on gold. This is similar to the regression we perform and it is based on the well known framework of the Capital Asset Pricing Model, where the expected return of a company is said to depend on the risk free rate and the market portfolio's excess return (Berk and Demarzo 2007). We thus mimic Tufano's approach of expanding the CAPM by including a variable that accounts for the returns on the agricultural commodity index. Furthermore, we use the CAPM framework to assess the relationship between realized returns instead of expected returns. Tufano (1998) ascertains with his sample of 48 North American gold mining firms that the beta of the gold price is negatively affected by an increase in the hedging variable. Tufano (1996) also finds that the use of derivative hedging tools against commodity price fluctuations is positively related to the stock price. The type of regression model used in Tufano (1996) is commonly used in research with this particular approach and is also to be found in the work of Chang, Hong and Kuan (2005) and Jin and Jorion (2005). By using an expanded version of the CAPM we ultimately assume that the market beta is the same for all hedging companies since we perform a regression using a subsample containing only hedging firms. The same is assumed for non-hedging companies. The coefficient on the market excess return variable in the CAPM is theoretically computed as the ratio of the covariance between a specific security's return and the return from an approximated market portfolio, and the variance of the market portfolio's returns (Berk and Demarzo 2007).

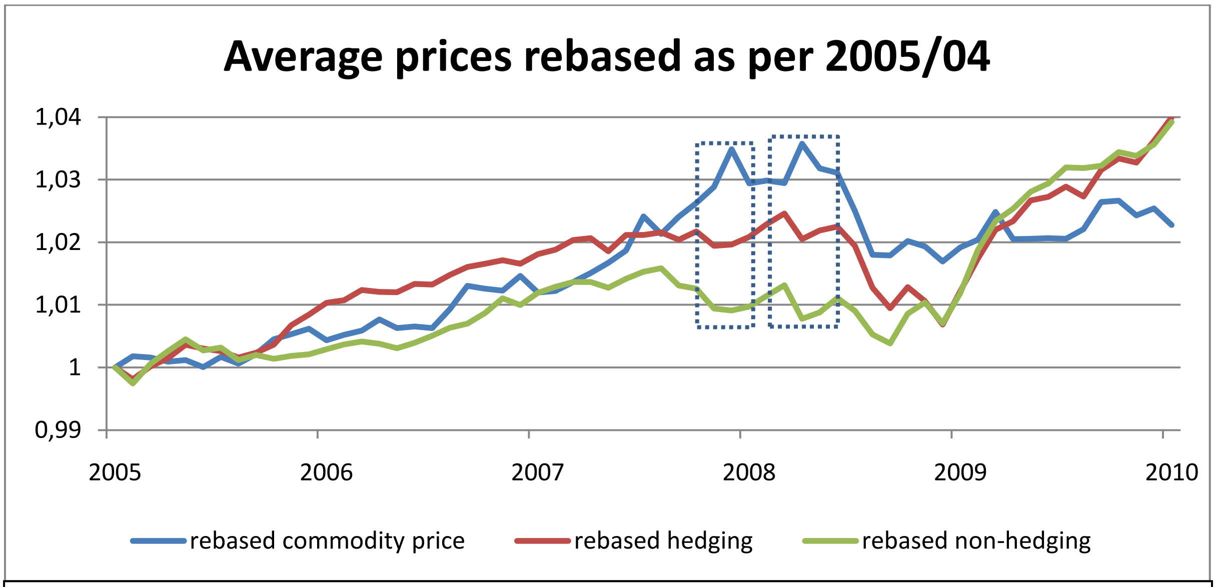
Thus, in the study of how hedging impacts stock price returns, we initially assume that the market beta is the same for all companies within each subsample by performing a regression where we do not consider each company separately. This assumption is legitimatized by pointing out that all 53 firms are in the same business, which most probably makes them more homogenous in their exposure towards the Market Portfolio. Finally, by evaluating the exposures and coefficients for all the firms within our sample on an individual level we apply the CAPM once again. Now we consider the fact that, in reality, the firms in our sample may have had different market betas during our sample period. This will theoretically result in more reliable coefficients and thus a more reliable analysis of the coefficients.

We expect, based on theories and previous research, that hedging firms' stock price and return should be weakly but possibly positively dependent on the commodity return or even independent of the commodity return. Furthermore, in accordance with hedging theory we expect to see tendencies of this by both investigating each firm's exposure to the commodity return individually, but also by one regression each using the two sub-samples consisting of hedging companies and non-hedging companies. That would entail the conclusion that hedging does make firms' stock returns independent of commodity price fluctuations and thus only dependent on other factors such as the market portfolio (but also most likely management competence and the competitiveness of the company's business idea). We expect to see that stock prices appear to be smoothed when hedging is employed.

ii. Sample

Our sample consists of 53 companies of which 25 pursue such hedging activities as mentioned initially in the paper. The average stock return for all 53 companies is in our study equally weighted and computed on a monthly basis, with starting day on the 1st of April 2005 and ending on the 31st of March 2010. This leaves us with 59 months and thus 59 observations, one average stock return per month. The mean of the 59 average stock returns is 0.06%, with a standard deviation of 0.21%, a minimum value of -0.52% and the maximum value is 0.60%. The frequency used, i.e. monthly data, is in line with previous research that use the same methodology to investigate the impact of hedging, for example Chang, Hong and Kuan (2005).

The sample is subsequently divided into two subsamples where we in the same manner compute average stock returns on a monthly basis, but for the 25 hedging firms and the 28 non-hedging firms separately. We use the same time period and obtain 59 observations per sub-sample. The mean value for the hedging companies' average returns is 0.07% with a standard deviation of 0.22%. Minimum value equals -0.66% and maximum value equals 0.52%. Regarding the non-hedging subsample our mean value for the average stock returns is 0.06%, standard deviation is 0.22%, minimum value -0.53% and maximum value is 0.68%. The monthly average commodity return has mean value 0.04%, standard deviation 0.26%, minimum value -0.69% and maximum value 0.61%. See table Vd in appendix for a summation of the variables statistics used in this part. The monthly prices of the two equally-weighted portfolios of hedging companies and non-hedging companies along with monthly commodity prices are rebased on the 1st of April and plotted in graph Va.



Graph Va. Commodity prices along with average stock prices for the portfolio of hedging companies and non-hedging companies, respectively. Commodity prices along with portfolio prices have been rebased as per 2005-04-01. As can be seen with the naked eye, stock prices of non-hedging companies are inversely related to commodity prices to a greater extent (as indicated by the dashed boxes).

iii. Method and Results

The results from the three regressions based on average monthly returns are in line with our expectations based on theoretical models and predictions. Three linear OLS (optimal least squared) time-series regressions were performed, based on monthly data with the first regression based on the whole sample (53 firms) and the other two on the two sub-samples of hedging and non-hedging firms.

$$R_{it} = \alpha_t + \beta_1 r_{ft} + \beta_2 (R_{mt} - r_{ft}) + \beta_3 R_{ct}$$

R_{it} = realized average monthly return on stock, sample i, time t

r_{ft} = risk-free rate, time t

$(R_{mt} - r_{ft})$ = realized market excess return, time t

R_{ct} = realized average monthly return on commodity index, time t

The first regression using monthly average returns for the whole sample of 53 firms yields a significant relation between the stock returns and; the risk-free rate (significant on a 0% level), the market excess return (significant on a 0% level) and also the commodity index return (significant on a 2.5% level). We obtained a coefficient of the risk-free rate of 0.9168 and a coefficient of the market excess return of 0.8858. The coefficient of the greatest interest here is the beta of the commodity return which is -0.0989, and as mentioned statistically significant.

This implies that if the commodity index return increases by 1% the average stock return decreases by 9.89%, holding all other variables fixed. Thus we find a negative impact of the commodity returns on the firms' stock returns, which implies that stock prices are inversely influenced by increases in commodity prices. This is in line with our expectations, since we are investigating firms that use the agricultural commodities as ingredients in their production and thus face these prices as expenses. The R-squared value obtained is 0.8180. See table Va in appendix for an overview.

The results based on the regression using monthly average stock returns for hedging firms implies that the relation between stock returns and the risk-free is statistically significant on a 0% level with a coefficient of 0.9482. The same is true when it comes to the significance level of the coefficient on the market excess return that measures 0.9395. What is interesting and also in line with theory is the insignificant relation between commodity return and stock return for hedging companies. The significance level of the coefficient on commodity index return is 55.4%, which implies that stock returns are more or less unaffected by the prevailing agricultural commodity returns. Hedging firms' stock prices thus do not depend on the price of the ingredient commodity used in the core production, thus hedging tools offset the impact of commodity price fluctuations and smoothes stock returns. The R-squared obtained of the regression is 0.8178. We refer to table Vb in appendix.

The non-hedging firms' stock returns are significantly related with the risk-free rate on a 0% level, with a coefficient of 0.8854. As in the regressions above, the market excess return is still statistically significant on a 0% level, with a coefficient of 0.8321 for the sub-sample of only non-hedging firms. We do in addition ascertain a significant relation between stock returns and commodity index returns when it comes to non-hedging firms. The significance level is 3% and the coefficient is –0.1677. This implies that non-hedging firms' stock prices are related and affected by the price of the ingredient commodities in their production and in addition in a negative way. The conclusion is perfectly in line with theory and the conclusion is therefore that an increase in the price of the commodity used in production decreases the firms' stock price. The R-squared measure of the regression is 0.6928. Table Vc in appendix shows these findings.

Next we expand our research by performing the following regression on firm level, i.e. using average realized monthly returns for each specific company instead of using average values within the whole sample or one of the two subsamples as done above.

$R_{it} = \alpha_{it} + \beta_1 r_{ft} + \beta_2 (R_{mt} - r_{ft}) + \beta_3 R_{ct}$

R_{it} = realized average monthly return on stock, firm i, time t

r_{ft} = risk-free rate, time t

(R_{mt} - r_{ft}) = realized market excess return, time t

R_{ct} = realized average monthly return on commodity index, time t

The complete result of the obtained coefficients from the 53 regressions is to be found in appendix (table Ve). With reference to these regressions, it appears that to a great extent, hedging firms enjoy a stock return that is statistically insignificant related to the commodity index return. 80% of the coefficients on the commodity index return variables are statistically insignificant. The average value of the hedging firms' betas of the commodity index return is 0.013916. Thus, in general the hedging firms have an insignificant and slightly positive beta. We also notice that the majority of the non-hedging firms experience a statistically insignificant relationship between their stock returns and the commodity index returns as well. This can be explained by many factors, e.g. by the possibility of prevailing hedging activities that we do not consider as hedging in this research. The average beta value for the non-hedging firms is -0.15203, i.e. when the commodity index return increases by 1% the average non-hedging firm's stock return decreases by more than 15% holding all others factors fixed. By presuming the same situation for the hedging firms; the average hedging firm in our sample then experience a subtle increase of the stock return, namely 0.14%.

To statistically verify whether or not the difference between the average betas is statistically significant, a student's t-test, also known as an unpaired t-test, is performed. The validity of the test depends upon several factors that all are judged to be fulfilled, namely; the difference between the sub-samples' betas is normally distributed and the variance is homogenous in the two sub-samples. The validity of the distribution is confirmed by comparing the averages with the median values which in this case are close (the difference between the average value and median value is 0.07 for the sample of hedging firms, 0.01 for non-hedging firms and less than 0.004 for the whole sample). Moreover, the standard deviations for the two sub-samples are similar in size; 0.363 and 0.288, respectively. Hence, the utilization of the student's t-test is legitimate.

The t-statistic used is;

$$t = \frac{\overline{X_n} - \bar{\mu}}{s_n/\sqrt{n}} = \frac{\left(0{,}01392 - (-0{,}15202)\right) - 0}{0{,}3335/\sqrt{53}} = 3{,}6223$$

With n-1 (52) degrees of freedom, the obtained t-statistic implies that the difference between the average betas for hedging companies and non-hedging companies is statistically different from zero on a 0% level. We have thus found additional and actually even stronger evidence in favour of our hypothesis that hedging companies are less exposed to commodity prices than non-hedging companies are.

Thus, from these regressions performed with the aim to examine the impact of hedging activities on stock price, we can ascertain the following. Hedging activities make the stock price returns less dependent on the price fluctuations in the agricultural commodity index. This can be stated by the statistically insignificant coefficient of the commodity index return in the regression based on the sub-sample with hedging firms only. The corresponding regression for the sub-sample with the non-hedging firms points in the opposite direction, namely at a significant and negative beta meaning that these firms' stock prices are exposed and negatively correlated with changes in the prices of the commodities. These results along with its implications are confirmed using the extended CAPM without the assumption that all firms in each sub-sample have the same market beta which is done by performing regressions for all firms separately – even though this result is to some extent sprawling. Some of the regressions, for reasons we cannot know, do show statistically insignificant relationships between the non-hedging firms' stock returns and the commodity index return. In spite of this, a big negative magnitude of the average beta for the non-hedging companies along with a positive average beta for the hedging companies indicate that hedging activities against commodity price fluctuations lowers the negative impact of such price fluctuations on the stock returns of a firm.

VI. IMPACT OF HEDGING ON INVESTMENT LEVELS

i. Empirical models

As in the previous assessment of stock price sensitivity to commodity prices, the analysis of the impact of hedging on investment levels covers the publicly held firms with SIC codes 514 and 515 listed in the Zephyr-database. These companies, because of their exposure to fluctuations in the price of their agricultural production ingredients, are incentivized to employ commodity hedging to protect their earnings from fluctuations. As shown in the previous section, the theory of hedging, i.e. that hedging smoothes fluctuations in stock price, seems to hold true in reality.

However, this fact does not equate that hedging increases firm value. Before an assessment of the effect of hedging on firm value, we chose to study the value creating activity known as investing.

With the starting point in the framework developed by Froot et al (1993) where investment projects are assumed to be a non-stochastic process, hedges are assumed to be valuable only when there is no relationship between the timing of investment projects with positive net present values and low cash flows as a result of high production input prices. Applied on the industry studied in this particular paper, the theory would imply that a hedge that protects against input price fluctuations, does maintain the internally created cash flow streams of the company regardless of increasing input prices. These preserved streams in turn enable the company to fund essential investment projects whenever beneficial investment opportunities exist. The investment expenditures generate future benefits for the company and hence increase the value of the firm. Consequently, for a hedge to be valuable for a firm under the assumption that the timing of profitable investment projects is a non-stochastic process, timing of these projects has to coincide with high commodity prices which, if a hedge was not employed, would result in low cash flows and therefore in an inability to invest in the available investment opportunity that otherwise would increase the value of the company.

The process to assess the eventual value-enhancing effect of ingredient hedging therefore commences by evaluating the relationship between the timing of the industry's investment projects and the commodity prices. Moreover, an important assumption we make initially but eventually deviate from is that profitable investment projects follow a non-stochastic process, thus that the availability of positive net present value projects is constant and that all investments undertaken thus are profitable. Therefore, it will consequently be assumed that the companies that invest the most and on a constant level create the largest future benefits which should, with respect to valuation theory, be reflected in an increased firm value. This means that for hedging to be valuable in an investment context, hedging companies should on average invest more than non-hedging companies when commodity prices are high.

What also possibly makes smooth cash flow before capital expenditures more valuable for a firm is that internally generated funds, i.e. free cash flow before capital expenditures, are cheaper than externally raised funds because of an augmenting marginal cost which increases with the amount of external funds raised, as mentioned in Froot et al (1993). As a result, if it increases the free cash flow generated, hedging could be more valuable than not hedging even if the capital expenditure is on the same level for both hedging and non-hedging companies. Both size and standard deviation of the free cash flow will therefore be relevant to evaluate along with size and standard deviation of capital expenditures. Hence, as a first step in the investigation of the effect of hedging on the value creating activities i.e. engaging in profitable investment projects, we will assess the impact of hedging on the generating of cheap funds (to fund these investments with). This is done by studying the linear relationship between lagged asset-scaled free cash flow before capital expenditures generated by the firm and; inflation adjusted commodity price, the natural logarithm of lagged Tobin's Q, a hedging dummy and the natural logarithm of lagged assets. The rationale for using the natural logarithm of lagged assets along with lagged Tobin's Q is because these two metrics appear to not be normally distributed as their median and mean values differ substantially. Using the natural logarithm of these metrics instead of their absolute values is also in line with recent previous studies such as Carter et al (2003) (who study the input price exposure of US Airline companies). The prediction for this regression is that the free cash flow before capital expenditures decreases when commodity prices increases, thus that the coefficient on commodity price is negative. When it comes to the coefficient on the logarithm of lagged Tobin's Q, it should according to corporate valuation theory be positive as firm value represent all future earnings, thus the more valuable a company is, the higher is the cash flow that the company is predicted to generate. Regarding the coefficient on the natural logarithm of the lagged total assets the results from earlier research differ among authors, why we do not have any predictions other than that the variable should affect cash flows.

As a second step in this part of the study, the effects of hedging on the actual investment levels will be assessed. This is done by estimating the linear relationship between lagged asset-scaled capital expenditures and; inflation adjusted commodity price, the natural logarithm of lagged Tobin's Q, a hedging dummy, the natural logarithm of lagged assets, dividend payout ratio, lagged asset-scaled free cash flow before capital expenditures and leverage in terms of net debt to equity ratio. Our predictions of this outcome of a linear OLS regression are basically the very same as for the earlier coefficients of the commodity price, the Tobin's Q-variable, the hedging dummy and the lagged assets variable because of the same reasons as discussed above. Hedging companies are thus assumed to invest more because of their presumed higher stability in internally generated cash flows. When it comes to the dividend payout ratio, theory suggests that capital expenditures should decrease with dividend payouts since the cash flow generated internally either can be paid out or be retained in the company and thus be used to fund investment projects. Moreover, the relationship between the lagged asset-scaled free cash flow before capital expenditures and the lagged asset-scaled capital expenditure is hypothesised to be positive since the more cheap funds available, the more the company can afford to invest in available investment projects. The same holds true for leverage- the more debt undertaken the more funds are available for profitable investment projects.

ii. Sample

Annually reported capital expenditure, along with annual free cash flow, book value of total assets and net debt are retrieved from both Compustat and FactSet as some of the firms in the sample were not covered in the respective databases. Free cash flow is per definition computed as net income before interest, taxes, depreciation and amortization but less changes in net working capital and capital expenditures. Free cash flow is a metric used for expressing the real net cash flow that is generated by the firm as it takes into account the changes in working capital and capital expenditures that are balance sheet items (and otherwise are disregarded when just looking at the income statement earnings). Since working capital consists of short-term, mostly interest-free net debt, free cash flow is a much cheaper source of funds than externally gathered money – for example long-term debt and new issuance. For our study we use free cash flow before capital expenditure. The resulting metric therefore expresses the amount of cash available for investing in future benefits. Hence, the metric, hereafter referred to as "Free cash flow before capex", can be used in order to assess how much of the free cash flow available for investments that is spent on available projects. Table VIa shows the annual patterns of the commodity price, total assets, free cash flow before capital expenditures and capital expenditures on a stand-alone basis. All numbers are in millions of dollars except for the commodity price which is reported in dollars.

Table VIa

Year	Commodity price (annual average)	Total assets (H)	Total assets (NH)	Total assets (all)	FCF before capex (H)	FCF before capex (NH)	FCF before capex (all)	Capex (H)	Capex (NH)	Capex (all)
2000	165,2	7313,3	2394,5	4853,9	389,0	302,5	345,8	283,9	161,7	222,8
2001	160,4	8313,6	2764,8	5539,2	460,6	336,0	398,3	269,0	202,9	236,0
2002	162,7	8617,9	2917,3	5767,6	604,1	371,3	487,7	267,6	195,3	231,5
2003	179,5	8291,3	3022,1	5656,7	467,2	353,8	410,5	244,8	203,5	224,2
2004	192,8	8154,7	3325,7	5740,2	490,2	387,7	439,0	245,9	194,5	220,2
2005	188,2	8004,3	3609,6	5807,0	567,9	422,4	495,2	290,2	197,5	243,9
2006	212,1	8228,8	3623,9	5926,4	464,6	393,4	429,0	301,5	235,0	268,3
2007	259,8	9818,4	4013,3	6915,9	429,8	371,0	400,4	368,4	271,0	319,7
2008	317,7	9961,9	4301,0	7131,5	377,2	422,6	399,9	413,8	278,4	346,1
2009	260,5	10631,8	4698,3	7665,1	838,9	492,2	665,6	424,5	274,9	349,7

Table VIa. This table shows the average annual agricultural commodity index prices in dollars along with average annual reported total assets, free cash flow and capital expenditures in millions of dollars for both the hedging (as indicated by H) and the non-hedging (as indicated by NH) companies in our sample. The figures covering the total sample of the 53 firms are indicated by (all).

Interestingly, the total assets are substantially higher for the hedging companies within our sample than for the non-hedging companies. However, since the sample includes all publicly listed American companies registered under the SIC code 514 and 515 in the Zephyr database, these findings should not be the result of data mining. Because total assets differ so significantly, comparing free cash flows and capital expenditure for hedging companies and non-hedging companies is not relevant on a stand-alone basis. These financial figures should instead be compared in relation to the size of the companies. Table VIb summarizes annual free cash flow and capital expenditure scaled by lagged assets in order to make comparable the free cash flows and capital expenditures.

Also worthy to point out is that hedging companies in 2008 on average invested more than they generated in funds internally. Hence they needed to access other sources than internal funds to finance their investments.

Table VIb

Year	Commodity price (annual average)	FCF before capex-to-assets (H)	FCF before capex-to-assets (NH)	FCF before capex-to-assets (all)	Capex-to-assets (H)	Capex-to-assets (NH)	Capex-to-assets (all)	Capex-to-FCF before capex (H)	Capex-to-FCF before capex (NH)	Capex-to-FCF before capex (all)
2000	165,2	5,3%	12,6%	7,1%	3,9%	6,8%	4,6%	73,0%	53,5%	64,4%
2001	160,4	5,5%	12,2%	7,2%	3,2%	7,3%	4,3%	58,4%	60,4%	59,2%
2002	162,7	7,0%	12,7%	8,5%	3,1%	6,7%	4,0%	44,3%	52,6%	47,5%
2003	179,5	5,6%	11,7%	7,3%	3,0%	6,7%	4,0%	52,4%	57,5%	54,6%
2004	192,8	6,0%	11,7%	7,6%	3,0%	5,8%	3,8%	50,2%	50,2%	50,2%
2005	188,2	7,1%	11,7%	8,5%	3,6%	5,5%	4,2%	51,1%	46,8%	49,2%
2006	212,1	5,6%	10,9%	7,2%	3,7%	6,5%	4,5%	64,9%	59,7%	62,5%
2007	259,8	4,4%	9,2%	5,8%	3,8%	6,8%	4,6%	85,7%	73,0%	79,8%
2008	317,7	3,8%	9,8%	5,6%	4,2%	6,5%	4,9%	109,7%	65,9%	86,5%
2009	260,5	7,9%	10,5%	8,7%	4,0%	5,9%	4,6%	50,6%	55,9%	52,5%

Table VIb. This table shows lagged assets-scaled free cash flow before capital expenditures and lagged assets-scaled capital expenditures for the years 2000-2009. The last three columns show how much of the internally generated free cash flow before capital expenditures that is used for capital expenditures. The year 2008 for hedging companies is remarkably high in the sense that hedging companies invested more than they generated internally.

As can be seen in table VIb, hedging companies appear to have a constantly lower cash flow-to-assets ratio along with a slightly lower capital expenditure-to-assets ratio. The average hedging firm consequently invests less than the average non-hedging firm. Also, hedging companies seem to have substantially lower free cash flows before capital expenditures scaled by lagged assets.

iii. Method and Results

Assuming that available investment projects are a non-stochastic process, non-hedging companies seem to have an advantage in creating value by investing in profitable projects (expressed by capital expenditures) and also in generating cheap funds as these companies do have higher free cash flow before capital expenditures. However, only comparing annual averages is not relevant without comparing standard deviations for the whole sample. Table VIc shows the standard deviations of free cash flow before capital expenditures and capital expenditures, both scaled by total assets on an annual basis for the whole sample of 53 firms.

Table VIc

Year	Capex-to-Assets (H)	FCF before capex-to-assets (H)	Capex-to-FCF before capex (H)	Capex-to-Assets (NH)	FCF before capex-to-assets (NH)	Capex-to-FCF before capex (NH)
2004	0%	4%	2%	3%	12%	149%
2005	0%	4%	1%	5%	10%	84%
2006	0%	4%	2%	6%	9%	454%
2007	0%	4%	1%	4%	9%	1156%
2008	0%	9%	0%	5%	9%	1075%
2009	3%	6%	18%	4%	7%	226%

Table VIc. This table shows standard deviations for the metrics as indicated by the headlines. As can be seen, all averaged items can be reliably compared to each other except for the capex-to-FCF before capex as that measure is characterized by a too high standard deviation among firms.

As can be seen, the standard deviation is on a fairly low level for all measures except for the capital expenditure to free cash flow before capital expenditure. Therefore, only averages for capital expenditure to assets and free cash flow to assets are comparable among hedging and non-hedging companies.

Because non-hedging companies have higher free cash flow before capital expenditure and higher capital expenditures for all years covered, non-hedging companies appear to have an advantage in creating firm value by investing more and investing using cheaper funds. This evidence thus points towards the fact that non-hedging companies could be more valuable. However, in order to determine whether this higher asset-scaled free cash flow before capital expenditure and the capital expenditures per se depends on hedging or not, their linear relationship to hedging has to be assessed using an OLS regression.

The linear dependency of hedging on the free cash flow before capital expenditures is derived via a cross-sectional regression using lagged asset-scaled free cash flow before capital expenditure as dependent variable and inflation-adjusted commodity price, lagged Tobin's Q and a hedging dummy variable as independent variables. Tobin's Q is used as a proxy for firm market value and will be explained closer in the next section. As previously discussed, we have here assumed that available investment projects can be explained as a non-stochastic process.

The regression equation is thus;

$$\frac{FCF\ before\ capex}{Total\ assets_{t-1}} = \alpha_{i,t} + \beta_1 \times \left(inflation\ adjusted\ commodity\ price_{i,t}\right) + \beta_2 \times ln\left(Tobin'sQ_{i,t-1}\right) + \beta_3 \times \left(hedging\ dummy_{i,t}\right) + \beta_4 \times ln\left(Total\ assets_{i,t-1}\right) + u_{i,t}$$

Since heteroskedasticity could be present in our sample we choose to perform a least squared regression using robust standard errors and adjusting for cluster effects. For this regression an R-squared value of only 4.05% is reached. The only control variables that generate statistically significant results are the natural logarithm of lagged Tobin's Q and lagged assets, which means that no conclusions in favour of our hypothesis can be made. (Appendix, table VI.d) Because of the low R-squared value we are reluctant to draw any conclusions at all, even though it appears that the free cash flow generated internally that can be used to cost-efficiently fund available investment projects are completely independent of both the prevailing inflation adjusted commodity price and of the company's hedging. Since it seems that the free cash flow generated by the company in large is unaffected by the commodity input price exposure in terms of the insignificant coefficient on both the commodity price per se and the hedging dummy, employing hedges might not be a valuable decision for firms in this industry. The internally generated cash flow therefore appears to be dependent on other factors. Presumably the top-line income statement items, such as the sales figure which is not assessed in this study, have a greater impact on the cash flow generated than the costs of the goods sold (i.e. the commodity input prices) have.

Next, we assess the effects of hedging on capital expenditures with the following OLS regression;

$$\frac{capex}{Total\ assets_{t-1}} = \alpha_{i,t} + \beta_1 \times \left(inflation\ adjusted\ commodity\ price_{i,t}\right) + \beta_2 \times ln\left(Tobin'sQ_{i,t-1}\right) + \beta_3 \times \left(hedging\ dummy_{i,t}\right) + \beta_4 \times ln\left(Total\ assets_{i,t-1}\right) + \beta_5 \times ln\left(dividend\ payout\ ratio_{i,t}\right) + \beta_6 \times ln\left(\frac{FCF\ before\ capex_{i,t}}{Total\ assets_{i,t-1}}\right) + \beta_7 \times ln\left(\frac{Net\ debt_{i,t-1}}{Shareholders'\ equity_{i,t-1}}\right) + u_{i,t}$$

Also in this regression heteroskedasticity could be present meaning it is desirable to perform an OLS regression using robust standard errors and adjusting for cluster effects. For this regression an R-squared value of 67.1% is reached that yields significance on the inflation adjusted commodity price, the hedging dummy and the lagged assets-scaled cash flow before capital expenditures.

In line with theory is the negative and significant (on a 5.6% level) coefficient on the inflation-adjusted commodity price that equals a value of -0.0006982. Firms thus appear to adjust their capital expenditures after the commodity price. However, what might be surprising are the negative coefficients on the hedging dummy and on the cash flow to assets variable. According to the outcomes of this regression hedging companies tend to invest less than non-hedging companies do. What is more astonishing is the strongly negative coefficient on the cash flow to assets control variable that measures -1.70 and is significant on a 0.3% level. (Please see appendix, table VI.e, for further details.) This implies that companies invest distinctly less the more cash flow they have available which in relation to theory is rather counterintuitive. However, as the control variables used yield a rather high R-squared value and as we adjust for heteroskedasticity and cluster effects, the results are nonetheless valid. There must thus be a logical explanation. Because of the findings from the previous OLS regression, where we found the cash flows' exposures to the commodity price and to the hedging dummy, to both be insignificant, the only logical explanation to the decreases in capital expenditure levels when the commodity prices increase must be that available profitable investment projects on average coincide with low commodity prices. Available investment projects are thus a stochastic process as opposed to being a non-stochastic process as assumed initially. The stochastic nature of the availability of profitable investment projects could as well explain the slightly negative coefficient on the hedging dummy. Hedging companies might simply face less profitable investment opportunities or at least decide to invest less if they judge the investment projects to be less profitable than non-hedging companies do. The difference in investment levels could thus be explained by a risk-averse behaviour of hedging companies- perfectly in line with the risk averseness inherent in the decision to hedge instead of liquidity constraints. However, to the negative coefficient on the cash flow variable we find no rational explanation and therefore exclude a potential existence of applicable theories to such explanations from the scope of this bachelor thesis.

Moreover, the fact that hedging companies seem to invest less does not necessarily imply that hedging companies are less valuable. It is possible that the decision to not invest is rewarding if the available investment projects on average are unprofitable. If so, investors are better off if management decides to not invest and instead use the funds available for dividends or save the funds for future more profitable projects that might arise. This reasoning is increasingly credible when ascertaining that the most recent financial crisis is included in our time period. On the other hand, as can be seen in table VIa, hedging companies invest less than non-hedging companies during all years included in the study, which logically cannot be a value-maximizing strategy. This however, assumes that all companies can hedge to the extent they wish, i.e. that companies face no constraints when it comes to hedging.

Because profitable investment projects are a stochastic process, and the particular stochastic process faced by each firm therefore differs among firms, it is plausible to assume that each company decides to hedge (or not to) to the extent that maximizes the value. If for example, as indicated by the regression above, profitable investment projects for company A coincide with low commodity prices, then it can be assumed that company A decides not to hedge in order to benefit from the upside risk of not hedging, i.e. enjoying a period of lower input prices than hedgers would do if commodity prices were to decrease. Similarly, company B would choose to hedge if management knew or predicted that profitable investment projects will be present when commodity input prices are high. All companies are thus assumed to be able to hedge how much or how little as they judge to be relevant. However, as discoursed in Geczy, Minton and Schrand (1996), small companies, as opposed to large companies, tend to get excluded from the hedging market because of their assumed size-related liquidity constraints and increased costs associated with undertaking hedging arrangements. If this is true for our sample, the above reasoning when it comes to risk-averseness of the companies and the decisions to hedge or not becomes slightly hirpling, though still might hold true. This can be tested via the below cross-sectional regression;

$$\frac{capex}{Total\ assets_{t-1}} = \alpha_{i,t} + \beta_1 \times (small\ dummy)_{i,t} + \beta_2 \times (nonhedging\ dummy)_{i,t} + \beta_3 \times (small\ dummy)_{i,t} \times (nonhedging\ dummy)_{i,t} + u_{i,t}$$

The "small dummy" is a dummy variable that takes on the value 1 if the size of the company, i.e. the book value of total assets of a certain company is higher than the median of all the firms' book value of assets which measure 14,102 millions of dollars, and takes on the value 0 else wise. The variable called "nonhedging dummy" takes on the value 1 if the company is a non-hedging company and the value 0 if it is a hedging company. The interaction variable is the product of the above discussed variables. If the findings of Gezcy et al holds true for our sample, i.e. that there are companies that are unable to get access to the hedging market and consequently invest less than they desire, the interaction variable should yield a negative coefficient.

When regressing the above regression equation, adjusting for heteroskedastic standard errors and cluster effects, we find a negative coefficient (-0.1086682) on the interaction variable that is significant on a 7% level. This means that there are companies that invest less than they desire because they are excluded from the hedging market. This invalidates the assumption that companies invest as much as they want with respect to available profitable investment projects. However, as our findings indicate that hedging companies invested less during our sample period the fact that there are small firms that desire to hedge in order to increase their capital expenditures, i.e. that these firms currently are categorized as non-hedging companies and invests less than they desire to, does not have any severe implications for our results. It is still true that among our sample companies, hedging companies invested less and the commodity price did not affect the internal cash flows in any direction.

VII. DOES HEDGING AFFECT FIRM VALUE?

i. Empirical models

As previously mentioned, one of the motives behind hedging suggests that hedging tools are used by managers to maximize shareholder value, i.e. to maximize firm value. There are several previous studies made with the main objective to examine the link between hedging and firm value, even though the approach to the question formulation differs between studies and authors. To use derivatives to hedge against the exchange rate risk exposure is for instance a value-increasing strategy (Allayannis and Ofek, 2000). As we have been able to ascertain above, the free cash flow is, in our sample, insignificantly related to a hedging dummy, implying that cash flows are independent of whether firms hedge or not and instead fluctuates depending on other factors. In addition, we saw a higher capital expenditure for the non-hedging firms as explained in the section above. Still we find it interesting to carry out further regressions to address the relation between hedging activities and firm value. We assumed investment opportunities to be a stochastic process and further highlights a potential situation where there have been a lack of interesting projects that corresponds to a positive net present value during the recent years. Thus, it might have been a smart and conscious move when a firm, with a predicted cash flow based on other factors than hedging contracts etc., decides to not engage in new projects. Our aim to investigate the firm market value is encouraged by these previous findings since hedging firms might have been taking on higher firm values by adopting a wise investment strategy during the recent financial crisis.

To address this question one first need to decide how to define firm value. The ratio of market value of the enterprise to replacement cost of assets is known as a proxy for the market value of a firm. (Allayannis and Weston, 2001) The ratio is known as ”Tobin’s Q” after its originator James Tobin who claimed that if asset prices are set correctly in the capital market, the combined market value of all firms on the stock market should equal their replacement costs (Tobin, 1969). Tobin’s Q ratio per each firm and year is calculated as per;

$$Tobin's\ Q = \frac{market\ capitalization\ +\ net\ debt}{book\ value\ of\ shareholders'\ equity\ +\ net\ debt}$$

The utilization of Tobin's Q as a proxy for firm market value is common within literature where the impact of hedging on firm value is studied as it measures relative firm value and thus can be compared between firms of differing size. We refer to both Allayannis and Weston (2001) and Chang, Hong and Kuan (2005). To obtain a reliable indication of how hedging activities affect firm value it is of great importance to isolate the influence that other variables might have on the Tobin's Q. We therefore add variables that might have an impact on firm value, namely; a) the yearly opening balance of leverage, computed as net debt divided by shareholder's equity, which is assumed to be related to the firm's value, b) Return on assets, computed by dividing net income (at time t) with total assets (opening balance, t-1) and is used as a measure for profitability. The assumption behind the utilization of this variable is that if hedging generates higher profits, such firms will also experience higher values of Tobin's Q, c) Investment growth is the third variable taken into account when studying firm value under the assumption that investment opportunities are higher for firms that use hedging tools (Froot et al, 1993). It is proxied as capital expenditures ("capex") divided by free cash flow; d) Dividend payout policy, as firms' attitude towards paying dividends according to previous research have an impact on Tobin's Q. A dividend-paying firm is probably less capital constrained than a non-dividend paying firm and one can thus expect a dividend-paying firm to have a higher Tobin's Q. Dividend payout ratio is taken accounted for by including the dividend payout ratio in the regression, e) the size of a firm ought to have an impact on its value. Larger firms might find it more feasible to use hedging tools, which sometimes implies extensive start-up costs. As a proxy for firm size we use the natural logarithm of total assets because they are assumed to not be normally distributed as their median and average value differs substantially, f) a dummy variable as the focus of study is how/if eventual hedging activities against agricultural commodities' price fluctuations affect firms' value. Thus, we use a dummy variable for hedging. (Allayannis and Weston, 2001)

In addition we expand our research by taking the phenomena reverse causation into consideration. Companies with high Tobin's Q might have high investment opportunities, in particular high free cash flows, and thus strong incentives to hedge. If this is the case, firms with high market values chose to hedge in a bigger extent than firms with lower market values. (Allayannis and Weston, 2001) This would thus imply that the Tobin's Q decides the hedging strategy and not the reversal that hedging strategies affect the Tobin's Q. One way to examine this is to perform a time-series regression with a lagged variable under the assumption that firms with a high market value in this period engage in a hedging strategy in the next period. To perform this one need data on exactly when new hedging contracts signs or increases in hedging activities takes place, which we do not have had access to. We therefore perform a regression where the Tobin's Q is an independent variable and thus the dummy for hedging is the dependent variable. We expect our results of this extended analysis to be in line with what Allayannis and Weston (2001) were able to verify, namely that hedging causes firm values to increase and that there is no reverse causation in this setting.

ii. Sample

The sample used is the same as for the regressions in part V, that is, 53 U.S. listed companies use agricultural commodities as ingredients in production. Apart from previous sample processing, we here keep the 53 companies in one sample and perform a regression where we compare the effect on Tobin's Q of hedging activities by introducing a dummy variable (that takes on value 1 if the company hedges, 0 else wise). All variables are constructed per each firm on a yearly basis. We stretch the timeline back six years and thus include the years from 2004 up and until 2009. The cross-sectional regression includes 262 observations.

The dependent variable in our regression is the natural logarithm (the natural log value in parenthesis) of our computed proxy for firm value, Tobin's Q. We observed a mean value of Tobin's Q that equals 3.0643 (0.8607), a standard deviation of 3.4559 (0.6334), minimum value of 0.7549 (-0.2812) and maximum value of 32.6974 (3.4873). See table VII.c in appendix. Since we obtained a median value of the Tobin's Q that equals 2.2163 the decision to use to the natural logarithm of the variable is legitimate. The higher mean value, 3.0643, indicates a skewed distribution of the variable and to correct for this we address the employment of the natural logarithm that makes the distribution more symmetric. Theoretically, the Tobin's Q proxy is in fact a skewed distributed variable. (Lang and Stulz (1994), Servaes (1996))

The variable leverage has a mean value of 0.0356 and a standard deviation of 17.6696 (min. value -265.2258 and max. value 102.206). Return on assets (ROA) has a mean value of 0.0762, a standard deviation that equals 0.0642, the lowest ROA in our sample is 0.0030 and the highest obtained equals 0.7404. Investment growth's mean value is 0.6561 and its standard deviation is 25.2382 with minimum value being -238.6364 and maximum value being 312.50. The variable dividend (payout ratio) has got a mean value in our sample that equals 26.7333 and a standard deviation of 35.6097. 17 (32.08%) of the 53 companies in the sample don't pay out dividends at all during our sample period. Meanwhile the maximum value for this is 336.3636. The size measures (the natural log value in parenthesis) on average 6854.929 (7.5821), with standard deviation being 11461.57 (1.7832), minimum value 40.1173 (3.6918) and maximum value 67993 (11.1272). (We refer to table VII.c in appendix for an overview.)

iii. Method and Results

We perform the following regression as an OLS cross-sectional regression with 262 observations.

$\ln(\text{Tobin's Q})_{i,t-1} = \alpha + \beta_1 \text{ (leverage)}_{i,t-1} + \beta_2 \text{ (ROA)}_{i,t} + \beta_3 \text{ (growth)}_{i,t} + \beta_4 \text{ (div)}_{i,t} + \beta_5 \text{ (hedging)}_{i,t} + \beta_6 \text{ (ln(size)}_{i,t-1}$

$\ln(\text{Tobin's Q})_{i,t-1}$ = natural logarithm of Tobin's Q, firm i, time (t-1)
$\text{leverage}_{i,t-1}$ = leverage, firm i, time (t-1)
$\text{ROA}_{i,t}$ = return on assets, firm i, time t
$\text{growth}_{i,t}$ = investment growth, firm i, time t
$\text{div}_{i,t}$ = payout ratio, firm i, time t
$\text{hedging}_{i,t}$ = hedging dummy, firm i, time t
$\ln(\text{size})_{i,t-1}$ = natural logarithm of firm size, firm i, time (t-1)

The regressions yield statistically significant coefficients on the variables for return on assets, dividend-payments and hedging on a <5% level. In addition, the variable for leverage is statistically significant on a 10% level. We also find that growth and the logarithm for size are both statistically insignificant.

The variable of greatest interest for the subsequent analysis is the dummy for hedging, which is significant below a 1% level. The coefficient is 0.1413 and thus implies an increase in the proxy for firm value when the hedging-dummy equals 1, holding all other variables fixed. The control variable in this context that has the biggest impact on the dependent variable is return on assets with a coefficient of 6.9919. Thus, return on assets, i.e. profitability, is highly and significant related to firms' market value. Leverage, computed to control for the firms' capital structures, has a weak negative impact on the firms' market values as the coefficient is -0.0007. The factor containing the payout ratio, dividends, has a positive but small impact on Tobin's Q with a coefficient that equals 0.0019. The reached R^2-value is 0.4128. We can thus ascertain that there is a prevailing positive relationship between the implementation of hedging activities within the firms in our sample and their corresponding proxies for market firm value. See appendix, table VII.a for an overview of these findings.

In addition we perform the following regression to test for reverse causation.

$$(\text{hedging})_{i,t} = \alpha + \beta_1 (\text{leverage})_{i,t-1} + \beta_2 (\ln(\text{size})_{i,t-1} + \beta_3 \ln(\text{Tobin's Q})_{i,t-1}$$

We find that the size variable is statistically significant at 0% and have a positive impact (β_2 equals 0.1194) on the hedging dummy. (Further results from this regression are presented in appendix, table VII.b.) This should be interpreted as follows: an increase in ln(size), i.e. an increase in the size of the firm, makes it more likely that the firm undertakes hedging activities. I.e. size seems to have an impact on hedging decisions, making it more likely that large firms use hedging tools. This is line with theory that, as mentioned earlier, states how fixed costs associated with the entering phase of hedging contracts could make it more difficult for smaller firms to afford to employ derivative hedging strategies (Allayannis and Weston 2001). The variables leverage and the natural logarithm of Tobin's Q is though statistically insignificant at a significance level of 10%, which would indicate that there is no such reverse causation influencing the relationship between hedging and firm market value. That is, based on our sample, we cannot for sure assert that firms with a higher market value possess a greater probability of undertaking hedging activities. We therefore keep our conclusions stated based on our first regression where the proxy for firm market value is used as the dependent variable. We can walk out on this section with the conclusion that hedging activities influence the firms', in our sample, market values in a positive and statistically significant way. In addition, as it appears in section VI (table VI.d) the cash flow is significantly and positively related to the natural logarithm of Tobin's Q. This implies that as the Tobin's Q for a firm increases so does the cash flow, holding other factors fixed. As stated in the last two regressions; hedging affects Tobin's Q in a positive way, i.e. hedging could lead to higher cash flows. This is though a weak conclusion as we have not been able to prove it technically. Another dimension of how to explain a firm's market value is to consider the common view on hedging strategies on the market. Hedging companies might be valued at a higher level due to irrationalism and risk-aversion among investors that hence prefer hedging companies before non-hedging companies, based on hedging tools' capacity to smooth earnings and reduce unfeasible downturns.

VIII. SUMMARY AND DISCUSSION OF RESULTS

The findings of the empirical studies carried out in this paper indicate that hedging increases firm value and smoothes stock price movements. However, when it comes to the impact of hedging, we find a negative relationship between hedging and investment levels for our sample period. The relationship between hedging and cash flows available for such value-enhancing activities as investment projects were found to be insignificant for our sample. The explanations for the puzzling results when it comes to the coefficient and significance on independent variables on the cash flow and investment levels are many.

First of all, we only study the linear relationship between hedging and companies' cash flows and investment levels and the linear relationship between stock price returns and commodity prices, respectively. There might also be a non-linear relationship between the variables that describes the exposures more closely. For instance, Chang, Hong and Kuan (2005), find a significant non-linear relationship between Canadian Oil companies' stock prices and oil prices.

Moreover, the decision to assess the exposure of the stock price to a commodity index might have been a less beneficial trade-off between having a sample consisting of fewer firms that hedge their exposure to the very same commodity and having a large sample of 53 firms like we do, and measure their exposure to a composite index. Since the firms' respective ingredient commodity is included in the composite index, we do not regard this probable bias to be of significant importance.

Our sample period (2004-2009) is fairly short when one takes into account that our sample period includes the most severe recession since the Great Depression during the 1930's. Since the latest recession has been included and not adjusted for, the bias induced by this massive downturn in the world economy can be of considerable importance. Furthermore, in the regressions where annual data is used, using low-frequency data for such short period of time could be the reason for some of the counterintuitive and contradictive results, even though we prioritize including only recent data in our sample period in order to make the results up to date.

Furthermore, when it comes to identifying the companies as hedging or non-hedging and thus creating two sub-samples, we might to an extent have misidentified some companies as non-hedgers because they do not hedge using derivatives. For instance, we do not take into account if companies hedge by using storage to any extent. Physical reserves in commodities can be regarded as a type of hedge. In addition, this type of hedging has proven to lead to a higher Tobin's Q in some cases (Chang, Hong and Kuan, 2005). Also, the fact that the quantity hedged is completely overlooked and disregarded in our study may have had impacts on the results. As the quantity hedged almost never is reported in detail in the 10-K reports, such an evaluation would need accessing information not available for the average investor.

In general, all regressions performed could possibly be extended with more independent variables in order to minimize the omitted variables bias thus increase the explanatory power in terms of the R-squared values. For example, an extended model for evaluating the impact of hedging on Tobin's Q could be used to get even more reliable results. There are multiple factors that are said to affect firm market value and thus could be used as control variables. For instance, one could expand the research and cover firms active in different industries (i.e. not only cover agricultural commodities) to be able to control for industry effects. Allayannis and Weston (2001) and Lang and Stulz (1994) suggest that if the hedging firms are active in an industry that for different reasons enjoys a high Tobin's Q in general, the firms' values will not be high because of the hedging but because of industry specific circumstances. In this study we have only regarded firms operating in the same industry. Thus we have not been able to control for industry effects. Analogically, a control variable for geographic diversification could be included since theories suggest that it increases value (Coase, 1937 and Dunning, 1973).

For basically all statistical tests of this study, the reversed causality, i.e. that the relationship between cause and effect is reversed has to be taken into account. That means that the effect might in some of the cases be preceded by the cause. E.g., hedging companies might not be more valuable in terms of higher Tobin's Q than non-hedging companies. Rather, it could be the other way around, i.e. that companies that have higher Tobin's Q and thus have a higher relative value, hedges because of their higher value. We address this issue by testing for reversed causality when it comes to Tobin's Q and we are able to ascertain an absence of it, even though the same question remains and applies to the cash flow and capital expenditures' cross sectional regressions.

What is important to bear in mind when reviewing the results from our study is that they are based on historical data and thus the certain circumstances that prevailed during our sample period. That might imply that the findings are not applicable on any other period of time, neither in the future or in the past. In spite of these possible short-comings of our study, we are certain that our results at least indicate that a high relative firm value is related to the employment of agricultural commodity hedging derivatives. Because we find no relationship between hedging and investment levels we decide to explain the augmented relative firm value in terms of higher Tobin's Q for companies that hedge by pleading investors irrational. With reference to our results, investors appear to irrationally value hedging companies higher than they value non-hedging companies.

IX. CONCLUSION

We have been able to ascertain how producing firms (buyers of agricultural commodities that are listed on the U.S. stock exchanges) using hedging tools to protect them from their exposure to price fluctuations of agricultural commodities smooth their stock price and increase their firm market value. As we have been unable to identify any significant relationship between hedging and the value-increasing activities of investing in profitable investment projects, we explain the higher value of companies that do hedge by pleading investors risk averse and thus irrational in attaching a higher value to hedging companies despite the fact that there are no associated higher levels of neither cash flows or capital expenditures in hedging companies. Data on hedging behaviour among firms together with data on relevant commodity prices can thus be used in arbitrage pricing.

X. SUGGESTIONS FOR FURTHER RESEARCH

As we conclude that hedging firms, in accordance with hedging theory, are less sensitive to fluctuations in the underlying commodity price and that hedging firms, perhaps because of this, are more valuable than non-hedging firms without being able to find any other reason for this than risk aversion among investors we believe that there are yet many questions unanswered. For example, an interesting research could be explaining in detail how the cash flows were affected by the changes in commodity prices by taking into account all other income statement items that affect cash flows. Also, a more qualitative approach to this field of research could be taken on. For instance, qualitatively taking into account the risk averseness could yield apprehensive conclusions.

Moreover, as an augmented valuation of hedging companies is found in this study, an aspect completely overlooked in this piece of research that could further be assessed is the utilization of natural hedges in terms of keeping stock and the negotiation with suppliers. Also the quantity hedged could here be explored in order to gain further insights of the implications of hedging as a means to reduce risk and make stock holders better off.

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XII. APPENDICES

i. Abstract from the year 2006 10-K filings of Pilgrim's Pride Corp

"Item 7A. Quantitative and Qualitative Disclosures About Market Risks

Market Risk. Our principal market risks are exposure to changes in broiler and commodity prices and interest rates on borrowings. Although we have international sales and related accounts receivable from foreign customers, there is no foreign currency exchange risk as all sales are denominated in U.S. dollars.

Commodities Risk. We are a purchaser of certain agricultural commodities used for the manufacture of poultry feeds. We use commodity futures and options for economic hedging purposes to reduce the effect of changing commodity prices. In addition, we enter into forward purchase contracts to ensure a sufficient supply of our feed ingredient inventories. Feed ingredient futures and option contracts, primarily corn and soybean meal, are accounted for at fair value. Changes in fair value of these commodity futures and options are recorded as a component of product cost in the consolidated statements of operations. As of September 30, 2006, the notional amounts and fair value of our outstanding commodity futures and options positions were not material.

Feed ingredient forward purchase commitments for corn and soybean meal in the ordinary course of business were $68.8 million at September 30, 2006. These commitments include both priced and unpriced contracts. Unpriced feed ingredient commitments are valued at market for the month of delivery as of September 30, 2006.

Based on estimated annual feed usage, a 10% increase in the weighted average cost of feed ingredients would increase our annualized cost of sales by an estimated $60 million to $70 million. The sensitivity analysis presented above is the measure of margin reduction resulting from a hypothetical increase in market prices related to corn and soybean meal. Sensitivity analyses do not consider the actions management may take to mitigate exposure to changes, nor do they consider the effects that such hypothetical adverse changes may have on overall economic activity. In addition, actual changes in market prices may differ from hypothetical changes.

Interest Rate Risk. We have exposure to changes in interest rates on certain debt obligations. The interest rates on our amended senior credit facilities fluctuate based on the London Interbank Offered Rate (LIBOR). Assuming the $250.0 million revolver was fully drawn, a 1% change in LIBOR would increase annual interest expense by approximately $2.5 million."

ii. Tables

Table Va

y=sample average return	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
rf (risk-free rate)	0.9168024	0.0586698	15.63	0.000
market excess ret.	0.8857618	0.0645267	13.73	0.000
commodity index ret.	-0.0988557	0.0430219	-2.3	0.025
_cons	0.0005603	0.0001141	4.91	0.000

R-squared: 0.8180

No obs: 59

Table Vb

y=hedging firms' ave ret	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
rf (risk-free rate)	0.9481932	0.0527697	17.97	0.000
market excess ret.	0.9394502	0.0514214	18.27	0.000
commodity index ret.	-0.0299996	0.0504591	-0.59	0.554
_cons	0.0005408	0.0001217	4.44	0.000

R-squared: 0.8178

No obs: 59

Table Vc

y=non-hedging firms' ave ret	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
rf (risk-free rate)	0.8854115	0.0907574	9.76	0.000
market excess ret.	0.8320733	0.0964081	8.63	0.000
commodity index ret.	-0.1677117	0.0546992	-3.07	0.003
_cons	0.0005798	0.0001536	3.78	0.000

R-squared: 0.6928

No obs: 59

Table Vd

Summarize	Obs	Mean	Std. Dev.	Min	Max
date	60			200504	201003
rf (risk-free rate)	59	-0.0000622	0.0038805	-0.0150421	0.0117003
rm (market return)	60	0.0001044	0.0021438	-0.0070431	0.0044399
commodity index ret.	60	0.0003787	0.0026163	-0.0068595	0.0061333
hedging firms' ave ret	60	0.0006556	0.0022438	-0.0065667	0.005239
non-hedging firms' ave ret	60	0.0006432	0.0021607	-0.0053304	0.0068016
whole sample ave ret	60	0.0006494	0.0021054	0.0051558	0.0059938
market excess rer.	59	0.0001257	0.0042895	-0.0154448	0.0119868

Table Ve

Hedging firm:	β (com index ret.)	Non-hedging firm:	β (com index ret.)
1	0.126	1	-0.248
2	0.694**	2	0.361
3	-0.0756	3	-0.284
4	-0.0237	4	-0.352
5	-0.0807	5	-0.19
6	0.318	6	-0.0186
7	-0.334	7	-0.379
8	-0.23	8	-0.337*
9	-0.404**	9	-0.327
10	-0.389	10	-0.194
11	0.01	11	-0.0753
12	0.138	12	-0.391*
13	-0.0616	13	-0.142
14	-0.0579	14	-0.595***
15	0.0683	15	-0.0716
16	0.386*	16	0.0199
17	1.044	17	0.144
18	-0.5**	18	-0.2
19	-0.261	19	-0.0777
20	0.227	20	0.227
21	-0.215	21	-0.719*
22	0.469	22	-0.041
23	-0.163	23	-0.243
24	-0.391*	24	0.007
25	0.0541	25	0.492
Average:	**0.013916**	26	-0.0844
		27	0.195
		28	-0.733*
		Average:	**-0.15203**

*p<0.05, **p<0.01, ***p<0.001

Table VI.d

y=cash flow to assets	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
infl. adj. commodity price	-0.00000736	0.0002818	-0.03	0.980
ln(Tobin's Q)	0.0548333	0.0184155	2.98	0.031
hedging	-0.0127352	0.0146982	-0.87	0.426
ln(assets)	0.0238222	0.0112125	2.12	0.087
_cons	-0.2536481	0.153975	-1.65	0.160

R-squared: 0.0405

No obs: 258

Table VI.e

y=capex to assets	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
infl. adj. commodity price	-0.0006982	0.0002815	-2.48	0.056
ln(Tobin's Q)	-0.0134423	0.0431705	-0.31	0.768
hedging	-0.0631836	0.0225669	-2.8	0.038
ln(assets)	-0.0307987	0.0226403	-1.36	0.232
div payout ratio	0.1779548	0.1387139	1.28	0.256
cash flow to assets	-1.696656	0.3091963	-5.49	0.003
leverage	-0.0001796	0.0003049	-0.59	0.581
_cons	0.4538411	0.2610259	1.74	0.143

R-squared: 0.6711

No obs: 258

Table VI.f

y=capex to assets	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
small(dummy)	-0.0065184	0.0015817	-4.12	0.009
nonhedging(dummy)	0.1345185	0.0384449	3.5	0.017
small*nonhedging	-0.1086682	0.0473725	-2.29	0.070
_cons	0.0512099	0.0014148	36.19	0.000

R-squared: 0.0143

No obs: 258

Table VI.g

Summarize	Obs	Mean	Std. Dev.	Min	Max
tobin's q	258	3.055827	3.480121	0.7548938	32.69743
assets	258	6858.233	11540.3	40.11729	67993
leverage	258	0.0316904	17.80647	-265.2258	102.206
ROA	258	0.0760001	0.0646498	0.0030312	0.7403795
growth	258	.6555971	25.43383	-238.6364	312.5
div	258	26.62938	35.7842	0	336.3636
hedging	258	.4689922	.5000075	0	1
year	258			2004	2009
infl. adj. commodity price	258	234.849	45.33834	188.1737	317.7242
free cash flow	258	187.0144	630.6832	-5299	3096
capex	258	295.8453	483.8173	.035684	2446
small(dummy)	258	.120155	.3257747	0	1
nonhedging(dummy)	258	.5310078	.5000075	0	1
cash flow	258	-108.831	620.8419	-7078	1198
ln(assets)	258	7.568764	1.789153	3.691807	11.12716
ln(tobin's q)	258	.8546147	.6356265	-.2811782	3.487297
cash flow to assets	258	-.0341836	.2578585	-2.815423	.4989124
capex to assets	258	.1210147	.5688769	3.97e-06	5.106811
div payout ratio	258	.2662938	.357842	0	3.363636
small*nonhedging	258	.0077519	.0878736	0	1

Table VII.a

y=ln(Tobin's Q)	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
leverage	-0.0006594	0.0003267	-2.02	0.100
ROA	6.991938	1.273636	5.49	0.003
growth	0.0059044	0.0047035	1.26	0.265
div	0.0018529	0.0005849	3.17	0.025
hedging	0.141288	0.0271149	5.21	0.003
ln(size)	-0.0187749	0.0114171	-1.64	0.161
_cons	0.3507204	0.1667386	2.10	0.089

R-squared: 0.4128

No obs: 262

Table VII.b

y=hedging(dummy)	β (coef.)	Std. Err. (robust)	t-stat	P> | t |
leverage	-0.0015383	0.0007728	-1.99	0.103
ln(size)	0.1194267	0.006163	19.38	0.000
ln(Tobin's Q)	0.0049645	0.0158111	0.31	0.766
_cons	-0.4402576	0.0505919	-8.7	0.000

R-squared: 0.1863

No obs: 262

Table VII.c

Summarize	Obs	Mean	Std. Dev.	Min	Max
tobin's q	262	3.064272	3.455863	0.7548938	32.69743
size	262	6854.929	11461.57	40.11729	67993
leverage	262	0.0356123	17.66955	-265.2258	102.206
ROA	262	0.0761741	0.0642129	0.0030312	0.7403795
growth	262	0.6560546	25.23819	-238.6364	312.5
div	262	26.73334	35.6097	0	336.3636
hedging	262	0.4694656	0.5000219	0	1
year	262			2004	2009
ln(Tobin's Q)	262	0.860685	0.6333738	-0.2811782	3.487297
ln(size)	262	7.582102	1.783178	3.691807	11.12716

Table VII.d

	Hedging firm:		Non-hedging firm:
1	Archer Daniels Midland Company	1	Alberto-Culver Company (Old)
2	Bunge Ltd	2	Amcon Distributing Company
3	Campbell Soup Company	3	Chiquita Brands International Inc.
4	Coca-Cola Enterprises Inc.	4	Sanderson Farms Inc.
5	ConAgra Foods Inc.	5	BJ's Wholesale Club Inc.
6	Corn Products International Inc.	6	Calavo Growers Inc.
7	Del Monte Foods Company	7	Dean Foods Company
8	Farmer Bros. Co	8	Dollar Tree Stores Inc.
9	Flowers Foods Inc.	9	Hain Celestial Group Inc., The
10	Green Mountain Coffee Inc.	10	Hansen Natural Corporation
11	HJ Heinz Company	11	Inventure Group Inc., The
12	Hormel Foods Corporation	12	J & J Snack Foods Corporation
13	Kellogg Company	13	Kroger Company, The
14	Kraft Foods Inc.	14	Lance Inc.
15	Krispy Kreme Doughnuts Inc.	15	McCormick & Company Inc.
16	Monsanto Company	16	NBTY Inc.
17	Origin Agritech Ltd	17	Nutraceutical International Corporation
18	Ralcorp Holdings Inc	18	Peet's Coffee & Tea Inc.
19	Sara Lee Corporation	19	PepsiCo Inc.
20	Smithfield Foods Inc.	20	Pilgrim's Pride Corporation (old)
21	Starbucks Coffee Company, The	21	Scotts Company, The
22	Synutra International Inc.	22	Seaboard Corporation
23	Tootsie Roll Industries Inc.	23	Seneca Foods Corporation
24	TreeHouse Foods Inc.	24	Supervalu Inc.
25	Tyson Foods Inc.	25	Synergy Brands Inc.
		26	Sysco Corporation
		27	Tasty Baking Comp.
		28	United Natural Foods Inc.