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The Value of Foreign Currency Hedging

A study on the German market

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June 2013

Abstract
This study examines the use of derivatives by 137 public firms in Germany in 2006-2010. To our knowledge our study is the first examination of the relation between hedging and market value on the German market. We find in univariate tests that the use of derivatives by non-financial firms does not add value. The results from our tests are inconsistent with theoretical predictions. Additionally our multivariate tests turn out to be inconsistent compared to the reported significant results within the documented U.S. sample examination as regards a value-enhancing effect imposed by derivatives. We identify influence factors in the areas of corporate governance, internationalization and managerial ability as a possible explanation for country-specific differences between firms in Germany and the U.S.

Keywords: Firm value; Hedging; Currency derivatives; Volatility

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1 Introduction

The term risk management can be described by ensuring a less risky outcome of a certain target variable by controlling the actual outcome in advance. From a corporate perspective risk management is used with the main objective to handle various exposures towards specific risk factors in order to mitigate the volatility of the firm's cash flows. The most common risk factors originate from macroeconomic factors, specifically the risk with regard to exchange rates, interest rates and commodity prices (Oxelheim and Wihlborg, 2008).

Since Germany is the world's third biggest exporting country (see Appendix 1), German companies are most likely to rely heavily on revenues generated by exporting their products to other customers in foreign countries, and since numerous German firms operate on an international basis; consequently they are exposed towards the mentioned risk factors.

Especially the increased volatility with regard to global exchange rate risks has to be monitored by the firms. We specifically identify the volatility of the EUR/USD-exchange rate as a notable risk factor since the United States of America are Germany's biggest trading partner that has not the Euro as its currency (see Appendix 2). The EUR/USD-exchange rate experienced periods of extraordinary increased volatility during our examined time period (see Appendix 3). The course of the chart clearly gives evidence for the impact of the global financial crisis and Europe's debt crisis.

Naturally the crisis also affected the German equity index (DAX) during our examined time period experiencing a dashing value loss of -54.6% from December 24th, 2007 until March 2nd, 2009 (see Appendix 4). Hence we also identify stock volatility as a severe risk factor.

A multinational company is likely to rely on an increased diversity of the numerous markets it is operating in. On the other hand, an increase in market access inevitably comes along with an increasing exposure towards risk compared to companies solely operating on a domestic basis. As a result also the need for handling those risks

increases. The management of price risk in Germany has been performed for numerous years.

Consequently it's only logical that a majority of firms as of today manage their price risks with regard to their anticipated exposure denominated in foreign currency. This implies that the majority of highly exposed firms manage their exposure to an increasing extent and that the magnitude of their foreign sales is being secured with respect to its corresponding forward price. A positive conclusion to be drawn is that risk management's importance in a corporate context increases. On the other hand an increased use of derivatives comes along with an increased exposure with regard to the corresponding derivatives used. This finally leads to the logical question: Does hedging actually increase overall shareholder value?

2 Problem discussion

The theoretical basis with regard to risk management originates on the Irrelevance Theorem proposed by Miller and Modigliani (1961). Their hypothesis stresses the independence of a firm's value from risk management. They imply the shareholders' ability to replicate the actions of risk management at lower cost. The hypothesis holds, given the following four assumptions are not violated: Existence of a perfect capital market, symmetric information, given investment strategies and unrestricted market access. Nevertheless, in the real world markets are frictional, e.g., as a result of information asymmetries or taxes. Hence these assumptions are being violated.

The fundamental source of value creation due to risk management is based on the volatility reduction of the firm's cash flows (Culp, 2002). The theoretical framework mainly stresses four areas of interest in this respect: Mitigation of the underinvestment problem, reducing costs of financial distress, reducing expected tax liabilities and managerial risk aversion.

The most preeminent financial price risks can be identified as risk with regard to interest rates, exchange rates and commodity prices.

The majority of existing studies focuses on either the risk underlying countries, industries or the types of hedging. Allayannis *et al.* (2012) give evidence for corporate governance bearing a significant influence on a hedging premium, implying that country specific attributes are an important cause for value creation.

Jin and Jorion (2006) examined various industries, e.g., the gold mining industry, finding no value enhancing impact, whereas Carter *et al.* (2002) determined a positive premium for fuel hedgers.

As regards the type of hedging, different studies focus on either exchange risk, interest rate risk or commodity price risk. Positive hedging premiums have been found for all of these risk types. Hereby the foreign exchange risk turns out to be the most significant risk compared to the other risk types.

Allayannis and Weston (2001) were the first researchers to examine the connection between firm value, a firm's risk exposure and hedging with foreign currency derivatives. They examined 720 U.S. non-financial firms during 1990-1995 and found a positive value premium associated with the use of foreign currency derivatives. They further argue that risk management is most valuable when the home currency is appreciating and find supporting evidence for their proposition, even though the analysis was conducted on a rather superficial basis.

There are numerous studies following the methodology of Allayannis and Weston (2001), which examine different types of hedging practices in order to investigate on a value adding effect of risk management. Considering that different countries, e.g., United States and Germany, underlie different macroeconomic circumstances, the universality of their findings might actually be questioned.

As mentioned before the German market exhibits important differences when compared to the U.S. market. At first Germany is unequally more dependent on trading and selling its products on international trade markets, which increases its firms' overall exposure and therefore the need for additional risk management. Second, Germany's currency has recently been exposed to an increased grade of volatility as a result of the European debt crisis. Therefore hedging could ensure an increased likelihood of mitigating deviations in cash flows and create additional value.

Our study aims to carve out any country-specific idiosyncrasies with regard to publicly traded German firms', the so-called "Aktiengesellschaft", exposure towards foreign currency risk. As a result we aim to further strengthen the universal value enhancing impact coming along with the use of financial derivatives for purposes of risk management.

Another striking aspect in prior research is a lack of analysis of any possible time bound differences, missing out to account for periods of significantly different macroeconomic and firm-specific circumstances. Therefore we specifically aim to carve out any emergent differences as result of the European debt crisis and firm-specific

idiosyncrasies by analyzing and interpreting any significant differences of our control variables applied.

2.1 Purpose and research questions

The study on hand examines to which extent the use of foreign currency derivatives creates value for German firms. Specifically we aim to carve out time periods of increased volatility underlying the stocks of the analyzed firms and their influence on the corresponding value of hedging. This purpose leads to two research questions:

1. Does the use of currency derivatives generally increase firm value for German firms during the examined period of 2006 to 2010?
2. What country-specific reasons underlie our findings of a hedging premium or discount respectively?

2.2 Prior research on the use of derivatives

The empirical examination had been constrained heavily due to a lack of available data on hedging activities in the past. Hence a firm's use of derivatives has not been disclosed before the 1990s as it was considered to be a component of strategic competitiveness. As regards the reporting requirements in the U.S. firms have to report the notional amount of their derivatives used in the footnotes of their annual reports. For that reason earlier studies focused on the examination of survey data as regards the determination of derivatives use. Nance *et al.* (1993) used survey data on Fortune 500 firms' use of derivatives. They found that firms that hedge exhibit more convex tax functions have a lower coverage of fixed claims and more growth opportunities.

Géczy *et al.* (1997) conducted an analysis of 372 firms among the 1990 Fortune 500 firms that had reported their use of currency derivatives pursuant to recent disclosure rules imposed by the Financial Accounting Standard Board. The firms in their sample exhibited a "potential exposure to foreign currency risk from foreign operations, foreign denominated-debt, or a high concentration of foreign competitors in their industries. Approximately 41 percent of these firms turned out to be using currency swaps,

forwards, futures, options or combinations of these instruments" (Géczy *et al.*, 1997:1323).

The authors eventually found that firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives. They concluded that firms might use derivatives to reduce their overall cash flow volatility that might otherwise mitigate firms from investing in valuable growth opportunities. Additionally, firms with especially large foreign exchange rate exposure and economies of scale in hedging activities are also more likely to use currency derivatives. The source of foreign exchange rate exposure was also identified as a decisive factor as regards the choice of possible types of currency derivatives.

There are several studies accounting for the avoidance of external financing and increasing debt capacity as motives for hedging. Froot *et al.* (1993) argued that hedging reduces the probability that a firm will have to engage in costly external financing, and consequently the probability that the firm will not undertake profitable investments due to a lack of cheaper internal funds. In this sense hedging increases value due to explicit and implicit cost savings. According to Stulz (1996) hedging with derivatives reduces a firm's cash flow volatility, and therefore increases the firm's debt capacity.

Haushalter's (2000) empirical analysis provides further evidence. He examined 100 oil and gas producers from 1992 and 1994, finding a relation between a firm's hedging activity and its financing costs: "In particular, companies with greater financial leverage manage price risk more extensively…hedging is related to economies of scale in hedging costs and the basis risk associated with hedging instruments. Larger companies and companies whose production is located primarily in regions where prices have a high correlation with the prices on which exchange-traded derivatives are based are more likely to manage risks" (Haushalter, 2000:107).

The studies treated above examined factors that are related to a firm's decision-making with regard to the use of derivatives. Furthermore, Allayannis and Ofek (2001) found that, on average, firms rather use currency derivatives in order to hedge, not to

speculate. This may imply that a firm's use of derivatives is a value-increasing strategy. In a next step we aim to address the proposition of a value-enhancing strategy in a more narrow way by examining whether firm's use of foreign currency derivatives is rewarded by investors with higher market valuation.

Smith and Stulz (1985) argued that managerial risk aversion is a motive for hedging. Risk averse managers are assumed to have a private incentive to invest in less risky projects, even though there are projects with higher risk and more potential value. Given that the project with higher risk can be hedged, the management might conduct the project, consequently benefiting the shareholders by creating additional value.

Allayannis and Weston (2001) have been the first to empirically examine the relation between hedging activity and firm value. They applied Tobin's Q as a proxy for firm value, analyzing 720 non-financial U.S. firms between 1990 and 1995. They made a distinction between subsamples of firms that have foreign currency exposure due to foreign sales and firms that have not, in order to carve out differences in firm values depending on whether these firms hedge their exposure or not. By performing univariate tests they found higher mean values of Tobin's Q for those firms that hedged their foreign currency exposure. Furthermore they conducted multivariate tests, controlling for additional factors to influence the value of Tobin's Q.

They found that firms who actively manage their foreign currency exposure are rewarded a premium of 3.6%-5.3% of firm value. They further gave evidence for a value premium for currency hedging during times of dollar appreciation as well as during times of dollar depreciation. However, the determined premium during times of appreciation turned out to be much larger.

They also showed that a firm's initiation of an intern hedging program comes along with an increasing firm value compared to a firm that remains unhedged. Firms giving up on their hedging programs are proven to be penalized by a consecutive reduction in their firm value, extending the descriptive power of their finding that a value premium is being awarded for hedging foreign currency exposure. The authors concluded that

hedging firms are on average rewarded by investors with a 4.87% premium in terms of firm value.

Búa *et al.* (2013) analyzed value creation through currency hedging during the time period from 2004 to 2007 for the Spanish market. Similarly to Allayannis and Weston (2001) they found that hedging with derivatives generated an average premium of 1.53%. Foreign currency debt generated a premium of 7.52%. Operational hedging did not affect company value. The company value was approximated by Tobin's Q.

Pramborg (2004) also examined the value effect of hedging activity and foreign operations, using a sample of Swedish firms over the period 1997-2001. Hereby he found a positive value effect from hedging transaction exposure. However he did not find a premium arising from the hedging of translation exposure.

On the other hand there are studies with contradicting results. Khediri and Folus (2010) examined the impact of corporate hedging on firm value during the time period 2000-2002 for a sample of French firms. His univariate analysis showed lower firm values (proxied by Tobin's Q) for users of derivatives compared to nonusers. Also the results of multivariate tests didn't show results that are consistent with the mentioned US sample examinations. There was no evidence for a value-increasing effect by the use of derivatives. They identify factors like high ownership concentration and weak systems of corporate governance to be the reason for the discovered value discount.

Finally Nguyen and Faff (2007) performed comparable tests in the Australian setting for the time period of 1999-2000. They found a negative relation for firm value (proxied by Tobin's Q). Especially as regards the impact of interest rate derivatives. They argue that managers would be well advised to enhance their efforts as regards communicating their value-driven strategies to the financial market in a timely manner.

Considering the disappointing value effects arising from the use of foreign currency derivatives for France, Sweden and Australia and their country specific similarities to

Germany as regards the high dependency on their export markets and their high degree of industrialization one might expect a similar outcome for German firms.

3 Data and methodology

3.1 Research approach

As mentioned before previous studies of hedging and its effect on value have been performed with different approaches. Earlier studies were done using survey data, because firms were not required to disclose their position in derivatives. More recent studies have been empirical and based on secondary data. Our approach is to use secondary data which enables us to use the whole population. A problem with using secondary data is that the motivations for using derivatives is not disclosed, however we assume that all firms use it to reduce exchange rate risk exposure as Allayannis and Ofek (2001) found.

Our study is accomplished through testing hypotheses derived from theory and empirical findings. The analysis focuses primarily on whether the use of derivatives is value creating or not and secondly on what country-specific reasons motivate our findings.

3.2 Sample

Our sample consists of all non-financial listed German firms, which are found in the DataStream database. Financial firms are excluded because they are market makers and might have other motives for using derivatives than non-financial firms (Allayannis and Weston, 2001). Furthermore we excluded public utility firms because of their heavily regulated industries. Some companies have missing data between 2005 and 2010 and are therefore also excluded. The level of hedging is not considered in our sample, since the data is lacking and the firms' position (i.e., short, long, or net) is not disclosed[1]. If it were to be included our sample would decrease drastically. Our final dataset consists of 137 companies which translate to 685 firm-year observations within the time period. In order to collect the necessary data we use DataStream together with annual reports.

[1] As of 2009 the accounting rules has changed in Germany, thus firms provide information regarding the notional amount of derivatives used in their annual reports, which should help in future research.

We include companies that use derivatives (i.e., forwards, futures, options, swaps, or a combination of these) to hedge currency exposure. The observations are divided using a binary variable based on whether a company used derivatives or not that year. Previous empirical studies have found that foreign debt is used for hedging purposes [e.g., Elliott *et al.* (2003); Kedia and Mozumdar (2003)]. However, in our study firms that use foreign debt for hedging, and do not use derivatives, will be classified as non-hedgers[2]. Table 2 (in the following chapter) presents a summary of the main variables that we use in our study. It also includes a summary of the two subsamples based on whether a firm has exchange rate exposure or not, since most of our analysis is performed in these subsamples. As a proxy for a firm's market value we use Tobin's Q.

3.3 Benefits of panel data

The data we examine exhibit the characteristics of panel data, since they consist of both time-series and cross-sectional observations (Damodar, 2004). The use of panel data features several benefits.

First, panel data is more informative than cross-sectional data which is measured at a single point in time, or time-series data which is measured for a single entity. Consequently it gives us the opportunity to consider the heterogeneity of the observations by analyzing the data both in the cross-sectional dimension and over time simultaneously.

Second, by adding more time periods it enables us to increase the amount of observations for a limited-size cross section (or vice versa). Thus it allows for more variation, more degrees of freedom, less collinearity, and makes our results more generalizable (Brooks, 2008).

[2] Allayannis and Weston (2001) results did not change when including firms with foreign debt as hedgers.

3.4 Dependent variable

The dependent variable is the market value, which is represented by Tobin's Q in our study. Tobin's Q is defined as the division between the market value of a firm and the replacement cost of its total assets. Since the firms in our sample are of different size, using Tobin's Q will facilitate the comparison. To calculate Tobin's Q there are several different methods available. Lindenberg and Ross (1981) provide a comprehensive model that is commonly used, however there are severe limitations as regards the availability of data needed by this methodology. For that reason we estimate Tobin's following an algorithm which has been applied by numerous researchers in similar studies. Hence we define Q as the sum of total assets and market value of equity minus the book value of equity, all divided by total assets.[3] This gives us the following formula for Tobin's Q:

$$Tobin's\ Q = \frac{\text{Book value of total assets} + \text{Market value of equity} - \text{Book value of equity}}{\text{Book value of total assets}}$$

3.5 Explanatory variable

In order to measure the value impact arising from the use of financial derivatives for hedging purposes we employ a dummy variable (henceforth: FCD dummy). We define the dummy to equal 1 if a firm reports in its annual reports that it uses forwards, futures, options or swaps for hedging purposes, and 0 if the firm does not hedge.

3.6 Control variables

In order to validate that it is hedging that creates value for the firm, we need to exclude the effect on firm value from a set of control variables. Along the lines described by Allayannis and Weston (2001) and Jin and Jorion (2006), we control for the following variables:

[3] This methodology was also applied by Pramborg (2004), Allayannis *et al.* (2012), Jin and Jorion (2006), Lookman (2009).

1 *Size:* Previous studies have shown that larger firms are more likely to hedge currency exposure [e.g., Mian (1996); Nance *et al.* (1993)], although the evidence is inconclusive regarding the effect firm size has on firm value. Therefore we need to control for size which is done by using the natural logarithm of total assets[4].

$$Size = \ln(Total\ assets)$$

2 *Access to financial markets:* If a firm has weak access to financial markets, it has incentives to make only positive net present value investments, which in turn might affect firm value positively. Fazzari *et al.* (1988) found that firms with dividends are less expected to be restricted on the financial markets. However, the signaling of dividends usually has a positive effect on firm value (Asquit and Mullins, 1983). Thus, we use a dummy variable that equals 1 if the firm paid a dividend the current year.

3 *Leverage:* The trade-off theory suggests that a firm's cost of capital is influenced by its leverage, and thus it also influences its value. The value is influenced through tax shields, which increase with leverage, but also by the risk and the expected costs of financial distress. To control for differences in leverage we use the ratio of total debt to shareholder's equity.

$$Leverage = \frac{\text{Book value of debt}}{\text{Market value of equity}}$$

4 *Profitability:* The market relies on profitability measures when valuing a firm, thus more profitable firms will have higher firm values. To exclude the effects of profitability we use return on assets (ROA); net income divided by total assets.

$$Profitability = \frac{\text{Net income}}{\text{Total assets}}$$

[4] Allayannis and Weston (2001) also used the log of total sales and the log of capital expenditures as alternative size controls with very similar results, which led us to choose the log of total assets.

5 *Growth opportunities:* Firm value is affected by future investment opportunities, and Géczy *et al.* (1997) found that hedgers are more likely to have larger investment opportunities. Allayannis and Weston (2001) suggest that capital expenditures are a proxy for investment opportunities. Therefore, we control for growth opportunities by using the ratio of capital expenditures to total sales.

$$Growth\ opportunities = \frac{\text{Capital expenditures}}{\text{Total sales}}$$

6 *Industrial diversification:* There is empirical evidence that industrial diversification reduces firm value [e.g., Allayannis and Weston (2001); Lang and Stulz (1994)]. However, Fauver *et al.* (2004) came to the conclusion that value of German firms was unaffected by industrial diversification. In order to control this we use a dummy variable that equals 1 if the firm is operating in more than one segment. The classification is based on the two-digit SIC code.

7 *Geographic diversification:* Allayannis and Weston (2001) suggest that multinationality is positively related to firm value for U.S. firms. However, Fauver *et al.* (2004) also found that international diversification has no effect on the value of firms headquartered in Germany. We do include it as a control variable to exclude its possible effect on firm value. It is a dummy variable equal to 1 if the company has at least 10% foreign sales out of total sales.

8 *Time effects:* The firm value fluctuates over time and is based on future expectations. Macroeconomic changes, such as restrictions of capital flows, changes in institutional frameworks, or changes in fiscal or monetary policies, can impact the firm value. We control for the time effects by using year dummies to increase the robustness of our study.

9 *Industry effect:* Allayannis and Weston (2001) construct industry-adjusted Qs to control for industry effects; however if we apply the same process to our sample we end up with negative Q values, which prevent the use of natural logarithms. In order to control for industry effects we instead use dummy variables, to make the different

industries comparable. Firms are classified using the classification provided by DataStream.

Table 1

Industry dummies

Industry	Value	No. firms
Basic Materials	1	15
Industrials	2	45
Consumer Goods	3	25
Health Care	4	14
Consumer Services	5	19
Technology	6	19

10 *Volatility:* In times of increased volatility the uncertainty in a firm's cash flows increases, hence lower firm value. Hedging is then used as a tool to try to manage this uncertainty. To control for volatility we calculate daily volatility of a firm's stock return, and recalculate it to annual volatility. When examining the relation between the expected value and the volatility of the nominal excess return on stocks Glosten et al. (1993) give evidence for a negative relation between conditional expected monthly returns and conditional variance of monthly returns. Considering the macroeconomic circumstances of our examined time period as regards an extraordinary high market volatility as shown in Appendix 3 and 4, we expect the volatility of our examined stocks to bear a significant negative impact on firm value.

3.7 Diagnostic testing

In order to detect any possible violations of OLS assumptions we test our (multiple) linear regressions for: Heteroscedasticity, Non-normality, Multicollinearity, Non-linearity

In order to detect heteroscedasticity we perform a regression of the squared residuals as dependent and our control variables as the independent variables from the original regression. Since the F-test is significant, we use robust standard errors (see Appendix 5). Consequently, we base our T-statistics on White (1980) standard errors. Thus we are provided with a covariance estimator that is robust to cross-equation correlation and to different error variances in each cross-section as well. As regards our possibilities to estimate robust standard errors in EViews we use ”White period” (with period effects) in our time-fixed effects model. We will further use ”White diagonal” for purposes of robustness testing which allows for autocorrelation among the residuals.

We apply the Jarque-Bera test in order to test for non-normality of the residuals. The p-value of 0 reveals that we can reject the null hypothesis that the distribution of the residuals is normal[5] (see Appendix 6).

In order to detect multicollinearity we set up a correlation matrix between the independent variables (see Appendix 7). We interpret any value exceeding 0.8 as an indicator for multicollinearity of the corresponding control variables. Since all values are less than 0.8 we conclude that there is no multicollinearity, which indicates the stability of our regression models.

We finally examine linearity within the model’s parameters by applying the Ramsey RESET test. It turns out that none of the regressions gives indication for non-linearity among the variables. Hence we conclude that the function is specified correctly.

Lastly there is no indication of serial correlation in the residuals.

[5] In section 4.1 we will show that the distribution of our dependent variable is skewed.

4 Empirical findings

4.1 Descriptive statistics

To give a picture of our sample and to highlight differences in the subsamples we present in Table 2 a summary of the statistics of all firms as well as of the subsamples.

In our sample 80% of the firms are users of foreign currency derivatives, which is substantially higher than what Allayannis and Weston (2001) found for the U.S. market, but in accordance with other studies on the German market [e.g., Bodnar and Gebhardt (1999); Fatemi and Glaum (2000)]. Since Germany is a heavily export-orientated country it also provides greater incentives for hedging. This is supported by the fact that 90% of our sample has foreign sales, and 86% are geographically diversified. The companies in the foreign sales subsample is on average bigger in terms of assets, sales or market value of equity.

Our tests also show that it is not that uncommon for firms without foreign sales to engage in hedging; in our sample 28% of the firms do. Since they do not have any direct exposure to foreign currencies through foreign sales, they must have other reasons for hedging (e.g., licensing fees in foreign currencies, see chapter 5 for further discussion). Tobin's Q is on average higher for the firms with no foreign sales; however the variation is also notably higher.

Since the median (1.37) is smaller than the mean (1.70) it indicates that the distribution is skewed. Therefore, we will use the natural logarithm of Tobin's Q in the multivariate tests to control for this skewness, as it makes the distribution more symmetric (Brooks, 2008).

Table 2

Descriptive statistics

	N	Mean	Std. Dev.	Median	Minimum	Maximum
Panel A: All firms						
Total assets	685	7701	22610	804	6.10	195145
Total sales	685	6883	17537	1015	0.05	151616
Foreign sales dummy	685	0.90	0.30	1.00	0.00	1.00
Market value of equity	685	4460	11111	627	11	99118
FCD dummy	685	0.80	0.40	1.00	0.00	1.00
Tobin's Q	685	1.70	1.15	1.37	0.53	13.62
Return on assets	685	0.05	0.11	0.05	-1.00	0.45
Growth	685	0.06	0.12	0.03	0.00	1.60
Leverage	685	0.47	0.77	0.22	0.00	8.43
Dividend dummy	685	0.80	0.40	1.00	0.00	1.00
Geographic dummy	685	0.86	0.34	1.00	0.00	1.00
Segment dummy	685	0.55	0.50	1.00	0.00	1.00
Panel B: Firms with foreign sales > 0						
Total assets	618	8489	23671	948	44	195145
Total sales	618	7591	18324	1253	33	151616
Market value of equity	618	4900	11612	784	11	99118
FCD dummy	618	0.85	0.35	1.00	0.00	1.00
Tobin's Q	618	1.64	0.96	1.35	0.53	11.50
Panel C: Firms with foreign sales = 0						
Total assets	67	434	671	223	6.10	3057
Total sales	67	355	589	97	0.05	2550
Market value of equity	67	404	566	155	26	2360
FCD dummy	67	0.28	0.45	0.00	0.00	1.00
Tobin's Q	67	2.28	2.15	1.46	0.79	13.62

This table presents a summary for the statistics of our sample of non-financial firms retrieved from DataStream (panel A) and for the subsamples of firms with and without foreign sales (panel B and C). The foreign sales dummy equals 1 if the company has reported foreign sales. The FCD dummy equals 1 if the company reports use of foreign currency derivatives. Tobin's Q is the market value of assets divided by the replacement costs of assets, which is proxied by book value of assets. Return on assets is the annual net income divided by total assets. Growth opportunities are calculated as capital expenditures divided by sales. Leverage is the ratio of long term debt to shareholder equity. The dividend dummy equals 1 if the company paid dividends that year. The geographic dummy equals 1 if the company has at least 10% foreign sales. The segment dummy is set to 1 if the company operates in more than one business segment based on the two-digit SIC code.

4.2 Univariate tests

In order to test our main hypothesis that hedging with foreign currency derivatives creates value we compare the Tobin's Q of hedgers and non-hedgers. We also divide it into the two subsamples of firms with and without foreign sales. Table 3 presents the mean Tobin's Q for each subsample and for hedgers and non-hedgers respectively, accompanied by the results from the tests.

The tests are performed through six separate regressions of the two subsamples: one for the whole period and one for each year. We test the impact of hedging on Tobin's Q by regressing the FCD dummy against Tobin's Q. As seen in Table 3 the differences in firm value is of noticeable negative magnitude in most years, which is inconsistent with our expectations.

For the subsample with foreign sales, hedgers are characterized by lower Tobin's Q and the difference is significant for the whole time period but only for 2008 and 2009 when looking at yearly values. Firms that hedge although they do not have foreign sales also experience on average lower Tobin's Q; however the difference is not significant.

The difference in Tobin's Q by hedgers and non-hedgers that have foreign sales is quite large, however when compared to the mean Tobin's Q across our overall sample, hedgers have approximately an 11% value discount.

Our results are consistent with the findings of Khediri and Folus (2010) and Nguyen and Faff (2007) who also find hedging discount for firm samples in France and Australia. As aforementioned those countries are comparable to the German market as regards their export-orientation and their degree of industrialization.

On the other hand our findings contradict numerous studies that give evidence for a valuation premium imposed by the use of derivatives. One nearby explanation might be found in the existence of huge differences in both the structural characteristics and the market valuation of German and U.S. firms.

Table 3
Comparison of Tobin's Q: hedgers vs. non-hedgers

		Foreign sales > 0		Foreign sales = 0					
Year		Hedgers (1)	Non-hedgers (2)	Hedgers (3)	Non-hedgers (4)	Difference (5) = (1) – (2)	*p*-value	Difference (7) = (3) – (4)	*p*-value
All years	Mean	1.59	1.95	1.90	2.43	-0.36	0.001	-0.53	0.368
	Std. Dev.	0.96	0.93	0.87	2.47				
	N	527	91	19	48				
2006	Mean	1.81	2.18	1.70	2.43	-0.37	0.230	-0.73	0.422
	Std. Dev.	1.28	1.21	0.65	1.68				
	N	103	20	4	10				
2007	Mean	1.75	2.11	1.75	2.17	-0.36	0.155	-0.42	0.640
	Std. Dev.	1.01	0.96	0.54	1.46				
	N	105	19	3	10				
2008	Mean	1.27	1.51	1.49	2.22	-0.24	0.099	-0.73	0.616
	Std. Dev.	0.59	0.56	0.78	2.72				
	N	105	19	4	9				
2009	Mean	1.44	1.99	2.27	2.32	-0.55	0.007	-0.05	0.975
	Std. Dev.	0.73	0.93	1.35	2.43				
	N	107	17	4	9				
2010	Mean	1.67	1.94	2.26	2.98	-0.27	0.268	-0.72	0.722
	Std. Dev.	0.94	0.77	0.93	3.82				
	N	107	16	4	10				

This table presents a univariate comparison of Tobin's Q between firms that either used or did not use foreign currency derivatives for the two subsamples of firms with and without foreign sales. The sample includes all 137 firms for the whole time period (2006-2010). A firm is classified as a hedger for a given year if the firm reports the use foreign currency derivatives that year.

4.3 Multivariate tests

4.3.1 Sample of firms with foreign sales

In our univariate tests we find that users of foreign currency derivatives (henceforth: FCDs) are being penalized by investors with a lower market valuation than nonusers. However we need to control for variables that could have a significant impact on Tobin's Q as well. We will do so in a multivariate framework which is based on the framework of Allayannis and Weston (2001). We use the natural logarithm of Tobin's Q as dependent variable in order to consider the skewness of its distribution, since the medians are smaller than the means. We further forgo performing a simple OLS-regression in order to capture time-specific heterogeneity by year dummies. Thus the empirical model has the following form:

$$\ln(Tobin's\ Q) = \alpha + \beta * FCD_{Dummy} + \gamma \boldsymbol{X} + \varepsilon$$

Table 4 presents the results of our time-fixed effects model for the sample of firms with foreign sales. In order to make the direct economic impact on Tobin's Q visible we standardize the coefficients in our multivariate framework. Finally we calculate $Exp(Standardized\ coefficients)$ which enables us to make direct interpretations about the coefficients' value impact on Tobin's Q and not only on ln (Tobin's Q).

4.3.1.1 Estimation for time-fixed effects

The results pertaining to the control variables indicate that the coefficients of leverage, profitability, stock volatility and the year dummies from 2008 until 2010 are statistically significant. The coefficients for the use of FCDs, size, dividends, geographical diversification, growth opportunities, geographical diversification, industry diversification and the industry sector dummies remain statistically insignificant.

The result for the hedgers is in line with our finding in the univariate setting. Even though the coefficient is only significant at a confidence level of 80.3% we show that users of FCDs are being penalized by investors through a valuation discount. The coefficient implies a valuation discount of 8.3% for users of FCDs. As regards the

economic impact, an increase of the FCD use by one standard deviation leads to a decline in Tobin's Q by 6.88%.

Table 4

Foreign currency derivatives use and firm value for firms with foreign sales: Cross-section results for time-fixed effects

Observations	618					
R^2	0.49					
	All firms with foreign sales > 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD dummy	-0.083	0.064	-1.291	0.197	-0.071	-6.88%
Size (log of total assets)	-0.014	0.012	-1.154	0.249	-0.063	-6.15%
Dividend dummy	0.028	0.052	0.536	0.592	0.026	2.64%
Debt to Equity	-0.102	0.031	-3.273***	0.001	-0.198	-17.96%
Return on assets	2.704	0.510	5.298***	0.000	0.516	67.56%
Growth (capital expenditure / sales)	-0.082	0.237	-0.346	0.729	-0.011	-1.07%
Geographical diversification	0.081	0.069	1.174	0.241	0.040	4.11%
Diversification dummy	-0.022	0.048	-0.458	0.647	-0.027	-2.63%
Stock volatility (annual)	0.344	0.148	2.317**	0.021	0.135	14.41%
Industry dummy 1 (Basic materials)	-0.031	0.067	-0.471	0.638	-0.022	-2.14%
Industry dummy 3 (Consumer goods)	0.020	0.062	0.316	0.752	0.019	1.89%
Industry dummy 4 (Healthcare)	-0.002	0.066	-0.025	0.980	-0.001	-0.12%
Industry dummy 5 (Consumer services)	-0.002	0.065	-0.026	0.979	-0.001	-0.14%
Industry dummy 6 (Technology)	0.099	0.090	1.100	0.272	0.085	8.83%
2007 year dummy	-0.017	0.020	-0.868	0.386	-0.017	-1.64%
2008 year dummy	-0.318	0.041	-7.689***	0.000	-0.310	-26.62%
2009 year dummy	-0.143	0.028	-5.020***	0.000	-0.139	-12.95%
2010 year dummy	-0.079	0.023	-3.449***	0.001	-0.077	-7.41%

The table presents our results for our time-fixed effects regression with regard to firms with foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage as the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We define a firm with foreign sales > 10% of total sales as geographically diversified. The diversificaton dummy equals 1, if a firm is active in more than one business segment and 0 otherwise. We consider the firms' annual volatility as the stock volatility. We further consider dummys for the different industry segments and years. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. ('White period' in EViews)

We further find that especially firm profitability, as measured by the return on assets, and the annual cross-sectional stock volatility are positively and significantly related to Tobin's Q. Especially the value effect of the returns on assets turns out to be extraordinary, as an increase by one standard deviation leads to a dashing value increase of 67.56%. Hence we identify firm profitability as the absolute predominant value indicator for public companies in Germany from an investor's point of view. This result supports the findings of Allayannis and Weston (2001) and Pramborg (2004).

We identify the annual stock volatility as a second important value driver by increasing the Q by 14.41%. This result clearly contradicts our expectations of a value-reducing effect imposed by an increase in stock volatility. However we assume the highly significant and negative year dummies from 2008 to 2010 to essentially capture the originally expected effects arising from the control variable for stock volatility, hence putting the explanation power of its estimators strongly into perspective. For that reason we conduct a specific robustness test and perform an OLS-regression where we exclude all the year dummies while keeping the remaining control variables (see Appendix 8). According to the new results we succeed in isolating the impact of the year dummies. Stock volatility now leads to a value-reducing effect of -3.96% of Q which fits with our proposition. However the R-squared is being reduced from 49.4% to 44.3%.

Furthermore we find that the coefficient on leverage is negative and statistically significant, indicating that more leverage leads to decreased firm value. The discounted value of leverage is consistent with the evidence documented in Allayannis and Weston (2001) and Nguyen and Faff (2007). Our findings indicate an increased likelihood of bankruptcy and financial distress as a result of an increase in the debt to equity ratio. Also the threat of underinvestment by the management might increase with leverage.

Finally the negative coefficients of the year dummies from 2008 until 2010 clearly reflect the value-destroying results of the global financial crisis peaking at a reduction of the Q by -26.62% in 2008.

We further find that the coefficient for firm size is negative but only significant at a confidence level of 75.1%. This may indicate that larger firms are characterized by lower firm value. This discount for larger firms is consistent with the evidence presented in Allayannis and Weston (2001) and Pramborg (2004).

The coefficient for the dividend dummy is insignificant. The independence of firm value from its dividend policy is in line with the result of Pramborg (2004).

Growth opportunities, as proxied by the ratio of capital expenditures to sales, are insignificant and negatively related to Tobin's Q. This result might reflect a certain inability of the firms to transfer costly projects into profitable investments. A certain lack of firm-relevant investment opportunities within the economy might also be indicated, which would be in line with the findings of Allayannis and Weston (2001) and Pramborg (2004) who find that firms with more investment opportunities are valued with higher Tobin's Q. Another possible explanation might be the very special time period of our examination. Since our data were basically collected during the global financial crisis (2008-2010) investors might have expected firms to retain their profits in order to handle further possible economic shocks better.

We also find that the coefficient for the industrial diversification is negative and statistically insignificant. The discount for diversified firms is consistent with the evidence from Lang and Stulz (1994), Berger and Ofek (1995), Servaes (1996), Pramborg (2004), and Nguyen and Faff (2007).

Geographical diversification is positively related to firm value even though it is insignificant. Our finding of a value-enhancing effect from geographical diversification is in line with the findings of Morck and Yeung (1991) and Bodnar *et al.* (1997). When examining the effect of geographic and industrial diversification on firm value for a sample of over 20,000 firm-year observations of U.S. corporations from 1987-1993 they find that firms with international operations are on average 2.2% higher valued than comparable domestic single activity firms.

The insignificance of the year dummy for 2007 might confirm that only extraordinary macroeconomic events like the global financial crisis, which began in 2008, may bear a significant impact on the market values of an economy's public firms.

The results for the tested industry dummies remain throughout insignificant. Notable is the result of Germany's technology sector which would be positively significant at a confidence level of 72.8%. This finding gives evidence for its huge importance for the German economy and its notable success during the examined time period.

In order to check our findings for robustness we allow now for correlation over time or across cross-section by choosing the option 'White diagonal' as for the estimation of the White (1980) standard errors (see Appendix 9).

The results are in line with our previous findings. Additionally the control variables for the use of FDCs, size, technology sector and geographical diversification become significant which confirms the findings of our reference articles.

4.3.1.2 Estimation for time- and cross-section fixed effects

Balanced panel data enables to control for the existence of non-observable individual heterogeneity. The idea of individual heterogeneity claims that there are individual firm-characteristics which among cross sections but are constant over time. However the pooled OLS regression does not consider this kind of heterogeneity. Consequently its application leads to a biased estimator. In order to control for the aforementioned individual-specific effects, researchers have followed methods like a random or fixed effects model or a non-linear analysis (Brooks, 2008).

When testing whether the fixed effects are redundant or not, we identify the period (F-value of 36.89) to be much more important than the cross-section (F-value of 12.10), since its corresponding F-statistic is clearly higher. The p-values associated with the test statistics are zero, indicating that the restrictions are not supported by the data and that a pooled sample could not be used (see Appendix 10).

In order to check if the random effects model might lead to less biased results for the estimators we perform the Hausman test. Its null hypothesis postulates that no correlation among the residuals and the regressors is allowed. In such a case the random effects estimator would be consistent and efficient. The test statistic is asymptotically distributed as chi-squared with λ degrees of freedom (Brooks, 2008).

The cross-section is set to random and the p-value for the test is zero, indicating that the random effects model is not appropriate and that the fixed effects specification is to be preferred. Therefore, we will not further analyze this model (see Appendix 11).
When running the fixed effects regression we also eliminate the autocorrelation as the Durbin-Watson statistic is 2.05. Additionally, as seen by the R-squared of roughly 87%, the fixed effects regression has a high explanatory power of Tobin's Q. The F-statistic further supports that the variables do actually explain the variance of Tobin's Q.

Table 5

Foreign currency derivatives use and firm value: Cross-section results for time- and cross-section fixed effects

Observations	618					
R^2	0.87					
	All firms with foreign sales > 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD dummy	0.017	0.066	0.252	0.801	0.014	1.43%
Size (log of total assets)	-0.123	0.085	-1.442	0.150	-0.553	-42.49%
Dividend dummy	0.095	0.033	2.928***	0.004	0.089	9.34%
Debt to Equity	-0.008	0.021	-0.391	0.696	-0.016	-1.55%
Return on assets	1.182	0.263	4.489***	0.000	0.226	25.32%
Growth (capital expenditure / sales)	-0.231	0.240	-0.964	0.336	-0.030	-2.99%
Stock volatility (annual)	0.149	0.090	1.661*	0.097	0.058	6.02%

The table presents our results for the time- and firm fixed-effects regression with regard to firms with foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We consider the firms' annual volatility as the stock volatility. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. (White 'diagonal' in EViews)

Consistent with our previous findings we find significant coefficients for the control variables for profitability and stock volatility as seen in Table 5. Surprisingly also the payment of dividends seems to induce a value-enhancing impact of 9.34%. This effect may be explained by the Wealth Redistribution Hypothesis which claims that a dividend increase induces a value expropriation from a firm's creditors to its shareholders. Consequently investors might value firms that pay dividends higher as firms that do not. Empirical support is provided by Asquit and Mullins (1983) who finds that initiating dividends increases shareholders' wealth. The same effect occurs for subsequent payments of dividends.

Interestingly the coefficient for the FCD dummy turns out to be slightly positive, even though highly insignificant. This may be an indicator for significant heterogeneity with regard to the management's ability in our examined firms. The coefficient for firm size now bears an even more devastating value effect of -42.49% which is significant at a confidence level of 85%.

Lastly we utilize 'growth opportunities' as a proxy variable for the diversification dummy in order to avoid co-linearity among the regressors. Considering that 90.2% of our sample firms actually have foreign sales we also expect a sufficient amount of them to actively invest in foreign production facilties and broaden their range of foreign business segments. This might explain the value-reducing impact of -2.99% induced by an increase in the control variable for growth opportunities since numerous researchers find a discount for industrial diversification [e.g., Lang and Stulz (1994); Berger and Ofek (1995); Servaes (1996); Pramborg (2004); and Nguyen and Faff (2007)].

4.3.2 Sample of firms with no foreign sales

4.3.2.1 Estimation for time-fixed effects

Table 6 presents the results of a time-fixed regression for the sample of firms with no foreign sales.

Table 6

Foreign currency derivatives use and firm value for firms with no foreign sales: Cross-section results for time-fixed effects

Observations	67
R^2	0.80

	All firms with foreign sales = 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD dummy	0.020	0.113	0.174	0.863	0.015	0.38%
Size (log of total assets)	-0.245	0.041	-5.926***	0.000	-0.590	-1.70%
Dividend dummy	-0.227	0.104	-2.190**	0.033	-0.188	-3.90%
Debt to Equity	-0.546	0.124	-4.387***	0.000	-0.322	-10.85%
Return on assets	-0.032	0.328	-0.098	0.923	-0.013	-1.30%
Growth (capital expenditure / sales)	-0.082	0.237	-0.346	0.729	-0.047	-3.24%
Diversification dummy	0.038	0.058	0.662	0.511	0.032	0.37%
Stock volatility (annual)	-0.150	0.278	-0.541	0.591	-0.045	-6.82%
Industry dummy 1 (Basic materials)	0.198	0.199	0.997	0.324	0.144	6.90%
Industry dummy 3 (Consumer goods)	-0.124	0.145	-0.853	0.398	-0.056	-3.00%
Industry dummy 4 (Healthcare)	0.029	0.141	0.207	0.837	0.018	0.70%
Industry dummy 5 (Consumer services)	0.115	0.103	1.119	0.269	0.056	2.03%
Industry dummy 6 (Technology)	0.752	0.116	6.460***	0.000	0.457	15.97%
2007 year dummy	0.023	0.067	0.338	0.737	0.015	0.26%
2008 year dummy	-0.129	0.110	-1.179	0.244	-0.087	-2.38%
2009 year dummy	0.037	0.131	0.284	0.778	0.025	0.82%
2010 year dummy	0.124	0.102	1.216	0.230	0.086	2.18%

The table presents our results for our time-fixed effects regression with regard to firms with no foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage as the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We define a firm with foreign sales > 10% of total sales as geographically diversified. The diversificaton dummy equals 1, if a firm is active in more than one business segment and 0 otherwise. We consider the firms' annual volatility as the stock volatility. We further consider dummys for the different industry segments and years. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. ('White period' in EViews)

Consistent to our findings when examining firms that have foreign sales we identify the coefficients for debt to equity, size and the technology sector to bear a significant impact on Tobin's Q. Additionally the dividend dummy turns out to bear a negative significant value impact of -3.90% on Tobin's Q. This result is reasonable considering that the time period of our examination was basically during the global financial crisis. Consistent with our argumentation about a value-reducing effect of additional capital expenditures during the crisis investors might have expected firms to retain their profits in order to handle further possible economic shocks better.

In contrast to our prior results the value impact of the use of FCDs turns out to be positive now, even though the coefficient is highly insignificant. Interestingly an increase in return on assets by one standard deviation now leads to a decreasing value of -1.30%. The most devastating value impact occurs when leverage is being increased by one standard deviation (-10.85%). Firms that are not geographically diversified might consequently be valued lower. This result confirms the before mentioned positive value effects as a result of geographical diversification. Another explanation might be that firms with no foreign sales are more likely to get into financial distress as a result of a relatively lower financial flexibility. Hence their value is being penalized by investors.

Consistent with our argumentation about the high importance of Germany's technology sector we find the industry to carry out a value-increasing effect of 15.97%. Furthermore the sector 'Basic materials' induces value-enhancing impact of 6.90% even though the coefficient remains insignificant.

Once again we check our findings for robustness by allowing for correlation over time or across cross-section by choosing the option 'White diagonal' for the estimation of the White (1980) standard errors (see Appendix 12).

The robustness of the model is being confirmed since all the coefficients that were significant in our previous framework also remain significant. Additionally now we also find the industry the sector 'Basic materials' to become significant.

4.3.2.2 Estimation for time- and cross-section fixed effects

Finally we present the results of a time- and cross-section fixed regression for the sample of firms with no foreign sales.

Table 7

Foreign currency derivatives use and firm value: Cross-section results for time- and cross-section fixed effects

Observations	67
R^2	0.91

	All firms with foreign sales = 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD dummy	0.114	0.077	1.476	0.148	0.087	9.12%
Size (log of total assets)	-0.118	0.220	-0.535	0.595	-0.284	-24.75%
Dividend dummy	-0.218	0.111	-1.954*	0.058	-0.181	-16.55%
Debt to Equity	-0.564	0.228	-2.479**	0.017	-0.332	-28.27%
Return on assets	-0.548	0.205	-2.675**	0.011	-0.224	-20.10%
Growth (capital expenditure / sales)	-0.035	0.066	-0.525	0.602	-0.020	-1.94%
Stock volatility (annual)	-0.271	0.248	-1.094	0.280	-0.081	-7.81%

The table presents our results for the time- and firm fixed-effects regression with regard to firms with no foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We consider the firms' annual volatility as the stock volatility. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. (White 'diagonal' in EViews)

Consistent with our previous findings we identify the coefficients for the leverage and the dividend dummy to bear significant negative value effect on the Q. Especially the leverage's value effect of -28.27% is notable. Surprisingly we further find a significant negative value effect of -20.10% induced by return on assets. However it has to be pointed out that the size of our sample is rather small (67 observations) compared to the sample for firms with foreign sales (618 observations). Taking this into account our results for the sample for firms with no foreign sales should be regarded with suspicion since the estimators might be biased.

The use of FCDs increases the Q by 9.12% at a confidence level of 85.2%. This finding contradicts our findings of a value-reducing effect by using FCDs and implies that the FCDs themselves might actually not be the causal reason for value reduction[6].

4.4 Sensitivity analysis

In order to examine the robustness of our results to alternative value measures we construct two alternative measures: a simple market to book ratio (Simple Q) and a market to sales ratio.

Table 8

Alternative Measures of Tobin's Q

Panel A: Summary Statistics

Measure of Tobin's Q	Correlation with Benchmark	Mean	Mean: Foreign sales > 0	Std. Dev.	Skewness	Minimum	Median	Maximum
Benchmark Q	1.0	1.70	1.64	1.15	4.59	0.53	1.37	13.6
Simple Q	0.99	1.33	1.26	1.19	4.46	0.26	0.98	13.5
Market to Sales	0.66	6.04	1.29	68.38	17.11	0.12	1.02	1352.17

Panel B: Hedging premium for time-fixed regression

	FCD dummy			
	Firms with foreign sales > 0		Firms with foreign sales = 0	
Alternative Measures of Tobin's Q	Estimate	%Premium	Estimate	%Premium
ln (Benchmark)	-0.084	-8.44%	-0.133	-13.29%
	(-1.215)		(-1.067)	
ln (Simple Q)	-0.109	-10.89%	-0.207	-20.07%
	(-1.184)		(-1.251)	
ln (Market to Sales)	0.062	6.16%	-0.856	-0.86%
	(-0.347)		(-1.827*)	

In this table we present summary statistics for two alternative measures of Tobin's Q. Herefore we chose the simple market to book ratio and the market to sales ratio (Panel A). In Panel B we show the corresponding hedging premiums or discounts respectively. We include control variables for size, profitability, growth opportunities, debt to equity, dividends paid, diversification and stock volatiliy. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. Coefficient estimates are denoted on the top. t-ratios in parentheses. We base our T-statistics on White (1980) standard errors. ('White period' in EViews)

Panel A presents descriptive statistics of the different value measures. Column 1 displays the difference between our Q and the other value measures. We find a correlation of 0.99 to the Simple Q and 0.66 to Market to Sales. The mean (median) of our Q is 1.70 (1.37) compared with 1.33 (0.98) for the Simple Q and 6.04 (1.02) for

[6] Section 4.5 will further back up this hypothesis.

Market to Sales. It is noticeable that our Q's standard deviation and skewness is very similar to the Simple Q while there's a big difference when compared with the corresponding values for Market to Sales. This is also an explanation for the clearly higher mean value of Market to Sales.

In Panel B we show the estimates for the hedging discounts and the corresponding percentages for firms with foreign sales (column 1 and 2) and no foreign sales (column 3 and 4). As regards the firms with foreign sales, the hedging discount for firm value is -8.44% and significant at a confidence level of 77.52%. This result is consistent with the hedging discount of -10.89% we find for the Simple Q. On the other hand we find a hedging premium of 6.16% for Market to Sales which is highly insignificant though.

As for the firms with no foreign sales we throughout find hedging discounts whereas only the discount for Market to Sales (-0.86%) turns out to be significant at the 10% level.

4.5 Reverse causality tests

In the previous sections we find evidence that the use of FCDs reduces firm value. However the use of FCDs might not be the causal reason for the decline in market value, since there might be an alternative explanation. A relatively low market value in terms of Tobin's Q might just reflect a significant lack of a firm's profitable investment opportunities. Hence lower values for firms that hedge might just reflect such specific circumstances. In order to test for the possibility of this reverse causation we derive a possible explanation by examining the firms' hedging policies. Hereby we use the method from Allayannis and Weston (2001) and classify firms each year into the following four categories:

1. Firms that remain unhedged in the current and next period $(N_t\ N_{t+1})$
2. Firms that quit hedging in the next period, $(H_t\ N_{t+1})$
3. Firms that start hedging in the next period, $(N_t H_{t+1})$
4. Firms that hedge in the current and next period $(H_t\ H_{t+1})$

We then construct dummy variables for the first three categories and use these variables in a cross-sectional regression:

$$Q_t = \alpha + \beta_1\big(Firm\ remains\ unhedged\ (N_t\ N_{t+1})\big) + \beta_2\big(Firm\ quits\ hedging\ in\ the\ next\ period, (H_t\ N_{t+1})\big) + \beta_3\big(Firm\ starts\ hedging\ in\ the\ next\ period, (N_t H_{t+1})\big) + \gamma \boldsymbol{X_t} + \varepsilon_t$$

$\boldsymbol{X}$ represents the vector of the explanatory variables applied in our multivariate regressions (e.g. size, diversification, leverage), ε is the error term.

Assuming that a firm with a high Q decides to hedge, then a firm that starts to hedge in the next period $H_t\ N_{t+1}$ would be expected to have a lower Q compared to a firm that remains unhedged. Hence, $\beta_3 < \beta_1$ would be expected. Furthermore if a firm doesn't hedge because it has a low Q we expect firms that decide to quit hedging in the next period to have higher Q's, that is $\beta_2 > 0$. Finally according to our previous findings firms that do not hedge exhibit higher values for Q, that is $\beta_1 > 0$.

Therefore we propose the following three hypotheses treating the causal relation between hedging and the firm's Q:

Hypothesis 1: $\beta_1 = 0$ $(Hedging\ adds\ no\ value)$
Hypothesis 2: $\beta_3 = \beta_1$ $(The\ decision\ to\ start\ hedging\ is\ not\ influenced\ by\ Q)$
***Hypothesis* 3**: $\beta_2 = 0$ $(The\ decision\ to\ quit\ hedging\ is\ not\ influenced\ by\ Q)$

We present the results of our time-fixed regression for firms with foreign sales in Table 9. We show in previous sections that hedging firms are valued lower than non-hedging firms. Consequently and consistent with our hypothesis we cannot reject Hypothesis 1 for the Q (p-value of 0.316). Interestingly our hypothesis that hedging adds no value can only be rejected at a significance level of 68.4% which implies that hedging might actually not be the causal reason for a reduced Q.

We further test the linear restrictions imposed by Hypothesis 2 and 3 by performing a Wald-test. It cannot be rejected that the decision to start hedging is not influenced by the

size of Q (p-value of 0.949). We also cannot reject that Hypothesis 3, that the decision to quit hedging is unaffected by Q (p-value of 0.198). We finally test Hypothesis 2 and 3 jointly and also cannot reject the null hypothesis of no reverse causality implied by both of these hypotheses.

Considering the performed tests we find no evidence that a significant relation between the use of FCDs and firm value originates from reverse causality. Finally our tests confirmed our finding that hedging firms have a lower market value compared to non-hedging firms. However we find reasonable indication that hedging might not be the causal reason for the value decline.

Table 9

Results of reverse causality tests

Dependent variable: ln (Tobin's Q) at time t	Number of obs.	Tobin's Q
Firms remain hedged in the next period	84	-0.058 (-1.003)
Firm quits hedging in the next period	4	-0.173 (-1.29)
Firm begins hedging in the next period	8	-0.065 (-0.682)
Wald-tests (p-value)		
Hypothesis 1 (Hedging adds no value)		0.316
Hypothesis 2 (The decision to quit hedging is not influenced by Q)		0.949
Hypothesis 3 (The decision to start hedging is not influenced by Q)		0.198
Hypothesis 2 and 3 jointly		0.432

On this table we present a time-series analysis with regard to the effect of hedging policy. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. We include control variables, for size, profitability, growth opportunities, debt to equity, dividends paid, geographical and segmental diversification, stock volatility and year dummies. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. Coefficient estimates are denoted on the top. t-ratios in parentheses. We base our T-statistics on White (1980) standard errors. ('White period' in EViews)

5 Discussion

Since our tests show that hedging does not add value, rather it is accompanied with a value discount, we will discuss possible explanations for this.

Foreign debt has been shown to be a very important tool for hedging exchange rate risk and it might provide an explanation for our findings (Aabo, 2006). Data on foreign debt levels is not readily available, so we could not investigate to what extent German firms employ it as a hedging strategy. However, we can assume that it is probably commonly used because of the characteristics of the German economy (Aabo, 2006). As German firms are heavily export-oriented they might have operating exposures which are not short-term. As regards liquidity of hedging contracts, the market for long-term contracts is not as liquid as for short-term contracts (Aabo and Simkins, 2005). If foreign debt is used as a hedging strategy it might affect the possible value creation from hedging with foreign currency derivatives negatively, since they are considered substitutes [e.g., Géczy *et al.* (1997); Elliott *et al.* (2003)]. Thus the theoretical value creation potential of foreign currency derivatives is limited due to the use of foreign debt. This could be further applied to other operational hedges (e.g., matching cash flows and operational flexibility) and diversification, which can reduce the need for foreign currency hedging (Aabo and Ploeen, 2013).

We assumed that all firms that used foreign currency derivatives used it for the purpose of hedging exchange rate exposures. This is not necessarily true, since it could also be used to create additional or completely new risk exposures[7]. A survey of 74 large non-financial German firms concluded that the risk management of these firms contained a speculative element (Glaum, 2002). Furthermore, the same survey suggests that selective hedging does not generally benefit the firm's shareholders. With this in mind, our findings that hedging firms experience a value discount might be because investors view the hedging firms as speculators.

[7] Although we did try to circumvent this problem by excluding financial firms, it does not ensure the exclusion of speculative hedgers. It is not uncommon that managers believe that they can "beat the market", especially so in Germany as opposed to the US (Bodnar and Gebhardt, 1999).

Considering that in our sample 28% of firms with no exchange rate exposure use foreign currency derivatives, this suggests that they hedge for other reasons. We did find companies that hedged costs, which would then not be captured by our measure of direct exposure, but it also adds some support to the speculative element. Furthermore, it raises the question if hedging might be casually employed, which has been shown to be value reducing (Lookman, 2009). Jankensgård (2013) found a premium for firms with a centralized approach to derivatives, whereas there was no premium for decentralized firms. This stresses the importance of using hedging as part of a holistic risk management strategy, and not to be carried out carelessly, if it is to be value creating. However, as pointed out by Oxelheim and Wihlborg (2008), most companies are indirectly exposed to macroeconomic risks such as the exchange rate, although they might not be exporters.

In a comparative study of surveys of German and US firms, Bodnar and Gebhardt (1999) find that German firms focus more on managing accounting results whereas US firm focus more on managing cash flows. The reason for this is that in Germany accounting results are not only for informative purposes, they also play a role in the taxation. Additionally, many firms actually claim that minimizing cash flow variability is not important when using derivatives. This seems to be in contrast with the idea of maximizing shareholder value.

Our finding of a significant value discount for users of foreign currency derivatives contradicts numerous US studies that give evidence that the use of derivatives is valued at a premium. This implies that there are crucial differences in both the characteristics and the market valuation of German and U.S. firms.

One possible explanation might be limited investor protection. Controlling shareholders have a higher chance to expropriate value from minority shareholders (La Porta *et al*., 2002). Since the controlling shareholder's ability to extract private benefits increases, the outside investors are more likely to value a firm at a relatively higher discount as a consequence of a controlling shareholder's higher ability to expropriate private wealth (Pinkowitz *et al*., 2007). It turns out that firms with controlling shareholders in weak

governance systems have a higher incentive to hedge, even though firm value is not being maximized. Large shareholders are likely to have a majority of their private wealth invested in rather few companies and are therefore not well-diversified. Consequently their demand for additional security is reflected by a bigger risk aversion. Thus they are more inclined to go forth with a hedging strategy. Lookman (2009) compared hedging of 'big' risks to 'small' risk and concluded that hedging of a 'big' risk is associated with lower firm value, whereas hedging of a 'small' risk is associated with higher firm value. It is easier for outside investors to estimate a firm's exposure to a big risk factor, whereas the information asymmetry regarding small risk factors is more prominent. Thus investors might not value hedging of the same risks as the large shareholders do, since their exposure to them is different.

For that reason we conclude that in the German market investors do not anticipate that the use of derivatives comes along with a value-enhancing effect on a firm given the existence of ownership concentration (Faccio and Lang, 2002) and weaker investor protection (La Porta *et al*., 2002). They value the decision for hedging with a discount.

Our conclusion is further supported by the finding of Allayannis *et al*. (2012). They argue that value creation for firms due to the use of FCD requires strong internal corporate governance. The firms should also reside in countries with strong external governance, i.e., a jurisdiction that stresses strong shareholder rights, strong creditor rights, or with an English legal origin. Logically, value creation turns out to be insignificant for firms exhibiting weak internal governance and residing in countries with weak external governance. They argue that a weak jurisdiction in this regard would increase the likelihood of insiders engaging in risk management only for the purpose of enhancing their own benefit, thus possibly harming firm value.

Fatemi and Glaum (2000) did a survey of risk management practices of German firms, and they found that almost 90% of the firms used derivatives, but less than 25% fully hedged their exchange rate exposure. It indicates that classifying firms as hedgers based on whether they use derivatives or not might be misleading, and thus the results should be interpreted with caution.

6 Conclusion

This study examines the use of derivatives by 137 public firms in Germany in 2006-2010. To our knowledge our study is the first examination of the relation between hedging and market value on the German market. We find that the use of derivatives by non-financial firms does not add value. The results from our tests are inconsistent with theoretical predictions. The empirical evidence of a discount among German derivative users is in contrast to Allayannis and Weston (2001) who documented a hedging premium for US firms, but verifies the findings of Khediri and Folus (2010) and Nguyen and Faff (2007). This discrepancy suggests that there are major differences between firms in Germany and the U.S. This suggests a need for both further theoretical and empirical analysis. In particular, to understand the precise mechanisms by which the use of derivatives affects firm value. Perhaps corporate governance, internationalization or managerial ability plays a role as suggested by Allayannis *et al*. (2012).

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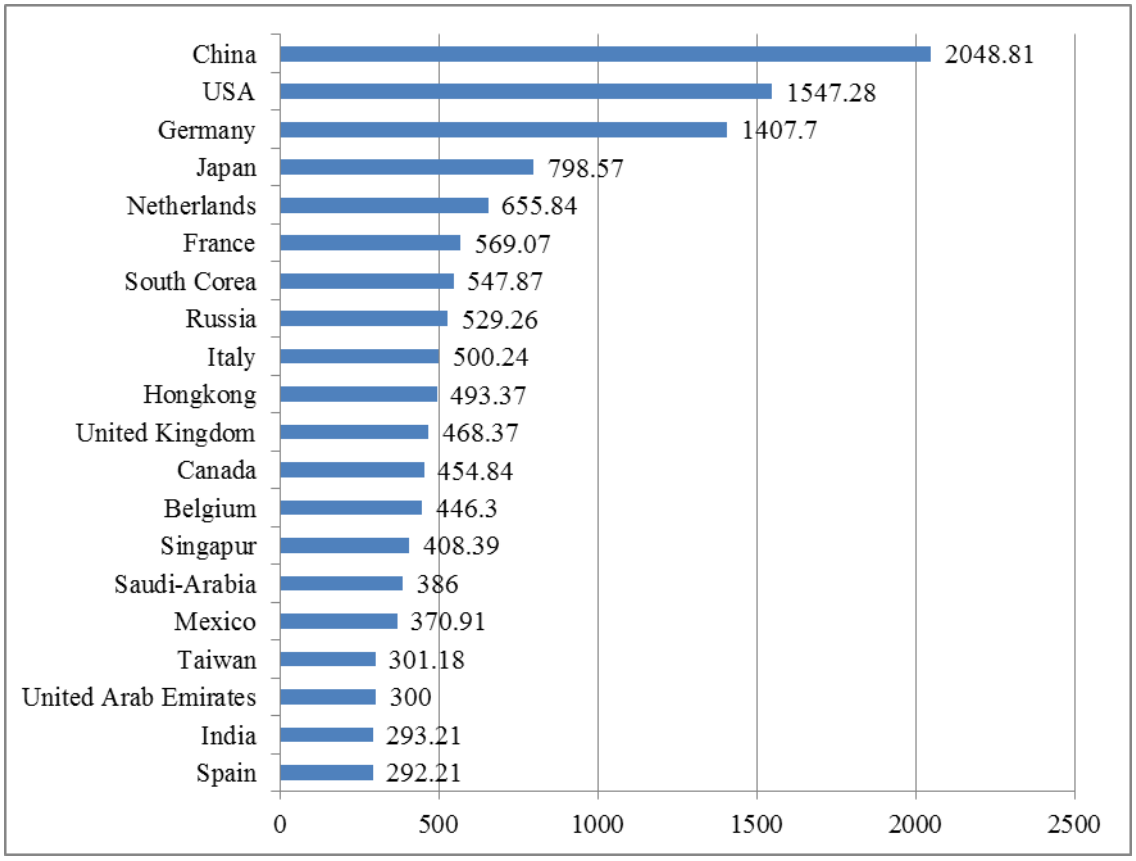
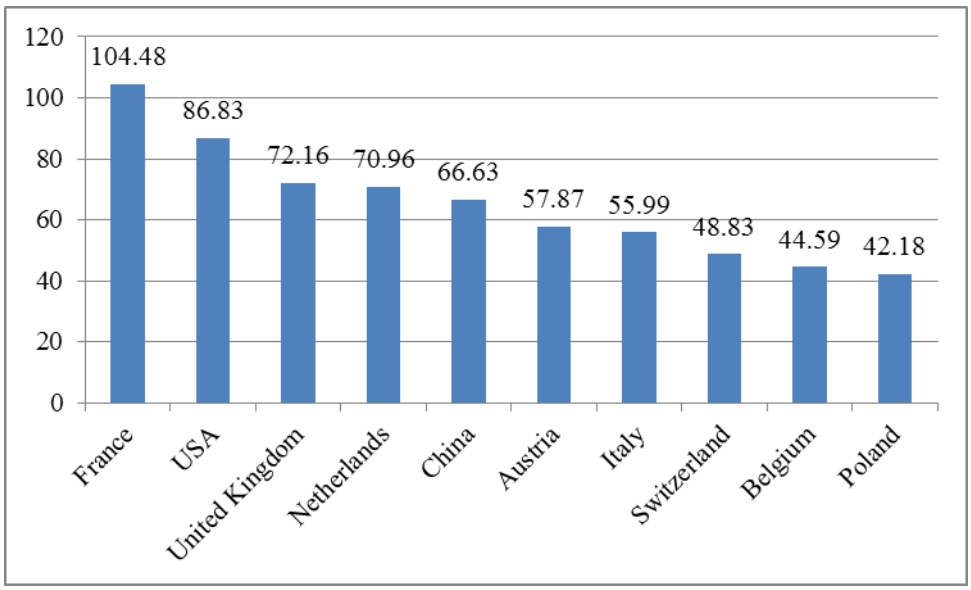
Thomson Reuters DataStream

Appendix 1: 20 biggest exporting countries in 2012 (Exports in Billion US-Dollar)



Source: Statista

Appendix 2: Ranking of Germany's most important trading partners measured by exports in 2012 (Export volume in Billion Euro)

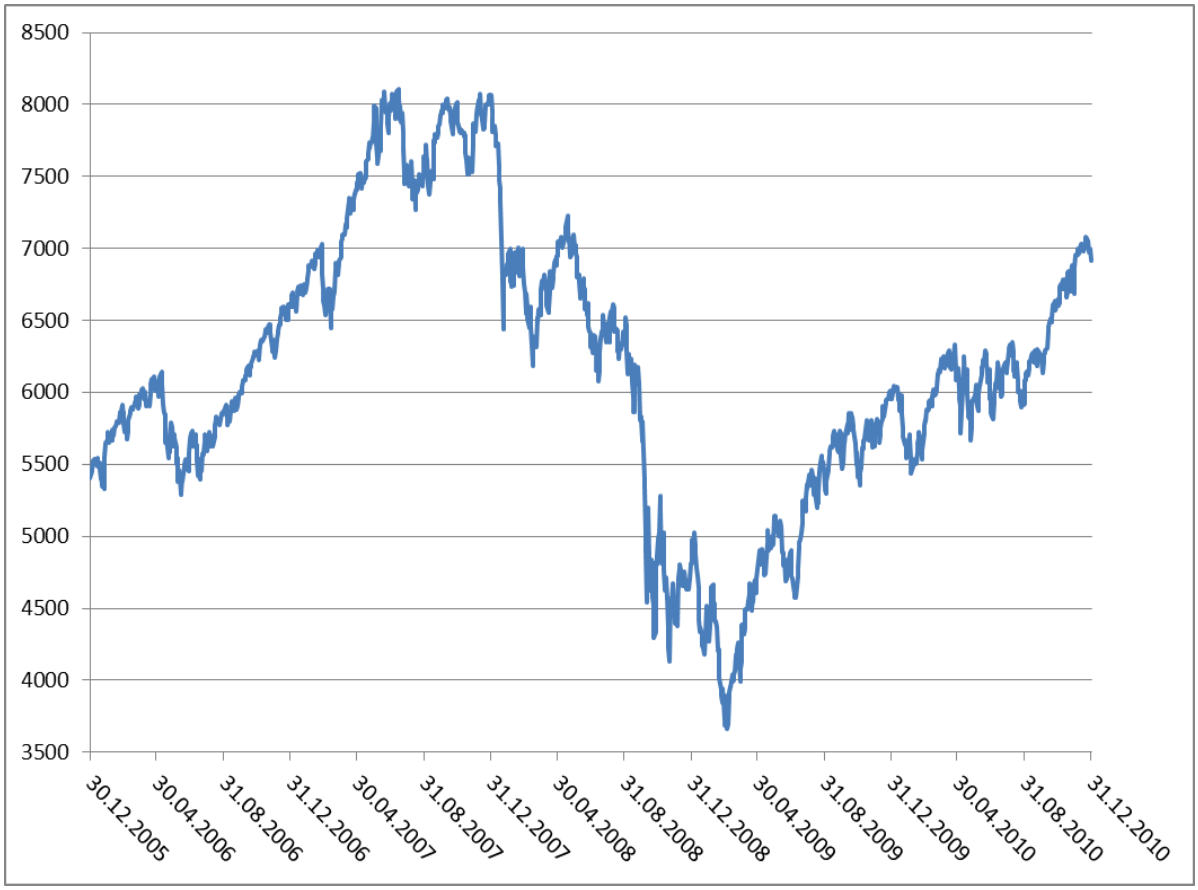


Source: Statista

Appendix 3: EUR/USD-exchange rate from 2006 to 2010

Source: Thomson Reuters DataStream

Appendix 4: DAX performance from 2006 to 2010



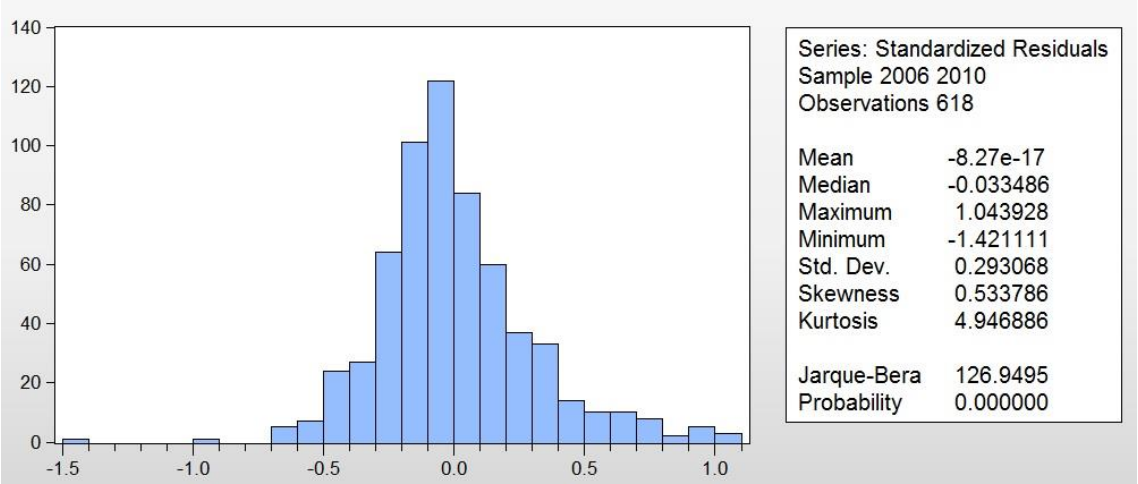
Source: Thomson Reuters DataStream

Appendix 5: Test for heteroscedasticity

Dependent Variable: SQUARED RESIDUALS
Method: Panel Least Squares
Date: 05/23/13 Time: 21:56
Sample: 2006 2010
Periods included: 5
Cross-sections included: 124
Total panel (unbalanced) observations: 618

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.261158	0.206687	1.263543	0.2069
FCD_DY	-0.022528	0.060513	-0.372287	0.7098
SIZE	-0.024502	0.013116	-1.8681	0.0622
DIVID_DY	-0.001998	0.061428	-0.032521	0.9741
LEV	-0.062403	0.027514	-2.268014	0.0237
ROA	4.044683	0.276842	14.61006	0
G	-0.055343	0.376806	-0.146873	0.8833
GEO_DY	0.146481	0.098212	1.491477	0.1364
DIV_DY	0.003993	0.041068	0.09722	0.9226
STOCK_VOLA	0.640067	0.167892	3.812369	0.0002
IND_DY1	-0.123331	0.076061	-1.621475	0.1054
IND_DY3	-0.013851	0.058399	-0.237179	0.8126
IND_DY4	-0.125072	0.071305	-1.754042	0.0799
IND_DY5	-0.038332	0.062565	-0.612679	0.5403
IND_DY6	0.132186	0.062655	2.109753	0.0353
_2007_DY	-0.062809	0.060985	-1.029909	0.3035
_2008_DY	-0.361556	0.071606	-5.049245	0
_2009_DY	-0.173994	0.064394	-2.702042	0.0071
_2010_DY	-0.107491	0.061157	-1.757612	0.0793

Appendix 6: Test for normality



Appendix 7: Identification of Multicollinearity

	FCD_DY	SIZE	DIVID_DY	LEV	ROA	G	GEO_DY	DIV_DY	STOCK_VOLA	IND_DY1	IND_DY3	IND_DY4	IND_DY5	IND_DY6	_2007_DY	_2008_DY	_2009_DY	_2010_DY
FCD_DY	1.00																	
SIZE	0.34	1.00																
DIVID_DY	0.01	0.24	1.00															
LEV	0.00	0.18	-0.12	1.00														
ROA	-0.14	-0.16	0.28	-0.32	1.00													
G	0.07	0.25	0.02	0.19	-0.09	1.00												
GEO_DY	0.13	0.10	-0.02	-0.05	-0.02	0.04	1.00											
DIV_DY	0.10	0.18	0.01	0.04	-0.02	0.00	-0.10	1.00										
STOCK_VOLA	0.00	-0.16	-0.39	0.29	-0.21	0.02	0.02	0.01	1.00									
IND_DY1	0.13	0.15	0.07	-0.04	0.02	0.07	-0.13	0.11	-0.04	1.00								
IND_DY3	-0.10	0.21	0.02	0.03	-0.03	0.10	-0.02	0.20	-0.01	-0.15	1.00							
IND_DY4	0.06	-0.02	-0.04	0.10	0.02	-0.09	0.07	-0.09	0.02	-0.10	-0.16	1.00						
IND_DY5	-0.05	-0.14	-0.18	-0.03	0.02	-0.10	0.00	-0.04	0.06	-0.13	-0.20	-0.13	1.00					
IND_DY6	-0.11	-0.20	0.04	-0.09	0.07	-0.08	-0.09	0.05	-0.02	-0.13	-0.20	-0.14	-0.17	1.00				
_2007_DY	-0.01	-0.01	-0.03	-0.06	0.04	0.02	0.01	0.00	-0.16	0.00	0.00	0.00	0.00	0.00	1.00			
_2008_DY	-0.01	0.00	0.06	0.16	-0.04	0.03	-0.01	0.00	0.45	0.00	0.00	0.00	0.00	0.00	-0.25	1.00		
_2009_DY	0.01	0.01	-0.03	0.05	-0.09	0.00	-0.05	0.00	0.16	0.00	0.00	0.00	0.00	0.00	-0.25	-0.25	1.00	
_2010_DY	0.02	0.04	-0.01	-0.08	0.06	-0.04	0.03	0.00	-0.22	0.00	0.00	0.00	-0.01	0.00	-0.25	-0.25	-0.25	1.00

Appendix 8: Foreign currency derivatives use and firm value for firms with foreign sales: Cross-section results for OLS-regression

Observations	618
R^2	0.44

	All firms with foreign sales > 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD_DY	-0.079	0.039	-2.007	0.045	-0.068	-6.58%
SIZE	-0.018	0.009	-2.127	0.034	-0.081	-7.81%
DIVID_DY	-0.056	0.038	-1.457	0.146	-0.052	-5.07%
LEV	-0.105	0.018	-5.854	0.000	-0.204	-18.42%
ROA	2.702	0.180	15.039	0.000	0.516	67.49%
G	-0.071	0.245	-0.290	0.772	-0.009	-0.93%
GEO_DY	0.104	0.064	1.624	0.105	0.051	5.27%
DIV_DY	-0.017	0.027	-0.619	0.536	-0.020	-1.98%
STOCK_VOLA	-0.103	0.089	-1.163	0.245	-0.040	-3.96%
IND_DY1	-0.035	0.050	-0.697	0.486	-0.024	-2.34%
IND_DY3	0.019	0.038	0.510	0.611	0.019	1.88%
IND_DY4	-0.003	0.046	-0.069	0.945	-0.002	-0.23%
IND_DY5	-0.009	0.041	-0.224	0.823	-0.008	-0.77%
IND_DY6	0.094	0.041	2.294	0.022	0.080	8.35%

The table presents our results for our time-fixed effects regression with regard to firms with foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage as the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We define a firm with foreign sales > 10% of total sales as geographically diversified. The diversificaton dummy equals 1, if a firm is active in more than one business segment and 0 otherwise. We consider the firms' annual volatility as the stock volatility. We further consider dummys for the different industry segments and years. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. ('White period' in EViews)

Appendix 9: Foreign currency derivatives use and firm value for firms with foreign sales: Cross-section results for time-fixed effects and White diagonal (1980) standard errors

Observations	618
R^2	0.49

	All firms with foreign sales > 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD dummy	-0.083	0.041	-2.016*	0.044	-0.071	-6.88%
Size (log of total assets)	-0.014	0.007	-1.950*	0.052	-0.063	-6.15%
Dividend dummy	0.028	0.040	0.700	0.484	0.026	2.64%
Debt to Equity	-0.102	0.022	-4.573***	0.000	-0.198	-17.96%
Return on assets	2.704	0.352	7.674***	0.000	0.516	67.56%
Growth (capital expenditure / sales)	-0.082	0.182	-0.452	0.651	-0.011	-1.07%
Geographical diversification	0.081	0.047	1.717*	0.087	0.040	4.11%
Diversification dummy	-0.022	0.027	-0.821	0.412	-0.027	-2.63%
Stock volatility (annual)	0.344	0.117	2.952**	0.003	0.135	14.41%
Industry dummy 1 (Basic materials)	-0.031	0.036	-0.869	0.385	-0.022	-2.14%
Industry dummy 3 (Consumer goods)	0.020	0.034	0.581	0.562	0.019	1.89%
Industry dummy 4 (Healthcare)	-0.002	0.039	-0.043	0.966	-0.001	-0.12%
Industry dummy 5 (Consumer services)	-0.002	0.039	-0.043	0.965	-0.001	-0.14%
Industry dummy 6 (Technology)	0.099	0.050	1.984**	0.048	0.085	8.83%
2007 year dummy	-0.017	0.038	-0.443	0.658	-0.017	-1.64%
2008 year dummy	-0.318	0.047	-6.796***	0.000	-0.310	-26.62%
2009 year dummy	-0.143	0.041	-3.515***	0.001	-0.139	-12.95%
2010 year dummy	-0.079	0.039	-2.057**	0.040	-0.077	-7.41%

The table presents our results for our time-fixed effects regression with regard to firms with foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage as the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We define a firm with foreign sales > 10% of total sales as geographically diversified. The diversificaton dummy equals 1, if a firm is active in more than one business segment and 0 otherwise. We consider the firms' annual volatility as the stock volatility. We further consider dummys for the different industry segments and years. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. ('White diagonal' in EViews)

Appendix 10: Redundant Fixed Effects Tests

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section and period fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	12,095348	-123.483	0
Cross-section Chi-square	868,995461	123	0
Period F	36,892115	-4.483	0
Period Chi-square	164,761936	4	0
Cross-Section/Period F	13,284659	-127.483	0
Cross-Section/Period Chi-square	928,567072	127	0

Appendix 11: Hausman Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	111.369743	7	0

Appendix 12: Foreign currency derivatives use and firm value for firms with no foreign sales: Cross-section results for time-fixed effects and White diagonal (1980) standard errors

Observations	67					
R^2	0.80					
	All firms with foreign sales = 0					
Dependent variable: ln (Tobin's Q)	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficient	Economic impact on Tobin's Q (in %)
FCD dummy	0.020	0.124	0.159	0.875	0.015	1.52%
Size (log of total assets)	-0.245	0.033	-7.404***	0.000	-0.590	-44.57%
Dividend dummy	-0.227	0.100	-2.268**	0.028	-0.188	-17.17%
Debt to Equity	-0.546	0.128	-4.27***	0.000	-0.322	-27.50%
Return on assets	-0.032	0.213	-0.150	0.881	-0.013	-1.30%
Growth (capital expenditure / sales)	-0.204	0.129	-1.578	0.121	-0.116	-10.95%
Diversification dummy	0.038	0.085	0.451	0.654	0.032	3.23%
Stock volatility (annual)	-0.150	0.252	-0.598	0.553	-0.045	-4.41%
Industry dummy 1 (Basic materials)	0.198	0.103	1.935*	0.059	0.144	15.50%
Industry dummy 3 (Consumer goods)	-0.124	0.138	-0.899	0.373	-0.056	-5.40%
Industry dummy 4 (Healthcare)	0.029	0.117	0.250	0.804	0.018	1.79%
Industry dummy 5 (Consumer services)	0.115	0.137	0.842	0.404	0.056	5.77%
Industry dummy 6 (Technology)	0.752	0.114	6.607***	0.000	0.457	57.90%
2007 year dummy	0.023	0.115	0.197	0.845	0.015	1.53%
2008 year dummy	-0.129	0.114	-1.137	0.261	-0.087	-8.35%
2009 year dummy	0.037	0.124	0.299	0.766	0.025	2.53%
2010 year dummy	0.124	0.106	1.175	0.246	0.086	9.00%

The table presents our results for our time-fixed effects regression with regard to firms with no foreign sales. The data sample includes als DATASTREAM public firms of the list "DS-Nonfinancials". Hereby we excluded public utilities. Tobin's Q equals the sum of a firm's total assets and market value of equity minus book value of equity divided by total assets. The FCD dummy equals 1, if a firm reports the use of forwards, futures, options or swaps for purposes of foreign currency hedging. The dividend dummy equals 1, if a firm paid dividends in a certain year and 0 otherwise. We consider leverage as the ratio of total debt to shareholder's equity. We calculate the return on assets as the annually compounded net income divided by total assets. We proxy the firms' growth opportunities by the ratio of capitel expenditures to sales. We define a firm with foreign sales > 10% of total sales as geographically diversified. The diversificaton dummy equals 1, if a firm is active in more than one business segment and 0 otherwise. We consider the firms' annual volatility as the stock volatility. We further consider dummys for the different industry segments and years. ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. We base our T-statistics on White (1980) standard errors. ('White diagonal' in EViews)