Financial derivatives and firm value: What have we learned?

Sabri Boubaker♠, Patricia Bachiller♣, Salma Mefteh-Wali*

Abstract

Despite an enormous amount of research on the relationship between financial hedging and firm performance, the literature provides so far no clear-cut findings on whether the use of derivatives results in higher firm valuation. Using a meta-analysis of 51 studies, this research explains whether the absence of a consensus is due to different country specificities and hedging types. The findings show that the use of foreign currency derivatives, alone or along with other types of derivatives, drives firm value positively. They also show that hedging presents an economic advantage for all firms, especially those from common law and developed countries.

Keywords: Derivatives use; Hedging; Firm value; Meta-analysis

JEL Classification: C83; F23; G15; G32

♠ EM Normandie Business School, Métis Lab, Paris, France, Email: sboubaker@em-normandie.fr
& Institut de Recherche en Gestion (EA 2354), Université Paris Est, Créteil, France
♣ Faculty of Economics and Business Administration, University of Zaragoza, Gran Vía, 2 50005 Zragoza (Spain), Tel: +34 876 554725; Fax: +34 976 761769, Email: pbachiller@unizar.es
* ESSCA School of Management, 1 rue Joseph Lakanal - BP 40348, 49003 Angers, France, Tél. : +33 (0)2 41 73 47 47 - Fax : +33 (0)2 41 73 47 48. Email: salma.mefteh@essca.fr

1. Introduction

There has been a long and controversial debate in risk management research about the effect of corporate hedging on firm value. Prior studies highlight two opposing views. The first one considers that corporate hedging increases firm performance by reducing the volatility of profits and expected tax liability in presence of convex tax schedule (Smith and Stulz, 1985), lowering financial distress costs and increasing firm leverage (Stulz, 1996; Ross, 1997 and Leland, 1998), mitigating underinvestment costs stemming from agency costs of debt and costly recourse to external financing (Bessembinder, 1991; Froot *et al.*, 1993), and alleviating information asymmetry (e.g. DeMarzo and Duffie, 1991, 1995). The second view considers that the use of derivatives is detrimental to firm value. Indeed, financial risk management programs can decrease firm value if they are aimed to only satisfy managerial self-interests (Knopf *et al.*, 2002; Hagelin *et al.*, 2007), they are used for speculative purposes that increase risk exposure (Adam et *al.*, 2017), and they are ineffective in reducing risk (Copeland and Joshi, 1996 and Hagelin and Pramborg, 2004). The large number of derivatives' debacles and the huge financial losses associated with the use of these instruments consistently call into question their ability to increase value. Firms such as Allied Lyons, Metallgesellschaft, Showa Shell Sekiyu, and Procter and Gamble made headlines in the financial press for their significant losses in the derivatives markets in particular during the early 1990s due to poorly designed financial engineering, purely speculative operations, and insufficient control of these instruments.[1]

These conceptual differences have been mirrored in the many empirical works on the topic. The empirical evidence on the implications of hedging for firm value is also mixed. Some studies show that it increases firm value (Allayannis and Weston, 2001; Kim *et al.*, 2006; Carter et *al*, 2006, among other) whereas others reveal that hedging programs are associated with decreased firm value (e.g., Fauver and Naranjo, 2010; Hagelin *et al.*, 2007, Adam et *al.,* 2017). Several other studies do not find any significant relation between corporate hedging and firm value (Bartram et al., 2011, Belghitar et *al.*, 2013). Thus, the empirical status quo suggests that the jury is still out and the relationship between financial hedging and firm performance is not yet clear.

[1] More details on those debacles are in Jacque (2015), "Global derivatives debacles: From Theory to Malpractice", World Scientific, 2nd Edition.

This paper presents a meta-analytic review of quantitative studies that link derivatives use to firm value. Numerous researchers (e.g., Gooding and Wagner 1985; Damanpour 1991; Datta *et al.* 1992) explain that meta-analysis is a useful tool when individual studies lead to conflicting results. According to Hunter and Schmidt (1990), the methodological advantage of a meta-analytic study is that statistical artifacts such as sampling and measurement errors can be accounted for. Moreover, it allows for much greater precision than other forms of research reviews. We present here a statistical integration of the prior research on the relationship between derivatives use and firm value. In particular, we analyze the existing theoretical arguments and empirical evidence of risk management as a driver of firm value. We mainly focus on the use of derivatives as a means of corporate risk management since most studies consider the use of derivatives as a hedging tool because it is more easily observable than operational hedging.

The aim of our study is to answer the following questions: (i) Does the use of derivatives for hedging purposes add value to the firm? Do country-specific reasons explain the relationship between financial hedging and firm value? By answering these questions, we aim to better understand whether derivative use is beneficial for shareholders and if differences in prior results depend on country specificities.

Our meta-study contributes to the literature on the corporate hedging. It focuses on the heterogeneity of the value effect of financial derivatives by providing a comprehensive analysis that sheds additional light on the debate. It rigorously combines the results from 51 papers to identify the causes of absence of consensual conclusions among the existing empirical studies. This issue has been examined through narrative literature reviews (Aretz and Bartram, 2010) and meta-analysis (Arnold et *afl.*, 2014 and Geyer-Klingeberg et *al.*, 2019) who compiled diverse theoretical and empirical to emphasize the corporate incentives to hedge. In this research we focus on the direct relationship between corporate hedging and firm value while controlling for effect size and publication bias. The meta analysis aims to produce generalized inference and thus overcomes small-sample issues associated with individual studies (Hunter & Schmidt, 2004). Analyzing publication bias in meta-analyses is important given the contradictory conclusions of the effect of financial hedging on firm value. Our meta-analysis also

examines whether other variables (e.g., type of exposure hedged and the degree of the development of the country) explain the average effect size.

The rest of the paper is structured as follows. Section 2 presents prior relevant literature. Section 3 describes the sample. Section 4 details the methodology. Sections 5 and 6 present and discuss the empirical results, respectively. Section 7 concludes.

2. Literature review

2.1. The role of derivatives use

The adoption of a hedging strategy can have a mixed effect on firm performance. According to the positive theory of corporate hedging, derivatives use can increase the value of non-financial firms (Smith and Stulz, 1985). Conventional explanations include tax incentives, cost of financial distress, under-investment problem and information asymmetry. First, Smith and Stulz (1985) demonstrate that a reduction in the variability of taxable income can lower expected taxes for firms with convex effective tax functions, hence increasing the expected post-tax value of the firm. Second, Leland (1998) and Graham and Rogers (2002) argue that hedging reduces the volatility of firm value; thus, decreasing the expected costs of financial losses and increasing firm value. Consequently, it allows firms to carry more debt and enjoy greater tax shields. Third, Froot *et al.* (1993) demonstrate that hedging can mitigate underinvestment by ensuring a firm to have sufficient internal funds to avoid unnecessary fluctuations in either investment spending or external financing, leading to higher firm value. Fourth, DeMarzo and Duffie (1995) explain that hedging can reduce the amount of noise in earnings caused by fluctuation of macroeconomic factors such as exchange rate, interest rate and commodity prices[2]. Consequently, when hedging enhances the firm informational environment, it improves stock liquidity, lowers the cost of capital and increases firm value.

The theories discussed above consider hedging program's effectiveness in reducing exposure to financial risks, leading to greater shareholder value. However, this cannot always be verified for many reasons. First, it is possible that the risk hedging policy put in place is not relevant. According to Copeland and Joshi (1996) and Hagelin and

[2] Dadalt *et al.* (2002) considers that noise in this context correspond to factors that shape earnings while being beyond the control of the management team.

Pramborg (2004), the relationship between exchange rate[3] and other economic factors (e.g., interest rates, relative prices, income, expenditure, and supply and demand of goods) is complex. Anticipating all the consequences of hedging policies on firm value is difficult. Survey evidence of Alkebäck and Hagelin (1999) suggests that financial directors in Swedish firms perceive the use of derivatives as complicated.

Second, it is possible that risk management is too costly, but ineffective in reducing total risk. Consequently, if management fails to reduce total risk by hedging, shareholder value may be eroded (Hagelin and Pramborg, 2004). Even when the risk management policy is adapted, the resulting benefits may be lower than the costs of setting up a hedging program. Indeed, the conception and implementation require a commitment of financial, physical and human resources that can represent significant costs for the firm (Clark and Mefteh, 2010). If the benefits of hedging are not high enough to offset these costs, firm value does not increase at the end.

Third, firms can speculate within the context of their hedging programs by varying the size and the timing of their derivatives transactions based on managers' market views. This would increase their exposure to risk and, if so, accept a decline in shareholder value. Adam *et al*. (2017) find that the extent of selective hedging is positively correlated with a firm's future stock return volatility, which suggests that selective hedging increases risk. Speculation can sometimes be at the origin of financial catastrophes. The Allied Lyons example is indicative of the negative consequences for the firm of an uncontrolled use of derivatives. This British food and liquor firm recorded a $269 million loss in 1991 because of speculative positions in the foreign exchange derivatives market.

Fourth, according to the agency theory, managers are the agents of the shareholders who mandate them to maximize the value of the equity. However, their interests can be divergent. Managers may be tempted to set up hedging program that stabilize cash flows but do not maximize shareholder value because their human capital is largely invested in their firms and difficult to diversify outside of it. Hagelin *et al.* (2007) find that foreign currency hedging programs that meet the only managers' interests reduce firm value. According to Smith and Stulz (1985), when a manager personally holds a block of shares, she/he tends to engage in hedging activities even when they are not required to do so to protect her/his own interests. As discussed above,

[3] The reasons could also be extended to interest rates and commodities prices.

risk management provides firms with internal financing resources. It enables them to avoid the "deadweight costs" of external financing and to seize investment opportunities. However, Tufano (1998) explains that managers may undertake negative-NPV investments because of some private benefits while benefiting from the absence of capital market scrutiny, making resource allocation improper and decreasing shareholder value. Allayannis *et al.* (2012) find that the foreign currency hedging premium is statistically significant and economically large only for firms that have strong internal and external corporate governance. All in all, it is difficult to advance an *a priori* clear relationship between financial hedging and firm value. This relationship remains an empirical issue due to the arguments that are for and against increasing firm value by hedging financial risks.

2.2. Country effect

The vast majority of published research on the effect of financial hedging on firm value uses single country data. However, Allayannis et al. (2012) studied a sample of firms from thirty-nine countries. They give evidence that country specific attributes are an important determinant of hedging premium. Many studies conducted in non-US markets explain that their countries exhibit important differences when compared to the U.S. market. Those differences could explain the conflicting results. In this vein, Claessens *et al.* (2001) explain that the legal and financial environment of a firm justify its risk-taking and corporate finance behaviors. They conclude that firms in common law environments adopt a different behavior from those in civil law countries. Mefteh-Wali and Rigobert (2018) and Ben Khediri and Folus (2010) study French non-financial listed firms and show that the value-effect of derivatives use depends on the country specificities. They explain that French firms are characterized by high ownership concentration structures and predominance of family shareholders. This environment landscape allows better monitoring of managers, helps reduce the agency conflicts between shareholders and managers, and influences the objective of firms from using financial hedging. This is very important since managers can use derivatives to maximize their own utility rather than firm value (Smith and Stulz, 1985).

Lau (2016) provides empirical evidence that financial hedging contributes negatively to firm value and explains the reasons of the ineffectiveness of the derivatives use. First, the institutional environment and corporate governance practices in developing countries are weaker than in developed markets, leading to higher agency

costs and lower value creation through hedging. Second, despite the fact that many derivatives markets in developing countries offer most of the basic derivatives contracts they remain relatively less liquid, increasing the cost of derivative hedging. Third, managers in developing countries might have lower capacity and expertise than in the developed countries in dealing with derivatives. In a survey on Malaysian listed firms, Othman and Ameer (2011) found that the lack of expertise in handling derivatives, difficulties in understanding complex derivatives and high transaction costs are the main concerns of managers regarding derivatives use in this country. For all these reasons, the effect of financial hedging on firm value is likely to vary depending on the context as country-specific idiosyncrasies. The country effect is likely to explain the conflicting results in prior research.

3. Sample description

3.1 Selection of prior studies

To identify relevant studies, our literature search responds to the combination of keywords "hedging and firm value", "derivatives use and firm value", "Risk management and firm value". We focus on empirical studies that considered non-financial firms only as it is difficult to separate trading from hedging activities for financial firms. The search was completed in May 2019. Our meta-analysis includes articles published in academic journals in the fields of finance, economics, administrative science and non-published working papers. The databases used to collect the articles are the ISI Web of Knowledge, ScienceDirect, EJS Ebsco, ABI Inform, and Google Scholar. References in more recent articles were also used to identify older research papers.

We selected the empirical studies for inclusion in the meta-analysis based on a set of criteria: (i) The paper deals with the use of derivatives to hedge financial risk exposure (i.e., exposure to the fluctuation of foreign currencies, interest rates, or commodities prices); (ii) it contains at least one regression relating derivatives use to firm value; (iii) it proxies firm value using Tobin's Q or natural logarithm of Tobin Q and it reports sample sizes and t–statistics (or p–values) of the coefficient of the variable of interest (i.e., derivatives use) in the firm value regression.

These searches yielded 51 published and unpublished studies covering 2001–2018, with quantitative and comparable data on hedging and firm value. Table 1 shows

general information on all the studies included in our sample. Slightly more than 27% of sampled papers have not been yet published. The analyzed period spreads from 1985 to 2015. The number of firms is equal to 14,790 with a total of 112,107 firm-year observations. Only 8% of the sample studies investigate the use of derivatives to hedge commodities risk whereas 20% do not specify the nature of the hedged risk (e.g., foreign currency, interest and commodity risk). The majority of sample studies (73%) have focused on foreign currency derivatives.

[Insert Table 1 about here]

3.2 Publication bias

Publication bias arises when papers that do not accept the null hypothesis– the use of derivatives affect positively and significantly firm value–, are less likely to be published than those producing a statistically significant result. That is, researchers, referees and editors are more inclined to publish results that are statistically significant and support a given theory whereas insignificant results and those showing an effect inconsistent with the theory tend to be underrepresented among the published literature. Therefore, if journals predominantly publish studies with statistically significant results, published articles misrepresent true situations. This is a particular serious issue in fields that show little agreement regarding the sign of the relationships.

To analyze whether there is a publication bias, we use the funnel asymmetry test and regress the effect size, measured by the *t–value* of the coefficient of derivatives use in explaining firm value on the inverse of its standard error (Stanley and Doucouliagos, 2010). This model can be written as following.

$$\text{Effect size} = \beta_0 + \beta_1 * 1/SE + \varepsilon \qquad (1)$$

The estimates of the constant indicate the presence of a publication bias, and the estimates of β_1 test for the existence of a hedging premium beyond publication selection bias. Table 2 shows that the constant is statistically significant, which indicates a sign of a publication selection bias. The coefficient *1/SE*, that measures the hedging–firm value effect corrected for publication selection, is also statistically significant, which indicates that the literature identifies, in most cases, a positive link between hedging and firm value.

[Insert Table 2 about here]

4. Methodology

4.1 The effect size

In the meta-analysis, the most widely used metric is the Pearson correlation coefficient *r*. The use of this coefficient as the effect size is appropriate; it is scale-free and indicates both the direction and magnitude of the relationships (Lipsey and Wilson, 2001). This study computes the effect size as the correlation coefficient *r* that indicates the association between hedging and firm value after controlling for other confounding factors. For studies that report *p–value* and Student's *t–test*, we compute *r* as

r = *t–test* / square root (*t–test*^{2} + freedom degrees) (2)

Table 3 shows descriptive statistics of correlation coefficients from primary studies for the relationship between hedging and firm value. For each study, coefficients of hedging (currency, commodities and all derivatives) have been selected. That is, a positive (negative) sign of *r* means that the use of derivatives improves (decreases) firm value. When one study offered various correlations coefficients (i.e., due to various subsamples), we use the mean correlation coefficient as the unique correlation coefficient for this study to maintain independence between observations (Hunter and Schmidt, 1990).

[Insert Table 3 about here]

Hunter and Schmidt (1990) meta-analysis has been carried out to obtain comparable effects and convert them to a common metric. Following this methodology, statistical aggregation techniques for cumulating correlations are employed to compute the correct correlation score between hedging and firm value. For each association between derivatives use and firm value variable, we compute the weighted mean correlation coefficient ($\bar{r}=\Sigma N_i\ r_i\ /\ \Sigma N_i$), the total observed variance ($S_r^2 = \Sigma N_i\ (r_i\text{-})^2/\ \Sigma N_i$) and the sampling error variance ($S_e^2 = (1–r_i^2)^2\ k/\ \Sigma N_i$), where *r* is the effect size for sample *i*, N_i is the number of observations in each sample, and *k* the number of effect sizes. This technique gives more weight to larger sample sizes to reduce sampling error, which declines as sample size increases.

Two tests are employed to estimate whether the empirical correlations are homogeneous. First, the 75% rule of thumb, according to which, there is no true variance in the studies if 75% of the observed variance across studies can be explained

by sampling errors [(100) $S_e^2/S_r^2 \geq 75$], that is, the association is homogeneous. Second, the Q statistic

$$Q = k\,(S_r^2)/(S_e^2) = N\,S_e^2 / (1 - \square)^2 \qquad (3)$$

where *k* is the number of effect sizes included in the analysis, S_r^2 the total observed variance, S_e^2 the sampling error variance, *N* the total sample size of the effect sizes and $\square$ the mean correlation coefficient. Q is distributed as a chi–square with k–1 degrees of freedom, and a significant Q would indicate rejection of the null hypothesis of homogeneity. If this statistic is statistically significant, it means that the association is not homogeneous, and it would have to search the moderating effects that cause variability within the results.

4.2 The meta regression model

We carry out a meta-regression of the relation between hedging and firm value. This technique can be defined as the regression analysis of regression analyzes. That is, the aggregated effect sizes are obtained from regression models. The objective is to condense effect sizes from studies included in the analysis within an only summary effect and to deduce study characteristics that explain the variations associated with the different results obtained in the primary studies. The effect sizes coefficients from primary studies are regressed on exogenous variables that quantify differences in methodologies and samples. As Geyer-Klingeberg *et al.* (2019) assert, this technique surpasses the averaging effect sizes because it considers the effect of several explanatory variables in a multiple regression framework. Meta-analysis allows inferences without depending on specific sample characteristics and is increasingly used in financial economics (e.g., García-Meca and Sánchez-Ballesta, 2010; Bachiller, 2017; and Dykes and Kolev, 2019).

We use four types of independent variables, namely, (i) the nature of derivatives (i.e., foreign currency, commodities or hedging without risk hedge specification), (ii) the country law origin (common law versus civil law), (iii) the degree of the development of the country (developed versus developing country), and (iv) a variable that indicates that regressions control for the endogeneity problem. We use the Fisher's Z transformation of correlation coefficients between hedging and firm value (Tobin's Q or its natural logarithm) obtained from the studies as the dependent variable in the meta-regression. We estimate the following relationship

Fisher's Z = f (*Derivatives kind, Law system, Developed, Endogeneity*) (4)

where *Derivatives kind* has been categorized as

- *Foreign currency* is a dummy variable that takes the value of 1 when the study uses a sample of firms using foreign currency derivatives, and 0 otherwise.

– *Commodities* is a dummy variable that takes the value of 1 when the study uses a sample of firms using commodity derivatives and 0 otherwise.

– *All derivatives* is a dummy variable that takes the value of 1 when the study does not specify the nature of the derivatives they use for risk-hedging (i.e., foreign currency, interest and commodity), and 0 otherwise.

We use two classifications to study the country effect. The first one is based on the level of development of the country. More developed countries have more developed markets that facilitate access to derivatives and allow more efficient hedging. The second one is based on the country legal system. Allayannis *et al*. (2012) show the relationship between financial hedging and firm value is determined by country-specific external governance. According to their results, financial hedging enhances value for firms located in common law countries (La Porta *et al*., 1998, 2002), with strong shareholder protection and with strong creditors' rights. We consider the legal system of the country by using a dichotomous variable, *common law*, that is equals to 1 for firms located in common law countries, and 0 otherwise.

Allayannis et al. (2012) explain that without accounting for endogeneity, the hedging premiums might be biased. The sources of endogeneity could be reverse causality (i.e., firms with higher values use more financial hedging), and unobserved firm-, country- or industry-specific effects. To control for this issue, the variable *Endogeneity* is included in Equation 4. It is a dummy variable that takes the value of 1 when the empirical method used in the primary study control for the endogeneity problem and 0 otherwise. We consider that the use of two-step regressions, instrumental variable regressions and fixed effect models address the endogeneity issue. The descriptive statistics of the independent variables are shown in Table 4.

[Insert Table 4 about here]

5. Empirical analysis

Table 5 portrays the results of the Q statistic based on our sample of 51 studies that analyze the relationship between derivative use and firm value. As can be seen, the association is positive and significant for the overall sample, confirming the view that hedging leads to higher firm valuation. The significance of the Q–statistic does not allow assuming homogeneity in the sample. We divide the sample depending on the derivatives instrument used by firms to assess the nature of the relationship between (i) foreign currency hedging (*Foreign currency*), (ii) Commodities hedging (*Commodities*), and joint currency, interest and commodities hedging (*All derivatives*) and firm value. The results show that the hedging premium is statistically significant at the 1% (5%) threshold level for *Foreign currency* (*All derivatives* and *Commodities*)[4] variables. The Q statistic indicates heterogeneity in the sample for the foreign currency hedging and all hedging, but homogeneity can be assumed for the commodities hedging. The presence of heterogeneity in the primary papers that focus on currency and all hedging suggest that other moderators could determine firm value that hedge risks. However, homogeneity in the primary papers that analyze commodities hedging indicates that these studies show a similar result, namely, hedging commodities exposure increases the firm value and there is consensus in the previous research about this relationship.

[Insert Table 5 about here]

The division of the sample by country shows that the positive association between hedging and firm value is maintained in all cases, but the relationship is statistically stronger for common law and developed countries compared to civil law an developing countries. The homogeneity test indicates that all samples by countries are not homogenous.

[Insert Table 6 about here]

The meta-regression analysis where the dependent variable is Fisher's Z transformation of the correlation coefficient and the independent variables are derivative kind (*Foreign currency/All derivatives*), country (*Common Law*), the level of development (*Developed*), and endogeneity (*Endogeneity*) are shown in Table 6.

[4] The perspective provided by meta-analysis seeks to find moderators that determine the relationship between variables and allow us to reconsider the anomalies, mixed results and gaps in previous research. Therefore, the notion of homogeneity/heterogeneity of results is the starting point for applying this approach.

The results show a positive and significant coefficient for the variable *Foreign currency* in models 1 and 2, which means that this variable is directly correlated with firm value. The currency hedging increases firm value, measured by Q Tobin. A significant positive value effect is found when firms use all kinds of derivatives (*All derivatives*) to hedge risks (models 3 and 4). So, it can be concluded that hedging exposure has a positive effect on firm value both in currency risks and all risks. As for the country variables, the coefficients of *Common Law* in models 1 and 3 show that firms in common law countries benefit from hedging. This relationship is positive and statistically significant in both models (i.e., currency and joint hedging) The coefficients of *Developed* are positive and statistically significant in models 2 and 4 at the 1% threshold, indicating that country development is relevant for hedging purposes and that the financial hedging premium can be explained by the country characteristics, i.e., the legal, economic and financial environment. The distinction by countries helps to clarify the circumstances under which derivatives hedging is most valuable and our results also allow concluding that hedging impact on firm value is determined by legal, economic and financial country characteristics. This study asserts that there are significant differences between the hedging premium of companies that operate in common law and developed countries and other countries. It can be observed that companies improve their firm value after hedging; but if the country has a common law system and is developed, the benefit will be higher. Developed countries has a more satisfactory corporate governance system, which generally involves changing a nation's corporate and securities laws, strengthening the disclosure requirements, enhancing the independence and competence of the national judiciary and establishing a regulatory regime capable of balancing the competing claims of managers and outside shareholders. The control for endogeneity bias (*Endogeneity*) has a positive impact on the estimated hedging premium, suggesting that studies controlling for endogeneity bias in the relation between financial hedging and firm value exhibit higher hedging premiums.

6. Conclusions

The relevance of the use of corporate hedging is one of the most discussed economic topics in corporate finance (Geyer-Klingeberg *et al.*, 2019). There is up to now no consensus about the relationship between hedging and firm value; findings are mixed and do not allow clear-cut conclusions. The lack of consistent evidence in the empirical hedging literature might be explained by several factors, including, data (time

period and nature of risk), model specifications, methodologies and country specificities.

This study performs a meta-analysis of 122,107 estimates from of 51 empirical studies about the relationship between financial hedging and firm value. The methodology allows to quantitatively generalize results by identifying the factors that influence this relationship and detecting divergences between prior empirical results. It also identifies the conditions that make hedging lead to higher valuation and unifies prior conflicting results. After controlling for publication bias and endogeneity, our results show that derivatives use increases firm value. They also show that the hedging premium is significant but depends on the nature of the derivative product. Additional analyzes show that the use of derivatives is more valuable in common law and developed countries.

This paper provides users with valuable information for policy makers, regulators, shareholders, and other stakeholders alike as it provides them with information regarding the effect of derivative use on firm value. As stated by Bartram (2019), this kind of study "*is consistent with the assertions of some policy makers that derivatives could be important in limiting the severity of economic downturns in developing economies with typically fewer liquid derivatives markets.*" More research is needed to improve our understanding about the hedging strategies pre and post financial crisis. Many studies have analyzed hedging practices in both periods without distinguishing the role of derivatives before and after the crisis.

References

Adam T. R., Fernando, C.S., Salas J. M., 2017. Why do firms engage in selective hedging? Evidence from the gold mining industry, Journal of Banking and Finance, 77, 269–282.

Alkebäck P., Hagelin A., 1999. Derivative usage by nonfinancial firms in Sweden with an international comparison. Journal of International Financial Management and Accounting 10(2), 105–120.

Aretz, K., Bartram, S. M. (2010). Corporate hedging and shareholder value. Journal of Financial Research*, 23*(4), 317of Fi

Arnold, M. M., Rathgeber, A. M., Stockl, S. (2014). Determinants of corporate hedging: A (statistical) meta-analysis. Quarterly Review of Economics and Finance, *54*(4), 443,terl

Bachiller, P., 2017. A meta-analysis of the impact of privatization on firm performance, Management Decision 55 (1), 178–202.

Bartram, S.M., 2019. Corporate hedging and speculation with derivatives. Journal of Corporate Finance 57, 9–34.

Bessembinder, H., 1991. Forward contracts and firm value: investment incentive and contracting effects. Journal of Financial and Quantitative Analysis 26, 519–532.

Claessens S., Demirguc-Kunt A., Huizinga H., 2001. How does foreign entry affect domestic banking markets? Journal of Banking and Finance 25, 891–911

Copeland, T. E., Yash J., 1996. "Why derivatives don't reduce FX risk". The McKinsey Quarterly, Winter 66.

Damanpour, F., 1991.Organizational innovation: A meta-analysis of effects of determinants and moderators. Academy of Management Journal 34, 555–590.

Datta, D. K., George E. P., V. K. Narayanan., 1992. Factors influencing wealth creation from mergers and acquisitions: A meta-analysis. Strategic Management Journal 13, 67–84

DeMarzo, P., Duffie, D., 1995. Corporate incentives for hedging and hedge accounting. Review of Financial Studies 8 (3), 743–771.

Dykes, B. J., Kolev, D., 2018, Entry timing in foreign markets: A meta-analytic review and critique, Journal of International Management 24 (4), 404–416.

Froot, K.A., Scharfstein, D.S., Stein, J.C., 1993. Risk management: coordinating corporate investment and financing policies. Journal of Finance 48 (5), 1629–1658.

García-Meca, E., Sánchez-Ballesta, J.P., 2010. The association of board independence and ownership concentration with voluntary disclosure, a meta-analysis, European Accounting Review 19 (3), 603–627.

Geyer–Klingeberg, J., Hang, M., Rathgeber, A.W., 2019. What drives financial hedging? A meta-regression analysis of corporate hedging determinants". International Review of Financial Analysis, 61, 203–221

Gooding, R. Z., Wagner, J. A., 1985. A meta-analytic review of the relationship between size and performance: The productivity and efficiency of organizations and their subunits. Administrative Science Quarterly 30*(4*), 462–481.

Graham, J.R., Rogers, D.A., 2002. Do firms hedge in response to tax incentives?, Journal of Finance 57, 815–839.

Hagelin, N., B. Pramborg., 2004. Hedging foreign exchange exposure: Risk reduction from transaction and translation hedging, Journal of International Financial Management and Accounting,15, 1–20.

Hunter, J.E., Schmidt, F.L., 1990. Methods of meta-analysis: Correcting error and bias in research findings, Sage, Beverly Hills, CA.

Jacque (2015), "Global derivatives debacles: From Theory to Malpractice", World Scientific, 2nd Edition.

Knopf, J. D., J. Nam., J. H. Thornton Jr., 2002. The volatility and price sensitivities of managerial stock option portfolios and corporate hedging, Journal of Finance 57, 801–814.

Kuzmina, O., Kuznetsova, O., 2018. Operational and financial hedging: Evidence from export and import behavior, Journal of Corporate finance 48, 109–121

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1997. Legal determinants of external finance. Journal of Finance 52, 1131–1150

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 1998. Law and finance, Journal of Political Economy 106, 1113–55.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 2002. Investor protection and corporate valuation, Journal of Finance 57, 1147–70.

Leland, H., 1998. Agency costs, risk management, and capital structure. Journal of Finance 53 (4), 1213–1243.

Miller, M. H., Modigliani, F., 1961. Dividend policy, growth, and the valuation of shares, Journal of Business 34, 411–433

Modigliani, F., Miller, M.H., 1958. The cost of capital, corporation finance and the theory of investment, American Economic Review 48, 261–297

Ross, S.A., 1997. The Determination of Financial Structure: The incentive-signaling approach, The Bell Journal of Economics 8(1), 23–40

Smith, C.W., Stulz, R.M., 1985. The determinants of firms' hedging policies. Journal of Financial Quantitative Analysis 20 (4), 391–405.

Stanley, T.D., Doucouliagos, H., 2010. Picture this: a simple graph that reveals much ado about research, Journal of Economic Surveys 24 (1), 170–191.

Stulz, R.M., 1996. Rethinking risk management. Journal of Applied Corporate Finance 9, 8–24.

Tufano, P., 1996. Who manages risk? An empirical examination of risk management practices in the gold mining industry, Journal of Finance 51, 1097–1137.

Tufano, P., 1998. Agency costs of corporate risk management, Financial Management 27, 67–77.

Studies used in the meta-analysis

1. Ahmed, H., Azevedo, A., Guney, Yilmaz., 2014, The effect of hedging on firm value and performance: Evidence from the nonfinancial UK firms. Available at: http://www.reserachgate.com.

2. Alam, N., Gupta, A., 2018. Does hedging enhance firm value in good and bad times, International Journal of Accounting and Information Management 26 (1), 132–52.
3. Allayannis, G. S., Weston, J. P., 1998. The use of foreign currency derivatives and firm market value, SSRN Electronic Journal. 14 (1), 243–76.
4. Allayannis, G., Lel, U., Miller, D. P., 2012. The use of foreign currency derivatives, corporate governance, and firm value around the world, Journal of International Economics 87 (1), 65–79.
5. Ayturk, Y., Gurbuz, A. O., Yanik, S., 2016. Corporate derivatives use and firm value: Evidence from Turkey, Borsa Istanbul Review 16 (2), 108–20.
6. Bae, S. C., Kim, H. S., Kwon, T. H., 2018. Currency derivatives for hedging: New evidence on determinants, firm risk, and performance, Journal of Futures Markets 38 (4), 446–67.
7. Bashir, H., Sultan, K., Jghef, O., 2013. Impact of derivatives usage on firm value: Evidence from non-financial firms of Pakistan, Journal of Management Research 5 (4), 108–28.
8. Belghitar, Y., Clark, E., Mefteh, S., 2013. Foreign currency derivative use and shareholder value, International Review of Financial Analysis 29, 283–93.
9. Belghitar, Y., Clark, E., Judge, A., 2008. The value effects of foreign currency and interest rate hedging: the UK evidence. International Journal of Business 13 (1), 43–60.
10. Berrospide, J. M., Purnanandam, A., Rajan, U., 2008. Divisions of research & statistics and monetary affairs corporate hedging, investment and value, Advance Access published.
11. Berrospide, J. M., Purnanandam, A. K., Rajan, U., 2010. Corporate hedging, investment and value, SSRN Electronic Journal, 202, Advance Access published 2010: doi:10.2139/ssrn.1009657.
12. Bielmeier, T., 2013. The value of foreign currency hedging: A study on the German market. Lund University Publications
13. Carter, D. A, Rogers, D. A., Simkins, B. J., 2006. Does hedging affect firm value? Evidence from the US airline industry, Financial Management 35, 53–86.
14. Chou, S., Lai, C.-H., 2013. Overconfident CEOs, hedging and performance. Working Paper at National Yunlin University of Science & Technology.
15. Clark, E., Judge, A., 2009. Foreign currency derivatives versus foreign currency debt and the hedging premium, European Financial Management 15 (3), 606–42.
16. Clark, E., Mefteh, S., 2010. Foreign currency derivatives use, firm value and the effect of the exposure profile: Evidence from France, International Journal of Business 15 (2), 183–96.
17. Dos Santos, R. B., Lima, F. G., Gatsios, R. C., de Almeida, R. B., 2017. Risk management and value creation: new evidence for Brazilian non-financial companies, Applied Economics 49 (58), 5815–27.
18. Fauver, L., Naranjo, A., 2010. Derivative usage and firm value: The influence of agency costs and monitoring problems, Journal of Corporate Finance 16 (5), 719–35.

19. Giraldo-Prieto, C. A., González Uribe, G. J., Vesga Bermejo, C., and Ferreira Herrera, D. C., 2017. Financial hedging with derivatives and its impact on the Colombian market value for listed companies, Contaduría y Administración 62 (5), 1572–1590.
20. Gleason, K. C., Kim, Y. S., Mathur, I., 2005. The operational and financial hedging strategies of U.S. high technology firms, Advance Access published.
21. Gómez-González, J. E., León Rincón, C. E., Leiton Rodríguez, K. J., 2012. Does the use of foreign currency derivatives affect firms' market value? Evidence from Colombia, Emerging Markets Finance and Trade 48 (4), 50–66.
22. Hagelin, N., Holmen, M., Knopf, J., Pramborg, B., 2007. Managerial stock options and the hedging premium, European Financial Management 13, 721–41
23. Iqbal, N., Saqib, M., Mehmood, A., 2014. Dynamics of derivatives usage and firm's value, Wulfenia Journal. 21 (6), 122–40.
24. Jankensgård, H., 2015. Does centralisation of FX derivative usage impact firm value? European Financial Management 21 (2), 309–32.
25. Jin, Y., Jorion, P., 2006. Firm value and hedging: Evidence from U.S. oil and gas producers, Journal of Finance 61 (2), 893–919.
26. Kapitsinas, S. K., 2008. The impact of derivatives usage on firm value: Evidence from Greece, 10947, Advance Access published 2008.
27. Khediri, K. Ben, 2010. Do investors really value derivatives use? Empirical evidence from France, The Journal of Risk Finance, 11 (1), 62–74.
28. Khediri, K. Ben, Folus, D., 2010. Does hedging increase firm value? Evidence from French firms, Applied Economics Letters 17 (10), 995–98.
29. Kim, Y. S., Mathur, I., Nam, J., 2006. Is operational hedging a substitute for or a complement to financial hedging? Journal of Corporate Finance 12 (4), 834–853.
30. Kim, H. T., Papanastassiou, M., Nguyen, Q., 2017. Multinationals and the impact of corruption on financial derivatives use and firm value: Evidence from East Asia, Journal of Multinational Financial Management 39, 39–59.
31. Korkeamäki, T., Liljeblom, E., Pfister, M., 2016. Airline fuel hedging and management ownership, Journal of Risk Finance 17 (5), 492–509.
32. Lau, C. K., 2016. How corporate derivatives use impact firm performance?, Pacific-Basin Finance Journal 40, 102–14.
33. Li, H., Visaltanachoti, N., Luo, R. H., 2014. Foreign currency derivatives and firm value: Evidence from New Zealand, Journal of Financial Risk Management 3, 96–112.
34. Lin, R., Chang, Y., 2009. Does hedging add value? Evidence from the global airline industry, SSRN Electronic Journal, Advance Access published 2009: doi:10.2139/ssrn.1342850.
35. Lookman, A. A., 2004. Does hedging really increase firm value? Evidence from oil and gas producing firms, Paper presented at European Finance Association Annual Meeting 2004, Maastricht
36. Luo, R. H., 2016. Foreign currency derivatives and corporate value: Evidence from China, Proceedings of the Australia-Middle East Conference on Business and Social Sciences, 117–26.

37. Luo, H., Wang, R., 2018. Foreign currency risk hedging and firm value in China, Journal of Multinational Financial Management 47, 129–143.
38. Mefteh-wali, S., Rigobert, M., 2018. The dual nature of foreign currency debt and its impact on firm performance: Evidence from French non-financial firms, Management International 33, 1–26.
39. Moeller, S. B., MacKay, P., 2006. The value of corporate risk management, SSRN Electronic Journal 62 (3), 1379–1419.
40. Nguyen, H., Faff, R., 2010. Does the type of derivative instrument used by companies impact firm value?, Applied Economics Letters 17 (7), 681–83.
41. Nova, M., Cerqueira, A., Brandão, E., 2015. Hedging with derivatives and firm value: Evidence for the non-financial firms listed on the London Stock Exchange. FEP Working Papers 568, Universidade do Porto, Faculdade de Economia do Porto.
42. Panaretou, A., 2014. Corporate risk management and firm value: evidence from the UK market, The European Journal of Finance 20 (12), 1161–86.
43. Phan, D., Nguyen, H., Faff, R., 2014. Uncovering the asymmetric linkage between financial derivatives and firm value - The case of oil and gas exploration and production companies, Energy Economics 45, 340–52.
44. Pramborg, B., 2004. Derivatives hedging, geographical diversification, and firm market value, Journal of Multinational Financial Management 14 (2), 117–33.
45. Rossi Júnior, J. L., Laham, J., 2008. The impact of hedging on firm value: Evidence from Brazil, Journal of International Finance and Economics 8 (1), 76–91.
46. Senol, Z; Karaca, S.S., Erdogan, S., 2017. The effects of financial risk management on firm's value: An empirical evidence from Borsa Istanbul Stock Exchange, Financial Studies 21 (4), 27–45.
47. Treanor, S. D., Carter, D. A., Rogers, D. A., Simkins, B. J., 2013. Operational and financial hedging: Friend or Foe? Evidence from the U.S. airline industry, Journal of Accounting and Finance 13 (6), 64–91.
48. Treanor, S. D., Rogers, D. A., Carter, D. A., Simkins, B. J., 2014. Exposure, hedging, and value: New evidence from the U.S. airline industry, International Review of Financial Analysis 34 (C), 200–211.
49. Vivel Búa, M., Otero González, L., Fernández López, S., Durán Santomil, P., 2015. Is value creation consistent with currency hedging?, The European Journal of Finance 21 (10), 912–45.
50. Zhang, M., 2013. Foreign exchange risk hedging and firm value: Empirical study from MNCs in China, Tilburg University.
51. Zhou H., Wang L., Wu J., 2012, Impacts of derivatives on firms' value: Empirical results from Chinese companies. In: Mao E., Xu L., Tian W. (eds) Emerging Computation and Information Technologies for Education. Advances in Intelligent and Soft Computing, 146. Springer, Berlin, Heidelberg.

Tables

Table 1: Main characteristics of sample studies

Study	P/WP	Period	Type of derivatives	Country	Number of firms	Number of firms–years obs.	Methodology
1	WP	2005–2012	Foreign currency	United Kingdom	288	2304	OLS, 2SLS, GMM
2	P	2008–2015	Foreign currency	India	129	904	OLS
3	P	1990–1995	Foreign currency	United States	720	1296	OLS
4	P	1990–1999	Foreign currency	Several	372	492	OLS
5	P	2007–2013	All derivatives	Turkey	204	1161	GMM
6	P	2005–2010	Foreign currency	Korea	886	886	OLS
7	P	2006–2010	All derivatives	Pakistan	107	536	FE
8	P	2002–2005	Foreign currency	France	211	239	OLS
9	P	1995	Foreign currency	United Kingdom	412	285	OLS
10	WP	1997–2004	Foreign currency	Brazil	167	1024	OLS
11	WP	1997–2005	Foreign currency	Brazil	350	1132	OLS
12	WP	2007–2010	Foreign currency	Germany	137	343	OLS
13	P	1992–2003	Foreign currency	United States	26	228	FE
14	WP	2005–2010	Foreign currency	United States	125	414	OLS, 2SLS, FE
15	P	1995	Foreign currency	United Kingdom	412	307	GMM
16	P	2004	Foreign currency	France	176	101	OLS
17	P	2006–2014	All derivatives	Brazil	282	1794	OLS
26	WP	2004–2006	All derivatives	Greece	81	244	2SLS
27	P	2000–2002	Foreign currency	France	250	731	RE
28	P	2001	All derivatives	France	320	320	GMM
29	P	1998	Foreign currency	United States	424	424	OLS
30	P	2003–2013	All derivatives	East Asia	881	9692	OLS
31	P	2005–2015	Commodities (fuel)	United States	26	260	GMM
32	P	2003–2012	All derivatives	Malaysa	364	2255	OLS
33	P	2007	Foreign currency	New Zealand	134	134	OLS
34	WP	1995–2005	Foreign currency	Several	69	208	OLS
35	WP	1999–2000	Commodities (oil)	United States	125	198	OLS
36	WP	2007–2013	Foreign currency	China	30	810	OLS
37	P	2000–2013	Foreign currency	China	2629	70000	OLS, 2SLS, RE
38	P	1985–2004	All derivatives	United States	31	2145	GMM
39	P	2002–2012	Foreign currency	France	115	422	FE
40	P	1999–2000	Foreign currency	Australia	428	428	OLS
41	WP	2005–2013	Foreign currency	United Kingdom	130	712	OLS, 2SLS
42	P	2003–2010	Foreign currency	United Kingdom	186	995	OLS

18	P	1991–2000	All derivatives	United States	1746	8191	OLS, 2SLS	43	P	1998–2009	Foreign currency	United States	94	736	RE, FE
19	P	2008–2014	Foreign currency	Colombia	39	975	OLS	44	P	1997–2001	Foreign currency	Sweden	128	390	OLS
20	WP	1998	Foreign currency	United States	216	424	OLS	45	WP	1996–2005	Foreign currency	Brazil	212	518	FE
21	P	1995–2008	Foreign currency	Colombia	81	4536	OLS	46	P	2008–2015	All derivatives	Turkey	31	248	FE
22	P	1997–2001	Foreign currency	Sweden	275	308	FE	47	P	1996–2006	Foreign currency	United States	1	238	RE
23	P	2007–2011	Foreign currency	Pakistan	75	375	OLS	48	P	1994–2008	Commodities (fuel)	United States	29	288	RE
24	P	2009	Foreign currency	Sweden	207	192	GMM	49	P	2004–2007	Foreign currency	Spain	94	331	FE, RE
25	P	1998–2001	Commodities (oil)	United States	119	324	OLS	50	WP	2007–2012	Foreign currency	China	97	480	OLS
								51	WP	2007–2010	Foreign currency	China	119	129	OLS
Overall		*1985–2015*		*18 countries*	*14,790*	*122,107*	*6 methods*								

P: published; WP: working paper.
Methodology: OLS: Ordinary Least Squares regression; 2SLS: Two–Stage least squares regression; FE: Fixed effect model; RE: Random effect model, GMM: generalized method of moments.
The papers listed in this table are provided with the same order in the references list.

Table 2: Test of the publication selection bias (The funnel asymmetry test)

Constant	1.603***
	(0.000)
1/SE	0.06***
	(0.000)
Number of observations	463
R^2	0.039

Notes: Dependent variable is estimated effect size measured as *t–value* of the relationships between Tobin's Q (or its natural logarithm) and hedging in the studies included in the meta–analysis. P–values are in parentheses. SE is standard Error. *** denotes statistical significance at the 1% level

Table 3: Descriptive statistics of *r* value for the relationship between derivatives use and firm value

	Number of estimates	Minimum	Maximum	Mean	Standard deviation
Overall sample	51	–0.10	0.36	0.08	0.09
Foreign currency	38	–0.10	0.31	0.08	0.08
All derivatives	9	–0.03	0.36	0.12	0.14
Commodities	4	–0.02	0.10	0.06	0.06
Country					
Common law countries	22	–0.07	0.36	0.09	0.11
Civil law countries	27	–0.10	0.31	0.07	0.08
Many countries	2	0.16	0.17	0.16	0.01
Developed countries	31	–0.10	0.31	0.06	0.09
Developing countries	20	0.01	0.36	0.09	0.09

Table 4: Descriptive statistics of the independent variables

	Independent variables	Category	Number of Observations
Derivatives	Foreign currency	Studies analyze currency derivatives use	345
		Otherwise	118
	All derivatives	Studies analyze foreign, commodities and interest derivatives use	73
		otherwise	390
	Commodities	Studies analyze commodities derivatives use	45
		Otherwise	418
Country	Common law countries	Studies analyze companies from common law countries	181
		Otherwise	285
	Civil law countries	Studies analyze companies from civil law countries	196
		Otherwise	267
	Many countries	Studies analyze companies from several countries	86
		Otherwise	377
	Developed countries	Studies analyze companies from developed countries	338
		Otherwise	125
	Developing countries	Studies analyze companies from developing countries	125
		Otherwise	338

Table 5: Meta–analysis for derivatives use-firm value relationship

Variable	Sample	Effect sizes	– r	$\%S_e^2/S_r^2$	Conf. interval (95%) Min	Max	Q–statistic
Overall sample	85,072	51	0.045**	12.66%	0.035	0.055	402.794***
Subgroups by hedging product							
- Foreign currency	66,894	38	0.040***	42.79%	0.034	0.046	88.801***
- All derivatives	17,108	9	0.062**	3.14%	0.013	0.082	318.008***
- Commodities	1,070	4	0.061**	134.90%	0.035	0.088	2.965
Subgroups by zone							
- Common law countries	61,343	22	0.039***	46.11%	0.033	0.045	58.559***
- Civil law countries	958	27	0.168*	12.93%	0.081	0.257	15.471***
- Many countries	22770	2	0.055**	6.67%	0.030	0.081	329.968***
- Developed	23,951	31	0.098***	22.98%	–0.085	0.112	134.900***
- Developing	31,120	20	0.053**	7.40%	–0.038	0.067	270.385***

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

 is the mean correlation coefficient. Se^2 is the sampling error variance. Sr^2 is the total observed variance. This table shows the Hunter and Schmidt (1990) meta–analysis. Where Q–statistic is calculated as $N*S_e^2 / (1 -)^2$

Table 6: Results of meta–analysis for effect sizes Using Fischer's z transformation

	Model 1	Model 2	Model 3	Model 4
Foreign currency	**0.298*** (0.000)**	**0.124* (0.065)**		
All countries			**0.224*** (0.000)**	**0.225*** (0.000)**
Common law countries	**0.077 (0.098)***		**0.132*** (0.003)**	
Developed countries		**0.283*** (0.000)**		**0.351*** (0.000)**
Endogeneity	**0.163*** (0.001)**	**0.147*** (0.003)**	**0.239*** (0.000)**	**0.110*** (0.021)**
F–value	39.470***	46.526***	37.068***	57.307***
R^2 corrected	0.200	0.228	0.189	0.267

This table shows estimated coefficients of the multivariate regression (in brackets, p value). The dependent variable is Fisher's Z transformation of the correlation coefficient. Foreign currency is a dummy variable that takes the value of 1 when the study uses a sample of firms using foreign currency derivatives and 0 otherwise. All is a dummy variable that takes the value of 1 when the study uses a sample of firms that use derivatives without any specification about risk hedged (Foreign currency, interest and commodity) and 0 otherwise. Common Law is dummy variable that takes the value of 1 when firms studied on a paper are located in common law countries and 0 otherwise. Endogeneity is a dummy variable that takes the value of 1 when the methodology used in the primary study deals with the endogeneity problem and 0 otherwise. Number of observations: 463. Number of studies: 51.

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.