

Determinants of Corporate Hedging: Evidence from Emerging Market

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Abstract

The main purpose of this study is to understand the determinants of corporate hedging in emerging markets. The dependent variable, hedging, is estimated by a categorical variable. This process necessitates the usage of logistic regression. The analysis is conducted using data from non-financial companies listed in Borsa Istanbul (BIST) between 2010 and 2014. Evidence reveals that the cost of underinvestment has the highest impact on the likelihood of hedging. Firms with higher cost of underinvestment are more likely to use financial derivatives. The second most important determinant of hedging is growth opportunities. Interestingly, firms with greater growth opportunities are less likely to use derivatives in emerging markets. Results indicate that firm size, foreign sales, profitability, and dividend yield are the other predictors that increase the likelihood of hedging. On the other hand, growth opportunities, free-float rate, interest coverage ratio, and leverage have a negative relationship with the possibility of using financial derivatives.

Keywords: hedging, financial distress, underinvestment, information asymmetry, hedging substitutes, logistic regression

1. Introduction

In a perfect market, the irrelevance propositions of Modigliani and Miller imply that hedging does not increase firm value. Thus, risk management is irrelevant. There is no information asymmetry, transaction costs or taxes in perfect capital markets. Investors can use the information and financial investment tools to diversify their portfolio risk with the same cost as firms do, for the reduction of risk. In other words, shareholders can reduce their risk by holding well-diversified portfolios with the same cost as firms can. On the other hand, when the market is not perfect, it will be more costly for individual investors to diversify their risk. So, shareholders prefer their firm to diversify risk on behalf of them.

Market imperfections force the corporation to hedge investment risk and to reduce the volatility of corporate earnings and cash flows. Many studies analyze why firms hedge and which market imperfections make firms to hedge. Mayers and Smith (1982), mentioned seven possible explanations for corporate hedging: the comparative advantage of risk bearing, lower expected transactions cost of bankruptcy, providing real service efficiencies, monitoring, bonding investment decisions, lowering the expected tax liabilities and reducing regulatory costs. However, in this study, Mayers and Smith (1982) did not provide any empirical support for the aforementioned possible reasons for corporate hedging. On their later work, Mayers and Smith (1990) examined the reinsurance market and found strong evidence for the effect of ownership structure, size, geographic concentration and line-of-business concentration on the demand for reinsurance by insurance companies.

In the literature, many theories based on market imperfections try to explain possible reasons for corporate demand for hedging. Managers' risk aversion, minimizing expected tax liabilities, reducing some costs such as financial distress cost, underinvestment costs and decreasing information asymmetry between shareholders and managers are some of the determinants of firm off-balance-sheet derivative usage. In fact, Mayers and Smith (1982) argued that hedging increases firm value through reducing financing costs.

The main purpose of this study is to understand the determinants, in the emerging markets, of firms' desire to hedge their positions. Hedging and firm value are closely related, and in fact, hedging increases firm value (e.g. Allayannis, Lel, & Miller, 2012; Carter, Rogers, & Simkins, 2006; Allayannis & Weston, 2001). Indeed, Allayannis et al. (2012) analyze the effect of hedging on firm value for thirty-nine countries, and find a significant value premium for hedgers. When considered from this point of view, exploring the determinants of

hedging in emerging markets help us understand the value enhancing strategies of firms better. It is a fact that, there are many studies in the literature on the hedging determinants of firms in developed countries. However, in the emerging economies, derivatives markets are not as deep as the ones in the developed countries. Moreover, firms in emerging markets are not so familiar with the financial derivatives as it is a new concept for almost all emerging market countries. For instance, as an advanced emerging market example, in Turkey, the Derivatives Market (VIOP) was established in 2002 whereas, in Japan, rice futures market was established in 1688 and in the USA, modern commodity futures market began in 1848 (Jarrow & Chatterjea, 2013). In fact, after 1970s, a new era started with the usage of financial derivatives in order to protect against the exchange and interest rate swings and, soon afterwards, trading volume in the derivatives market of Chicago Board of Trade exceeded the trading volume in New York Stock Exchange (Jarrow & Chatterjea, 2013). In this respect, the development level of the economies may induce different hedging determinants for their firms. This paper aims to contribute to the literature along two dimensions. First, the hedging determinants of firms in an emerging market, Turkey, will be explored with a panel data set in which hedging information is handily available. Second, the well-known hedging determinant, information asymmetry, is estimated with three different proxies: domestic institutional ownership, foreign ownership and free-float rate. The main logic for using three different information asymmetry proxies is that, in emerging markets, the most commonly used information asymmetry proxy, institutional ownership, is not as important as it is in developed economies. In emerging markets, foreign ownership and transparency to the stock market are more significant information asymmetry proxies.

This paper is organized as follows. Section 2 reviews the related literature on corporate hedging. Section 3 describes the data, variables and the analysis method utilized to explore hedging determinants. Section 4 presents the results of the analysis; and Section 5 concludes.

2. Literature Review

Based on related literature on corporate hedging, tax incentives, expected cost of financial distress, underinvestment costs, managerial risk aversion and information asymmetry between shareholders and managers are the well-known market imperfections that force firms to use derivatives to hedge their investment risks.

Smith and Stulz (1985) argued that the structure of tax code makes hedging an advantageous strategy for firms. They claimed that reducing the variability of the pre-tax value of a firm (via hedging) reduces the expected tax liability and increases the expected post-tax value of a firm. It is argued that the expected tax liability is reduced if the firm's tax function is convex. The convexity is made possible by a statutory progressive tax schedule, such as the one in the U.S. tax code of the USA. Without progressiveness, firms have no tax incentive to hedge as they do not have the ability to appreciate tax preference items (Graham & Rogers, 1999). Many empirical studies try to measure the convexity of tax function of U.S. firms, which face a progressive corporate tax code. Note that not all firms have a convex tax function in countries with a statutory progressive tax schedule. In fact, Graham and Smith (1999) analyzed a large sample of U.S. firms and found that 25% of the firms in the sample had concave tax functions. Moreover, Graham and Rogers (1999) criticized previous empirical studies that tried to measure the firm's tax function convexity as they use a variable based on existing net-operation-loss carry forwards. This variable, they claim is too simple to capture tax incentives.

Although, it is considered that tax function convexity together with a progressive tax code make hedging an advantageous strategy since it increases the firm value, empirical findings do not strongly support this thesis. Using a proper measure of tax function convexity, Graham and Rogers (2002) analyzed whether firms hedge in response to tax incentives, and find no empirical support for that. Similarly, the study, in which Geczy, Minton and Schrand (1997) attempted to find an answer to why firms use currency derivatives, does not support the progressive tax code incentive theory. Arnold, Rathgeber and Stöckl (2014) used a different method, a meta-analysis, to explore the hedging determinants and find no explanatory power of tax codes. Moreover, Fok, Carroll and Chiou (1997) do not find any evidence that proves the existence of a value increasing effect of any form of hedging that causes a reduction in expected tax liability. In addition to the lack of sufficient evidence to support the hypothesis that hedging increases firm value by reducing the expected tax liability, in Turkey, the tax code is not even statutory progressive. That is the necessity assumption of the hypothesis, i.e. having a progressive tax code, is not valid in Turkey. Therefore, in this study, a tax function is not utilized as a determinant of hedging.

In addition to reducing the expected tax liabilities, increasing debt capacity is the second possible hedging reason for firms. Leland (1998) showed that hedging reduces income volatility, a risk factor. Due to the reduced risk, the firms' optimal leverage, i.e., debt capacity is increased. Higher leverage allows a firm to benefit from increased tax deductions due to higher interest payments. Moreover, the unused portion of debt capacity leads to lower

distress costs. Thus, hedging increases firm value. In fact, the findings of Graham and Rogers (2002) support the hypothesis that firms do hedge in response to the incentive of increased debt capacity. On the other hand, Dionne and Triki (2013) develop a model in which leverage and hedging decisions are made simultaneously. According to their findings, firms do not hedge to increase their debt capacity (Dionne & Triki, 2013).

Based on hedging literature, another well-known hedging determinant is financial distress costs. Financial distress firms have difficulty meeting their financial obligations. In fact, these firms have to incur the cost of using expensive borrowing, losing some investment opportunities and possibly, working with less qualified employees. Mayers and Smith (1982) argue that firms try to shift their risk to insurance companies through buying insurance in order to lower the probability of incurring bankruptcy costs. Moreover, Smith and Stulz (1985) claim that market creates two incentives for shareholders to hedge: reputation and reducing the cost of financial distress. According to their hypothesis, hedging creates a reputation in the bond market which causes an increase in the price of new debt and, so, firms that frequently need to borrow can benefit from this reputation. Also, hedging reduces the probability of financial distress by reducing the volatility of accounting earnings (Smith & Stulz, 1985). Therefore, financial distress costs cause firms to hedge (Nance, Smith, & Smithson, 1993; Mian, 1996; Geczy et al., 1997; Fok et al., 1997; Graham & Rogers, 1999, 2002; Dionne & Triki, 2013; Dionne & Triki, 2013; Arnold et al., 2014).

Although, bankruptcy costs are a small fraction of large firms' assets, these costs are sufficient to cause these firms to hedge. In fact, transaction costs of bankruptcy are inversely proportional to firm size (Warner, 1977). In other words, the expected amount of reduction in bankruptcy costs for small firms is larger than it is for large firms (Smith & Stulz, 1985). Following this study, many researchers started utilizing size as a proxy for financial distress and predict that small firms are more likely to hedge in order to reduce financial distress (e.g. Nance, Smith, & Smithson, 1993; Mian, 1996). Leverage and interest coverage ratios are used as a measure of probability of financial distress in this study as in Geczy et al. (1997), and in Aretz and Bartram (2009). Debt ratio is used in many studies as a proxy for the probability of financial distress, and a positive relationship between debt ratio and hedging is established (Graham & Rogers, 1999, 2002; Fok et al., 1997; Dionne & Triki, 2013).

In addition to the aforementioned reasons for hedging, the underinvestment cost is another driving force that pushes companies to hedge. As Myers and Majluf (1984) state, there is a conflict of interest between bondholders and shareholders. Myers (1977) shows that managers acting in the interest of shareholders can forego positive net present projects in case bondholders get the large fraction of the cash flow from the investment. In other words, with risky debt outstanding, value-increasing investment opportunities may well be foregone because of the ensuring wealth transfer from shareholders to bondholders. Naturally, there is a cost related to underinvesting. Myers (1977) calls this cost the "underinvestment problem". Bondholders want the firm to invest in the project, but shareholders oppose it. This incentive problem can be controlled by hedging through derivatives (Mayers & Smith, 1987). Following Mayers and Smith (1987), many studies on hedging utilizes the underinvestment cost as a determinant for hedging (e.g. Mayers & Smith, 1990; Nance et al., 1993; Mian, 1996; Fok et al., 1997; Geczy, et al., 1997; Graham & Roger, 2002; Arnold et al., 2014). Firms with valuable investment opportunities suffer from underinvestment problem more seriously. So, it is necessary to use a proxy that captures the investment opportunity set. Although, there is a general consensus of the effect of underinvestment cost on the hedging decision, the empirical findings are contradictory. Using market-to-book ratio as the growth opportunities of a firm, Mian (1996) finds a negative relation between underinvestment possibility and hedging decision. However, Nance, Smith and Smithson (1993), Geczy, Minton and Schrand (1997) find a positive relationship between growth opportunities of a firm and derivative usage by using research and development expenditures as a proxy for growth opportunities.

In line with the approach of Geczy et al. (1997), in this study, plant, property and equipment (PP&E) scaled by firm size is used as a proxy for growth opportunities. Moreover, in order to capture the underinvestment cost, the interaction between growth opportunities and debt ratio is included as in Geczy et al. (1997), Graham and Rogers (2002). The ratio of PP&E to size is the proxy for growth opportunities whereas the interaction term is the proxy for the cost of underinvestment. The other commonly used growth opportunity proxy, market-to-book ratio is not used in this paper as our preliminary multicollinearity analysis indicated that the market-to-book ratio had a multicollinearity problem with the other independent variables used in the analysis. Although there are conflicting findings on the relationship between underinvestment cost and hedging possibility in the literature, it is expected that, in this study, both growth opportunities and underinvestment cost, shall have a positive effect on the possibility of hedging.

In line with the literature, another market imperfection that forces firms to hedge is the information asymmetry.

In a perfect market with information symmetry, hedging does not affect a firm's value since shareholders can easily diversify their own portfolio risk. But, when managers have private information that shareholders do not have, shareholders cannot adopt an appropriate strategy to diversify their portfolio risk. So, shareholders expect managers to hedge on behalf of them. Thus, firm risk will decrease, and as a consequence, shareholders' portfolio risk will decrease. In their model, DeMarzo and Duffie (1991) show the incentive of a firm to hedge when managers have proprietary information about the dividend stream that shareholders do not have. Signaling theory suggests that, in some circumstances, insiders try to signal private information to outsiders in order to increase firm value by, to conveying their managerial ability and/or investment project quality, etc. (Ross, 1977; Bhattacharya, 1979; Constantinides & Grundy, 1989; Leland & Pyle, 1977). Hedging is one of the signaling tools for managers. Breeden and Viswanathan (1998), claim that managers try to signal their managerial ability to outsiders through hedging. According to their model, in which a manager cares only about his/her own reputation managers with high ability always hedge. On the other hand, a low ability manager hedges only when the ability difference between them and other companies' high flying managers is low. Obviously, this is because there is a chance to catch up with them. On the other hand, if the managerial ability difference is high, the low ability manager does not prefer to hedge, or they hedge less than their optimal level in order not to signal their ability level to the market (Zhao, 2004). Contrary to the other information asymmetry and hedging studies, Zhao (2004) claimed that there is an inverse relationship between information asymmetry and hedging.

According to the literature, information asymmetry between managers and shareholders creates an incentive to hedge (DeMarzo & Duffie, 1991; Breeden & Viswanathan, 1998; Dionne & Triki, 2013). Thus, information asymmetry will be one of the explanatory variables in this paper. Furthermore, free-float rate, percentage of domestic institutional ownership and the percentage of foreign ownership are the proxies for information asymmetry. If the percentage of institutional owners is high, the access of outsiders to the management information will be easier and the degree of information asymmetry will be lower. In other words, institutional ownership reduces the information asymmetry (Agrawal & Mandelker, 1990; Chung & Zhang, 2011; Dionne & Triki, 2013). Accordingly, when information asymmetry is low, managers do not need to hedge in order to signal their ability or the value of the firm to outsiders. Summing up, the higher the institutional ownership, the lower the information asymmetry, and therefore, the lower the incentive to hedge.

Needless to say, there are transaction costs attached to the usage of derivatives, such as options, swaps, forwards and futures. Large firms can benefit from economies of scale when it comes to transaction costs in the options market, and (over-the-counter) forwards market. Moreover, large companies are more likely to hire knowledgeable managers who have expertise in the area of such complex financial instruments. This management team adopts and follows a hedging program for the risks of the firm more easily. From this point of view, the size of a firm plays an important role in the hedging decision of the company. In fact, larger firms are more likely to hedge when it is considered from the economies of scale perspective. On the other hand, financial distress and bankruptcy costs are higher for small firms (Warner, 1977). Notwithstanding the fact that larger firms are more likely to hedge according to the economies of scales, from the perspective of financial distress cost small firms are more likely to hedge. Therefore, the effect of firm size on hedging can be positive or negative.

In addition to off-balance-sheet strategies, firms can also use on-balance-sheet instruments to reduce the volatility of firm value. Preferred stock and convertible debt are the two on-balance-sheet variables that may be used to control the agency cost of debt and equity (Nance et al., 1993). Convertible debt can be used to control the agency conflict between shareholders and bondholders whereas preferred stock reduces the likelihood of financial distress. Thus, usage of convertible debt and preferred stock can affect the incentive to use financial derivatives to hedge. Nevertheless, in Turkey neither preferred stock nor convertible debt is used commonly. So, they have not been included in this study.

Moreover, lowering dividend yields and using more liquid assets reduce the probability of financial distress and agency costs by increasing the ability of future payments to bondholders (Nance et al., 1993). Therefore, firms with low dividend yield and high liquidity ratio are less likely to hedge.

In a nutshell, based on related literature on corporate hedging, the possible hedging determinants are: expected cost of financial distress, probability of underinvestment, expected cost of underinvestment, information asymmetry, the scale of economies, and hedging substitutes such as lowering dividend payment and using more liquid assets. The purpose of this paper is to explore the corporate hedging determinants in emerging markets. We hope that this paper will be a guide for corporations involved in a hedging strategy.

3. Method

3.1 Data

The empirical study is conducted with 256 Turkish firms that are traded at Borsa Istanbul between 2010 and 2014. The data is collected from two main sources: the FINNET database for the secondary data of financial statements, Turkish Central Registry Agency (e-MKK) Information Portal for the ownership data and financial footnotes for hedging data. Manufacturing, electric, gas and water, construction and public work, wholesale and retail trade, hotels and restaurants, transportation, communication and storage, technology are the sectors of the firms whose data was used in this paper. Financial institutions and intermediaries, banks, insurance companies, financial leasing and factoring companies, real estate investment trusts and investment trusts are not included due to their specific nature of financial statements.

In the empirical analysis, time period is between 2010 and 2014. The missing observations are infrequent, and the data is almost complete. Therefore, converting unbalanced data to balanced panel data will remove the additional disturbance from the unbalanced random effect term (Baltagi, 2005). Moreover, firms that do not have at least 3 years of observations are excluded in order not to have a missing data problem. As a consequence of this process, the panel data consists of a 5-year period and 256 cross sections; in other words, 1280 firm-year observations.

3.2 Measures

3.2.1 The Dependent Variable

The dependent variable in this study is categorical. It is equal to 1 if the firm hedges and 0 otherwise. The hedging data is available in the footnotes to the financial statements of firms. We call these financial footnotes. In order to construct the binary dependent variable, the financial footnotes are searched for the terms: “hedge”, “hedging”, “option”, “future contract”, “forwards”, “interest rate derivative”, “swap”, “currency swap”, and “interest rate swap”. If at least one of these term is found, then the firm in question is accepted to be a hedging firm.

3.2.2 Independent Variables

Explanatory variables and their proxies along with their expected relationship with hedging are given in Table 1. The possibility of financial distress is the first independent variable, which is estimated by two different ratios: interest coverage ratio and debt ratio. As the interest coverage ratio increases, the ability to pay the future payments also increases. So, firms with higher interest coverage ratio are less likely to suffer financial distress. The financial distress hypothesis predicts a negative relationship between the interest coverage ratio and the likelihood of hedging. On the other hand, it is expected to have a positive relationship between leverage and hedging as high leverage firms are more likely to find themselves in financial distress.

Similarly, the possibility of underinvestment problem is measured by the growth opportunities of firms. PP&E scaled by total assets is the proxy for growth opportunities. With a high ratio of PP&E to total assets, firms are more likely to have an underinvestment problem, and thus, more likely to hedge. Furthermore, the interaction term with leverage and the ratio of PP&E to total assets can capture the effect of underinvestment cost. In fact, the interaction term is a more accurate proxy for underinvestment cost. The higher the expected underinvestment cost is, the more likely it is that a firm hedges.

Table 1. Variables

Variable	Calculation	Symbol	Expected Impact
Probability of Financial Distress	EBIT/Interest Expense	INTERESTCOV	Negative
	Debt Ratio	LEVERAGE	Positive
Probability of Underinvestment	PPE/Total Asset	PPE/TA	Positive
Cost of Underinvestment	PPE/TA*Leverage	PPE/TA*LEV	Positive
Information Asymmetry	Domestic Institutional Own. %	INSTITUTE	Negative
	Foreign Own. %	FOREIGN-OWN	Positive
	Free-Float Rate	FREE-FLOAT	Negative
Scale Economies	Natural Logarithm of Total Assets	SIZE	Undetermined
Liquidity	Quick Ratio	LIQUIDITY	Negative
Dividend Payment	Dividend Yield	DIV	Positive
Foreign Sales	Foreign Sales/Sales	FOREIGN_SALE	Positive
Profitability	Return on Equity	ROE	Negative

Information asymmetry is estimated by three different variables: Domestic institutional ownership percentage, foreign ownership percentage and free-float rate. In the literature, there are empirical findings that foreign investors prefer investing in firms that diversify their financial risk (Massa & Zhang, 2012). In line with literature, the likelihood of hedging would be high for a firm that has a high percentage of foreign ownership. On the other hand, institutional ownership decreases the information asymmetry between management and investors. As the information asymmetry decreases, the manager's incentive to convey information to shareholders by using a hedging strategy decreases since shareholders are already aware of managerial performance and firm value. High percentage of institutional ownership means low information asymmetry. In fact, it is expected to have a negative relationship between domestic institutional ownership and the likelihood of hedging. Therefore, the effects of foreign ownership and institutional ownership on the likelihood of hedging are separately examined in this paper. Nevertheless, in emerging markets, especially in Turkey, foreign ownership is mostly through institutional ownership. In fact, the average percentage of foreign institutional ownership is 66% among all foreign ownership, and the average percentage of individual foreign investors is 0.6%. Therefore, institutional ownership is taken only in the form of domestic institutional ownership since foreign ownership is already an explanatory variable in the analysis.

Financial derivative usage requires some transaction costs and larger firms can benefit from the economies of scale. Also, hiring a management team that can adopt and follow a hedging program may be costly for small firms. Therefore, size (of a firm) is expected to have a positive effect on the possibility of hedging. On the other hand, the cost of financial distress is higher for small firms when compared to large firms. From the financial distress point of view, the relationship should be negative. Thus, the effect of size on the likelihood of hedging depends on the dominant effect of scale economies, or financial distress costs.

In addition to hedging determinants, there are two independent variables which represent hedging substitutes: Liquidity ratio and dividend payout ratio. A high liquidity ratio and/or a low dividend payout ratio may convince bondholders about the ability of future payments. This reduces the financial distress cost. The expected relationship between liquidity ratio and the likelihood of hedging is negative, whereas it is positive for dividend payout ratio.

Finally, foreign sales and profitability are the other two independent variables used as control variables. Firms with foreign sales are more likely to suffer from currency risk. Their high currency risk increases the likelihood of financial derivative usage; therefore, a positive relationship is expected. The other control variable, profitability, allows firms to meet the required future payments and catch up with possible investment opportunities by internal financing. So, highly profitable firms have lower financial distress costs and lower underinvestment costs. Therefore, highly profitable firms are less likely to hedge.

3.3 Analysis

3.3.1 Univariate Analysis

A panel data analysis with 256 cross-sections and a 5-year time series is performed. Totally, there are 1280 observations. Nevertheless, for 89 firm-year observations, the hedging information is missing. Therefore, the total number is reduced to 1191. It is observed that some firms change their financial derivative usage during the 5-year time period. In other words, one firm can be a hedger for some years and non-hedger for the other years. There are 371 hedgers out of 1191 observations.

Before multivariate analysis, univariate analysis helps us to understand the relationship of independent variables for hedgers and non-hedgers. Hedgers are expected to have lower institutional ownership, interest coverage ratio, liquidity and profitability. Moreover, hedgers have a higher leverage ratio, foreign sales, ratio of PP&E to total assets, and dividend payout ratio.

3.3.2 Multivariate Analysis

The dichotomous dependent variable "hedging" precludes the use of multiple regression. Logistic regression is used in the analysis since it is similar to multiple regression and does not require multivariate normality and equal-variance-covariance matrices across groups (Hair, Black, Babin, & Anderson, pp. 413-434). Logistic regression uses the maximum likelihood estimation method, which maximizes the likelihood of an event that will occur, instead of the least squares method of multiple regression which minimizes the sum of squared differences of errors (Hair et al., 2010).

In logistic regression, two groups of interests, hedgers=1 and non-hedgers=0, are selected as the two possible values the dependent variable y_i can take. It measures the relationship between the dichotomous dependent variable, "hedging", and explanatory variables, by converting the dependent variable to probability scores. In

addition to coefficient estimates, marginal effect results are also given. The meaning of the coefficients in logistic regression is not identical to that of multiple regression analysis. In multiple regression the coefficient of an explanatory variable represents the change in the dependent variable with a 1-unit change in that explanatory variable. However, in logistic regression, coefficients of the independent variables show the direction of the relationship between the probability of y_t and predictor variable, x_t . On the other hand, marginal effects measure the instantaneous rate of change which means for small changes in x_t , the likelihood of y_t changes by an amount that is close to the multiple of the marginal effect and the small change in x_t . However, there is no guarantee about that for large changes in x_t (Williams, 2016).

Before proceeding with the analysis, Pearson correlations of independent variables are calculated in order to check the possibility of multicollinearity. Pearson correlation data are given in Table 2. Most of the correlations are very low. As expected, the correlation between (PP&E)/TA and (PP&E)*Leverage is high, which is 0.78. The second largest correlation, 0.63, is between foreign ownership and size, which is still acceptable. In addition to Pearson correlations, the tolerance and the variance inflation factor (VIF) of the explanatory variables are calculated in order to ensure the lack of multicollinearity as it may occur due to the combined effect of two or more independent variables. Tolerance should be high enough and VIF should be low enough in order not to have a multicollinearity problem. For tolerance, the cutoff threshold value is 0.10, so for VIF, the cutoff threshold value is 10 (Hair et al., 2010). All of the tolerance values are higher than the threshold value, 0.10. The smallest tolerance value is 0.558 which is still high. Moreover, all the VIF values are smaller than 10. Therefore, there is no multicollinearity among the independent variables.

Table 2. Correlation matrix

Variables	Int.Cov	Leverage	Ppe/ta	Ppe/ta*lev	Institute	F.Own	FreeFloat	Size	Liq.	Div	F.Sale	ROE
Int.Cov	1.00											
Leverage	-0.07**	1.00										
Ppe/ta	-0.08**	0.07**	1.00									
Ppe/ta*Le	-0.06**	0.78***	0.50***	1.00								
Institute	-0.02	-0.06**	-0.06**	-0.07**	1.00							
Fore.Own	-0.01	-0.05*	-0.06**	-0.08***	0.05*	1.00						
Free-float	0.05	0.07**	0.01	0.04	-0.04	-0.22**	1.00					
Size	-0.04	0.03	-0.02	0.04	0.12**	0.63***	-0.25***	1.00				
Liquidity	0.24***	-0.23***	-0.18**	-0.22***	0.03	-0.04	-0.04	-0.14*	1.00			
Div	0.00	-0.05*	-0.01	-0.05*	0.01	0.05*	-0.07**	0.09**	0.00	1.00		
Fore.Sale	-0.04	0.04	0.05	0.05	-0.04	0.09***	-0.00	0.10**	-0.11	-0.01	1.00	
ROE	0.00	0.04	-0.03	0.04	0.07**	0.19***	-0.19***	0.23**	-0.02	0.06*	0.06*	1.00

*** Significant at 1%.

** Significant at 5%.

* Significant at 10%.

4. Results

4.1 Descriptive Statistics

According to the descriptive statistics given in Table 3, the average foreign ownership is 22% (std.dev=29%), meaning that foreigners are interested in Turkish firms. Interestingly, the average domestic institutional ownership is 2% (std.dev=26%) where the maximum domestic institutional ownership is 81%. Although, the average profitability of Turkish firms is 20%, there are firms with negative profit. The average free-float rate in the Turkish market is 32%.

Table 3. Descriptive statistics

Variable	Mean	Median	Min	Max	Std. Dev.
Leverage	0.25	0.19	0.00	9.36	0.47
Interest Cov.	0.02	0.00	0.00	0.05	7.17
PPE/TA	0.32	0.30	0.00	0.21	0.42
PPE/TA*Leverage	0.09	0.05	0.00	7.53	0.26
Dom. Inst. Own. %	0.02	0.00	0.00	0.81	0.05
Foreign Own. %	0.22	0.05	0.00	0.99	0.29
Free-Float Rate	0.32	0.27	0.00	0.99	0.21
Size	19.51	19.34	14.01	26.16	1.83
Liquidity	2.26	0.81	0.00	226.00	10.44
Dividend Yield	0.03	0.00	0.00	6.19	0.22
Foreign Sales	0.19	0.09	0.00	1.00	0.23
Profitability	0.20	0.14	-3.22	31.98	0.90

4.2 Univariate Analysis Results

Mean differences and t-statistics are given in Table 4. Hedgers and non-hedgers have significant mean difference for leverage, the PP&E ratio, size, dividend yield, foreign sales ratio, free-float rate, domestic institutional ownership percentage, and foreign ownership percentage. Other variables show the expected relationship for hedgers. In other words, hedgers have lower interest coverage ratio, higher underinvestment cost (PPE/TA*leverage), lower liquidity, higher profitability, but the mean differences are insignificant.

Table 4. Univariate analysis

Variable	Expected Relation	Mean Difference Hedger-Nonhedger	t-statistics
Leverage	Hedger>Nonhedger	0.0529	-2.549***
Interest Cov.	Hedger<Nonhedger	-10.4339	0.971
PPE/TA	Hedger>Nonhedger	-0.0213	1.680*
PPE/TA*Leverage	Hedger>Nonhedger	0.0134	-1.153
Dom. Inst. Own. %	Hedger<Nonhedger	0.0056	-1.646*
Foreign Own. %	Hedger>Nonhedger	0.2306	-13.283***
Free-Float Rate	Hedger<Nonhedger	-0.0788	6.289***
Size	Undetermined	1.8306	-17.230***
Liquidity	Hedger<Nonhedger	-0.6293	0.982
Dividend Yield	Hedger>Nonhedger	0.0206	-3.120**
Foreign Sales	Hedger>Nonhedger	0.7796	-5.377***
Profitability	Hedger<Nonhedger	0.0175	-0.890

*** Significant at 1%.

** Significant at 5%.

* Significant at 10%.

4.3 Multivariate Analysis Results

Logistic regression results are given in Table 5. The sign of each coefficient gives the direction of the relationship between the likelihood of hedging and the associated explanatory variable. On the other hand, when a small change in an explanatory variable takes place, the multiple of the marginal effect and the amount of small change in that variable gives the increase (or decrease) in the probability of hedging.

All the explanatory variables are significant (significance levels are given in Table 5), except the variables of domestic institutional ownership, foreign ownership, and liquidity. Mc-Fadden R-square is 0.2877 which means explanatory variables used in the analysis, explain %29 of the firm's likelihood of using financial derivatives.

The underinvestment cost, size, dividend yield, foreign sales and profitability have significant positive coefficients and correspondingly positive marginal effects on the probability of a firm's using financial derivatives to hedge itself. That is to say, these predictor variables increase the likelihood of hedging. The underinvestment cost has the highest marginal effect, and accordingly, it is the most important hedging determinant in Turkey. The marginal effect of underinvestment cost is 1.438. The next two most important

factors are dividend yield and foreign sales with marginal effects 0.308 and 0.249, respectively.

Leverage, interest coverage ratio, growth opportunities and free-float rate have significant negative coefficients and thus, negative marginal effects. In other words, these explanatory variables decrease the likelihood of hedging. Interestingly, the most important negative impact comes from the (PP&E)/TA ratio with -0.609 marginal effects. After this ratio, free-float rate and leverage are the other two important predictors reducing the possibility of using financial derivatives. Their marginal effects are very close to each other. In fact, it is -0.253 for free-float rate and -0.243 for leverage.

Although, institutional ownership and foreign ownership are insignificant, their relation is in the expected direction. Foreign ownership has a positive coefficient and institutional ownership has a negative coefficient. Similarly, the other insignificant variable, liquidity has the expected negative influence on the possibility of hedging.

Table 5. Logistic regression results

Variable	Coefficient	Marginal Effect	Standard Error	z-statistics
Leverage	-1.324**	-0.243	-2.549	-2.108
Interest Cov.	-0.002*	-0.0004	0.001	-1.612
PPE/TA	-3.312***	-0.609	0.752	-4.406
PPE/TA*Leverage	7.826***	1.438	2.094	3.737
Dom. Inst. Own. %	-1.969	-0.362	1.663	-1.183
Foreign Own. %	0.368	0.068	0.318	1.158
Free-Float Rate	-1.374**	-0.253	0.486	-2.825
Size	0.709***	0.130	0.067	10.559
Liquidity	-0.030	-0.006	0.049	-0.619
Dividend Yield	1.675*	0.308	0.939	1.783
Foreign Sales	1.357***	0.249	0.339	4.000
Profitability	0.847***	0.156	0.266	3.184
Constant	-14.355***	-2.638	1.329	-10.795

*** Significant at 1%.

** Significant at 5%.

* Significant at 10%.

5. Conclusion and Discussion

Underinvestment cost has the highest marginal effect on the likelihood of hedging. The probability of hedging increases as underinvestment cost increases too. On the other hand, unexpectedly, the possibility of underinvestment, which is estimated by growth opportunities, decreases the likelihood of hedging. In other words, for Turkey, which is an advanced emerging market country, the most important determinant of hedging is underinvestment cost. In fact, companies decrease their financial derivative usage as their underinvestment possibility increases. Not the possibility, but the cost of underinvestment is the driving force for hedging for companies in emerging markets.

The second main finding is that two of the information asymmetry proxies, used in this research, namely, foreign ownership and institutional ownership, do not have any significant effect on the probability of hedging. The only significant information asymmetry proxy is the free-float rate. In an emerging market, when a company is traded in the stock market, it has to provide financial statements to the public, a fact that decreases information asymmetry. As a firm's transparency to the stock market increases with higher free-float rate, its likelihood of hedging decreases since management does not need to convey information to the public through hedging. The findings support our claim that in an emerging market, not institutional ownership, but transparency to the stock market is one of the main determinants of corporate hedging.

Interest coverage shows the ability of a firm to pay the interest of its outstanding debt. High coverage ratio reduces the cost of financial distress. According to the analysis results, although the coefficient of interest coverage ratio is significantly negative, its marginal effect is too small. The negative sign of the coefficient of interest coverage ratio concludes that when a firm can easily pay its financial obligations, the firm's likelihood of hedging decreases. On the other hand, the other financial distress proxy, leverage, unexpectedly has a negative effect on the probability of hedging. High leveraged firms are assumed to be financially distressed, and it is

expected to have a higher necessity for hedging. Supporting the findings of Dionne and Triki (2013), the empirical analysis in this article indicates that firms in an emerging market do not hedge in order to increase their debt capacity.

The positive impact of size on the likelihood of hedging shows that, in Turkey, larger firms can benefit from the economies of scale sufficiently and use financial derivatives more easily. In addition to size, profitability has also a positive impact on the possibility of using financial derivatives. Profitability allows firms to meet the required future payments and catch up with possible investment opportunities by internal financing. Although highly profitable firms have lower financial distress and underinvestment cost, analysis results indicate that they are more likely to hedge. One possible explanation is that, in emerging markets, profitable firms have enough funding to hire a team that will follow financial risks and hedge using derivatives. In fact, transaction costs may discourage firms from using derivatives. Apparently, highly profitable firms manage both of these costs. Thus, they are able to use financial derivatives.

Concerning control variables that we employed, namely, “foreign sales” and “dividend yield”, they both increase the likelihood of hedging. In fact, their marginal effect is higher than most of the other predictor variables. Not surprisingly, exporter firms are more likely to have a currency risk. That is why exporters are more likely to use financial derivatives in order to reduce their currency risk. On the other hand, a lower dividend payout ratio may convince bondholders about a firm’s ability of future payments, and thus reduce the financial distress cost. In other words, as dividend payout ratio increases, financial distress of a firm increases, and therefore, the likelihood of hedging rises.

In a nutshell, empirical findings indicate that underinvestment cost is the main determinant of hedging in Turkey, which is an advanced emerging market country. The evidence demonstrates that dividend yield, information asymmetry, underinvestment cost, foreign sales, leverage, profitability and size are the other important determinants of corporate hedging. We need more data to prove that these conclusions also apply for other emerging market countries.

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