Managerial optimism, hedging, and foreign exchange rate exposure in US firms

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Abstract

In this study, we shed light on the impact of managerial optimism on foreign exchange rate (FX) hedging and exposure. We conduct a longitudinal study with a sample of non-financial companies in the U.S. and examine how executive optimism influences corporate hedging decisions. We estimate corporate FX exposure by measuring stock return sensitivity to the U.S. dollar exchange rate index movements and subsequently explore the effect of managerial risk attitudes on exposure. We adopt multiple measures for CEO and CFO optimism based on executive compensative, stock trading, investment decisions and media report. We find that CEOs and CFOs with high (low) optimism adopt less (more) FX financial hedging, resulting in higher (lower) levels of foreign exchange rate risk exposures. We also examine the roles that executive personal traits play in determining financial hedging and corporate exposure in the context of foreign exchange rate risk.

Keywords: optimism, foreign exchange risk, hedging

JEL Classification Codes: D81, F31, F23, G32

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1. Introduction

Foreign exchange rate (FX) risk is caused by uncertain movements of currency rates. Jorion (1990) measures corporate FX risk exposure by estimating firm stock sensitivity to foreign exchange rate fluctuations. Therefore, regression coefficients of the change in the firm stock return on one unit change in the foreign exchange rate index are FX firm-level risk estimates (Jorion, 1990). To minimize FX risk exposure, firms utilize operational hedging and financial derivative instruments including forwards, futures, options and swaps. Financial hedging facilitates risk reduction for companies so that the uncertainty of currency rate changes in the future can be locked via applying FX derivatives.

It is well examined that corporate governance quality has a crucial impact on the hedging policies as well as risk exposure levels. It is found that institutional investors can produce a positive corporate governance environment by providing greater protection for shareholders (Aggarwal et al., 2011). At the country level, Hutson and Stevenson (2010) find that stronger corporate governance proxied by shareholders and creditor rights is associated with lower exchange rate exposure. Hege et al. (2021) find that firms with better corporate governance quality reacted to the regulatory reform of the 2002 Sarbanes-Oxley Act and adopted greater levels of hedging against foreign exchange rate risk and thus mitigated foreign exchange rate exposure. In terms of corporate governance strength, corporate hedging policies are essentially affected by shareholder rights and the effectiveness of board monitoring. It concludes that firms with stronger governance tend to hedge to minimise risk rather than increase managerial personal utility (Allayannis et al., 2012, Lel, 2012). Moreover, stronger corporate governance subsumes more efficient managerial incentives to conduct risk management and closer board monitoring and eventually achieve the objectives of firm value maximisation. Furthermore, firms with good corporate governance quality hedge more as the hedging theories suggest that derivatives implementation can reduce the usage of external funds to alleviate the underinvestment problem and address agency conflicts (Froot et al., 1993).

Board characters also significantly affect corporate derivatives usage and currency rate exposure. Typical characteristics of board structure are board size, board independence, board gender equality, and chairman duality. Sikarwar (2022) examines how board attributes affect corporate hedging activities and impact foreign exchange risk exposure levels for multiple emerging markets. A larger and more independent board can better supervise the management (Whidbee and Wohar, 1999, Klein, 2002, Borokhovich et al., 2004), exposing firms to lower currency risk by conducting more hedging (Sikarwar, 2022). In the companies with greater board independence, more women directors sitting on board are influential in corporate risk

management with decreasing risk exposure.

Besides, other determinants of corporate hedging and risk exposure to foreign exchange rate movements have been previously examined at the firm level in the US (Jorion, 1990, Dolde, 1993, Nance et al., 1993, Géczy et al., 1997, Allayannis and Weston, 2001, Aggarwal and Harper, 2010). However, a basic underlying assumption for hedging is that managers are risk-averse based on the managerial personal utility theory. Hence, other prior studies specifically examine CEO optimism levels and focus on how CEO risk incentives measured by Delta and Vega affect corporate hedging and risk-taking (Lambert et al., 1991, Guay, 1999, Carpenter, 2000, Rogers, 2002, Croci et al., 2017, Doukas and Mandal, 2018). Instead, our research employs the measures developed by Malmendier and Tate (2005) and the measures modified by Campbell et al. (2011) to classify managerial optimism levels based on whether executive officers exhibit exercising deep-in-the-money options is delayed. Compared to prior studies on CEO optimism, we comprehensively measure not only high-optimistic but also low-optimistic executives based on two additional approaches. Following Campbell et al. (2011), we also classify executive officers as high- or low-optimistic according to the difference between their stock purchasing and selling volume. Our research intends to separately discuss how CEOs and CFOs with different optimism levels affect hedging decisions and the extent of foreign exchange risk exposure. As an additional robustness check on the firm level, we also test firms with an overall high or low degree of optimism.

There is a burgeoning literature on how executive optimism affects the corporate decision making of a series of corporate activities, such as financing, investing, dividends paying, and mergers and acquisitions conducting. Managers with high optimism tend not to seek external funding, which they conceive is unduly costly but tend to overinvest when managers have access to internal funds (Malmendier and Tate, 2005, Deshmukh et al., 2021). Highly optimistic managers also utilise more debt financing (Hackbarth, 2008, Ben-David et al., 2013). Managerial optimism can reduce the propensity to invest in externally financed projects with positive net present value, as optimistic managers think markets underestimate the risk premium. Moreover, highly optimistic managers tend to be overconfident about the investments they pick by overestimating the expected cash flows (Heaton, 2005, Malmendier and Tate, 2005, Goel and Thakor, 2008). Managerial optimism is more likely to get a company involved in value-destroying and overvalued mergers or acquisitions, especially with sufficient retained earnings (Liu and Taffler, 2008, Malmendier and Tate, 2008). In addition, managerial optimism negatively influences corporate dividend distribution because highly optimistic managers are prone to maintain more internal funds to invest instead of to divert, as internal funds are less

costly than external financing (Deshmukh et al., 2013).

Managers with high optimism tend to be excessively positive about future development of the company and overvalue investment returns. Managerial optimism conceivably makes a company be involved in projects with higher risk as highly optimistic executives are prone to undertake more risk. Hence, it seems evident that managerial optimism denotes the risk attitudes of top executives. Managerial risk attitudes are likely to influence corporate hedging decisions as hedging is inversely associated with the extent of risk that a company undertakes. Moreover, managerial optimism can be observed through persistent option exercising and holding behaviours of executive officers, their stock purchasing and selling volumes, as well as firm-level investment scales (Malmendier and Tate, 2005, 2008, Campbell et al., 2011, Hirshleifer et al., 2012). Hence, we develop a main research idea to explore how managerial optimism, measured from multiple perspectives, affects corporate hedging decisions and risk exposure to foreign exchange rate fluctuations.

This longitudinal study examines the impact of managerial optimism on financial hedging and foreign exchange risk exposure at the firm level. Based on three measures, we classify CEOs and CFOs as high- or low-optimistic. A text-based method, following Hoberg and Moon (2017), is applied to establish proxies of corporate financial hedging based on annual reports. We aim to explore the association between executive optimism level and corporate financial hedging and foreign exchange risk exposures for nonfinancial firms listed in the Standard and Poor's 1500 index between 2006 and 2020. We first utilise a two-stage approach advanced by Jorion (1990) to examine stock sensitivity to the US dollar exchange rate fluctuations and subsequently explore the determinants of corporate risk exposures with the explained variable of the coefficient obtained at the first stage.

Our paper contributes to the literature in several important ways. Firstly, instead of depending on the assumption that managers are risk-averse in classic hedging theories, we conduct a novel study to examine the impact of both high and low executive optimism levels on foreign exchange rate risk exposure and hedging with a longitudinal data sample. Our results suggest that CEOs and CFOs classified as high-optimistic (low-optimistic) conduct less (more) hedging, resulting in more (less) risk that the firm is exposed to. Secondly, this study supplements literature regarding the impact of CFOs and explore their roles in decisions making of hedging compared to CEOs. Thirdly, three different measures of executive optimism, at both individual and the firm level, will validate the results. Fourthly, our paper is also the first to examine how CFO characteristics, including age, professional experience, education background and so forth, influence hedging decision making and firm-level risk exposure. Finally, a text-based method

with a web crawler program to proxy financial hedging enables full coverage of non-financial companies in all industries, and this also provide additional empirical evidence that text-based method can be applied to proxy foreign exchange financial hedging at the firm level.

The remainder of this paper is structured as follows. We review literature and establish hypotheses in section 2. We discuss our data and methodology in section 3. Section 4 includes descriptive statistics and analysis of univariate results, and section 5 presents the multivariate analysis with our findings. We conclude and summarize in section 6.

2. Literature review and hypotheses establishment

2.1 Foreign exchange hedging

Two classic theories applied in prior studies with regard to corporate hedging activities are firm value maximization and managerial utility maximization theories (Smith and Stulz, 1985, Froot et al., 1993, Graham and Rogers, 2002). Due to the imperfect market, hedging with derivatives can reduce the volatility of cash flows and provide sufficient internal funds, which lowers the anticipated financial distress costs and relieve underinvestment problem (Mayers and Smith, 1982, Smith and Stulz, 1985, Froot et al., 1993, Nance et al., 1993, Tufano, 1996, Jin and Jorion, 2006, Campello et al., 2011). Hedging theory also suggests that expected taxes can be reduced due to the concave tax function that firms are confronted with (Mayers and Smith, 1982, Smith and Stulz, 1985). Moreover, because hedging is observed as a proxy by outsiders to interpret managerial behaviours, it can reduce information asymmetries between management and shareholders, which potentially resolve agency conflicts (DeMarzo and Duffie, 1995, Mefteh-Wali et al., 2012, Breeden and Viswanathan, 2015).

The second theory assumes that risk-averse managers would conduct more hedging to diversify their personal portfolio as it is less expensive to hedge at the firm level than to hedge on their own (Smith and Stulz, 1985, Tufano, 1996). However, hedging in this context becomes an incentive for insiders to maximize their personal utility instead of for the interests of shareholders (Jin and Jorion, 2006). Kumar and Rabinovitch (2013) also supplement that manager are unable to trade human capital or short stocks of the firm they manage, which makes it hard for managers to reduce the volatility of cash flows with diversification strategies.

It is well examined that a large proportion of companies use currency derivatives. Howton and Perfect (1998) report that around 61% of Fortune 500 S&P companies in the U.S. adopt financial hedging policies. There are 173 out of 325 (53.23%) companies use currency derivatives in Gay and Nam (1998). Hoberg and Moon (2017) develop a novel text-based

approach to measure corporate uses of currency derivatives based on keywords occurrences in 10-Ks, with which they find 55.3% observations is involved in using currency derivatives. 59.6% of firm-year observations in the US from 1996 to 2013 reported in Qiu (2019) are currency derivatives users. Sun et al. (2021) utilize a web-crawler program in Python to conduct the textual analysis with the same counting algorithm and find 40.6% of firm-year observations foreign exchange derivative instruments over the 1993-2016 period in the US.

We find several determinants of financial hedging in literature. Firm leverage positively increases financial hedging, supported by significant empirical results (Dolde, 1993, Berkman and Bradbury, 1996, Haushalter, 2000). Leland (1998) also argue that hedging firms can maintain higher leverage and benefit from tax advantages due to the optimal capital structure. Berkman and Bradbury (1996) present results that liquidity decreases the use of derivative instruments. Several studies also point out that market-to-book ratio, as an indicator of growth opportunities, positively affect hedging, due to more internal funds generated to relieve underinvestment dilemma (Froot et al., 1993, DeMarzo and Duffie, 1995, Kumar and Rabinovitch, 2013). ROA as an indicator of firm is found to negatively associate with hedging and positively relates to foreign exchange risk exposure, because profitable firms are less likely to encounter financial distresses and therefore hedge less (Graham and Rogers, 1999, 2002, Kuzmina and Kuznetsova, 2018). However, conflicting results also present in literature, which can be interpreted by economies of scale, as more profitable companies are more likely to hedge due to hedging costs (Allayannis and Ofek, 2001, Allayannis and Weston, 2001, Hsin et al., 2007, Iatridis, 2012).

Furthermore, corporate governance quality has also been examined to significantly affect financial hedging activities in prior studies. Hedging can reduce financial distress costs, relieve underinvestment problem and enjoy tax benefits, in order to maximize shareholder value. For example, higher percentage of independent directors on board indicates a stronger corporate governance with better board independence and effectiveness, alleviating agency conflicts caused by managerial entrenchment (Cyert et al., 2002). Kumar and Rabinovitch (2013) also present negative and significant results between board independence and percentage of production hedged. On the contrary, Lel (2012) demonstrate that firms with better governance tend to hedge more. By utilising comprehensive governance indices with 10 and 41 attributes, Hege et al. (2021) find that firms that have experienced corporate governance improvements after the 2002 Sarbanes-Oxley Act are more likely to conduct hedging.

2.2 Foreign exchange risk exposure

There has been a significant amount of research conducted on the extent and determinants of exposures to foreign exchange risk (Bodnar and Gentry, 1993, Bartov and Bodnar, 1994, Choi and Prasad, 1995, Bartov et al., 1996, Choi and Elyasiani, 1997, Allayannis and Ofek, 2001, Griffin and Stulz, 2001, Bodnar and Wong, 2003, Hutson and Stevenson, 2010, Hutson and Laing, 2014). They generally follow the two-stage approach advanced by Jorion (1990) which firstly examines the stock return sensitivity to foreign exchange rate movements with market factors controlled and secondly regresses other firm-specific variables on the risk exposure estimates. The two-factor model utilized at the first stage is considered to be superior to the methodology used in Adler and Dumas (1984) as the latter ignores the influence from the market.

Hutson and Laing (2014) present summary statistics results for the period 1999-2009 with 14.06% of firms with significant exposure at the 5% level. Hutson and Stevenson (2010) find that about 11.6% of the 1156 US firms are significantly exposed to FX risk for the 1984-2003 period. With a similar sample composed of 1047 US company over the 1990-2003 period, Aggarwal and Harper (2010) report that 10-15% of sample companies are significantly exposed to foreign exchange rates movements. Comparatively, Muller and Verschoor (2006) show that around 13% to 22% of sample companies in Europe are significantly exposed to various currency exchange rates movements.

A great deal of work has also been produced to investigate the association between foreign exchange hedging and exposures, as well as the determinants of financial hedging against foreign exchange risk. Strong evidence that financial hedging with currency derivatives can lower corporate exchange rate exposure has been provided in prior research including Allayannis and Ofek (2001) and Hutson and Laing (2014). Choi and Prasad (1995) find a positive link between foreign exchange rate movements and firm-specific operations. Muller and Verschoor (2006) present a significant result that illiquid firms are exposed less to foreign exchange rate fluctuations. Hege et al. (2021) find that firms with better corporate governance quality are more likely to conduct hedging and therefore exposed to less FX risk. Moreover, Hutson and Stevenson (2010) provide strong empirical evidence that creditor rights and FX risk exposure are negatively associated, which is explained by managerial hedging incentives to lower financial distress costs.

2.3 Managerial optimism level, hedging and risk exposure

Managers are found to be affected by their judgements on the future market movements when

making hedging decisions (Dolde, 1993, Bodnar et al., 1998, Glaum, 2002). Adam et al. (2015) found that overconfident managers affect corporate risk management with a unique dataset composed of 92 gold mining firms in North America. Likewise, overconfident executives are granted more incentive compensations by which their optimism level can be reduced, according to the exploitation and strong-incentive hypotheses (Gervais et al., 2011, Humphery-Jenner et al., 2016). CEOs who are overconfident or highly optimistic are more likely to overestimate the expected return of investments and pursue more riskier projects (Malmendier and Tate, 2005, 2008, Hirshleifer et al., 2012). Therefore, corporate hedging decisions are probably affected by CEOs' optimism level.

By reviewing literature, we conclude that the overconfidence level of managers is observed by their granted compensation. We find that several studies measure managerial risk aversion with their stock ownership and option holdings based on the theory of managerial utility maximization (Stulz, 1984, Smith and Stulz, 1985, Tufano, 1996, Rajgopal and Shevlin, 2002). Moreover, in some other research the sensitivity of managerial wealth to the change in stock prices and volatility of stock returns are proxied for executive risk aversion or risk-taking incentives, denoted as Delta and Vega, respectively (referring to (Lambert et al., 1991, Guay, 1999, Carpenter, 2000, Rogers, 2002, Croci et al., 2017, Doukas and Mandal, 2018). Alternatively, in prior studies managerial optimism can be observed from their persistent behaviours of exercising stock options and purchasing stocks of the companies they serve (Malmendier and Tate, 2005, 2008, Campbell et al., 2011, Hirshleifer et al., 2012). Firstly, rational executive officers try to prevent their undiversified personal wealth exposed to volatile stock price movements (Lambert et al., 1991, Hall and Murphy, 2002) by exercising stock options once options are in the money. However, a highly optimistic manager exhibits a late exercising behaviour on the deep in-the-money options they are holding due to more future payoffs estimated. Secondly, highly optimistic managers purchase more stocks than they sell because they overestimate the future returns generated from investing in the companies they work for, while rational or risk-averse managers conceivably choose not to increase their personal exposure they cannot short stocks to hedge.

The research on the relation between hedging and executive wealth sensitivity have been broadly examined. For instance, Guay (1999) provide evidence that convex compensation incentivizes CEOs to take more risk and makes CEOs adopt less hedging. Firms with more risk-taking preference are prompt to grant compensations with higher pay-performance sensitivity (Aggarwal and Samwick, 1999). Rogers (2002) also find an inverse influence of CEO's risk-taking incentives (convex compensation) on hedging decisions. Knopf et al. (2002)

find weak evidence in support of the positive relation between hedging and delta, and their results suggest that greater Vega is significantly negatively associated with hedging. However, Doukas and Mandal (2018) find no support for the statement that CEO Delta or Vega affects hedging. Due to data availability and research novelty, we employ the third measure to further explore how executive officers with different optimism degrees affect firm-level financial hedging and risk.

The link between managerial entrenchment and hedging comprises managerial risk aversion, because Kumar and Rabinovitch (2013) argue that more entrenched managers gain more personal utility and higher expected marginal value of cash flows from investments due to the "empire building" assumption and external borrowing costs, so they are assumed to avoid the risk arisen from investment and therefore hedge more. However, it is still questionable as overconfident managers might seek risky projects with higher positive NPVs. Hence, we conduct further research to examine the role that executive optimism level would solely play in determining hedging and risk exposure.

There are other factors related to executive personal traits which have significant influence on corporate hedging as well as risk exposure. Mixed results for the influence of age on corporate hedging and risk taking are found in literature, such as positive relation between CEO age and risk-taking (Hambrick and Mason, 1984, Prendergast and Stole, 1996, Serfling, 2014), negative relation (Hirshleifer and Thakor, 1992, Holmström, 1999) and non-linear relation (Lambert et al., 1991, Pan et al., 2016) The impact of personal experience especially related to professions are explored on corporate hedging decisions and risky choice (Hertwig et al., 2004, Kaustia and Knüpfer, 2008, Choi and Varian, 2009, Chiang et al., 2011). Moreover, female executives tend to be involved more risk management due to their risk aversion (Barsky et al., 1997, Huang and Kisgen, 2013), while Schubert et al. (1999) and Atkinson et al. (2003) do not find significant results. Another evidence from oil and gas industries are provided by Croci et al. (2017), suggesting that CEO age and approaching to retirement are positively associated with hedging, but managerial risk incentive theory cannot be empirically justified. Some research find that firm size can significantly affect firm price volatility and hedging (Rampini et al., 2014, Doshi et al., 2018).

To date, limited studies have taken the impact of CFO into consideration when examining for hedging and risk exposure. Recent research by Peltomäki et al. (2021) test the role that CEO and CFO respectively plays in affecting the level of firm risk. They find that firms with older CEOs and CFOs are exposed to lower idiosyncratic risk, while firms led by female(s) have general higher total risk. This implies that both CEO and CFO affect corporate risk exposure.

However, their research does not classify the specific type of risk exposures or consider financial hedging. Knopf et al. (2002) and Doukas and Mandal (2018) argue that CEO is the ultimate executive officer who makes hedging decisions, so they only use CEO relevant variables including characteristics and compensation data. However, it is still questionable how CFOs affect corporate hedging and subsequently influence corporate foreign risk exposure. This paper contributes to the literature and explores how managerial optimism affects financial hedging and foreign exchange rate exposure. More specifically we examine the following two hypotheses.

Hypothesis 1: high (low) managerial optimism is negatively (positively) associated with corporate financial hedging.

Hypothesis 2: high (low) managerial optimism is positively (negatively) associated with corporate foreign exchange rate exposure.

3. Data and methodology

3.1 Sample

The data sample used in this research includes 14,256 observations is composed of 1,136 unique companies listed in the Standard and Poor 1500 index between 2006 and 2020. The companies in financial industry with an SIC code of 6000 and 6999 are excluded, as companies in financial service and insurance industries generally use financial derivatives for speculative purposes instead of for hedging against FX risk (Allayannis and Ofek, 2001). In addition, financial companies have distinct business operations and obey different industry regulations compared to other non-financial companies (Ahmed and Duellman, 2013). The data sample begins from 2006 on due to a new approach for calculation of the estimated aggregated value of in-the-money stock options from 2006 onwards. Data for all variables are collected on a fiscal year basis. The data for other control variables are collected from DataStream, Thomson Financial Insider Transactions database, Capital IQ and so forth. Detailed explanations for variables and data sources can be found in Appendix 1.

3.2 Dependent variables

3.2.1 Risk exposure estimates

Following the two-stage approach advanced by Jorion (1990), estimates of foreign exchange rate risk exposure are firstly obtained by first estimating the stock return sensitivity to the trade-weighted U.S. dollar index with the market factor controlled:

$$r_t^i = \alpha_0^i + \alpha_1^i R_t + \alpha_2^i FX_t + e_t^i \quad [1]$$

Where r_t^i is the logarithm difference return of stock share price for firm i in fiscal year t, R_t is the logarithm difference change in the Standard and Poor's 1500 index over the same period, and FX is the logarithm difference return on the US dollar trade-weighted exchange rate index for the same time period t. Compared to the approach initiated by Adler and Dumas (1984), Jorion's two-factor model controls market movements which takes joint effects of macroeconomic factors on the association between foreign exchange risk exposure and stock returns into consideration. The time-series regression coefficient α_2^i is obtained through the ordinary least squares (OLS) estimation for each firm in a certain fiscal year. Daily data of stock return changes are used for estimations in order to align with the data for other variables which are based on fiscal year[1]. At the second stage, the square root of the absolute value of coefficient $\left|\alpha_2^i\right|$ is transformed following prior studies to get a normally distributed error term, reducing the impact caused by truncation bias (Dominguez and Tesar, 2006, Hutson and Stevenson, 2010, Hutson and Laing, 2014). In estimations of FX exposure, the variable of financial hedging is also included as a control variable to explore the determinants of foreign exchange risk exposure in the multivariate analysis part.

3.2.2 Financial hedging

The second main dependent variable utilized in the study is financial hedging against foreign exchange rate risk, proxied by word mentions of relevant keywords in the annual reports. This text-based method has been broadly applied in prior studies and further calibrated across time (Guay, 1999, Graham and Rogers, 2002, Kim et al., 2006, Campello et al., 2011, Hoberg and Moon, 2017, Nguyen et al., 2019, Alexandridis et al., 2021, Sun et al., 2021). A text-based method further developed by Hoberg and Moon (2017) is adopted in this research with a crawler programme operated in Python being used to count occurrences of keywords in each firm's 10-K filing which can be accessed through the Electronic Data Gathering, Analysis and Retrieval system (EDGAR) database on the U.S. Securities and Exchange Commission (SEC) website. We use the same three wordlists mentioned in Hoberg and Moon (2017). Similarly, we also make it a criterion that at least one word from each of three wordlists including their plural forms and the minimum distance between any two keywords should be 25 words within the same paragraph[2].

[1] The data for daily stock return changes in each single OLS estimation match the beginning and ending dates of the corresponding fiscal year.

[2] False-positive word mentions are excluded from our results, such as phrases of "in the future", "forward-looking", or negative

(A) “currency”, “foreign exchange”

(B) “forward”, “future”, “option”, “swap”, “spot”, “derivative”, “hedge”, “hedging”, “hedged”

(C) “contract”, “position”, “instrument”, “agreement”, “obligation”, “transaction”, “Strategy”.

As the latest data published by Hoberg and Moon (2017) end in 2017 and less than 70% firm-year observations are overlapped with our data sample, we do not directly rely on their data but rather follow their algorithm to collect data using Python. To examine whether our algorithm still holds as that in Hoberg and Moon (2017), we adopt two additional robustness checks. We test the spearman rank correlation between the data of raw hedging mentions released by Hoberg and Moon and our results. The correlation coefficient is 0.7910 at the 1% significant level, indicating that our hedging results are highly correlated with their results. We also randomly select 2% of our sample firm-year observations and manually cross check our hedging results by reviewing 10-K files. Our accuracy rate is 87% which is consistent with the accuracy rate of 87% reported in Sun et al. (2021) and is in the range of 80%-97% reported in Hoberg and Moon (2017).

A dummy variable of FX hedging is assigned the value of 1 if the raw mentions are greater than 0 and assigned the value of 0 if the raw mentions are equal to 0. The dummy hedging variable is examined in logistic (Logit) models, while we also get robust results from Probit models. We also do additional robustness tests with Tobit models where the dependent variable is raw hedging mentions.

3.3 Independent variables

Subsequently, we examine the impact of CEO and CFO optimism levels on FX hedging and risk exposure with multiple validated approaches. Following (Malmendier and Tate, 2005, 2008) and Campbell et al. (2011), four measures of CFO and CEO optimism are used in this research, including option holding and exercising behaviour, net stock purchase, media mentions and investment rate. The first three measures are established on the executive level, while the fourth robustly validates optimism at firm level.

3.3.1 Option holding and exercising behaviour-based measure

The core concept of option-based optimism measure states that CEOs and CFOs are assumed to be highly optimistic if they could have exercised deep in-the-money stock options to reduce their undiversified portfolios prior to the expiration dates. On the contrary, risk-averse or

statements regarding hedging activities such as “do not use”, “do not hedge”, “do not enter”, etc.

rational executives are expected to exercise in-the-money stock options to decrease their personal exposures.

Because we do not have access to the detailed private data used in (Malmendier and Tate, 2005, 2008), we follow Core and Guay (2002) and Campbell et al. (2011) to first calculate option moneyness and then establish binary indicator variables to stand for optimism levels of CEOs and CFOs in the sample. We compute the respective percent moneyness value of options being held and exercised by executives in the given fiscal year. Detailed calculation process and relevant formulas can be found in equation [2] and [3]. We make it a criterion that CEOs and CFOs with high optimism hold more than 100% moneyness options at least twice throughout the sample period. In line with Campbell et al. (2011), we classify them as highly optimistic since the first year when their option holding behaviour is exhibited. Hirshleifer et al. (2012) also classify CEOs as overconfident the first time when they exhibit the behaviour of holding deep in-the-money options, because this delayed exercising behaviour is already required to occur at least twice to avoid a transitory effect. Thus, it is reasonable to record executive high-optimism level from the first time they are identified for delayed exercising once they exhibit late exercising behaviour at least twice during the sample time.

$$\text{Moneyness (option holdings)} = \frac{\frac{\text{options estimated value}}{\text{number of options}}}{\text{stock price} - \frac{\text{options estimated value}}{\text{number of options}}} \quad [2]$$

$$\text{Moneyness (option exercises)} = \frac{\frac{\text{estimated option value from exercising}}{\text{number of options exercised}}}{\text{stock price} - \frac{\text{estimated option value from exercising}}{\text{number of options exercise}}} \quad [3]$$

The realizable value per option is estimated by dividing the total realizable value of in-the-money unexercised exercisable options by the total number of unexercised exercisable options. The estimated average exercise price for options being held can be obtained by using the share price at the fiscal year end minus the realizable value per option. Therefore, the average percentage of moneyness for the options being held is the per-option realizable value over the estimated average exercise price.

Likewise, moneyness of options exercised during the current fiscal year equals to the per-option realizable value from exercising options divided by the estimated average exercise price for exercised options. Correspondingly, per-option realizable value from exercising is calculated as the total estimated value from exercising options over the total number of options exercised. The estimated average exercise price for exercised options is by subtracting the per-option

realizable value from exercising from the fiscal year end share price.

In contrast to high optimism, we also construct low- and moderate-optimism indicators based on both option holding and exercising moneyness. Following Campbell et al. (2011), we assign the value of 1 to low-optimism indicator variable where both option holding and exercising moneyness are less than 30%, because low-optimistic executives do not hold deep in-the-money stock options and exercise options with a purpose of reducing their personal exposure prior to the expiration. Similarly, moderate-optimism binary variable is equated to 1 when either option holding or exercising moneyness is between 30% and 100%. Based on our multivariate results, the impact of moderately optimistic CEOs and CFOs on hedging and risk exposure is similar to executives with low optimism degree. Thus, we merge the data for low and moderate optimism indicator variables together to construct an alternative low optimism binary variable.

However, there are caveats concerning the construction of the option-based method. Firstly, it is not feasible to classify their optimism levels if they have no option grants throughout the sample period, because their optimism extent cannot be reflected on option exercising or holding behaviour. Secondly, it is biased to classify them as low optimistic if the options they hold are always out of the money, as they do not have a chance to make exercising decisions. Thirdly, CEOs and CFOs can process inside information by whether to exercise or to hold stock options. Fourthly and finally, their exercising behaviour might be potentially affected by the expectations or power from the board.

Regarding the first three concerns, we remove unclassifiable CEOs and CFOs and adopt a press-based measure, an optimism measure based on net stock purchases and an investment rate-based approach as robustness analysis. In terms of the last point, we also include a firm-specific variable of the proportion of independent directors on board to control for board power, as a board with more independence tend to reduce risk exposure (Sikarwar, 2022).

In addition, as some executive officers are not granted any stock options or the options they hold are out-of-the-money throughout the duration, our regression sample size for the option-based optimism measure is reduced to 8,714 observations. Moreover, not all CEOs and CFOs can be classified with this measure when estimated realizable option value for corresponding firm-year observations is 0 or option grant data is unavailable.

3.3.2 Net stock purchase-based measure

For robustness We also include net stock purchases indicators as our second measures for

optimism. We similarly follow the method modified by Campbell et al. (2011) who use the same logic initially introduced in Malmendier and Tate (2005). High and low optimism indicators are established based on the difference between stock purchased and sold by CEOs and CFOs. To reduce the bias caused by transitory effect, we also require that a net stock buyer classified as highly optimistic is in the top quantile of the sampled CEOs and CFOs respectively and should purchase shares which increase their stock ownership by at least 10%. Then, high optimism binary variable is assigned the value of 1 if the mentioned two criteria are fulfilled. Correspondingly, low optimism binary variable is assigned the value of 1 if a net seller is in the bottom quantile of the distribution and decreases their stock ownership by at least 10% from selling shares. This net stock purchase-based method is able to classify the optimism levels of all CEOs and CFOs in our sample with their available transaction data in the Thomson Financial Insider Transactions database.

3.3.3 Investment rate-based measure at firm-level

A firm-level based measure for optimism is also utilized with corporate investment rate data. The investment rate is the ratio of capital expenditure over property, plant, and equipment (PP&E) at the beginning of a fiscal year. Corporate investment is associated with CEO optimism, which has been proved both theoretically and empirically in Malmendier and Tate (2005). As a robustness analysis, we link the corporate investment extent with executive optimism degree to further explore its impact on corporate hedging and risk exposure. We use the raw investment rate above the mean to classify CEOs and CFOs as highly optimistic, and vice versa.

3.4 Control variables

3.4.1 Firm-specific controls

Firm size. The scale of firm size positively influences the use of corporate derivatives use due to economies of scale (Hagelin and Pramborg, 2006, Bodnar et al., 2011, Hutson and Laing, 2014), and therefore larger firms are exposed to less FX risk (Hutson and O'Driscoll, 2010, Hutson and Stevenson, 2010, Hutson and Laing, 2014). Hence, we predict a positive relation between a firm size control and FX hedging and a negative relation for FX risk exposure.

Leverage. Leverage is the ratio of long-term debt divided by total assets, regarded as a proxy of financial distress. According to the cost of financial distress theory, corporate hedging activities can decrease the risk of financial distress (Smith and Stulz, 1985) and potential underinvestment risk due to decreasing need for expensive external funds (Froot et al., 1993). Hence, firms with higher degree of leverage are anticipated to hedge more, which

correspondingly leads to lower risk exposure of foreign exchange rates movements (He and Ng, 1998, Kim et al., 2006). Several prior studies have presented positive significant results for the impact of leverage on hedging (Smith and Stulz, 1985, Dolde, 1993, Froot et al., 1993, Géczy et al., 1997, Haushalter, 2000).

Quick ratio. Firm liquidity is indicated by the quick ratio which is measured by the difference between current assets and inventories over current liabilities. Companies with more liquidity have sufficient internal funds, which lowers probability of incurring financial distress and underinvestment problem, resulting in less financial hedging and more risk exposures (Nance et al., 1993, Géczy et al., 1997), suggesting a negative association between firm liquidity and hedging activities and a positive relation between liquidity and risk exposure (Kim et al., 2006, Hutson and Laing, 2014).

Market-to-book ratio. As a proxy for growth opportunities, firms with higher market-to-book ratio tend to hedge, which therefore alleviates the underinvestment problem and lessens anticipated costs of financial constraints (Smith and Stulz, 1985, Froot et al., 1993, DeMarzo and Duffie, 1995, Kumar and Rabinovitch, 2013). Higher possibilities of hedging cause lower level of risk exposure. Hence, a positive (negative) correlation between the market-to-book ratio and hedging (risk exposure) can be predicted.

R&D/sales ratio. As another proxy for growth opportunities, we also include the ratio of R&D expense over sales, which is in line with (Géczy et al., 1997, Hege et al., 2021). R&D expense indicates the extent of business differentiation (Miller and Reuer, 1998), so firms with higher proportions of R&D expense are confronted with less risk exposure.

Fraction of independent directors. Board independence is measured by the number of independent directors divided by total number of directors on board. Higher percentage of independent directors on board indicates a stronger corporate governance with better board independence and effectiveness, alleviating agency conflicts caused by managerial entrenchment (Cyert et al., 2002). Kumar and Rabinovitch (2013) also present negative and significant results between board independence and percentage of production hedged. On the contrary, Lel (2012) demonstrate that firms with better governance tend to hedge more. As executives might be motivated to take riskier projects and reduce the use of currency derivatives due to agency conflicts, firms with more independent directors on board tend to closely monitor management and are thus involved in more risk management (Cyert et al., 2002, Kumar and Rabinovitch, 2013). (Whidbee and Wohar, 1999) prove that higher proportion of independent directors increases corporate hedging against interest rate fluctuations. Hence, board

independence has a positive impact on corporate hedging and a negative influence on foreign exchange risk exposures. Banerjee et al. (2015) also point out that overconfident CEOs potentially tend to take more risky investments, while independent boards are prone to execute supervisory power to lower the costs caused by employing overconfident CEOs.

ROA. Return on total assets (ROA) as an indicator of profitability is selected as a control variable. Several studies show a negative relation between ROA and hedging because less profitable companies are more likely to adopt hedging, in order to lower financial distress costs and lessen underinvestment problem (Graham and Rogers, 1999, Kuzmina and Kuznetsova, 2018). However, Iatridis (2012) provide empirical evidence with a logistic model based on the UK stock market, suggesting a positive and significant relationship between hedging and ROA due to economies of scale effects in hedging costs. Similar but insignificant results can also be found in Allayannis and Ofek (2001), who use a Probit model. We assume that less profitable companies might not be able to afford costs for foreign exchange hedging, resulting in the fact that corporate profitability increases the chances of hedging and reduces risk exposure. Hsin et al. (2007) also present that ROA negatively affect corporate foreign currency risk, which is consistent with the results reported in Allayannis and Weston (2001) and Allayannis and Ofek (2001)

3.4.2 Personal traits variables

Stock ownership. A positive correlation between executive entrenchment and their stock ownership has been examined in the prior studies, theoretically supported by the motivation of personal utility maximization (Stulz, 1984, Smith and Stulz, 1985, Jin and Jorion, 2006) Korkeamäki et al. (2016) examine the determinants of hedging in the airline industry and find that rising executive ownership can increase hedging. Similarly, Géczy et al. (1997) and Carter et al. (2006) also provide evidence that managerial ownership can positively affect corporate risk management. Tufano (1996) use the log of shares value held by officers and directors excluding option holdings and find a positive association between executive stock ownership and risk management based on the theories of managerial utility maximization and agency conflicts. Market value at the end of the corresponding fiscal year is employed instead of the number of shares held by executive officers with intention of reducing valuation bias (Kumar and Rabinovitch, 2013) (Kumar and Rabinovitch, 2013). We take logs of shares holdings fractions, as raw fraction figures are severely skewed. The skewness of stock ownership related variables massively reduces to the range between -1 to 0 after being taken logs.

Cash compensation. Cash compensation ratio indicates the extent to which executives can

diversify their personal scenarios (Guay, 1999, Croci et al., 2017). Cash compensation is composed of salary and bonus which are not dynamically correlated with firm performance and market movements. Thus, managers are less likely to be motivated to use currency derivatives when their compensation contains a large proportion of salary and bonus. Negative relation between cash compensation ratio and hedging is expected, and correspondingly fewer hedging leads to more risk exposure.

Age. Executives are hypothesized to be risk averse and prefer quiet life especially approaching to their retirement (Bertrand and Mullainathan, 2003, Yim, 2013). Furthermore, Croci et al. (2017) suggest that the quiet life hypothesis also support the positive relation between CEO age and hedging.

Tenure. It is examined a positive relation between CEO tenure and risk exposure (Hermalin, 1993, Fu and Li, 2010, Chen, 2015) by adopting less hedging (Doukas and Mandal, 2018). On the other hand, a CEO who serves the firm for a longer time period becomes more dominant and more entrenched (Finkelstein and Hambrick, 1989, Kumar and Rabinovitch, 2013). Hence, CEOs with longer tenure are predicted to hedge more to reduce their personal exposure. Prior findings also suggest that there is a positive relation between CEO tenure and risk-taking behaviours (John et al., 2008, Pathan, 2009). Following Kumar and Rabinovitch (2013) We assign the value of 1 to a binary variable to indicate if a CEO serves the firm for more than 20 years.

Duality. Duality is a binary variable which equals to 1 if the CEO is also appointed as the chairman on Board, and 0 otherwise. CEO duality increases CEO power but impairs board independence and effectiveness (Jensen, 1993, Boyd, 1994). According to the managerial entrenchment and personal utility maximization theories, a CEO with dual roles on board tend to behave to maximize their personal benefits (Kumar and Rabinovitch, 2013). As a consequence, CEOs who also holds a chairman role are prone to diversify their stock portfolios by hedging at the firm level due to lower hedging costs (Stulz, 1984, Smith and Stulz, 1985). Hence, CEO duality is expected to increase hedging and diminish risk exposure level. However, Croci et al. (2017) argue that CEOs with dual roles on board are less likely to be replaced when their company faces financial distress problem, so CEO duality decreases hedging probability. Mixed results for the impact of CEO duality on hedging can be found in prior studies. Croci et al. (2017) show that a CEO who also holds the chairman position significantly negatively impacts hedging decision at the 5% level, while Doukas and Mandal (2018) find no significant impact. The logic of CEO entrenchment theory can also be applied to the case of CFOs that CFOs are more entrenched if they are appointed as board of directors (Bedard et al., 2014).

However, due to the supervision from the board executives with dual roles are less likely to increase hedging for their personal interest (Whidbee and Wohar, 1999, Borokhovich et al., 2004).

Education background. CEOs who have financial education background tend to be overconfident and take more risky projects (Gervais and Odean, 2001, Malmendier and Tate, 2005, Doukas and Mandal, 2018).

We also cross-check data of control variables among different databases, including DataStream, Bloomberg, BoardEx, CompuStat and Capital IQ. We trace back to 10-K filings and proxy statements to manually correct errors spot in our data sample.

Following Berger et al. (1997), Hutson and Stevenson (2010) and Hutson and Laing (2014), the natural logarithms of the market-to-book ratio, the quick ratio and the fraction of stock ownership are taken to reduce the skewness bias. The data for other variables do not have to be taken logs, as their log forms would increase the skewness figures.

3.5 Model specification

The regression results estimated by Logit models are reported in the multivariate analysis section. In the Logit estimations, the dependent variable is hedging dummy variable. 4-digit Standard Industrial Classification (SIC) codes are collected to classify sampled firms into 9 major industry groups. A series of dummy variables based on 9 industry groups are included to control industry effects. Time-varying effects are also controlled in regressions by adding indicator year dummies where one dummy variable equals to 1 in a certain year and the other year dummies equal to 0, and so on.

Linear regression models are used for explaining risk exposure estimates, while pooled Logit models are used with the dependent variable of hedging binary variable while controlling industry and year fixed effects. Some research uses Logit model for hedging (Géczy et al., 1997, Allayannis and Ofek, 2001, Kim et al., 2006, Ahmad and Haris, 2012, Iatridis, 2012), and some use Tobit model for estimation (Haushalter, 2000, Knopf et al., 2002, Kumar and Rabinovitch, 2013).

Generic expressions for models are present below,

$$hedging_t^i = \beta_0 + \beta_1 * CE(F)O\_Optimism\ Indicator_t^i + \sum_{n=2}^{9(8)} \beta_n * Control\ variables_t^i + \varepsilon_t^i \quad [4]$$

$$\sqrt{|\alpha_2^i|} = \gamma_0 + \gamma_1 * CE(F)O\_Optimism\ Indicator_t^i + \gamma_2 * hedging_t^i + \sum_{n=3}^{10(9)} \beta_n * Control\ variables_t^i + \varepsilon_t^i \quad [5]$$

where $\sqrt{|\alpha_2^i|}$ is the square root of the absolute value of risk estimates obtained from equation[1], hedging is a binary variable which equals to 1 if firms discuss the use of currency derivatives in 10-Ks and 0 otherwise, control variables are CEO duality (which equals to 1 if CEO also holds the chairman position and 0 otherwise), fraction of CEO stockholdings, fraction of CFO stockholdings, fraction of shares held by executive officers excluding CEO, fraction of shares held by executive officers excluding CFO, proportion of independent directors, long-term debt over total assets, quick ratio, market-to-book ratio and ROA.

4. Summary statistics and univariate analysis

Table 1 reports the summary statistics for dependent, independent and control variables. In our sample about 62.8% of firm-year observations are involved in hedging against foreign exchange risk from 2006 to 2020 for the firms listed in the S&P 1500. This figure is close to the numbers reported in prior studies. This percentage is slightly higher than the 55.3% reported in Hoberg and Moon (2017).

We classify managerial optimism levels with the first time they exhibit relevant behaviours, as this approach has been proven in Campbell et al. (2011) that leads to similar results when limiting it with the second time they exhibit late exercising behaviours. Several studies adopt the same approach to construct overconfidence variables (Hirshleifer et al., 2012, Humphery-Jenner et al., 2016). We merge variables of low and moderate-optimism indicators together, as moderately optimistic CEOs and CFOs align with those who are low-optimistic with regards to the impact on corporate hedging and risk exposures in multivariate analysis. We follow Hirshleifer et al. (2012) and Ahmed and Duellman (2013) to report descriptive statistics results on the CEO-year or CFO-year basis instead of CEO or CFO basis reported in Campbell et al. (2011), because they might not always be classified as high- or low-optimistic across the years they serve the companies. In our sample, about 20% of CEO-year observations are classified as highly optimistic and 71.2% are identified with low optimism according to the option-based measure. There are around 34% of CEOs classified as highly optimistic in Campbell et al. (2011) and about 61% of CEO-year for the 1993-2003 period are overconfident in Hirshleifer et al. (2012) with the option-based method. Our results for the high-optimism CEO-year observations are lower compared to prior studies, probably because of different sample periods covered. Our result for CEO-year classified as low-optimism is close to that reported in Campbell et al. (2011) which is about 66% for the sum of CEOs with low and moderate optimism.

In terms of the measure based on net stock purchase excluding option-related transactions, there are approximately 25% and 8% of CEO-year observations with low and high optimism, respectively, which are comparatively lower than that reported in Campbell et al. (2011) with the respective figures of 27% and 39%. Ahmed and Duellman (2013) also present a relatively lower figure, 26.1% for the proportion of overconfident CEOs.

As we use raw numbers of investment rate to proxy executive optimism extent at the firm-level, we separately count that approximate 68% and 32% of observations in our sample are above and below the sample median, indicating low and high optimism level, respectively.

Table 2 presents two matrices for the full sample and a subsample based on option exercising and holding behaviour. In each matrix, the upper diagonal is for the Pearson correlation, and the bottom one is for the Spearman rank correlation. Within each matrix the optimism indicator variables are highly correlated with each other at the 1% significance level. Other control variables to be included in the same model are not highly correlated with each other. Other correlation coefficients are generally below 0.3. It is noticed that correlation coefficients between the low-optimism and the high-optimism indicators in the measures of option-based and investment-based are -0.79 and -0.49 at 1% significance level, respectively. Besides, the correlation between CEO and CFO optimism indicators is significantly strong, such as the absolute value of correlation coefficients which are above 0.4 for the option-based measure and regarding the stock purchase-based measure 0.27 and 0.18 for the coefficients between CEO and CFO low-optimism and high-optimism indicators, respectively. Hence, CEO and CFO low-optimism and high-optimism variables should be separately examined in individual models due to the strong correlation.

Table 3 reports the univariate results including t-tests and Wilcoxon–Mann–Whitney rank sum tests for differences between high-optimism and non-high-optimism groups across 3 measures[3]. The means differences results are all significant at the 10% level or better. Consistent with our prediction, firms with highly optimistic executives have lower means for hedging and higher means for risk exposure compared to those with CEOs and CFOs not classified as highly optimistic for all three optimism measures. Likewise, CEOs and CFOs who have low optimism exhibit higher mean hedging value than those who are not classified as low-optimistic does, and firms with low-optimistic CEOs and/or CFOs have lower mean foreign currency risk exposure. Moreover, firms with high-optimistic CEOs and/or CFOs have lower significant median and higher risk exposure than the non-high-optimism group, while firms with low-

[3] We report the univariate results categorized by low-optimism indicator in Appendix 3.

optimistic CEOs and/or CFOs have higher significant median and lower risk exposure than the non-low-optimism group.

The absolute value of means differences between high and non-high-optimism groups for CEOs are moderately smaller than that for CFOs, implying that highly optimistic CFOs might have greater influence on the corporate hedging decisions and exposure regarding foreign exchange risk than highly optimistic CEOs. This finding holds for both option-based and stock purchase-based measures. For instance, in the option-based approach, the mean differences between non-high-optimistic and high-optimistic CEO groups for hedging are 0.0718, while the same peer groups of CFOs have a greater means difference which is 0.1042. The findings for risk exposure and stock purchase-based measure are consistent for peer groups classified by high-optimism indicator.

Furthermore, top executive officers with high optimism measured by option holdings have greater impact on reducing foreign exchange hedging than that measured by net stock purchase on average, with the absolute mean differences of 0.0718 versus 0.0252 for CEO and 0.1042 versus 0.0858 for CFO. However, managerial optimism measured by option holding produces smaller influence on the mean risk exposure than the group measured by stock purchasing, comparing the magnitudes of risk exposure mean differences. For example, the mean difference for the former measure is 0.0227 between CEO without and with low optimism groups, while the figure is 0.0434 for the stock purchase measure.

In panel D, we present results for the full sample classified by sign of the exposure coefficient and FX hedger. There are 14.63% of sample companies are significantly exposed to foreign exchange rate fluctuations. In our sample, about half of companies have negative FX risk exposure, but companies with negative risk exposure are more significantly exposed to foreign exchange rate movements (1140 versus 943 observations). This difference is significant at the 1% level or better both in mean-comparison test and Wilcoxon rank-sum test. There are 8948 firms (62.77% of the full sample) are involved in FX financial hedging activities. Moreover, a lower percentage of hedging firms are significantly exposed than that of non-hedgers (14.28% versus 15.17%), which is intuitively consistent with our prediction.

There are approximately 13%-16% of firm-year observations in our sample are prominently exposed to FX risk exposure at the 5% level, which is consistent with the results disclosed in prior studies. For example, the proportion of significant exposure in our sample is close to the 14.06% present in Hutson and Laing (2014), 10-15% in Aggarwal and Harper (2010) and 15% in (Choi and Prasad, 1995). Our results are slightly higher than the 11.6% in Hutson and

Stevenson (2010) for 1156 US firms over the 1984-2003 period, while our sample is subject to higher percentage as it covers two crisis periods.

5. Multivariate analysis

We report multivariate results in table 4 for the determinants of financial hedging and foreign exchange risk rate exposure with firm and industry fixed effects. In table 4 and 5, we examine managerial optimism measured by executive option exercising and net stock purchasing behaviours, respectively. We adopt a pooled logistic regression estimation (results presented in columns (1) – (4)) with the dependent variable of hedging dummy which equals to 1 if there are at least one mention of foreign exchange derivatives in the 10-K filing and 0 otherwise. The results for pooled OLS estimation are contained in columns (5) – (8) with the square root of the absolute risk exposure estimates as the dependent variable.

We find that CEOs and CFOs classified as low-optimistic can significantly positively affect corporate hedging at the 1% level, while highly optimistic CEOs and CFOs have negative impact on hedging decisions at the 5% significance level or better despite the weak result of CFO high-optimism in panel B. Besides, we do not observe that whether CEO or CFO optimism has greater influence on corporate hedging as comparing coefficient magnitudes does not lead to consistent conclusions. For example, in option-based measure, low-optimistic CEOs increase hedging propensity by 0.1985 units, lower than 0.3325 for CFOs, but it is 0.1976 versus 0.13 for the stock purchasing-based measure. Furthermore, in the option-based measure, managerial low-optimism has weaker influence on hedging and risk exposure than high-optimism. For example, CE(F)O low optimism can decrease hedging by 0.1985 (0.3325) units, but CE(F)O high optimism can increase 0.2596 (0.3614) units. Similar finding also emerges in the result for risk exposure, namely 0.0301 versus 0.04 for CEO low and high optimism affecting risk exposure, respectively; 0.0369 versus 0.0375 for CFO low and high optimism affecting risk exposure, respectively.

Moreover, we estimate other firm-level variables including firm size, managerial stockholdings, proportion of independent directors on board, leverage, liquidity, growth opportunity and profitability.

It is statistically significant that firm size has a strong positive (negative) impact on FX hedging (FX risk exposure) at the 1% significance level. Our findings are consistent with prior studies (Hutson and O'Driscoll, 2010, Bodnar et al., 2011, Hutson and Laing, 2014).

Managerial stockholdings are all positively associated with hedging at the 1% significance level, implying that managers with more stock ownership are more entrenched and tend to hedge more. Our result is consistent with prior studies which also find a positive relation between hedging and executive stock ownership (Smith and Stulz, 1985, Tufano, 1996, Kumar and Rabinovitch, 2013). We find no significant relation between executive stock ownership and risk exposure, which is consistent with the results reported in (Doukas and Mandal, 2018).

Furthermore, our statistic evidence suggests that board independence positively influences corporate hedging decisions and negatively affects FX risk exposure across all three measures at the 5% significance level or better. Our results suggest that higher proportion of independent directors on board increases the likelihood of hedging based on the theory of shareholder value maximization that hedging can reduce the volatility of cash flows in the firms with stronger governance, which potentially lessens agency problem. Using governance index as a proxy of corporate governance quality to estimate the determinants of hedging adoption, Lel (2012) find that firms with stronger corporate governance tend to hedge more. Similarly, Whidbee and Wohar (1999) also show that firms with higher percentage of independent directors increase hedging. Kumar and Rabinovitch (2013) report negative coefficients for board independence which nevertheless are not significant for both hedging measures. Sikarwar (2022) present strong empirical evidence that firms with more board independence are involved in more efficient risk management by increasing hedging, resulting in less FX risk exposure, because boards can better supervise the management to maximize shareholder value.

Market-to-book ratio and R&D expense, both regarded as proxy for corporate growth opportunities can positively affect hedging, consistent with the results present in prior studies (Géczy et al., 1997, Gay and Nam, 1998, Knopf et al., 2002). Firms with higher market-to-book ratio tend to hedge more to prevent underinvestment problem and exploit potential growth opportunities, explained by underinvestment cost theory (Smith and Stulz, 1985, Froot et al., 1993, DeMarzo and Duffie, 1995). Firms that spend more on R&D items are exposed to less foreign exchange rate fluctuations, as their risk can be differentiated by various business or product lines (Hutson and Laing, 2014).

We find strong evidence that quick ratio is significantly inversely related to hedging with 99% confidence level for both optimism measures. Financial constrained firms would be better off by Increasing liquidity (Nance et al., 1993). Aligned with findings in Hutson and Stevenson (2010) and Hutson and Laing (2014), financial hedging against foreign exchange rate risk and internal liquidity are substitute for each other, since more liquid financial structure can ease financial distress and underinvestment problem with sufficient internal funds.

Leverage has significant positive impact on corporate currency derivatives usages at the 1% significant level. This finding is consistent with prior studies (e.g., (Smith and Stulz, 1985, He and Ng, 1998, Haushalter, 2000, Kumar and Rabinovitch, 2013). Motivated by shareholder value maximation theory, highly levered firms have a larger probability to hedge because hedging increases firm value by reducing financial distress costs (Nance et al., 1993), as well as alleviating underinvestment problem by generating sufficient internal funds which is cheaper than external financing (Myers and Majluf, 1984, Froot et al., 1993). Likewise, highly leveraged firms and firms with more growth options are more likely to hedge for the purposes of relieving financial distress and underinvestment problem, which correspondingly decreases the extent of their foreign currency exposure.

Firms with greater profitability are more likely to hedge across all three models. In our results ROA is significantly positively correlated with currency derivatives use and significantly inversely associated with risk exposure at the 1% level. Our results is consistent with Iatridis (2012) because of economies of scale, implying that more profitable firms have greater ability to afford hedging costs and therefore hedge more. More hedging results in less FX risk exposure for the firms with greater profitability. Significant relations between ROA and risk exposure can also be found in Hirshleifer et al. (2012).

Apart from two measures based on stock option holding and exercising behaviours as well as net stock purchase transactions, we additionally employ a firm-level optimism measure based on investment rate as a validation test. We report the logistic regression estimates in Table 7. As a proxy of executive optimism level at the firm level (Malmendier and Tate, 2005, Campbell et al., 2011), investment rate proxied for low optimism significantly increase the likelihood of currency derivatives use and therefore lower the foreign exchange risk exposure at the 1% level. On the contrary, high-optimism indicator has significant negative and impact on hedging and risk, respectively, at the 5% significance level or better. We notice that in logit regression estimates, firms with low optimism have a greater impact on hedging decisions and risk exposure changes than those with high optimism, as the absolute value of the coefficient for low-optimism indicator is 3.4065 which is substantially larger than 0.7078 for high-optimism indicator. The same evidence exhibits 10 times differences for risk exposure, with 0.66 versus 0.084 for low and high optimism respectively. Other control variables present consistent results for investment rate-based meas ure across all three models, which strongly proves that the impact of executive optimism level on hedging and risk exposure examined in this research is robust either at individual aspect or at the firm level.

6. Robustness Check Discussion

6.1 Managerial traits

In table 7, we adopt a logit model and OLS regression to examine managerial optimism with a consideration of managerial personal traits. Panel A and B present the results for CEO- and CFO-related determinants. We find similar results for managerial optimism indicator variables based on option holding and stock purchasing measures that firms with high- (low-) optimistic CEOs and CFOs are less (more) likely to adopt FX hedging, and therefore exposed to more (less) FX risk exposure at the 5% significance level or better. However, we do not find strong evidence on hedging estimation for the stock purchasing-based measure.

The proportion of cash compensation that CEOs and CFOs receive has a significant negative impact on FX derivatives use and a significant positive impact on corporate FX risk exposure at the 1% level. Our finding suggests that executive officers with more cash compensation tend to inversely affect corporate hedging decision, as their personal exposure can be diversified by investing the cash they receive.

We find that executive age has a negative influence on FX risk exposure at the 5% significance level or better for both optimism measure. Our finding on risk exposure is consistent with prior studies (Guay, 1999, Serfling, 2014). However, the positive relation between executive age is not consistently significant for different optimism measure despite the positive signs of coefficients that is consistent with Croci et al. (2017). CEO who also serves as the chairman on board are more likely to adopt hedging policies, which is consistent with Fogel et al. (2013). CEO with dual roles is more entrenched and tend to hedge more to increase their personal utility at the expense of shareholders value (Stulz, 1984, Smith and Stulz, 1985). However, the result is only prominent for the option-based measure. We do not find strong evidence for the impact of CEO duality on FX risk exposure. Notably, we find that CEO's technical education background increases the likelihood of corporate hedging at the 1% significance level, but the increasing hedging instead rises firm risk exposure.

6.2 Press-based measure

Apart from three main measures of managerial optimism, we also conduct an additional robustness test based on media coverage by searching keywords in the text of new articles. This press-based measure has been broadly adopted in prior studies on various research topics relevant to managerial overconfidence or optimism (Malmendier and Tate, 2005, Campbell et al., 2011, Hirshleifer et al., 2012, Banerjee et al., 2015). We validate managerial measure with 3,223 observations for CEOs by searching LexisNexis database to download news articles

which mention their names. We use a 3-year window to exclude the influence from corporate major events as they can dramatically affect press outcomes (Campbell et al., 2011). For each selected CEO during each year, we record the total number of news articles that mention the respective CEOs, in the given year, one year prior to and after the given year. We then count the number of articles containing optimism-related words (keyword list D) as well as the number of articles containing negated optimism-related words (keyword list E).

(D) 'confidence', 'confident', 'optimism', 'optimistic', 'overconfident', 'overconfidence', 'overoptimistic', 'overoptimism', 'over-optimistic', 'over-optimism'

(E) 'pessimistic', 'pessimism', 'overpessimistic', 'overpessimism', 'over-pessimistic', 'over-pessimism', 'reliable', 'steady', 'practical', 'conservative', 'frugal', 'cautious', 'gloomy', 'caution'

An executive office is classified as highly optimistic in the press-based method if the number of news containing words from optimism-related words list is more than that from the negated optimism-related words list. Likewise, the low-optimism binary variable is assigned 1 if the number of news using the words from the list E is more than that from the list D.

In the empirical results, We do not find strong evidence as Hirshleifer et al. (2012), but the coefficient signs of optimism variables are consistent with the other three measures[4]. Particularly, CEO optimism has a prominent impact on FX risk exposure that firms with low-optimistic CEOs are confronted with less risk exposure, while firms with high-optimistic CEOs are exposed to more foreign exchange rate risk.

6.3 Robustness test for option-based measure

Table 8.1 reports the results for robustness check for the impact of CEO and CFO optimism levels on the likelihood of using currency derivatives and risk exposure. Following Campbell et al. (2011) and Hirshleifer et al. (2012), we similarly adopt three moneyness cut-offs to test the sensitivity of option moneyness for further robustness tests. CEOs and CFOs classified as highly optimistic are categorized into three groups, composed of those who hold 100%-200%, 200%-300% and more than 300% in-the-money options. We examine the impact of executive high optimism level for each group, and we find robust results for the groups holding deeper option moneyness, but we do not find evidence for the executives who are classified as less high-optimistic (holding options with 100%-200% moneyness).

[4] The results for the press-based measure are available upon request.

6.4 Robustness test for net stock purchase-based measure

Another robustness check for the net stock purchase-based measures is reported in table 8.2. Billett and Qian (2008) also examine insider trading behaviours with net stock purchase data which includes stock transactions through option exercising. Additionally, Campbell et al. (2011) respectively examine optimism classified by stock transaction including and excluding shared traded through option exercise. The results for the net stock purchase-based measure including option exercise related trading show consistent coefficient directions for both low and high optimism indicators, despite of insignificant empirical results for managerial high-optimism indicators are not significant. However, the results for low managerial optimism are consistent and statistically significant between two measures based on net stock purchasing (excluding and including option-related transactions).

7. Summary and conclusions

We examine the impact of different levels of CEO and CFO optimism on corporate financial hedging against foreign exchange rate fluctuations and foreign currency rate risk exposure. We find strong evidence suggesting that firms with CEOs and/or CFOs having low optimism (high optimism) are more (less) likely to be involved in currency hedging activities with derivative instruments, and therefore are exposed to less (more) risk. We present robust results that are consistent throughout multiple optimism measures. We replicate two approaches to proxy managerial optimism at the individual level based on stock option exercising behaviours that executive officers exhibit, as well as the quantity of their net stock purchasing. Additionally, we validate executive optimism measures with a firm-level method based on the investment rate. To the best of our knowledge, our research is the first to explore to what extent CEO and CFO risk attitudes affect corporate hedging decisions and foreign exchange risk exposure.

This research is of importance both in academic and managerially focused outlets. Firstly, the measure of financial hedging is based on textual analysis, which supplements more empirical evidence for the future research to examine hedging across extensive industries without the need to manually collect data. Secondly, our results indicate that both CEOs and CFOs can dominantly affect corporate hedging policies and risk exposure levels, while managerial optimism levels can be observed from executive behaviours of stock option exercising, stock purchasing and corporate investment decision-making. Thirdly, our paper sheds light on the impact of managerial optimism on hedging and risk exposure in the context of foreign exchange, which also enables further risk management research in the areas of commodity price and interest rate risk hedging.

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Table 1 Descriptive statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) p25	(6) p50	(7) p75	(8) max
Dependent variables								
FX hedge mentions	14,256	12.73	21.13	0.00	0.00	3.00	17.00	237.00
riskexp_abs_fx	14,256	0.48	0.61	0.00	0.15	0.33	0.63	31.75
Independent variables								
CEO low-optimism (option-based)	8,714	0.71	0.45	0	0	1	1	1
CEO high-optimism (option-based)	8,714	0.20	0.40	0	0	0	0	1
CEO low-optimism (stock purchase-based)	14,256	0.25	0.43	0	0	0	1	1
CEO high-optimism (stock purchase-based)	14,256	0.08	0.27	0	0	0	0	1
CFO low-optimism (option-based)	8,714	0.76	0.43	0	1	1	1	1
CFO high-optimism (option-based)	8,714	0.17	0.37	0	0	0	0	1
CFO low-optimism (stock purchase-based)	14,256	0.20	0.40	0	0	0	0	1
CFO high-optimism (stock purchase-based)	14,256	0.01	0.11	0	0	0	0	1
Low-optimism (investment rate-based)	14,256	0.05	0.04	-0.18	0.00	0.05	0.08	0.12
High-optimism (investment rate-based)	14,256	0.08	0.19	0.00	0.00	0.00	0.14	13.19
Firm-specific control variables								
SIZE	14,256	0.25	0.43	0.00	0.00	0.00	1.00	1.00
SHRS ($ thousands)	14,256	13,639.40	113,338.86	0.00	1,141.48	4,888.44	12,524.00	12,502,099.00
IND	14,256	0.80	0.11	0.00	0.75	0.83	0.89	1.00
RD	14,256	30.89	1,311.38	0.00	0.00	0.06	4.25	118,500.00
MTBV	14,256	4.83	21.49	0.00	1.61	2.53	4.15	1,398.36
QUICK	14,256	0.17	0.84	-9.21	-0.27	0.17	0.64	5.58
DA	14,256	0.22	0.22	0.00	0.06	0.20	0.33	4.05
ROA	14,256	0.06	0.12	-3.93	0.04	0.07	0.11	1.62
Personal trait control variables								
ceocash	14,256	0.23	0.205	0	0.107	0.164	0.276	1
ceoshrs ($ thousands)	14,256	5,181.00	19,651.00	0	0	1,749.00	5,201.00	940,911.00
ceoage	14,256	56.56	7.10	28	52	56	61	94
ceotenure	14,256	0.16	0.37	0	0	0	0	1
ceogender	14,256	0.039	0.19	0	0	0	0	1

ceoduality	14,256	0.47	0.50	0	0	0	1	1
ceochange	14,256	0.095	0.29	0	0	0	0	1
ceoedufin	14,256	0.60	0.49	0	0	1	1	1
ceoedutech	14,256	0.33	0.47	0	0	0	1	1
ceoexp	14,256	0.43	0.50	0	0	0	1	1
cfocash	14,256	0.31	0.19	0	0.18	0.26	0.38	1
cfoshrs ($ thousands)	14,256	1,741.00	8,653.00	0	20.75	606.00	1,679.00	839,690.00
cfoage	14,256	51.58	6.46	29	47	52	56	75
cfotenure	14,256	0.05	0.22	0	0	0	0	1
cfodir	14,256	0.11	0.31	0	0	0	0	1
cfoedufin	14,256	0.76	0.43	0	1	1	1	1

Table 2 Correlation Matrices

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. fxhedge	1	0.07*	-0.01	0.04*	-0.02	0.10*	-0.11*	0.17*	0.20*	0.18*	0.22*	0.06*	-0.00	0.10*	0.03*
2. CEO low-optimism (stock purchase-based)	0.07*	1	-0.17*	0.27*	-0.05*	-0.04*	0.13*	0.10*	0.15*	0.03*	0.08*	0.22*	0.01	-0.03*	0.20*
3. CEO high-optimism (stock purchase-based)	-0.01	-0.17*	1	-0.09*	0.18*	-0.00	-0.02*	-0.04*	-0.07*	0.01	0.00	-0.11*	-0.03*	0.06*	-0.13*
4. CFO low-optimism (stock purchase-based)	0.04*	0.27*	-0.09*	1	-0.06*	-0.01	0.07*	0.04*	0.10*	0.01	0.08*	0.11*	0.04*	-0.05*	0.13*
5. CFO high-optimism (stock purchase-based)	-0.02	-0.05*	0.18*	-0.06*	1	-0.01	-0.00	-0.04*	-0.06*	0.00	-0.04*	-0.04*	-0.01	0.02	-0.03*
6. Low-optimism (investment rate-based)	0.10*	-0.04*	-0.00	-0.01	-0.01	1	-0.79*	0.12*	0.05*	0.12*	-0.04*	-0.06*	-0.14*	0.11*	-0.03*
7. High-optimism (investment rate-based)	-0.09*	0.08*	-0.01	0.04*	0.01	-0.49*	1	-0.11*	-0.01	-0.16*	0.08*	0.17*	0.16*	-0.17*	0.14*
8. SIZE	0.17*	0.10*	-0.04*	0.04*	-0.04*	0.12*	-0.09*	1	0.33*	0.25*	-0.04*	0.02	-0.29*	0.24*	-0.04*
9. SHRS	0.03*	0.03*	-0.02	0.02	-0.01	-0.01	0.01	0.07*	1	0.14*	0.01	0.11*	-0.12*	0.12*	0.06*
10. IND	0.18*	0.03*	0.02	0.02*	0.00	0.10*	-0.09*	0.19*	-0.01	1	0.07*	0.03*	-0.17*	0.19*	-0.03*
11. RD	-0.03*	-0.01	-0.00	-0.00	-0.00	-0.02*	0.01	-0.01	-0.00	-0.00	1	0.23*	0.39*	-0.19*	0.01
12. MTBV	0.03*	0.05*	-0.01	0.02	-0.01	-0.01	0.01	0.02*	0.01	0.01	-0.00	1	0.07*	-0.05*	0.40*
13. QUICK	-0.05*	-0.00	-0.01	0.01	-0.01	-0.09*	0.09*	-0.12*	-0.00	-0.04*	0.02	-0.01	1	-0.33*	0.11*
14. DA	0.06*	-0.03*	0.06*	-0.04*	0.03*	0.07*	-0.09*	0.15*	0.00	0.08*	-0.02	0.05*	-0.11*	1	-0.17*
15. ROA	0.06*	0.14*	-0.11*	0.09*	-0.01	0.02	-0.02	0.01	0.02*	0.00	-0.16*	0.05*	0.00	-0.03*	1

Notes: This table presents a correlation matrix for the full sample composed of 14,256 observations and includes the independent variables derived from net stock purchase and investment rate measures. The upper diagonals in each panel are the Pearson correlations, and the bottom ones are the Spearman rank correlations. Detailed descriptions for all variables can be found in the data and methodology section or in Appendix 1. *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. Further details on data sources and variable definitions can be found in Appendix 1. "*" denotes the correlation coefficients with the p-value less than 0.01.

Table 3 Univariate results

Panel A: option-based measure				
	CEO		CFO	
High-optimism indicator	=1	=0	=1	=0
No. of obs.	1740	6974	1461	7253
No. significant exposure at 5% level	240	1099	201	1138
% significant	13.79%	15.76%	13.76%	15.69%
	Hedging	Risk exposure	Hedging	Risk exposure
Mean diff.	0.0718***	-0.0296***	0.1042***	-0.0304***
Wilcoxon rank sum test	5.6028***	-3.8922***	7.6011***	-3.3865***
Panel B: net stock purchase-based measure				
	CEO		CFO	
High-optimism indicator	=1	=0	=1	=0
No. of obs.	1125	13131	186	14070
No. significant exposure at 5% level	174	1911	34	2051
% significant	15.47%	14.55%	18.28%	14.58%
	Hedging	Risk exposure	Hedging	Risk exposure
Mean diff.	0.0252*	-0.0786***	0.0858**	-0.0939***
Wilcoxon rank sum test	1.6787*	-7.2101***	2.4039**	-2.9468***
Panel C: investment rate-based measure				
Optimism indicator	High	Low		
No. of obs.	4560	9696		
No. significant exposure at 5% level	696	1389		
% significant	15.26%	14.33%		
	Hedging	Risk exposure		
Mean diff.	0.1071***	-0.0627***		
Wilcoxon rank sum test	12.3371***	-10.9165***		

Panel D: full sample					
	All	α_2^i<0	α_2^i >0	Hedgers	Non-hedgers
No. of obs.	14256	7138	7118	8948	5308
No. significant FX exposure at 5% level	2085	1140	943	1278	805
% significant	14.63%	15.97%	13.25%	14.28%	15.17%
Mean diff.		5.4443***		11.8360***	
Wilcoxon rank sum test		3.3390***		11.3290***	

Notes: this table presents the univariate results for hedging and risk exposure categorized by option-based, net stock purchase-based, investment rate-based optimism measures and full sample in panel A, B, C and D respectively. Square root term of the absolute value of risk coefficient as well as hedging dummy are used for t tests and Wilcoxon–Mann–Whitney rank sum tests. We conduct t-tests and Wilcoxon–Mann–Whitney rank sum tests and report corresponding mean differences and z statistics. Within each of panel A and B, we test high-optimism indicators, where we present numbers of observations for the indicator binary variables assigned the value of 1 and 0, respectively. The sum and the percentage of observations with significant foreign exchange rate risk exposure at the 5% level are also included in the table. "∗", "∗∗", and "∗∗∗" denote significance at the 10%, 5%, and 1% level, respectively.

Table 4 Main regression results for the impact of CEO and CFO optimism on foreign exchange hedging and currency risk exposure based on option holding and exercising

	Hedging				Risk exposure			
	CEO		CFO		CEO		CFO	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low-optimism indicator	0.1985***		0.3325***		-0.0301***		-0.0369***	
	(3.44)		(5.50)		(-4.09)		(-4.68)	
High-optimism indicator		-0.2596***		-0.3614***		0.0400***		0.0375***
		(-3.93)		(-5.22)		(4.69)		(4.06)
fxhedge					-0.0360***	-0.0356***	-0.0350***	-0.0353***
					(-4.53)	(-4.49)	(-4.40)	(-4.44)
SIZE	0.9491***	0.9445***	0.9359***	0.9307***	-0.0537***	-0.0529***	-0.0523***	-0.0520***
	(13.32)	(13.25)	(13.11)	(13.05)	(-6.94)	(-6.83)	(-6.75)	(-6.72)
SHRS	0.0502***	0.0498***	0.0497***	0.0497***	-0.0010*	-0.0009	-0.0010*	-0.0010*
	(11.79)	(11.68)	(11.65)	(11.64)	(-1.67)	(-1.56)	(-1.66)	(-1.67)
IND	1.4479***	1.4438***	1.4342***	1.4385***	-0.0828**	-0.0818**	-0.0839***	-0.0850***
	(6.07)	(6.04)	(6.02)	(6.03)	(-2.55)	(-2.52)	(-2.58)	(-2.62)
RD	0.0469***	0.0470***	0.0471***	0.0469***	-0.0024***	-0.0024***	-0.0024***	-0.0024***
	(7.56)	(7.57)	(7.58)	(7.56)	(-2.86)	(-2.85)	(-2.82)	(-2.80)
MTBV	0.0271*	0.0279*	0.0301**	0.0289*	-0.0070***	-0.0071***	-0.0072***	-0.0070***
	(1.82)	(1.87)	(2.03)	(1.95)	(-3.75)	(-3.80)	(-3.86)	(-3.77)
QUICK	-0.2383***	-0.2362***	-0.2375***	-0.2365***	0.0064	0.0061	0.0065	0.0064
	(-6.28)	(-6.25)	(-6.24)	(-6.22)	(1.40)	(1.34)	(1.41)	(1.40)
DA	0.9611***	0.9636***	0.9786***	0.9810***	-0.0387**	-0.0388**	-0.0402**	-0.0401**
	(6.46)	(6.48)	(6.52)	(6.56)	(-2.38)	(-2.40)	(-2.47)	(-2.47)
ROA	1.8500***	1.8642***	1.9141***	1.9057***	-0.2753***	-0.2781***	-0.2783***	-0.2771***
	(6.61)	(6.64)	(6.80)	(6.82)	(-7.83)	(-7.88)	(-7.92)	(-7.90)
Constant	0.5195	0.7434	0.4505	0.7752	0.5981***	0.5671***	0.6055***	0.5724***
	(0.79)	(1.15)	(0.71)	(1.22)	(20.15)	(18.95)	(20.25)	(19.13)
Observations	8,714	8,714	8,714	8,714	8,714	8,714	8,714	8,714
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.183	0.184	0.185	0.185				
Adjusted R-squared					0.109	0.109	0.109	0.109

Notes: this table presents the results for the influence of CEO and CFO optimism levels on corporate hedging likelihood and foreign exchange rate risk exposure based on option holding and exercising. Column (1) (2) (3) (4) present the results estimated from logit regressions with the dependent variable of hedging dummy which equals to 0 if there is no mention of hedging activities in firm 10-Ks, and 1 otherwise; column (5) (6) (7) (8) present the results estimated from linear regressions with the dependent variable of the square root of the absolute value of risk exposure coefficient $\sqrt{|\alpha_2^i|}$ obtained from the two-factor model advanced by Jorion (1990). The independent variable of the high-optimism indicator is a binary variable which equals to 1 if late option exercising behaviours are exhibited by executives, while the low-optimism indicator variable is a binary variables which equals to 1 if executives exercise options with fewer moneyness and hold options that are less valuable. *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. We utilize log forms of restricted stock holdings, R&D sales, market-to-book ratio and quick ratio. Further details on data sources and variable definitions can be found in Appendix 1. Robust t-statistics are included in parentheses. ***, ** and * denote significance at 1%, 5%, and 10%, respectively.

Table 5 Main regression results for the impact of CEO and CFO optimism on foreign exchange hedging and currency risk exposure based on net stock purchasing

	Hedging				Risk exposure			
	CEO		CFO		CEO		CFO	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low-optimism indicator	0.1976***		0.1300**		-0.0196***		-0.0271***	
	(4.16)		(2.55)		(-3.36)		(-4.30)	
High-optimism indicator		-0.1665**		-0.1033		0.0528***		0.0637**
		(-2.28)		(-0.59)		(4.97)		(2.28)
fxhedge					-0.0299***	-0.0299***	-0.0300***	-0.0305***
					(-4.80)	(-4.81)	(-4.82)	(-4.89)
SIZE	0.8828***	0.9001***	0.9000***	0.9039***	-0.0514***	-0.0520***	-0.0525***	-0.0529***
	(16.70)	(17.12)	(17.10)	(17.17)	(-8.20)	(-8.34)	(-8.42)	(-8.48)
SHRS	0.0442***	0.0440***	0.0439***	0.0440***	-0.0006	-0.0006	-0.0006	-0.0006
	(12.86)	(12.85)	(12.82)	(12.85)	(-1.29)	(-1.26)	(-1.20)	(-1.21)
IND	1.7490***	1.7744***	1.7564***	1.7683***	-0.0674**	-0.0710***	-0.0669**	-0.0695***
	(9.70)	(9.85)	(9.75)	(9.80)	(-2.51)	(-2.65)	(-2.50)	(-2.60)
RD	0.0605***	0.0619***	0.0609***	0.0618***	-0.0020***	-0.0022***	-0.0019***	-0.0021***
	(12.71)	(13.05)	(12.79)	(13.01)	(-2.90)	(-3.14)	(-2.81)	(-3.06)
MTBV	0.0028	0.0040	0.0042	0.0042	-0.0055***	-0.0056***	-0.0056***	-0.0056***
	(0.38)	(0.54)	(0.57)	(0.57)	(-5.14)	(-5.18)	(-5.25)	(-5.21)
QUICK	-0.1992***	-0.2006***	-0.2010***	-0.1989***	0.0077**	0.0082**	0.0081**	0.0077**
	(-6.88)	(-6.96)	(-6.97)	(-6.91)	(2.12)	(2.24)	(2.22)	(2.11)
DA	0.6526***	0.6630***	0.6555***	0.6540***	-0.0293**	-0.0326**	-0.0300**	-0.0300**
	(5.76)	(5.83)	(5.79)	(5.77)	(-2.11)	(-2.36)	(-2.16)	(-2.16)
ROA	1.3348***	1.3978***	1.3967***	1.4364***	-0.2351***	-0.2333***	-0.2372***	-0.2437***
	(6.49)	(6.77)	(6.77)	(6.95)	(-6.36)	(-6.29)	(-6.45)	(-6.60)
Constant	-0.1149	-0.0734	-0.1086	-0.0793	0.5750***	0.5674***	0.5748***	0.5715***
	(-0.29)	(-0.18)	(-0.27)	(-0.20)	(24.00)	(23.63)	(23.99)	(23.87)
Observations	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.172	0.172	0.172	0.171				
Adjusted R-squared					0.103	0.104	0.103	0.103

Notes: this table presents the results for the influence of CEO and CFO optimism levels on corporate hedging likelihood and foreign exchange rate risk exposure based on managerial net stock purchasing behaviours. Column (1) (2) (3) (4) present the results estimated from logit regressions with the dependent variable of hedging dummy which equals to 0 if there is no mentions of hedging activities in firm 10-Ks, and 1 otherwise; column (5) (6) (7) (8) present the results estimated from linear regressions with the dependent variable of the square root of the absolute value of risk exposure coefficient $\sqrt{|\alpha_2^i|}$ obtained from the two-factor model advanced by Jorion (1990). The independent variables of the high- and low-optimism indicators are binary variables constructed by executive stock purchasing behaviours excluding option related transactions. *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. We utilize log forms of restricted stock holdings, R&D sales, market-to-book ratio and quick ratio. Further details on data sources and variable definitions can be found in Appendix 1. Robust t-statistics are included in parentheses. ***, ** and * denote significance at 1%, 5%, and 10%, respectively.

Table 6 Main regression results for the impact of CEO and CFO optimism on foreign exchange hedging and currency risk exposure based on investment rate

	Hedging		Risk exposure	
VARIABLES	(1)	(2)	(3)	(4)
Low-optimism indicator	3.3376***		-0.6536***	
	(6.72)		(-9.78)	
High-optimism indicator		-0.8755***		0.0873**
		(-5.96)		(2.31)
fxhedge			-0.0272***	-0.0287***
			(-4.38)	(-4.59)
SIZE	0.8866***	0.8866***	-0.0502***	-0.0522***
	(16.86)	(16.88)	(-8.08)	(-8.35)
SHRS	0.0435***	0.0436***	-0.0005	-0.0006
	(12.68)	(12.71)	(-1.06)	(-1.20)
IND	1.7111***	1.6908***	-0.0561**	-0.0600**
	(9.46)	(9.34)	(-2.09)	(-2.22)
RD	0.0632***	0.0655***	-0.0024***	-0.0025***
	(13.32)	(13.71)	(-3.43)	(-3.56)
MTBV	0.0042	0.0059	-0.0057***	-0.0058***
	(0.57)	(0.80)	(-5.24)	(-5.33)
QUICK	-0.1821***	-0.1821***	0.0046	0.0059
	(-6.44)	(-6.50)	(1.27)	(1.60)
DA	0.6383***	0.6339***	-0.0259*	-0.0267*
	(5.63)	(5.65)	(-1.85)	(-1.91)
ROA	1.4093***	1.4428***	-0.2401***	-0.2412***
	(6.88)	(6.93)	(-6.47)	(-6.44)
Constant	-0.2772	-0.0563	0.5886***	0.5581***
	(-0.68)	(-0.14)	(24.60)	(22.70)
Observations	14,256	14,256	14,256	14,256

Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Pseudo R-squared	0.174	0.174		
Adjusted R-squared			0.108	0.105

Notes: this table presents the results for the influence of CEO and CFO optimism levels on corporate hedging likelihood and foreign exchange rate risk exposure based on corporate investment rate. Column (1) and (2) present the results estimated from logit regressions with the dependent variable of hedging dummy which equals to 0 if there is no mentions of hedging activities in firm 10-Ks, and 1 otherwise; column (3) and (4) present the results estimated from linear regressions with the dependent variable of the square root of the absolute value of risk exposure coefficient $\sqrt{|\alpha_2^i|}$ obtained from the two-factor model advanced by Jorion (1990). The independent variables of the optimism extent indicators are built up with investment rate computed as capital expenditure over beginning of year property, plant, and equipment (PP&E). *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. We utilize log forms of restricted stock holdings, R&D sales, market-to-book ratio and quick ratio. Further details on data sources and variable definitions can be found in Appendix 1. Robust t-statistics are included in parentheses. ***, ** and * denote significance at 1%, 5%, and 10%, respectively.

Table 7 Regression results for the impact of CEO and CFO optimism and personal traits on hedging and risk exposure

Panel A: the impact of CEO optimism and personal traits on foreign exchange hedging and currency risk exposure based on option holding and exercising

	Hedging				Risk exposure			
	Option-based		Net stock purchase-based		Option-based		Net stock purchase-based	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low-optimism indicator	0.2028***		0.1233**		-0.0295***		-0.0163***	
	(3.47)		(2.52)		(-4.02)		(-2.78)	
High-optimism indicator		-0.2724***		-0.1298*		0.0386***		0.0500***
		(-4.09)		(-1.73)		(4.52)		(4.68)
fxhedge					-0.0349***	-0.0345***	-0.0277***	-0.0276***
					(-4.39)	(-4.34)	(-4.40)	(-4.39)
SIZE	0.8416***	0.8374***	0.7862***	0.7938***	-0.0473***	-0.0466***	-0.0449***	-0.0452***
	(11.35)	(11.29)	(14.53)	(14.70)	(-5.93)	(-5.85)	(-7.04)	(-7.11)
IND	0.9023***	0.8944***	1.2014***	1.2090***	-0.0615*	-0.0606*	-0.0488*	-0.0519*
	(3.64)	(3.61)	(6.40)	(6.44)	(-1.78)	(-1.76)	(-1.74)	(-1.85)
RD	0.0346***	0.0346***	0.0495***	0.0503***	-0.0027***	-0.0027***	-0.0023***	-0.0024***
	(5.44)	(5.45)	(10.10)	(10.29)	(-3.13)	(-3.10)	(-3.26)	(-3.43)
MTBV	0.0237	0.0248*	0.0010	0.0017	-0.0065***	-0.0066***	-0.0053***	-0.0053***
	(1.62)	(1.69)	(0.14)	(0.24)	(-3.45)	(-3.50)	(-4.91)	(-4.95)
QUICK	-0.2428***	-0.2409***	-0.1836***	-0.1846***	0.0045	0.0043	0.0056	0.0060
	(-6.45)	(-6.43)	(-6.44)	(-6.49)	(0.97)	(0.92)	(1.49)	(1.62)
DA	0.8438***	0.8482***	0.5055***	0.5129***	-0.0295*	-0.0297*	-0.0213	-0.0245*
	(5.52)	(5.55)	(4.51)	(4.56)	(-1.78)	(-1.81)	(-1.52)	(-1.76)
ROA	1.6290***	1.6452***	1.2660***	1.2931***	-0.2695***	-0.2719***	-0.2310***	-0.2283***
	(6.28)	(6.32)	(6.47)	(6.62)	(-7.67)	(-7.71)	(-6.23)	(-6.14)
ceocash	-1.5842***	-1.5849***	-1.5026***	-1.5281***	0.0577***	0.0577***	0.0682***	0.0682***
	(-10.56)	(-10.57)	(-13.40)	(-13.71)	(2.72)	(2.73)	(4.10)	(4.11)
ceoshrs	0.0209***	0.0206***	0.0125***	0.0123***	-0.0001	-0.0001	0.0004	0.0005
	(5.36)	(5.29)	(4.05)	(3.98)	(-0.18)	(-0.10)	(1.11)	(1.17)
ceoage	0.0029	0.0023	0.0064**	0.0064**	-0.0013**	-0.0012**	-0.0013***	-0.0013***
	(0.69)	(0.55)	(2.05)	(2.05)	(-2.48)	(-2.33)	(-3.16)	(-3.15)
ceotenure	-0.0533	-0.0497	-0.0392	-0.0337	0.0139	0.0133	0.0147*	0.0146*
	(-0.69)	(-0.64)	(-0.66)	(-0.57)	(1.36)	(1.30)	(1.79)	(1.80)
ceoduality	0.2211***	0.2227***	0.0479	0.0540	-0.0026	-0.0026	-0.0019	-0.0023

	(3.83)	(3.86)	(1.08)	(1.22)	(-0.36)	(-0.36)	(-0.32)	(-0.39)
ceochange	0.3227***	0.3110***	0.2388***	0.2346***	-0.0176	-0.0160	-0.0089	-0.0099
	(3.08)	(2.96)	(3.32)	(3.26)	(-1.39)	(-1.25)	(-0.98)	(-1.09)
ceoedufin	0.0308	0.0286	0.1221***	0.1220***	-0.0078	-0.0075	0.0010	0.0009
	(0.54)	(0.51)	(2.86)	(2.86)	(-1.09)	(-1.06)	(0.18)	(0.16)
ceoedutech	0.4537***	0.4554***	0.3845***	0.3863***	0.0134*	0.0132*	0.0147**	0.0140**
	(7.49)	(7.51)	(8.34)	(8.37)	(1.74)	(1.72)	(2.38)	(2.27)
Constant	1.1297*	1.4008**	0.4437	0.4794	0.6311***	0.5968***	0.5996***	0.5929***
	(1.74)	(2.17)	(1.03)	(1.11)	(14.42)	(13.54)	(17.63)	(17.45)
Observations	8,714	8,714	14,256	14,256	8,714	8,714	14,256	14,256
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.193	0.194	0.182	0.182				
Adjusted R-squared					0.110	0.110	0.105	0.106

Panel B: the impact of CFO optimism and personal traits on foreign exchange hedging and currency risk exposure based on option holding and exercising

	Hedging				Risk exposure			
	Option-based		Net stock purchase-based		Option-based		Net stock purchase-based	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low-optimism indicator	0.3586***		0.0757		-0.0381***		-0.0246***	
	(5.89)		(1.47)		(-4.84)		(-3.91)	
High-optimism indicator		-0.3951***		-0.0312		0.0387***		0.0584**
		(-5.67)		(-0.18)		(4.20)		(2.08)
fxhedge					-0.0323***	-0.0326***	-0.0277***	-0.0280***
					(-4.07)	(-4.11)	(-4.42)	(-4.46)
SIZE	0.7968***	0.7905***	0.7688***	0.7702***	-0.0454***	-0.0452***	-0.0471***	-0.0472***
	(10.89)	(10.81)	(14.20)	(14.22)	(-5.69)	(-5.65)	(-7.32)	(-7.32)
IND	0.9565***	0.9568***	1.2361***	1.2402***	-0.0637*	-0.0648*	-0.0534*	-0.0552**
	(3.89)	(3.88)	(6.68)	(6.70)	(-1.88)	(-1.91)	(-1.96)	(-2.02)
RD	0.0396***	0.0395***	0.0529***	0.0534***	-0.0021**	-0.0020**	-0.0018**	-0.0019***
	(6.24)	(6.22)	(10.90)	(11.04)	(-2.41)	(-2.40)	(-2.54)	(-2.75)
MTBV	0.0211	0.0198	0.0008	0.0008	-0.0071***	-0.0069***	-0.0056***	-0.0056***
	(1.42)	(1.34)	(0.10)	(0.10)	(-3.81)	(-3.71)	(-5.24)	(-5.20)
QUICK	-0.2341***	-0.2332***	-0.1848***	-0.1834***	0.0065	0.0065	0.0077**	0.0073**
	(-6.35)	(-6.34)	(-6.49)	(-6.45)	(1.43)	(1.43)	(2.11)	(2.00)

DA	0.8570***	0.8609***	0.5522***	0.5501***	-0.0377**	-0.0376**	-0.0307**	-0.0306**
	(5.83)	(5.87)	(4.96)	(4.95)	(-2.30)	(-2.29)	(-2.20)	(-2.18)
ROA	1.7338***	1.7294***	1.2599***	1.2807***	-0.2693***	-0.2681***	-0.2289***	-0.2343***
	(6.48)	(6.53)	(6.31)	(6.41)	(-7.67)	(-7.64)	(-6.26)	(-6.39)
cfocash	-1.7735***	-1.7790***	-1.5943***	-1.6064***	0.0582***	0.0586***	0.0511***	0.0542***
	(-11.44)	(-11.47)	(-13.72)	(-13.87)	(2.65)	(2.67)	(3.02)	(3.21)
cfoshrs	0.0251***	0.0249***	0.0230***	0.0231***	-0.0003	-0.0003	0.0000	0.0000
	(5.74)	(5.70)	(6.75)	(6.78)	(-0.51)	(-0.51)	(0.06)	(0.04)
cfoage	0.0061	0.0058	0.0068**	0.0069**	-0.0019***	-0.0018***	-0.0018***	-0.0018***
	(1.44)	(1.36)	(2.11)	(2.12)	(-3.40)	(-3.33)	(-4.28)	(-4.27)
cfotenure	-0.0302	-0.0188	-0.1980**	-0.1941**	0.0003	-0.0009	-0.0134	-0.0143
	(-0.24)	(-0.15)	(-2.17)	(-2.13)	(0.02)	(-0.05)	(-1.10)	(-1.18)
cfodir	-0.1113	-0.1161	-0.2649***	-0.2631***	-0.0005	0.0001	0.0017	0.0009
	(-1.35)	(-1.40)	(-4.14)	(-4.11)	(-0.04)	(0.01)	(0.19)	(0.10)
cfoedufin	0.0100	0.0101	0.0198	0.0201	-0.0070	-0.0070	-0.0026	-0.0028
	(0.16)	(0.16)	(0.41)	(0.42)	(-0.87)	(-0.87)	(-0.41)	(-0.44)
Constant	1.3595**	1.7367***	0.8701**	0.8925**	0.6689***	0.6326***	0.6424***	0.6378***
	(2.15)	(2.75)	(2.05)	(2.10)	(14.91)	(14.12)	(18.82)	(18.69)
Observations	8,714	8,714	14,256	14,256	8,714	8,714	14,256	14,256
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.191	0.191	0.181	0.180				
Adjusted R-squared					0.111	0.110	0.105	0.105

Notes: this table presents the results for the influence of CEO and CFO optimism levels (reported in panel A and B, respectively) and personal traits on corporate hedging likelihood and foreign exchange rate risk exposure based on two optimism measures of option holdings and stock purchasing. In each panel, column (1) (2) (3) (4) present the results estimated from logit regressions with the dependent variable of hedging dummy which equals to 0 if there is no mentions of hedging activities in firm 10-Ks, and 1 otherwise; column (5) (6) (7) (8) present the results estimated from linear regressions with the dependent variable of the square root of the absolute value of risk exposure coefficient $\sqrt{|\alpha_2^i|}$ obtained from the two-factor model advanced by Jorion (1990). *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *rdsales* is R&D expenses divided by total sales. *mbratio* is market-to-book ratio. *size* is a firm size control with total assets. *indepdir* is the proportion of independent directors on board. *quick* refers to quick ratio. *ltda* is the long-term debt to assets ratio. *roa* is the ratio of return on assets. *ceocash* is cash ratio that equals total current compensation (a sum of salary and bonus) divided by total compensation that CEO receives. *ceoshrs* is the value of restricted stock held by CEO. *ceoage* is CEO age. *ceotenure* is a binary variable that equals 1 if CEO has been in the position for over 20 years, and 0 otherwise. *ceogender* is a binary variable which equals 1 if the current CEO is female, and 0 otherwise. *ceoduality* is a binary variable that equals 1 if CEO is also the chairman of the firm, and 0 otherwise. *ceochange* is a binary variable that equals 1 if CEO is replaced in the current year, and 0 otherwise. *ceoedufin* is a binary variable that equals 1 if CEO holds an educational degree in finance fields, and 0 otherwise. *ceoedutech* is a binary

variable that equals 1 if CEO holds an educational degree in technological fields, and 0 otherwise. *ceoexp* is a binary variable that equals 1 if CEO has obtained working experience in a technological company, and 0 otherwise. *cfocash* is cash ratio that equals total current compensation (a sum of salary and bonus) divided by total compensation that CFO receives. *cfoshrs* is the value of restricted stock held by CFO. *cfoage* is CFO age. *cfotenure* is a binary variable that equals 1 if CFO has been in the position for over 20 years, and 0 otherwise. *cfodir* is binary variable that equals 1 if CFO is also on board of the firm, and 0 otherwise. *cfoedufin* is a binary variable that equals 1 if CFO holds an educational degree in finance fields, and 0 otherwise. We utilize log forms of restricted stock holdings, R&D sales, market-to-book ratio and quick ratio. Further details on data sources and variable definitions can be found in Appendix 1. Robust t-statistics are included in parentheses. ***, ** and * denote significance at 1%, 5%, and 10%, respectively.

Table 8.1 Robustness check for the option-based measure

Panel A: regression results for the impact of CEO optimism on FX hedging and risk exposure

	Hedging			Risk exposure		
	100-200	200-300	300+	100-200	200-300	300+
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
High-optimism indicator	0.0276	-0.4030***	-0.5674***	-0.0025	0.0390**	0.1115***
	(0.34)	(-3.07)	(-4.71)	(-0.25)	(2.44)	(6.35)
fxhedge				-0.0371***	-0.0365***	-0.0343***
				(-4.67)	(-4.59)	(-4.33)
SIZE	0.9489***	0.9432***	0.9423***	-0.0540***	-0.0534***	-0.0526***
	(13.33)	(13.25)	(13.23)	(-6.97)	(-6.89)	(-6.81)
SHRS	0.0513***	0.0510***	0.0498***	-0.0011*	-0.0011*	-0.0008
	(12.04)	(11.98)	(11.69)	(-1.91)	(-1.87)	(-1.41)
IND	1.5060***	1.4758***	1.4489***	-0.0922***	-0.0894***	-0.0817**
	(6.32)	(6.18)	(6.08)	(-2.85)	(-2.75)	(-2.51)
RD	0.0459***	0.0463***	0.0471***	-0.0023***	-0.0023***	-0.0025***
	(7.41)	(7.46)	(7.59)	(-2.72)	(-2.75)	(-2.93)
MTBV	0.0246*	0.0250*	0.0299**	-0.0066***	-0.0067***	-0.0075***
	(1.65)	(1.68)	(2.00)	(-3.56)	(-3.59)	(-4.04)
QUICK	-0.2420***	-0.2386***	-0.2338***	0.0070	0.0067	0.0057
	(-6.31)	(-6.23)	(-6.27)	(1.52)	(1.45)	(1.25)
DA	0.9526***	0.9576***	0.9951***	-0.0373**	-0.0378**	-0.0444***
	(6.38)	(6.43)	(6.63)	(-2.30)	(-2.35)	(-2.69)
ROA	1.7531***	1.8143***	1.8093***	-0.2619***	-0.2672***	-0.2730***
	(6.41)	(6.57)	(6.56)	(-7.50)	(-7.64)	(-7.86)
Constant	0.5976	0.6207	0.8694	0.5860***	0.5814***	0.5684***
	(0.89)	(0.92)	(1.41)	(19.71)	(19.54)	(18.99)
Observations	8,714	8,714	8,714	8,714	8,714	8,714
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.182	0.183	0.184			
Adjusted R-squared				0.107	0.107	0.112

Panel B: regression results for the impact of CFO optimism on FX hedging and risk exposure

	Hedging			Risk exposure		
	100-200	200-300	300+	100-200	200-300	300+
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
High-optimism indicator	-0.0964	-0.6035***	-0.5708***	-0.0022	0.0556***	0.1032***
	(-1.12)	(-4.49)	(-4.09)	(-0.20)	(2.89)	(5.05)
fxhedge				-0.0371***	-0.0360***	-0.0350***
				(-4.67)	(-4.54)	(-4.40)
SIZE	0.9467***	0.9422***	0.9407***	-0.0540***	-0.0534***	-0.0526***
	(13.29)	(13.24)	(13.20)	(-6.97)	(-6.89)	(-6.80)
SHRS	0.0510***	0.0514***	0.0502***	-0.0011*	-0.0011*	-0.0009
	(11.97)	(12.07)	(11.74)	(-1.91)	(-1.92)	(-1.60)
IND	1.4985***	1.4632***	1.4726***	-0.0922***	-0.0890***	-0.0867***
	(6.29)	(6.13)	(6.17)	(-2.84)	(-2.74)	(-2.67)
RD	0.0461***	0.0461***	0.0464***	-0.0023***	-0.0023***	-0.0024***
	(7.43)	(7.42)	(7.49)	(-2.72)	(-2.72)	(-2.80)
MTBV	0.0251*	0.0252*	0.0281*	-0.0066***	-0.0067***	-0.0072***
	(1.69)	(1.71)	(1.89)	(-3.57)	(-3.62)	(-3.85)
QUICK	-0.2426***	-0.2382***	-0.2333***	0.0070	0.0067	0.0057
	(-6.32)	(-6.31)	(-6.11)	(1.52)	(1.46)	(1.24)
DA	0.9545***	0.9475***	0.9865***	-0.0371**	-0.0366**	-0.0427***
	(6.39)	(6.33)	(6.57)	(-2.29)	(-2.26)	(-2.59)
ROA	1.7787***	1.8159***	1.8145***	-0.2619***	-0.2669***	-0.2727***
	(6.47)	(6.58)	(6.65)	(-7.48)	(-7.66)	(-7.87)
Constant	0.5996	0.6304	0.8444	0.5859***	0.5798***	0.5765***
	(0.89)	(0.93)	(1.37)	(19.70)	(19.49)	(19.36)
Observations	8,714	8,714	8,714	8,714	8,714	8,714
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.182	0.184	0.184			

Adjusted R-squared	0.107	0.108	0.110

Notes: this table presents the robustness check results for the influence of CEO and CFO optimism levels on corporate hedging likelihood and foreign exchange rate risk exposure based on three cut-offs of option-based optimism measure. In panel A and B, column (1) (2) (3) present the results estimated from logit regressions with the dependent variable of hedging dummy which equals to 0 if there is no mentions of hedging activities in firm 10-Ks, and 1 otherwise; column (4) (5) (6) present the results estimated from linear regressions with the dependent variable of the square root of the absolute value of risk exposure coefficient $\sqrt{|\alpha_2^i|}$ obtained from the two-factor model advanced by Jorion (1990). The independent variables of the high-optimism indicators are binary variables which equal to 1 if executives hold options with corresponding option moneyness, 100%-200%, 200%-300% and above 300%. *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. We utilize log forms of restricted stock holdings, R&D sales, market-to-book ratio and quick ratio. Further details on data sources and variable definitions can be found in Appendix 1. Robust t-statistics are included in parentheses. ***, ** and * denote significance at 1%, 5%, and 10%, respectively.

Table 8.2 Robustness check for the net stock purchasing-based measure <u>including</u> stock options related trading

	Hedging				Risk exposure			
	CEO		CFO		CEO		CFO	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low-optimism indicator	0.1481***		0.1313**		-0.0171***		-0.0192***	
	(3.10)		(2.47)		(-2.93)		(-2.92)	
High-optimism indicator		-0.0593		-0.0591		0.0535***		0.0175
		(-0.52)		(-0.42)		(3.23)		(0.82)
fxhedge					-0.0301***	-0.0305***	-0.0302***	-0.0305***
					(-4.84)	(-4.90)	(-4.85)	(-4.91)
SIZE	0.8926***	0.9049***	0.9003***	0.9044***	-0.0522***	-0.0534***	-0.0529***	-0.0534***
	(16.93)	(17.22)	(17.12)	(17.19)	(-8.35)	(-8.57)	(-8.48)	(-8.56)
execuow	0.0440***	0.0441***	0.0440***	0.0441***	-0.0006	-0.0006	-0.0006	-0.0006
	(12.83)	(12.87)	(12.83)	(12.86)	(-1.26)	(-1.29)	(-1.24)	(-1.27)
IND	1.7598***	1.7693***	1.7600***	1.7681***	-0.0681**	-0.0712***	-0.0678**	-0.0689**
	(9.76)	(9.81)	(9.77)	(9.80)	(-2.54)	(-2.66)	(-2.53)	(-2.57)
RD	0.0607***	0.0618***	0.0609***	0.0618***	-0.0020***	-0.0021***	-0.0020***	-0.0021***
	(12.76)	(13.03)	(12.79)	(13.02)	(-2.91)	(-3.09)	(-2.90)	(-3.10)
MTBV	0.0034	0.0042	0.0042	0.0042	-0.0056***	-0.0056***	-0.0056***	-0.0057***
	(0.46)	(0.57)	(0.56)	(0.57)	(-5.17)	(-5.22)	(-5.24)	(-5.24)
QUICK	-0.1993***	-0.1991***	-0.2012***	-0.1989***	0.0078**	0.0078**	0.0080**	0.0077**

	(-6.90)	(-6.92)	(-6.97)	(-6.91)	(2.13)	(2.14)	(2.19)	(2.10)
DA	0.6543***	0.6536***	0.6559***	0.6534***	-0.0295**	-0.0306**	-0.0298**	-0.0295**
	(5.77)	(5.76)	(5.79)	(5.76)	(-2.12)	(-2.20)	(-2.15)	(-2.11)
ROA	1.3660***	1.4342***	1.3996***	1.4370***	-0.2369***	-0.2411***	-0.2395***	-0.2439***
	(6.61)	(6.92)	(6.78)	(6.95)	(-6.41)	(-6.53)	(-6.49)	(-6.59)
Constant	-0.0994	-0.0802	-0.1072	-0.0769	0.5754***	0.5729***	0.5743***	0.5721***
	(-0.25)	(-0.20)	(-0.27)	(-0.19)	(24.01)	(23.92)	(23.96)	(23.89)
Observations	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.172	0.171	0.172	0.171				
Adjusted R-squared					0.103	0.103	0.103	0.102

Notes: this table presents the results for the influence of CEO and CFO optimism levels on corporate hedging likelihood and foreign exchange rate risk exposure based on the measure of net stock purchase including stock options related trading. Column (1) (2) (3) (4) present the results estimated from logit regressions with the dependent variable of hedging dummy which equals to 0 if there is no mentions of hedging activities in firm 10-Ks, and 1 otherwise; column (5) (6) (7) (8) present the results estimated from linear regressions with the dependent variable of the square root of the absolute value of risk exposure coefficient $\sqrt{|\alpha_2^i|}$ obtained from the two-factor model advanced by Jorion (1990). The independent variables of the high- and low-optimism indicators are binary variables constructed by executive stock purchasing behaviours including option related transactions. The results are generally consistent with that reported in Table 4 panel B. The independent variables of the optimism extent indicators in panel C are built up with investment rate computed as capital expenditure over beginning of year property, plant, and equipment (PP&E). *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. We utilize log forms of restricted stock holdings, R&D sales, market-to-book ratio and quick ratio. Further details on data sources and variable definitions can be found in Appendix 1. Robust t-statistics are included in parentheses. ***, ** and * denote significance at 1%, 5%, and 10%, respectively.

Appendix 1 Variables explanation and data sources

Variable names	Definitions	Expected signs	
		Hedging	Risk
riskexp_sqr_fx	Square root of the absolute value of foreign exchange rate risk exposure coefficient estimated from the two-factor model in Jorion (1990)	NA	NA
FX hedge mentions	Raw mentions related to currency derivatives collected in 10-Ks according to Hoberg and Moon (2017). Please refer to Section 3 for detailed description.	NA	-
fxhedge	A binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. Please refer to Section 3 for detailed description.	NA	-
Option-based high-optimism indicator	A binary variable equal to 1 if executives exhibit the behaviour of holding deep in-the-money stock option, and 0 otherwise. Please refer to Section 3.3 for detailed description.	-	+
Option-based low-optimism indicator	A binary variable equal to 1 if executives do not exhibit the behaviour of holding deep in-the-money stock option, and 0 otherwise. Please refer to Section 3.3 for detailed description.	+	-
Net stock purchase-based high-optimism indicator	A binary variable equal to 1 if executives purchase more stock than sell, and 0 otherwise. Please refer to Section 3.3 for detailed description.	-	+
Net stock purchase-based low-optimism indicator	A binary variable equal to 1 if executives purchase more stock than sell, and 0 otherwise. Please refer to Section 3.3 for detailed description.	+	-
Investment rate-based high-optimism indicator	It equals to 1 if capital expenditures divided by property, plant, and equipment at the beginning of a fiscal year is greater than the median, and 0 otherwise.	-	+
Investment rate-based low-optimism indicator	It equals to 1 if capital expenditures divided by property, plant, and equipment at the beginning of a fiscal year is less than the median, and 0 otherwise.	+	-
SIZE	Firm size proxied by total assets	+	-
SHRS	The value of restricted stock held by CEOs, CFOs and the three other most highly compensated executive officers ($ thousands)	+	-
IND	Proportion of independent director on board	+	-
RD	R&D/sales	+	-
MTBV	Market-to-book ratio	+	-
QUICK	Quick ratio	-	+
DA	Long-term debt/total assets	+	-
ROA	Return on assets	+	-
ceocash	Cash ratio equals total current compensation (a sum of salary and bonus) divided by total compensation that CEO receives	-	+
ceoshrs	The value of restricted stock held by CEOs ($ thousands)	+	-
ceoage	CEO age	+	-
ceotenure	Binary variable that equals 1 if CEO has been in the position for over 20 years, and 0 otherwise	-	-
ceogender	Binary variable that equals 1 if the current CEO is female, and it is assigned the value of 0 if the	-	-

	current CEO is male.		
ceoduality	Binary variable that equals 1 if CEO is also the chairman of the firm, and 0 otherwise	+	-
ceochange	Binary variable that equals 1 if CEO is replaced in the current year, and 0 otherwise	+	-
ceoedufin	Binary variable that equals 1 if CEO holds an educational degree in finance fields, and 0 otherwise	+	-
ceoedutech	Binary variable that equals 1 if CEO holds an educational degree in technological fields, and 0 otherwise	+	-
ceoexp	Binary variable that equals 1 if CEO has obtained working experience in a technological company, and 0 otherwise	+	-
cfocash	Cash ratio equals total current compensation (a sum of salary and bonus) divided by total compensation that CFO receives	-	+
cfoshrs	The value of restricted stock held by CFOs ($ thousands)	+	-
cfoage	CFO age	+	-
cfotenure	Binary variable that equals 1 if CFO has been in the position for over 20 years, and 0 otherwise	-	+
cfodir	Binary variable that equals 1 if CFO is also on board of the firm, and 0 otherwise	-	+
cfoedufin	Binary variable that equals 1 if CFO holds an educational degree in finance fields, and 0 otherwise	+	-

Appendix 2 Correlation matrix for the subsample with option-based measure

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. fxhedge	1	0.06*	-0.06*	0.08*	-0.08*	0.18*	0.22*	0.19*	0.18*	0.05*	-0.02	0.12*	0.05*
2. CEO low-optimism (option-based)	0.06*	1	-0.79*	0.48*	-0.46*	0.05*	0.00	0.10*	-0.04*	-0.21*	-0.06*	0.06*	-0.19*
3. CEO high-optimism (option-based)	-0.06*	-0.79*	1	-0.49*	0.56*	-0.07*	-0.01	-0.09*	0.05*	0.23*	0.08*	-0.07*	0.20*
4. CFO low-optimism (option-based)	0.08*	0.48*	-0.49*	1	-0.79*	0.08*	0.02	0.09*	-0.01	-0.20*	-0.04*	0.05*	-0.20*
5. CFO high-optimism (option-based)	-0.08*	-0.46*	0.56*	-0.79*	1	-0.09*	-0.01	-0.09*	0.01	0.20*	0.05*	-0.06*	0.20*
6. SIZE	0.18*	0.05*	-0.07*	0.08*	-0.09*	1	0.37*	0.25*	-0.07*	0.01	-0.30*	0.22*	-0.03*
7. SHRS	0.14*	-0.06*	0.05*	-0.03*	0.04*	0.35*	1	0.17*	-0.03*	0.08*	-0.17*	0.13*	0.04*
8. IND	0.17*	0.09*	-0.09*	0.08*	-0.08*	0.19*	0.08*	1	0.04*	0.04*	-0.16*	0.19*	-0.00
9. RD	-0.03*	0.01	-0.01	0.00	0.00	-0.00	-0.01	-0.01	1	0.22*	0.42*	-0.21*	-0.01
10. MTBV	0.03	-0.03*	0.04*	-0.06*	0.06*	0.02	0.05*	0.01	-0.00	1	0.06*	-0.04*	0.39*
11. QUICK	-0.11*	-0.08*	0.10*	-0.07*	0.08*	-0.20*	-0.08*	-0.08*	0.03*	-0.01	1	-0.34*	0.07*
12. DA	0.07*	0.01	-0.02	0.00	0.00	0.13*	0.01	0.08*	-0.02	0.06*	-0.18*	1	-0.14*
13. ROA	0.07*	-0.13*	0.13*	-0.13*	0.14*	0.02	0.07*	0.02	-0.15*	0.05*	-0.05*	-0.00	1

Notes: This table presents a correlation matrix for the subsample composed of 8,714 observations and includes the independent variables derived from option-based measures. The upper diagonals in each panel are the Pearson correlations, and the bottom ones are the Spearman rank correlations. Detailed descriptions for all variables can be found in the data and methodology section or in Appendix 1. *fxhedge* is a binary variable equals to 0 if there is no hedge mentions in 10-Ks, and 1 otherwise. *RD* is R&D expenses divided by total sales. *MTBV* is market-to-book ratio. *SIZE* is a firm size control with total assets. *SHRS* is executive restricted stock holdings. *IND* is the proportion of independent directors on board. *QUICK* refers to quick ratio. *DA* is the long-term debt to assets ratio. *ROA* is the ratio of return on assets. Further details on data sources and variable definitions can be found in Appendix 1. "*" denotes the correlation coefficients with the p-value less than 0.01.

Appendix 3 Univariate results (supplemental)

Panel A: option-based measure				
	CEO		CFO	
Low-optimism indicator	=1	=0	=1	=0
No. of obs.	6205	2509	6607	2107
No. significant exposure at 5% level	970	369	1033	306
% significant	15.63%	14.71%	15.63%	14.52%
	Hedging	Risk exposure	Hedging	Risk exposure
Mean diff.	-0.0586***	0.0227**	-0.0939***	0.0353***
Wilcoxon rank sum test	-5.1816***	3.4137***	-7.8505***	4.6162***
Panel B: net stock purchase-based measure				
	CEO		CFO	
Low-optimism indicator	=1	=0	=1	=0
No. of obs.	3576	10680	2810	11446
No. significant exposure at 5% level	494	1591	377	1708
% significant	13.81%	14.90%	13.42%	14.92%
	Hedging	Risk exposure	Hedging	Risk exposure
Mean diff.	-0.0756***	0.0434***	-0.0444***	0.0396***
Wilcoxon rank sum test	-8.0914***	6.3401***	-4.3662***	5.2390***
Panel C: investment rate-based measure				
Optimism indicator	High	Low		
No. of obs.	4560	9696		
No. significant exposure at 5% level	696	1389		
% significant	15.26%	14.33%		
	Hedging	Risk exposure		
Mean diff.	0.1071***	-0.0627***		
Wilcoxon rank sum test	12.3371***	-10.9165***		

Notes: this table presents the univariate results for hedging and risk exposure categorized by option-based, net stock purchase-based and investment rate-based optimism measures in panel A, B and C, respectively. Square root term of the absolute value of risk coefficient as well as hedging dummy are used for t tests and Wilcoxon–Mann–Whitney rank sum tests. We conduct t-tests and Wilcoxon–Mann–Whitney rank sum tests and report corresponding mean differences and z statistics. Within each of panel A and B, we test low-optimism indicators, where we present numbers of observations for the indicator binary variables assigned the value of 1 and 0, respectively. The sum and the percentage of observations with significant foreign exchange rate risk exposure at the 5% level are also included in the table. "∗", "∗∗", and "∗∗∗" denote significance at the 10%, 5%, and 1% level, respectively.