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Linking Country Governance Quality and Derivatives Use: Insights from Firms' Hedging Behavior in East Asia

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Abstract

This paper examines the link between countries' governance quality and firms' use of derivatives using a novel hand-collected dataset. Our panel data includes 881 non-financial firms across eight East Asian countries. We found that better country governance induces firms to use derivatives to hedge exposure and mitigate costs. Firms in countries with weak governance use derivatives for speculative and/or selective hedging or self-management purposes. Overall, our findings provide strong evidence of the role of countries' governance quality in driving firms' derivatives-related behaviors. This macro-based effect on derivatives use is independent of firm-specific factors, which are frequently invoked by hedging theories.

Keywords: Hedging; derivatives use; country governance quality; country-specific characteristics; firm behavior.

JEL code: G30, D21, F10.

1. Introduction

Derivatives are widely used risk management instruments that have contributed significantly to the strong growth and innovation of financial markets over the last 30 years. Given the global scale and trading volume of derivative markets, derivatives have become more complicated and interconnected. The Bank for International Settlement reports that at the end of December 2015 and 2016, in the global OTC derivatives markets, the notional value of outstanding contracts was USD 493 trillion and USD 483 trillion, respectively (BIS, 2015, 2016). These figures indicate that derivatives are one of the main pillars of the global financial system.

The rationale behind hedging, however, is not supported consistently by the evidence in empirical studies. There is research that suggests that using derivatives increases the value of firms by addressing market imperfections, such as taxes, agency problems, bankruptcy, and financial distress (Nance et al., 1993; Froot et al.,1993; Smith and Stulz, 1985; Mayer and Smith, 1990; Mayer and Smith, 1982; Bessembinder, 1991). Nevertheless, other evidence (Graham and Rogers, 2002; Charumathi and Kota, 2012) lends little support to these theories. Bartram et al. (2009) indicate that traditional theories have little power to explain decisions regarding the use of derivatives. The inconclusive evidence may arise from the fact that most existing studies consider only firm-specific factors as determinants of hedging behavior, while the characteristics of the country where a firm operates may influence its decision to use derivatives. While firm determinants alone cannot fully explain firms' behaviors, little is known about the role of country-specific factors in shaping firms' decisions to use derivatives.

Additionally, although there is a growing amount of literature on derivatives in developed countries, the research on East Asian firms is still relatively scarce, even though there has been a large increase in derivative use in these countries. The annual survey of the Future Industry Association in 2015 revealed that trading in Asia-Pacific accounts for about one-third of global trading volume (FIA, 2015).

The purpose of this paper, therefore, is to investigate the link between the incentives for non-financial firms to use derivatives and countries' governance quality for at least two reasons. First, it will help managers diagnose what sources enhance firm value, because given a type of market imperfection the benefits of derivatives use differ across different firms. Second, it will induce managers to figure out the type of risk(s) that should be hedged and the identity targets of hedging, so that they can conduct an effective hedging strategy.

Using unique hand-collected data on derivative use, we focused the analysis on a sample of 9,691 observations from eight East Asian countries during the period of 2003–2013. This sample was chosen because our sampled firms are located in countries with great variance in terms of economic, political, and social environments. In particular, some countries share the same governance quality as that of the U.S., and other developed countries. Some are more problematic because of less transparent markets, weaker law enforcement and lower government effectiveness. Such variation provides us with a natural laboratory to explore the effect

of country governance quality on derivatives use. Country heterogeneity also allows us to focus on differences in governance mechanisms that are arguably exogenous to firms' derivatives use. Lastly, given that many of our firms (nearly 45%) are domestic and almost 48% are domestic MNCs, we would expect the role of country-specific characteristics to become more salient in determining derivatives use. Such variation gives us a unique opportunity to explore whether a country's characteristics determine derivatives use independently from firm-specific factors. Country heterogeneity also allows us to focus on differences in governance mechanisms that are arguably exogenous to firms' derivatives use.

This research primarily contributes to the literature in the following ways:

Firstly, theoretical contribution of this study is to incorporate institutional theory into the analysis of derivative activities. Joining institutional theory through investigating country-level governance quality with hedging theory through controlling firm-specific factors into one single framework of analysis, our study stresses the importance of incorporating country-level factors to explore motivations for using financial derivatives by non-financial firms. Such understanding also can offer a new explanation for the sources of advantages enabling firms in a country to exploit benefits of hedging better than those firms that are in another country.

Secondly, the fundamental starting point in any discussion of conditions under which firms' hedging can add value is Modigliani and Miller's (MM) theorem. Modigliani and Miller (1958) found that under a specific set of assumptions about frictionless markets, equal access to market prices, rational investors, and equal access to costless information, hedging is irrelevant and cannot contribute to the creation of firm value. This paper, therefore, improves upon the key assumptions of the MM theorem and contributes to the methodological literature by building on institutional conditions and the heterogeneity of firms. We find that hedging can add value and rewards firms if there are well-governed and good-functioning institutions.

The main findings of our study can be summarized as follows. Results from both univariate and multivariate analyses reveal that governance mechanisms have a strong positive effect on firms' decisions to use derivatives. Firms are more likely to use derivatives, and use them more extensively, when they are located in countries with lower corruption levels. In countries with better governance mechanisms, firms use derivatives to hedge exposure, yet in weakly governed or highly corrupt countries, firms do not use derivatives for risk management but rather for speculative and/or selective hedging. We also find that countries with higher degrees of economic, financial, and political risk encourage firms to use derivatives.

We proceed with the remainder of this paper as follows. Section 2 reviews the literature on incentives for derivatives use in East Asia and provides the theoretical background, discusses the existing empirical literature on country-specific factors, and develops hypotheses. Section 3 describes our sample and identifies variables. Section 4 presents empirical specifications. Section 5 reports empirical analyses and robustness tests. Section 6 concludes the

paper.

2. Literature review on derivatives use in East Asia

Due to the lack of data on hedging positions, there is a dearth of studies on derivatives use by East Asian firms and those studies that exist are limited in scope. To the best of our knowledge, only Allayannis et al. (2003) analyzed the exchange rate derivative use of 372 non-financial firms across 8 East Asian countries between 1996-1998. Unlike studies on US firms, their study found that there is limited support for hypotheses of costs of bankruptcy and financial distress, and agency cost of debt. More interestingly, they indicate that derivative use does not increase firm value and there is no evidence that East Asian firms eliminate their foreign exchange exposure by using derivatives, because the use of foreign exchange derivatives was selective, too narrow in scope, and interrupted when the Asian financial crisis began.

Other studies examine derivatives use within only one country and the focus of most studies is the understanding of determinants of currency derivatives usage. The evidence from Hu and Wang's (2006) study of 419 non-financial firms in Hong Kong does not support hedging theory. On the contrary, Tungsong (2010) investigates the case of Thailand, and provides strong evidence that firms use derivatives to alleviate the costs of financial distress, and the agency costs of debt. Likewise, Lantara (2012) examines firms in Indonesia and indicates that the larger the firm, the higher the growth opportunities and the greater the exposures that firms face, the greater the derivatives use.

All other studies analyze the case of non-financial firms in Malaysia (e.g., Fazilah et al., 2008; Ahmad and Haris, 2012; Shaari et al., 2013; Chong et al., 2014). The common feature of these studies is that almost all the variables examined were statistically significant but do not support the hypothesized prediction. Firstly, contrary to arguments of substitutes to hedging with derivatives, Fazilah et al. (2008) found that the smaller the dividend yield, the higher the probability of firms using derivatives, whereas Shaari et al. (2013) found a statistically positive relationship between liquidity and the use of derivatives. Secondly, it is surprising that in the analysis of the hypothesis of financial distress and bankruptcy costs, Shaari et al. (2013) showed that firms with lower leverage or lower profitability use more derivatives to hedge those costs. Recently, Chong et al. (2014) surveyed 219 non-financial firms in Malaysia, but they concentrated on hedging practices rather than testing hedging theory.

3. Theoretical framework and hypotheses

3.1. Hedging theory and derivatives use

Financial derivatives are defined as financial instruments whose prices are dependent on/ derived from the value of other, more basic, underlying variables (Hull, 2012). In the context of this paper, we focus on the types most widely used by non-financial firms in different countries to manage market risks: foreign currency, interest rate, and commodity price derivatives. When the underlying variables are foreign currencies, interest rates, and commodity prices, the types of derivatives will be foreign currency, interest rate, and commodity price derivatives, respectively.[1]

Modigliani and Miller's (1958) seminal paper shows that in anefficient market, the financing policies of firms are irrelevant; that is,hedg-

ing or derivatives use does not affect firm value. Hence, the incentives of hedging depend on the degree to which the use of derivatives effectively addresses market imperfections, such as corporate taxes (see Smith and Stulz, 1985; Mayers and Smith, 1990), financial distress or bankruptcy costs (see Nance et al., 1993; Froot et al., 1993), or the agency costs of debts (see Mayers and Smith, 1982; Bessembinder, 1991).

The existing evidence however, provides mixed support for hedging theories. Judge (2006) found that there is a strong relationship between financial distress costs and foreign currency hedging decisions, a much stronger relationship than that found in many previous studies in the U.K.. Recently, Chen and King (2014) examined 1,832 U.S. non-financial firms and presented significant evidence which is consistent with financial distress cost arguments. In contrast, Charumathi and Kota (2012) state that there is no evidence supporting this hypothesis. Supanvanij and Stauss (2010) found that tax loss carried forward is an important factor in determining the use of foreign currency derivatives, while Kumar and Rabinovitch (2013) indicated that foreign tax credits are in the direction hypothesized and firms use derivatives to increase the present value of tax losses. In contrast, Sprcic and Sevic (2012) found that the evidence in favor of the tax hypothesis is very weak, while Gay et al. (2011) did not find any evidence in support of the tax incentive to increase debt capacity.

Empirical studies on testing the agency costs of debt theory also provide inconclusive evidence. Chen and King (2014), among others, found evidence to support the agency costs of debt theory. However, Charumathi and Kota (2012) did not find evidence in support of the agency costs of debt hypothesis. This finding is consistent with a recent study by Lievenbruck and Schmid (2014) and earlier studies such as Nance et al. (1993).[2]

3.2. Institutional theory and country-specific characteristics

The institution-based view argues that a network of firms is a coordinated system of value-added activities whose structure is determined by the institutions that control or affect firms' objectives and behaviors (Dunning, 2003). North (1990, 1994) was among the first to emphasize the importance of institutions. He considers institutions much more than background conditions and defines institutions as the "rules of the game," including the formal rules (laws, regulations) and informal constraints (customs, norms, cultures) that organizations face. Institutions shape firm actions by determining the transaction costs and transformation costs of production. As such, institutions play a key role in determining the organizational outcomes and effectiveness of organizations (Khanna and Rivkin, 2001) as well as framing their strategic organizational choices (Peng et al., 2005).

Therefore, to better understand the determinants of firms' activities and their effects, it is necessary to consider institutional influences inside the firm and the external environment where firms operate simultaneously. In the paper we incorporate institutional theory (e.g., North, 1990, 1994; Dunning, 2003; Peng et al., 2005) and Dunning's OLI paradigm (Dunning, 1988; Dunning and Lundan, 2008) into the analysis of derivative activities. This approach sheds a new light on hedging theory (e.g., Smith and

Stulz, 1985; Mayers and Smith, 1990; Nance et al., 1993; Froot et al., 1993), which concentrates mainly on firm-specific characteristics. Through this research approach, we intend to show whether a firm's decision to use financial derivatives is not only determined by factors within that firm's boundary and we argue that it is necessary to improve hedging theory as well as the variables used to measure the determinants of derivatives' use.

Although there are abundant studies on traditional hedging theories, within the literature on hedging few empirical studies have investigated the link between differences in cross-country characteristics and firms' use of derivatives. Furthermore, the findings of these studies provide mixed evidence. For example, Lievenbruck and Schmid (2014) together with Lel (2012) found a significant association between GDP per capita and the use of derivatives in the predicted directions, although Lievenbruck and Schmid only found supporting evidence in the case of commodity price derivatives use. The effect of financial risk is always statistically significant but inconsistent with the hypothesized prediction (see Bartram et al.,2009). Likewise, regulatory quality and long-term interest rates are insignificant, while the effect of inflation rates and long-term exchange rates are very weak (see Bartram et al., 2009; Livenbruck and Schmid, 2014).

Thus, our study explores countries with great variances in terms of economic, political, and social environments. Hence, we expect to observe differences in derivatives use due to the differences in country risks and governance mechanisms.

3.2.1. Governance mechanisms

The governance quality of a country in general represents attributes of legal systems, institutions, regulations and policies established by its government that help to define that country's business and economic environments, frame legal and social relations, and condition the effectiveness and transparency of the government and political institutions (Knack, 2001). Kaufmann et al. (2005), Oh and Oetzel (2011) show that the quality of a country's governance has a significant impact on its government's ability and willingness to respond to economic volatility. In a weakly governed country with high levels of political uncertainty and poor organizational capabilities, the government is less effective at responding to unexpected economic events than that of a well governed country (Oh and Oetzel, 2011). Furthermore, according to Globerman and Shapiro (2003), governance mechanisms consist of institutions and policies targeting economic, legal, and social relations. Good governance mechanisms value an "independent judiciary and legislation, fair and transparent laws with impartial enforcement, reliable public financial information and high public trust" (Li, 2005, pp.298). As such, good governance mechanisms can reduce transaction, production, and R&D costs, and increase market efficiency, leading to reductions in the variability of firms' profitability and high-return, and to low-risk investments (Ngobo and Fouda, 2012; Wu and Chen, 2014). They implement policies that favor free and open markets and form effective and non-corrupt institutions (Globerman and Shapiro, 2003). On the contrary, poor governance mechanisms increase costs and uncertainty (Cuervo-Cazurra, 2008a), and they can lead to smaller, more vol-

atile, and less liquid stock markets in emerging economies (Lin et al., 2008) as well as a lack of transparent financial data and other information on firms and a shortage of specialized financial intermediaries (Khanna et al., 2005).

In this study, we investigate two aspects of governance mechanisms: corruption and the quality of the governance system, which is measured by regulatory quality, government effectiveness, and the rule of law. Corruption is the key dimension of governance quality as it reflects the exercise of public power for private gain (Kaufmann et al., 2005). Peng et al. (2008), Svensson (2005), Godinez and Liu (2015), among other scholars, argue that corruption can be considered as an outcome reflecting economic, political and legal institutions of a country. Thus, it is a vital part of a country's institutions and lies at "the core of any national environment" (Wei, 2000; Godinez and Liu, 2015, pp.34). Regulatory quality, government effectiveness, and the rule of law are additional aspects of country governance quality (Globerman and Shapiro, 2003; Javorcik, 2004). By these indicators, we refer to the ability of the government to formulate and implement sound policies and regulations (Svendsen and Haugland, 2011). We also refer to the quality of public and civil services and the degree of their independence from political pressures as well as the credibility of the government's commitment to such policies and how these can influence a firm's strategic decisions (Cuervo-Cazurra, 2008b).

While the concept of corruption is widely studied in the economics and international business areas, to our knowledge, there is currently no research linking corruption with derivatives use in the literature (Gastanaga et al., 1998; Cuervo-Cazurra, 2006; Bailey, 2018). Bardhan (1997), Mudambi and Navarra (2002), Quazi (2014), and others view corruption as a "grabbing hand," because it increases uncertainty and transaction costs, and one major cause of corruption is bad governance mechanisms (Lambsdorff, 2006). Firms in highly corrupt countries may face higher transaction costs due to bribe payments and related expenses (Brouthers et al., 2008), due to the lower quality of infrastructure services, and lower economic growth and financial stability (Rose-Ackerman, 1978, 1999), which in turn leads to higher hedging costs that may reduce the benefits or even make the costs outweigh the benefits, and eventually dampens the effectiveness of derivative activities. While those firms operating in countries with lower levels of corruption can capitalize on the advantages generated by a more favorable institutional context, which in turn has a positive impact on the performance and profitability of firms (Levy and Spiller, 1994; Bergara et al., 1998). Tran (2014) shows that corruption critically deteriorates the administration performance, and a low level of corruption leads to a high level of transparency. Empirically, Le (2016) finds that corruption in Vietnam has negative impact on firm growth measured by firm sale. In particular, the author examines 1377 firms in Vietnam from 2005 to 2011 and figures out that one-percentage increase in corruption rate reduces 16,833 percentage points in firm revenue.

Building upon this insight, we propose the following hypothesis:

Hypothesis 1: Firms located in countries with higher corruption levels are less likely to

use derivatives.

Considering the globalized macroeconomic environment, we wonder whether corruption influences firms' decisions on derivatives use through firm-specific and country-specific characteristics. Depending on the levels of corruption, various factors might play a role in explaining a firm's hedging behavior. Petrou (2015) along with Petrou and Thanos (2014) show that corruption often generates additional difficulties rather than opportunities for firms to benefit from non-market environments. In addition, a high level of corruption is associated with a sophisticated bribery system, discouraging firms from using derivatives as a risk management tool. We thus propose the following hypothesis:

Hypothesis 1a: High levels of corruption discourage firms from using derivatives to reduce exposure as stated by hedging theory.

Likewise, we expect a positive relationship between firms' use of derivatives and quality of governance mechanisms. Several studies motivated by La Porta et al. (1997, 1998) emphasize that legal institutions (either laws or enforcement) play a significant role in explaining cross-country differences in financial development, decision-making, and valuation, because laws and the quality of their enforcement determine the rights and operation of firms participating in financial systems. Beck and Levine (2008) note that finance can be considered a set of contracts. Because derivatives are financial contracts, we expect that legal institutions are likely to influence derivatives use. Bevan et al. (2004) document that an efficient legal infrastructure reduces institutional uncertainty as well as facilitates contract establishment and lowers transaction costs. Finally, Bach (2017) shows evidence that improved legal system in Vietnam speeds up firm size growth in terms of total assets, and persistently facilitates labor productivity growth. We therefore propose that better governance mechanisms encourage firms to enter into derivatives contracts, given the lower cost of hedging.

Hypothesis 2: Firms located in countries with higher governance quality are more prone to using derivatives.

3.2.2. Country risk

Shapiro (1999) defines country risk as the general level of political and economic uncertainty in a country that influences the value of investments in that country. Allien and Carletti (2013) further indicate that the interactions of institutions and markets determine the country risks that drive firms' activities (Cantwell et al., 2010). Relatedly, uncertainties in government policies and the economic environment may lead to a higher cost of capital due to the increased probability of financial distress, so firms tend to have greater exposure (Huang et al., 2015; Glover and Levine, 2015).

Although the topic of political and economic uncertainty has been investigated extensively, there has been little discussion of the link between derivatives use and country risks. Bartram et al. (2009) state that firms located in countries with greater economic, financial, and political risks are more likely to use derivatives. On the other hand, firms based in less risky countries may have lower expected financial distress costs and less need for risk management. Recently, Azad et al. (2012) found evidence consistent with the argument that greater macroeconomic risk encourages firms

to use derivatives more.

Hypothesis 3: Firms in countries with higher country risk have a greater incentive to use derivatives.

To sum up, using derivatives to manage risk is a complex decision that may involve various factors. Hedging theories focus on the role of firm-specific factors. Institutional theory, on the other hand, stresses the importance of incorporating country factors to explore firms' behavior in terms of derivatives use. In this paper, by combining hedging and institutional theories into a single framework of analysis, we complement and shed new light on the current literature on derivatives use. We also provide new insights into the nature of firms' hedging behaviors. In doing so, we address some open questions on the determinants of derivatives use.

4. Data and methods

4.1. Sample

We focused the analysis on 881 non-financial firms across industries between 2003 and 2013. These firms were located in eight East Asian countries: Singapore, Hong Kong, the Philippines, Thailand, Malaysia, Indonesia, China, and Japan. Our sample spanned beyond the global financial crisis of 2007–2008, which generated real exogenous shocks to firms. Under such volatile environments, it is instructive to study why and how firms decide to use financial derivatives. We present the construction of the sample and the data-collection procedure in detail below.

We obtained the list of Japanese firms from the Financial Times list of the Japan FT500 [3] and the list of Singapore companies from the Business Times[4]. For other companies, we used the ranking of listed companies from websites of stock exchanges of each country and from the list of Bloomberg. We excluded firms that did not have annual reports in English or did not have annual reports from 2003-2013.

We hand- collected the information on derivatives use and some explanatory variables from firms' annual reports. We strived to verify the data accuracy by searching through a subset of firms' annual reports, in which the electronic annual reports in PDF format were obtained via the websites of each firm, Morningstar[5] (an independent investment research firm that provides a direct link to each company's annual recent reports), or the stock exchanges of each country. As the eight countries in our sample had different local currencies with different values, it could have resulted in a sampling bias. Hence, we decided to use a common currency to represent the extent of derivatives use and all other financial data, and we chose United States dollars (USD).

We augmented this database on derivatives usage from annual reports with financial data on explanatory variables from the Datastream database. In terms of the data not available on Datastream, we searched the annual reports of firms to fill in as much missing data as possible. Some country-specific data such as corruption indices were obtained from Transparency International (TI) and reports of central banks of sample countries, while proxies for governance mechanisms were obtained from the World Bank. All financial data were yearly and in thousands of USD.

Descriptive statistics of sample

Panel A in Table 1 shows that across the

Table 1: Summary statistics of derivatives use of sample firms

Panel A: Derivatives use by country

Countries	Total	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	N	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Indonesia	429	158	36.83	122	28.44	111	25.87	31	7.23
Philippines	352	352	100.00	139	39.49	99	28.12	57	16.24
Singapore	1639	651	39.72	735	44.98	434	26.58	168	10.29
Japan	1661	1661	100.00	1293	78.22	1020	61.71	233	14.10
Hong Kong	1606	382	23.79	350	21.88	265	16.56	95	5.94
Malaysia	1760	669	38.01	661	37.58	219	12.46	112	6.38
China	1111	179	16.11	202	18.20	100	9.01	88	7.93
Thailand	1133	1133	100.00	613	54.10	247	21.84	84	7.43
Total	9691	5185	53.50	4115	42.55	2495	25.81	868	8.99

Panel B: Derivatives use by year

Years	Total	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	N	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
2003–2006	3524	1752	49.72	1293	36.71	782	22.20	217	6.16
2007–2008	881	477	54.14	387	43.98	225	25.57	79	9.00
2009–2013	4405	2462	55.89	2021	46.06	1261	28.77	488	11.14
Total	9691	5185	53.50	4115	42.55	2495	25.81	868	8.99

Note: Table 1 shows the number and percentage of firms that use derivatives by country and by year for all firms. We present the percentage of firms using derivatives separately for foreign currency derivatives, interest rate derivatives, and commodity price derivatives. Panel A presents the use of the three types of derivatives based on firm-year observations by country. Panel B shows the trend of derivatives use over time.

entire sample, more than half (53.5%) used at least one type of derivative, and 100% of firms in Japan, Thailand, and the Philippines used some kind of derivative during the sample period. The most commonly used instruments were foreign currency derivatives (42.55%), followed by interest rate derivatives (25.81%) and commodity price derivatives (8.99%).

Panel B presents how derivatives use changed over time. We divided the sample into three periods based on the global financial crisis. Derivatives were used more frequently over time, increasing from 49.72 % in the period from 2003–2006 to 54.14% in the period from 2007–2008 and 55.89% in the period from 2009–2013.

4.2. Dependent variables

To examine the decision to use derivatives and the intensity of derivatives use, we considered two kinds of dependent variables. To measure a firm's likelihood of using derivatives, we constructed a binary variable with the value of one or zero depending on whether a firm used derivatives. To measure the intensity of a firm's derivative use, we constructed a continuous variable defined as the total notional number of derivatives contracts scaled by the firm size for a user and zero for a firm that does not use derivatives. We searched annual reports for information on derivatives use and classified firms as derivatives users if their annual reports specifically mentioned the use of any type of derivatives contracts (i.e., forwards, swaps, futures, or options). Almost every firm stated that they did not enter into derivatives contracts for

trading or speculation purposes; we therefore assumed that all firms in our sample used derivatives mainly for hedging.

4.3. Independent variables

4.3.1. Country-specific factors

To measure country risk, we used the overall risk rating scores (i.e. average of the scores for sovereign risk, currency risk, and banking sector risk of each country on a scale from 0 (minimum risk) to 100 (maximum risk)) provided by the Economist Intelligence Unit.

We used two sets of proxies for governance mechanisms: corruption and quality of governance. To measure the corruption level, we collected the Corruption Perception Index (CPI) from the TI, ranging from 0 (highly corrupt) to 100 (very clean). Quality of governance mechanisms was constructed using three measures. The first was the rule of law, which is a proxy for the quality of law enforcement. The second was regulatory quality, which measures a government's ability to formulate and implement sound policies and regulations. The last was government effectiveness, which measures the quality of public and civil services and the credibility of the government's commitment to policies. All these variables were on a scale from -2.5 (weak governance) to 2.5 (strong governance), and they were obtained from the World Bank.

We implemented Pearson correlations for country-specific variables (untabulated). The pair-wise correlations showed that rule of law, regulatory quality, and government effectiveness were highly correlated, suggesting that some of these variables should be dropped in the multivariate analysis. Therefore, we only used government effectiveness, which represents the overall legal system, in the following analyses.[6]

4.3.2. Firm-specific factors

To test traditional hedging theories, we employed the most standard variables identified in the extant literature. Firstly, we used two measures of borrowing capacity as proxies for a firm's pre-hedging probability of financial distress: financial leverage and interest coverage. Secondly, we measured three aspects of the firm's effective tax function: deferred taxes. Following Kumar and Rabinovitch (2013), we also used the range of the firm's tax rate as a proxy for the progressive region of the tax schedule and expected positive coefficients of these variables. Thirdly, three sets of variables were developed to capture the essence of the conditions underlying the agency costs of debt hypothesis: leverage ratio, ratio of market to book value, and current ratio.

We also controlled for the existence of other means of financial hedging—convertible debts, preferred stocks, current ratio, and dividend payout - as firms issue these debt instruments and liquid assets instead of hedging with derivatives (Nance et al., 1993). In addition, we controlled for firm size, which is measured by the natural logarithm of total assets. We expected this variable to have a positive effect on derivatives use.

4.4. Control variables

Other country-level factors could have been confounded with governance quality proxies to affect firms' hedging behavior. Thus, we controlled for such country effects and country time-invariant characteristics by using GDP per capita ratio to proxy for the relative performance of the countries and financial system

Table 2: Definitions of independent variables

Variables	Definitions	Sources
Panel A: Firm-specific variables		
Leverage	Total debt to total assets	Datastream
Interest coverage ratio	Earnings before interest and taxes (EBIT) to total interest expenses	Datastream
Deferred taxes	Deferred taxes represent the accumulation of taxes that are deferred as a result of timing differences between reporting sales and expenses for tax and financial reporting purposes	Datastream
Tax rate	Income taxes to pre-tax income	Datastream
Market to book value	Market value of a firm's common equity divided by book value of common equity	Datastream
Current ratio	Short-term assets to short-term liabilities	Datastream
Firm size	Natural logarithm of market value of total assets scaled by Producer Price Index (PPI)	Datastream
Convertible debt	Book value of convertible debt divided by firm size	Datastream
Preferred stock	Book value of preferred stock divided by firm size	Datastream
Dividend payout	Dividends per share to earnings per share	Datastream
Panel B: Country-specific variables		
Overall risk rating	Average scores for sovereign risk, currency risk, banking sector risk, and economic structure risk of each country on a scale from 0 (minimum risk) to 100 (maximum risk)	Economist Intelligence Unit
Corruption Perception Index (CPI)	Inverse ranking of country corruption levels on a scale from 0 (highly corrupt) to 100 (very clean)	Transparency International (TI)
Regulatory quality	Index measuring the governmental ability to formulate and implement sound policies and regulations with values from -2.5 (weak) to 2.5 (strong)	World Bank
Government effectiveness	Index measuring the quality of public and civil servicesand the degree of its independence from political pressures as well as the credibility of the government's commitment to such policies with values from -2.5 (weak) to 2.5 (strong)	World Bank
Panel C: Control variables		
FORSALES	Foreign sales to total sales	Datastream
FORASSETS	Foreign assets to total assets	Datastream
GDP per capita	Natural logarithm of GDP per capita of respective countries, measured in thousands of USD	World Bank
DEPOSITSTOGDP	Financial system deposits to GDP: The demand, time, and saving deposits in deposit money banks and other financial institutions as a share of GDP	World Bank

Note: Table 2 defines the firm-specific and country-specific independent variables and control variables that we examine.

deposits to GDP to proxy for financial market development. These variables were obtained from the World Bank's World Development Indicators. Further, we controlled for the exposure that a firm may face by employing the ratio of foreign sales to total sales and the ratio of foreign assets to total assets. Positive coefficients on these variables were expected.

4.5. Modeling procedures

Following our discussion above, we estimated a series of Probit models and Tobit models in general forms as Equation (1) and Equation (2) below:

Probability (Derivatives use$_{it}$*) = f (firm-specific variables, country-specific variables)* (1)

Derivatives use$_{it}$ *= f (firm-specific variables, country-specific variables)* (2)

Where:

Probability (Derivatives use) is a binary variable that indicates whether firm *i* uses derivatives at year *t*.

Derivatives use is a continuous variable that is measured by the notional number of derivatives contracts scaled by total assets.

Country-specific variables include proxies for country risk and governance mechanisms.

Firm-specific variables are the variables that are used in testing value-creation theories through hedging and control variables for exposure to financial risks.

It is worth noting that in our analysis, we used country random effects to focus on the effects of country-level factors and the variance component structure, as the main explanatory variables were at the country level and time invariant.[7] We also used industry and year fixed effects to measure the within-industry differences in the effect of country-level factors on firms' derivatives usage and control for unobserved time-varying effects. In addition, following Rogers (1993), we employed a clustering method to adjust for the heteroscedasticity and serial correlation of standard errors.

5. Results and discussion

5.1. Multivariate analysis: Determinants of the decision to use derivatives

5.1.1. Pooled probit results

Analysis by country-specific factors

In line with Hypothesis 1, we find that corruption is positively and significantly associated with the likelihood of a firm using derivatives. This result may be attributed to a lower transaction cost associated with lower corruption. Put differently, lower corruption enables firms to enter financial derivatives contracts at a lower cost. Likewise, consistent with Hypothesis 2, there is a significant and positive effect of government effectiveness on a firm's tendency to use derivatives. This result is due to how a well-functioning legal system and high legal enforceability lower the costs of contracting and administrating, thereby facilitating firms'use of derivatives.

Taken together, these findings suggest that good governance increases a firm's inclination to use derivatives. Moreover, firms in weakly governed countries are likely to use derivatives for purposes other than reducing exposure to financial risks. In particular, when examining the proxies for exposure, we find the coefficient estimates of all other proxies are insignificant; implying that exposure to financial risks does not play an important role in the determinants of a firm's derivatives usage. This finding is

Table 3: Probit regression estimates of the likelihood of using derivatives

Explanatory variables	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Country- specific factors								
Corruption	0.105***	0.0939***	0.097***	0.0855***	0.109***	0.0972***	0.0416***	0.0366***
	(3.87)	(4.04)	(3.77)	(3.78)	(7.09)	(9.36)	(3.84)	(2.81)
Government effectiveness	0.651	0.503*	0.644*	0.496*	0.0838	-0.0402	-0.296	-0.246
	(1.02)	(1.76)	(2.09)	(2.03)	(0.24)	(-0.10)	(-1.15)	(-0.81)
Overall risk rating	0.132*	0.111*	0.126*	0.105*	0.105**	0.0923**	0.0367	0.0337
	(1.77)	(1.65)	(1.81)	(1.72)	(2.44)	(2.38)	(1.11)	(0.98)
Firm- specific factors								
Firm size		0.0436***		0.0449***		0.0409*		0.0142
		(3.9)		(4.09)		(1.9)		(0.84)
Leverage		0.0197**		0.0252***		0.0347***		-0.0333
		(2.31)		(4.3)		(2.79)		(-0.22)
Interest coverage		0.0521		0.0295**		-0.007		0.0132
		(1.5)		(2.31)		(-0.96)		(1.39)
Tax rate		-0.0247***		-0.0268**		-0.0537		-0.0213
		(-2.71)		(-2.30)		(-0.46)		(-0.88)
Deferred taxes		-0.0283*		-0.0577***		0.0512***		0.0493***
		(-1.76)		(-3.93)		(2.7)		(6.14)
Market to book value		-0.0106***		-0.0117***		-0.0127*		-0.0961**
		(-3.55)		(-3.03)		(-1.78)		(-2.22)
Current ratio		-0.0737		-0.0762		-0.0667		-0.0129
		(-0.94)		(-0.93)		(-0.77)		(-0.96)
Dividend payout		-0.0694		-0.0953		-0.0222**		0.0485
		(-1.27)		(-0.73)		(-2.55)		(0.25)
Control variables								
FORSALES	0.0757	0.0125	0.0108	0.0174	0.0203*	0.0256**	0.0139	0.0939
	(0.47)	(0.84)	(0.58)	(0.96)	(1.74)	(-2.06)	(0.96)	(0.53)
FORASSETS	-0.0326	-0.0302	-0.028	-0.0248	-0.021	-0.0212	-0.0192	-0.0256
	(-1.39)	(-1.11)	(-1.12)	(-0.91)	(-1.02)	(-0.97)	(-1.27)	(-1.10)
GDP per capita	-0.0616***	-0.0530***	-0.059***	-0.0496***	-0.0530***	-0.0430***	-0.0107	-0.0889
	(-3.30)	(-2.93)	(-3.37)	(-2.90)	(-5.61)	(-5.19)	(-1.57)	(-0.95)
DEPOSITSTOGDP	-1.253	-1.436*	-0.931	-1.066	0.328	-0.755	0.587	0.606
	(-1.57)	(-1.68)	(-1.21)	(-1.21)	(0.34)	(-0.83)	(0.8)	(0.82)
Intercept	-8.927**	-7.627**	-8.561**	-7.271**	-8.984***	-7.962***	-4.520***	-4.225**
	(-2.36)	(-2.22)	(-2.39)	(-2.25)	(-4.01)	(-4.13)	(-2.72)	(-2.31)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	3672	2686	3671	2679	3663	2680	3644	2661
Adjusted R-squared	0.1356	0.1776	0.1301	0.1675	0.1361	0.1775	0.0551	0.0797

*Note: Table 3 reports the regression for the probability of using any type of derivatives, foreign currency, interest rate, and commodity price derivatives. The dependent variable is binary variable, which takes on a value of 1 if firms use derivatives, and 0 otherwise. All independent variables definitions are reported in Table 2. The coefficients and significance levels are reported oneach model. Standard errors are clustered by country to control for heteroscedasticity and serial correlation. Model 1 investigates the country-specific characteristics only; both firm-specific and country-specific variables are included in the Model 2. Asterisks ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively; t-statistics in parentheses with standard errors clustered by countries.*

similar to that of Allayannis et al. (2003), who found that there is no evidence that East Asian firms eliminate their foreign exchange exposure by using derivatives.

The estimated coefficient on overall risk rating, the proxy for country risk, is positive and statistically different from zero. This finding supports Hypothesis 3 and implies that firms in more risky countries are more likely to use derivatives to manage a higher level of exposure to market risks.

Analysis by type of derivatives

We find that the results somewhat depend on the underlying assets of derivatives contracts. In the case of foreign currency derivatives, broadly similar to the results obtained for the use of any derivatives, we find a positive and statistically significant association between government effectiveness, overall risk rating, and firms' decisions to use derivatives. Conversely, for the use of interest rate derivatives, government effectiveness does not affect firms' likelihood of using derivatives, although there is a significant link between the use of interest rate derivatives and corruption and overall risk rating. For the use of commodity price derivatives, notably, the results lie in stark contrast to the results of any derivatives, foreign currency derivatives, and interest rate derivatives use when we are unable to find any evidence that there is a link between governance mechanisms and country risk and firms' decisions on using derivatives. However, we observe that the coefficient on corruption is always significant and positive, suggesting that a country's governance quality has a strong impact on a firm's decision to use that type of derivative.

5.1.2. Pooled probit results based on corruption levels

In this section, we replicate pooled probit regressions with respect to the corruption level (CPI). We group countries into low and high corruption levels based on the scales of the CPI as defined by the TI. The low corruption level group consists of all countries that have scores equal to or greater than 75, whereas any country with a CPI score less than 75 is placed in the high corruption level group. In that way, we can identify the factors that might or might not be determinants of derivatives usage by firms located in countries with low corruption and the factors most likely to affect firms' decisions when they are influenced by high corruption.

When the corruption level is low, the results show that governance mechanism quality is a significant determinant to explain why firms use derivatives, but traditional hedging theories have very little power to explain why firms use derivatives. We find mixed supporting evidence for the hypothesis of bankruptcy and financial distress costs: Leverage is positively related to firms' likelihood to use derivatives, while the interest coverage ratio is never different from zero at any significance level. We do not find any link between the agency costs of debt and decisions on derivatives use by firms in countries with low corruption.

The significant and positive coefficient estimates of foreign sales to total sales and leverage, however, suggest that firms with greater exposure to exchange rate and interest rate risks are more likely to use derivatives. This result indicates that firms in countries with low corruption appear to use derivatives to mitigate exposure to financial risks rather than to speculate, in line with arguments about speculation

Table 4: Probit estimations for determinants of derivative use based on corruption levels

Explanatory variables	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	Low corruption	High corruption	Low corruption	High corruption	Low corruption	High corruption	Low corruption	High corruption
Country-specific factors								
Government effectiveness	0.598***	0.819***	1.368***	0.525**	0.773***	1.570***	1.329**	0.970**
	(2.76)	(2.74)	(3.32)	(2.07)	(3.23)	(7.86)	(2.19)	(2.19)
Overall risk rating	-0.0638	0.0435	-0.281	0.0557	0.0656	0.0616	0.0556	-0.0173
	(-0.20)	(0.86)	(-0.80)	(1.05)	(0.24)	(0.20)	(0.42)	(-0.37)
Firm-specific factors								
Firm size	0.0327***	0.0297**	0.0414***	0.0283*	0.0500	0.0396	-0.0353	0.0262
	(13.36)	(2.22)	(3.17)	(1.88)	(1.18)	(1.58)	(-0.86)	(1.33)
Leverage	0.0194***	0.0114	0.0274***	0.0167	0.0363***	0.0204	-0.0417***	0.0109
	(2.83)	(0.62)	(4.17)	(1.37)	(4.60)	(1.19)	(-2.81)	(0.78)
Interest coverage	0.0192	0.0438	0.0674*	0.0287	-0.0751***	-0.0116	0.0326***	-0.0225
	(1.54)	(1.26)	(1.67)	(1.06)	(-3.28)	(-0.74)	(9.15)	(-0.86)
Tax rate	-0.0303*	0.0350	-0.0313***	-0.0759	-0.0249	0.0474***	-0.0439***	0.0142
	(-1.72)	(0.24)	(-2.92)	(-0.65)	(-0.91)	(4.92)	(-2.74)	(1.02)
Deferred taxes	0.0063	-0.0358***	0.0216	-0.0594***	0.0209	0.0592***	0.0534***	0.0384***
	(0.10)	(-4.99)	(0.39)	(-4.37)	(1.06)	(3.59)	(4.14)	(4.06)
Market to book value	-0.0863	-0.0842**	-0.0169**	-0.0568	0.0113	-0.0411***	-0.0396	-0.0179
	(-1.08)	(-2.28)	(-2.04)	(-1.27)	(0.36)	(-2.71)	(-1.60)	(-0.75)
Control variables								
FORSALES	0.0117**	0.0474	0.0103***	0.0610	0.0828***	0.0527***	-0.0214*	0.0344
	(2.33)	(1.12)	(11.61)	(1.37)	(3.46)	(3.46)	(-1.71)	(1.28)
FORASSETS	-0.0348	0.0310	-0.0156	0.0240	-0.0297	0.0106	-0.0614***	0.0152
	(-1.26)	(1.41)	(-0.61)	(0.79)	(-0.90)	(1.64)	(-81.82)	(0.37)
GDP per capita	0.0400***	0.0127***	0.0547***	0.0114***	0.0330***	0.0132***	0.0356***	0.0485**
	(7.44)	(5.05)	(6.76)	(3.80)	(4.43)	(7.79)	(2.87)	(2.55)
DEPOSITSTOGDP	-1.349	-2.932***	-1.898	-2.826***	-2.159***	-3.994***	4.257	-0.296
	(-1.05)	(-3.46)	(-0.74)	(-3.72)	(-2.75)	(-3.86)	(1.35)	(-0.51)
Intercept	0.170	-3.502	5.295	-3.869	-2.843	-2.809**	-2.169	-1.389
	(0.02)	(-1.51)	(0.66)	(-1.54)	(-0.42)	(-1.99)	(-0.73)	(-0.67)
Other firm-specific factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	927	1757	927	1750	927	1748	822	1733
Adjusted R-squared	0.0873	0.1880	0.0933	0.1654	0.0933	0.2001	0.0942	0.0854

*Note: Table 4 presents regressions from pooled probit models of the likelihood of using derivatives on the basis of corruption levels: low corruption, and high corruption. We define corruption levels based on a corruption index, in which those countries having scores greater than 75 are grouped into low corruption level, and those countries having scores less than 75 are considered to be highly corrupt. The dependent variable is binary variable, which takes on a value of 1 if a firm uses derivatives, and 0 otherwise. All independent variables definitions are reported in Table 2. The coefficients and significance levels are reported on each model. Standard errors are clustered by country to control for heteroscedasticity and serial correlation. Asterisks ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.*

of prior studies such as Géczy et al. (1997) and Júnior (2013).

When the level of corruption is high, the factors influencing firms' decisions on using derivatives are different. First, the observed negative coefficient estimate on deferred taxes implies that in highly corrupt countries the more progressive marginal tax rates are, the less the firms are induced to use derivatives. Second, the market to book ratio has a highly significant and negative effect on the probability of firms' using derivatives in highly corrupt countries but an insignificant effect in countries with low corruption. This result suggests that firms in highly corrupt countries do not use derivatives to reduce the agency costs of debt. Meanwhile, firms with growth opportunities in countries with low corruption may have more sufficient funds and/or higher external financing availability and thus have less incentive to use derivatives to deal with the mismatch between domestic costs and foreign revenues. Third, the observed insignificant coefficient estimates on all proxies for exposure indicate that firms in highly corrupt countries do not use derivatives to eliminate exposure to financial risks. They use derivatives for other purposes, such as speculation or self-management purposes.

5.2. Multivariate analysis: Determinants of the intensity of derivatives use

5.2.1. Pooled Tobit estimations

Consistent with Hypothesis 1, the corruption index has a significant and positive impact on the intensity of derivatives use. We also observed a positive effect on government effectiveness. Taken together, these results suggest that good institutions with strong legal enforceability and governance capabilities lower hedging costs, hence facilitating firms' use of derivatives. Meanwhile, firms in countries with high levels of corruption are less motivated to use derivatives, because entering into contracts is costlier due to bribes and other administrative payments.

Regarding types of derivatives, the effects of some factors vary across types of derivatives. In terms of interest rate derivatives, our findings suggest that corruption is a significant determinant influencing firms' extent of using derivatives and that there is no significant effect of government effectiveness or country risk on firms' level of derivatives use. For commodity price derivatives, the findings suggest that there is a strong relation between a country's corruption level and risks and a firms' decision on the extent of derivatives use. This result is different from the findings of previous studies that firms use commodity price derivatives for other reasonsarising from industry-specific factors.

5.2.2. Moderating effect of corruption levels

When the corruption level is low, consistent with the findings from probit estimations, Table 6 shows that although some firm-specific factors are statistically significant determinants of firms' level of derivatives use, they do not support any traditional hedging theories, as most of the significant results are counter to predictions. In particular, the results do not support the hypothesis of economies of scale, as evidenced by the insignificant coefficient estimate on firm size. We are also unable to find any supporting evidence in favor of the corporate tax hypothesis or the argument about agency costs of debt. On the other hand, even though leverage and interest coverage are statistically

Table 5: Tobit estimates for the extent of the corporate use of derivatives

Explanatory variables	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Country-specific factors								
Corruption	0.0267	0.0585*	0.0304*	0.0467*	0.0143**	0.0136**	0.0102**	0.0675**
	(1.16)	(1.93)	(1.74)	(1.72)	(2.17)	(2.01)	(1.97)	(1.98)
Government effectiveness	0.204***	0.0329*	0.0447*	-0.0350	-0.234	-0.223	-0.0598	-0.0699
	(4.22)	(1.96)	(1.84)	(-0.35)	(-1.45)	(-1.16)	(-0.73)	(-0.12)
Overall risk rating	0.0204***	0.0108	0.0864	0.0457	0.0678	0.0195	0.0120*	0.0972
	(2.59)	(1.52)	(1.29)	(0.66)	(0.08)	(0.20)	(1.69)	(1.55)
Control variables								
FORSALES	0.0673	0.0459	0.0545	0.0394	0.0722	0.0465	0.0955	0.0559
	(1.08)	(1.13)	(0.88)	(1.03)	(1.21)	(1.29)	(1.24)	(0.72)
FORASSETS	-0.0117*	-0.0775	-0.0758	-0.0404	-0.0154*	-0.0915	-0.0155	-0.0182
	(-1.87)	(-1.25)	(-1.38)	(-0.77)	(-1.74)	(-1.28)	(-1.48)	(-1.33)
GDP per capita	-0.0363	-0.0301	-0.0223	-0.0191	-0.0196	-0.0198	0.0170	0.0191
	(-0.97)	(-0.89)	(-0.54)	(-0.54)	(-0.46)	(-0.59)	(0.92)	(1.19)
DEPOSITSTOGDP	-0.281*	-0.269*	-0.276*	-0.279*	-0.121	-0.237	0.282	0.254
	(-1.67)	(-1.72)	(-1.79)	(-1.69)	(-0.47)	(-0.80)	(0.62)	(0.72)
Intercept	-0.729	-0.419	-0.428	-0.281	-0.924	-0.738	-2.054**	-1.657**
	(-1.22)	(-0.90)	(-0.71)	(-0.60)	(-1.22)	(-1.33)	(-2.46)	(-2.30)
Firm-specific factors	No	Yes	No	Yes	No	Yes	No	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	3471	2540	3676	2691	3422	2486	3595	2627
Adjusted R-squared	0.071	0.112	0.091	0.1406	0.073	0.1066	0.0664	0.1291

*Note: Table 5 reports the pooled tobit regressions with censoring at zero and one for the extent of firms' using any type of derivatives, foreign currency, interest rate, and commodity price derivatives. The dependent variable is continuous variable, which is measured as the notional amount of derivatives use divided by total assets. Non-derivative users are set to zero. All independent variables definitions are reported in Table 2. The coefficients and significance levels are reported on each model. Standard errors are clustered by country to control for heteroscedasticity and serial correlation. Model 1 investigates the country-specific characteristics only; both firm-specific and country-specific variables are included in Model 2. Asterisks ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively; t-statistics in parentheses with standard errors clustered by countries.*

Table 6: Tobit estimates for the extent of corporate derivative use based on corruption levels

Explanatory variables	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	Low corruption	High corruption	Low corruption	High corruption	Low corruption	High corruption	Low corruption	High corruption
Country-specific factors								
Government effectiveness	18.97***	0.389*	17.34***	0.335	26.29***	0.542***	4.450***	0.0903
	(4.95)	(1.83)	(9.81)	(1.52)	(3.85)	(5.00)	(5.93)	(0.51)
Overall risk rating	0.924	0.0437***	-0.582	0.0409**	0.712	0.0491***	0.321	-0.0842
	(0.69)	(2.73)	(-1.34)	(2.50)	(0.73)	(4.97)	(0.99)	(-0.59)
Firm-specific factors								
Firm size	-0.871	-0.0268***	-0.482	-0.0598***	-0.0780	-0.0963	-0.0583	-0.0226
	(-1.50)	(-13.93)	(-1.49)	(-5.42)	(-0.08)	(-0.11)	(-0.24)	(-0.59)
Leverage	-0.0491**	-0.0454	-0.0464	0.0850	-0.0127	-0.0432	-0.0238	-0.0195
	(-2.17)	(-0.34)	(-0.49)	(0.10)	(-0.17)	(-0.52)	(-1.18)	(-0.81)
Interest coverage	-0.0174***	-0.0129	-0.0138***	0.0991	-0.0597***	-0.0127*	0.0455***	-0.0374
	(-36.18)	(-0.03)	(-25.71)	(0.35)	(-3.68)	(-1.73)	(2.79)	(-0.77)
Tax rate	-0.0101	0.0126**	-0.0600***	0.0851*	-0.0531	0.0226***	-0.0101	0.0582
	(-0.58)	(2.53)	(-5.84)	(1.93)	(-0.69)	(5.14)	(-1.20)	(1.00)
Deferred taxes	0.0640	-0.0235	0.0531	-0.0503	0.0821	0.0353	0.0103	0.0149
	(1.52)	(-0.04)	(1.40)	(-1.01)	(1.33)	(0.59)	(1.07)	(1.01)
Market to book value	-0.121	-0.0917	-0.138***	0.0109	-0.0319	-0.0817**	-0.0622	-0.0198
	(-1.39)	(-0.27)	(-4.77)	(0.04)	(-0.33)	(-2.22)	(-0.99)	(-0.89)
Current ratio	-0.145	-0.0260*	-0.197	-0.0514***	-0.0247	0.0160	-0.299***	0.0303
	(-0.28)	(-1.71)	(-1.12)	(-4.17)	(-0.05)	(0.14)	(-10.63)	(0.03)
Dividend payout	0.0458	-0.0201**	0.0351***	-0.0266***	-0.0656***	-0.0707*	-0.0460	0.0201
	(0.18)	(-2.04)	(8.85)	(-3.32)	(-2.82)	(-1.66)	(-0.45)	(0.45)
Convertible debt	2.176	-6.063***	-7.059	-5.734***	-23.11***	-3.470	-25.27***	-4.444*
	(0.12)	(-3.05)	(-0.60)	(-3.30)	(-4.06)	(-1.25)	(-5.09)	(-1.87)
Control variables								
FORSALES	0.0183	0.0317***	0.0754	0.0278***	0.0105	0.0143***	-0.0125***	0.0126*
	(1.18)	(4.11)	(0.56)	(5.21)	(1.43)	(3.27)	(-2.84)	(1.81)
FORASSETS	-0.0257	0.0181	-0.0171	0.0133	-0.0131	0.0551	-0.0360***	0.0306
	(-0.61)	(0.78)	(-0.86)	(0.69)	(-0.36)	(0.65)	(-5.38)	(0.40)
GDP per capita	-9.342***	0.131***	-6.811***	0.159***	-9.416***	0.0496*	0.890***	0.0326
	(-49.72)	(4.43)	(-15.04)	(5.66)	(-11.73)	(1.67)	(7.37)	(1.41)
DEPOSITSTOGDP	-0.338	-1.951***	3.525	-1.965***	-0.607	-0.972*	12.37	-0.0209
	(-0.50)	(-5.66)	(0.24)	(-4.37)	(-0.13)	(-1.69)	(1.20)	(-0.11)
Intercept	133.9***	-0.369	128.8***	-0.905	142.6***	1.011*	-32.77***	-0.446
	(3.52)	(-0.57)	(17.15)	(-1.36)	(3.99)	(1.94)	(-5.38)	(-1.63)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	804	1669	907	1716	848	1578	887	1675
Adjusted R-squared	0.0220	0.0411	0.0303	0.0484	0.0132	0.152	0.0953	0.1842

*Table 6 reports the pooled tobit regressions with censoring at zero and one for the extent of firms' using derivatives on the basis of corruption levels: low corruption, and high corruption level. We define corruption levels based on a corruption index, in which those countries having scores greater than 75 are grouped into low corruption level, and those countries having scores less than 75 are considered to be highly corrupt. The dependent variable is continuous variable, which is measured as the notional amount of derivatives use divided by total assets. Non-derivative users are set to zero. All independent variables definitions are reported in Table 2. The coefficients and significance levels are reported on each model. Standard errors are clustered by country to control for heteroscedasticity and serial correlation. Asterisks ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively; t-statistics in parentheses*

significant, they are both the opposite of the predicted sign.

We observe that governance mechanism quality is a consistently important factor influencing non-financial firms' level of derivatives use, as government effectiveness is statistically different from zero and positively associated with firms' level of derivatives use in all models. On the other hand, it is interesting to note that non-financial firms in countries with low corruption consider countries' risk levels when they make decisions on the extent of derivatives use. This finding is consistent with our prior finding from the probit model in the previous section.

We note that the factors affecting firms' derivatives use in countries with low corruption and countries with high corruption differ somewhat**.** First, firm size is a significant determinant of derivatives use by firms located in highly corrupt countries, as evidenced by the negative and significant coefficient estimates. We propose that in highly corrupt countries small firms face greater information asymmetries and higher financing transaction costs, which is likely to make external financing more expensive for smaller firms and thus motivate them to use higher levels of derivatives.

Second, the coefficient estimates on current ratio and convertible debts are statistically different from zero and negatively related to firms' derivatives use decisions, while these variables are insignificant factors for firms located in countries with low corruption. This finding supports Hypothesis 1 that firms have less incentive to enter into derivatives contracts if they are located in highly corrupt countries. Meanwhile, the countries with low corruption facilitate the use of derivatives, so firms based in these countries are not induced to use liquid assets and debt instruments as substitutes for derivatives.

Third, overall risk rating has a highly significant and positive effect on the likelihood of firms using derivatives, while it is an insignificant determinant of derivatives use by firms located in countries with low levels of corruption. This result supports Hypothesis 3 and suggests that firms in highly corrupt countries use derivatives more aggressively, simply because those countries have higher degrees of economic, financial, and political risk.

5.3. Robustness tests

To address the endogeneity problem, in this section, we implement lagged variables in a panel data framework with respect to corruption levels. This method not only offers a solution to the endogeneity issue but also enables us to control for unobserved heterogeneity, which is unchanged over time and correlates with the independent variables (see Chen and King, 2014).

We find that firms in countries with low corruption levels use derivatives to hedge exposure, while firms located in highly corrupt countries use derivatives for selective hedging and not for the reasons stated by traditional hedging theories. In particular, the number of derivatives used in the previous year is positively related to decisions on levels of derivatives use in the current year by firms in countries with low corruption, while it does not affect decisions of firms in countries with high corruption levels. This result suggests that firms located in countries with low corruption use derivatives as their norm. In contrast, in highly corrupt

Table 7: Results panel data regression with lagged variables based on corruption levels

Explanatory variables	Any derivatives		Foreign currency derivatives		Interest rate derivatives		Commodity price derivatives	
	Low corruption	High corruption	Low corruption	High corruption	Low corruption	High corruption	Low corruption	High corruption
Lagged derivative use	0.292***	0.212	0.0571***	0.471	0.700***	0.0589	0.0786***	0.527***
	(49.91)	(1.42)	(8.02)	(1.61)	(55.80)	(0.11)	(239.47)	(3.12)
Country-specific factors								
Government effectiveness	1.112***	-0.171	4.548*	-0.0762	7.693***	0.0114	-0.166	-0.0712***
	(10.27)	(-0.41)	(1.76)	(-0.48)	(9.23)	(0.06)	(-0.67)	(-4.52)
Overall risk rating	5.221***	0.0160**	6.226**	0.0764*	-1.678***	0.0867	0.119***	0.0744
	(3.27)	(2.03)	(2.19)	(1.80)	(-3.02)	(1.01)	(4.00)	(0.50)
Control variables								
FORSALES	5.221***	0.0160	6.226**	0.0764*	-1.678***	0.0867	0.119***	0.0744
	(3.27)	(1.03)	(2.19)	(1.80)	(-3.02)	(1.01)	(4.00)	(0.50)
FORASSETS	0.0164***	0.0190	0.0124**	0.0610	-0.0533	0.0619	0.0697***	0.0363
	(5.37)	(1.51)	(2.08)	(1.29)	(-0.62)	(1.07)	(49.10)	(1.09)
GDP per capita	128.6	2.676*	121.2	1.132	74.07	-0.0521	3.271**	0.0958
	(1.28)	(1.89)	(1.04)	(1.26)	(1.33)	(-0.05)	(2.23)	(0.43)
DEPOSITSTOGDP	10.69	-1.242**	7.931	-0.297***	14.30	-0.257	-0.671***	-0.0968***
	(0.65)	(-2.36)	(0.79)	(-2.99)	(0.99)	(-0.88)	(-3.31)	(-2.64)
Intercept	-26.503	1.275	-1.0536	0.2440***	-0.8267	1.002***	-2.973**	-0.0602
	(-0.32)	(1.3)	(-0.66)	(4.49)	(-0.90)	(-4.34)	(-5.32)	(-1.3)
Firm-level factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Current country-level factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No of observations	268	602	270	695	298	724	324	788
Adjusted R-squared	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Table 7 presents Panel data regressions with one-year lagged measure of all explanatory variables and one-year lagged derivatives use lagged variables based on corruption levels. We define corruption levels based on a corruption index, in which those countries having scores greater than 75 are grouped into low corruption level, and those countries having scores less than 75 are considered to be highly corrupt. The dependent variable is continuous variable, which is measured as the notional amount of derivatives use divided by total assets. Non-derivative users are set to zero. All independent variables definitions are reported in Table 2. The coefficients and significance levels are reported on each model. Standard errors are clustered by country to control for heteroscedasticity and serial correlation. Asterisks ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively; t-statistics in parentheses.*

Table 8: Pearson correlation matrix

	Corruption	Government effectiveness	Overall risk rating	Firm size	Leverage	Interest coverage	Deferred taxes	Tax rate	Market to book value	Current ratio	Dividend payout	FORSALES	FORASSETS	GDP per capita	DEPOSITS TOGDP
Corruption	1														
Government effectiveness	0.479***	1													
Overall risk rating	-0.397***	-0.492***	1												
Firm size	0.191***	0.094***	-0.204***	1											
Leverage	-0.015	-0.013	0.017*	-0.064***	1										
Interest coverage	-0.014	-0.006	0.009	-0.002	-0.008	1									
Deferred taxes	-0.044***	-0.021**	0.048***	-0.049***	-0.006	0.008*	1								
Tax rate	0.023**	0.018*	-0.019*	0.002	0.015	-0.013	-0.084	1							
Market to book value	-0.023**	-0.029***	0.0294***	0.016	0.003	-0.001	0.001	-0.037	1						
Current ratio	-0.031***	-0.033***	0.038***	-0.043***	-0.015	-0.001	0.021	-0.029	0.009	1					
Dividend payout	-0.032***	-0.083	0.021*	0.276***	-0.078***	0.045***	-0.017	0.024*	0.068	-0.029***	1				
FORSALES	0.381***	0.364***	-0.348***	-0.030**	0.019	0.011	0.082	-0.012	-0.019	-0.009	-0.047	1			
FORASSETS	0.371***	0.361***	-0.346***	0.045***	0.013	0.033**	0.059***	0.008	0.024	-0.015	-0.131***	0.183***	1		
GDP per capita	0.308***	0.179***	-0.143***	-0.061	-0.098	-0.012	-0.011	0.019*	-0.016	-0.030***	-0.038***	0.399***	0.377***	1	
DEPOSITSTOGDP	0.597***	0.617***	-0.256***	0.236***	0.023**	-0.002	-0.055***	0.069	-0.023**	-0.0231**	-0.057***	0.308***	0.313***	0.456***	1

countries, firms "take their view" on decisions on the extent of derivatives use or, in Júnior's (2013) words, they selectively hedge. This result is similar to Allayannis et al.'s (2003) finding that non-financial firms in East Asian countries engage in selective hedging.

On the other hand, we find no relationship between the extent of derivatives usage and the likelihood of firms in highly corrupt countries using derivatives to reduce costs of bankruptcy and financial distress, agency costs of debt, economies of scale, or corporate tax burdens. However, the findings suggest that firms located in countries with low corruption levels use derivatives to reduce their expected tax liability, thus reducing the volatility of pre-tax firm value, as evidenced by the significant and positive estimated coefficients on both tax rate and deferred taxes, which is consistent with Nance et al. (1993) and Kumar and Rabinovitch (2013). The findings also indicate that the ratio of foreign assets to total assets has a strongly significant and positive effect on decisions on the extent of derivatives use by firms in countries with low levels of corruption, indicating that firms use derivatives to hedge, while all proxies for exposure are insignificant in the case of high corruption levels.

6. Conclusion

We explored the link between countries' governance quality and derivatives use by non-financial firms in eight diverse economically and institutionally countries in East Asia between 2003 and 2013. Our empirical findings strongly suggest that countries' governance mechanisms have a significant and positive effect on firms' decisions on derivatives usage.

Corruption levels play a significant role in explaining the use of derivatives. Firms in highly corrupt countries such as Indonesia have

less incentive to use derivatives. On the other hand, firms located in countries with low corruption levels, such as Singapore and Japan, have a greater incentive to use derivatives and use them with a greater intensity. We conjecture that firms in well-governed countries use derivatives to hedge exposure and overcome their costs arising from market imperfections, whereas firms located in weakly governed countries use derivatives for speculating and/or selective hedging.

Regarding the theoretical contributions, by bridging institutional and hedging theories we provide a comprehensive examination of the determinants of derivative usage with a focus on country-specific factors that have not been thoroughly examined in the existing literature to date, namely governance mechanisms, corruption levels and country risks. Our study suggests that country- level governance may explain some of the ambiguity in the existing empirical literature. Furthermore, our research approach and findings propose some avenues for further theoretical and empirical research on institutional environments and how these affect firms' decisions about using derivatives. The study provides important policy implications that emphasize the role of policy makers in institutional development in terms of enabling firms to explore the benefits of hedging, such as enhancing legal systems, and improving government efficiency.

Finally, as our sample consists of a diverse group of countries including three high-income countries (Japan, Hong Kong and Singapore), one upper-middle income (Malaysia) and four lower-middle income countries (the Philippines, Indonesia, Thailand, China) our findings may act as a baseline to conduct further studies in a broad range of environments.

Notes:

1. Foreign currency, interest rate, and commodity price derivatives are settled at a specific future date, and their values are derived from changes in foreign currencies (exchange rates), interest rates, and prices of commodities, respectively.
2. Overall, Guay and Kothari (2003) suggest the need to rethink the past empirical research on firms' derivatives use.
3. FT 500 2013, http://www.ft.com/indepth/ft500, Financial Times
4. Business Times, http://www.businesstimes.com.sg/companies-markets/ranking-of-singapore-companies-by-market-capitalisation-0
5. http://quote.morningstar.com/stock-filing/Annual-Report/
6. The results are almost the same if we use the other two variables instead of government effectiveness.
7. We also performed the Hausman tests on the random-effects versus the fixed-effects model. The result showed that the random-effects model gave better fit.

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