



This is the pre-peer reviewed version of the following article: Fonseka, M. M., Gao-Liang, T. & Farooque, O. A. (2019). Impact of Environmental Information Disclosure and Real Estate Segments on Cost of Debt: Evidence from Chinese Real Estate Industry. *Economics of Transition and Institutional Change*, 441- 460, which has been published in final form at: <https://doi.org/10.1111/ecot.12238>.

This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for use of Self-Archived Versions (<https://authorservices.wiley.com/author-resources/Journal-Authors/licensing/self-archiving.html>).

Downloaded from rune@une.edu.au, the institutional research repository of the University of New England at Armidale, NSW Australia.

Impact of Environmental Information Disclosure and Real Estate Segments on Cost of Debt: Evidence from Chinese Real Estate Industry

M. M. Fonseca

*School of Management,
Xi'an Jiaotong University*

and

Trian, Gao-Liang

*School of Management,
Xi'an Jiaotong University*

and

Omar Al Farooque

*UNE Business School,
University of New England*

ABSTRACT

This paper examines the joint effects of the real estate segments and environmental information disclosure on the cost of debt in real estate firms in China. Building on extant literature, using 869 firm-year observations from 2006 to 2014 and applying both Feasible General Least Squares (FGLS) and Two-stage Least Squares (2SLS) Instrumental Variable (IV) approaches, we provide evidence that the commercial real estate segment leads to an increase in the cost of debt, while environmental information disclosure leads to a decrease in the cost of debt. However, the joint effects of the real estate segments and environmental information disclosure on cost of debt indicate a significantly positive relationship with the cost of debt, suggesting that the types of real estate segments (i.e. commercial or residential) does have significant moderating effects on the relationship between environmental information disclosure and the cost of debt. This signifies that even with increased levels of environmental information disclosure in commercial real estate sectors, its cost of debt is higher than for residential real estate sectors. Similar results are documented for the recent financial crisis period in the sample. These findings have important policy implications for environmental risk assessments for real estate sectors, their lending institutions and wider stakeholder groups.

Keywords: Cost of debt; Environmental information disclosure; Commercial real estate segment; Residential real estate segment

1. Introduction

Real estate development has been playing an important role in China's rapid economic growth since the opening up of the Chinese economy in 1980s. As a result of a flourishing real estate market, property prices are increasing in major cities in China (Wu, Gyourko, and Deng, 2012). Since 2000, low interest rates globally and sufficient liquidity have pushed real estate prices in developed countries to climb continuously, and the collateral loans of real estate play a vital role in the financial sector (Zhang and Sun 2006). On account of the recent financial crisis, stakeholders have realized the importance of the impact of the financial crisis on the real estate industry. A sharp adjustment of real estate prices during the financial crisis would severely worsen the value of bank assets, causing great damage to the global economy. The US real estate bubble caused a spike in mortgage failures and foreclosures which spilled over to the mortgage-backed securities market (Thakor, 2015). As a result, the market value of real estate related assets held by banks dropped significantly relative to historic cost (Bhat et al., 2011; Diamond and Rajan, 2011; Kolasinski, 2011). Given that the real estate sector is a fast growing sector in China, Zhang and Sun (2006) contend that the Chinese Government is watchful of the possible financial risks and corresponding shocks to China's economy accrued from the real estate market overheating. Due to the possible real estate bubble, examining China's real estate development and its impacts on financial stability deserves due attention.

Wang (2008) noted that residential real estate would concern geographical, political, economic, cultural, social and environmental factors when choosing location for real estate development, but they are not in high weight in China. On the other hand, the success of a commercial real estate business exclusively depends on the political, economic, cultural, social and environmental factors (Li and Yang, 2004; Wang, 2008).

Prior studies find that commercial real estate prices are more highly volatile than residential real estate prices (Kan et al., 2004; Wang, 2008; Wei, 2006; Igan and Pinheiro, 2009) and the default risk of commercial real estate sector loans is much higher than in the residential real estate sector (Igan and Pinheiro, 2009). Therefore, it is important to investigate how the types of real estate segments (i.e. residential and commercial) affect the cost of debt.

The real estate industry is identified as an environmentally sensitive industry and one of most important sectors of the economy. The real estate development activities typically relate to the consumption of large amounts of resources¹ and energy² and have significant adverse impacts on the environment that have been extensively highlighted in news and other reports. It normally includes dust and gas emission³, noise pollution, waste generation⁴, misuse of water and land, air pollution and unhealthy building atmosphere etc. The energy consumption during the construction phase of a project and the embedded carbon dioxide (CO₂) emissions of building materials are also significant. In addition, the real estate sector is responsible for a host of other environmental impacts on water resources, waste generation, air quality and biodiversity (Sharifi and Murayama, 2013). Ciliberti et al. (2008) suggest that many consumers prefer to purchase products from firms that are socially responsible and take care for the environment and maintain good citizenship behavior (Roy and Alam, 2007). This is also the case with investors preferring to invest and lenders preferring to lend in

¹ Over fifty percent of raw materials obtained from nature were used to build various types of buildings and their ancillary equipment (WBCSD, 2009).

² These buildings consume more than 40% of global energy in construction and operation (WBCSD, 2009). The existing building stock accounts for 30% of total energy consumption and 25% of greenhouse gas emission in China (CCIA, 2010; CHI, 2010). However, residential and non-residential real estate consume approximately 7.6% of total primary energy.

³ Estimates of the contribution of the real estate sector to global greenhouse gas emissions range from 7.9% (IPCC, 2007) to up to 30% (UNEP, 2009) and 25% of greenhouse gas emission in China (CCIA, 2010; CHI, 2010). However, residential and non-residential real estate produce approximately 6.0% of total greenhouse gas emissions when both direct inputs are considered.

⁴ The real estate constructions in China accounted for 40% of total amount of waste in 2010 (Wang et al., 2010).

these similar types of environmentally friendly businesses. However, ongoing expansion and growth of real estate firms are exposed to a number of sustainable development challenges involving various economic, environmental and social issues (Shen et al., 2010) which make these firms increasingly targeted by the environmentalist groups and government agencies to meet their social performance.

These issues have prompted real estate firms to engage in the sustainability debate and start devising management strategies to respond to the awareness of stakeholders and the general public. In recent years, these firms have been paying more attention to environmental issues as China encounters the most severe environmental pollution in its history. As the stakeholders become more worried about the environmental pollution, they demand firms disclose information relevant to their environmental performance (i.e. EID), and demonstrate the extent of environmental responsibilities fulfilled (Cho et al., 2010; Criado-Jimenez et al., 2008; Delmas and Toffel, 2008; Evans et al., 2009; Erlandsson and Tillman, 2009; Jose and Lee, 2007). In recognition of the above, the Shanghai Stock Exchange in 2008 issued a guide about EID for listed firms to enhance and enrich their disclosure of environmental information in their annual and corporate sustainability reports (Liu et al., 2010; Park et al., 2010).

In the literature, most studies examine the association between the financial disclosure and the cost of capital. However, the relationship between the level of EID and the cost of debt, especially related to real estate industry segments, has received little attention in the real estate finance and economics literature. No prior studies have examined the joint effects of real estate industry segments and EID on the cost of debt of real estate firms. To fill the research gap, we examine such relationships between the real estate industry segments, level of EID and the cost of debt in real estate firms in

China, where the EID is not a mandatory requirement by legislation, and where bank financing is so far the dominant source of external financing for real estate firms. Using a sample of 869 Chinese real estate firm-year observations from 2006 to 2014, we firstly investigate how the types of real estate segments (i.e. commercial and residential) affect the cost of debt. Secondly, we investigate whether a high level of EID can enhance a firm's value by reducing the cost of debt in real estate firms. Finally, we investigate whether a high level of EID does make any difference on the cost of debt in commercial and residential real estate segments.

Our study provides important contributions to the relevant literature in a number of ways. First, prior studies do not adequately investigate different types of business operation on the cost of debt. This study explores the effect of different types of real estate segments (i.e. commercial and residential real estate) on the cost of debt. We find a positive relationship between the commercial real estate sector and the cost of debt, meaning that the cost of debt increases for the commercial real estate than the residential sector in China.

Second, unlike the prior literature, this study investigates the effect of the level of EID on the cost of debt in one industry (i.e. real estate industry) and finds a negative association between them. Prior studies of Gray et al. (1995), Deegan and Gordon (1996), Sinclair-Desgagné and Gozlan(2003), Gao et al. (2005), Ho and Taylor (2007), Brammer and Pavelin (2008),Liu and Anbumozhi (2009) and Kuo et al. (2012) find an industry effect for EID, and EID is highly determined by the industry to which a firm belongs. Different industries have different characteristics which may relate to the

extent of resource dependence and pollution patterns. This study implies that a higher level of EID reduces a firm's cost of debt by reducing any agency and/or information asymmetry problem between the lenders and the firm and lowering the external monitoring cost for the lender. The extent to which one industry directs corporate EID strategies in a single country has not been appropriately investigated in prior studies. Hence, this study contributes to the EID literature by emphasizing that the level of EID varies extensively among firms within the real estate industry and it can provide benefits for a firm within it.

Third, the cost of debt is highly linked to the risk of default in the business. Hence, the cost of debt may be higher for the commercial real estate industry segment than the residential real estate industry segment in China. In this research, we also investigate whether the level of EID on the cost of debt varies with the types of real estate segments. We find that the type of real estate segment (i.e. commercial or residential real estate development) does not have a significant moderating effect on the relationship between EID and the cost of debt during a non-financial crisis period, which signifies that although EID is important for both segments equally, an increased level of EID does not reduce the cost of debt for commercial real estate when compared with residential real estate firms. Such a moderating effect remains different between the financial crisis period and non-financial crisis period, given the fact that the cost of debt for commercial real estate firms appeared to be much more expensive in the financial crisis period than the non-financial crisis period because of a scarcity of resources and the economic downturn. Therefore, commercial real estate firms face a financial cost disadvantage

only in the financial crisis period with the increased level of EID.

Fourth, prior literature such as Thompson (1998), Aintablian et al. (2007) Cowton and Thompson (2000), Gray and Bebbington (2001) and Thompson and Cowton (2004) find that banks include an appraisal of environmental aspects in the credit risk assessments for their lending decisions in developed economies. In this study, our findings extend the literature on EID and the cost of debt in the largest developing economy by using of the EID data from non-financial institutions.

Fifth, it is documented that shocks to credit markets from the global financial crisis worsened credit market conditions. Prior studies find that the financial crisis affects credit market conditions adversely and it reduces the quantity of credit available to borrowers and increases costs of borrowing (Ivashina & Scharfstein, 2010). Loveland (2016) and Sääskilahti (2016) suggest and define the 2008-2010 period as the global financial crisis. During the financial crisis period, real estate sector loan portfolios also experienced significant losses (Cole and White, 2012). However, there is no prior research which investigates the effect of different types of real estate firms on the cost of debt during the period of the global financial crisis and how the level of EID influences the cost of debt during the financial crisis period. We believe that the findings of this study fill this gap to some extent.

The remainder of the paper is organized as follows. Section 2 explains the real estate industry and EID in China, followed by a literature review and hypotheses development in Section 3. Section 4 presents the empirical research design and data. Section 5 provides the empirical results and a discussion and, finally, Section 6 summarizes concluding remarks.

2. Real estate industry and environmental information disclosure (EID) in China

2.1 Real estate industry in China

The real estate industry in China mainly includes land development, housing & commercial construction, material producers, transfer, lease, maintenance, professional services, management and marketing. Figure 1 shows real estate industry investment in five areas including residential investment, villa, luxury apartment, office building, commercial business space, and others. There are notable increases in investments in the areas of residential and commercial business construction, and the values reached up to RMB 64325.15 billion and RMB 2401.42 billion, respectively, in 2014.

<Insert Figure 1 here>

In recent years with relatively low economic growth, the real estate industry has severely suffered because of a housing oversupply problem mismatching with housing demand. As a consequence, the real estate company makes poor cash flow and low profit margins in China. Figure 2 shows the value of real estate investment and real estate sales from the year 2000 to 2014 indicating that the amount of sales remains lower than the amount of investment since 2008.

<Insert Figure 2 here>

Table 1 shows the area of both residential and commercial real estate sales and also the source of funding of real estate enterprises in China from 2006-2014. It depicts that the area of annual sales of commercial business is higher than the area of sales of residential business. Moreover, unit prices for the commercial real estate is also more expensive than for residential real estate. Therefore, one can argue that, on average, commercial real estate firms outperform the residential estate firms in China. However, Table 1 reveals that the area of the commercial and residential real estate increased up to 2013 and then slightly decreased in 2014. Again, in regards to the source of funding, the proportion of debt capital to total funds is still significant. In 2006, debt capital

accounted for 60.32% of total funds but this decreased to 58.67% in 2014. Hence, we can argue that debt financing is very important for the development of the real estate industry and its stability in China.

<Insert Table 1 here>

2.2 Corporate EID in China

Corporate EID is identified as the process of disclosing information regarding the actions made by a firm in keeping with the natural environmental protection and utilization of resources (Gray et al., 1995). In 2007, the first Environmental Disclosure Regulation and Guide was issued by the China State Environmental Protection Administration (CSEPA). It required firms to disclose environmental information irrespective of whether or not they had caused pollution. Moreover, if they had caused pollution, the firm should report the remedial measures implemented. In 2008, the CSEPA also introduced an instruction to strengthen supervision on the environmental protection of listed firms in both Shanghai and Sheng Zhen markets.

To implement the scientific development concept of EID and to improve environment conditions as outlined by the State Council, the Shanghai Security Exchange (SSE) also issued a *Guideline on Environmental Information Disclosure for Listed Companies* in 2008. The guideline demonstrated the scope of the voluntary environmental information to be disclosed by listed firms in China and required firms to disclose environmental information in order to fulfill the social responsibility of environment protection, promote the importance of environmental protection work, and strengthen the social supervision of environmental protection work done by listed firms.

3. Theoretical background, literature review and hypotheses development

3.1 Types of real estate firms and the cost of debt

Most stakeholders often lack in-depth knowledge and familiarity with specific real

estate markets (Edgington, 1995). This problem is exacerbated by the fact that the real estate industry is segmented into commercial and residential sectors (Gotham, 2006). He points out that the distinguishing feature of real estate, local specificity and heterogeneity, makes it difficult to communicate information about assets, liabilities, and opportunities to a large audience of investors and lenders in a clear and credible manner. Hence, one can argue that information asymmetry between real estate firms and their stakeholders may vary depending on a firm's business focus (i.e. commercial and residential sectors).

Wang (2008) noted that residential real estate would concern geographical, political, economic, cultural, social and environmental factors when choosing location for real estate development but these are not important in China. On the other hand, the success of a commercial real estate business exclusively depends on the political, economic, cultural, social and environmental factors (Li and Yang, 2004; Wang, 2008).

Gotham (2006) argues that the US has fostered spatially distinct and segmented locations for different types of real estate activity (e.g. residential and commercial land use), a condition that supports the illiquidity of real estate and national land-use planning. Real estate sector is restricted to the extent that state and local governments exercise political authority within their own geographical areas. In contrast, in China, the government still retains ultimate ownership of all lands and it allows individuals or real estate firms to purchase the right to use land for a certain number of years: 70 years for residential uses and 40/50 years for commercial uses (Wu et al., 2012 and Wu et al.

2015).⁵ In the typical real estate project development process, local governments firstly, lease land parcels to developers and then they allocate to local firms. The developers then build property on the parcels, and sell those units to households/enterprises. Households have the right to live in, rent out or sell their housing units during the leasehold period. Commercial properties can be used for business purposes only. According to government regulations, residential properties in China cannot be used for commercial purposes and vice-versa. Moreover, precisely what will happen regarding ownership of the land and any improvement to the land when the leasehold expires is unclear at present in China (Wu et al., 2012).

After obtaining land for real estate development, the developers have to pay property related taxes and fees for construction process and taxes and fees for sales process. This fee system varies according to the location of the property and real estate segments. Hence, fees and taxes for commercial real estate sector are different from residential real estate sector and it is higher for commercial segments than residential segments.

Kan et al. (2004) differentiate between prices of commercial and residential properties and examine their volatility. In their theoretical models, they find that volatility of commercial property prices is higher than for residential property prices. Wei (2006) finds that residential property prices are relatively stable as compared to commercial property prices in most regions in China.

Igan and Pinheiro (2009) note that commercial real estate loans are generally considered to be riskier than loans for residential purposes, not only because the

⁵While many countries limit tenant rights to residential real estate, Brazil has established early lease termination and automatic renewal rights on commercial real estate deals.

primary source of repayment is cash flows from the real estate collateral but also because commercial real estate prices have historically shown more volatility.⁶ In a comparison of residential versus commercial, it was the residential real estate prices and real estate loans which contributed more to the overall growth of the real estate industry in the US (Igan and Pinheiro, 2009).

However, Igan and Pinheiro (2009) note that commercial real estate loans have lower default risk than residential real estate loans and, moreover, commercial real estate loans were much better secured than they were before because of the developments in mortgage-backed securities markets. Moreover, they worried that a zealous industry-wide attempt to contain risks might choke the lending sector by "slamming the brakes on good loans" (BNA Daily Report for Executives, Sept. 15, 2006). Wang (2008) finds that the risk associated with commercial real estate sector in China is high due to its reliance on rent to obtain long-term benefits and to meet large scale requirement of capital while the return period is relatively long. On the other hand, risks associated with residential real estate sector are low due to investment income received when sale is completed and its return period is short (Wang, 2008).

Real estate markets vary by size, volume of turnover, legislative and judicial regulations, differences in valuation methods, differing roles of professional property consultants, and differences in real estate training and practice (Charney, 2001; Beauregard, 1994). In line with this argument, the perception of banks on residential and commercial real estate firms is different in terms of size, valuation, regulation and risks. Hence, one can argue that the cost of debt to residential real estate developers may substantially differ from commercial real estate developers after controlling the other firm characteristics which affect the cost of debt. Based on the review outlined

⁶In the period shown, for instance, the annualized volatility of commercial real estate price index was 3.44 percentage points while that of the residential real estate price index was 1.77 percentage points.

above, we propose the following hypothesis:

H₁. The cost of debt of the commercial real estate segment (commercial sector) is higher than the residential real estate segment (residential sector).

3.2 Environmental information disclosure (EID) and the cost of debt

Lending institutions face three types of risks associated with environmental exposure through their lending decisions (Thompson and Cowton, 2004). First, indirect risk is occurs where a borrower defaults on a loan due to the adverse financial consequences of environmental regulation or changes in demand for its products due to environmental sentiment. Second, direct risk occurs where the lenders have taken over mortgaged assets which lost their commercial value due to environmental pollutants or the need for an environmental clean-up from a defaulting borrower (Boyer and Laffont, 1997). Third, reputation risk occurs where the lending institutions in their lending decisions, face a loss of reputation due to adverse environmental actions by the borrowing firm. Therefore, lenders need to monitor and evaluate environmental factors in order to mitigate the above mentioned risks (Buxton, 1997; Coulson & Dixon, 1995 and Thompson, 1998). Aintablian et al. (2007) and Thompson (1998) link environmental risk and its potential impact on the present value of bank loan portfolios. Prior research found that banks carry out appraisals of environmental risk in their credit risk assessments, which affect their lending decisions.⁷

Debt financing plays a vital role in emerging economies. Both developed and emerging markets show an increase in leverage over past decades. However, this is more prominent in emerging markets (Mitton, 2008). Debt is one of the main sources of external finance. Moreover, it is critical for a firm's operating flexibility as well as for financing investment projects. Francis et al. (2005) find a relationship between the

⁷ See Thompson (1998), Aintablian et al. (2007) Cowton and Thompson (2000), Gray and Bebbington (2001) and Thompson and Cowton (2004) for an overview.

cost of capital and the level of voluntary information disclosure. They reveal that firms in sectors that require greater external financing have higher levels of voluntary disclosure which leads to reduced cost of debt and equity.

Prior studies show that a firm's public disclosures lowers information asymmetry by disseminating information that enables stakeholders to have equal access to financial and other information (Verrecchia, 2001; Graham et al., 2005; Diamond, 1985; Bushman, 1991). Botosan (1997) found that high quality voluntary disclosure reduces a firm's cost of capital. Moreover, this reveals that firms have high incentives to lower the information asymmetry between managers and investors (Clarkson et al., 1994). Proper information disclosure reduces information asymmetry as well as adverse selection problems. According to Dhaliwal et al. (2011), information asymmetry leads to investment risk which affects the expected rate of return. However, some researchers argue that firms do not reveal all related information as this potentially harms future cash flows.⁸The reason behind this argument is that disclosing information can lead to actions by different outside groups including pressure groups, competitors and the general public, which may cause significant threats to the future cash flows of a firm. Hence, it is obvious to state that a firm incurs a cost for a more open policy on EID (Dye, 1985; Verrecchia, 1990). The effect of the level of environmental disclosure on the cost of debt remains unclear, but we assume it would reduce the cost of debt.

Consistent with agency theory, a firm makes a number of agreements between numerous economic agents within their markets. This agreement is consistent with environmental disclosure being helpful in deciding managerial reimbursement contracts (Lanen, 1999). Belkaoui and Karpik (1989) argue that agency theory became a demanding proposal as a rationale for environmental disclosure. According to agency

⁸ See Dye (1985) and Verrecchia (1990)

theory, the management of a firm may decide not to disclose the negative information of an environmental incident in order to safeguard them or deny/withhold information from shareholders in order to protect the firm's value. However, a failure to disclose such information leads to increased business risk and, eventually, an increase in the cost of debt.

Again, Barth and McNichols (1994) suggest that the disclosure of destructive or obnoxious information such as penalties and lawsuits which are not reported in the financial statements of the firm has a negative impact on the firm's value. Further, the firm can improve the trustworthiness by disclosing both positive and negative information, and it gains a reputation for providing reliable and a superior quality disclosure (Blacconiere and Patten, 1994). This reputation directly reduces the cost of capital for a firm (Skinner, 1994). All stakeholders recognize that firms that disclose high level information are responsible corporate citizens. In contrast, Moroney et al. (2012) reveal that not only firms with better environmental performance but also firms that have a higher tendency to pollute the environment usually disclose more environmental information to reduce information asymmetry. Lambert et al. (2007) reveal that if a firm discloses information regarding diversifiable risk, that kind of disclosure does not affect the cost of capital.

It is obvious that the focus of agency theory limits the scope of relevant environmental disclosure as well as its intended purpose. However, legitimacy and stakeholder theories provide a more comprehensive perception of environmental disclosure as they explicitly recognize that firms include political and social, as well as institutional frameworks (Cormier and Gordon, 2001; Deegan et al., 2002). Gray et al. (1995) suggest that social and environmental disclosure originate from a theoretical view point which assumes that environmental disclosure is a better approach to

legitimize a firm's continuous existence to its numerous stakeholders. Thus, environmental disclosure can be identified as a symbolic way of conveying information to the outside world to control its political or economic position in the market (Neu et al., 1998). Moreover, there is evidence that shows firms react to external events in order to maintain or build up their image. According to legitimacy and stakeholder theories, one can argue that a firm with a high level of EID can obtain lower cost loan than firms which have lower level of EID. Based on the review outlined above, we propose the following hypothesis:

H₂. The level of environmental information disclosure in real estate firms is negatively associated with the cost of debt.

3.3 Joint effect EID and types of real estate segments on the cost of debt

Prior studies find that the segments of business industry in which a firm operates affects its level of environmental disclosure (Bewley and Li, 2000; Cormier and Gordon, 2001; Deegan and Gordon, 1996; Gray et al., 1995; Ho and Taylor, 2007; Brammer and Pavelin, 2008; Sinclair-Desgagné and Gozlan, 2003) because pollution propensity and outside monitoring vary from one line of business to another (Dawkins and Fraas, 2011). The nature of the sector in which businesses operate also influences the quality of information they produce because it is associated with the degree of environmental involvement of key stakeholders (Sinclair-Desgagné and Gozlan, 2003). In particular, firms that operate in areas that are environmentally sensitive and have high environmental impact (Cowen et al., 1987; Morris, 1997; Patten, 2002; Liu and Anbumozhi, 2009; Salama et al., 2012) tend to produce more environmental information (Deegan and Gordon, 1996; Moneva and Llana, 1996; Sharma, 1997; Hoffman, 1999; Bowen, 2000; Patten, 2002; Brammer and Pavelin, 2008).

Commercial real estate developers sell or lease the properties with a predetermined business objective and its land use as an investment to achieve an anticipated rate of

return. On the other hand, residential real estate developers sell or lease the properties for individual use, such as homeownership. The demand for environment information by end users can be varied. Therefore, one can argue that institutional buyers demand more environmental information than individual buyers. Based on the facts outlined above, one can expect higher levels of EID for the commercial real estate developer than residential real estate developer. According to Hypothesis 1, it is expected that the types of real estate segments affect the real estate developer's cost of debt. In line with these arguments, it can be stated that the increase in EID may in fact increase or decrease the cost of debt for real estate developers who focus primarily on commercial developments over their counterparts who focus on the residential development. Based on the review outlined above, we propose the following hypothesis:

H₃. The increasing level of EID from commercial real estate segment is more positively associated with the cost of debt than from residential real estate segment.

4. Research design

4.1 Data and sample

In this research, we selected all real estate firms based on the CITIC industry classification⁹ from publicly listed real estate firms. The CITIC has classified firms into three groups, namely residential, commercial and real estate services based on their main real estate operation segments. We excluded firms with missing data and real estate services firms from the sample. The relevant financial data was mainly obtained from WIND database. The number of directors, number of independent directors, Chairman-CEO duality and ownership of institutional investors of firms were obtained from CSMAR database. The EID data was manually collected from the firms' consolidated annual reports and social responsibility reports. The final sample

⁹China's CITIC industry classification was developed by CITIC Securities Co. Ltd and Standard & Poor's and Morgan Stanley Capital International Inc. They adopted the Global Industry Classification Standard (GICS) and understanding of local industries for developing this industry segments.

comprised 869 firm-year observations for the period 2006 to 2014 inclusive.

4.2 Conceptual model

We estimate Eqn. (1) using cross-sectional time series Feasible General Least Squares (FGLS)¹⁰ multiple regression to test the first hypothesis that the types of real estate segments (RET) is positively associated with the cost of debt.

$$COD_{i,t} = \alpha + \sum_{j=1}^{16} \beta_{j,(t-1)} FC_{j,i,t} + \beta_{16,(t-1)} RET_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where the dependent variable, $COD_{i,t}$, is the cost of debt. Control variables (FC) were used to estimate the effects of firm characteristics with a vector of β_{1-16} coefficients (year dummy variables are unreported), and RET is a dummy variable denoting 1 for the commercial real estate firms and 0 for the residential real estate firms.

We estimate Eqn. (2) using FGLS multiple regression to test the second hypothesis that the level of EID is negatively associated with the cost of debt.

$$COD_{i,t} = \alpha + \sum_{j=1}^{16} \beta_{j,(t-1)} FC_{j,i,t} + \beta_{16,(t-1)} RET_{i,t} + \beta_{17,(t-1)} EID_{i,t} + \varepsilon_{i,t} \quad (2)$$

Where, the test variable EID is the level of environment information disclosure.

We estimate Eqn. (3) using FGLS multiple regression to test the third hypothesis that the interaction effect of the level of EID and types of real estate segments (i.e. commercial and residential) is associated with the cost of debt.

$$COD_{i,t} = \alpha + \sum_{j=1}^{16} \beta_{j,(t-1)} FC_{j,i,t} + \beta_{17,(t-1)} RET_{i,t} + \beta_{18,(t-1)} EID_{i,t} + \beta_{19,(t-1)} RET_{i,t} * EID_{i,t} + \varepsilon_{i,t} \quad (3)$$

4.3 Measurement of variables

In this section, we describe the dependent and independent variables of interest and control (independent) variables of the research.

4.3.1 Measurement of the level of environmental information disclosure (EID)

¹⁰The FGLS regression models which transforms original variables to satisfy the standard least squares assumptions and modified emergence of heteroscedasticity and autocorrelation problems in panel data.

Based on prior research (e.g. Patten 2002; Al-Tuwaijri et al. 2004; Clarkson et al. 2008; Diao et al. 2009), a conceptual model for EID index has been developed.¹¹ It consists of environmental awareness and responsibility, investment for environmental management, technological application for environmental protection and other environmental related information. The level of EID is one of the main test variables of this study. To measure the level of corporate EID in China, ten components relating to their environmental management are chosen based on the concept model Details of the components listed in the Appendix Table A.

In the Appendix Table A, each component is scored according to the level of disclosure, based on the adherence of the level of EID to the Global Reporting Initiatives (GRI). The score ranges between 0 and 3, where 3 is assigned for qualitative and quantitative information with monetary information, 2 is assigned for concrete non-monetary information (qualitative information in detail), and 1 is assigned for general non-monetary information. Zero (0) is assigned for absence of information (Wiseman, 1982). Monetary and non-monetary environmental disclosure information is an effective tool to gauge the level of corporate EID. Each firm has gained a score for evaluating its level of corporate EID based on Equation 4, and the level of the EID is evaluated based on the ordinary score.

$$EDI_i = \sum_{j=1}^n SCID_i \quad (4)$$

The level of EDI_i is the total score of EID for the firm i and $SCID_i$ is the score of the j^{th} component for the firm i , in which $j= 1, 2 \dots 10$.

4.3.2 Measurement of the types of real estate segments (RET)

We employ a dummy variable to identify the real estate developer's type and consider

¹¹This is a common practice which is found in the Sustainability Reporting Guidelines and the Indicator Protocols Set Environment initiated by the Global Reporting Initiative (GRI).

their main real estate development activities as a dummy variable which is 1 for the commercial real estate development and 0 for the residential real estate development.

4.3.3 Measurement of the cost of debt (COD)

COD measures the effective interest rate that a firm pays on its current level of debt. Consistent with prior research (e.g. Bliss and Gul 2012; Francis et al. 2005a; Francis et al. 2005b; Gray et al. 2009; Kim et al. 2011; Pittman and Fortin 2004), we employ a firm's effective interest rate in this study as our proxy measure of the COD. Specifically, a firm's COD is computed as interest expenditure during the year divided by the average amount of total debt (i.e. both short term and long term debt) during the year.¹²

4.3.4 Control variables

We include firm size, firm age, ownership, market to book ratio, leverage, beta (BETA), tangibility ratio, firm growth rate, cash flow adequacy ratio, ROA, regional gross production per capita, number of directors and independent directors, Chairman-CEO duality, ratio of institutional investors' shares to total number of outstanding shares and agency cost as control variables. Market beta (BETA) is estimated using a market model based on the daily stock returns for a 24 month period, firm size (SIZE) is computed based on natural logarithm of total assets, market-to-book ratio (MBV) is calculated as the ratio of the market value of equity to the book value of equity (using the natural logarithm value), and ownership (OWN) which is measured as a dummy variable that equals 1 if the firm is a SOE (state owned enterprise) and 0 otherwise. Cash flow adequacy (CASH_ADE) measures how well the company can cover the annual payments of all the long-term annual debt with the cash flow from its operating

¹² In some studies, yield spread was used as an alternative proxy measure of the COD. However, it cannot be used as a proxy measure of the COD due to the small size of the corporate bond market and this was acknowledged by Shailer and Wang (2015). Byun et al. (2013) use effective interest rate as a proxy for the cost of debt due to credit spreads for bond issuance are unavailable for a significant portion of their sample and obtained qualitatively similar results.

activities, which is calculated by cash flow from operations to long-term debt paid plus fixed assets purchased plus cash dividends distributed. We use several control measurements, namely the ratio of total institutional owned shares to total outstanding shares, number of directors on the board, number of independent directors, Chairman-CEO duality and agency cost as a proxy for corporate governance. Agency cost is calculated as the ratio of administrative expenses of the company (board, management, entertainment, accommodation, and travel expenses) to operating revenue. Although there are economic and financial reforms, significant regional disparities in market and legal institutions across provinces can be observed in China (Chen et al., 2011). Hence, we also include the natural log value of regional gross production per capita (LN_GRPCAP) as a control variable for this. Details of variable descriptions and data sources are provided in the Appendix Table B.

5. Empirical results and discussion

5.1 Results of descriptive analyses

Figure 3 shows the number of both commercial and residential real estate firms for the sample period 2006 to 2014 where the number of residential real estate firms are much higher than the number of commercial real estate firms. However, the number in each category of firms is approximately static over the sample period.

<Insert Figure 3 here>

Table 2 shows descriptive statistics of the dependent and independent variables of the sample firms. Columns 3–6 of Table 2 report the means, standard deviations, the minimum and maximum of variables including the main variables of interest (e.g. cost of debt (COD: LN_IR), environmental information disclosure (EID) and types of real estate segments (RET)). For the level of EID measure, the average disclosure level of

sample firms is 5.499. There is substantial dispersion in the EID score as represented by the range of EID, which varies from zero to 21 with a standard deviation of 5.284. The average cost of debt and standard deviation in natural logarithm are -3.523 and 1.277, respectively. As for the types of real estate segments, the number of commercial real estate is 133 firms which is 20.37 of the sample firms, and the rest are residential real estate firms.

<Insert Table 2 here>

Figure 4 depicts the level of EID and the changes in the cost of debt over the sample period annually. The level of EID shows an increasing trend over the sample period. Between 2006 and 2013, the average EID increased substantially while in 2014 it decreased slightly. Again, Figure 4 reveals that the cost of debt declined from 2006 to 2010 and then increased in the 2010 to 2014 period. However, Figure 4 does not demonstrate a relationship between the level of EID and the cost of debt as they are showing opposite patterns which requires further analysis of the data.

<Insert Figure 4 here>

We winsorized all continuous variables at the 1% level in order to avoid the outlier effect. Table 3 shows the correlation matrices for the dependent, independent and control variables. The results confirm that collinearity among the independent variables is not evident, as the maximum correlation between institutional shareholding and size of the firm is found to be 0.58. The average Variance Inflation Factors (VIF) are also less than 2.06 and all variables have VIF levels less than 3.44 (3.44 VIF for the market to book ratio) suggesting no serious multicollinearity problem with the data (see

Appendix Table C),.

<Insert Table 3 here>

5.2 Types of real estate segments and the cost of debt– H1

In this section, we show the effect of the real estate segments on the cost of debt of real estate firms in China. We use a dummy variable RET, 1 for a real estate firm if the main operation is the commercial real estate business segment and zero (0) for the residential real estate business segment. The cross-sectional time series Feasible General Least Squares (FGLS) regression results are presented in Table 4. Models 1 and 2 consist of control variables and a test variable of interest (e.g. types of real estate segments), respectively. In Model 1, it shows that the age of firm, state-ownership, leverage, Beta, and number of directors on corporate boards have a significantly positive effect on the cost of debt. In addition, firm size, profitability, and a firm's growth are significantly negatively related to the cost of debt.

Model 2 extends the effect of a firm's types of main real estate segments (RET) on the cost of debt (COD: LN_IR) along with the control variables. Model 2 demonstrates that the commercial real estate sector leads to an increase in the cost of debt, implying that the real estate firms which engage in development of commercial real estate experience an increase of 56.4% in the cost of debt. Therefore, H₁ is supported. Igan and Pinheiro (2009) and Kan et al. (2004) argue that the price volatility of commercial real estate is higher than residential real estate prices and that both the business and default risks of the commercial real estate business segment are higher than the residential real estate business segment. Wang (2008) also found that the risk associated with commercial real estate sector in China is higher than for the residential real estate sector. These views and our finding suggest that lenders have been able to charge higher

rates for debt and in fact increase the cost of debt for the commercial real estate segment over the residential segment counterpart. Most of the control variables in Model 2 provide similar findings to Model 1. The only difference is the negative effect of a number of independent directors on corporate boards and regional domestic per capita income on the cost of debt, and the positive impact of cash adequacy on the cost of debt.

<Insert Table 4 here>

5.3 Environmental information disclosure and the cost of debt– H2

In this section, we show the effects of EID on the cost of debt of real estate firms in China. The results of the FGLS regression are presented in Table 4 Model 3. As expected, Model 3 shows a significantly negative effect on the cost of debt, suggesting that a 1% point increase in a firm-level EID leads to a reduction in the cost of debt by 1.4%.

Therefore, H₂ is supported. This is because a high level of EID reduces information asymmetry and the adverse selection problem. It helps lenders to analyze real estate developers' business risk related to the environment more precisely and enables lenders to grant lower interest loans to firms that have a high level of EID. Again, in Model 3, the types of real estate segments variable RET appears to have a similar significantly positive effect on the cost of debt, as found in Model 2. All control variables are also showing consistent findings between Model 2 and Model 3.

5.4 Joint effect of EID and types of real estate segments on the cost of debt– H3

In this section, we show the joint effects of the level of EID and the types of real estate segments on the cost of debt of real estate firms in China without considering the financial crisis period. The interaction term between RET and EID indicates if the increase of EID makes any difference on the cost of debt in residential and commercial

real estate segments. We employ a Wald test to test whether the coefficients of the interaction effect differ between commercial and residential real estates. The test confirms that the commercial real estate segment is not substantially different from the residential real estate segment (see Appendix Table D). The results of the FGLS regression are presented in Table 4 Model 4. Consistent with Model 3, the regression findings in Model 4 reveal the exact identical relationship of RET and EID with the cost of debt. In regards to the interaction term, the joint effects of the real estate segment and EDI (RET x EID) is found to be negatively associated with the cost of debt although statistically insignificant. Hence, we find that an increasing of level of EID does not make any significant difference on the cost of debt in both real estate segments.

Therefore, H₃ is not supported without considering the financial crisis.

We also plot a graph which shows the marginal interaction effect of EID and the types of real estate segments on the cost of debt in Figure 5. The graph shows that the interaction of the level of EDI and real estate segments does not make any difference on the cost of debt and it strengthens the findings from the regression results outlined in Table 4 Model 4. However, it shows that the commercial real estate segment cost of debt is higher than for the residential real estate segment.

<Insert Figure 4here>

5.5 Robustness check – during financial crisis

Extant literature focuses on shocks to credit markets and notes that the global financial crisis worsened credit market conditions, i.e. the quantity of credit available for borrowers is lower and costs of borrowing are higher (Ivashina & Scharfstein, 2010).

Hence, we also investigate whether our results are robust for the global financial crisis.

To check the robustness of the results, we carried out similar analyses for the financial crisis period 2008-2010 as we did in Table 4 for the whole sample period. The results of the FGLS regression are presented Table 5. The regression results in Table 5 (Models 2, 3 and 4) confirm the significant positive relationships between the real estate segment of firms and the cost of debt, as documented in Table 4. Similarly, the relationship between EID and the cost of debt is found robust in Table 5 (Models 3 and 4), demonstrating the significantly negative effect of EID on the cost of debt. Again, unlike Table 4 (Model 4), the joint effects of the interaction term real estate segment and EDI (RET x EID) in Table 5 (Model 4) indicate a significantly positive relationship with the cost of debt. This implies that increasing the level of EID has resulted in increased cost of debt for the commercial real estate developers rather than the residential real estate developers during the financial crisis period. The joint effect of a 1% point increase in EID by the commercial real estate segment increases their cost of debt by 3.8%. These findings taken during the financial crisis period support all three hypotheses of the study.

<Insert Table 5 here>

We also plot a graph in Figure 6 which illustrates the marginal interaction effect of EID and RET on the cost of debt. The graph also supports evidence that the interaction of the level of EDI and real estate segments does make a difference on the cost of debt during the financial crisis period.

<Insert Figure 6 here>

5.6 Robustness checks – endogeneity

It is possible that our baseline regression results reported in Table 4 could be impacted

by endogeneity (e.g. simultaneity and/or reverse causality) giving rise to biased regression coefficient estimates. Hence, as part of our robustness checks, we perform instrumental variables (2SLS) regression analysis following Larcker and Rusticus (2010) and Wooldridge (2010). In the extended regression model below, a dummy variable for the financial crisis (FIN_CRISIS) is included in equation (3) which is shown as 1 for the financial crisis period 2008-2010 and 0 for rest of the period.

$$COD_{i,t} = \alpha + \sum_{j=1}^{16} \beta_{j,(t-1)} FC_{j,i,t} + \beta_{17,(t-1)} FIN_CRISIS_{i,t} + \beta_{17,(t-1)} RET_{i,t} + \beta_{18,(t-1)} EID_{i,t} + \beta_{19,(t-1)} RET_{i,t} * EID_{i,t} + \varepsilon_{i,t}$$

The results of the 2SLS regression are shown in Table 6. In the first stage regression model (i.e. Model 2A), we compute an instrumental variable (IV) for EID using the average value for the real estate segment year from the EID composite index (EID_AVRES)¹³. We find that our IV denoted by EID_AVRES¹⁴ is significantly positively associated with EID ($p < 0.05$) as expected. We also observe that several of the control variables (SIZE, LEV, ROA, and TANGI) are significantly associated with EID ($p < 0.10$ or better) in the regression model specifications.

In the second stage regression model (i.e. Model 1A), we find that the RET regression coefficient is significant ($p < 0.01$) and positively associated with the cost of debt, thereby providing additional support for H1. Table 6 also shows that we achieve qualitatively similar results regarding the significantly negative association between

¹³In particular, Liu et al. (2014) use average female directors at the industry segment level (i.e. proportion of female directors in the firm's 1-digit CSRC coded industry classification) as an IV and Xu et al. (2014) employ the industry average CSR score as instruments for the CSR index. Our method of IV is therefore similar to their approaches.

¹⁴Stock and Yogo (2005) suggest an F-statistic in the first stage regression model of greater than ten indicates that an IV is not weak. Our F-statistic of 46.67 for EID_AVRES therefore shows that it represents a suitable IV.

EID and the cost of debt ($p < 0.01$ or better), so H2 is once again supported by the empirical results. In addition, we also observe that the interaction term regression coefficients for RET x EID are significant and positively associated with the cost of debt ($p < 0.01$ or better), thus H3 is once again supported by the empirical results. Finally, in terms of the control variables, we find that AGE, OWN, ROA, MBV, LN_DIR, LN_NIDIR, CASH_ADE and FIN_CRISIS are also significantly associated with the cost of debt ($p < 0.10$ or better) in the regression model specifications as per our expectation.

<Insert Table 6 here>

In Figure 7, we illustrate the marginal interaction effect of EID and the types of real estate segments on the firms' cost of debt resulting from the 2SLS regression. The graph also shows that the cost of debt for commercial real estate is higher than for the residential real estate segment and increasing levels of EID leads to reduce costs for both real estate segments. However, a reduction in the cost of debt for residential real estate sector is higher than commercial real estate sector after taking account of the effect of financial crisis on the cost of debt.

<Insert Figure 7 here>

6. Conclusion

In this study, we investigate the joint effect of the types of real estate segments (RET) and environmental information disclosure (EID) on real estate firms' cost of debt, which has received little attention in the real estate finance and economics literature. The real estate industry is a highly important sector in China. It plays a crucial role in the economy and in social development but has significant environmental effect as well

which could impact on the possible financial risk and corresponding shocks to the banking sector in the Chinese economy which is the world's second largest economy in terms of GDP. Building on extant literature, using 869 firm-year observations from 2006 to 2014 and applying both Feasible General Least Squares (FGLS) and Two-stage Least Squares (2SLS) Instrumental Variable (IV) approaches, we extend the prior literature to investigate the effects of the cost of debt in different types of real estate segments with the presence of environmental information disclosure, and develop test hypotheses of the study accordingly.

We document that the cost of debt for commercial real estate firms is higher than residential real estate firms in China. As expected, we find a negative association between EID and the cost of debt for both types of real estate firms, revealing that the high level of EID reduces a firm's cost of debt by enabling firms to have better rates for loan financing. However, interestingly, when commercial real estate firms increase their level of EID, it increases their cost of debt more than residential real estate counterparts. This suggests that the types of real estate segments (i.e. commercial or residential) does have a significant moderating effect on the relationship between EID and the cost of debt. This moderation effect remains indifferent between the financial crisis period and non-financial crisis period, implying that commercial real estate firms are financially disadvantaged in borrowing funds in both periods even with the increased level of EID.

Similar results are documented for the recent financial crisis period in the sample. These findings are consistent with the corresponding results of prior studies about the appraisal of environmental effects in a bank's credit risk assessments in lending decisions. It can be argued that as part of the credit risk assessments, appraisal of environmental risk is important to the lending decisions. Accordingly, the commercial

real estate segment pays more attention to environmental issues than the residential real estate segment in their businesses and they disclose more environment information (EID) than their residential real estate counterpart. However, the effect of the level of EID on the cost of debt is not similar for residential and commercial real estate segments. We find that the increasing level of EID leads to an increase in the cost of debt in commercial real estate developers rather than for residential real estate developers. These findings have important policy implications for environment risk assessment for lending institutions and real estate developers for both segments and wider stakeholder groups.

Reference

- Aintablian, S., McGraw, P. A., Roberts, G. S. (2007). Bank monitoring and environmental risk. *Journal of Business Finance and Accounting* 34(1), 389–401.
- Barth, M.B., McNichols, M.F., Wilson, G.P. (1997). Factors influencing firms' disclosures about environmental liabilities, *Review of Accounting Studies* 2, 35–64.
- Barth, M. E., McNichols, M.F., (1994). Estimation and market valuation of environmental liabilities relating to superfund sites, *Journal of Accounting Research* 32 (Supplement), 177–209.
- Beauregard, R. A.,(1994). Capital Switching and the Built Environment: United States, 1970–89.” *Environment and Planning A* 26, 715–32
- Bhat, G., Frankel, R., Martin, X., (2011). Panacea, Pandora's Box, or placebo: feedback in bank mortgage-backed security holdings and fair value accounting. *Journal of Accounting & Economics* 52:2, 153–173.
- Berardi, U., (2012). Sustainability assessment in the construction sector: rating systems and rated buildings. *Sustainable Development* 20, 411–424
- Bens, D. A., Monahan, S. J., (2004). Disclosure Quality and the Excess Value of Diversification. *Journal of Accounting Research* 42(4), 691–730.
- Bewley, K. and Li. Y. (2001). Disclosure of environmental information by Canadian manufacturing companies: A voluntary disclosure perspective. In *Advances in Environmental Accounting & Management* 1, 201–226
- Blacconiere, W., & Patten, D. (1994). Environmental disclosures, regulatory costs, and changes in firm value. *Journal of Accounting and Economics*, 18, 357–377
- Bliss, M.A., & Gul, F.A. (2012). Political connection and cost of debt: some Malaysian evidence. *Journal of Banking and Finance* 36, 1520-1527.
- Brammer, S, Pavelin, S., (2008). Factors influencing the quality of corporate environmental disclosure. *Business Strategy and the Environment* 17(2), 120–136.

- Bowen, FE. (2000). Environmental visibility: a trigger of green organizational responsiveness? *Business Strategy and the Environment* 9(2), 92–107.
- Boyer, M., Laffont, J-J., (1997). Environmental risks and bank liability, *European Economic Review* 41(8), 1427-1459
- Botosan, C., (1997). Disclosure level and the cost of equity capital. *The Accounting Review* 72, 323–349
- Belkaoui, A. & Karpik, P.G., (1989). Determinants of the corporate decision to disclose social information. *Accounting, Auditing and Accountability Journal*, 2(1), 36-51.
- Brammer, S, Pavelin S., (2008). Factors influencing the quality of corporate environmental disclosure. *Business Strategy and the Environment* 17(2), 120–136.
- Bushman, R., (1991). Public disclosure and the structure of private information markets. *Journal of Accounting Research* 29, 261–276
- Buxton, A., (1997). Business ethics: getting on the right track. *CIB News*, February, 1–4.
- Case, P., 1996. Land, lending and liability. *Chartered Banker* 2:4, 44–49
- Byun, H-Y., Choi, S., Hwang, L-S, Kim, R.G. (2013) Business group affiliation, ownership structure, and the cost of debt. *Journal of Corporate Finance* 23, 311–331
- Charney, Igal. (2001). Three Dimensions of Capital Switching within the Real Estate Sector: A Canadian Case Study. *International Journal of Urban and Regional Research* 25 (4): 740–58.
- Chen, Q., Goh, C., Sun, B. & Xu, L.C. (2011). Market integration in China. *World Bank Policy Research Working Paper*, WPS 5630. World Bank.
- Cho, C.H., Roberts, R.W., Patten, D.M., (2010). The language of US corporate environmental disclosure. *Accounting Organization Society* 35: 4, 431-443.
- Ciliberti, F., Pontrandolfo, P., Scozzi, B., (2008). Investigating corporate social responsibility in supply chains: a SME perspective. *Journal of Cleaner Production* 16:15, 1579-1588.
- Clarkson, P., Kao, J. L., Richardson, G.D., (1994). The voluntary inclusion of forecasts in the MD&A section of annual reports, *Contemporary Accounting Research*, 11: Fall, 423–450
- Cormier, D., Gordon, I.M., (2001). An examination of social and environmental reporting strategies. *Accounting, Auditing & Accountability Journal*, 14:5, 587 - 617
- Cowen SS., Ferreri, LB, Parker LD., (1987). The impact of corporate characteristics on social responsibility disclosure: a typology and frequency-based analysis. *Accounting, Organizations and Society* 12(2), 111–122.
- Criado-Jimenez, I, Fernandez-Chulian, M., Larrinaga-Gonzalez, C., Husillos- Carques, F.J. (2008). Compliance with mandatory environmental reporting in financial statements: the case of Spain (2001-2003). *Journal Business Ethics* 79(3), 245-262.
- Cowton, C. J., Thompson, P., (2000). Do codes make a difference? The case of bank lending and the environment. *Journal of Business Ethics* 24(2), 165–178.
- Coulson, A.B., Dixon, R., (1995). Environmental risk and marketing strategy: implications for financial institutions. *International Journal of Bank Marketing* 13(2), 22–29.
- Dawkins, C. and Fraas, J., (2011). *Coming Clean: The Impact of Environmental Performance and Visibility on Corporate Climate Change Disclosure*. Springer Science & Business Media B.V., 303–322.
- Deegan, C., Gordon, B., (1996.) A study of the environmental disclosure practices of Australian corporations. *Accounting and Business Research* 26(3), 187–199.
- Delmas, M.A., Toffel, M.W., (2008). Organizational responses to environmental demands: opening the black box. *Strategic Management Journal* 29(10), 1027-1055
- Dhaliwal, D.S., Li, O.Z, Tsang, A, Yang, Y.G.(2011). Voluntary Nonfinancial Disclosure and the Cost of Equity Capital: The Initiation of Corporate Social Responsibility Reporting. *The Accounting Review*, 86(1), 59-100.
- Diamond, D.W., Rajan, R.G., (2011). Fear of fire sales, illiquidity seeking, and credit freezes. *Quarterly Journal of Economics* 126:2, 557–591.
- Dye, R., (1985). Disclosure of nonproprietary information. *Journal of Accounting Research* 23:

Spring, 123–145

Francis, J., LaFond, R., Olsson, P., Schipper, K., (2005). The market pricing of accruals quality. *Journal of Accounting and Economics* 39, 295–327.

Edgington, D. W. (1995). Locational Preferences of Japanese Real Estate Investors in North America. *Urban Geography* 16, 373–96.

Eichholtz, P., Kok, N., Quigley, J.M., (2009). Doing Well by Doing Good? Green Office Buildings. Center for the Study of Energy Markets, University of California Energy Institute, UC Berkeley. <http://escholarship.org/uc/item/4bf4j0gw>, 36 p.

Elgendy, K., (2010). Comparing ESTIDAMA's Pearl rating system to LEED and BREEAM. Carboun, Available online at: <http://www.carboun.com/>.

Evans, M.F., Gilpatric, S.M., Liu, L.R., (2009). Regulation with direct benefits of information disclosure and imperfect monitoring. *Journal of Environment Economics and Management* 57(3), 284–292.

Erlandsson, J., Tillman, A., (2009). Analyzing influencing factors of corporate environmental information collection, management and communication. *Journal of Cleaner Production* 17, 800–810.

Francis, J., LaFond, R., Olsson, P., & Schipper, K. (2005a). The market pricing of accruals quality. *Journal of Accounting and Economics* 39, 295–327.

Francis, J. R., I. K. Khurana, and R. Pereira. (2005b). Disclosure incentives and effects on cost of capital around the world. *Accounting Review* 80 (4): 1125–62.

Gao, S.S., Herav, S. and Xiao, J.Z. 2005, 'Determinants of Corporate Social and Environmental Reporting in Hong Kong: A Research Note', *Accounting Forum*, 29: 233–42.

Gray, R., Kouhy, R., Lavers, S., (1995). Corporate social and environmental reporting. A review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing and Accountability Journal* 8(2), 47–77.

Gray, P., Koh, P.S., Tong, Y.H., (2009). Accruals quality, information risk and cost of capital; evidence from Australia, *Journal of Business Finance & Accounting* 36, 5–72

Gray, R., Bebbington, J., (2001). *Accounting for the environment* (2nd ed.). London: Sage.

Greenstein, M. M., Sami, H., (1994). The Impact of the SEC's Segment Disclosure Requirement on the Bid-Ask Spread, the *Accounting Review* 69(1), 179–99.

Graham J.R., Harvey C.R., Rajgopal, S., (2005). The economic implications of corporate financial reporting. *Journal of Accounting and Economics* 40, 3–37.

Gotham, K. F., (2006). The Secondary Circuit of Capital Reconsidered: Globalization and the U.S. Real Estate Sector, *American Journal of Sociology*, 112(1), 231–275

Ho, L.C. & Taylor, M.E. (2007). An empirical analysis of triple bottom-line reporting and its determinants: evidence from the United States and Japan. *Journal of International Financial Management and Accounting* 1(2), 123–150.

Hoffman A.J., (1999). Institutional evolution and change: environmentalism and the U.S. chemical industry. *Academy of Management Journal* 42(4), 351–371.

Igan D. & Pinheiro, M., (2009). Exposure to Real Estate Losses: Evidence from the U.S. Banks, IMF Working Paper, WP/09/79

Ivashina, V., & Scharfstein, D., (2010). Bank lending during the financial crisis of 2008. *Journal of Financial Economics*, 97, 319–338.

Jose, A., Lee, S.M., (2007). Environmental reporting of global corporations: a content analysis based on website disclosures. *Journal of Business Ethics* 72(4), 307–321

Kan, Kwong & Charles K. Y. Leung (2004). The Dynamics and Volatility of Commercial and Residential Property Prices: Theory and Evidence, *Journal of Regional Science* 44, 95–123.

Kim, J.B, Simunic, D.A Stein, M.T., Yi, C.H., (2011). Voluntary audits and the cost of debt capital for privately held firms; Korean evidence, *Contemporary Accounting Research* 28, 585–615.

Kuo, L., Yeh, C. and Yu, H. 2012, 'Disclosure of Corporate Social Responsibility and Environmental Management: Evidence from China', *Corporate Social Responsibility and Environmental Management*, 19: 273–87.

- Larcker, D., Rusticus, T., (2010). On the use of instrumental variables in accounting research. *Journal of Accounting and Economics* 49, 186–205.
- Lambert, R., Leuz, C., Verrecchia, R., (2007). Accounting information, disclosure, and the cost of capital. *Journal of Accounting Research* 45, 385–420.
- Lanen, W., (1999). Waste minimization at 3M Company: a field study in nonfinancial performance measurement, *Journal of Management Accounting Research* 11, 29–43.
- Li, J. and Yang, H. (2004). Analysis on the location factors of urban commercial land development. *Journal of Wuhan University (Engineering Science Edition)* 06, 125-128. (In Chinese)
- Liu, X.B., Anbumozhi, V., (2009). Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. *Journal Clean Production* 17(6), 593–600.
- Liu, X.B., Yu, Q.Q., Fujitsuka, T., Liu, B.B., Bi, J., Shishime, T., (2010). Functional mechanisms of mandatory corporate environmental disclosure: an empirical study in China. *Journal Clean Production* 18(8), 823-832.
- Liu, Y., Wei, Z., Xia, F., (2014). Do women directors improve firm performance in China? *Journal of Corporate Finance* 28, 169-184.
- Loveland, R. (2016). How prompt was regulatory corrective action during the financial crisis? *Journal of Financial Stability* 25, 16–36
- Mitton, T.J. (2008). Why Have Debt Ratios Increased for Firms in Emerging Markets? *European Financial Management* 14, 127-151
- Moneva J, Llena F., (1996). Análisis de la información sobre responsabilidad social en las empresas industriales que cotizan en Bolsa. *Revista Española de Financiación y Contabilidad*, XXV: 361–401.
- Moroney, R., Windsor, C., Aw Y.T., (2012). Evidence of assurance enhancing the quality of voluntary environmental disclosures: An empirical analysis. *Accounting and Finance* 52, 903–939
- Neu, D., Warsame, H. and Pedwell, K. (1998). Managing public impressions: environmental disclosures in annual reports, *Accounting, Organizations and Society* 23(3), 265–282.
- Park, J., Sarkis, J., Wu, Z.H., 2010. Creating integrated business and environmental value within the context of China's circular economy and ecological modernization. *Journal Clean Production* 18(15), 1494-1501.
- Patten DM. (2002). The relation between environmental performance and environmental disclosure: a research note. *Accounting, Organizations and Society* 27, 763–773
- Pittman, J. A., and S. Fortin. 2004. Auditor choice and the cost of debt capital for newly public firms. *Journal of Accounting and Economics* 37 (1): 113–36
- Reed, R., Bilos, A., Wilkinson, S., Schulte, K., 2009. International comparison of sustainable rating tools. *Journal of Sustainable Real Estate* 1, 1–22.
- Roy, P., Alam, M., (2007). Corporate social responsibility and affirmative action program. *Social Responsibility Journal* 3, 69-78.
- Salama A, Dixon R, Habbash M. (2012). An examination of environmental disclosure in UK corporate annual reports. *Journal of Accounting –Business and Management* 19, 19–42.
- Saunders, T., (2008). A Discussion Document Comparing International Environmental Assessment Methods for Buildings. BREAAAM.
- Sinclair-Desgagné, B, Gozlan E. (2003). A theory of environmental risk disclosure. *Journal of Environmental Economics and Management* 45, 377–393.
- Sääskilähti, R. (2016). Local bank competition and small business lending after the onset of the financial crisis, *Journal of Banking & Finance* 69, 37–51
- Shailer, G., Wang, K., (2015), Government ownership and the cost of debt for Chinese listed corporations. *Emerging Markets Review* 22, 1–17.
- Shen, L.Y., Tam, V.W.Y., Tam, L., Ji, Y.B., (2010). Project feasibility study: the key to successful implementation of sustainable and socially responsible construction management practice. *Journal of Cleaner Production* 18(3), 254-259.
- Sardinha, I.D., Reijnders, L. and Antunes, P., (2011). Using corporate social responsibility

benchmarking framework to identify and assess corporate social responsibility trends of real estate companies owning and developing shopping centres, *Journal of Cleaner Production* 19, 1486-1493

Sharifi, A., Murayama, A., (2013). A critical review of seven selected neighborhood sustainability assessment tools. *Environment Impact Assessment Review* 38, 73–87.

Sharma S., (1997). A longitudinal analysis of environmental responsiveness strategies: antecedents and outcomes. In *Best Paper Proceedings*, Keys JB, Dozier LN (eds). Academy of Management: Boston, MA.

Skinner, D., (1994). Why firms voluntarily disclose bad news, *Journal of Accounting Research* 32: Spring, 38–60.

Stock, J H., Yogo, M., (2005). Testing for weak instruments in linear IV regression. Chapter 5 in Stock, J.H., Andrews, D.W.K. (Eds), *Identification and Inference for Econometric Models: Essays in Honor of Thomas J. Rothenberg*, Cambridge University Press.

Thakor, A.V., (2015). The financial crisis of 2007–2009: why did it happen and what did we learn? *Review of Corporate Finance Studies*, 4:2, 155-205 doi:10.1093/rcfs/cfv001

Thompson, P., (1998). Bank lending and the environment: policies and opportunities. *International Journal of Bank Marketing* 16:6, 243–252.

Thompson, P., & Cowton, C. J., (2004). Bringing the environment into bank lending: implications for environmental reporting. *British Accounting Review* 36:2, 197–219.

Verrecchia, R. (1990). Endogenous proprietary costs through firm interdependence. *Journal of Accounting and Economics* 12:1, 245–250.

Verrecchia, RE., (2001). Essays on disclosure. *Journal of Accounting and Economics* 32, 97–180.

Wang, L., (2008). Research on the difference between commercial real estate and residential real estate development, *Productivity Research* 17, 120-122 (In Chinese)

WBCSD (World Business Council for Sustainable Development), (2000). *Corporate Social Responsibility: Making Good Business Sense*. WBCSD, Geneva.

WBCSD (World Business Council for Sustainable Development), August (2009). *Transforming the Market: Energy Efficiency in Buildings*. WBCSD.

Wei, L., (2006). Analysis of differences between commercial real estate and residential real estate development. *Chongqing architecture*, 11, 130-131.(In Chinese)

Wu, J., Gyourko, J., Deng, Y., (2012). Evaluating conditions in major Chinese housing markets. *Regional Science and Urban Economics*, 420:3, 0531–0543

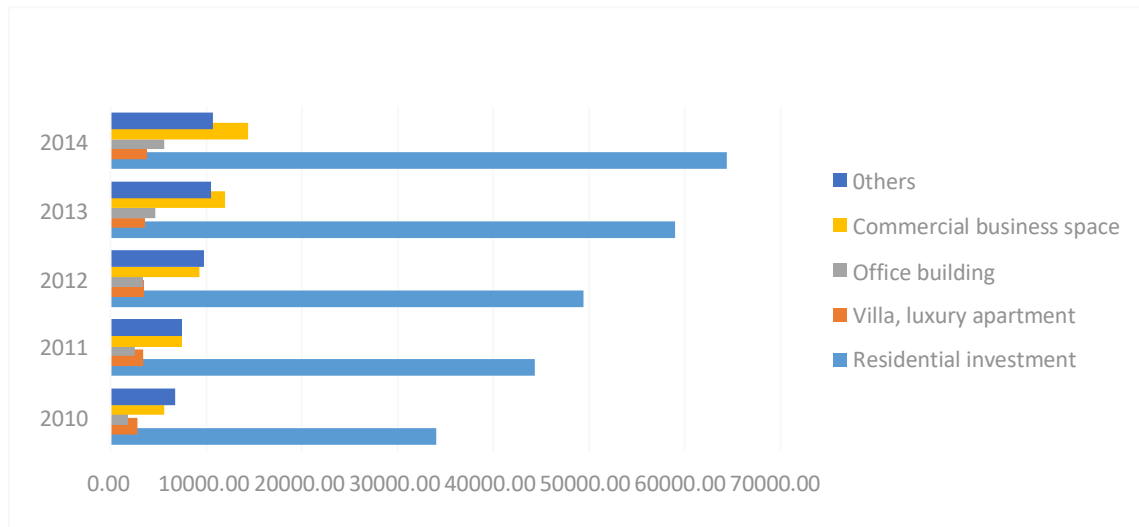
Wu Q., Li Y., Yan S., (2015). The incentives of China's urban land finance, *Land Use Policy* 42, 432–442 <http://dx.doi.org/10.1016/j.landusepol.2014.08.015>

Xu, S., Liu, D., Huang, J., (2014). Corporate social responsibility, the cost of equity capital and ownership structure: An analysis of Chinese listed firms. *Australian Journal of Management*, DOI: 10.1177/0312896213517894.

Zhang, X. and Sun, T., (2006). China's Real Estate Cycle and Potential Financial Risks *China & World Economy*, 14:4, 57 – 74

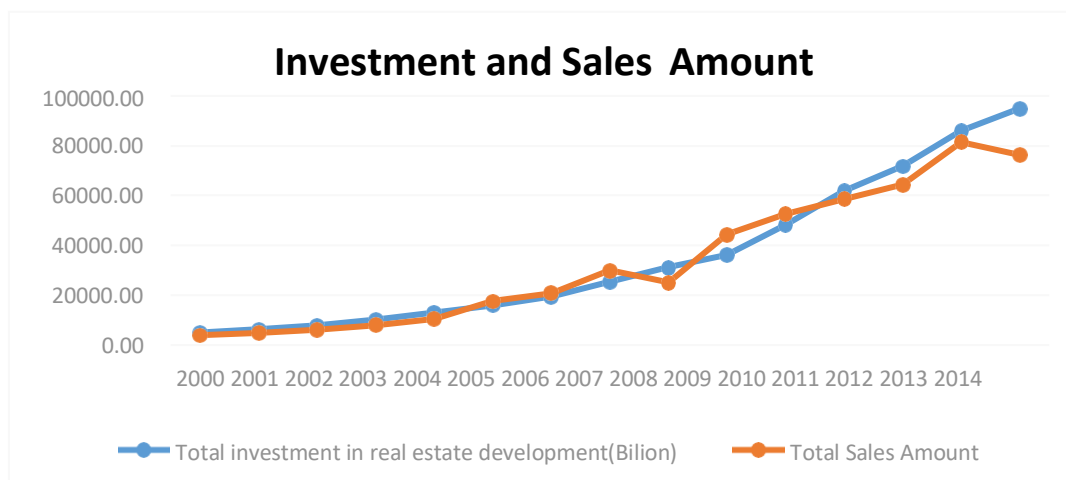
Zhu Y, Lin B., (2004). Sustainable housing and urban construction in China. *Energy Building* 36(12), 1287–97.

Figure 1. Different area of real estate industry investment



(Data Source: National Bureau of Statistics of China)

Figure 2. Investment and sales in real estate firms (in Rmb billions)



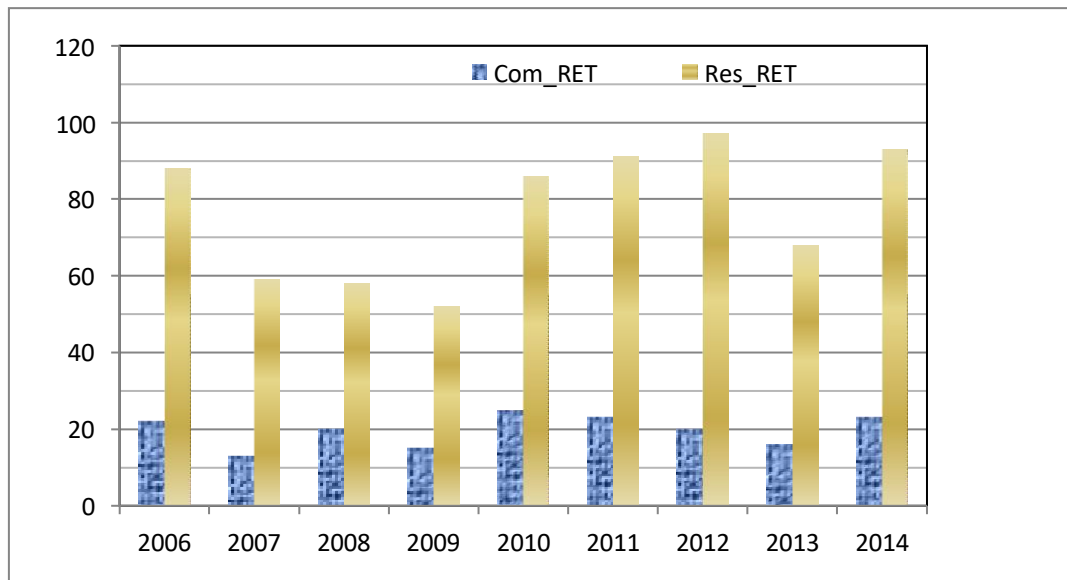
(Data Source: National Bureau of Statistics of China)

Table 1. Real estate building sales and industry source of funds from 2006-2014

Year	Commercial building sales area(million m ²)	Residential building sales area(million m ²)	Source of funds	Domestic loan	Utilization of foreign capital	Self-raised funds	Self-financing proportion
2006	618.57	554.23	27135.55	5356.98	400.15	8597.09	31.68%
2007	773.55	701.36	37477.96	7015.64	641.04	11772.53	31.41%
2008	659.70	592.80	39619.4	7605.7	728.2	15312.1	38.65%
2009	947.55	861.85	57799	11364.5	479.4	17949.1	31.05%
2010	1047.65	933.77	72944.04	12563.7	790.68	26637.21	36.52%
2011	1093.67	965.28	85688.73	13056.8	785.15	35004.57	40.85%
2012	1113.04	984.68	96536.81	14778.39	402.09	39081.96	40.48%
2013	1305.51	1157.23	122122.47	19672.66	534.17	47424.95	38.83%
2014	1206.49	1051.88	121991.48	21242.61	639.26	50419.8	41.33%

Data Source: National Bureau of Statistics of China and CSMAR Economics database

Figure 3. Number of commercial and residential real estate firms for the sample period



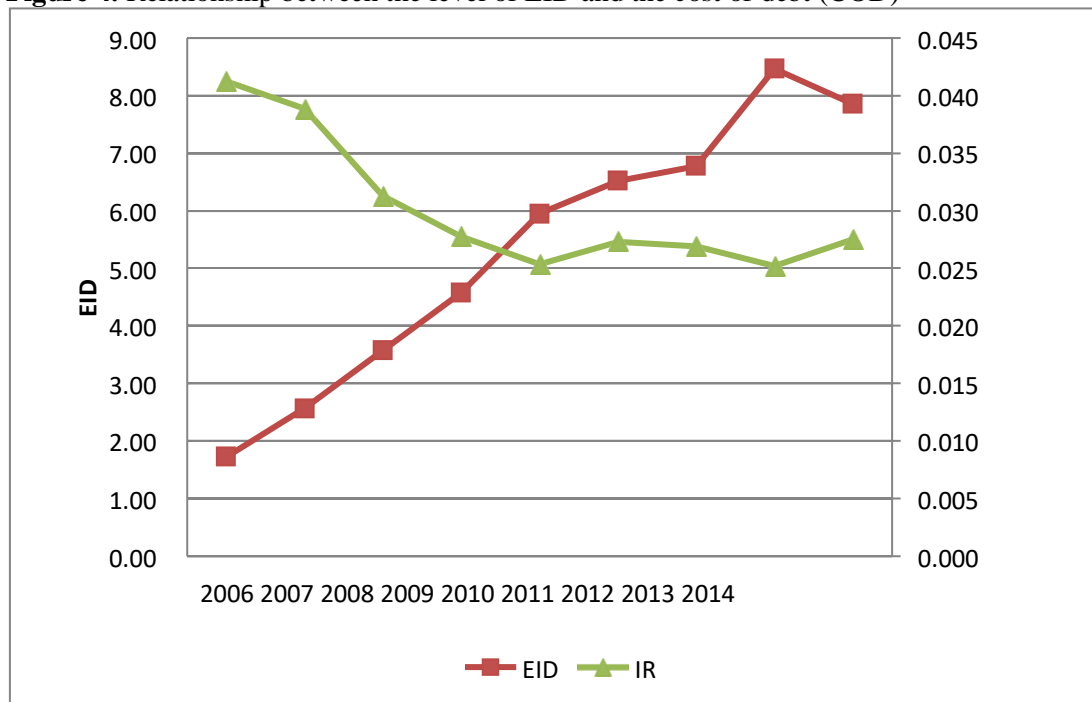
Note: Com_RET and Res_RET denote commercial real estate developers and residential real estate developers respectively.

Table 2. Descriptive statistics of dependent and independent variables

Variable	Obs	Mean	Std. Dev.	Min	Max
COD: LN_IR	869	-3.523	1.277	-7.860	-0.071
EID	869	5.499	5.284	0	21
RET	869	[133] ^a	[20.37] ^b		
LN_AGE	869	2.699	0.316	1.386	3.258
SIZE	869	22.242	1.293	17.122	25.329
LEV	869	1.766	0.815	0.102	9.210
BETA	869	1.195	0.390	-0.193	2.273
ROA	869	0.047	0.076	-0.549	0.462
MBV	869	-0.209	0.765	-1.676	2.315
GROWTH	869	0.185	0.339	-0.730	2.353
TANGI	869	0.260	0.622	-8.847	0.854
LN_NDIR	869	2.154	0.216	1.609	2.708
LN_NIDIR	869	1.147	0.200	0.693	1.609
INS_SH	869	0.328	0.251	0	0.854
AGENCY	869	0.150	0.591	0.003	9.019
CASH_ADE	869	-0.531	5.196	-46.159	13.297
LN_GRPAP	869	10.762	0.536	8.663	11.564
OWN	869	[302] ^a	[34.75] ^b		
DUAL	869	[177] ^a	[15.91] ^b		

Note: Variable name and definitions are in Table 4. []^a and []^b include number of firms their percentages.

Figure 4. Relationship between the level of EID and the cost of debt (COD)



Note: EID and COD denote environmental information disclosure level and the cost of debt respectively.

Table 3. Pearson's correlation matrices

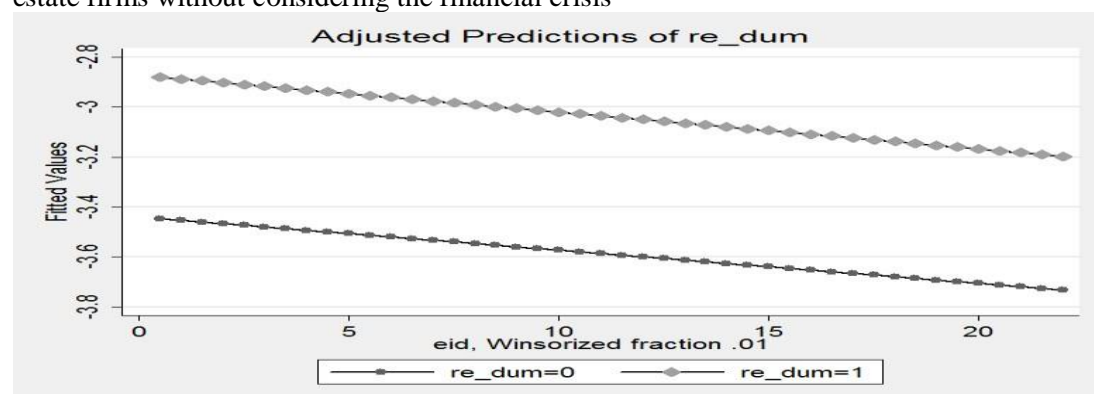
Variable	COD: LN_IR	LN_AGE	SIZE	OWN	LEV	BETA	ROA	MBV	GROWTH	TANGI	LN_NDIR	LN_NIDIR	INS_SH	AGENCY	CASH_ADE	LN_GRPAP	DUAL	RET	EID
COD: LN_IR	1.000																		
LN_AGE	0.011	1.000																	
SIZE	-0.209*	0.139*	1.000																
OWN	0.066	-0.127*	0.033	1.000															
LEV	0.083*	-0.079*	-0.300*	0.063	1.000														
BETA	0.016	0.180*	0.196*	-0.109*	-0.144*	1.000													
ROA	-0.214*	0.0718*	0.305*	-0.001	0.123*	-0.060	1.000												
MBV	0.069*	-0.058	-0.546*	-0.010	0.378*	-0.311*	0.018	1.000											
GROWTH	-0.267*	-0.035	0.315*	0.059	-0.167*	-0.098*	0.275*	-0.085*	1.000										
TANGI	-0.074*	-0.020	0.155*	0.058	0.352*	-0.058	0.474*	-0.048	0.115*	1.000									
LN_NDIR	0.042	0.036	0.164*	0.072*	-0.027	-0.040	0.046	-0.037	0.001	0.094*	1.000								
LN_NIDIR	-0.011	0.083*	0.271*	0.059	-0.021	0.020	0.075*	-0.075*	0.049	0.118*	0.520*	1.000							
INS_SH	-0.145*	0.223*	0.581*	-0.129*	-0.137*	0.210*	0.190*	-0.174*	0.181*	0.065	0.020	0.149*	1.000						
AGENCY	0.098*	-0.046	-0.216*	-0.029	0.007	0.020	-0.370*	0.129*	-0.142*	-0.281*	-0.040	-0.069*	-0.092*	1.000					
CASH_ADE	0.018	0.028	0.018	-0.036	0.043	0.004	0.045	0.003	0.056	0.015	0.003	0.038	-0.002	-0.040	1.000				
LN_GRPAP	-0.073*	0.221*	0.374*	0.015	0.057	0.176*	0.224*	-0.067*	-0.033	0.154*	0.056	0.079*	0.424*	-0.105*	0.025	1.000			
DUAL	0.008	-0.061	-0.141*	-0.027	0.031	-0.021	-0.142*	0.058	-0.012	0.005	-0.123*	-0.091*	-0.097*	0.048	-0.021	-0.032	1.000		
RET	0.156*	-0.050	0.006	0.033	0.061	-0.030	-0.077*	0.101*	-0.054	-0.051	0.080*	0.203*	0.093*	0.027	0.039	0.016	-0.119*	1.000	
EID	-0.079*	0.159*	0.396*	-0.074*	-0.099*	0.098*	0.109*	-0.178*	0.084*	0.032	0.010	0.090*	0.331*	-0.072*	-0.009	0.290*	-0.017	0.024	1.000

Table 4. Effect of types of real estate segments, EID and joint effects of EID and types of real estate segments on the cost of debt

COD: LN_IR	Model 1	Model 2	Model 3	Model 4
Ln_AGE	0.356*** (0.096)	0.413*** (0.094)	0.426*** (0.095)	0.430*** (0.095)
SIZE	-0.134*** (0.038)	-0.115*** (0.038)	-0.109*** (0.039)	-0.113*** (0.039)
OWN	0.093* (0.057)	0.104* (0.056)	0.123** (0.058)	0.125** (0.058)
LEV	0.065** (0.031)	0.062* (0.037)	0.055* (0.038)	0.052* (0.038)
BETA	0.252*** (0.082)	0.326*** (0.083)	0.302*** (0.084)	0.306*** (0.085)
ROA	-2.259*** (0.463)	-2.126*** (0.507)	-2.009*** (0.511)	-2.000*** (0.511)
MBV	-0.078 (0.060)	-0.085 (0.058)	-0.091 (0.059)	-0.093 (0.059)
GROWTH	-0.446*** (0.102)	-0.505*** (0.095)	-0.498*** (0.096)	-0.506*** (0.096)
TANGI	0.025 (0.060)	0.083 (0.068)	0.076 (0.069)	0.075 (0.070)
LN_NDIR	0.395** (0.191)	0.674** (0.184)	0.682*** (0.188)	0.684*** (0.187)
LN_NIDIR	-0.026 (0.211)	-0.502** (0.213)	-0.554** (0.217)	-0.556*** (0.217)
INS_SH	-0.069 (0.150)	-0.062 (0.149)	-0.041 (0.151)	-0.036 (0.151)
AGENCY	-0.044 (0.046)	-0.047 (0.041)	-0.047 (0.041)	-0.047 (0.041)
CASH_ADE	0.008 (0.005)	0.009* (0.005)	0.010* (0.005)	0.010** (0.005)
LN_GRPAP	-0.063 (0.059)	-0.120** (0.059)	-0.104* (0.060)	-0.103* (0.060)
DUAL	0.078 (0.067)	0.108 (0.069)	0.112 (0.070)	0.111 (0.070)
RET		0.564*** (0.062)	0.558*** (0.063)	0.566*** (0.086)
EID			-0.014** (0.006)	-0.013** (0.007)
RET x EID				-0.001 (0.011)
Constant	-1.857* (0.979)	-2.065** (0.979)	-2.236** (0.984)	-2.178** (0.986)
YEAR EFFCT	YES	YES	YES	YES
N	869	869	869	869
Wald Chi2	321.85	310.66	307.57	313.35
Prob> chi2	0.000	0.000	0.000	0.000

Note: ***, ** and * indicate significance at 1%, 5% and 10% respectively. Variables definitions and abbreviations are in Table 4.

Figure 5. Marginal plot of Interaction effect of EID and types of real estate segments of real estate firms without considering the financial crisis



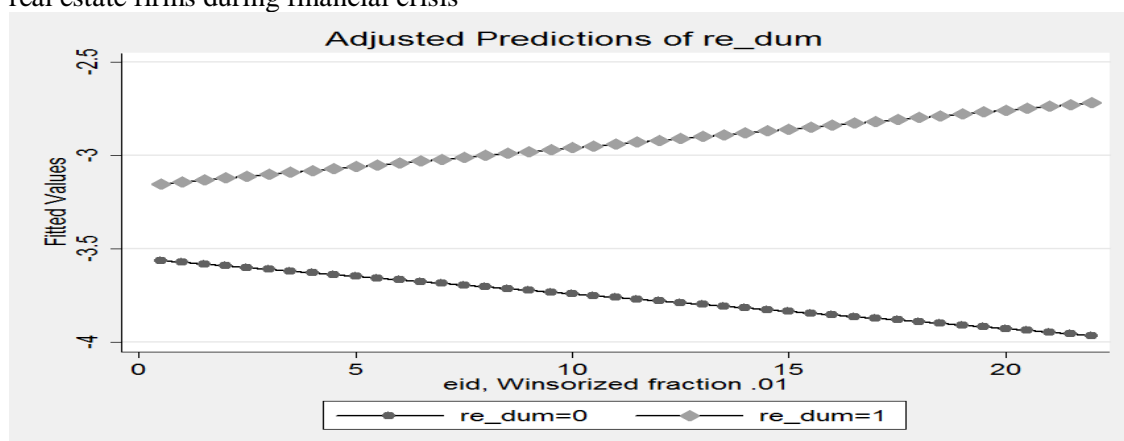
Note: The RET = 1 is commercial real estate development segment and 0 is residential real estate development segment.

Table 5. Effect of EID, types of real estate segments and interaction between them on the cost of debt during financial crisis period

Variable	Model 1		Model 2		Model 3		Model 4	
Ln_AGE	0.532***	(0.127)	0.508***	(0.092)	0.528***	(0.090)	0.582***	(0.092)
SIZE	-0.081	(0.062)	-0.098*	(0.052)	-0.091*	(0.052)	-0.075	(0.051)
OWN	0.322***	(0.071)	0.277***	(0.068)	0.307***	(0.072)	0.300***	(0.068)
LEV	0.329***	(0.044)	0.266***	(0.065)	0.286***	(0.067)	0.308***	(0.067)
BETA	-0.055	(0.105)	0.076	(0.123)	0.062	(0.122)	0.051	(0.118)
ROA	-4.295***	(0.582)	-3.555***	(0.666)	-3.764***	(0.670)	-3.778***	(0.652)
MBV	-0.185**	(0.078)	-0.286***	(0.070)	-0.283***	(0.071)	-0.253***	(0.069)
GROWTH	-0.347***	(0.098)	-0.372***	(0.097)	-0.344***	(0.099)	-0.344***	(0.097)
TANGI	0.0544	(0.118)	0.042	(0.080)	0.052	(0.080)	0.036	(0.082)
LN_NDIR	0.656***	(0.197)	0.850***	(0.195)	1.035***	(0.225)	0.961***	(0.218)
LN_NIDIR	-0.140	(0.253)	-0.674***	(0.255)	-0.875***	(0.284)	-0.857***	(0.272)
INS_SH	0.477**	(0.222)	0.373**	(0.176)	0.441***	(0.183)	0.524***	(0.177)
AGENCY	-0.007	(0.116)	0.059	(0.123)	0.039	(0.125)	0.026	(0.127)
CASH_ADE	-0.014**	(0.006)	-0.014*	(0.008)	-0.010	(0.008)	-0.010	(0.008)
LN_GRP_CAP	-0.206**	(0.080)	-0.146*	(0.080)	-0.162**	(0.082)	-0.219***	(0.083)
DUAL	-0.133	(0.109)	0.049	(0.108)	-0.002	(0.108)	-0.004***	(0.106)
RET			0.593***	(0.074)	0.541***	(0.078)	0.391***	(0.096)
EID					-0.014**	(0.006)	-0.019***	(0.006)
RET x EID							0.038**	(0.015)
Constant	-2.602*	(1.383)	-2.795***	(1.067)	-2.931***	(1.072)	-2.735***	(1.021)
Year Effect	YES		YES		YES		YES	
N	247		247		247		247	
Wald chi2	1218.14		1264.29		3907.76		1279.67	
Prob> chi2	0.000		0.000		0.000		0.000	

Note: ***, ** and * indicate significance at 1%, 5% and 10% respectively. Variables definitions and abbreviations are in Table 4.

Figure 6. Marginal plot of Interaction effect of EID and the types of real estate segments of real estate firms during financial crisis



Note: RET = 1 is commercial real estate development segment and RET= 0 is residential real estate development segment.

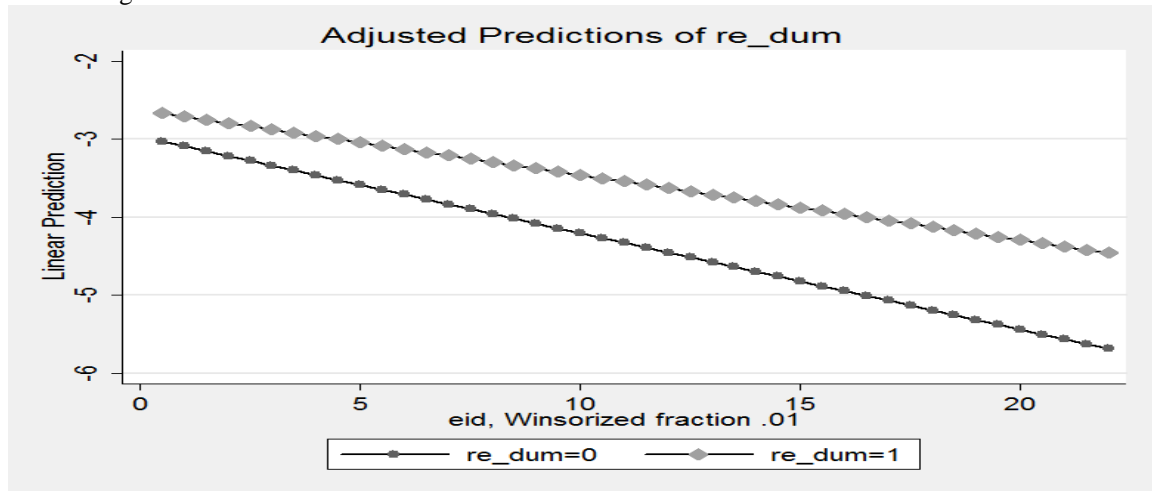
Table 6. Instrumental variables two-stage least squares (2SLS) regression results

Variable	2SLS Regression-2nd Stage		2SLS Regression-1st Stage	
	Model 1A		Model 2A	
Ln_AGE	0.354***	(0.097)	-0.271	(1.183)
SIZE	0.032	(0.045)	1.264***	(0.460)
OWN	0.137*	(0.070)	-0.176	(0.652)
LEV	0.097	(0.075)	0.182***	(0.422)
BETA	0.118	(0.107)	-1.602	(0.702)
ROA	-2.101***	(0.210)	-1.851***	(0.229)
MBV	-0.110**	(0.048)	0.250	(0.461)
GROWTH	-0.692	(0.109)	-0.053	(0.590)
TANGI	-0.043	(0.057)	-0.522*	(0.435)
LN_NDIR	0.647***	(0.030)	-1.028	(2.386)
LN_NIDIR	-0.488**	(0.246)	1.064	(2.166)
INS_SH	-0.072	(0.173)	-0.512	(1.423)
AGENCY	0.001	(0.028)	-0.230	(0.233)
CASH_ADE	0.006**	(0.001)	-0.008	(0.029)
LN_GRPAP	-0.028	(0.041)	0.723	(0.592)
DUAL	0.074	(0.062)	0.152	(0.641)
FIN_CRISIS	0.006**	(0.005)	0.257	(1.304)
RET	0.339***	(0.040)	0.002	(0.995)
EID	-0.124***	(0.021)		
RET x EID	0.040***	(0.005)		
EID_AVRES			1.021**	(0.485)
RET x EID_AVRES			-0.057	(0.234)
Constant	-5.238***	(0.142)	-32.840**	(15.183)
YEAR EFFCT	YES		YES	
N	869		869	

Wald chi2 / F	386.54	46.67
Prob> chi2/ Prob> F	0.0001	0.0001
R2/ Adj R2	0.001	0.223

Note: ***, ** and * indicate significance at 1%, 5% and 10% respectively. Variables definitions and abbreviations are in Table 4.

Figure 7. Marginal plot of the interaction effects of EID and RET on the firms' cost of debt with considering of financial crisis



APPENDIX:

Table A: Components for measuring corporate EID

Components	Definition	Central aspect reflecting EID
I ₁	Firm's environmental investment expenditure for technologies development	Investment
I ₂	Government appropriate funds, finance allowance and taxes abatement related to the environment	Investment
I ₃	Disposal and treatment of generated waste, recycling and integrated utilization of waste products	Technology
I ₄	Information related to ISO environmental system authentication	Consciousness and responsibility
I ₅	Construction and operation of environmental improvement	Technology
I ₆	Influence of government environmental protection policy	Consciousness and responsibility
I ₇	Loans related to environmental protection	Investment
I ₈	Lawsuit, atonement, penalty, and bounty related to environmental protection	Consciousness and responsibility
I ₉	Firm's environmental protection policies, strategies and goals	Consciousness and responsibility
I ₁₀	Other environmental related information	Others

Table B: Descriptions of control and test variables and their data sources

Abbreviation	Description of the variable	Calculation	Data source
AGE	Firm age	Natural logarithms value difference between incepted year and beginning of the accounting year	WIND Database
SIZE	Firm size	The natural log of the total assets in each at the begging of the year	WIND Database
LEV	Leverage	The ratio of total assets to interest bearing liability in each firm at the beginning of the year	WIND Database
GROWTH	Asset growth year to year	(total assets at t year - total assets at (t-1))/ total assets at (t-1) year in each firm at the begging of the year	WIND Database
TANGI	Tangibility ratio	Ratio of Property Plant and Equipments to total assets in each firm at the begging of the year	WIND Database
ROA	Return on asset	Return on Assets at in each firm the beginning of the year	WIND Database
MBV	Market book value	Market to book value ratio in each firm at the beginning of the year	WIND Database
OWN	Ownership	A dummy variable (state-owned 1, or otherwise 0)in each firm at the beginning of the year	WIND Database
BETA	Market risk	As described in text as a control variable	WIND Database
LN_NDIR	Number of Directors	Natural logarithms of number of directors in each firm at the beginning of the year	CSMAR Database
LN_NIDIR	Number of Independent Directors	Natural logarithms of number of independent directors in each firm at the beginning of the year	CSMAR Database
INS_SH	Institutional Investors	Ratio of total Private institutional owned share to total share outstanding at the beginning of the year	CSMAR Database
AGENCY	Agency cost	Ratio of administrative expenses to operational revenuein each firm at the beginning of the year	CSMAR Database
CASH_ADE	Cash Flow Adequacy	Cash flow adequacy ratio is measured by cash flow from operations to long-term debt paid plus fixed assets purchased plus cash dividends distributed.	WIND Database
LN_GRPCAP	Regional Gross Production Per Capita	Natural log of Regional gross domestic production per person	CSMAR Database
DUAL	Chairman-CEO duality	A dummy variable (both chairman and CEO are same person 1, or otherwise 0)	CSMAR Database
RET	Real Estate Dummy	Dummy variable if real estate developer is mainly do commercial is 1 and residential development is 0	CITIC data from WIND
EID	Environment information disclosure	Composite index	Annual and CSR reports

Table C: Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
LN_AGE	1.390	0.720
SIZE	3.630	0.275
LEV	1.210	0.825
BETA	1.630	0.615
ROA	1.610	0.620
MBV	1.580	0.633
GROWTH	3.440	0.291
TANGI	1.310	0.761
LN_NDIR	1.630	0.614
LN_NIDIR	2.860	0.350
INS_SH	2.940	0.340
AGENCY	2.120	0.472
CASH_ADE	1.290	0.776
LN_GRPCAP	1.020	0.979
ln_grpcap	1.690	0.591
DUAL	1.110	0.899
RET	2.290	0.436
EID	1.620	0.616
RETx EID	2.480	0.404
Year Dummy 1	3.300	0.303
Year Dummy 2	2.760	0.362
Year Dummy 3	2.900	0.345
Year Dummy 4	1.790	0.557
Year Dummy 5	2.530	0.396
Year Dummy 6	2.060	0.486
Year Dummy 7	1.860	0.536
Year Dummy 8	1.670	0.600
Ave. VIF	2.060	

Table D: Wald test result

testparmi.re_dum# c.EID
 1.re_dum#c.weidy = 0

Whole sample period
 $\chi^2(1) = 0.02$
 Prob> $\chi^2 = 0.8947$

Global Financial crisis sample period (2008-2010)
 $\chi^2(1) = 6.01$
 Prob> $\chi^2 = 0.0142$