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**NANYANG
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THREE ESSAYS ON CORPORATE FINANCE

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NANYANG BUSINESS SCHOOL

2018

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Chapter 1: Stock Liquidity and Corporate Social Responsibility

Abstract

We show that stock liquidity negatively affects firms' corporate social responsibility (CSR) ratings. To identify the causal effect, we use the decimalization of stock trading as an exogenous shock to liquidity. The negative liquidity effect on CSR is more pronounced for firms with CEOs approaching the retirement age, firms with more analyst coverage, and firms with more short-term institutional ownership. These findings suggest that liquidity discourages firms' investment in CSR activities through inducing managerial short-termism. Our findings reveal the real effect of stock liquidity as an important stock market characteristic on firms' engagement in CSR activities and highlight a dark side of liquidity in exacerbating the conflict between shareholders and other stakeholders.

JEL Classification: G12, G14, G32, M14

Keywords: stock liquidity; corporate social responsibility (CSR); decision horizon; short-termism

1. Introduction

The debate on whether corporate social responsibility (CSR) creates value for shareholders is still ongoing. The classic shareholder expense view claims that pursuing CSR strategies is harmful to shareholder wealth due to the conflict of interest between shareholders and other stakeholders (Friedman, 1970; Benabou and Tirole, 2010). The stakeholder value maximization view, however, holds that CSR is also beneficial for shareholders because it aligns the interest of other stakeholders with that of shareholders in the long run (Dowell, Hart, and Yeung, 2000; Orlitzky, Schmidt, and Rynes, 2003).

Recent literature has paid attention to the horizon issue of the CSR investment. These studies show that although CSR leads to conflict of interest between shareholders and other stakeholders in the short run in that the adoption of CSR is at the expenses of shareholders without immediate benefits (Wang and Bansal, 2012; Kecskes, Mansi, and Nguyen, 2016), CSR as an intangible corporate asset that accrues gains over the long-term and increases firm value in the long run (Russo and Fouts, 1997; Freeman, Wicks, and Parmar, 2004; Deng, Kang, and Low, 2013; Fatemi, Fooladi, and Tehranian, 2015).¹ Anecdotes are also consistent with these findings. As Bruce Nolop writes for *The Wall Street Journal* (2014), “*While social responsibility may reduce the stock price over the short term, the price eventually may be higher due to the expected rewards in the future or the avoidance of risks that may threaten a company’s long-term value or even its viability*”. Furthermore, according to McKinsey’s survey in 2009,² approximately 30% of executives believe that CSR can increase shareholder value in the short run, while more than 70% of executives believe that CSR contributes to shareholder value in the long run.

¹ Prior literature also suggests that CSR accrues gains over the long term because it takes to build intangible assets such as social capital and reputation, and relationships with other stakeholders, which require organizational capabilities (Choi and Kim, 2016).

² Valuing corporate social responsibility: McKinsey Global Survey Results (2009).

In this paper, we investigate whether and how stock liquidity, an important stock market characteristic, affects managers' decisions to invest in CSR. We also aim to reveal the real effects of financial market on firms' CSR activities.

Stock liquidity, defined as the ability to trade a significant quantity of a firm's stock at a low cost in a short time, has been documented as an important tool for shareholders to influence the management (Edmans, Fang, and Zur, 2013). Prior studies examine how stock liquidity affects managerial incentives in two views. On the one hand, the governance argument asserts that liquidity enhances the intervention of blockholders on managers through facilitating the formation of blocks (Kyle and Vila, 1991; Kahn and Winton, 1998; Maug 1998), accelerating impounding value enhancement from the intervention into stock price (Faure-Grimaud and Gromb, 2004), and reinforcing blockholders' exit threat of selling shares (Admati and Pfleiderer, 2009; Edmans, 2009; Edmans and Manso, 2011; Edmans, Fang, and Zur, 2013). On the other hand, the short-termism argument maintains that liquidity attracts short-term institutional investors because it allows these investors to dump their stake with low costs (Coffee, 1991; Bhidé, 1993). The pressure from these short-term investors to deliver short-term performance induces managerial short-termism (Stein, 1988, 1989).³

We posit two competing hypotheses concerning the impact of stock liquidity on firms' CSR activities based on the above literature on the role of stock liquidity in affecting managerial incentives. Specifically, the governance view yields the prediction that stock liquidity encourages firms' CSR activities because more liquid stocks promote the formation of blockholders who are concerned with long-term corporate investment such as CSR. Ferrell, Liang, and Renneboog (2016) show that firms with better governance engage in more CSR. In

³ See Porter (1992), Fang, Tian, and Tice (2014) and Chang, Chen, and Zolotoy (2016) for how liquidity induces managerial short-termism in corporate policies.

contrast, the short-termism view posits that liquidity impedes firms' CSR investments because liquidity attracts short-term institutional investors and the pressure from these investors strengthens managerial incentives to deliver short-term performance by focusing on short-term corporate strategies. Collectively, this is ultimately a question that merits an empirical investigation.

Using a sample of 21,783 firm-year observations with CSR ratings from 1995 to 2013, we empirically investigate how stock liquidity affects firms' CSR. Similar to previous studies (Waddock and Graves, 1997; Deng, Kang, and Low, 2013; Flammer, 2015), our main measure of CSR is from the Kinder, Lydenberg, and Domini Research & Analytics (KLD) database, which covers firms' CSR ratings in terms of product quality, diversity, human rights, employee relations, environment, and community. Our main measure of stock liquidity is the relative effective spread as in prior studies, e.g., Fang, Noe, and Tice (2009), Fang, Tian, and Tice (2014), Chang, Chen, and Zolotoy (2016), and Chen et al. (2017).

Our main results show that firms with higher stock liquidity are less likely to engage in CSR activities, which is consistent with the short-termism argument. The negative effect of stock liquidity on CSR investment is both statistically and economically significant. Specifically, a one-standard-deviation increase in stock liquidity, on average, decrease firms' CSR ratings by 7%. We conduct various checks to ensure that our main findings are robust to alternative variable definitions and model specifications.

We also perform several tests to alleviate the endogeneity concern. First, we employ the decimalization of stock trading in 2001 as a natural experiment to establish a causal link between stock liquidity and firms' CSR activities. In 2001, the NYSE, AMEX, and NASDAQ started to implement an increment in quoting and trading stocks from one-sixteenth to decimals. This rule

change serves as a positive exogenous shock to stock liquidity (Fang, Noe, and Tice, 2009). Furthermore, although the decimalization of stock trading improves the stock liquidity of all firms listed on NYSE, AMEX, and NASDAQ (Chordia, Roll, and Subrahmanyam, 2008), it has a stronger effect on low-priced stocks (Edmans, Fang, and Zur, 2013). First, following Fang, Noe, and Tice (2009), we regress the change in firm's CSR surrounding decimalization on the change in liquidity from the year prior to decimalization to the year after decimalization and we find the exogenous increase in liquidity brought by decimalization leads to decrease in CSR ratings. Then, we employ a difference-in-differences (DiD) model and compare the change of firms' CSR ratings before and after this event between firms with high and low stock prices. Our empirical results show that the CSR rating of firms with low stock prices significantly declines after the decimalization compared to that of firms with high stock prices. To further substantiate the causality from stock liquidity to firms' CSR investments, we follow Bertrand and Mullainathan (2003) and examine the dynamics of firms' CSR rating differentials around the stock trading decimalization. The findings indicate that differentials of firms' CSR ratings appear only after the decimalization. Moreover, we perform an additional DiD following Fang, Tian, and Tice (2014) to construct a treatment group and a control group where firms are similar before decimalization between the groups, to alleviate the concern that results are driven by firms' heterogeneity before decimalization. We find CSR rating for firms experiencing a larger increase in liquidity surrounding decimalization decreases more compared to firms with a smaller improvement in liquidity. Collectively, our tests of endogeneity point to a causal impact of stock liquidity on firms' CSR performance.

After establishing the causal relationship between stock liquidity and CSR, we explore the potential mechanisms through which stock liquidity possibly affects firms' engagement in CSR

activities. Prior literature document that managers are more subject to myopia when they approach the retirement age (Gibbons and Murphy, 1992; Jenter and Lewellen, 2015), when their firms are followed by more analysts (He and Tian, 2013), or when their firms are held by short-term institutional investors (Bushee, 1998). To the extent that liquidity induces managerial short-termism in investing in CSR, the negative effect of liquidity on CSR should be more pronounced for firms with retiring CEOs, more analyst coverage, or higher short-term institutional ownership. To test this implication, we interact stock liquidity with indicators denoting the approach of retirement age, more analyst coverage, and higher short-term institutional ownership to examine how the liquidity effect on CSR varies according to these characteristics. We find that the liquidity effect is indeed more pronounced for firms where CEOs are closer to retirement, firms with more analyst coverage, and firms with higher short-term institutional ownership. To further substantiate the short-termism channel, we show that an exogenous increase in stock liquidity due to decimalization increases the holdings by short-term institutional investors and non-dedicated institutional investors. These results confirm the argument that stock liquidity induces managerial short-termism. They also indicate a dark side of stock liquidity in exacerbating the conflict between shareholders and other stakeholders by reducing firms' CSR commitments.

Last, we explore the effect of liquidity on various aspects of the CSR ratings by examining the six dimensions' scores. We find liquidity has a significant negative impact on four dimensions: product quality, human rights, employee relations, and environment. We further investigate the real effect of stock liquidity on CSR performance by examining the firm's pollution prevention. Using the data provided by the Toxic Release Inventory (TRI) program under the United States Environmental Protection Agency⁴ and the Compustat Industrial Annual files, we get the

⁴ The database is by far the most comprehensive database about waste production and releases by operating facilities in the United States. We compute a firm's total waste produced (in pounds) in all facilities.

pollution prevention amount, which includes the aspects of the total waste produced, the amounts of individual chemicals produced. We find that the stock liquidity negatively affects firm's pollution prevention performance.

Our study contributes to the existing literature in two ways. First, our paper adds to the literature on the determinants of CSR. Prior studies identify various factors, such as foreign competitive threat (Flammer, 2015), institutional ownership (Erhemjamts and Huang, 2016) and legal origin (Liang and Renneboog, 2017), which affect firms' CSR investments. We extend this literature by showing that liquidity as an important stock market characteristic induces short-termism and thus impedes CSR investments. This finding suggests an important perspective for policymakers who are interested in cultivating CSR in the economy.

Second, our study contributes to the ongoing debate on the effects of stock liquidity. Some studies show that liquidity improves corporate governance by encouraging voice of blockholders (Kyle and Vila, 1991; Kahn and Winton, 1998; Maug 1998) or imposing an exit threat (Edmans, 2009; Edmans and Manso, 2011), while other studies reveal a dark side of liquidity because it allows investors to sell their stakes of firms in trouble (Coffee, 1991; Bhidé, 1993). We demonstrate that stock liquidity can exacerbate managerial short-termism, thereby discouraging firms' CSR investments. By doing so, our paper complements Fang, Tian, and Tice (2014) in uncovering the dark side of stock liquidity in hindering firms' investment that can be beneficial for shareholders in the long run.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 describes the data, the sample, and the variable construction. The main empirical results are presented in Section 4. Further analysis is reported in Section 5. Section 6 concludes.

2. Related literature

Our paper contributes to two strands of literature. The first strand of literature emphasizes the effect of stock liquidity on corporate policies, while the second strand of literature focuses on the determinants of CSR.

2.1. Stock liquidity and corporate policies

There are multiple views on how stock liquidity affects firms' governance and managerial incentives. On the one hand, Maug (1998) argues that as a result of lower trading costs, higher stock liquidity enables the blocks to form at ease, which helps improve the monitoring of shareholders. Faure-Grimaud and Gromb (2004) show that liquidity enhances blockholders' monitoring through allowing these investors to enjoy gains from the intervention, which can be quickly impounded into the stock price. Consistent with the governance argument, Fang, Noe, and Tice (2009) show a positive effect of stock liquidity on firm value as liquidity improves the feedback efficiency from investors to managers and the efficiency of equity-based compensation through price. Norli, Ostergaard, and Schindele (2015) document that stock liquidity helps overcome the free-rider problem and thus increases the probability of shareholder activism. Brogaard, Li, and Xia (2017) find that stock liquidity significantly reduces firm bankruptcy risk by improving stock price informational efficiency and corporate governance. Chen et al. (2017) show that firms with high liquidity are less likely to engage in extreme tax avoidance as it enhances shareholders' monitoring over the management.

On the other hand, Coffee (1991) and Bhidé (1993) argue that liquidity reduces the trading costs of selling stocks of firms in trouble. As a result, liquidity does not improve firms' governance but exacerbates managers' short-termism. In line with this short-termism argument, Fang, Tian, and Tice (2014) find that liquidity impedes corporate innovation by increasing the

exposure to takeover market and the trading pressure from short-term institutional investors. Kang and Kim (2015) show that higher liquidity leads to higher CEO turnover in firms with higher transient institutional ownership. Chang, Chen, and Zolotoy (2016) show that liquidity increases firms' stock price crash risk as it induces managers to inflate short-term earnings by withholding bad news.

There is a third view by Admati and Pfleiderer (2009), Edmans (2009), and Edmans and Manso (2011), which argues that the exit threat by blockholders also improves firms' governance because managers' equity-based compensation can be adversely affected ex-post by investors' selling. The study of Edmans, Fang, and Zur (2013), which examines the effect of liquidity on corporate governance, finds supportive evidence to this view.

Taken together, the evidence on how stock liquidity affects managerial incentives is mixed. Our study adds to this debate by documenting that stock liquidity leads to managerial myopia and thus has a detrimental impact on firms' long-term CSR investments.

2.2. Determinants of CSR

Extant studies have identified various factors affecting CSR. For example, Flammer (2015) shows that competitive threats from foreign rivals encourage domestic firms' engagement in CSR as these firms treat CSR as a strategy to maintain their comparative advantage. Dimson, Karakas, and Li (2015) show that socially responsible institutional investors are more likely to target firms for CSR. Erhemjamts and Huang (2016) find that long-term (short-term) institutional investors promote (discourage) CSR as a long-term investment that increases firm value. The study of Ferrell, Liang, and Renneboog (2016) finds that firms with better governance are more likely to make CSR commitments. The analysis of Liang and Renneboog (2017) shows the

importance of country-level legal origin in explaining the cross-country difference in CSR strategies. In addition, Di Giuli and Kostovetsky (2014) find that politics plays an important role in firms' CSR investment. Hong, Kubik, and Scheinkman (2012) document financial constraints as an important reason why firms do not engage in CSR.

Despite these factors, there is no research that investigates how stock market characteristics affect CSR investments. Our study fills the literature gap by documenting the adverse impact of stock liquidity, as a key stock market characteristic, on firms' CSR investments. By doing so, our analysis offers new insights into the determinants of firms' investment in CSR and highlights the real effect of stock market characteristics.

3. Data, sample, and variables

3.1. Data and sample

We obtain corporate social responsibility (CSR) data from MSCI ESG STATS (formerly known as KLD STATS), which tracks firms' CSR ratings since 1991. We get liquidity data from the Trade and Quote database (TAQ), stock return data from Center for Research in Security Prices (CRSP), firm financial data from Compustat, analyst coverage data from Institutional Brokers Estimates Systems (I/B/E/S), institutional holdings data from Thomson Reuter's Institutional Holdings database, institutional investor classification data from Brian Bushee's website,⁵ managerial compensation data from Compustat Executive Compensation (Execucomp).

Our sample includes firm-year observations jointly covered by KLD, Compustat, CRSP, and TAQ. We required a minimum of four observations with CSR ratings for each industry-year, which makes our starting year for the study to be 1995, our final sample consists of 21,783 firm-

⁵ <http://acct.wharton.upenn.edu/faculty/bushee/Iclass.html>

year observations from 1995 to 2013. Table A2 in Appendix A shows the sample distribution over the years. The number of sample firms is steady around 300 over the 1995 to 2000 period before increasing to 480 in 2001 and 533 in 2002. The KLD database covers approximately 650 companies in the Domini 400 Social SM Index and the Standard & Poor's (S&P) 500 since 1991, and firms in the Russell 3000 since 2003. Thus, there is a big jump in the number of our sample observations from 2002 to 2003. The number of firms per year is then fairly stable at around 1300 to 1900 over the 2003 to 2013 period.

3.2. Measuring corporate social responsibility

To construct CSR measures, we follow prior CSR literature (e.g. Flammer, 2015) and measure a firm's social performance using the score from the KLD database that reflects the extent of the firm's involvement in CSR activity. KLD rates firms along six dimensions of corporate social responsibility: product quality and safety, diversity, human rights, employee relations, environment, and community.⁶ In each dimension, there are a number of strength (positive CSR policy) indicators as well as a number of concern (negative CSR policy) indicators. Our primary CSR measure (*CSR*) is defined as the sum of the strength scores in the above-mentioned six dimensions. A higher value of *CSR* indicates a better social performance.

To check the robustness, we also construct four alternative CSR proxies. We define the variable *CSR_NET* as the Net KLD index by subtracting the concerns scores from the strengths scores. The variable *CSR7* is the CSR scores plus the strength score of another dimension - corporate governance. The variable *CSR_ADJ* is the adjusted CSR scores following Deng, Kang,

⁶ KLD also rates firms along the corporate governance dimension. Since it is different from corporate social responsibility, we exclude this dimension in computing our primary measure of CSR. In robustness check, we use alternative measure of CSR which sums up all strengths of seven dimension (including corporate governance dimension) and we obtain similar results.

and Low (2013). The variable *CSR_Con* is the total concerns scores for the six dimensions. We discuss more in detail of these alternative CSR measures in robustness tests. In the auxiliary analysis, we also consider these six sub-indices of the CSR index.

3.3. *Measuring stock liquidity*

Our primary measure of liquidity is the relative effective spread calculated using the intraday TAQ data. It is generally perceived to be one of the best liquidity measures (e.g., Fang, Noe, and Tice (2009), Fang, Tian, and Tice (2014)). Given that it is constructed based on the realized high-frequency trading data, the effective spread is often used as a benchmark to assess the performance of other liquidity measures calculated using low-frequency price and volume data (e.g., Hasbrouck, 2009, Goyenko, Holden, and Trzcinka (2009)).

The relative effective spread is defined as the difference between the execution price and the midpoint of the prevailing bid-ask quote (the effective spread) divided by the midpoint of the prevailing bid-ask quote. Daily relative effective spread for a given stock as the trade-weighted average of the relative effective spreads of all trades for a given stock during the day, as per TAQ. The annual relative effective spread is then calculated by averaging the daily spreads over the firm's fiscal year. Since a higher value of relative effective spread indicates lower stock liquidity, we define stock liquidity (*LIQ*) as the annual relative effective spread multiplied by -100 to facilitate interpretation. Thus, higher values of *LIQ* implies higher stock liquidity.

We also consider the following three alternative measures of stock liquidity: Amihud's (2002) price impact measure (*Amihud ILLIQ*), Lesmond's (2005) percentage of zero daily returns measure (*ZERO*), and quoted bid-ask spread (*Quoted spread*). Amihud's (2002) price impact

measure. We discuss these alternative stock liquidity measures in greater detail in robustness tests described in Section 4.2.

3.4. *Control variables*

We control for firm-specific conditions that might influence firms' CSR. Our choice of control variables is consistent with the prior literature (e.g. Brammer and Millington, 2005; Di Giuli and Kostovetsky, 2014; Ferrell, Liang, and Renneboog, 2016; Liang and Renneboog, 2017). Specifically, firm size (*Size*) is a standard control measured by the natural logarithm of total asset as larger firms tend to engage in more CSR activity. We include return on assets (*ROA*) as a proxy for firm performance, to capture the “doing good by doing well effect. We also control for the market valuation of the firm using market to book ratio (*Market-to-book*). Other control variables include leverage ratio (*Leverage*), cash ratio (*Cash*), investment expenditure (*Investment*), analyst coverage (*Analyst Coverage*), and research and development expenses (*R&D Expense*). Detailed definitions of these variables are in Table A1 in Appendix A.

3.5. *Descriptive statistics*

We report the summary statistics of main variables in Panel A of Table 1. The average (median) CSR score of our sample firms is 1.232 (1.000). Our main measure of liquidity (*LIQ*), has the mean value equal to -0.196 and has the standard deviation equal to 0.340. The average (median) firm in our sample has a leverage ratio equals to 0.474 (0.478). Table 1 also reports summary statistics for other control variables described above. Since our sampling approach and variable construction criteria follow the literature, in the interest of brevity, we omit the discussion of the descriptive statistics for control variables. In Panel B, we present the correlation

matrix. We find that CSR is positively correlated with firm size (*Size*), return on assets (*ROA*) which is consistent with larger firms and more profitable firms are more likely to invest in CSR. However, the correlation between *CSR* and *LIQ* is positive. It may be driven by the increasing time trends of both stock liquidity and firm's CSR investment over the time. Nevertheless, the positive correlation would bias against us finding the negative relation between stock liquidity and CSR.

[Insert Table 1 about here]

4. Main findings

4.1. The baseline models

In this section, we perform regression analyses to examine the effect of stock liquidity on firms' corporate social responsibility performance. The regression model can be represented as follows:

$$(1) \quad CSR_{i,t+1} = \beta_0 + \beta_1 LIQ_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 Cash_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Market\ to\ book_{i,t} + \beta_7 Investment_{i,t} + Firm_i + Year_t + \varepsilon_{i,t}$$

where i denotes the firm, t denotes the year, $Firm_i$ denotes the firm fixed effect, $Year_t$ denotes the year fixed effect and $\varepsilon_{i,t}$ is the error term. We adjust the standard errors for heteroskedasticity and cluster the standard errors at the firm level. To ensure the robustness of our main result, we augment the above model to perform another two forms of specification: controlling for industry fixed effects based on two-digit SIC codes, using Fama-MacBeth's (1973) approach of regressions.

We present the baseline regression results in Table 2. Column (1) shows the results using our baseline setting. The coefficient of stock liquidity is negative and statistically significant at the 1%

significance level, suggesting that firms with higher stock liquidity are associated with lower level of CSR performance. A one-standard-deviation increase in stock liquidity (i.e. 0.340) is associated with a $0.340 \times 0.258 = 0.088$ decrease in the CSR score, which is around 7.1% of our sample mean of CSR score (i.e. 1.232). Thus, the effect of stock liquidity on firm CSR is not only statistically significant but economically meaningful.

[Insert Table 2 about here]

The results for control variables are largely consistent with the prior literature (e.g. Di Giuli and Kostovetsky, 2014). Specifically, the CSR score is positively associated with firm size and cash holdings, and negatively correlated with the market-to-book ratio. Untabulated statistics show that the largest variance inflation factor (VIF) is below 5, suggesting that multicollinearity does not pose a serious problem in our setting (O'Brien (2007)).

In column (2) and (3) of Table 2, we show that our baseline results are robust to alternative model specifications. Column (2) shows the regression results using industry fixed effects and year fixed effects and the coefficient on stock liquidity remains positive and is three times larger as that in column (1). Column (3) reports the results using Fama-MacBeth's (1973) procedure that corrects standard errors for cross-sectional correlations. The results are consistent with that in column (1) with even bigger magnitude.

Taken together, our baseline results in Table 2 suggest that firms with higher stock liquidity exhibit lower CSR ratings. The significant negative relation between stock liquidity and corporate social responsibility is consistent with the short-termism view that stock liquidity induces managerial myopia, thus lowering companies' engagement in CSR activities.

4.2. Robustness tests

We conduct a battery of robustness checks using the model in Column (1) of Table 2 on alternative measures of CSR and stock liquidity to ensure the validity of our results. Table 3 presents the results of robustness checks. We only tabulate the coefficients of stock liquidity for the sake of brevity.

We begin by considering alternative measures of CSR. First, besides the strength indicators for the six dimensions in KLD database, we consider the concerns indicators as well and construct CSR concerns score (*CSR_Con*). The existence of strength may due to there is a concern so we want to show our results are not driven by the concerns indicators. Moreover, we construct net CSR score (*CSR_NET*) by subtracting the concerns from strengths (e.g. Servaes and Tamayo, 2013; Di Giuli and Kostovetsky, 2014). Second, we plus back the strength score of the seventh dimension in KLD – corporate governance to get another strength CSR score (*CSR7*). Third, we construct the adjusted CSR score (*CSR_ADJ*) to overcome the issues of time-varying number of strength and concern indicators for each dimension over time which is mentioned in Deng, Kang and Low (2013). Specifically, the adjusted CSR score is calculated by dividing the strength and concern scores for each dimension by the respective number of strength and concern scores for that dimension and then taking the difference between the adjusted total strength score and the adjusted total concern score. The results of these tests are shown in Panel A of Table 3. We find an insignificant effect of stock liquidity on concerns. For the three remaining alternative CSR measures in columns (2) to (4), the coefficient on stock liquidity is negative and significant, suggesting that our findings are robust to alternative measures of CSR.

Next, we examine whether different measures of stock liquidity could affect our result. We consider the following three alternative measures of stock liquidity: Amihud's (2002) price impact measure, Lesmond's (2005) percentage of zero daily returns measure, and relative quoted

spread defined using CRSP daily file. Amihud's (2002) illiquidity measure captures the stock price changes per \$ millions of trading volume. The percentage of zero daily returns is the number of trading days with zero daily returns and positive trading volume divided by the number of annual trading days over the firm's fiscal year. The relative quoted spread is calculated as the quoted bid-ask spread divided by the midpoint of bid and ask price using CRSP daily file. We report these results in Panel B of Table 3. Since the three alternative stock liquidity proxies measure illiquidity, larger values indicate lower level of stock liquidity. The coefficients for all three alternative measures are positive and significant, suggesting higher illiquidity are associated with higher CSR scores. This suggests our findings are robust to different measures of stock liquidity.

We also investigate the stock liquidity impacts on firm CSR in future years. In Panel C of Table 3, we replace the key independent variable with stock liquidity (*LIQ*) lagged one and two years, respectively. The coefficient estimates on liquidity measures continue to be negative and significant at the 1% level. The results show that the impact of stock liquidity on CSR is persistent.

[Insert Table 3 about here]

4.3. *Endogeneity*

While we document a strong negative relation between stock liquidity and CSR, the results could be subject to endogeneity arising from omitted variables or reverse causality running from CSR to stock liquidity. In our baseline regressions, we include firm fixed effects to exclude the possibility that firm-specific time-invariant omitted variables drive the results. However, there may still be rooms for other time-varying omitted variables. To further alleviate these concerns,

we employ two difference-in-differences (DiD) approaches utilizing decimalization as an exogenous shock to liquidity to address endogeneity. The decimalization has been widely used in prior literature to establish causal links (e.g. Fang, Noe, and Tice, 2009; Fang, Tian and Tice, 2014; Chang, Chen, and Zolotoy, 2016; Brogaard, Li, and Xia, 2017).

Before 2001, the minimum tick size for quoting and trading a stock is one-sixteenth of \$1 on the three major U.S. exchange. On January 29, 2001, the NYSE and Amex reduced the minimum tick size and began quoting and trading all listed stocks in decimals. The NASDAQ later changed its tick size to decimal prices between March 12, 2001, and April 9, 2001, as well. The decimalization in 2001 lowers the cost of trading and increases liquidity. Bessembinder (2003) shows that quoted bid-ask spreads fall following decimalization using a sample of NYSE and NASDAQ stocks. Chordia, Roll, and Subrahmanyam (2008) document that decimalization leads to increased stock liquidity.

Decimalization is a good quasi-natural experiment for us to identify the causal impact of stock liquidity on CSR in two ways. First, decimalization generates exogenous changes in stock liquidity but it is unlikely to directly affect firm's CSR activity. Different firms also experience different levels of improvement in stock liquidity surrounding decimalization, which allows us to explore the cross-sectional variations. Second, decimalization provides us with a tool to address the reverse causality concern as we do not expect that change in liquidity caused by decimalization can be attributed to the changes in future CSR.

Following Fang, Noe, and Tice (2009), the change in liquidity caused by the exogenous shock of decimalization can be used to identify the causal effect of liquidity on firm performance. We first regress change in CSR rating surrounding decimalization on the change in liquidity from the fiscal year prior to decimalization to the fiscal year after decimalization. The results are shown in

Panel A of Table 4. An increase in liquidity surrounding decimalization result in a decrease in firm's CSR rating. The results are similar using the alternative measures of liquidity.

Following the idea of Edmans, Fang, and Zur (2013) who suggest that moving from \$1/16 to \$1/100 is a greater proportional change for – and thus should have a greater effect on – liquidity for low-priced stocks. We thus create a dummy variable *LowPrc* which takes value one if the firm's stock price in the pre-decimalization year was below the sample median and zero otherwise. If decimalization has a stronger effect on the liquidity of firms with low price, then we should observe the negative relation between stock liquidity and CSR be stronger for such firms. Formally, the specification is shown as follows:

$$(2) \quad CSR_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 LowPrc_i + \beta_3 Post_t * LowPrc_i + Controls_{i,t-1} + Firm_i + Year_t + \varepsilon_{i,t}$$

where *Post* is a dummy variable that equals to one for the fiscal year after the decimalization and zero for the fiscal year before the decimalization, *LowPrc* is defined above.

We report the results in Panel B of Table 4. The coefficient on $Post \times LowPrc$ is negative and significant, suggesting that the decrease in CSR surrounding decimalization was more pronounced for firms with low stock prices, which is consistent with our prediction. To further substantiate the forward causality from liquidity to CSR, we follow Bertrand and Mullainathan (2003) and examine the dynamics of firm's CSR performance around decimalization. In particular, we include pre-trend and post-trend dummy variables to show that the effects of liquidity appear in the post-decimalization years. We modify the Equation (2) to include the year dummies and their interactions with *LowPrc*. *Before*⁻¹ is a dummy variable equals to 1 if it's one year before decimalization and zero otherwise. *Current* is a dummy variable equals to 1 if it's the decimalization year and zero otherwise. *After*⁻¹ (*After*^{2&3}) are dummy variables that take value 1

if it's one year (two or three years) after decimalization. The omitted group (benchmark) consists of the observations two or three years before decimalization. This result is shown in Panel B of Table 4. We observe statistically insignificant coefficients for $LowPrc \times Before^{-1}$ and $LowPrc \times Current$, suggesting the parallel trend assumption for the DiD is not violated. The coefficients for interactions between $LowPrc$ and $After^1$ ($After^{2\&3}$) are negative and significant, indicating the low-priced firms experience a stronger decrease in CSR following decimalization compared to high-priced firms. This result mitigates the concern that the causality may move in the opposite direction from CSR to liquidity.

[Insert Table 4 about here]

To further address endogeneity concern due to omitted variables, we employ another DiD approach to construct a treatment group and a control group in the pre-decimalization year following prior literature (e.g. Fang, Tian, and Tice, 2014; Brogaard, Li, and Xia, 2017). We construct two groups of firms with similar characteristics prior to decimalization but experienced different levels of the change in liquidity around decimalization. The DiD on the matched sample help mitigate the concerns of omitted variables and alleviate biases driven by time trends. We rank all firms based on their changes in liquidity around decimalization and assign them into terciles. We only retain the firms in top and bottom terciles. For each firm in the top tercile (firms with the largest increase in liquidity), we use propensity score matching to find a matching firm from the bottom tercile. This method provides us with a treatment group and a matched control group. The firms in the two groups should have similar firm characteristics and liquidity prior to decimalization but experience a different change in liquidity in response to the exogenous shock of decimalization.

We report the multivariate DiD regressions results based on the matched sample in Panel C of Table 4. We again show the CSR dynamics. The coefficients on *Current*, *After¹*, *After^{2&3}* are all significantly positive and monotonically increasing, indicating a strong increasing trend of CSR among these years. More importantly, we observe the coefficients on *Treat × After¹* and *Treat × After^{2&3}* are significantly negative, suggesting that treatment firms (i.e. highest increase in liquidity) experienced a larger decline in CSR ratings than control firms after the decimalization. The insignificance of the interaction terms *Treat × Before⁻¹* and *Treat × Current* helps to mitigate the reverse causality concern in that the liquidity effect only started to appear after the liquidity shock. In sum, these findings suggest a negative causal relation running from stock liquidity to CSR.

To ensure the validity of our DiD setting, we also perform some diagnostic analyses to verify the parallel trend assumption. The results are reported in Appendix B. First, we show the probit regressions results for both pre- and post-matched samples. All explanatory variables are insignificant in the post-matched probit regressions, suggesting no different observable firm characteristics exist between our treatment firms and matched control firms. Second, we perform t-tests on firms' pre-decimalization characteristics between treatment firms and control firms and find there is no significant difference of firm characteristics between the two groups. These diagnostic tests suggest the parallel trend assumption for our DiD setting is not violated.

5. Stock liquidity and CSR: which channel matters?

Our baseline results suggest that higher stock liquidity leads to lower CSR performance. As discussed in Sections 1 and 2, such an effect is consistent with the short-termism view. In this

section, we develop several tests to probe the possible channels through which stock liquidity reduces CSR.

5.1. Institutional ownership and the liquidity-CSR relation

Increased liquidity makes the selling of stocks easier and less costly, so it attracts short-term and transient institutional investors (e.g. Fang, Tian, and Tice, 2014).⁷ The presence of the short-term investors pressurizes managers to meet short-term performance targets and focus more on short-term corporate strategies. Given corporate social responsibility is a long-term investment, the short-term focused managers will engage in less CSR activities as it is costly in the short run. Thus, if short-term institutional investors play an important role in shaping the negative liquidity-CSR relation, we should observe the effects of stock liquidity on CSR to be more pronounced for firms with a higher proportion of transient institutional ownership and a higher short-term institutional ownership.

Following Bushee's (1998) classification of institutional investors, we categorize institutions as either transient (*TRAIO*) or non-transient (*NONTRAIO*). Transient institutional investors usually hold highly diversified portfolio, exhibit high portfolio turnovers, and have a strong incentive to pursue short-term trading profits. We define non-transient institutions as dedicated institutions who generally have low portfolio turnovers, monitor firm management intensely and rely on information beyond current earnings to assess managers' performance (e.g., Gaspar, Massa, and Matos, 2005; Fang, Tian, and Tice, 2014). We also follow Yan and Zhang (2009) to classify the institutional investors into two types: short-term institutional investors (*STIO*) and long-term institutional investors (*LTIO*).

⁷ Fang, Tian, and Tice (2014) show transient institutional ownership increased for a group of firms which experienced the largest increase in stock liquidity surrounding decimalization while transient institutional ownership dropped for the group of firms experiencing the lowest increase in stock liquidity surrounding decimalization.

Table 5 Panel A shows the regression results for institutional ownership. In Column (1), we observe the coefficient of interaction between *LIQ* and *STIO* is negative and significant, suggesting CSR decreases more in firms with more short-term-oriented institutions given the same level increase in liquidity. Improved liquidity also makes firms with higher long-term-oriented institutions more willing to invest in CSR as the interaction between *LIQ* and *LTIO* is significantly positive. In Column (2), we find similar results that the negative liquidity-CSR relation is stronger in firms with higher transient institutional ownership since the interaction between *LIQ* and *TRAI*O is significantly negative. These findings provide support for the short-termism view that the pressure from short-term investors drives managers into short-term focused CSR activities.

Next, we examine whether there is high short-term institutional ownership or transient institutional ownership when stock liquidity is high. If more shares are owned by short-term institutional investors, managers may be more short-term oriented. In unreported results, stock liquidity is strongly positively associated with total institutional ownership, short-term institutional ownership as well as transient institutional ownership. We then conduct a DiD tests using the propensity score matched sample to identify the change in institutional ownership from its average over the three years before decimalization to its average over the three years after decimalization for the treatment and control groups. The results in Panel B of Table 5 show that the difference of short-term institutional ownership between treatment group and control group increases from -1.7% to 2.4% after decimalization, leading to a DiD estimator of 4.1%, significant at the 5% level. Similarly, the DiD estimator for transient institutional ownership is 6.2%. We find there is a decrease in dedicated institutional ownership surrounding decimalization.

In summary, we show that an exogenous increase in stock liquidity due to decimalization increases the holdings by short-term institutional investors and non-dedicated institutional investors and the negative effect of liquidity is stronger in firms with high short-term/non-dedicated institutional ownerships. Their short-term focus and lack of monitoring may be a mechanism through which stock liquidity decreases CSR.

5.2. Degree of managerial myopia and the liquidity-CSR relation

To further substantiate the short-termism channel, we then examine the effects of liquidity on firms whose managers are more likely to be subject to myopia. We expect the negative impact of liquidity on CSR to be stronger for firms with more myopic managers. When CEOs' wealth is more closely tied and more sensitive to the firm performance, they should be more concerned about the large sales of stocks by short-term investors, and thus they are more likely to deliver the short-term performance demanded by these investors. We use the CEO wealth-performance-sensitivity measure (*CEO_WPS*) constructed by Edmans (2009) to proxy for managerial myopia. When managers approach their retirement age, they tend to be more short-term focused as there are only a few years in position toward retirement (e.g. Gibbons and Murphy, 1992; Jenter and Lewellen, 2011). To capture this, we create a dummy variable *CEO_AGE63* which equals to one if the CEO is 63 or older and zero otherwise. He and Tian (2013) argue that analysts may exert too much pressure on managers to meet the short-term earnings target and impede firms' investment in long-term projects. Thus, we define *Analyst* as the number of analysts who have issued at least one earnings forecast for the firm. Higher values of *CEO_WPS*, *CEO_AGE63*, and *Analyst* indicate higher degrees of managerial myopia.

We report the results in Panel C of Table 5. Consistent with our hypothesis, we find the negative liquidity-CSR relation is stronger for firms whose managers are more subject to short-termism, which is characterized by having higher CEO wealth-performance-sensitivity, having CEO being 63 or older, and having more analyst coverage. These findings lend further support for the short-termism channel.

5.3. Earnings pressures and the liquidity -CSR relation

Short-termism view predicts that managers have stronger incentives to cut CSR investments if they are subject to actual earnings pressure. To test this argument, I divided the sample into two subgroups according to performance pressure that managers face and examine whether our results are more pronounced when performance pressure is higher. I partition the sample into two subsamples based on absolute change of earnings per share (EPS): 1) the small change subsample (SC), where absolute change of EPS is below sample median; 2) the large change subsample (LC), where absolute change of EPS is above sample median. Firms in the LC group have either large decline of EPS or large increase of EPS. Firms with large decline of EPS are very likely to miss the earnings target by a large amount, which is unlikely to be recovered by cut in CSR investments. Thus, managers do not have strong incentive to cut CSR investments. Firms with large increase of EPS are well-performing firms so managers of these firms do not have incentives to cut CSR investments either. In contrast, firms in the SC group are likely to be those firms with high earnings pressure because such firms either experience a small drop in EPS which could possibly miss the target or experience a small increase in EPS which could possibly just meet the target. In each of these two situations, performance pressures are higher for managers in the SC group.

The regression results are shown in Panel D of Table 5. As predicted by the short-termism view, the coefficient of LIQ is negative and significant in the SC group, indicated in column (1). The results indicate that the negative effect of stock liquidity on CSR is evident only for the SC subsample in which managers' short-term accounting performance pressure is higher. It supports the argument that higher liquidity strengthens managers' incentives to meet short-term earnings goal and thus discourage them to invest in CSR.

[Insert Table 5 about here]

5.4. Other possible mechanisms

There may be other mechanisms through which stock liquidity can affect CSR. For example, firms with lower stock liquidity tend to be the ones that are less transparent and face more uncertainty in their investment projects. These firms have more incentives to buy insurance against future litigation risks related to social and environment issues, which translates into more CSR investments and a higher CSR rating. To rule out this hypothesis, we conduct two subsample analyses. First, we classify firms into high litigation risk and low litigation risk according to industry. We define a dummy variable *High Litigation Risk* that equals to one if a firm is in litigious industries (i.e. Chemicals, Industrial and Commercial Machinery, Electronic and other Electrical Equipment, Retail Trade) and zero otherwise. This alternative mechanism predicts the effect of liquidity to be stronger in firms with high litigation risk. The result in column (1) of Table 6 suggest that there is no significant difference between high litigation risk firms and low litigation risk firms, as indicated by the insignificant coefficient on the interaction term. Similarly we define a dummy variable *High Info. Asymmetry* that equals to one if the firm has below median analyst coverage and zero otherwise. The significantly positive coefficient of

the interaction term in column (2) suggest the negative effect of liquidity is stronger among firms with low information asymmetry, inconsistent with the alternative mechanism that the results are primarily driven by high information asymmetry firms.

Another possible mechanism is through takeover threat. Stein (1988) argues that takeover pressure could induce managers to sacrifice long-term performance for current profits to keep the stock from becoming undervalued in the presence of information asymmetry. Shleifer and Summers (1988) suggest that managers have less power over shareholders when takeover threats are high and Kyle and Vila (1991) show that high liquidity increases a firm's exposure to takeovers. To test this mechanism, we examine whether liquidity has a stronger effect in firms with high takeover threat measured as low anti-takeover provisions. We capture it using *High E-index* which equals to one if the firm has above median E-index and zero otherwise. In column (3) of Table 6, we find the coefficient of the interaction term $LIQ \times High\ E-index$ is insignificant, which cannot support the takeover threat channel.

[Insert Table 6 about here]

5.5. *Sub-index regressions*

In the above-mentioned tests, we find that stock liquidity reduces firms' CSR performance. However, the reduction in CSR can take on many different forms. For example, companies may decide to invest less in R&D of environment-friendly products, deteriorate in work-life benefits (e.g., child care, flexible office time) to their employees, donate less to charity, etc. Given the wide variety of CSR investments, their contribution to a company's long-term value may differ. Thus, it is useful to examine how stock liquidity affects different dimensions of CSR activity.

In this section, we extend our baseline specification to examine the effect of liquidity on the various dimension of the CSR investments. Table 7 reports the results. The results in column (1) show that companies substantially decrease their product quality improvement investment because it involves process innovation that is usually a long-term and risky investment, which is in line with the short-termism argument. The finding is also consistent with that of Fang, Tian, and Tice (2014) who document stock liquidity impedes corporate innovation.

In columns (3) and (5), the coefficients on *LIQ* are significant and negative, implying that companies significantly decrease their investment in human rights dimension and environment dimension, such as positive records in South Africa, indigenous people relation, and clean energy and pollution prevention. These findings suggest that firms with high stock liquidity may be pressured to cut investment in these CSR dimensions in order to meet short-term earnings target. The effect of liquidity on employee relations is negative and statistically significant at the 1% level, as shown in Column (4). This implies that firms with high stock liquidity may decrease the general employee-related CSR investment, such as no-layoff policy and cash profit sharing scheme.

Although insignificant, the coefficient estimates of *LIQ* in columns (2) and (6) are still negative, suggesting a potential weak negative effect of liquidity on Diversity dimension and Community dimension. The results indicate that companies are less likely to decrease their CSR efforts targeting broader stakeholders, such as charitable giving and internal promotion or work/life benefits. For example, having a strong promotion plan and work/life benefits may help companies attract, motivate, and maintain the most talented employees/management, thus directly adding company's value. To sum up, the negative relation between *LIQ* and each of the

six dimension of CSR rating, of which four are significant, further supports a significant negative impact of *LIQ* on the overall CSR.

[Insert Table 7 about here]

5.6. Real effects of stock liquidity: pollution prevention

We further examine the real effects of stock liquidity on CSR investment by looking at one specific aspect: pollution prevention. We obtain firm's investment in pollution prevention from the Toxic Release Inventory (TRI) program. Following Doshi, Dowell, and Toffel (2013), we extrapolate the amount of waste reduced by pollution prevention activities as firms do not disclose such information.⁸ We use two alternative measures of pollution prevention. *Prevention* is defined as the log-transformed amount of waste reduced by pollution prevention activities and scaled by total assets.

The results are reported in Table 8. The results show that stock liquidity is negatively related to pollution prevention activity given the coefficient on *LIQ* is significant and negative at the 5% level, suggesting that firms with high stock liquidity may cut investment in pollution prevention. By documenting a negative relation between stock liquidity and firm's pollution prevention investment, we uncover one specific channel on the real effect of stock liquidity on firm's actual policy, which is consistent with both our baseline results and the sub-index regression results (Environment dimension).

[Insert Table 8 about here]

⁸ For a given year, the amount of waste produced is predicted to multiply the production ratio by the total waste generated in the previous year, where the production ratio of a facility is the production level in the current year divided by the production level in the previous year. We then subtract the actual waste from the predicted waste to get the amount of waste that is reduced by pollution prevention.

6. Conclusion

Corporate social responsibility is an intangible asset for the firms where it takes time to build and accrues gains over the long run. Using a large sample of U.S. firms from 1995 to 2013, we find stock liquidity, an important stock market characteristic, negatively affects firm's CSR investment. We employ various tests to establish the causal link from stock liquidity to CSR by utilizing the decimalization in 2001 which generates exogenous change in liquidity. We then examine the underlying mechanisms that drive our results. In particular, we show that the negative liquidity-CSR relation is more pronounced in firms where managerial short-termism issue is more severe, i.e., firms with more short-term institutional ownership, firms with CEO's wealth more sensitive to performance, firms with CEOs approaching the retirement age, and firms with more analyst coverage. These findings suggest that liquidity discourages firms' investment in CSR activities through inducing managerial short-termism.

Our findings reveal the real effect of stock liquidity as an important stock market characteristic on firms' engagement in CSR activities and thus suggest a new determinant of CSR. This paper also highlights one dark side of liquidity where it impedes investment that can be beneficial for shareholders in the long run and adds to the understanding of the real effects of stock liquidity on firms' policy.

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Table 1: Descriptive Statistics

This table reports the descriptive statistics. The sample consists of firm-years jointly covered in the merged Compustat/CRSP database, TAQ, and the KLD database between 1995 and 2013. Stock liquidity (*LIQ*) is defined as -100 times relative effective spread, which is the ratio of the absolute difference between the trade price and the midpoint of the bid-ask quote over the trade price. Corporate social responsibility score (*CSR*) is defined as the sum of the scores of the six major dimensions in KLD based on approximately 80 strength indicators: product quality and safety, diversity, human rights, employee relations, environment, and community. Detailed variable definitions are in Appendix A. Panel A reports the summary statistics and Panel B presents the correlation matrix for the main variables. * indicates statistical significant at the 5% level.

Panel A: Summary Statistics

Variable	Obs	Mean	SD	Q1	Median	Q3
<i>CSR</i>	21,783	1.232	2.030	0.000	0.000	2.000
<i>LIQ</i>	21,783	-0.196	0.340	-0.183	-0.093	-0.051
<i>Size</i>	21,783	6.877	1.761	5.696	6.787	7.995
<i>Leverage</i>	21,783	0.474	0.220	0.303	0.478	0.625
<i>Cash</i>	21,783	0.140	0.154	0.033	0.089	0.191
<i>ROA</i>	21,783	0.109	0.180	0.074	0.130	0.190
<i>Market-to-book</i>	21,783	3.512	4.771	1.387	2.213	3.724
<i>Investment</i>	21,783	0.251	0.222	0.078	0.180	0.359
<i>Analyst</i>	21,783	1.418	1.313	0.000	1.609	2.639
<i>R&D Expense</i>	21,783	0.047	0.096	0.000	0.004	0.055

Panel B: Correlation Matrix of Main Variables

	<i>CSR</i>	<i>LIQ</i>	<i>Size</i>	<i>Leverage</i>	<i>Cash</i>	<i>ROA</i>	<i>MtB</i>	<i>Inv</i>	<i>Analyst</i>
<i>LIQ</i>	0.125*								
<i>Size</i>	0.486*	0.470*							
<i>Leverage</i>	0.141*	0.091*	0.411*						
<i>Cash</i>	-0.104*	-0.123*	-0.415*	-0.330*					
<i>ROA</i>	0.117*	0.258*	0.346*	0.072*	-0.371*				
<i>Market-to-book</i>	0.049*	0.027*	-0.100*	0.219*	0.224*	-0.102*			
<i>Investment</i>	0.063*	0.059*	0.227*	0.229*	-0.360*	0.203*	-0.090*		
<i>Analyst</i>	0.235*	0.246*	0.287*	-0.013	-0.019*	0.105*	0.056*	0.024*	
<i>R&D Expense</i>	-0.039*	-0.090*	-0.337*	-0.170*	0.475*	-0.578*	0.290*	-0.298*	0.063*

Table 2: Stock Liquidity and Corporate Social Responsibility: Main Results

This table reports the regression results for the relation between stock liquidity and corporate social responsibility score. The sample consists of firm-years jointly covered in the merged Compustat/CRSP database, TAQ, and the KLD database between 1995 and 2013. The regression in column (1) is estimated using OLS with firm fixed effect and year fixed effect; that in column (2) is estimated using OLS with industry fixed effect and year fixed effect; that in column (3) is estimated using Fama-MacBeth regressions controlling for industry fixed effect. Standard errors are clustered at the firm level and t -statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Dep. Vars.	(1) CSR_{t+1}	(2) CSR_{t+1}	(3) CSR_{t+1}
Regression method	OLS	OLS	Fama-MacBeth
<i>LIQ</i>	-0.258*** (-3.6)	-1.086*** (-9.7)	-1.104*** (-11.3)
<i>Size</i>	0.198*** (3.5)	0.738*** (17.6)	0.685*** (12.6)
<i>Leverage</i>	0.140 (1.1)	-0.742*** (-5.2)	-0.259 (-1.5)
<i>Cash</i>	0.339*** (2.7)	0.822*** (5.9)	1.544*** (4.9)
<i>ROA</i>	-0.084 (-0.7)	0.148 (1.0)	0.552** (2.4)
<i>Market-to-book</i>	-0.007 (-1.4)	0.032*** (6.4)	0.035*** (5.9)
<i>Investment</i>	0.192 (0.6)	0.315** (2.0)	0.822*** (4.2)
<i>Analyst</i>	0.099*** (3.0)	0.121*** (4.7)	0.113*** (8.8)
<i>R&D Expense</i>	0.180 (0.6)	1.929*** (6.4)	4.272*** (4.4)
Observations	21,783	21,783	21,783
Adj R-squared	0.765	0.333	0.328
Firm FE	Yes	No	No
Year FE	Yes	Yes	No
Industry FE	No	Yes	Yes
Cluster	Firm	Firm	Firm

Table 3: Stock Liquidity and Corporate Social Responsibility: Additional Analyses

This table presents the results of robustness tests. The sample consists of firm-years jointly covered in the merged Compustat/CRSP database, TAQ, and the KLD database between 1995 and 2013. Panel A and Panel B reports the results using alternative measures of corporate social responsibility and alternative measures of stock liquidity, respectively. Panel C reports the results using lagged liquidity measure at year t-1 and year t-2. All regressions include other control variables, firm fixed effect and year fixed effect. Standard errors are clustered at the firm level and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Alternative measures of CSR

	(1)	(2)	(3)	(4)
Dep. Var.	<i>CSR_Con</i> _{<i>t+1</i>}	<i>CSR_NET</i> _{<i>t+1</i>}	<i>CSR7</i> _{<i>t+1</i>}	<i>CSR_ADJ</i> _{<i>t+1</i>}
<i>LIQ</i>	-0.051 (-1.3)	-0.206*** (-2.8)	-0.363*** (-4.5)	-0.032** (-2.0)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	21,783	21,783	21,783	21,777
Adj R-squared	0.687	0.578	0.701	0.501

Panel B: Alternative measures of stock liquidity

	Dependent variable: <i>CSR</i> _{<i>t+1</i>}		
Liquidity Vars.	<i>Amihud ILLIQ</i>	<i>ZERO</i>	<i>Quoted Spread</i>
<i>Liquidity Measure</i>	0.066** (2.0)	5.650*** (5.3)	3.061** (2.0)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	20,630	21,429	21,779
Adj R-squared	0.726	0.718	0.716

Panel C: Long term effect of stock liquidity on CSR

	Dependent variable: <i>CSR</i> _{<i>t+1</i>}	
Liquidity Vars.	<i>LIQ</i> _{<i>t-1</i>}	<i>LIQ</i> _{<i>t-2</i>}
<i>Liquidity Measure</i>	-0.438*** (-4.0)	-0.471*** (-4.0)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	17,637	14,470
Adj R-squared	0.724	0.746

Table 4: Stock Liquidity and Corporate Social Responsibility: Tests on 2001 Decimalization

This table presents the results of changes in CSR around the 2001 decimalization. In Panel A, Δ denotes the change in each variable from the fiscal year before decimalization to the fiscal year after decimalization and change of CSR are regressed on the change in liquidity measures and change in control variables. Panel B presents the difference-in-differences (DiD) analysis using low price dummy from 1998 to 2004. *Post* is a dummy variable that equals to one for the fiscal year after the decimalization. *LowPrc* is a dummy variable equals to one if a firm's closing stock price in the fiscal year prior to the decimalization was below the sample median and zero otherwise. Panel B also presents the CSR dynamics when performing the DiD analysis using low price dummy. *Before*⁻¹ is a dummy variable equals to one for the fiscal year one year before decimalization and zero otherwise. *Current* is a dummy variable equals to one if the fiscal year is the decimalization year. *After*¹ (*After*² & ³) are dummy variables that equal to one if the fiscal year is one year (two and three years) after the decimalization year and zero otherwise. In Panel C, we report the difference-in-differences regression results based on a matched sample. We follow Fang, Tian, and Tice (2014) to obtain a matched sample using propensity score matching. Firms are sorted into terciles based on their change in *LIQ* from pre-decimalization year to post-decimalization year. Firms in the top (bottom) tercile belong to treatment (control) group. For each firm in the treatment group, we use probit model to perform a one-to-one nearest neighbor propensity score matching. *Treat* is a dummy variable equal to one if a firm is in the treatment group and zero if in the control group. All control variables and industry fixed effect are included in the probit model. The results of probit regressions and diagnostic tests are reported in Appendix B. Control variables are included in all regressions. Standard errors are clustered at the firm level and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Reverse Causality

Liquidity Vars.	Dependent variable: ΔCSR			
	ΔLIQ	$\Delta Amihud\ ILLIQ$	$\Delta ZERO$	$\Delta Quoted\ Spread$
$\Delta Liquidity\ Measure$	-1.308* (-1.8)	0.077*** (8.0)	5.273** (2.3)	4.614*** (3.5)
Observations	249	249	249	248
Adjusted R-squared	0.021	0.015	0.029	0.016
Controls	Included	Included	Included	Included
Cluster	Firm	Firm	Firm	Firm

Panel B: Interactions with Low-priced Stock with CSR dynamics

Dep. Vars.	(1) CSR	(2) CSR
<i>Post</i>	0.497*** (3.5)	0.077*** (8.0)
<i>LowPrc * Post</i>	-0.332** (-2.3)	
<i>Before</i> ⁻¹		0.115 (1.1)
<i>Current</i>		0.220* (1.7)
<i>After</i> ¹		0.476*** (3.2)
<i>After</i> ^{2 &3}		0.701*** (4.3)
<i>LowPrc × Before</i> ⁻¹		0.015 (0.1)
<i>LowPrc × Current</i>		-0.124 (-0.7)
<i>LowPrc × After</i> ¹		-0.416** (-2.3)
<i>LowPrc × After</i> ^{2 &3}		-0.510** (-2.4)
Observations	1728	1,728
Adj R-squared	0.862	0.858
Controls	Included	Included
Firm FE	Yes	Yes
Year FE	Yes	NA
Cluster	Firm	Firm

Panel C: Difference-in-Differences Regressions using PSM matched sample

Dep. Vars.	(1) CSR
<i>Before</i> ⁻¹	0.064 (0.651)
<i>Current</i>	0.295** (0.038)
<i>After</i> ¹	0.565*** (0.000)
<i>After</i> ^{2 &3}	0.925*** (0.000)
<i>Treat</i> × <i>Before</i> ⁻¹	0.043 (0.829)
<i>Treat</i> × <i>Current</i>	-0.207 (0.301)
<i>Treat</i> × <i>After</i> ¹	-0.362* (0.073)
<i>Treat</i> × <i>After</i> ^{2 &3}	-0.853*** (0.000)
Observations	673
Adj R-squared	0.118
Controls	Included
Firm FE	Yes
Cluster	Firm

Table 5: Tests on Possible Mechanisms

This table presents the results on the possible channels of how stock liquidity affects firm's CSR. In Panel A, we report the results regarding the effect of institutional ownership on the liquidity-CSR relation. *TRAIO* and *NONTRAIO* are transient institutional ownership and dedicated institutional ownership based on the Bushee (1998, 2001) classification. *STIO* and *LTIO* denote the short-term institutional ownership and long-term institutional ownership respectively based on Yan and Zhang (2009). In Panel B, we report the DiD tests using the propensity matched sample on how exogenous changes in stock liquidity due to decimalization affect ownership of different types of institutional investors. Ownership variables are measured as the average institutional ownership in the three-year window before or after decimalization. Panel C reports the results of interacting liquidity and managerial myopia proxies. *CEO_WPS* is the CEO wealth-performance-sensitivity measure. *CEO_AGE63* is a dummy variable equals to one if the CEO is 63 or older and zero otherwise. In Panel D, we split the sample based on absolute change of earnings per share (EPS). *Small Change* denotes firms with below median absolute change of EPS and *Large Change* denotes firms with above median absolute change of EPS. The control variables, firm fixed effect and year fixed effect are included in all the regressions. Standard errors are clustered by firm for all regressions and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: The Role of Institutional Investors

	(1)	(2)	(3)
	<i>CSR_{t+1}</i>	<i>CSR_{t+1}</i>	<i>CSR_{t+1}</i>
<i>LIQ</i>	-0.241*** (-3.0)	-0.211* (-1.9)	-0.148** (-2.3)
<i>LIQ x IO</i>	-0.148 (-1.1)		
<i>IO</i>	-0.652*** (-4.6)		
<i>LIQ x STIO</i>		-2.105*** (-3.6)	
<i>STIO</i>		-0.610*** (-3.3)	
<i>LIQ x LTIO</i>		0.564 (0.8)	
<i>LTIO</i>		-0.657*** (-2.8)	
<i>LIQ x TRATIO</i>			-0.504** (-2.0)
<i>TRATIO</i>			-0.300*** (-3.2)
<i>LIQ x NONTRAIO</i>			0.169 (0.8)
<i>NONTRAIO</i>			-0.321*** (-3.3)
Observations	21,783	21,783	21,783
Adj R-squared	0.718	0.716	0.718
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Cluster	Firm	Firm	Firm

Panel B: Institutional ownership change around 2001 Decimalization

	Treat – Control Difference (After)	Treat – Control Difference (Before)	Mean DiD Estimator (After – Before)	p-value for DiD Estimator
<i>STIO</i>	0.024* (1.9)	-0.017 (-1.3)	0.041** (2.2)	0.026**
<i>LTIO</i>	-0.000 (-0.1)	-0.004 (-0.6)	0.004 (0.4)	0.703
<i>TRAIO</i>	0.052*** (3.0)	-0.010 (-0.6)	0.062** (2.5)	0.013**
<i>NONTRAIO</i>	-0.015* (-1.9)	0.010 (1.1)	-0.025** (-2.1)	0.037**

Panel C: Degree of Managerial Myopia

	(1) <i>CSR_{t+1}</i>	(2) <i>CSR_{t+1}</i>	(3) <i>CSR_{t+1}</i>
<i>LIQ</i>	-0.249*** (-3.5)	-0.862*** (-2.6)	-0.206*** (-2.7)
<i>LIQ</i> × <i>CEO_AGE63</i>	-0.523* (-1.7)		
<i>CEO_AGE63</i>	-0.081 (-1.2)		
<i>LIQ</i> × <i>CEO_WPS</i>		-0.001* (-1.7)	
<i>CEO_WPS</i>		-0.000 (-0.8)	
<i>LIQ</i> × <i>Analyst</i>			-0.178* (-1.7)
<i>Analyst</i>			0.078** (2.1)
Observations	21,783	21,783	21,783
Adj R-squared	0.718	0.716	0.718
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Cluster	Firm	Firm	Firm

Panel D: Earnings pressure and the effect of *LIQ* on *CSR*

	(1)	(2)
	<i>CSR_{t+1}</i>	<i>CSR_{t+1}</i>
Absolute change of EPS	<i>Small Change (SC)</i>	<i>Large Change (LC)</i>
<i>LIQ</i>	-0.860*** (-2.8)	-0.195 (-1.1)
<i>Size</i>	0.316*** (2.6)	0.160* (1.7)
<i>Leverage</i>	0.116 (0.4)	0.419* (1.8)
<i>Cash</i>	0.339 (1.2)	0.458* (1.9)
<i>ROA</i>	0.343 (0.9)	-0.138 (-0.6)
<i>Market-to-book</i>	-0.021** (-2.0)	0.002 (0.2)
<i>Investment</i>	0.533 (0.8)	0.497 (1.0)
<i>Analyst</i>	0.169** (2.4)	0.112* (1.8)
<i>R&D Expense</i>	0.121 (0.2)	0.029 (0.1)
Observations	8,407	8,130
Adj R-squared	0.720	0.733
Firm FE	Yes	Yes
Year FE	Yes	Yes
Cluster	Firm	Firm

Table 6: Additional Channel Tests

This table reports the regression results based on three subsamples partitioned on litigation risk measure, information asymmetry measure, and entrenchment index, respectively. The sample consists of firm-years jointly covered in the merged Compustat/CRSP database, TAQ, and the KLD database between 1995 and 2013. *High Litigation Risk* is the group of firms which are in litigious industries such as Chemicals, Industrial and Commercial Machinery, Electronic and other Electrical Equipment, Retail Trade while *Low Litigation Risk* indicates firms otherwise. *High Info. Asymmetry* means firms with below median number of analyst following and *Low Info. Asymmetry* means firms with above median number of analyst following. *High E-index* indicates firms with above median Entrenchment index and *Low E-index* denote firms with below median Entrenchment index. Firm fixed effect and year fixed effects are included in all regressions. Standard errors are clustered at the firm level and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	(1) <i>CSR_{t+1}</i>	(2) <i>CSR_{t+1}</i>	(3) <i>CSR_{t+1}</i>
<i>LIQ</i>	-0.324*** (-3.2)	-0.589*** (-3.9)	-1.281*** (-3.4)
<i>LIQ × High Litigation Risk</i>	0.181 (1.3)		
<i>High Litigation Risk</i>	-0.264 (-1.2)		
<i>LIQ × High Info. Asymmetry</i>		0.396** (2.6)	
<i>High Info. Asymmetry</i>		0.576*** (6.0)	
<i>LIQ × High E-index</i>			-0.606 (-1.3)
<i>High E-index</i>			-0.167* (-1.8)
Observations	21,783	21,783	8,133
Adj R-squared	0.716	0.718	0.828
Controls	Included	Included	Included
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Cluster	Firm	Firm	Firm

Table 7: Stock Liquidity and Corporate Social Responsibility: Sub-index Regressions

This table presents the regression results using the strength score for each of the six dimensions in KLD as the dependent variable. The sample consists of firm-years jointly covered in the merged Compustat/CRSP database, TAQ, and the KLD database between 1995 and 2013. Firm fixed effect and year fixed effect are included in all the regressions. Standard errors are clustered by firm for all regressions and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Product	Diversity	Human rights	Employee relations	Environment	Community
<i>LIQ</i>	-0.025** (-2.0)	0.003 (0.1)	-0.014*** (-3.3)	-0.049*** (-2.7)	-0.044*** (-2.6)	-0.044** (-2.1)
<i>Size</i>	0.018 (1.5)	0.055** (2.3)	0.015** (2.2)	0.064*** (3.5)	0.005 (0.3)	0.012 (0.5)
<i>Leverage</i>	-0.006 (-0.2)	0.079 (1.3)	-0.048*** (-2.9)	-0.036 (-0.9)	0.086** (2.3)	0.044 (0.9)
<i>Cash</i>	0.007 (0.3)	0.215*** (3.4)	0.005 (0.6)	0.022 (0.5)	0.001 (0.0)	0.041 (1.0)
<i>ROA</i>	-0.004 (-0.2)	0.066 (1.0)	-0.015 (-1.5)	0.003 (0.1)	-0.071** (-2.1)	-0.061 (-1.1)
<i>Market-to-book</i>	0.001 (0.8)	-0.004* (-1.7)	0.000 (0.1)	-0.001 (-0.7)	-0.002* (-1.8)	-0.004* (-1.8)
<i>Investment</i>	-0.071 (-1.2)	0.124 (1.0)	0.063* (1.7)	0.205* (1.9)	-0.125 (-1.6)	0.157 (1.3)
<i>Analyst</i>	-0.001 (-0.2)	0.046*** (2.6)	-0.000 (-0.0)	0.026** (2.5)	0.022** (2.4)	0.026 (1.6)
<i>R&D Expense</i>	-0.011 (-0.2)	0.156 (1.1)	0.020 (1.0)	0.078 (0.8)	-0.028 (-0.4)	0.022 (0.2)
Observations	19,972	21,617	19,793	21,722	21,743	16,824
Adj R-squared	0.499	0.643	0.225	0.587	0.454	0.630
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm	Firm	Firm

Table 8: Stock Liquidity and Corporate Social Responsibility: Pollution Prevention

This table presents the results of the effects of liquidity on firm's pollution prevention activity. *Prevention* is the log-transformed amount of waste reduced by pollution prevention activities and scaled by total assets. Industry fixed effect and year fixed effect are included in the regression. Standard errors are clustered by firm for all regressions and *t*-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	(1) <i>Prevention</i> _{<i>t</i>+1}
<i>LIQ</i>	-1.086** (-2.4)
<i>Size</i>	0.022 (0.3)
<i>Leverage</i>	0.789 (1.4)
<i>Cash</i>	0.112 (0.1)
<i>ROA</i>	0.154 (0.2)
<i>Market-to-book</i>	-0.041* (-1.7)
<i>Investment</i>	4.297*** (5.0)
<i>Analyst</i>	0.008 (0.1)
<i>R&D Expense</i>	-4.849* (-1.9)
Observations	5,188
Adjusted R-squared	0.270
Industry FE	Yes
Year FE	Yes
Cluster	Firm

Appendix A

Table A1: Variable Definitions

Variable	Definition
<i>CSR</i>	The total score of the strength rating of six dimensions in KLD database, including community, diversity, employee relations, environment, human rights, and product quality.
<i>CSR_Con</i>	The total score of the concern rating of six dimensions in KLD database, including community, diversity, employee relations, environment, human rights, and product quality.
<i>CSR_NET</i>	Net KLD index by subtracting the concerns from the strengths.
<i>CSR7</i>	The CSR scores plus the strength score of corporate governance.
<i>CSR_ADJ</i>	Adjusted CSR scores following Deng, Kang, and Low (2013).
<i>LIQ</i>	Annual relative effective spread multiplied by -100 so that higher values of LIQ implies higher stock liquidity. The relative effective spread is the ratio of the absolute value of the difference between the trade price and the midpoint of the bid-ask quote over the trade price. The annual relative effective spread is computed as the arithmetic mean of the daily relative effective spread.
<i>Amihud ILLIQ</i>	Amihud (2002) price impact measure, which captures the stock price changes per \$ millions of trading volume.
<i>ZERO</i>	The percentage of trading days with zero returns in the fiscal year, following Lesmond (2005).
<i>Quoted spread</i>	The average value of daily quoted bid-ask spread in the fiscal year, multiplied by negative one. Daily quoted bid-ask spread is the difference between daily ask price and daily bid price scaled by the midpoint of bid and ask price with data from CRSP.
<i>Size</i>	Natural logarithm of total assets
<i>Leverage</i>	Ratio of total liability over total assets
<i>Cash</i>	Cash ratio
<i>ROA</i>	Return on assets
<i>Market-to-book</i>	Ratio of the market value of equity over the book value of equity
<i>Investment</i>	Capital expenditure
<i>Analyst</i>	Analyst coverage is calculated as the natural logarithm of (1+ number of analysts following), where the number of analyst following is defined as the number of analysts who have issued at least one earnings forecast for the firm in the fiscal year.
<i>R&D Expenses</i>	Research and development expenses scaled by total assets
<i>LTIO</i>	The percentage of shares held by long-term institutional investor, which is defined following Yan and Zhang (2009).
<i>STIO</i>	The percentage of shares held by short-term institutional investor, which is defined following Yan and Zhang (2009).
<i>TRAIO</i>	The percentage of shares held by transient institutional investor and quasi-indexers institutional investor defined using Bushee's (1998) classification.
<i>NONTRAIO</i>	The percentage of shares held by dedicated institutional investor defined using Bushee's (1998) classification.

<i>CEO_WPS</i>	The CEO wealth-performance-sensitivity measure by Edmans (2009). It is the dollar change in CEO wealth for a 100-percentage point change in firm value, divided by annual flow compensation.
<i>CEO_AGE63</i>	A dummy variable that equals to one if the CEO's age is equal or older than 63, and zero otherwise.
<i>High Litigation Risk</i>	A dummy variable equals to one if the firm is in litigious industry whose industry code falls within 2833 to 2836, 3570 to 3577, 3600 to 3674, 5200 to 5961, and 7370.
<i>High Info. Asymmetry</i>	A dummy variable equals to one if the number of analysts following the firm is below sample median.
<i>High E-index</i>	A dummy variable equals to one if the E-index of firm is above sample median.
<i>Prevention</i>	Log-transformed amount of waste reduced by pollution prevention activities and scaled by total assets

Table A2: Sample Distribution

This table presents the sample distribution by year. The sample consists of firm-years jointly covered in the merged Compustat/CRSP database, TAQ, and the KLD database between 1995 and 2013.

Year	N	Percentage
1995	288	1.32
1996	289	1.33
1997	289	1.33
1998	297	1.36
1999	274	1.26
2000	277	1.27
2001	470	2.16
2002	533	2.45
2003	1,366	6.27
2004	1,360	6.24
2005	1,924	8.83
2006	1,924	8.83
2007	1,915	8.79
2008	1,899	8.72
2009	1,825	8.38
2010	1,931	8.86
2011	1,875	8.61
2012	1,894	8.69
2013	1,153	5.29
Total	21,783	100.00

Appendix B: Propensity score matching regressions and diagnostics for 2001 decimalization

This table presents the propensity score matching regressions results for difference-in-differences analysis of stock liquidity on CSR surrounding the decimalization year. Panel A, column 1 reports the results of a probit model based on the pre-matched firms in the treatment and control groups. The dependent variable equals to one if the firm belongs to the treatment group and zero otherwise. The explanatory variables are the same control variables used in the baseline regressions measured in the pre-decimalization year, together with industry fixed effect. Column 2 presents the results of the same probit model based on the post-matched firms. Panel B shows the average variable values in the pre-decimalization year for treatment and control groups, the differences in means of each variable and corresponding p-value. Standard errors are clustered by firm. P-values are shown in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Probit regressions with pre- and post-matched sample

	Pre-match (1)	Post-match (2)
<i>LIQ</i>	0.734* (0.095)	0.060 (0.925)
<i>Size</i>	-0.549*** (0.000)	-0.195 (0.198)
<i>Leverage</i>	2.029** (0.018)	0.319 (0.753)
<i>Cash</i>	-3.820** (0.034)	-1.437 (0.482)
<i>ROA</i>	1.134 (0.519)	-0.081 (0.970)
<i>Market-to-book</i>	-0.160** (0.026)	-0.030 (0.724)
<i>Investment</i>	0.922 (0.212)	-0.031 (0.971)
<i>Constant</i>	4.283*** (0.000)	1.866 (0.195)
Industry fixed effects	Yes	Yes
Observations	174	104
Pseudo R-squared	0.325	0.055

Panel B: Differences in variables in pre-decimalization year

	Treatment group	Control group	Difference	p-statistics
<i>LIQ</i>	-0.337	-0.212	-0.125	0.113
<i>Size</i>	7.677	8.216	-0.538	0.162
<i>Leverage</i>	0.516	0.519	-0.003	0.935
<i>Cash</i>	0.064	0.074	-0.010	0.508
<i>ROA</i>	0.159	0.160	-0.001	0.963
<i>Market-to-book</i>	2.799	3.046	-0.247	0.591
<i>Investment</i>	0.278	0.284	-0.006	0.869

Chapter 2: Stock Liquidity and Accounting Conservatism

Abstract

We examine how stock liquidity affects firms' timeliness of loss recognition in financial reporting, namely, conditional accounting conservatism. Using both the 1997 liquidity shock and the 2001 decimalization as exogenous shocks to stock liquidity, we establish a negative causal effect of stock liquidity on accounting conservatism. Our results are robust to alternative measures of conservatism and various definitions of stock liquidity. The negative effect is more pronounced for firms with higher long-term institutional ownership, firms with stronger presence of blockholders and activists, firms with bank debt, and firms with higher CEO ownership. These findings suggest a substitution effect of stock liquidity on accounting conservatism. Namely, higher liquidity improves governance through facilitating threat of intervention and threat of exit for shareholders, and thus shareholders rely less on accounting conservatism as a governance mechanism.

JEL Classification: G12, G14, M41, G34, D82

Keywords: Stock Liquidity; Conservatism; Corporate Governance; Timeliness of Loss Recognition

1. Introduction

Conservative accounting policy requires a timelier manner of recognizing bad news as loss than good news as gain (Basu, 1997; Watt, 2003; Khan and Watts, 2009). Accounting conservatism has been shown to facilitate the efficiency of implementing contracts between shareholders and managers by mitigating the agency conflicts between them (Watts, 2003; Ball and Shivakumar, 2005; Chen, Hemmer, and Zhang, 2007). Prior studies document various factors that affect contracting demand for conservative accounting such as board of director characteristics (Ahmed and Duellman, 2007), managerial overconfidence (Ahmed and Duellman, 2013), managerial ownership (LaFond and Roychowdhury, 2008), institutional ownership (Ramalingegowda and Yu, 2012), and takeover threat (Jayaraman and Shivakumar, 2013).

In particular, LaFond and Watts (2008) document that information asymmetry between firm insiders and outside equity investors raises the demand for accounting conservatism. They use bid-ask spread as an alternative proxy of information asymmetry and show that stocks with low information asymmetry are associated with low accounting conservatism.¹ Nevertheless, stock liquidity is not merely a proxy of information asymmetry. It has a number of important implications that might affect accounting conservatism directly. In this study, we examine how stock liquidity, an important stock market characteristic, affects a firm's level of accounting conservatism through any non-information related channel.

The differential verifiability between bad news and good news provides prompt information about economic losses of negative Net Present Value (NPV) projects and thus shareholders have an early warning signal to take further protective actions towards their investments. This mechanism constrains managers' investment decision making and enhances the efficiency of firms' investment (Francis and Martin, 2010; Ahmed and Duellman, 2013; Garcia Lara, Garcia

¹ Khan and Watts (2009) document similar findings.

Osama, and Penalva, 2016). Further, the stricter variability of recognizing good news as gain defers managers' unverifiable compensation (Watts, 2003). It also helps achieve a more efficient economic equilibrium outcome by reducing the impact of news on share price, which shrinks managers' incentives of earnings management (Chen, Hemmer, and Zhang, 2007).

Our study is motivated by recent studies that document the governance and short-termism effects of stock liquidity. Recent studies (Maug, 1998; Edmans, 2009; Admati and Pfleiderer, 2009; Edmans and Manso, 2011) document that stock liquidity enhances corporate governance through blockholders' "threat of intervention" and "threat of exit". Maug (1998) demonstrates that stock liquidity enhances the ability of blockholders to purchase additional shares and benefit from price appreciation caused by their monitoring activities. High stock liquidity facilitates blockholders to overcome the free rider problem and increases their incentives to govern through intervention. Furthermore, Edmans (2009), Admati and Pfleiderer (2009), and Edmans and Manso (2011) suggest that blockholders can also discipline management by selling their shares, putting downward pressure on share prices, and reducing management equity compensation. Thus, the threat of exit by blockholders can also be an effective governance mechanism. With the improved corporate governance through "threat of intervention" and "threat of exit", the need for accounting conservatism as a governance mechanism is reduced. As a result, the *governance hypothesis* predicts a negative relation between stock liquidity and accounting conservatism.

In addition, stock liquidity reduces trading costs and thus attracts transient institutional investors who focus exclusively on short-term trading profits (Fang, Tian, and Tice, 2014; Chang, Chen, and Zolotoy, 2017). Since these investors favor firms with greater short-term earnings (Bushee, 1998, 2001), managers face the pressure to manipulate earnings to boost short-term stock performance (Matsumoto, 2002; Burns, Kedia, and Lipson, 2010; Chang, Chen, and

Zolotoy, 2017). Managers may have more incentives to accelerate the recognition of good news and delay the disclosure of bad news when stock liquidity is high, which results in lower accounting conservatism. Therefore, the *short-termism hypothesis* also predicts that stock liquidity is negatively related to accounting conservatism.

Nevertheless, Coffee (1991) and Bhidé (1993) argue that liquidity enables shareholders to sell stocks of troubled firms and thus weakens their incentive to intervene in firms' management. High stock liquidity also attracts transient institutional investors to the firm who are less likely to monitor firm management (Bushee, 1998, 2011). Therefore, it is also likely that high stock liquidity raises the demand for accounting conservatism through weakening corporate governance. Thus, the *run-away hypothesis* predicts that stock liquidity is positively related to accounting conservatism.

Overall, it is not clear whether stock liquidity affects accounting conservatism directly through its governance or short-termism effects on firm management. It is also not clear whether these effects result in a positive or a negative relation between stock liquidity and accounting conservatism. We examine these questions empirically in this study.

Using a large sample of U.S. firms during the period of 1994 to 2013, we show that higher stock liquidity is associated with a lower level of accounting conservatism. The results hold for a bunch of robustness checks. While this finding is consistent with both the governance and the short-termism hypotheses, it is also in line with prior studies that examines the relation between information asymmetry (measured by bid-ask spread, which is also a proxy for stock liquidity) and accounting conservatism (LaFond and Watts, 2008; Khan and Watts, 2009). To investigate the direct effect of stock liquidity on accounting conservatism and establish causality, we utilize the 2001 decimalization and the 1997 liquidity shock as exogenous shocks to stock liquidity. The

results show that accounting conservatism decreases around these two events due to an exogenous increase in stock liquidity. Since the changes in stock liquidity around decimalization are not caused by the changes in information asymmetry, we argue that the effect of stock liquidity on accounting conservatism is not merely through its relationship with information asymmetry. The tests also suggest a causal effect of stock liquidity on accounting conservatism.

Stock liquidity may improve corporate governance through “threat of intervention” or “threat of exit”, or induce managerial short-termism, both of which can result in a negative relation between stock liquidity and accounting conservatism. Thus, we further examine the channel through which stock liquidity affects accounting conservatism. We begin by distinguishing the governance channel from the short-termism channel. If the negative liquidity-conservatism relation is driven by higher liquidity attracting short-term investors thus pressuring managers into short-term focus, we should observe the liquidity effect to be stronger in firms with higher short-term institutional ownership. However, we find no evidence supporting this channel. Instead, we find that the negative effect of stock liquidity is actually more pronounced in firms with higher long-term institutional ownership, which supports the governance story that improved governance through liquidity reduces the demand for conservative accounting as a governance device. To further substantiate the governance channel, we find stronger negative liquidity effect on accounting conservatism in firms with greater presence of blockholders and activist institutional investors who are more likely to exert governance through “threat of intervention” and “threat of exit”. The results suggest high stock liquidity weakens the governance needs for accounting conservatism. We also show that this substitution effect is stronger when other governance mechanisms are stronger (measured by the presence of bank lenders) and when governance via liquidity is more effective (measured by the CEO ownership

and the pay-for-performance-sensitivity). Taken together, our findings support the argument that stock liquidity lowers companies' needs for conservative accounting by improving governance.

Our study makes several contributions to the stock liquidity and accounting conservatism literature. First, we contribute to the rapidly growing stream of research examining the effects of stock liquidity on corporate governance (e.g., Maug, 1998; Edmans, 2009; Admati and Pfleiderer, 2009; Edmans and Manso, 2011). In particular, we provide further evidence that stock liquidity enhances corporate governance through blockholder "threat of intervention" and "threat of exit", which reduces the demand for accounting conservatism.

Second, our study is related to recent research that examines the relation between stock liquidity and corporate disclosure. Prior studies in this stream of research use stock liquidity as a proxy for information asymmetry (e.g., LaFond and Watts, 2008; Khan and Watts, 2009) or a channel through which information quality affects firm valuation (Lang and Maffett, 2011; Ng, 2011; Bhattacharya, Desai, and Venkataraman, 2013). Little is known, however, about whether stock liquidity itself impacts corporate disclosure. Our study fills the gap by showing the direct effect of stock liquidity on accounting conservatism, which is an important aspect of corporate disclosure policies.

Third, our study adds to the literature on contracting explanation for accounting conservatism. Previous studies in this line of literature mainly focus on the role of manager and shareholder characteristics. Our paper is different from these studies in that we document the impact of stock liquidity as one of the important stock market characteristics on accounting conservatism. Thus, our analysis offers new insights into firms' decision to adopt conservative reporting. Furthermore, we show that liquidity serves as a substitute for firms' conservative accounting in mitigating agency problems between shareholders and managers, which highlights

an interface between the governance roles of capital market and accounting. Therefore, our findings complement prior literature on the governance role of accounting in mitigating the shareholder-manager conflict.²

The rest of the paper is organized as follows. Section 2 reviews relevant literature and develops the hypotheses. Section 3 discusses the data, sample, and variable constructions. Section 4 presents the main results for the relation between stock liquidity and accounting conservatism, and the results for robustness checks. In section 5, we probe the channel through which stock liquidity impacts accounting conservatism. Section 6 concludes.

2. Related Literature and Hypothesis Development

2.1. A brief literature review on accounting conservatism

Existing finance and accounting literature has paid extensive attention to agency conflicts among managers, shareholders, and debtholders in publicly held corporations, which arise from diverse welfare exposure to capital allocation and distribution.³ Contracts between these parties, such as management compensation contracts and debt contracts, are efficient tools to balance the benefits and align the interests of various parties that are trying to maximize their own wealth. Meanwhile, the efficiency of implementing contracts between different parties depends to a great extent on the reliability of accounting information from financial statements. This generates the demand for appropriate accounting measures of performance and net asset values (Watts, 2003). One mechanism to meet the contractual demand for accounting information is conditional

² See Ball (2001), Francis and Martin (2010), Ahmed and Duellman (2007), Chen, Hemmer, and Zhang (2007), Khan and Watts (2009), and Garcia Lara, Garcia Osma, and Penalva (2016) among others.

³ The conflicts between managers and shareholders resulting from the separation of ownership and control have been discussed extensively in Berle and Means (1932), Jensen and Meckling (1976) and Demsetz, (1983). Bodie and Taggart (1978) and Nash, Netter, and Poulsen (2003) have discussed the agency problems related to the welfare of debtholders.

accounting conservatism, defined as the stricter standard of verification for recognizing good news as gains than for recognizing bad news as losses (Basu, 1997; Watts, 2003).

An essential demand for accounting conservatism originates from the agency problem between managers and shareholders. Because of their limited tenure and liability, managers have the incentive to take or retain negative NPV projects if these projects benefit their own interests (Ball, 2001; Watts, 2003). The adoption of conservative accounting mitigates managerial opportunism by recognizing economic losses from negative NPV projects in a timelier manner. Since the recognition of losses is more likely to happen during the managers' tenure, their incentive to undertake such projects is reduced *ex ante* (Ball and Shivakumar, 2005). In addition, Watts (2003) argues that conservative accounting provides an early warning signal to shareholders, and thus enables them to limit economic losses by abandoning negative NPV projects.

A group of recent empirical studies provides supporting evidence that accounting conservatism constrains managerial self-dealing in making investment decisions. Francis and Martin (2010) document that firms with higher accounting conservatism make more profitable acquisitions. The positive relation between accounting conservatism and acquisition profitability is more pronounced for firms with higher *ex ante* agency costs. Garcia Lara, Garcia Osama, and Penalva (2016) argue that accounting conservatism decreases investment in settings where managers are likely to over-invest through improving the monitoring process over managerial investment decisions and increases investment in settings where managers are likely to under-invest through facilitating the access to external financing at a lower cost. Ahmed and Duellman (2011) show that firms with more conservative accounting have better investment decisions in terms of higher future profitability and lower likelihood of future special items charges.

Furthermore, Watts (2003) states that the asymmetric verification standard immediately penalizes managers' value-reducing activities while defers their currently unverifiable rewards until the benefits are realized. This counters managers' incentive to overstate firm assets or earnings, which are closely tied to their compensation package. Similarly, Chen, Hemmer, and Zhang (2007) develop a theoretical model that considers both accounting conservatism and accounting manipulation. The model illustrates that conservative accounting helps achieve a more efficient economic equilibrium outcome by reducing the impact of news on share prices, and thus shrinks managers' incentives of earnings management.

2.2. Hypothesis development

Our study is motivated by recent studies that document the governance and short-termism effects of stock liquidity. Maug (1998) demonstrates that stock liquidity enhances the ability of blockholders to purchase additional shares and benefit from price appreciation caused by their monitoring activities. Thus, a liquid market facilitates blockholders to overcome the free rider problem and increases their incentives to govern through intervention (also known as "voice"). The models developed by Faure-Grimaud and Gromb (2004) and Collin-Dufresne and Fos (2014) offer similar predictions. In support of the argument, Norli, Ostergaard, and Schindele (2015) document that blockholders are more likely to take actions in response to poor firm performance when a firm's stock is liquid. Chen et al. (2017) show that firms with higher stock liquidity engage less in extreme tax avoidance. The effect is amplified when a firm has a high proportion of activist shareholders and when the stock price is less informative, suggesting that stock liquidity enhances shareholder monitoring on tax avoidance activities.

In addition, Edmans (2009), Admati and Pfleiderer (2009), and Edmans and Manso (2011) highlight that blockholders can also govern by trading (also known as “exit”). If management compensation is tied to stock prices, blockholders can discipline management by selling their shares, putting downward pressure on share prices, and reducing management equity compensation. Thus, even without direct intervention, the threat of exit by blockholders can be an effective governance mechanism.⁴ By facilitating the ability of blockholders to sell shares without incurring large transaction costs, stock liquidity increases the credibility of the threat of exit and, consequently, supports the governance mechanism through trading. Bharath, Jayaraman, and Nagar (2013) provide empirical support for the “threat of exit” models by showing that exogenous shocks to stock liquidity have a stronger effect on the value of firms with larger blockholdings, particularly if managers’ wealth is sensitive to stock price. Edmans, Fang, and Zur (2013) show that liquidity encourages blocks to form in the first place, and conditional upon block formation, blockholders are more likely to govern through “exit” rather than “voice”. Dou et al. (2016) find that blockholders “influence” (rather than “select”) firms’ accounting practices, which is consistent with the monitoring role of blockholders suggested by Edmans (2009) and Edmans and Manso (2011).

One of the primary purposes of accounting conservatism is to meet the contractual demand for accounting information, which mitigates the agency problem between shareholders and managers. Since stock liquidity improves corporate governance through “threat of intervention” and “threat of exit”, the agency problem between shareholders and managers is less severe when stock liquidity is high, which results in a lower demand of accounting conservatism. Therefore,

⁴ For more discussion on governance through trading, see, among others, Parrino, Sias, and Starks (2003), Chen, Harford, and Li (2007), Gallagher, Gardner, and Swan (2013), and McCahery, Sautner, and Starks (2016).

we expect a negative impact of stock liquidity on accounting conservatism through the *governance* channel.

Furthermore, extant literature (e.g., Porter, 1992; Fang, Tian, and Tice, 2014; Chang, Chen, and Zolotoy, 2017) documents that high stock liquidity attracts transient institutional investors (i.e., institutional investors with short investment horizon and high portfolio turnover) because of the low trading costs. Porter (1992) states that transient institutional investors focus exclusively on short-term trading profits and exit in response to low reported earnings. Bushee (1998, 2001) shows that transient institutional investors favor firms with greater short-term earnings, pressuring managers to focus on short-term performance rather than long-term firm value. Consistent with this view, prior studies show that the presence of transient institutional investors encourages earnings management practices. For example, Matsumoto (2002) shows that firms with higher transient institutional ownership are more likely to manage earnings to avoid negative earnings surprise. Burns, Kedia, and Lipson (2010) document that transient institutional ownership is positively associated with both the likelihood and the severity of earnings restatements, concluding that firms attempt to mask bad performance by aggressively managing their earnings to prevent transient investors from leaving the firm. Chang, Chen, and Zolotoy (2017) find that high stock liquidity induces managers to withhold bad news, fearing that its disclosure may lead to selling by transient investors, which results in greater future stock price crash risk.

Since stock liquidity facilitates the trading of transient institutional investors, managers face greater pressure for short-term performance when stock liquidity is higher. The excessive focus on short-term performance creates incentives for managers to accelerate the disclosure of good news and delay the disclosure of bad news, which results in low accounting conservatism.

Therefore, stock liquidity can also reduce accounting conservatism through the managerial *short-termism* channel.

Nevertheless, Coffee (1991) argues that stock liquidity enables shareholders to sell stocks of troubled firms and thus weakens their incentive to intervene in firm management. Bhide (1993, p. 31) further states that “...stock liquidity discourages internal monitoring by reducing the costs of ‘exit’ of unhappy stockholders.” In addition, high stock liquidity attracts transient institutional investors to the firm. Since transient investors act more as “traders” rather than “owners”, their existence also weakens shareholder monitoring (Bushee, 1998, 2011). Therefore, it is also possible that high stock liquidity increases accounting conservatism through weakening corporate governance and thus increasing the demand for accounting conservatism.

3. Data, sample, and variables

3.1. Data and sample

We obtain stock liquidity data from the Trade and Quote database (TAQ). We get accounting information from the Compustat, stock price and return data from the Center for Research in Security Prices (CRSP), analyst coverage data from Institutional Brokers Estimates Systems (I/B/E/S), managerial compensation data from Compustat Executive Compensation (Execucomp). Institutional holdings data are from Thomson Reuter’s Institutional Holdings database. Institutional investor classification data are from Brian Bushee’s website.⁵

Our sample includes firm-year observations jointly covered by Compustat, CRSP, and TAQ. We delete firm years with missing data for any of the variables used in our baseline regressions, negative total assets or book value of equity, and price per share less than \$1 (e.g. Khan and Watts, 2009). We also remove firms in financial services industry (SIC codes 6000-6999) and

⁵ <http://acct.wharton.upenn.edu/faculty/bushee/Iclass.html>

utility industry (SIC codes 4900-4999) as they are subject to regulatory constraints that may affect their reporting. In total, we have 60,522 firm-year observations spanning from 1994 to 2013 because we are constrained by the availability of liquidity measure and we use lagged liquidity measure.

3.2. *Measuring accounting conservatism*

We focus on conditional conservatism in our study as we intend to capture the asymmetric verification standards for recognizing gains versus loss. Conditional conservatism imposes stronger verification requirements for the recognition of economic gains than for the recognition of economic losses, generating earnings that reflect bad news in a timelier fashion than good news. It is directly related to the short-termism view of stock liquidity where high stock liquidity can induce managerial myopia and put pressure on managers to deliver short-term performance. Such pressure may discourage managers to impose stronger verification requirements for gains. Ball and Shivakumar (2005) argue only conditional conservatism has a clear governance role and stock liquidity also have a governance role, which makes us focus on conditional conservatism.

Following Khan and Watts (2009), we construct *C_Score* as our baseline measure of accounting conservatism because it provides a firm-year estimate, it is easy to facilitate channel tests and interpretations, and is commonly used in the literature (e.g. Ahmed and Duellman, 2013; Kim and Zhang, 2016; Goh et al., 2017). Khan and Watts (2009) show that *C_Score* captures the variation in conservatism and reflects changes of conservatism in a timely fashion. A higher value of *C_Score* indicates a greater degree of conditional conservatism.⁶ However, *C_Score*

⁶ There are two broad forms of accounting conservatism in the literature: conditional conservatism and unconditional conservatism. The major distinction between the two forms of conservatism is that conditional conservatism depends on economic news events. It occurs when negative news is recognized in earnings in a timelier manner than positive economic news. We focus on the conditional conservatism in this paper because Qiang

may be subject to potential measurement errors. As robustness checks, we consider several alternative conservatism models and measures to mitigate the concern that our results are driven by measurement errors. We discuss these additional conservatism models and describe the results in Section 4.3.

3.3. *Measuring stock liquidity*

Our primary measure of liquidity is the relative effective spread calculated using the intraday TAQ data. It is generally perceived to be one of the best liquidity measures (e.g., Fang, Noe, and Tice, 2009; Fang, Tian, and Tice, 2014). Given that it is constructed based on the realized high-frequency trading data, the effective spread is often used as a benchmark to assess the performance of other liquidity measures calculated using low-frequency price and volume data (e.g., Hasbrouck, 2009, Goyenko, Holden, and Trzcinka, 2009).

The relative effective spread is defined as the difference between the execution price and the midpoint of the prevailing bid-ask quote (the effective spread) divided by the midpoint of the prevailing bid-ask quote. Daily relative effective spread for a given stock is computed as the trade-weighted average of the relative effective spreads of all trades for a given stock during the day, as per TAQ. The annual relative effective spread is calculated by taking the arithmetic mean of the daily spreads over the firm's fiscal year. Due to the nonnormality of relative effective spreads, we take the natural logarithm of the annual relative effective spread. Since a higher value of relative effective spread indicates lower stock liquidity, we define stock liquidity (*LIQ*)

(2007) finds that conditional conservatism arises in firms where contracting costs are high and liquidity mainly affects the contracting environment of the firms. Nevertheless, we also examine the effect of stock liquidity on unconditional conservatism and present the results in Section 4.4. The results are consistent with the liquidity effect on conditional conservatism.

as the natural logarithm of the annual relative effective spread multiplied by minus one to facilitate interpretations. Higher values of *LIQ* implies higher stock liquidity.

Besides, we use a number of alternative stock liquidity measures such as Amihud (2002) price impact measure, stock turnover, and trading volume, to mitigate the concerns of potential measurement errors. More details can be found in Section 4.4.

3.4. Control variables

Khan and Watts (2009) suggest when using *C_Score* as a dependent variable, the inputs variables market-to-book ratio (*MBE*), firm size (*SIZE*) and leverage (*TDB*) need to be controlled, otherwise, we may find a spurious relation between conservatism and liquidity. In addition, *MBE*, which captures firms' investment and growth opportunities (Smith and Watts, 1992), is found to be related to conservatism (e.g. Roychowdhury and Watts, 2007). *SIZE* is documented to have a positive association with conservatism (Givoly, Hayn, and Natarajan, 2007). *TDB* is shown to be positively related to conservatism (Ahmed et al., 2002). We also control for R&D and advertising expenses scaled by total assets (*RDAD*) as this is GAAP-mandated conservatism and could affect measures of conservatism utilizing accruals. Cash flow from operations (*CFO*) is included to control for firm profitability. We control for operating uncertainty using the standard deviation of revenue (*SdRev*) as greater operating uncertainty may increase conflicts between shareholder and bondholders and may lead to more conservative accounting (Ahmed et al., 2002). We also control for sales growth (*SaleGrowth*) as it may affect accruals such as inventory and accounts receivable. We control for information asymmetry using analyst coverage (*AnalystCov*) since information asymmetry is shown to be a determinant of conservatism (LaFond and Watts,

2008). Besides, we also include firm fixed effects to control for the impact of time-invariant firm characteristics.

3.5. Descriptive statistics

Table 1 presents the summary statistics and the correlation matrix of the main variables. We report the summary statistics in Panel A, which shows the mean, 10th percentile, 25th percentile, median, 75th percentile, 90th percentile, and the standard deviation, of the entire sample. An average firm in our sample has a *C_Score* of 0.101 and a standard deviation of 0.145, which is similar to that in Khan and Watts (2009). Liquidity, measured by minus one times the natural logarithm of relative effective spread (*LIQ*), has a mean of 5.817 and a standard deviation of 1.302, which is also comparable with prior literature (e.g. Fang, Noe, and Tice, 2009). Other firm characteristics look relatively standard and generally consistent with the prior literature (e.g. Fang, Noe, and Tice, 2009; Ahmed and Duellman, 2013). In Panel B, we report the correlation matrix. There is a statistically significant negative correlation between *C_Score* and *LIQ* at the 5% level. *C_Score* is also negatively correlated with firm size (*SIZE*), cash flow from operations (*CFO*), and analyst coverage (*AnalystCov*) and positively correlated with leverage ratio (*TDB*), market to book ratio (*MBE*), and standard deviation of revenues (*SdRev*), which are largely consistent with prior literature (e.g. Khan and Watts, 2009; Ahmed and Duellman, 2013).

[Insert Table 1 about here]

4. Main findings

To investigate the relation between liquidity and conservatism, we begin with simple distributions of conservatism measure across size and liquidity groups. All our liquidity

measures show a negative relation between liquidity and conservatism. We then conduct a multivariate analysis perform robustness checks with alternative models of conservatism and different measures of liquidity. Finally, we address the endogeneity concern by using two positive shocks to liquidity to identify a causal link.

4.1. Univariate analysis

We form portfolios by double-sorting firms using their firm size and level of liquidity. Since liquidity is highly correlated with firm size, we first sort the firms according to firm size and then assign firms into quantiles sorted by liquidity within each size group. We first divide the sample according to firm size (*SIZE*) because both conservatism (*C_Score*) and liquidity (*LIQ*) are highly correlated with firm size. In each year t , a firm is first classified as large (small) firm if the firm's *SIZE* measure is above (below) the median value. Then, within each size group, firms are further assigned into one of the five groups based on their liquidity measures. We compute the portfolio *C_Score* in year $t+1$ by taking the average of the *C_Score* across all firms in the group. Table 2 reports the mean values of *C_Score* across size and liquidity sorted portfolios.

C_Score declines monotonically with stock liquidity, for both large and small firms. Firms in more liquid groups have lower conservatism. The results hold for all five measures of stock liquidity and are economically large. The bottom rows of Panels A and B show the average difference in *C_Score* between the most and least liquid firms and the corresponding p -values. The differences are all statistically significant at the 1% level. Economically, the difference in the average *C_Score* between the least liquid group (*LIQ*) and the most liquid group is large (-0.179), where the magnitude is similar to the interquartile range of *C_Score* in our sample. The results show a negative relation between stock liquidity and accounting conservatism at the

univariate level. Although interesting, these unconditional relations require more refined multivariate tests, which we turn to next.

[Insert Table 2 about here]

4.2. The baseline model

We extend the analysis to a multivariate setting by controlling for other firm characteristics that could potentially affect conservatism. The baseline specification is defined as follows in Eq. (1):

$$C_Score_{i,t} = \beta_0 + \beta_1 LIQ_{i,t-1} + \beta_2 SIZE_{i,t-1} + \beta_3 MBE_{i,t-1} + \beta_4 TDB_{i,t-1} + \beta_5 SaleGrowth_{i,t-1} + \beta_6 RDAD_{i,t-1} + \beta_7 CFO_{i,t-1} + \beta_8 SdRev_{i,t-1} + \beta_9 AnalystCov_{i,t-1} + Firm_i + Year_t + \varepsilon_{i,t} \quad (1)$$

where i denotes the firm, t denotes the year, $Firm_i$ denotes the firm fixed effect, $Year_t$ denotes the year fixed effect and $\varepsilon_{i,t}$ is the error term. We cluster the standard errors at the firm level.

Table 3 reports the results of our baseline regressions. Columns (1) and (2) repeat the regressions without fixed effects, and with industry fixed effect and year fixed effect, respectively. Column (3) shows the regression result controlling for firm fixed effect and year fixed effects. We find the coefficients on all three specifications are negative and statistically significant at the 1% level. In column (3), the coefficient of LIQ is negative and significant (t -statistic = -16.0), suggesting that firms with higher liquidity are associated with lower conservatism. A one standard deviation increase in stock liquidity (1.302) is associated with a 0.034 decrease in C_Score , which is about one-third of the sample mean of C_Score (i.e. 0.101). Thus, the effect of stock liquidity on accounting conservatism is not only statistically significant but also economically meaningful. The results from the multivariate regression analysis also support the univariate results in Section 4.1. The negative relation between stock liquidity and

conservatism is consistent with the governance hypothesis and the short-termism hypothesis but is inconsistent with the run-away hypothesis motivated by Coffee (1991) and Bhidé (1993).

We find a positive and significant coefficient on firm size (*SIZE*), consistent with larger firms being more conservative as in Khan and Watts (2009). The coefficient of leverage (*TDB*) is negative and significant, consistent with firms with greater agency conflicts between lenders and shareholders demanding more conservative accounting. The coefficient on the market-to-book ratio (*MBE*) is positive yet insignificant, which may be due to the “buffer problem” documented by Roychowdhury and Watts (2007). Analyst coverage is negatively associated with conservatism, which is consistent with the argument that information asymmetry generates conservatism (LaFond and Watts, 2008). The results for other control variables are also largely consistent with the prior literature (e.g., Ahmed and Duellman, 2013).

[Insert Table 3 about here]

4.3. *Alternative conservatism models*

Besides *C_Score*, there are various models developed to measure accounting conservatism. In this section, we show that our results are robust to the use of these alternative accounting conservatism models. First, Basu’s (1997) asymmetric timeliness measure is widely used in the literature, which is the greater timeliness of earnings with respect to negative news relative to positive news. In particular, the following model specification is used in our estimation:

$$NI_{i,t} = \beta_0 + \beta_1 D_{i,t} + \beta_2 RET_{i,t} + \beta_3 D_{i,t} * RET_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 LIQ_{i,t} * RET_{i,t} + \beta_6 LIQ_{i,t} * D_{i,t} + \beta_7 LIQ_{i,t} * D_{i,t} * RET_{i,t} + \text{Additional Controls} + \varepsilon_{i,t} \quad (2)$$

where *NI* is net income before extraordinary items deflated by the market value of equity at the beginning of the fiscal year; *RET* is the annual returns compounded from monthly returns

beginning the fourth month after the prior fiscal year end; D is an indicator variable that equals to one if RET is negative and zero otherwise. Following prior studies (e.g. Basu, 1997; LaFond and Roychowdhury, 2008; LaFond and Watts, 2008), we control for firm size ($SIZE$), the market-to-book ratio (MBE) and leverage (TDB) and their interactions with D , RET and $D \times RET$. We denote this set of variables as *Additional Controls* for the sake of brevity. β_3 is the Basu asymmetric timeliness measure which indicates the extent to which earnings are reported conservatively. We perform two regressions: one with firm and year fixed effects; the other one with industry and year fixed effects. Standard errors are also clustered at the firm level to account for their serial correlations within a firm. Specifically, the effect of liquidity on asymmetric timeliness of loss recognition is captured by the coefficient β_7 , with a higher value indicating more asymmetric timeliness (i.e. more conservative accounting).

We present the results in Table 4. We observe that the coefficient on $D \times R$ is significantly positive, which is consistent with literature suggesting that firms recognize economic losses than gains in a more timely fashion. More importantly, the coefficients on $LIQ \times D \times R$, β_7 , are negative and significant at the 1% level in both specifications. These findings suggest that high liquidity reduces the level of accounting conservatism, which is consistent with our baseline results.

Second, stock liquidity potentially affects stock returns and firm values, which in turn conceivably influence the return-based Basu measure of conservatism. To further verify that our results are not driven by this issue, we use two other conservatism models that do not rely on stock returns. In particular, our second accounting conservatism model is based on the time-series of earnings, which measures the timely gain and loss incorporation as the tendency for increases and decreases in accounting income to reverse (e.g. Basu, 1997; Ball and Shivakumar, 2005). The model is shown as follows:

$$\Delta NI_{i,t} = \beta_0 + \beta_1 D_{i,t-1} + \beta_2 \Delta NI_{i,t-1} + \beta_3 D_{i,t-1} * \Delta NI_{i,t-1} + \beta_4 LIQ_{i,t} + \beta_5 LIQ_{i,t} * \Delta NI_{i,t-1} + \beta_6 LIQ_{i,t} * D_{i,t-1} + \beta_7 LIQ_{i,t} * D_{i,t-1} * \Delta NI_{i,t-1} + \text{Additional Controls} + \varepsilon_{i,t} \quad (3)$$

here the dependent variable is the change in earnings ($\Delta NI_{i,t}$) in year t . $D_{i,t-1}$ is an indicator variable equal to one if the change of earnings in year $t-1$ ($\Delta NI_{i,t-1}$) is negative and zero otherwise. Timely recognition of economic losses causes losses to be recognized as a “transitory” negative component of accounting income, which tends to reverse. Hence, more conservative accounting implies β_3 being negative in Equation (3). Thus, a reduction of conservatism corresponds to a positive β_7 . We report the results in columns (3) and (4) of Table 4. Consistent with Basu’s asymmetric timeliness model results, we find that firms in general adopt conservative accounting given that the coefficients of $D \times R$ are negative. The coefficient estimates of β_7 are positive and significant, suggesting that firms with higher liquidity exhibit a lower level of accounting conservatism.

Our last conservatism model is based on accruals following Ball and Shivakumar (2005) and is shown as follows:

$$ACC_{i,t} = \beta_0 + \beta_1 D_{i,t} + \beta_2 CFO_{i,t} + \beta_3 D_{i,t} * CFO_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 LIQ_{i,t} * CFO_{i,t} + \beta_6 LIQ_{i,t} * D_{i,t} + \beta_7 LIQ_{i,t} * D_{i,t} * CFO_{i,t} + \text{Additional Controls} + \varepsilon_{i,t} \quad (4)$$

where the dependent variable is accrual (ACC). CFO is cash flow from operations, and D is a dummy variable taking the value one if cash flow from operations is negative and zero otherwise. Economic losses are more likely to be recognized on a timely basis as unrealized accruals (i.e., non-cash basis) against income. In contrast, economic gains are often recognized when they are realized thus they are accounted for on a cash basis. Accrued losses are more likely in periods of negative cash flows and thus positive β_3 indicates greater conservatism. The results are shown in

columns (5) and (6) of Table 4. The significant and negative coefficients of the triple interaction term in both specifications suggest that more liquid firms have lower conservatism.

Taken together, our results are robust to all three widely used models of accounting conservatism and the use of firm fixed effects and industry fixed effects, suggesting that our results are not limited by any particular choice of conservatism measures.

[Insert Table 4 about here]

4.4. Additional sensitivity tests

In this subsection, we conduct further analyses to ensure that our baseline results are robust to alternative measures of stock liquidity and conservatism. First, we show our results are robust to alternative liquidity measures. We consider the following alternative stock liquidity measures: Amihud's (2002) price impact measure, stock turnover measure, quoted spread measure, and trading volume. Detailed definitions of these variables can be found in Appendix A. We again multiply minus one by Amihud measure and quoted spread measure so that higher values imply higher liquidity. The results are shown in Panel A of Table 5. For the sake of brevity, we only tabulate the coefficients of these liquidity measures. In all the four columns, the coefficients of various liquidity measures are all negative and significant. This suggests that our findings are robust to alternative measures of stock liquidity.

Second, we consider two alternative firm-year measures of unconditional conservatism – *ConAcc* and *Skewness*. To the extent that these two unconditional conservatism measures capture conditional conservatism with some noise, it would induce a bias against finding an association between stock liquidity and conservatism. *ConAcc* is based on the persistent use of accruals following Givoly and Hayn (2000) and Ahmed et al. (2002). Larger values of *ConAcc* indicates

greater conservatism. *Skewness* is the difference between cash flow skewness and earnings skewness developed by Givoly and Hayn (2000). Larger values of *Skewness* indicate greater conservatism. Detailed definitions are in Appendix A. Table 5 Panel B shows that the coefficients on *LIQ* are negative and significant for both measures. This suggests a negative relation between stock liquidity and the two alternative measures of conservatism, consistent with our baseline results.

[Insert Table 5 about here]

4.5. *Endogeneity*

While we document a strong negative association between stock liquidity and accounting conservatism, the results may be subject to endogeneity arising from either omitted variables or reverse causality from conservatism to liquidity. Utilizing two exogenous shocks to stock liquidity – 2001 tick price decimalization and 1997 tick size increment from 8ths to 16ths, we perform several tests, including the difference-in-differences (DiD) tests to mitigate these concerns.

4.5.1. *The 2001 decimalization*

The U.S. Securities and Exchange Commission (SEC) regulated that all stock markets within U.S. should convert all stock price quotes to decimal trading by April 9, 2001. On January 29, 2001, the NYSE and Amex began trading all listed stocks in decimals. The NASDAQ also changed its tick size to decimal form between March 12, 2001 and April 9, 2001. The decimalization in 2001 lowered spreads since there are now 100 price points instead of 16 price points within one dollar where traders can buy or sell, which lowers the cost of trading and increases the liquidity.

Decimalization is commonly used in prior literature as an exogenous shock to stock liquidity (e.g., Fang, Noe, and Tice, 2009; Bharath, Jayaraman, and Nagar, 2013; Edmans, Fang, and Zur, 2013; Kang and Kim, 2013; Fang, Tian, and Tice, 2014; Brogaard, Li, and Xia, 2017). It is a good quasi-natural experiment for us to identify the causal impact of stock liquidity on conservatism in three ways. First, the decimalization is implemented by the SEC in order to reduce stock trading costs, encourage quote competition, and promote the competitiveness of U.S. equity market compared to foreign markets. Thus, it is unlikely to be driven by firm accounting conservatism choice or firm's information environment. Second, decimalization generates an exogenous change in liquidity directly. Bessembinder (2003) shows that quoted bid-ask spreads fall following decimalization using a sample of NYSE and NASDAQ stocks. Chordia, Roll, and Subrahmanyam (2008) also show that decimalization results in increased stock liquidity. Third, there exist large cross-sectional variations in changes of liquidity among firms, which allows us to use DiD approach to exploit these variations. In summary, the exogenous change in liquidity caused by the decimalization is a good candidate to identify the causal effect of stock liquidity on accounting conservatism.

First, to address reverse causality from conservatism to liquidity, we regress the change in conservatism measures surrounding decimalization on the change in liquidity from the fiscal year prior to decimalization to the fiscal year after decimalization following Fang, Noe, and Tice (2009). There are two reasons for choosing a short window. First, it helps to reduce concerns relating to reverse causality as the change in liquidity is assumed to be exogenous brought by decimalization. Second, it allows us to better control for unobserved variables as the effect of such variables are less likely to be significant within a short time period. Table 6 Panel A reports the results. The coefficient of the change in liquidity (ΔLIQ) is negative and significant (t -

statistic = -14.5), indicating an increase in liquidity surrounding decimalization results in a decrease in firm conservatism. These results are consistent with liquidity having a negative causal effect on firm conservatism.

Next, we employ a DiD approach to further control for the impact of omitted and unobservable variables and remove biases caused by time trends. Following Fang, Tian, and Tice (2014), we construct a treatment group and a control group using propensity score matching and then compare the change in conservatism measure for the two groups of firms that are similar in firm characteristics but experience a significantly different change in liquidity around decimalization.

We rank all sample firms based on their increase in liquidity from the pre-decimalization year to the post-decimalization year. We assign them into terciles and retain only the top tercile of which firms experienced the largest increase in liquidity and bottom tercile representing firms that experienced the smallest increase in liquidity. Then we estimate a probit model in which the dependent variable is equal to one if the firm belongs to the top tercile (treatment group) and zero if the firm is in the bottom tercile. The probit model includes all the control variables and industry fixed effect as in our baseline regression model, measured in the pre-decimalization year. We use the predicted probabilities (propensity score) to perform nearest-neighbor propensity score matching with radius of 0.01. Each firm in the top tercile (treatment firms) is matched to a firm from the bottom tercile (control firms). If a firm from the bottom tercile is matched to more than one treatment firm, we retain the pair for which the distance between two firms' propensity scores is the smallest.⁷ We perform several diagnostic tests to ensure the parallel assumption is

⁷ The results are qualitatively unchanged if we retain all pairs of firms, i.e. we allow replacement in propensity score matching.

not violated since the validity of the DiD estimator is critically dependent on this assumption.⁸ In Figure 1, we plot the average *C_Score* for both the treatment firms and control firms from two years prior decimalization to two years after decimalization. As shown, the two lines for the treatment group and the control trend closely in parallel in the two years leading up to decimalization. For the sake of brevity, we put additional results on diagnostic tests in Appendix B1.

[Insert Figure 1 about here]

Panel B of Table 6 shows the DiD estimator and corresponding *t*-statistics. We calculate the average change of *C_Score* from the pre-decimalization year to the post-decimalization year for both treated and control firms. We next compute the difference in *C_Score* between the two groups. On average, firms in the treatment group experiences a larger average drop in *C_Score* by 0.037 (i.e., around one-third of the sample mean of *C_Score*) compared with firms in the control group. The difference is economically important and statistically significant at the 1% level. Finally, we perform the multivariate DiD regressions to control for the impact of other firm characteristics that could affect conservatism as follows:

$$C_Score_{i,t} = \beta_0 + \beta_1 Treat_i * Post_t + \beta_2 Post_t + \beta_3 Treat_i + \beta_4 Controls_{i,t} + \varepsilon_{i,t} \quad (5)$$

where *Treat* is a dummy variable equal to one if a firm is in the treatment group and zero otherwise. *Post* is a dummy variable that equals one for 2002 (post-decimalization year) and zero for 2000 (pre-decimalization year), and *Treat*×*Post* is the interaction between the two variables.

The control variables are the same as those used in the baseline regression. Standard errors are

⁸ We perform the diagnostic tests following Fang, Tian and Tice (2014) and Brogaard, Li and Xia (2017) and report the results in Appendix B1. First, we rerun the probit model based on the matched sample and the results are shown in column 2 of Panel A. All explanatory variables are insignificant indicating that there are no observable different characteristics between the treatment and control groups in the pre-decimalization year. Second, we compare the propensity scores of the treatment group and control group and the results are shown in Panel B. The two groups' scores line up closely. Third, we perform t-test to tests whether firm characteristics between the two groups are different. Panel C presents the results and no statistically significant differences exist between the two groups of firms' characteristics that affect firm's conservatism. All these tests suggest that parallel assumption is not violated.

clustered by firm. The results are reported in Panel C of Table 6. The coefficients of *Treat*×*Post* are negative and significant for both column (1) and column (2), indicating that treated firms experience a larger decline in *C_Score* after decimalization compared with control firms. Moreover, the coefficient estimate of *LIQ* in column (2) is close to the coefficient of *LIQ* in column (3) of Table 3 which is the baseline regression. These findings consistently show that liquidity has a negative causal impact on conservatism.

[Insert Table 6 about here]

4.5.2. The 1997 shock

We use another shock to liquidity in 1997,⁹ to mitigate the concern that there may be some unobservable factors that affect firm liquidity and accounting conservatism at the same time if only using one shock. The major US stock exchanges (e.g. NYSE, Amex and NASDAQ) reduced the minimum tick size from 1/8 of one dollar to 1/16 of one dollar in 1997 (hereinafter, 1997 shock). Chordia, Roll, and Subrahmanyam (2008) show that the spreads drop due to 1997 shock, which suggests an increase in stock liquidity. Therefore, we use the 1997 shock as another exogenous shock to liquidity to further identify the causal effect of liquidity on conservatism.

We repeat the analyses outlined above utilizing the 1997 shock.¹⁰ In Panel A of Table 6, the coefficient of the change in liquidity in column (2) is negative and significant (*t*-statistic = -10.9). We construct another treatment group and control group using the 1997 shock and perform the DiD regressions. The DiD estimates in Panel B of Table 6 yield similar results as that using the decimalization in 2001. Panel C of Table 6 shows that the coefficients of *Treat*×*Post* in columns (3) and (4) are both negative and significant, consistent with the results using the decimalization

⁹ The shock was used in Fang, Tian and Tice (2014) as an exogenous shock to liquidity.

¹⁰ We repeat the diagnostic tests for the 1997 liquidity shock and report the results in Appendix B2. The results suggest the parallel trend assumption is not violated for the 1997 shock.

in 2001. Besides, the magnitude of the coefficient estimates of *LIQ* are similar between the two liquidity shocks, which further supports the validity of both events as exogenous shocks to stock liquidity.

5. Further analyses

Our baseline results suggest that higher stock liquidity leads to lower accounting conservatism. As discussed in Section 1, while inconsistent with the run-away hypothesis, the negative liquidity-conservatism relation is consistent with both the governance hypothesis and the short-termism hypothesis. In this section, we develop several tests to evaluate which channel is more important in driving the relation.

5.1. Institutional ownership and the liquidity-conservatism relation

On the one hand, the short-termism hypothesis suggests that higher stock liquidity attracts transient institutional investors and short-term investors who pursue short-term trading profits. Thus, managers are under pressure to deliver short-term stock performance by accelerating good news recognition and delaying the negative news reporting. Hence, if the short-termism hypothesis shapes the negative liquidity-conservatism relation, the effect of stock liquidity on conservatism should be more pronounced for firms with a higher proportion of transient or short-term institutional ownership. On the other hand, the governance hypothesis suggests that higher liquidity improves corporate governance through facilitating blockholders formation, increasing their incentives to govern by intervention and imposing exit threat. Thus, the need for conservative accounting being a governance tool is reduced for firms with improved governance through “threat of intervention” and “threat of exit” induced by higher stock liquidity. If liquidity

affects conservatism mainly through the governance channel, the liquidity-conservatism relation should be stronger in the presence of blockholders and activist institutional investors.

Institutional investors are generally heterogeneous in their investment horizons and governing incentives. Following Bushee (1998), we classify institutional investors into transient (*TRAI*O) or non-transient (*NonTRAI*O). Transient institutional investors are characterized as having high portfolio turnovers, highly diversified portfolio holdings, and a strong interest in short-term trading profits. Non-transient institutions include quasi-indexer and dedicated institutions, who generally have low portfolio turnovers, monitor the firm management and rely on information beyond current earnings to evaluate managers' performance (e.g., Gaspar, Massa, and Matos, 2005; Fang, Tian, and Tice, 2014). Next, we categorize institutions into long-term (*LONG*) or short-term (*SHORT*) following Yan and Zhang (2009) which is based on portfolio turnover over the past four quarters.¹¹

We report the results in Panel A of Table 7. We first examine the effect of total institutional ownership on the liquidity-conservatism relation. *IO* is the percentage of shares held by all institutional investors. In column (1) of Panel A, we augment the baseline model by adding total institutional ownership and its interaction with stock liquidity and find a significantly negative coefficient of the interaction term. This result provides evidence that firms with higher institutional ownership experience a larger drop in conservatism when liquidity is increased.

To test the short-termism hypothesis, we examine whether the effect of stock liquidity is stronger for firms with higher short-term or transient investors ownership. In column (2), we decompose total institutional ownership into transient and non-transient institutional ownership and interact each of them with stock liquidity. We observe that the coefficient of interaction

¹¹ We also classify institutional investors into short-term and long-term following Derrien, Kecskes, and Thesmar (2013) and the results are unchanged.

between liquidity and transient institutional ownership is insignificant. The coefficient of interaction between liquidity and short-term institutional ownership is also insignificant as shown in column (3). Taken together, we find no evidence of a stronger negative stock-conservatism relation among firms with higher transient or short-term institutional ownership, suggesting that our results cannot be explained by the short-termism hypothesis.

5.2. *Strength of governance and the liquidity-conservatism relation*

Next, we explore the governance channel. Governance hypothesis suggests that enhanced liquidity improves corporate governance through facilitating “threat of intervention” and “threat of exit” and thus weakens the need for conservative accounting to govern the firms. Prior studies show that blockholders can be more effective in exerting governance when liquidity improves (e.g. Edmans, 2009; Admati, Pfleiderer, 2009; Edmans, Manso, 2011; Edmans, Fang, and Zur, 2013). In particular, blockholders are important in imposing exit threat, while activist institutional investors are generally experienced and effective in corporate intervention (Cremers and Nair, 2005). Besides, it is generally accepted that banks play a role in governance by monitoring the borrowers. Thus, on average, firms with bank loans are better governed than firms without bank loans. If liquidity affects conservatism via the governance channel by reducing the need for conservatism, the effect of liquidity should be more pronounced for firms with more blockholders and activists, and for firms with bank loans.

To capture the governance strength by blockholders and activists, we use four measures: blockholder dummy (*BlockDummy*), number of blockholders (*NumBlockholders*), activist dummy (*ActivistDummy*), and number of activists (*NumActivists*). *BlockDummy* (*ActivistDummy*) is a dummy variable which takes the value of one if there is at least one blockholder (activist) and

zero otherwise. *NumBlockholders* (*NumActivists*) is the number of blockholders (activists). Blockholders are defined as institutional investors who own no less than 5% of the total shares outstanding. Activists are defined according to Cremers and Nair (2005) and Larcker, Richardson, and Tuna (2007). We use *BankDebtDummy*, which is a dummy variable that equals to one if a firm has bank debt and zero otherwise, to capture the governance strength from banks. Larger values of these variables indicate better governance.

The results are reported in Panel B of Table 7. In column (1), the coefficient of the interaction term between stock liquidity and blockholder dummy is negative and statistically significant, suggesting that the negative effect of stock liquidity on conservatism is stronger for firms with blockholders. We also find the negative relation is more pronounced for firms with greater number of blockholders, as shown by the significantly negative coefficient of the interaction between liquidity and number of blockholders in column (2). In columns (3) and (4), we find the negative effects of liquidity are stronger for firms with activist shareholders and more activists respectively. Moreover, in column (5), the coefficient of the interaction term between liquidity and bank debt dummy is negative and significant, suggesting the negative impact of liquidity is stronger for firms with stronger monitoring from the bank. These findings suggest that the effect of liquidity on conservatism is stronger for firms with better governance measured by the presence of blockholders, activists, and banks. It supports the governance channel that enhanced liquidity substitutes for accounting conservatism by improving corporate governance.¹²

¹² The governance strength measures can be endogenously determined by firm characteristics. For example, firms with blockholders may be because that they have high information uncertainty. The demand for accounting conservatism may be higher for these firms. Therefore, we use industry-adjusted and characteristics-adjusted governance strength measure in the regressions and the results are qualitatively similar.

5.3. *Managerial characteristics and liquidity-conservatism relation*

The governance hypothesis posits that liquidity could enhance corporate governance through “threat of intervention” and “threat of exit” which in turn weakens the demand for conservatism as a governance tool. The implicit assumption is that the liquidity-induced governance mechanisms are effective in disciplining the managers by imposing credible threats. For example, the threat of selling a large amount of stocks is more credible for managers whose wealth is largely dependent on stock performance. If the alternative governance mechanisms induced by the improved liquidity are ineffective in disciplining managers, shareholders may still demand conservatism to govern these managers. To capture the effectiveness of the threats on managers, we use three variables: CEO ownership (*CEOownership*), CEO pay-for-performance sensitivity (*CEODelta*), and top 5 managers pay-for-performance sensitivity (*Top5Delta*). If a manager has higher ownership of the firm, we expect that she is more concerned about negative price impact by blockholders’ sales of stocks ex post if the blockholders are unsatisfied with her performance, which in turn impose a credible ex ante threat to her. This suggests that the effect of liquidity should be stronger for firms with higher CEO ownership since the liquidity-induced governance mechanisms are more effective in governing such firms. The same logic applies for the pay-for-performance sensitivity of the CEO and the top 5 managers. The higher the value of these three variables, the more effective the liquidity-induced governance mechanisms in disciplining the managers.

Table 7 Panel C presents the results. We find that the coefficients of the interaction terms between liquidity and all three governance-via-liquidity effectiveness measures are negative and significant, suggesting that liquidity has a larger negative effect on conservatism for firms with higher CEO ownership, and higher pay-for-performance sensitivity for CEO as well as the top 5

managers. The findings are consistent with the governance hypothesis in that the negative effect of liquidity is stronger for firms when liquidity-induced governance is more effective in disciplining the managers.

[Insert Table 7 about here]

6. Conclusion

Conservatism has been a central issue in accounting. It is defined as the differential verifiability required for recognition of gains versus losses and is often considered as a governance tool to mitigate the agency issues of a firm. Using a large sample of U.S. firms from 1994 to 2013, we document stock liquidity, an important stock market characteristic, negatively affects accounting conservatism. We show that the negative liquidity-conservatism relation is robust across a battery of alternative conservatism models and various measures of liquidity. By utilizing both the decimalization in 2001 and the 1997 liquidity shock, which generates exogenous variations in liquidity, we establish a negative causal effect of stock liquidity on accounting conservatism.

We then examine the underlying mechanisms. We find no evidence to support the short-termism hypothesis by showing stronger negative relation for firms with higher long-term or non-transient institutional ownership rather than short-term or transient institutional ownership. Besides, we find that the negative effect of liquidity on conservatism is more pronounced for firms with more blockholders and activists, firms with bank debt, and firms with higher CEO ownership. These findings support the governance hypothesis that liquidity improves corporate governance and thus lowers the need of conservatism as a governance device.

Our findings reveal the effect of stock liquidity as an important stock market characteristic on firms' disclosure policy by showing that liquidity can serve as a substitute for firms' conservative reporting in mitigating agency problems between managers and shareholders. We also add to the understanding of the rapidly growing literature on stock liquidity by extending the governance effect of liquidity to the accounting practice.

However, one should interpret the underlying mechanism with caution. Bid-ask spread is often used to measure information asymmetry and has been shown to positively affect conservatism. Although our liquidity measure is constructed based on real high frequency transactional data, it still capture the bid-ask spread as one component in the computation. It is very challenging to completely distinguish from the information channel from the corporate governance channel as argued by us. Our results provide some suggestive evidence that the effect of liquidity on conservatism is not only about information asymmetry but it also plays a corporate governance role in the context of conservatism.

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Appendix A: Variable Definitions

Variable	Definition
<i>C_Score</i>	Firm-year level measures of conservatism constructed following Khan and Watts (2009). Larger values indicate greater conservatism.
<i>LIQ</i>	Natural log of relative effective spread, multiplied by negative one. The relative effective spread is defined as the ratio of the absolute value of the difference between the trade price and the midpoint of the bid-ask quote over the trade price.
<i>SIZE</i>	Natural log of total assets.
<i>TDB</i>	The ratio of total liability over total assets.
<i>MBE</i>	Market to book equity ratio.
<i>SaleGrowth</i>	Percentage of annual growth in total sales.
<i>RDAD</i>	Total research and development expense plus advertising expense deflated by total sales.
<i>CFO</i>	Cash flows from operations deflated by total assets
<i>SdRev</i>	The standard deviation of the natural log of revenues measured from year t-5 to year t-1.
<i>AnalystCov</i>	Number of analysts following the firm during the fiscal year t.
<i>NI</i>	Net income before extraordinary items scaled by the beginning period of market capitalization. It's used in Basu (1997) asymmetric timeliness model.
<i>RET</i>	Annual returns compounded from monthly returns beginning the fourth month after fiscal year end. It's used in Basu (1997) asymmetric timeliness model.
ΔE	Change in earnings. It's used in earnings time-series model following Basu (1997), Ball and Shivakumar (2005).
<i>ACC</i>	Accruals (ACC) are measured as change of inventory + change of receivables + change of other current assets – change in account payable – change in other current liabilities – change in tax payable. It's used in the accruals-based test of loss recognition model following Ball and Shivakumar (2005).
<i>ConAcc</i>	A measure of conservatism based on the persistent use of negative accruals following Givoly and Hayn (2000), Ahmed and Duellman (2013). It's defined as income before extraordinary items less cash flow from operations plus depreciation expense deflated by average total assets, and averaged over last 3 years, multiplied by negative one. Larger values indicate greater conservatism.
<i>Skewness</i>	A measure of conservatism, which is the difference between cash flow skewness and earnings skewness following Givoly and Hayn (2000), Ahmed and Duellman (2013). Skewness of earnings (cash flows) is equal to $(x - \mu)^3 / \sigma^3$ where μ and σ are the mean and standard deviation of the earnings (cash flows) over the last five years. All variables are deflated by total assets. Larger values indicate greater conservatism.
<i>Ln(Amihud)</i>	Natural log of Amihud (2002) price impact measure, multiplied by negative one. The Amihud measure captures the stock price changes per \$ millions of trading volume.
<i>DailyTurnover</i>	The average value of daily share turnover in the fiscal year. Daily share

	turnover is defined as daily trading volume divided by shares outstanding.
<i>QuotedSpread</i>	The average value of daily quoted bid-ask spread in the fiscal year, multiplied by negative one. Daily quoted bid-ask spread is the difference between daily ask price and daily bid price scaled by the midpoint of bid and ask price with data from CRSP.
<i>Ln(TradingVol)</i>	Natural log of average monthly trading volume.
<i>IO</i>	The percentage of shares held by all the institutional investors.
<i>NonTRAIO</i>	The percentage of shares held by non-transient (quasi-index/dedicated) institutional investors, classified following Bushee (1998).
<i>TRAIO</i>	The percentage of shares held by transient institutional investors, classified following Bushee (1998).
<i>SHORT</i>	The percentage of shares held by short-term institutional investors, classified following Yan and Zhang (2009).
<i>LONG</i>	The percentage of shares held by long-term institutional investors, classified following Yan and Zhang (2009).
<i>BlockDummy</i>	A dummy variable equals to one if there is at least one blockholder for the firm-year and zero otherwise. Blockholders are institutional investors who own no less than 5% of the shares outstanding at the end of each year.
<i>NumBlockholders</i>	Number of the blockholders.
<i>ActivistDummy</i>	A dummy variable equals to one if there is at least one activist institutional investor for the firm-year and zero otherwise. Activist institutional investors are identified as in Cremers and Nair (2005) and Larcker, Richardson, and Tuna (2007).
<i>NumActivists</i>	Number of activist institutional investors.
<i>BankDebtDummy</i>	A dummy variable equals to one if a firm has bank debt and zero otherwise.
<i>NumBankLenders</i>	Number of bank lenders.
<i>CEOownership</i>	Percentage of shares held by CEO.
<i>CEODelta</i>	The pay-for-performance sensitivity of CEO, measured as the change in the value of a CEO's stock option award for every dollar change in the value of a firm's common equity.
<i>Top5Delta</i>	Pay-for-performance sensitivity for the top 5 managers.

Appendix B1: Propensity score matching regressions and diagnostics for 2001 decimalization

This table presents the propensity score matching regressions results for difference-in-differences analysis of stock liquidity on conservatism surrounding the decimalization. Panel A, column (1) reports the results of the probit regression based on the pre-matched firms in the treatment and control groups. The dependent variable equals to one if the firm belongs to the treatment group and zero otherwise. The explanatory variables are the control variables used in the baseline regressions measured in the pre-decimalization year, together with industry fixed effect. Column 2 presents the results of the same probit model based on the post-matched firms. Panel B reports the distribution of propensity scores for each of the treatment group and control group and their differences. Panel C shows the average variable values in the pre-decimalization year for treatment and control groups, the differences in means of each variable and corresponding t-statistics and p-value. Standard errors are clustered by firm. T-statistics are shown in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Probit regressions with pre- and post-matched sample

	Pre-match (1)	Post-match (2)
<i>LIQ</i>	0.303*** (4.2)	0.025 (0.3)
<i>SIZE</i>	0.116*** (3.0)	-0.019 (-0.4)
<i>MBE</i>	0.013** (2.2)	-0.003 (-0.3)
<i>TDB</i>	0.895*** (3.5)	0.058 (0.2)
<i>SaleGrowth</i>	-0.063 (-0.9)	0.182* (1.7)
<i>RDAD</i>	0.007 (0.7)	0.017 (0.3)
<i>CFO</i>	1.562*** (6.3)	0.014 (0.0)
<i>SdRev</i>	-0.085 (-0.8)	0.031 (0.2)
<i>AnalystCov</i>	-0.000 (-0.0)	-0.001 (-0.1)
Observations	1,581	752
p-value of Chi-squared	0	1
Pseudo R2	0.267	0.019

Panel B: Propensity score distribution

Group	N	Mean	SD	Min	p5	p50	p95	Max
Treatment	375	0.495	0.211	0.032	0.141	0.507	0.827	0.972
Control	375	0.499	0.215	0.032	0.141	0.516	0.837	0.978
Difference	375	-0.004	0.004	-0.010	-0.010	-0.003	0.000	0.002

Panel C: Differences in variables in pre-decimalization year

Variable	Treatment	Control	Difference	t-stat	p-value
<i>LIQ</i>	5.268	5.250	0.018	0.280	0.779
<i>SIZE</i>	6.249	6.220	0.029	0.239	0.811
<i>MBE</i>	3.317	3.352	-0.035	-0.079	0.937
<i>TDB</i>	0.211	0.208	0.003	0.203	0.839
<i>SaleGrowth</i>	0.261	0.213	0.048	1.172	0.241
<i>RDAD</i>	0.218	0.210	0.009	0.107	0.915
<i>CFO</i>	0.085	0.081	0.004	0.353	0.724
<i>SdRev</i>	0.399	0.386	0.013	0.464	0.643
<i>AnalystCov</i>	6.640	6.576	0.064	0.108	0.914

Appendix B2: Propensity score matching regressions and diagnostics for 1997 shock

This table presents the propensity score matching regressions results for difference-in-differences analysis of stock liquidity on conservatism surrounding the 1997 shock. Panel A, column (1) reports the results of the probit regression based on the pre-matched firms in the treatment and control groups. The dependent variable equals to one if the firm belongs to the treatment group and zero otherwise. The explanatory variables are the control variables used in the baseline regressions measured in 1996, together with industry fixed effect. Column 2 presents the results of the same probit model based on the post-matched firms. Panel B reports the distribution of propensity scores for each of the treatment group and control group and their differences. Panel C shows the average variable values in the pre-shock year (1996) for treatment and control groups, the differences in means of each variable and corresponding t-statistics and p-value. Standard errors are clustered by firm. T-statistics are shown in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Probit regressions with pre- and post-matched sample

	Pre-match (1)	Post-match (2)
<i>LIQ</i>	-0.952*** (-12.993)	0.073 (0.7)
<i>SIZE</i>	0.258*** (7.102)	-0.004 (-0.1)
<i>MBE</i>	0.054*** (4.924)	0.008 (0.6)
<i>TDB</i>	-0.386 (-1.546)	0.122 (0.4)
<i>SaleGrowth</i>	-0.009 (-0.626)	0.111* (1.8)
<i>RDAD</i>	0.004 (0.598)	-0.001 (-0.1)
<i>CFO</i>	0.279 (1.379)	-0.009 (-0.0)
<i>SdRev</i>	-0.070 (-0.608)	0.051 (0.4)
<i>AnalystCov</i>	0.049*** (7.528)	-0.005 (-0.6)
Observations	1,489	925
p-value of Chi-squared	0	1
Pseudo R2	0.154	0.012

Panel B: Propensity score distribution

Group	N	Mean	SD	Min	p5	p50	p95	Max
Treatment	465	0.499	0.162	0.031	0.233	0.500	0.778	0.979
Control	465	0.503	0.165	0.028	0.233	0.503	0.787	0.987
Difference	465	-0.005	0.004	-0.010	-0.010	-0.005	0.000	0.003

Panel C: Differences in variables in pre-shock year

Variable	Treatment	Control	Difference	t-stat	p-value
<i>LIQ</i>	5.058	5.039	0.020	0.342	0.732
<i>SIZE</i>	5.788	5.787	0.002	0.013	0.989
<i>MBE</i>	3.537	3.321	0.216	0.944	0.345
<i>TDB</i>	0.188	0.186	0.002	0.160	0.873
<i>SaleGrowth</i>	0.334	0.231	0.103	2.002	0.046
<i>RDAD</i>	0.421	0.229	0.192	0.801	0.423
<i>CFO</i>	0.060	0.068	-0.008	-0.629	0.529
<i>SdRev</i>	0.354	0.341	0.013	0.609	0.543
<i>AnalystCov</i>	6.710	6.675	0.034	0.069	0.945

Figure 1: Conservatism surrounding decimalization

This figure shows the average conservatism captured by the mean value of C_Score for treatment and control firms, from two years before decimalization to two years after decimalization. The sample comprises 375 treatment firms and 375 unique control firms matched based on the procedures described in Section 4.5. Panel A presents the average C_Score between the two groups of firms. In Panel B, the firm C_Score is detrended using the industry and year average C_Score and then averaged over treatment group and control group.

Panel A: Mean C_Score

Panel B: Detrended mean C_Score

Table 1: Descriptive Statistics

This table reports the summary statistics and correlation matrix for the sample firm-year observations. The sample consists of 60,522 firm-year observations between 1994 and 2013. The variables are defined in Appendix A. Panel A presents the summary statistics for the key variables. Panel B reports the correlation matrix for these main variables. * denotes statistical significance at 5% level.

Panel A: Summary Statistics

Variable	N	Mean	SD	10%	25%	Median	75%	90%
<i>C_Score</i>	60,522	0.101	0.145	-0.054	0.032	0.106	0.175	0.238
<i>LIQ</i>	60,522	5.817	1.302	4.149	4.750	5.761	6.861	7.623
<i>SIZE</i>	60,522	6.128	2.000	3.644	4.685	5.980	7.441	8.841
<i>MBE</i>	60,522	3.754	54.995	0.882	1.353	2.183	3.712	6.503
<i>TDB</i>	60,522	0.192	0.182	0.000	0.014	0.159	0.312	0.448
<i>SaleGrowth</i>	60,522	0.444	16.827	-0.130	0.002	0.109	0.275	0.596
<i>RDAD</i>	60,522	1.432	58.223	0.000	0.000	0.020	0.104	0.273
<i>CFO</i>	60,522	0.047	1.211	-0.147	0.007	0.082	0.146	0.224
<i>SdRev</i>	60,522	0.352	0.394	0.075	0.130	0.233	0.420	0.733
<i>AnalystCov</i>	60522	7.752	8.710	0	1	5	11	20

Panel B: Correlation Matrix

	<i>C_Score</i>	<i>LIQ</i>	<i>SIZE</i>	<i>MBE</i>	<i>TDB</i>	<i>SaleGrowth</i>	<i>RDAD</i>	<i>CFO</i>	<i>SdRev</i>	<i>AnalystCov</i>
<i>C_Score</i>	1.000									
<i>LIQ</i>	-0.499*	1.000								
<i>SIZE</i>	-0.517*	0.739*	1.000							
<i>MBE</i>	0.012*	0.006	-0.009*	1.000						
<i>TDB</i>	0.087*	0.062*	0.314*	0.016*	1.000					
<i>SaleGrowth</i>	-0.001	-0.004	-0.007	0.001	0.005	1.000				
<i>RDAD</i>	0.005	-0.008*	-0.025*	0.002	-0.016*	0.026*	1.000			
<i>CFO</i>	-0.044*	0.049*	0.040*	0.220*	-0.003	-0.007	-0.018*	1.000		
<i>SdRev</i>	0.058*	-0.108*	-0.186*	0.010*	-0.075*	0.037*	0.095*	-0.060*	1.000	
<i>AnalystCov</i>	-0.434*	0.628*	0.600*	0.009*	0.049*	-0.003	-0.006	0.029*	-0.012*	1.000

Table 2: Univariate Analysis

This table reports the univariate test. It reports the distribution of average *C_Score* sorted by firm size and liquidity. For each year, a firm is first classified as large (small) firm if beginning year *SIZE* measure is above (below) the median value. Then within each size group, firms are assigned into one of the five groups based on the liquidity measure. Group 1 consists of firms with the lowest liquidity, and firms in group 5 are the most liquid. For each size and liquidity group, we report the average *C_Score*. The liquidity measures are *LIQ*, *Ln(Amihud)*, *DailyTurnover*, *QuotedSpread*, and *Ln(TradingVol)*, which are defined in Appendix A. The 5-1 row reports the average *C_Score* difference and the corresponding p-value between the most liquid firms and least liquid firms within each size group. Panel A presents the results for large size firms while panel B presents the results for small size firms.

Panel A: Large firms

Liquidity measures	<i>C_Score</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>LIQ</i>	<i>Ln(Amihud)</i>	<i>DailyTurnover</i>	<i>QuotedSpread</i>	<i>Ln(TradingVol)</i>
1 (least liquid)	0.130	0.128	0.063	0.123	0.096
2	0.082	0.084	0.034	0.075	0.080
3	0.045	0.052	0.037	0.040	0.053
4	0.009	0.013	0.041	0.014	0.020
5 (most liquid)	-0.050	-0.059	0.041	-0.035	-0.032
5 - 1	-0.180	-0.187	-0.022	-0.158	-0.128
p-value	0.00	0.00	0.00	0.00	0.00

Panel B: Small firms

Liquidity measures	<i>C_Score</i>				
	(1)	(2)	(3)	(4)	(5)
	<i>LIQ</i>	<i>Ln(Amihud)</i>	<i>DailyTurnover</i>	<i>QuotedSpread</i>	<i>Ln(TradingVol)</i>
1 (least liquid)	0.229	0.233	0.204	0.227	0.221
2	0.185	0.186	0.178	0.185	0.183
3	0.154	0.155	0.150	0.154	0.151
4	0.130	0.129	0.135	0.131	0.130
5 (most liquid)	0.094	0.090	0.125	0.095	0.107
5 - 1	-0.135	-0.143	-0.079	-0.132	-0.114
p-value	0.00	0.00	0.00	0.00	0.00

Table 3: The Effect of Stock Liquidity on Accounting Conservatism

This table presents the regression results for the relation between stock liquidity and accounting conservatism. There are 60,522 firm-year observations between 1994 and 2013. The dependent variable is C_Score and the liquidity measure is the natural logarithm of relative effective spread multiplied by negative one. Other variable definitions are in Appendix A. Column (2) controls for the year fixed effect and industry fixed effect based on two-digit SIC codes. Column (3) controls for the firm fixed effect and year fixed effect. Standard errors are clustered at the firm level for all regressions and t-statistics are presented in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	(1) C_Score_t	(2) C_Score_t	(3) C_Score_t
LIQ_{t-1}	-0.014*** (-20.7)	-0.034*** (-30.9)	-0.026*** (-15.9)
$SIZE_{t-1}$	-0.032*** (-49.6)	-0.028*** (-41.1)	-0.014*** (-8.3)
MBE_{t-1}	0.000 (0.4)	0.000 (0.5)	0.000 (0.8)
TDB_{t-1}	0.187*** (37.7)	0.174*** (38.9)	0.116*** (18.1)
$SaleGrowth_{t-1}$	-0.000** (-2.3)	-0.000** (-2.4)	-0.000 (-0.0)
$RDAD_{t-1}$	-0.000 (-0.7)	-0.000 (-0.6)	-0.000 (-0.3)
CFO_{t-1}	-0.002*** (-3.8)	-0.002*** (-4.1)	-0.004 (-1.6)
$SdRev_{t-1}$	-0.008*** (-5.6)	-0.009*** (-6.9)	-0.001 (-0.2)
$AnalystCov_{t-1}$	-0.002*** (-16.6)	-0.001*** (-7.4)	-0.000 (-0.3)
<i>Constant</i>	0.358*** (110.2)	0.533*** (85.7)	0.393*** (37.1)
Observations	60,522	60,512	60,522
Adjusted R-squared	0.354	0.513	0.564
Firm FE	No	No	Yes
Year FE	No	Yes	Yes
Industry FE	No	Yes	No

Table 4: Results of Alternative Accounting Conservatism Models

This table reports the effect of stock liquidity under three accounting conservatism models. For the sake of brevity, I use D and R to denote different variables in the three models. Model 1 is the Basu (1997) asymmetric timeliness model where earnings are regressed on return, dummy where the return is less than 0 and their interactions with LIQ . Model 2 is the asymmetric loss recognition based on earnings time-series, where change in earnings is regressed on the lagged change in earnings, dummy where lagged change in earnings is negative and their interactions with LIQ . Model 3 is the accrual-based test of loss recognition, where accrual is regressed on cash flow from operations, dummy where operating cash flow is negative and their interactions with LIQ . For each model, two specifications are estimated and presented. The first specification controls for industry fixed effect based on two-digit SIC codes and year fixed effect. The second specification controls for firm fixed effect and year fixed effect. Additional controls are $SIZE$, MBE , TDB and their interactions with D , R and $D \times R$ and they are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	Model 1		Model 2		Model 3	
	(1)	(2)	(3)	(4)	(5)	(6)
	$R = RET, D = (RET < 0)$		$R = \Delta E_{t-1}, D = (\Delta E_{t-1} < 0)$		$R = CFO, D = (CFO < 0)$	
D	-0.007 (-0.9)	-0.019** (-2.4)	-0.052*** (-4.5)	-0.042*** (-3.1)	-0.157*** (-4.5)	-0.075** (-2.0)
R	-0.006 (-1.6)	-0.003 (-0.9)	-0.000 (-1.2)	-0.000 (-1.1)	-1.841*** (-10.7)	-1.559*** (-7.0)
$D \times R$	0.280*** (12.7)	0.161*** (6.5)	-0.969*** (-8.9)	-1.060*** (-8.1)	1.687*** (7.3)	1.421*** (4.7)
LIQ	0.013*** (9.3)	0.035*** (16.5)	0.011*** (6.3)	0.013*** (3.7)	-0.025*** (-5.7)	-0.017*** (-3.1)
$LIQ \times R$	-0.007*** (-3.7)	0.000 (0.1)	-0.031* (-1.7)	-0.029 (-1.3)	0.394*** (11.0)	0.405*** (10.1)
$LIQ \times D$	-0.003 (-1.5)	0.002 (1.2)	0.006** (2.1)	0.004 (1.2)	0.026*** (3.3)	0.031*** (4.0)
$LIQ \times D \times R$	-0.017*** (-3.1)	-0.027*** (-4.4)	0.111*** (3.0)	0.117** (2.4)	-0.342*** (-6.5)	-0.361*** (-6.0)
Observations	60,512	60,522	54,843	54,851	58,707	58,715
Adjusted R-squared	0.166	0.382	0.163	0.190	0.854	0.894
Additional Controls	Included	Included	Included	Included	Included	Included
Firm FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	No	Yes	No

Table 5: Additional Robustness Tests

This table presents the results for the additional robustness tests. Panel A reports the results on the effect of stock liquidity on conservatism (*C_Score*) using alternative liquidity measures. Columns (1) to (4) report the results of regressions with *Ln(Amihud)*, *DailyTurnover*, *QuotedSpread*, and *Ln(TradingVol)* as liquidity measures, respectively. Panel B reports the regressions results with alternative conservatism measures: *ConACC* and *Skewness*. Variable definitions are in Appendix A. Control variables are included in all regressions and we only report the coefficient on liquidity measures for brevity. Firm fixed effect and year fixed effect are controlled in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Alternative stock liquidity measures

	(1) <i>Ln(Amihud)</i>	(2) <i>DailyTurnover</i>	(3) <i>QuotedSpread</i>	(4) <i>Ln(TradingVol)</i>
<i>Liquidity Variable</i> $t-1$	-0.014*** (-22.0)	-0.399*** (-4.6)	-0.093* (-1.9)	-0.011*** (-11.8)
Observations	60,424	60,418	60,388	60,417
Adjusted R-squared	0.570	0.562	0.561	0.564
Controls	Included	Included	Included	Included
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Panel B: Alternative accounting conservatism measures

	(1) <i>ConAcc</i> t	(2) <i>Skewness</i> t
Dep. Var. <i>LIQ</i> $t-1$	-0.010*** (-9.8)	-0.338*** (-13.3)
Observations	60,329	52,230
Adjusted R-squared	0.363	0.055
Controls	Included	Included
Firm FE	Yes	Yes
Year FE	Yes	Yes

Table 6: Endogeneity Tests

This table presents the results of addressing endogeneity using the 2001 decimalization and the 1997 liquidity shock. In Panel A, Δ denotes the change in each variable from the fiscal year before decimalization to the fiscal year after decimalization and change of C_Score is regressed on the change in liquidity measures and change in control variables. The regression is performed for each of the 2001 decimalization and the 1997 liquidity shock. Industry fixed effect based on two-digit SIC codes are included in both regressions. Panel B and Panel C reports the difference-in-differences tests examining how exogenous changes in stock liquidity brought by the two liquidity shocks affect firm conservatism. Firms are sorted into terciles based on their change in LIQ from pre-decimalization year to post-decimalization year. Firms in the top (bottom) tercile belong to treatment (control) group. For each firm in the treatment group, we use the probit model to perform one-to-one nearest neighbor propensity score matching without replacement and radius 0.01 to match firms. All control variables and industry fixed effect are included in the probit model. The results of probit regressions and diagnostic tests are reported in Appendix B. Panel B reports the difference-in-differences estimator for C_Score based on the matched sample. Panel C reports regression results for the difference-in-differences setting based on the matched sample. $Treat$ is a dummy variable equal to one if a firm is in the treatment group and zero if in the control group. $Post$ is a dummy variable equal to one for the post-decimalization year (2002) and zero for the pre-decimalization year (2000). $Treat \times Post$ is the interaction between $Treat$ and $Post$. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Reverse causality

Dep. Var.	2001 Decimalization	1997 Liquidity Shock
	(1) ΔC_Score	(2) ΔC_Score
ΔLIQ	-0.034*** (-14.5)	-0.028*** (-10.9)
$\Delta SIZE$	0.002 (0.6)	-0.014*** (-4.2)
ΔMBE	-0.002*** (-3.0)	-0.000 (-0.2)
ΔTDB	-0.001 (-0.1)	0.162*** (15.7)
$\Delta SaleGrowth$	-0.008*** (-4.3)	0.000 (0.6)
$\Delta RDAD$	0.001*** (4.6)	-0.000 (-1.1)
ΔCFO	-0.021** (-2.2)	-0.007 (-1.1)
$\Delta SdRev$	-0.000 (-0.1)	0.013** (2.3)
$\Delta AnalystCov$	0.001*** (3.4)	0.000 (1.4)
Observations	2,409	2,266
Adjusted R-squared	0.286	0.301
Industry FE	Yes	Yes

Panel B: Difference-in-differences estimator

	Treatment		Control		DID	<i>t</i> -statistic	<i>p</i> -value
	Before	After	Before	After			
2001 Decimalization	0.149	0.135	0.153	0.178	-0.039	5.87	0.000***
1997 Liquidity Shock	0.092	0.081	0.099	0.127	-0.04	5015	0.000***

Panel C: Difference-in-differences regression

	2001 Decimalization		1997 Liquidity Shock	
	(1)	(2)	(3)	(4)
	<i>C_Score</i>	<i>C_Score</i>	<i>C_Score</i>	<i>C_Score</i>
<i>Treat</i> × <i>Post</i>	-0.014*** (-4.147)	-0.028*** (-4.700)	-0.014*** (-4.373)	-0.030*** (-5.874)
<i>Post</i>	0.009*** (3.226)	0.014*** (3.520)	0.016*** (7.221)	0.020*** (6.141)
<i>Treat</i>	-0.004* (-1.674)		-0.006** (-2.347)	
<i>SIZE</i>	-0.025*** (-24.979)	-0.006 (-0.816)	-0.036*** (-42.334)	-0.020*** (-2.810)
<i>MBE</i>	-0.005*** (-4.074)	-0.003*** (-3.348)	-0.003*** (-3.421)	-0.001 (-0.683)
<i>TDB</i>	0.075*** (9.790)	0.003 (0.121)	0.204*** (20.952)	0.181*** (8.644)
<i>SaleGrowth</i>	-0.005 (-1.488)	-0.007 (-0.973)	-0.004 (-1.504)	-0.006 (-1.264)
<i>RDAD</i>	-0.004*** (-2.971)	-0.002* (-1.908)	0.000 (0.565)	0.001 (0.805)
<i>CFO</i>	-0.045*** (-3.697)	-0.049*** (-3.207)	-0.006 (-0.619)	-0.004 (-0.221)
<i>SdRev</i>	-0.005 (-1.253)	-0.003 (-0.333)	-0.008** (-1.968)	0.012 (1.100)
<i>AnalystCov</i>	-0.001*** (-4.740)	0.000 (0.386)	-0.001*** (-5.497)	0.001 (1.103)
Observations	1,508	1,508	1,860	1,860
Adjusted R-squared	0.701	0.767	0.775	0.857
Firm FE	No	Yes	No	Yes
Industry FE	Yes	No	Yes	No

Table 7: Tests on Possible Mechanisms

This table presents the results on the possible channels of how stock liquidity affects accounting conservatism. Panel A reports the results regarding the effect of institutional ownership on the liquidity-conservatism relation. *IO*, *TRAI*O, *NonTRAI*O, *SHORT*, *LONG* are total institutional ownership, transient institutional ownership, non-transient institutional ownership, short-term institutional ownership, and long-term institutional ownership, respectively. Panel B reports the results regarding the effect of blockholders, activists and banks on the liquidity-conservatism relation. *BlockDummy* is a dummy variable that equals to one if there is at least one blockholder and zero otherwise. *NumBlockholders* is the number of blockholders. *ActivistDummy* is a dummy variable that equals to one if there is at least one activist and zero otherwise. *NumActivists* is the number of activists. *BankDebtDummy* is a dummy variable that takes the value one if the firm has bank loans and zero otherwise. Panel C reports the results regarding the effect of managerial characteristics on the liquidity-conservatism relation. *CEOownership* is the percentage of shares owned by CEO. *CEODelta* is the change in the value of a CEO's stock option award for every dollar change in the value of a firm's common equity. *Top5Delta* is the delta for the top 5 managers. The control variables, firm fixed effect and year fixed effect are included in all the regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Institutional ownerships

	(1) <i>C_Score_t</i>	(2) <i>C_Score_t</i>	(3) <i>C_Score_t</i>
<i>LIQ_{t-1}</i>	-0.017*** (-8.2)	-0.014*** (-6.9)	-0.020*** (-11.0)
<i>IO_{t-1}</i>	0.168*** (12.4)		
<i>LIQ_{t-1} × IO_{t-1}</i>	-0.024*** (-11.2)		
<i>TRAI</i> O _{t-1}		-0.039 (-1.4)	
<i>LIQ_{t-1} × TRAI</i> O _{t-1}		0.002 (0.3)	
<i>NonTRAI</i> O _{t-1}		0.198*** (12.4)	
<i>LIQ_{t-1} × NonTRAI</i> O _{t-1}		-0.030*** (-12.2)	
<i>SHORT_{t-1}</i>			0.000 (0.0)
<i>LIQ_{t-1} × SHORT_{t-1}</i>			-0.002 (-0.5)
<i>LONG_{t-1}</i>			0.286*** (8.1)
<i>LIQ_{t-1} × LONG_{t-1}</i>			-0.045*** (-8.3)
Observations	60,522	60,493	60,499
Adjusted R-squared	0.566	0.567	0.566
Controls	Included	Included	Included
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Panel B: Strength of governance

	(1)	(2)	(3)	(4)	(5)
	C_Score_t	C_Score_t	C_Score_t	C_Score_t	C_Score_t
LIQ_{t-1}	-0.022*** (-10.3)	-0.023*** (-11.2)	-0.011*** (-4.4)	-0.015*** (-7.2)	-0.019*** (-11.4)
$BlockDummy_{t-1}$	0.023*** (2.8)				
$LIQ_{t-1} \times BlockDummy_{t-1}$	-0.003** (-2.4)				
$NumBlockholders_{t-1}$		0.012*** (4.6)			
$LIQ_{t-1} \times NumBlockholders_{t-1}$		-0.001*** (-3.3)			
$ActivistDummy_{t-1}$			0.092*** (9.5)		
$LIQ_{t-1} \times ActivistDummy_{t-1}$			-0.016*** (-8.1)		
$NumActivists_{t-1}$				0.015*** (16.1)	
$LIQ_{t-1} \times NumActivists_{t-1}$				-0.002*** (-16.8)	
$BankDebtDummy_{t-1}$					0.075*** (13.1)
$LIQ_{t-1} \times BankDebtDummy_{t-1}$					-0.011*** (-11.7)
Observations	48,956	48,956	49,199	48,598	60,522
Adjusted R-squared	0.583	0.583	0.585	0.584	0.567
Controls	Included	Included	Included	Included	Included
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Panel C: Managerial Characteristics

	(1) <i>C_Score_t</i>	(2) <i>C_Score_t</i>	(3) <i>C_Score_t</i>
<i>LIQ_{t-1}</i>	-0.011 (-1.4)	-0.005 (-0.9)	0.009** (2.2)
<i>CEOownership_{t-1}</i>	0.009** (2.4)		
<i>LIQ_{t-1} × CEOownership_{t-1}</i>	-0.001** (-2.4)		
<i>CEODelta_{t-1}</i>		0.001 (0.3)	
<i>LIQ_{t-1} × CEODelta_{t-1}</i>		-0.002** (-2.2)	
<i>Top5Delta_{t-1}</i>			0.019*** (5.6)
<i>LIQ_{t-1} × Top5Delta_{t-1}</i>			-0.004*** (-7.6)
Observations	8,647	17,002	20,213
Adjusted R-squared	0.694	0.659	0.641
Controls	Included	Included	Included
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Chapter 3: Government Credit and Industry Structure: Evidence from China

Abstract

By merging the universal transaction-level data from China Customs and loan data from the China Development Banks (CDB), we analyze the effects of government credit on export activities in China. We find that CDB credit to SOEs leads to higher export amount of SOEs and lower export product varieties of private firms in the same industry. Moreover, CDB credit to upstream industries leads to higher export amount and more export destinations of private firms in downstream industries. This effect is not pronounced for SOEs in downstream industries. Infrastructure credit generally has positive effects on export activities for all types of firms. We use the pre-determined turnover timing of municipal politicians as an instrument for CDB loans. The results suggest government credit to upstream industries could have positive spillover effects on private firms in the downstream industries.

JEL Classification: E51, F30, G21, G28

Keywords: government credit; export activity; upstream loan; spillover effect

1. Introduction

Government ownership of bank is pervasive around the world and often plays a key role in credit allocations, especially in recent years.¹ There is a huge debate in the literature on the economic consequences of government credit. However, evidence is limited on how government credit affects the international trade by changing the industry structure of the supply chain. This paper explores the causal effects of government credit on international trade by using a universal transaction data on import and export in China. In particular, we study how government credit to basic industries and infrastructure projects affect firm exports and imports activities across different levels of the supply chain.

In this study, we use population data on all export and import transactions in China and the province-industry level loan data from China Development Bank (CDB) between 2000 and 2013.² We document three main findings. First, CDB loans to state-owned enterprises (SOEs) significantly help the exports of SOEs but hurt export activities of private firms in the same industry. Second, CDB credit to upstream industries leads to higher export amount and more export destinations of private firms in downstream industries. In contrast, SOEs in downstream cannot capture the benefits from the credit to their upstream industries. Third, Infrastructure credit generally has positive spillover effects on export activities for all types of firms. This paper, for the first time, studies the spillover effects of upstream industry credit on downstream firms’

¹ See La Porta et al. (2002) for the overview of government ownership of banks across the globe. Many countries have development banks. For example, there are the KfW Bankengruppe in Germany, the Korea Development Bank, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, and the Inter-American Development Bank Group. In the U.S., the National Infrastructure Reinvestment Bank was proposed in 2007. In the last two decades, the size of development financial institutions (DFIs) has been growing dramatically. For example, in 2015, the total assets of DFIs over GDP ratio is approximately 15% on average across 28 countries (from BankScope).

² The CDB is the largest policy bank in China with the mandate to provide subsidized credit to SOEs in strategic industries (e.g., energy and mining) and to local governments for infrastructure development. See Ru (2017) for detailed discussion of the CDB.

international trade activities by improving the quality and lowering the marginal costs of intermediate inputs.

China is the ideal testing field on international trade. First, China has been experiencing unprecedented high economic growth during the last three decades and is the second largest economy worldwide. Second, since China joined World Trade Organization (WTO) in 2001, it has become the largest trade partners of many countries including the U.S. At the same time, the total export amount from China reached approximately 2.3 trillion US dollars in 2014.³ Third, China is also the leading importer of many raw materials. It is important to understand the dynamics of export and import structure in China over time. Government credit from the China Development Bank (CDB) plays a critical role in shifting export-import dynamics in China.

The China Customs data record the universe of firms' export and import transactions from 2000 to 2013 with detailed transaction level information (e.g., product price, number of products, means of transportation, destination country, firm name, firm location, and firm ownership). We merge it with the province-industry level loan data from the CDB. First, we perform the ordinary least square (OLS) regressions of firm export activities on different types of CDB credit. In particular, we find that infrastructure loan amounts and upstream loan amounts are positively associated with export amounts of private firms. For SOEs, we do not find the similar significant correlations. Moreover, for private firms, we find that number of export destinations of a firm is positively related to both infrastructure loan amounts and upstream loan amounts. Number of export destinations are widely used in the literature to measure the performance of firms' export (e.g. Minetti and Zhu (2011), Manova, Wei and Zhang (2015), Chan and Manova (2015), Muuls (2015)).

³ WTO International Trade Statistics 2015. (https://www.wto.org/english/res_e/statis_e/its2015_e/its2015_e.pdf)

However, the OLS results hardly say anything on the causal effects of government credit which is often allocated endogenously. For example, the CDB has the mandate to grant credit to the undeveloped areas and bottle-necked industries in China. In order to establish causal links, we employ the same identification strategy as in Ru (2017) and use the municipal politicians' turnover cycles as the instrumental variable for CDB loans. Ru (2017) find that the municipal city secretaries in China tend to borrow significantly more in their early years in office and monotonically decrease the borrowings over the pre-determined five years of their tenures. Specifically, we first identify each city's largest SOE industry (i.e., focal industry), which is often pre-determined. Our instrumental variables are interaction terms between the dummy of focal industries and the predicted turnover cycles of the city. In the first stage regressions, we find that the province borrows significantly more for the focal industry of a city where the city secretary in her earlier years in office. In other words, the newly appointed city secretary tends to borrow significantly more for the focal industry in her city, which would be reflected in CDB province-industry level loan amounts.

In the second stage regressions, we find that CDB loans lead to significant increases in export amounts of SOEs in the same industry. For private firms, we do not find any significant effects of CDB direct loans. This is consistent with the fact that most of CDB credit for basic industries in China goes to SOEs. The CDB rarely lends to private firms in China.⁴ Moreover, increased CDB direct loan amounts also lead to an increase in the number of export destinations of SOEs in the same industries. Again, there is no effect on private firms. These suggest that SOEs, as expected, benefit from the credit from the CDB, in terms of increased export amounts and increased number of destination countries. Private firms in the same industry cannot benefit from the credit to SOEs.

⁴ Approximately 90% of CDB industrial loans are for SOEs. Only less than 10% go to the private firms which are typically big private firms with close connections with government.

Next, besides the effects of government credit in the same industry, we trace the effects of CDB credit across the supply chain. In particular, we perform the 2SLS, which regress firm export amounts and number of destinations on the upstream CDB credit amount respectively. We find that, in contrast with loans to the same industry, increases in CDB upstream loan amounts lead to increases in private firm export amounts and number of destination countries. There is no significant effect for SOEs. This suggests that CDB upstream loans help the downstream private firms export whereby SOEs in downstream industries cannot capture this spillover effects from upstream industry credit.

Furthermore, we also look at the heterogeneous effects of CDB direct loans (loans to the same industry) and upstream loans on other dimensions of export activities between SOEs vs. private firms (e.g., product variety and trade types). For product variety, we measure it by using the number of different product types of a firm.⁵ In 2SLS, we find that CDB direct loans would decrease the product variety level of private firms. This suggests that CDB credit to SOEs increases the exports, which in turn increases the competitive pressure for private firms in the same industry. To react, private firms become more concentrated in their core products by reducing the product variety. Moreover, we categorize the trade transactions into ordinary trade and processing trade. Processing trade refers to the export of imported raw and auxiliary materials after simply processing or assembly in the firm, which is usually less profitable and of lower value-added than ordinary trade. We find that increased CDB direct loans would increase the portion of processing trade in terms of total trade for private firms in the same industry. However, both infrastructure loans and upstream loans would reduce the export activities of processing trade for private firms. These findings suggest that CDB credit to SOEs could crowd out private firm export activities by

⁵ Number of different product types is defined by counting the number of unique four-digit product code under the Harmonized System (HS) of a firm's export.

reducing the ordinary trade and the product variety in the same industry. In contrast, CDB credit to upstream industries could crowd in private firms in the downstream industries by increasing the ordinary trade and the product variety.

Our contribution to the literature is three-fold. First, it adds to the growing literature on how credit availability affects international trade. Many studies suggest that credit constraints hinder international trade and stronger financial institutions provide firms with comparative advantages in international trade.⁶ However, there is limited evidence on the spillover effects of the credit, especially for the effects of government credit to upstream industries on downstream firms' trade activities. It is important to understand this spillover effects since, across the industry supply chain, the intermediate input is critical for firm productivity and exports.⁷ This paper fills this gap in the literature and documents an important channel of spillover effects of government credit.

Second, our findings suggest that government credit is an important channel to affect domestic value added in exports. It is related to the literature on value added trade of global value chains.⁸ For example, Kee and Tang (2016) documents that, unlike most of the other countries, the domestic content in exports of China has been increasing over time. We provide the evidence that government credit is one of the reasons behind that. By granting subsidized government credit to infrastructure and basic strategic industries (usually upstream), government could change the industry structure and move exports from low value-added processing trade to high value-added ordinary trade. This could help researchers and policy makers assess government direct credit programs and understand the full economic consequences of government direct credit program.

⁶ Kletzer and Bardhan (1987), Beck (2002), Matsuyama (2005), Manova (2013), Chaney (2013), Ju and Wei (2005, 2010, 2011), and Becker, Chen, and Greenberg (2013), Beck (2002, 2003), Svaleryd and Vlachos (2005), Hur, Raj, and Riyanto (2006), Manova (2013), and Becker et al. (2013) Manova, Wei, and Zhang (2015).

⁷ Feenstra (1994), Grossman and Helpman (1991). Kee (2015) provides evidence that firms improve their product scope and productivities when they have access to better quality and more varieties of local intermediate inputs.

⁸ See Feenstra (1998), Baldwin (2014), Timmer et al. (2014)

Third, by largely, this paper belongs to the literature on the finance-growth nexus. Many studies have shown the positive association between financial market development and economic growth and government involvement could potentially distort the credit allocation (e.g., King and Levine, 1993; Demirguc-Kunt and Maksimovic, 1998; Levine and Zervos, 1998; Rajan and Zingales, 1998; Levine, Loayza, and Beck, 2000). However, the social view argues that government credit has positive externalities which cannot be captured by the private sector (e.g., Stiglitz, 1993). The findings of this paper are closely connected with Ru (2017) who finds that government credit to SOEs could crowd out private firm activities in the same industry but crowd in private firms in downstream industries. By looking at international trade at the transaction level, this paper provides the micro evidence for Ru (2017) and also new evidence on how the government uses credit programs to shift the industry structure in China.

The rest of this paper is organized as follows. We first review the literature and describe the institutional background of China in Section 2. We then present our data and summary statistics in Section 3. Section 4 provides the empirical results. Section 5 concludes.

2. Literature Review and Institutional Background

2.1. Literature Review

For the nexus between finance and international trade, theoretically, previous research has shown that countries with stronger financial systems have a comparative advantage in international trade, for sectors that rely more on external finance (e.g. Kletzer and Bardhan, 1987; Beck, 2002; Matsuyama; 2005; Chaney, 2013; Ju and Wei (2005, 2010, 2011); Becker, Chen, and Greenberg, 2013). For example, Melitz (2003) proposes a dynamic industry model with heterogeneous firms to show how the exposure to trade will induce the more productive firms to start exporting while

forcing the least productive firms to exit. Incorporating credit constraints, Manova (2013) extends the model of Melitz (2003) and finds countries with developed financial system export more in financially vulnerable sectors because they enter more markets, ship more products to each destination, and sell more of each product.

Empirically, a large body of literature has also studied the effect of credit constraints on international trade. The macro level evidences confirm the predictions of the theoretical models that financially developed economies exhibit better export performance, especially in industries that are more dependent on credit (e.g. Beck, 2002; Beck, 2003; Svaleryd and Vlachos, 2005; Hur, Raj, and Riyanto, 2006; Becker, Chen, and Greenberg, 2013). Early firm-level studies have shown credit constraints are negatively associated with firms' export performance as well (e.g. Minetti and Zhu, 2011; Berman and Héricourt, 2010). More recently, many studies explored the exogenous shocks to firms' availability of external finance to establish a causal effect of credit conditions on trade (e.g. Manova, 2008; Amiti and Weinstein, 2011; Bricongne et al., 2012; Manova, Wei, and Zhang, 2015; Paravisini et al., 2015). A number of studies also documented the negative effect of credit constraints on exporting firms' number of destinations and number of products exported in various countries (e.g. Chan and Manova, 2015; Muuls, 2015; Hasan and Sheldon, 2016; Kiendrebeogo and Minea, 2016). Fan, Lai and Li (2015) and Crinò and Ogliari (2017) find that financing frictions would force firms to produce lower quality goods and thus to reduce the prices of these products because of lower quality.

For international trade, the structure of industry supply chain is another important factor. Using the same Customs data, Lee and Tang (2016) finds there is substitution of domestic for imported materials which is caused by the liberalization of trade and investment in China. However, there is little evidence on how credit allocation across industry supply chain affects the production

factors (e.g., quality and price of input materials) of export. Our study is very close to Ru (2017) which finds that local SOEs in China tend to borrow and invest significantly more during the early years of local politicians' five-year terms to help their career advancement. This increased credit to SOEs crowds out private firm activities in the same industry by reducing private firms' total assets and sales but crowds in private firms in downstream industries. Our paper documents that government credit is another important channel and different types of credit could have heterogeneous effects on export activities. This is novel and has not been studied before in the international trade literature. It also provides the micro evidence for Ru (2017).

2.2. Institutional Backgrounds

China remains a closed economy until the late 1970s. Starting with the famous economic reform (reform and opening-up) in 1978, China opened its economy and the trade began to grow. Throughout the reform, Chinese government reduced tariffs, trade barriers, and regulations, with the overall tariff rate falling from 56% to 15%. More than 60% of the imports were free of tariffs and only 9% of import were subject to licensing and import quotas by 2001. Trade amount between China and the rest of the world has increased from only \$20 billion at the beginning of the reforms to more than \$500 billion in 2001. On 11 December 2001, China became an official member of the World Trade Organization (WTO) after going through an arduous and prolonged negotiation of 15 years since its initial application. After joining the WTO, China's international trade rose rapidly and firms expanded fast to the global markets. Total trade amounts increased from nearly \$510 billion in 2001 to more than \$4.1 trillion in 2013 with the export amounts rising from \$266 billion to \$2.2 trillion. In 2013, China surpassed the United States to become the largest trading

nation in the world. Over the years, to promote international trade, integrate into the global economy and strengthen economic cooperation with other economies, China has established free trade agreements (FTA) with 14 countries or regions.⁹ China has been one of the most important players in international trade and has increasingly engaged in trade organizations and treaties in recent years.

Although China employs an open market economy, its economic model is often viewed as the socialist market economy characterized by a mixed system presenting the typical features of both the market and planning economies.¹⁰ The fundamental distinction between the Chinese model and the traditional Western market economy models lies in the degree of state-ownership and underlying authoritarian political philosophy, where the Chinese government has controlling power over the economic activity through corporatized government agencies and the state-owned enterprises. The China Development Bank (CDB) provides such a tool for the Chinese government to exert controls over the economy and to implement the fiscal policy.¹¹ CDB is the biggest policy bank in China under direct control by the State Council, which is mandated to provide medium- to long-term financing facilities that serve China's long-term economic and social development strategies, especially in undeveloped areas and bottle-necked industries.¹² It is also the largest development finance institution in the world with total assets of RMB 12.62 trillion and balance of loans of RMB 9.21 trillion as of 2015.¹³ Currently, it has 37 primary branches and 3 secondary

⁹ Currently, China has 19 free trade agreements under construction, where 14 of them have been signed and implemented. For example, China-Australia FTA, China-Switzerland FTA, China-ASEAN FTA. (<http://fta.mofcom.gov.cn/english/>)

¹⁰ See for example: "The rise of state capitalism". The Economist. 21 January 2012. Bremmer, Ian (2009). "State Capitalism Comes of Age". *Foreign Affairs*. Council on Foreign Relations.

¹¹ CDB is fully owned by states and have two main shareholders; the Ministry of Finance and the China Investment Corporation. China Investment Corporation is a sovereign wealth fund and it had over US\$810 billion in assets under management by the end of 2015.

¹² See Ru (2017) for detailed description of CDB's history and background.

¹³ It is also the largest Chinese bank for foreign investment and financing cooperation, long-term lending and bond issuance. It ranked 87th on the Fortune Global 500 list in 2015. (<http://www.cdb.com.cn>)

branches on the Chinese mainland, one offshore branch in Hong Kong and five representative offices in Cairo, Moscow, Rio de Janeiro, Caracas, and London.

The CDB is different from Chinese commercial banks in many ways despite the CDB and large commercial banks in China are all state-owned.¹⁴ First, the CDB issues policy loans which target mainly the infrastructure projects and the basic industries in China. Commercial banks are profit-driven and focus on rich provinces in China (e.g., areas along the east coast). Second, the CDB has longer and closer relationships with local governments than commercial banks do. CDB helped many local governments build the financing vehicles to raise debt for them. Around 50% to 60% of the outstanding loans of the local governments are coming from the CDB between 2006 and 2013 (Gao, Ru, and Tang, 2016).

Local politicians play an important role in obtaining credit from the CDB. In China, the Communist Party Committee Secretary at the municipal level (city secretary, thereafter) is essentially the leading political officer in the city. The city secretary has broad administrative power and controls within the city system and is responsible for the economic development of the city. For example, a city secretary generally has the sole power to appoint or remove any government officials in the city who are of lower political hierarchy. Maskin, Qian, and Xu (2000) show that promotion is one of the most important career aspirations for politicians in China. It is well known that GDP performance of the city has been the primary determinant of promotion for city secretaries (e.g. Li and Zhou, 2005). Thus, the city secretaries have strong motivations to borrow from the CDB and invest to boost the local GDP so that they can get promoted in future, which is consistent with Ru (2017) who documents promotion probabilities are positively associated with CDB loans increases. Career concerns incentivize a new city secretary to borrow

¹⁴ The big four commercial banks in China are Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Agriculture Bank of China (ABC), and Bank of China (BOC).

as soon and as much as possible from the CDB. In this paper, we employ the same identification method and explore the variations of CDB loans change following local politicians' turnover and thus the effect of CDB loans on firms' trade activities.

3. Data

3.1. China Customs Data

Our Chinese Customs data record the universe of firms' export and import transactions from 2000 to 2013, where these data have been collected and made available by the Chinese Customs Office. The data have been used in prior literature to study the export activities of China (e.g. Manova and Zhang (2009); Jarreau and Poncet (2014); Manova, Wei and Zhang (2015)). The data report the free-on-board value of firm exports (in US dollars) by product and country for over 200 hundred destinations and over 7000 products in the eight-digit Harmonized System (HS).¹⁵ The data also contain variables such as the product price, number of products, the type of trade, the means of transportation, the customs office where the transaction was processed, the region or city in China where the product was exported from or imported to, and any potential transfer country or region.¹⁶ Based on the information on firm ownership types, we assign firms in the Customs data into three groups: SOE, Private and Foreign. In China, state-owned enterprises (SOEs) are firms whose majority of shares are owned by government departments (e.g., Ministry of Finance, State-owned Assets Supervision and Administration Commission). Collectively-owned enterprises (COEs) are owned collectively by all residents in a community and they are mainly controlled by the local

¹⁵ Product classification is consistent across countries at the six-digit HS level. The number of distinct product codes in the Chinese eight-digit HS system is comparable to that in the ten-digit HS classification for the US.

¹⁶ See Manova and Zhang (2009) for more detail about the data and stylized facts about firm heterogeneity in Chinese trade.

governments. Hence, we assign SOEs and COEs to the SOE group since they are both controlled by the government. The foreign group contains the wholly foreign-owned affiliate firms. The private group contains the privately held firms and the joint venture firms of which the foreign ownership is less than 100%. We classify joint venture firms into the Private group because 1) they are different from the SOEs which are controlled by the government and are not necessarily profit maximizing entities; 2) they are different from foreign affiliate firms because these firms may be less financially constrained as they are backed by the parent companies. The Customs data also record the type of trade where exports are classified as ordinary trade, import-and-assembly processing trade (processing firm sources and pay for imported inputs), and pure assembly processing trade (processing firm receives foreign inputs for free).

Since we are interested in how government credit affects the export and import activities of the manufacturing firms, we exclude export-import firms that do not engage in manufacturing but serve exclusively as intermediaries between domestic producers (buyers) and foreign buyers (producers). There is no variable in the Customs data indicating whether a firm is trade intermediary, so we follow standard practice and use keywords in firms' names to identify them (e.g. Ahn, Khandelwal, & Wei, 2011; Manova, Wei, and Zhang, 2015).¹⁷ As the CDB loans data are available at 95 industries level, we utilize the concordance tables from World Integrated Trade Solution (WITS) to obtain four-digit SIC codes by matching the 6-digit HS codes of product.¹⁸ Then we match these SIC codes to the 95 industries assigned by the CDB loans. Finally, we drop observations with missing data on firm city and province information, industry codes using the CDB classification system and ownership type.¹⁹

¹⁷ We search for Chinese characters that mean “trading” and “importer” and “exporter”. In pinyin (Romanized Chinese), these phrases are: “jin4chu1kou3”, “jing1mao4”, “mao4yi4”, “ke1mao4” and “wai4jing1”.

¹⁸ The concordance table is available at “http://wits.worldbank.org/product_concordance.html”

¹⁹ We present a summary of the data cleaning process of China Customs Data in Appendix B.

From the cleaned Customs transaction-level data, we construct the firm-year level measures by aggregating the trades. We define the primary industry of the firm by using the firm's biggest export industry. For each firm and year, *LogExport* (*LogImport*) is the natural logarithm of the firm's total export (import) amount in the year. Figure 1 shows the total trade amounts for each of the three groups of firms and trade by each firm type group as a percentage of total trade amount. In Panel A, we observe export amounts rise for SOE firms, Private firms, and Foreign firms from 2000 to 2013. Private firms and foreign firms increase exports to a much larger extent. It is also confirmed by the bottom graph of Panel A where private firms take a larger portion of the total export market. In Panel B, imports increase quite similar among the three groups of firms.

[Insert Figure 1 about here]

NumExDestinations is the number of destination countries that firm exports to in the year. In Figure 2, we show the number of exporting firms within each firm type group in the top graph and the average number of firm's export destinations in the bottom graph. The number of private firms increases the most and number of SOEs are declining. SOEs tend to export to more countries than private firms and foreign affiliate firms even though all three types of firms export to more markets over the time. *NumExProducts* is the number of distinct four-digit HS product codes for a firm's export transactions, measuring the product varieties. *PctProcessing* is the share of processing exports in terms of total exports and *PctAssembly* is the share of pure assembly processing exports in terms of total processing trade. Table 1 presents the summary statistics and Table A1 in Appendix A contains the detailed variable definitions. The mean (median) amount for export is U.S. 6,300,000 (620,000) dollars and the mean (median) import amount is U.S. 7,840,000 (230,000) dollars. The distribution for both export and import amount are very right-skewed so we transform them by taking the natural logarithm. On average, a firm exports 6 types of products to 7.4

countries. 31% of an average firm's exports are processing trade and 23% of the processing exports are pure assembly exports.

[Insert Figure 2 about here]

3.2. CDB Loan Data

The proprietary CDB data contain loan information at the province-industry level. The data have information on the outstanding loan amounts, loan issuances and other loan variables across 95 industries and 31 provinces in mainland China from 1998 to 2013 at the monthly level.²⁰ The industries include infrastructure sectors (e.g. road, air, rail transportation, public facilities, and services) and industry sectors (e.g. agriculture, mining, textiles, machinery). We define *Infrastructure_Loan* at the province level for a firm if the firm is in the same province as the infrastructure loan. We define the province-industry level loan as *Direct_Loan* for a firm if the firm is in the same province and industry as the CDB industrial loan. The local government plays a key role in obtaining the CDB loans as most of the industrial loans go to local SOEs. Around 95% of the CDB industrial loans were granted to SOEs and the remaining 5% typically went to private firms with political connections (e.g. Ru, 2017). Figure 3 plots the total provincial CDB outstanding loan amounts.

[Insert Figure 3 about here]

Government credit could crowd out the private sector in the same industry but may have positive spillover effects on the private sector in related industries, especially the downstream industry. Ru (2017) finds that the loans to upstream industry of the private firms have positive effect on the private firms' total assets, total sales, ROA, and sales per worker, which is consistent

²⁰ The industry classification is comparable to the U.S. 2-digit SIC codes.

with the notion that loans to firms' upstream industry helped the downstream private sector. Therefore, we follow the same idea as suggested by Ru (2017) and define the *Upstream_Loan* for a firm if the CDB industrial loan is given to the upstream industry of the firm in the same province.

We use the national input-output (IO) matrix for 2007 from the National Bureau of Statistics of China to construct the upstream-downstream industry link. The CDB classifies the loans into 95 industries where the input-output matrix has 135 industries which are more detailed. We match these two industrial classifications by combining the IO industries. For each industry, we select the industry that has the highest supplies of inputs to be the upstream industry. Accordingly, the *Upstream_Loan* is defined using the constructed upstream-downstream industry link.

Table 1 presents the summary statistics for the CDB loans variables. Figure 4 illustrates the upstream-downstream flow process and Figure 5 illustrates graphically how the three types of CDB loans are defined.

[Insert Figure 4 about here]

[Insert Figure 5 about here]

3.3. Politician Profile Data and Chinese Industry Census Data

The data on Chinese local government politicians contain the basic information (e.g. gender, age, birth place) for all city mayors and city secretaries at the city-month level for 334 cities from 1949 to 2013.²¹ The normal term for a city secretary is five-year. In China, cities typically have their own five-year turnover cycles. In our sample, only one-third of the city secretaries' terms are synchronized with the national political turnover cycle which also occurred every five years. This

²¹ See Ru (2017) for detailed description of the local politicians' profiles data.

allows us to explore the variations of CDB loans amounts brought by the different five-year turnover cycles from different cities.

Given the concern that realized political turnover (e.g. promotion) can be endogenous, we use the predicted turnover cycle as instruments to predict loan changes following Ru (2017) to exploit the exogenous variations of CDB loans. The predicted turnover cycle is defined as follow. The first year of a city secretary's term is predicted by adding 5 years to the first year of previous city secretary's term. If there is no previous turnover cycle, we assign the actual first year of the city secretary as the predicted first year. For example, city secretary X took office in 2003 and secretary X's successor secretary Y took office in 2007. We then predict the first year of city secretary Y's term to be 2008 (i.e. $2003 + 5$). Since the predicted turnover cycle is pre-determined, it is unlikely that this would confound with contemporaneous economic conditions and can be used as the source of exogenous variation.

We use the Chinese Industry Census (CIC) data to define the city's focal industry, where cities in the same province usually focus on different industries and are often determined due to historical reasons.²² Following Ru (2017), for each year, we sum up the total assets of the SOEs by industry in the city and assign the industry with the largest SOEs total assets to be the city's focal industry.

[Insert Table 1 about here]

4. Empirical Analyses and Results

4.1. CDB Loans and Firm's Export

²² The CIC data is widely used in literature (e.g. Song et al., 2011; Ru, 2017).

To investigate the effects of CDB loans on firms' export activities, we begin by examining how the CDB loans affect the firm's export amount and whether the effects are different for various types of CDB loans. We merge the CDB province-industry level outstanding loans with the firm-level Customs data by firm's location and industry codes. Besides the industrial loans, we also include infrastructure loans in our regressions. Therefore, we perform the following regression analysis to explore how the three types of loans – *Direct_Loan*, *Infrastructure_Loan*, and *Upstream_Loan* – affect firm's export performance:

$$Y_{i,k,p,t} = \beta_0 + \beta_1 \text{Log}(\text{Direct_Loan})_{k,p,t} + \beta_2 \text{Log}(\text{Infrastructure_Loan})_{p,t} + \beta_3 \text{Log}(\text{Upstream_Loan})_{k,p,t} + \text{Firm FE} + \text{Year FE} + \varepsilon_{i,t} \quad (1)$$

where $Y_{i,k,p,t}$ are the dependent variables for firm i in industry k , province p , and year t . The dependent variables are the logarithm of total exports, number of firm export destination countries, number of export product types. $\varepsilon_{i,t}$ is the error term. We cluster the standard error at the firm level. We control for firm fixed effect to mitigate the concern that unobserved firm characteristics may affect our results and year fixed effect. Besides running the regressions for the full sample, we repeat the same regressions using the three subsamples of firms – SOE, private and foreign – to see whether government credit have different effects on different types of firms. The results are reported in Table 2.

We present the regression results of CDB loans effect on export amount in Panel A. The coefficients of *Direct_Loan* for private firms and foreign firms are insignificant, suggesting the CDB loans in the same industry have no effect on their export amounts. This may not be surprising as the CDB industrial loans are mostly granted to SOEs so private firms can hardly benefit from the CDB direct loans. However, both the coefficients of *Infrastructure_Loan* and *Upstream_Loan* are positive and statistically significant at the 1% level for private firms and foreign firms. This

suggests that the infrastructure loan amounts and upstream loan amounts are positively associated with export amounts for private firms and foreign affiliate firms. On average, when CDB infrastructure loans doubled, private firms in the same province increases export amounts by 6.27%, which is nearly U.S. \$400,000 evaluating at the average exporting firm in the sample (i.e. $\$6.3 \text{ million} * 0.0627 = \$395,010$).

In Panel B, we report the results of CDB loans on number of firm's export destination countries. Manova, Wei, and Zhang (2015) argue that tight credit conditions can reduce the firms' number of export destinations if they face a separate fixed cost in each market they enter. The fixed costs can be research on the profitability of potential markets, investment in market-specific capacity, product customization, regulatory compliance and so on. Given limited credit, financially constrained firms must decide which markets to serve and add export destinations in descending order of profitability until they exhaust their limited financial resources. We find CDB loans in the same industry (*Direct_Loan*) have no effect on private firms because they probably have no access to these loans. However, the coefficients on *Upstream_Loan* are significantly positive for both private group firms and foreign affiliate firms, suggesting that the private sector firms can export to more destinations if there are more loans to their upstream industries. Besides, given the significant and positive coefficient of *Infrastructure_Loan*, it suggests that infrastructure loan is another channel through which private firms can benefit from the CDB loans as it increases the number of private firms' export destinations. A 100% increase in infrastructure loan is associated with 0.3 more destination countries for private firms.

We then investigate whether the CDB loans affect the product varieties of export firms. Studies have shown credit constraints could reduce export firm's number of products (e.g. Manova, Wei, and Zhang, 2015; Muuls, 2015). We then examine whether different types of loans along the

supply chain can impact firm's export product varieties. We regress the number of distinct four-digit Harmonized System product codes of a firm's export on the CDB loans and present the results in Panel C of Table 2. We observe that coefficients of *Upstream_Loan* are significant and positive for non-SOE firms, suggesting the CDB upstream industrial loans can benefit the downstream private sector firms in terms of product scope.

Taken the results together, we find strong positive effects of CDB upstream loan amounts on private firms' export performance measured by export amounts, number of destination countries and product varieties. We also show infrastructure loan amounts are positively associated with firm's export amounts and number of export markets. This supports the notion that CDB aids infrastructure projects and basic industries such as energy and mining to help related industries, consistent with Stiglitz (1993) where government credit can have positive spillover effects.

[Insert Table 2 about here]

4.2. CDB Loans and Firm's Export Regime

Manova and Yu (2016) show that credit constraints push firms to conduct more processing trade and pure assembly trade. They find profits, profit-to-sales, and value added are higher for firms that conduct more ordinary trade relative to processing trade and more import-and-assembly trade relative to pure assembly. Higher value-added and more profitable trade regimes usually require more working capital and incur high upfront costs and credit constrained firms do not have enough financial resources to overcome this barrier. Processing trade contains import-and-assembly processing trade and pure assembly processing trade. The Chinese government also recognized the challenge that China depended too much on processing trade and China has often been the major

target of trade remedy measures.²³ Hence, we examine whether various types of CDB loans can promote firm exports to a higher value-added regime. In particular, we regress the share of processing exports (lower profitable trade regime than ordinary trade) in terms of total exports on CDB loans and present the results in Panel A of Table 3. Then in Panel B, within the regime of processing trade, we examine whether CDB loans help firms move from pure assembly exports to more profitable import-and-assembly exports.

In Panel A, the negative coefficients on *Infrastructure_Loan* for private firms and foreign firms indicate that more infrastructure loans are associated with less processing trade, in another word more ordinary trade. Similarly, CDB infrastructure loans are associated with less pure assembly trade in the regime of processing trade as the coefficients on *Infrastructure_Loan* for private firms and foreign firms are both significantly negative in Panel B. On average, if infrastructure loan amounts double, the share of processing trade would decrease by 1.8% and share of pure-assembly trade would decrease by 2.5% for private firms. Taken together, infrastructure loans have positive effects on non-SOE firms' trade regime in that they help private sectors firms to move to a more profitable and higher value-added trade regime (from pure assembly to import-and-assembly, and from processing trade to ordinary trade). The CDB upstream loans seem to increase import-and-assembly exports relative to pure assembly exports but decrease ordinary exports relative to processing exports.

[Insert Table 3 about here]

4.3. Instrumental Variable Approach

²³ In a report filed to WTO which summarizes China's trade performance since joining the WTO for 10 years, the Chinese government stated that one of the key challenges for China is that China over-dependent on processing trade. (https://www.wto.org/english/thewto_e/acc_e/s7lu_e.pdf)

The results in Table 2 and Table 3 may be subject to endogeneity. On one hand, CDB may lend to the industries or provinces with good growth potential where firms have good investment opportunities. On the other hand, CDB may grant credits to support the under-developed regions where firms in such regions typically have less investment opportunity at the first place. To explore the causal effects of CDB loans, we use 2SLS to exploit the exogenous variations of CDB credit flows using the predicted political turnover following the identification strategy in Ru (2017). Specifically, we interact city's focal industry defined using CIC data with the predicted city secretary turnover cycle defined using politician profile data and use these interactions to instrument CDB province-industry level loans. The city secretary would borrow more from the CDB for SOEs in the city's focal industry if the secretary is in her earlier years of the term. We treat this as an exogenous shock to the province-industry level CDB loans. For a given year, suppose the focal industry of city C is industry I and city C belongs to province P. If there is a predicted political turnover in city C, then we predict the new secretary of city C would borrow more in industry I once she takes office, which contributes to increase the total CDB industrial loans in province P and industry I. The regression can be represented as follows:

$$\begin{aligned} \text{Log}(\text{Loan})_{k,p,t} = & \beta_0 + \beta_1 \text{First}_{k,p,t} + \beta_2 \text{Second}_{k,p,t} + \beta_3 \text{Third}_{k,p,t} + \beta_4 \text{Fourth}_{k,p,t} + \beta_5 \text{Fifth}_{k,p,t} + \\ & \text{Industry FE} + \text{Province} \times \text{Year FE} \end{aligned} \quad (2)$$

where $\text{Log}(\text{Loan})_{k,p,t}$ is the logarithm of the CDB outstanding loan amount in industry k , province p and year t . $\text{First}_{k,p,t}$ is a dummy variable equals to one if there is a city in province p whose focal industry is k in year t with a secretary who is in his first year. $\text{Second}_{k,p,t}$ is a dummy variable equals to one if there is a city in province p whose focal industry is k in year t with a secretary who is in his second year. $\text{Third}_{k,p,t}$ to $\text{Fifth}_{k,p,t}$ are defined in the similar way.

We use the $First_{k,p,t}$ to $Fifth_{k,p,t}$ to instrument CDB loans and perform 2SLS regressions. Since the instruments for *Direct_Loan* and *Upstream_Loan* are different and we cannot instrument *Infrastructure_Loan* as it does not have variation within the province level, we report the 2SLS results separately for each of the *Direct_Loan* and *Upstream_Loan*. In the second stage regression, besides firm fixed effect, we include province×year fixed effect to control for any unobservable province and year economic conditions.

We first present the 2SLS regressions results for export amount in Table 4. Panel A shows the effect of CDB direct industrial loans on export amounts. The coefficient of *Direct_Loan* in Column (1) is 0.012 and significant at 1% level, suggesting CDB loans causally impact firms' export amounts positively and a 100% increase in CDB loans in an industry leads to an increase in export amounts for firms in the same industry and province by 1.2%. The subsample analysis further shows that the positive effect is driven by SOE firms as only the coefficient of *Direct_Loan* in Column (2) is significantly positive among the three subsamples. When CDB direct loan amounts double, SOEs export amounts would increase by 5.6%. This suggests CDB industrial loans increase the export amounts of SOEs in the same industry. Non-SOE firms cannot benefit from the CDB direct industrial loans since the coefficients in Column (3) and (4) are not statistically different from 0. In Panel B, we instrument for *Upstream_Loan* and report the 2SLS regressions results. Although the coefficient on *Upstream_Loan* in the full sample is positive and significant, the positive effects are now driven by the private sectors: private firms and foreign affiliate firms, given the significantly positive coefficients in Column (3) and (4). On average, when the upstream industrial loan doubled, the downstream private firms (foreign affiliate firms) increased export amounts by 3.15% (3.22%). This indicates that CDB upstream industrial loans are beneficial for private firms' export activity. This contrasts with the results in Panel A where the positive effect

of *Direct_Loan* on export amounts is driven by SOEs. In sum, although CDB industrial loans do not benefit non-SOE firms in the same industry, they have positive spillover effects on downstream private sector firms' export amounts.

[Insert Table 4 about here]

Next, we perform 2SLS using the number of firm's export destinations as the dependent variable and reports the results in Table 5. We find the higher CDB direct industrial loans in general leads to more export destination countries since the coefficient of *Direct_Loan* is 0.0562 at 1% significant level in Column (1) of Table 5. Although the coefficient in Column (4) is positive and significant which suggest foreign affiliate firms may capture part of the benefits, SOEs appear to drive most of the positive effect of CDB direct loans given the coefficient in Column (2) is 0.2418 at 1% significance level which is five times bigger than the coefficients in other columns. In Panel B, the coefficients on *Upstream_Loan* in both Column (3) and (4) are positive and significant at 1% level, suggesting CDB upstream loans help private firms to export to more countries. The results are consistent with our hypothesis that the CDB upstream loans have positive spillover effects on the downstream private sectors firms.

[Insert Table 5 about here]

We then perform the 2SLS regressions for product varieties and present the results in Table 6. In Panel A, the coefficients on *Direct_Loan* in Column (3) and Column (4) are both negative and significant, consistent with the notion that the CDB industrial loans in the same industry may crowd out the private sector firms in the product variety dimension. Considering our previous results that CDB loans to SOEs increase the SOEs export amounts, it could increase the competitive pressure for private firms in the same industry. Hence, private firms may be more focused on their core products by reducing their product variety. We do not observe positive

spillover effects from upstream loans provided the coefficient estimates are all insignificant in Panel B.

[Insert Table 6 about here]

Finally, we turn our attention to trade regimes and report the 2SLS regressions results in Table 7. The coefficient in Column (1) of Panel A is positive and significant, which means more CDB industrial loans lead to a higher portion of processing trade relative to ordinary trade. The subsample analyses reveal that the effects are driven by private sectors firms. The coefficient estimates in Column (3) and (4) are 0.0009 and 0.0015 respectively. On average, a 100% increase in CDB industrial loans results in the increase of processing trade percentage by 0.09% for private firms and 0.15% for foreign affiliate firms. The CDB industrial loans tend to crowd out private sector firms in the same industry to push these firms engaging in less ordinary trade which is typically more profitable and of higher value-add. This is probably due to increased competition from SOEs which receive more CDB loans and export more.

[Insert Table 7 about here]

As expected, CDB industrial loans generally benefit SOE firms export activities because these loans are mostly granted to SOEs. In some dimensions, the CDB industrial loans are detrimental to private firms in the same industry given the negative relation between direct loans and product scopes and percentage of ordinary trade, which is consistent with the view that government credit allocation can be inefficient. However, our results suggest that CDB industrial loans can be valuable to private firms in the downstream industries. In particular, CDB loans have positive spillover effects on the downstream private firms in terms of export amounts and number of destination countries. We uncover one good side of government credit by documenting the positive spillover effect of CDB loans on downstream private firms.

Finally, we calculate the net effects of CDB industrial loans by performing a back-of-the-envelope calculation. Although CDB industrial loans do not benefit the private sector in the same industry, they help private firms in downstream industries to export more. We use the estimated coefficients of CDB industrial loans in Table 4 to perform the back-of-the-envelope calculation. In particular, as shown in Panel B of Table 4, the coefficient of CDB upstream industrial loans on private firms is 0.0315, which means a one-unit increase in the logarithm of CDB upstream industrial loan increase the logarithm of each private firm's export amount by 0.0315 unit in the same province and in the downstream industry. We compute the percentage change of the CDB upstream loan amounts from last year to current year for each private firm in each year. We multiply this percentage change by 0.0315 to obtain the percentage change of this private firm's export amounts in the year. We find that a \$1 increase in CDB outstanding industrial loan amount leads to a \$0.16 increase in private firms' export amounts. Similarly, we repeat the back-of-the-envelope calculation for SOEs and foreign affiliate firms and find when CDB outstanding industrial loan amount increases by \$1, the export amount for SOEs (foreign affiliate firms) increases by \$0.71 (\$0.23).

5. Conclusion

This paper examines the heterogeneous effects of government credit across different levels of the supply chain (direct loan vs. upstream loan) and different types of government loans (infrastructure loan vs. industrial loan) on the firm's export activities. By merging the unique loan data from the China Development Bank with the detailed universal transaction-level data from China Customs, we find that the CDB direct loans lead to higher export amounts of SOEs and lower export product varieties of private firms in the same industry. However, these industrial loans help private firms

in the downstream industries in that higher CDB industrial loans results in higher export amounts and more export countries of private firms in the downstream industries. This effect is not pronounced for SOEs in downstream industries. Government loans to infrastructure generally have positive effects on export activities for all types of firms, with a stronger effect for private firms.²⁴

Besides China, many countries have their own national development finance institutions (DFI), even for the most developed economies such as US and Germany. One major concern for such DFIs is to facilitate and promote international trade. For example, the main objective for the Export–Import Bank of the United States which is a wholly owned federal government corporation, is to assist in financing and facilitating U.S. exports of goods and services. Based on the empirical findings of this paper, policy makers should consider different types of government credit at different levels along the supply chain when making lending decisions. Hence, this paper’s findings are important for policy makers across the globe.

²⁴ The results are qualitatively similar after we control for firm characteristics, though they are not incorporated in this version. Firm characteristics are obtained by using name matching the Customs data with the CIC firm level data. We will conduct more detailed quality checks of the matching and then update all the results with firm controls. I leave that to future version.

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Figure 1: Trade Amount by Firm Types

This figure shows the trend for trade amounts by three types of firms. The three types of firms are SOE, Private, and Foreign. SOE contains the state-owned enterprises and collectively-owned enterprises. The private group consists of private domestic firms and joint ventures. The foreign group contains the wholly foreign owned affiliate firms. The top figure of Panel A shows the export amounts for each of the three types of firms. The bottom figure of Panel A shows the export amount as a percentage of the total export amount. Panel B shows the import amount. The unit is in billion USD.

Panel A: Export

Panel B: Import

Figure 2: Extensive and Intensive Margins of Exporting Firms

This figure shows extensive margin (the number of firms that engage in export) and intensive margin (the average number of firms' export destinations) for exporting firms. The top graph of this figure shows the number of exporting firms for each type of firms over the years. The bottom figure shows average number of firms' export destination countries across three types of firms over time.

Figure 3: Time Trend of CDB Outstanding Loan Amounts

This figure plots the aggregate CDB outstanding loan amounts at province-level for each year. The unit is in billions RMB.

Figure 4: Illustration of upstream and downstream flow process

This figure illustrates how upstream industry is defined given a particular industry at the 2-digit Chinese industry classification level which is comparable to U.S. SIC 2-digit industry classification. Utilizing the Chinese National Input-Output (IO) matrix for 2007, we employ a simple method to identify the upstream-downstream link, where IO table (industry x industry table) describes the sale and purchase relationships between producers and consumers within an economy. For each industry, we select the industry that has the highest supplies of inputs to be the key upstream industry. Taking plastic products industry as an example illustrated in the below graph, the IO table shows contributions of inputs from all industries and we choose the industry that supply the most to plastic products industry as its key upstream industry. In this case, it's the chemical materials & chemical products manufacturing. Therefore, CDB loans to chemical materials industry are considered upstream loan to firms in the plastic products industry in our study and we intend to study how such upstream loans affect the export activities of the downstream firms along the industry supply chain.

Figure 5: Graphical representation of CDB loans

This figure graphically shows how various types of CDB loans are defined. Firm X belongs to industry U and province A and firm Y belongs to industry D and province A. Industry U is the upstream industry of industry D. In another word, industry D is the downstream industry of industry U. CDB industrial loans are at province $\times$ industry $\times$ year level. Suppose CDB grants industrial loan to province A and industry U, the loan is defined as *Direct_Loan* for firm X because the firm is in the same industry as the industrial loan. Meanwhile, the same loan is defined as *Upstream_Loan* for firm Y because firm Y is in the downstream industry of the industrial loan which is granted to industry U. CDB infrastructure loans are at province $\times$ year level. Thus, the infrastructure loan to province A is defined as *Infrastructure_Loan* for all firms in province A (i.e. the loan is the same for firm X and firm Y).

Table 1: Summary Statistics

This table reports the summary statistics. Variables in Panel A are at the firm $\times$ year level constructed from the China Customs data from 2000 to 2013. However, *PctProcessing* and *Pctassembly* are only available from 2000 to 2006 due to data limitation. Panel B shows the summary statistics for the CDB loan data. *Direct_Loan* and *Upstream_Loan* are at the province $\times$ industry $\times$ year level, which covers 31 provinces and 95 industries between 2000 and 2013. *Infrastructure_Loan* is at the province $\times$ year level covering 31 provinces from 2000 to 2013. The variable definitions are in Table A1 in Appendix.

Variable	N	Mean	SD	Min	25%	Median	75%	Max
Panel A: Firm Data								
<i>Export</i>	1,903,328	6.30	98.68	0.00	0.12	0.62	2.50	28267.27
<i>LogExport</i>	1,903,328	-0.67	2.34	-13.82	-2.11	-0.48	0.92	10.25
<i>NumExDestinations</i>	1,903,192	7.38	10.78	1.00	1.00	3.00	9.00	196.00
<i>NumExProducts</i>	1,903,328	5.97	17.60	1.00	1.00	2.00	5.00	823.00
<i>PctProcessing</i>	625,317	0.31	0.43	0.00	0.00	0.00	0.87	1.00
<i>PctAssembly</i>	255,837	0.23	0.41	0.00	0.00	0.00	0.21	1.00
<i>ExHHI</i>	1,903,328	0.64	0.32	0.00	0.34	0.65	1.00	1.00
<i>Import</i>	1,376,888	7.84	220.77	0.00	0.03	0.23	1.37	104405.6
<i>LogImport</i>	1,376,888	-1.72	2.96	-13.12	-3.54	-1.48	0.31	11.56
Panel B: Province Data								
<i>Direct_Loan</i>	27,698	12.70	54.36	0.00	0.00	0.08	2.19	1369.09
<i>Upstream_Loan</i>	33,370	21.91	62.10	0.00	0.00	0.41	6.05	1216.36
<i>Infrastructure_Loan</i>	434	638.03	498.19	0.00	255.64	490.64	943.12	2447.74

Table 2: Effects of CDB Loans on Firm's Export: Evidence from OLS Regressions

This table reports the regression results of firm exports on different CDB loans, estimated at the firm-year level. The sample is from 2000 to 2013. In Panel A, the dependent variable is *LogExport*, which reports the effect of CDB loans on firm's export amounts. In Panel B, we report the results of the effects of CDB loans on firm's number of export destinations (*NumExDestinations*). In Panel C, the dependent variable is *NumExProducts*, which is the number of products measured at the four-digit Harmonized System (HS) level. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Export Amount

	Dependent variable: <i>LogExport</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0006* (-1.923)	-0.0045*** (-3.826)	-0.0002 (-0.583)	-0.0001 (-0.206)
<i>Log(Infrastructure_Loan)</i>	0.0506*** (3.840)	-0.0262 (-1.029)	0.0627*** (3.399)	0.0697*** (3.183)
<i>Log(Upstream_Loan)</i>	0.0043*** (12.956)	0.0017 (1.391)	0.0047*** (10.691)	0.0044*** (7.861)
Observations	1,375,739	101,353	835,152	437,921
Adjusted R-squared	0.696	0.667	0.672	0.735
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Panel B: Number of Export Destinations

	Dependent variable: <i>NumExDestinaions</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	0.0006 (0.390)	-0.0208*** (-2.628)	0.0016 (0.846)	0.0047** (2.404)
<i>Log(Infrastructure_Loan)</i>	0.2709*** (5.233)	0.1978* (1.839)	0.3001*** (3.823)	0.1206 (1.497)
<i>Log(Upstream_Loan)</i>	0.0168*** (10.125)	-0.0039 (-0.470)	0.0200*** (8.972)	0.0176*** (8.077)
Observations	1,375,654	101,322	835,111	437,911
Adjusted R-squared	0.754	0.779	0.729	0.784
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Panel C: Product Varieties

	Dependent variable: <i>NumExProducts</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0041** (-2.051)	-0.0279* (-1.786)	-0.0020 (-0.858)	-0.0019 (-1.218)
<i>Log(Infrastructure_Loan)</i>	-0.0354 (-0.396)	-0.4146 (-1.560)	0.1417 (1.534)	0.0397 (0.544)
<i>Log(Upstream_Loan)</i>	0.0250*** (8.483)	-0.0106 (-0.528)	0.0329*** (8.966)	0.0245*** (12.586)
Observations	1,375,739	101,353	835,152	437,921
Adjusted R-squared	0.722	0.795	0.672	0.714
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Table 3: Effects of CDB Loans on Firm's Trade Regime

This table reports the regression results of CDB loans effects on firm's choice of trade type, estimated at the firm-year level. The sample is from 2000 to 2006, due to incomplete information on types of trade after 2007 in the Customs data. In Panel A, the dependent variable is *PctProcessing*, which is the share of processing exports in total exports. In Panel B, the dependent variable is *PctAssembly*, which is the share of pure assembly in processing exports. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: Processing Trade vs. Ordinary Trade

	Dependent variable: <i>PctProcessing</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0001 (-1.374)	-0.0001 (-0.812)	-0.0001 (-1.523)	0.0001 (0.989)
<i>Log(Infrastructure_Loan)</i>	-0.0164*** (-6.444)	-0.0000 (-0.010)	-0.0181*** (-5.206)	-0.0226*** (-5.006)
<i>Log(Upstream_Loan)</i>	0.0002*** (2.606)	0.0002 (1.040)	0.0003*** (3.657)	-0.0000 (-0.440)
Observations	416,030	56,218	200,390	159,359
Adjusted R-squared	0.891	0.768	0.881	0.876
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Panel B: Pure Assembly Process Trade vs. Import-and-Assembly Processing Trade

	Dependent variable: <i>PctAssembly</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	0.0001 (1.566)	0.0004 (0.811)	0.0003* (1.922)	-0.0000 (-0.115)
<i>Log(Infrastructure_Loan)</i>	-0.0242*** (-6.823)	0.0186 (1.141)	-0.0250*** (-4.844)	-0.0314*** (-6.210)
<i>Log(Upstream_Loan)</i>	-0.0002*** (-2.980)	-0.0005 (-1.044)	-0.0004*** (-3.354)	-0.0001 (-0.697)
Observations	197,605	13,393	73,500	110,709
Adjusted R-squared	0.891	0.820	0.878	0.908
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Table 4: Effects of CDB Loans on Export Amounts (2SLS)

This table shows the two-stage least squares regressions results by using *First* to *Fifth* as instrumental variables for the logarithm of the CDB province-industry level outstanding loan amounts in 39 industries and 27 provinces (excluding Beijing, Shanghai, Tianjin, and Chongqing). The sample is from 2000 to 2013. Panel A presents the 2SLS regression results for *Direct_Loan* while Panel B reports the second stage regression results for *Upstream_Loan*. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. Cragg-Donald Wald F-statistics for weak identification tests are reported. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: CDB Direct Loan

	Dependent variable: <i>LogExport</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	0.0120*** (3.019)	0.0558*** (4.335)	0.0080 (1.266)	0.0046 (0.861)
Observations	1,424,393	105,970	885,431	432,468
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1368	113.3	647.8	658

Panel B: CDB Upstream Loan

	Dependent variable: <i>LogExport</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Upstream_Loan)</i>	0.0305*** (5.408)	0.0215 (1.078)	0.0315*** (3.488)	0.0322*** (4.216)
Observations	1,309,454	90,557	807,321	411,135
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	557.5	40.9	247.5	269.6

Table 5: Effects of CDB Loans on Firm's Export Destinations (2SLS)

This table shows the two-stage least squares regressions by using *First* to *Fifth* as instrumental variables for the logarithm of the CDB province-industry level outstanding loan amounts in 39 industries and 27 provinces (excluding Beijing, Shanghai, Tianjin, and Chongqing). The sample is from 2000 to 2013. The dependent variable is the number of firm export destination countries. Panel A presents the regression results using *Direct_Loan* while Panel B reports the results using *Upstream_Loan*. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. Cragg-Donald Wald F-statistics for weak identification tests are reported. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: CDB Direct Loan

	Dependent variable: <i>NumExDestinations</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	0.0562*** (3.291)	0.2418*** (3.539)	0.0431 (1.571)	0.0427** (2.353)
Observations	1,424,302	105,943	885,390	432,452
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1367	113.2	647.3	658.1

Panel B: CDB Upstream Loan

	Dependent variable: <i>NumExDestinations</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Upstream_Loan)</i>	0.1365*** (5.875)	0.1403 (1.401)	0.1675*** (4.270)	0.1194*** (4.531)
Observations	1,309,368	90,534	807,277	411,119
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	557.7	40.90	247.6	269.5

Table 6: Effects of CDB Loans on Firm's Product Varieties (2SLS)

This table shows the two-stage least squares regressions by using *First* to *Fifth* as instrumental variables for the logarithm of the CDB province-industry level outstanding loan amount in 39 industries and 27 provinces (excluding Beijing, Shanghai, Tianjin, and Chongqing). The sample is from 2000 to 2013. The dependent variable is the number of a firm's product measured at the four-digit Harmonized System product code level. Panel A presents the regression results using *Direct_Loan* while Panel B reports the results using *Upstream_Loan*. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. Cragg-Donald Wald F-statistics for weak identification tests are reported. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: CDB Direct Loan

	Dependent variable: <i>NumExProducts</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0326 (-1.333)	0.1996 (1.546)	-0.0869** (-2.353)	-0.0850*** (-5.184)
Observations	1,424,393	105,970	885,431	432,468
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1368	113.3	647.8	658

Panel B: CDB Upstream Loan

	Dependent variable: <i>NumExProducts</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Upstream_Loan)</i>	0.0256 (0.781)	0.2694 (1.309)	-0.0712 (-1.375)	0.0057 (0.274)
Observations	1,309,454	90,557	807,321	411,135
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	557.5	40.86	247.5	269.6

Table 7: Effects of CDB Loans on Firm's Trade Regime (2SLS)

This table shows the two-stage least squares regressions by using *First* to *Fifth* as instrumental variables for the logarithm of the CDB province-industry level outstanding loan amount in 39 industries and 27 provinces (excluding Beijing, Shanghai, Tianjin, and Chongqing). The sample is from 2000 to 2006. In Panel A and B, the dependent variable is the share of processing trade. In Panel C and D, the dependent variable is share of pure-assembly trade. Panel A and C present the regression results using *Direct_Loan* while Panel B and D report the results using *Upstream_Loan*. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. Cragg-Donald Wald F-statistics for weak identification tests are reported. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: CDB Direct Loan and Share of Processing trade

	Dependent variable: <i>PctProcessing</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	0.0008** (2.133)	0.0005 (0.463)	0.0009* (1.731)	0.0015** (2.213)
Observations	431,055	58,931	212,838	159,267
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1669	201	877.3	714.4

Panel B: CDB Upstream Loan and Share of Processing trade

	Dependent variable: <i>PctProcessing</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Upstream_Loan)</i>	0.0003 (0.674)	0.0015 (1.017)	0.0008 (1.150)	-0.0006 (-0.762)
Observations	393,969	50,696	193,038	150,216
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1640	129.9	790.7	741.9

Panel C: CDB Direct Loan and Share of Pure-assembly trade

	Dependent variable: <i>PctAssembly</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0006 (-1.160)	-0.0011 (-0.634)	0.0007 (0.937)	-0.0012* (-1.674)
Observations	192,127	12,882	69,718	109,524
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	835.5	82.77	290.4	499.9

Panel D: CDB Upstream Loan and Share of Pure-assembly trade

	Dependent variable: <i>PctAssembly</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Upstream_Loan)</i>	-0.0006 (-0.977)	-0.0033 (-1.284)	-0.0006 (-0.585)	0.0004 (0.562)
Observations	186,446	12,068	67,673	106,702
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1061	57.28	375.5	614.7

Appendix A

Table A1: Variable Definitions

Variable	Definition
<i>Export</i>	The total export amount at the firm $\times$ year level in the Customs data. The unit is in millions USD.
<i>LogExport</i>	Natural log of the export amount (in millions USD) of the firm in the Customs data.
<i>NumExDestinations</i>	Number of a firm's export destination countries in the Customs data.
<i>NumExProducts</i>	Number of a firm's export product varieties (measured at the four-digit Harmonized System product code level) in the Customs data.
<i>PctProcessing</i>	Percentage of a firm's processing exports amount in terms of total exports, which is (pure assembly processing exports + import-and-assembly processing exports) / (pure assembly processing exports + import-and-assembly processing exports + ordinary exports).
<i>PctAssembly</i>	Percentage of a firm's assembly processing export amounts in terms of total processing export amounts, which is (pure assembly processing exports) / (pure assembly processing exports + import-and-assembly processing exports).
<i>ExHHI</i>	The Herfindahl index for a firm's export amount to each destination country in the Customs data. It's computed by squaring the percentage of a firm-destination export amount in terms of the firm's total export amount and then summing the resulting number. A higher number indicates a firm's export is more concentrated among a small number of countries.
<i>Import</i>	Total import amount at the firm $\times$ year level in the Customs data. The unit is in millions USD.
<i>LogImport</i>	Natural log of the import amount (in millions USD) of the firm in the Customs data
<i>Direct_Loan</i>	Amount of CDB total direct outstanding loan amounts at province $\times$ industry level, the loan is defined as "direct loans" for a firm if the firm is in the same province and industry as the loans. The unit is in hundred million RMB.
<i>Upstream_Loan</i>	Amount of CDB total upstream outstanding loan amounts at province $\times$ industry level, the loan is defined as "upstream loans" for a firm if the loan is given to the upstream industry of the firm in the same province. The unit is in hundred million RMB.
<i>Infrastructure_Loan</i>	Amount of CDB total infrastructure outstanding loan amounts at the province level. The unit is in hundred million RMB.

Table A2: CDB Loans Effects on Import Amounts (OLS)

This table reports the regressions of firm imports amount on CDB loan amounts, estimated at the firm-year level. The sample is from 2000 to 2013. The dependent variable is the natural logarithm of import amounts. The regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	Dependent variable: <i>LogImport</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0005 (-1.062)	-0.0043** (-2.372)	0.0003 (0.416)	-0.0002 (-0.279)
<i>Log(Infrastructure_Loan)</i>	-0.0858*** (-5.351)	-0.0727** (-2.024)	-0.0370 (-1.469)	-0.1318*** (-5.345)
<i>Log(Upstream_Loan)</i>	0.0030*** (6.216)	0.0026 (1.383)	0.0027*** (3.661)	0.0036*** (5.460)
Observations	935,135	71,670	432,173	419,829
Adjusted R-squared	0.722	0.671	0.705	0.727
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Table A3: CDB Loans Effects on Import Amounts (2SLS)

This table shows the two-stage least squares regressions results by using *First* to *Fifth* as instrumental variables for the logarithm of the CDB province-industry level outstanding loan amount in 39 industries and 27 provinces (excluding Beijing, Shanghai, Tianjin, and Chongqing). The sample is from 2000 to 2013. The dependent variable is the natural log of firm's import amount. Panel A presents the regression results using *Direct_Loan* while Panel B reports the results using *Upstream_Loan*. For each panel, the regression is performed using the full sample, the SOE group subsample, the Private group subsample, and the Foreign group subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. Cragg-Donald Wald F-statistics for weak identification tests are reported. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

Panel A: CDB Direct Loans

	Dependent variable: <i>LogImport</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	0.0050 (0.959)	-0.0216 (-0.942)	0.0037 (0.395)	0.0109* (1.875)
Observations	895,052	67,647	421,412	402,373
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	1012	71.1	366.8	594.2

Panel B: CDB Upstream Loans

	Dependent variable: <i>LogImport</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Upstream_Loan)</i>	0.0374*** (4.635)	0.0284 (0.823)	0.0565*** (3.828)	0.0184* (1.934)
Observations	813,564	58,865	378,009	372,836
Firm FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm
Wald F-stat	389.9	24.6	145.2	232.1

Table A4: CDB Loans Effects on Firm Export Country Concentration (OLS)

This table reports the regressions on how CDB loan amounts affect the concentration of a firm's export among destination countries. The sample is from 2000 to 2013. The dependent variable is the Herfindahl index for a firm's export amount to each destination country. The regression is performed using the full sample, the SOE firms subsample, the Private firms subsample, and the Foreign firms subsample. Firm fixed effect and Province $\times$ Year fixed effect are included in all regressions. Standard errors are clustered by firm for all regressions and t-statistics are reported in parentheses. ***, **, and * indicate statistical significant at the 1%, 5%, and 10% level, respectively.

	Dependent variable: <i>ExHHI</i>			
	(1) Full Sample	(2) SOE	(3) Private	(4) Foreign
<i>Log(Direct_Loan)</i>	-0.0000 (-0.210)	0.0003* (1.944)	0.0000 (0.713)	-0.0002** (-2.296)
<i>Log(Infrastructure_Loan)</i>	-0.0002 (-0.119)	0.0029 (0.950)	-0.0041 (-1.553)	0.0084*** (2.808)
<i>Log(Upstream_Loan)</i>	-0.0002*** (-4.795)	-0.0000 (-0.252)	-0.0003*** (-4.180)	-0.0002*** (-2.898)
Observations	1,375,739	101,353	835,152	437,921
Adjusted R-squared	0.664	0.613	0.648	0.684
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Cluster	Firm	Firm	Firm	Firm

Appendix B: Data Cleaning Summary for China Customs Data

This table presents the summary of the Customs data after each step of data cleaning process.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Original sample														
Obs (Total)	10,598,247	12,682,006	13,843,463	16,616,696	19,703,008	22,819,289	25,661,754	10,635,560	11,230,600	11,340,589	13,347,230	14,288,585	15,933,823	16,662,038
Obs (Import)	5,398,454	6,236,572	6,473,741	7,375,377	8,437,759	9,091,932	9,487,708	3,115,945	3,235,334	3,077,069	3,433,474	3,639,980	3,986,612	4,009,793
Obs (Export)	5,199,738	6,445,434	7,369,722	9,241,319	11,265,249	13,727,354	16,174,046	7,519,615	7,995,266	8,263,520	9,913,755	10,648,494	11,947,128	12,612,704
Num of Firms	82,064	89,660	104,245	124,299	153,779	179,667	208,425	236,505	251,965	262,984	285,691	310,873	328,827	344,192
After removing duplicates														
Total Obs	10,598,216	11,623,265	13,843,454	16,616,695	19,703,008	22,819,279	25,656,341	10,635,560	11,230,600	11,340,589	13,347,230	14,288,423	14,960,009	15,568,074
Obs (Import)	5,398,445	5,718,967	6,473,741	7,375,377	8,437,759	9,091,932	9,486,391	3,115,945	3,235,334	3,077,069	3,433,474	3,639,896	3,668,907	3,685,125
Obs (Export)	5,199,716	5,904,298	7,369,713	9,241,318	11,265,249	13,727,346	16,169,950	7,519,615	7,995,266	8,263,520	9,913,755	10,648,416	11,291,101	11,882,948
Num of Firms	82,064	89,660	104,245	124,299	153,779	179,667	208,425	236,505	251,965	262,984	285,691	310,873	328,827	344,192
After removing intermediary firms														
Total Obs	7,054,141	7,793,705	9,333,733	11,183,078	13,485,345	16,419,411	17,140,088	6,457,315	6,587,895	6,504,155	7,548,083	8,872,456	8,616,459	9,600,319
Obs (Import)	4,225,320	4,472,723	5,095,205	5,860,310	6,791,449	7,472,232	7,707,341	2,508,105	2,587,857	2,441,424	2,715,459	2,953,616	2,886,681	2,905,462
Obs (Export)	2,828,766	3,320,982	4,238,528	5,322,768	6,693,896	8,947,178	9,432,747	3,949,210	4,000,038	4,062,731	4,832,623	5,918,729	5,729,777	6,694,856
Num of Firms	73,281	79,857	93,019	109,489	132,421	161,681	169,393	187,342	197,493	202,873	216,764	253,330	245,149	257,542
After dropping observations with missing city information and missing firm ownership type information														
Total Obs	7,053,978	7,793,692	9,333,733	11,183,078	13,485,345	16,419,410	17,140,052	6,457,315	6,587,895	6,504,133	7,548,066	8,867,302	8,614,660	9,596,699
Obs (Import)	4,225,248	4,472,711	5,095,205	5,860,310	6,791,449	7,472,232	7,707,338	2,508,105	2,587,857	2,441,413	2,715,451	2,951,367	2,886,161	2,904,328
Obs (Export)	2,828,730	3,320,981	4,238,528	5,322,768	6,693,896	8,947,178	9,432,714	3,949,210	4,000,038	4,062,720	4,832,615	5,915,935	5,728,499	6,692,371
Num of Firms	73,203	79,848	93,019	109,489	132,421	161,680	169,392	187,342	197,493	202,867	216,759	253,326	245,131	257,512