Corporate board gender diversity and asset liquidity

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Abstract

Board gender diversity has gained significant attention in recent decades. In this paper, we explore the impact of board gender diversity on firms' asset liquidity decisions and find a negative but non-linear association between these two. Furthermore, our quantile analysis reveals heterogeneous effects across different points of asset liquidity. Additionally, our results remain robust when we conduct a set of econometric specifications, including moderating analysis (e.g., working capital strategies, performance, and macro effects), propensity score matching, instrumental variable analysis, alternative diversity measures, and GMM technique. Overall, our study provides valuable insights into the considerable influence female directors can have on corporate decision-making and contributes to the emerging literature on the role and importance of women in leadership positions.

Key words: Board gender diversity, asset liquidity, non-linear association
Classifications: G30, G34, G41, J16

1. Introduction

Corporate board gender diversity is one of the most topical corporate governance issues. Board gender diversity has gained substantial attention from academics, policymakers, practitioners, and mass media over the past decade. Literature has documented how the gender quota (e.g., California mandate) or investor-sponsored campaigns (Gormley et al., 2023) impacts board structure (Ahern and Dittmar, 2012; Gertsberg et al., 2021; Hamplová et al., 2022; Hwang et al., 2018). Parallel to and reinforcing these efforts present a growing number of contemporaneous studies examining the corporate outcomes of more women representation on boards with a majority focusing on corporate governance and decision-making (Adams and Ferreira, 2009; Clark et al., 2021; Griffin et al., 2021; Hutchinson et al., 2015; Martínez-García et al., 2022). Despite wide coverage of the impact of board diversity on different aspects of firms, little is known about its relationship with asset liquidity, one crucial indicator of firms' financial health and risk management. In this paper, we pioneer the exploration of possible attributes of a firm's asset liquidity and shed light on the recent debate about a gender-diverse board.

In the past few decades, there has been a growing emphasis on diversity, equity, and inclusion (DEI), particularly in the higher echelons as companies have come under closer scrutiny to improve board gender diversity. Norway first introduced a board diversity quota policy in 2003, requiring that at least 40% of board members be women. This was followed by other European countries such as Italy and Germany. More recently, California adopted a board gender quota in 2018 (Senate Bill (SB) 826), requiring that all publicly traded companies headquartered in the state have at least one female director by the end of 2019. Additionally, some investors and advocacy groups use various strategies to pressure companies to add more female directors to the corporate boards. In particular, the Big Three institutional investors (e.g., BlackRock, State Street, and

Vanguard) sponsored a gender diversity campaign in 2017, pressuring firms to appoint more female directors (Gormley et al., 2023). The efforts made by many companies in the past few years are a testament to the growing recognition of the importance of diversity in leadership.[1] Amid firms' concerted apathy to promote board gender diversity, a compelling question arises: how exactly does board gender diversity impact strategic decisions of companies?

As we delve into the intricacies of firms' various factors, one specific aspect has gained increasing importance and caught our attention: asset liquidity. Asset liquidity pertains to the strategic decision-making of resources, including but not limited to cash holdings, working capital management, and investment. Prior studies have documented how asset liquidity impacts or relates to firms' different aspects and outcomes, such as innovation (Pham et al., 2018), stock liquidity (Charoenwong et al., 2014; Gopalan et al., 2012), and capital structure (Morellec, 2001; Sibilkov, 2009). However, there is a lack of empirical investigation of the attributes of asset liquidity, let alone governance-related factors like board diversity. Given that asset liquidity significantly influences the financial stability and operational flexibility of a firm, there is a pressing need to examine factors that impact asset liquidity, particularly from a corporate governance perspective.

While female directors, in general, bring perspectives and experiences to the board that facilitates the resolution of complex issues and improve corporate governance (Gul et al., 2011; Huang and Kisgen, 2013), the effect of board gender diversity specifically on asset liquidity is subject to debate due to the following reasons. On the one hand, greater board gender diversity is typically associated with better monitoring and governance, which promotes investor confidence and efficient capital allocation. This ultimately can have a positive impact on asset liquidity. Additionally, a gender-diverse board is likely linked to improved board effectiveness and better

[1] Nearly 2,000 CEOs have pledged to advance DEI within their firms (PwC, 2021).

risk management (Chen et al., 2016), which can positively influence asset liquidity. On the other hand, board gender diversity can be negatively associated with asset liquidity due to better governance mitigating agency issues that arise from higher liquidity. The underlying rationale is that an enhanced monitoring mechanism may reduce asset liquidity to prevent opportunistic managers from exploiting cash reserves to participate in discretionary and self-perquisite spending and shielding themselves against market scrutiny (Atif et al., 2019). In addition, the existing literature indicates that high-risk firms tend to maintain a higher level of liquid assets as a risk mitigation strategy (Bates et al., 2009; Doan and Iskandar-Datta, 2020; Palazzo, 2012), it follows that a gender-diverse board, which has been associated with risk-averse behavior (Carter et al., 2017; García and Herrero, 2021; Gulamhussen and Santa, 2015; Palvia et al., 2015), is likely to exhibit lower asset liquidity. Accordingly, these firms may allocate their resources towards value creation rather than maintaining liquidity.[2] All combined, given the inconclusiveness regarding the relationship between these board gender diversity and asset liquidity, our objective in this paper is to ascertain their association.

Employing a sample of 4,675 publicly listed U.S. firms for the period 2000 to 2022, we find that board gender diversity is negatively associated with asset liquidity. Interestingly, our evidence shows that their relationship is non-linear and there is a heterogenous effect of gender diversity across different points of asset liquidity. Furthermore, our moderation analysis presents a strong influence from working capital management, market performance, macro environment (e.g., COVID-19), and investor sentiment. Our baseline results remain intact when we undergo a series of economics specifications, including propensity score matching (PSM), difference-in-

[2] Excess liquidity is considered to be detrimental to shareholders' value (Lee and Powell, 2011).

difference (DID), and instrumental variable (IV) analysis. Finally, our findings are remarkably robust to different measures of board gender diversity and alternative model specification.

Our research contributes to emerging literature on the importance of women in leadership positions and advances the understanding of the role boards play in an agency framework. Typically, board gender diversity impacts corporate outcomes through the improvement of the effectiveness of corporate governance. Scholars believe that the appointment of female directors enables the board to have different sets of viewpoints and expertise because women are known for being less inclined to take risks, exceptional monitors, and have distinctive perspectives (Green and Homroy, 2018). A diverse board is more likely to challenge management and provide better scrutiny of potential conflicts of interest. This can ultimately lead to better decision-making and improved overall corporate outcomes (Gupta et al., 2023; Nadeem et al., 2019). Within our framework, we demonstrate that the distinctive skills and individuality of female directors serve as an internal governance mechanism.

Our paper also extends to the literature on the growing significance of asset liquidity. Due to its large impact on a company's operational flexibility and risk management, prior studies have investigated its importance in cost of capital (Ortiz-Molina and Phillips, 2014), asset pricing (Miralles-Quirós et al., 2017), financial policy (Amihud and Mendelson, 1991), and many more (Meriläinen and Junttila, 2020; Nejadmalayeri, 2021; Nguyen and Vo, 2021; Usman, 2022). However, our analysis surpasses its impact and uncovers a novel but crucial factor that strongly impacts asset liquidity, which has not been reported in the extant literature.

The remainder of this paper is organized as follows. Section 2 describes our data and summary statistics. Section 3 presents our empirical specification and baseline results. Section 4

reports causal inference identification using moderating analysis. Section 5 shows the robustness of our findings and Section 6 concludes.

2. Data and summary statistics

2.1. Asset liquidity

We follow Gopalan et al. (2012) and construct three measures of asset liquidity from the Compustat dataset. Our first measure of asset liquidity (WAL1) assumes that all assets other than cash and equivalents are perfectly illiquid. Specifically, we assign a liquidity score of 1 to cash and equivalents and a score of 0 to all other assets of the firm. The second liquidity measure (WAL2), however, accounts for the semiliquid noncash current assets (CA) due to its ease of conversion into cash at a low cost. We assign a liquidity score of 1 to cash and equivalents, a score of 1/2 to noncash CA, and 0 to other assets. We calculate our third measure (WAL3) by assigning a liquidity score of 1 for cash and equivalents, 3/4 for noncash CA, 1/2 for tangible fixed assets, and 0 for the rest. The rationale of this measure, also claimed by Gopalan et al. (2012), is that noncurrent assets can be divided into tangible and intangible assets, and typically tangible assets (e.g., property, plant, and equipment) are more liquid than intangible assets (e.g., growth opportunities). A detailed description of all variables is presented in Table 1.

2.2. Measuring board diversity

We primarily rely on the Boardex database to obtain information on corporate boards. In addition to the calculation of board size, we use each director's gender and independence (e.g., independent director) to construct several measures, including the percentage of female directors on the board (*FemaleBoard%*), an indicator for having a female director (*Has Female*), the total number of female directors (*Total Female*), an indicator for being the executive director (*Exec Dir*), and the total number or percentage of independent directors (*Indep Dir* or *Indep Dir%*).

2.3. Firm-level data

The firm-level variables are obtained or created from several data sets. The variables that are constructed from Compustat include capital expenditure (*Capital Exp*), market-to-book ratio (*MB*), *Cash Flow*, *R&D*, *Leverage*, and working capital (*Trade*). We construct stock returns (*Return*) and the market performance indicator (*HMKTPerf*) from the annual fiscal year closing price in Compustat. Finally, we acquire the investor sentiment measure (BW) from Baker and Wurgler (2006). They combine investor sentiment with five other measures (e.g., the log difference in book-to-market ratios between dividend payers and non-dividend payers) and have developed an investor sentiment index. This index has become the most widely adopted measure in various applications (Tarkom and Yang, 2023; Zhou, 2018).

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Table 1 about here

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2.4. Summary statistics

Table 2 provides summary statistics of our key variables. For an average observation in our sample, there is one female director and female directors comprise approximately 12% of the boards, consistent with what has been reported in the previous studies (Gormley et al., 2023; Guo and Yang, 2023). On average, 75% of the company's boards consist of independent directors. The asset liquidity has a varying range of 0.23 (*WAL1*) to 0.57 (*WAL3*), comparatively similar to the statistics shown in Gopalan et al. (2012).

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Table 2 about here

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3. Empirical specifications and baseline results

3.1. Empirical setup

We begin our analysis with the influence of board gender diversity on asset liquidity. Specifically, we employ the multi-dimensional fixed effects ordinary least squares (OLS) estimations below:

$$Y_{it} = \lambda_0 + \lambda_1 FemaleBoard\%_{it} + \lambda_2 X_{it} + \lambda_3 Z_{it} + \delta_{it} + \varepsilon_{it} \quad (1)$$

where Y_{it} represents different measures of asset liquidity and *FemaleBoard* $\%_{it}$ is the share of female directors on board in company *i* at time *t*. The X_{it} is a vector of firm characteristic controls: *Profit*, capital expenditure (*Capital Exp*), market-to-book (*MB*), *Cash Flow*, *Return*, industry concentration (*HHI*), *R&D*, and *Leverage*. The Z_{it} takes board characteristics into consideration, including *Board Size*, the total number of independent directors (*Indep Dir*), the total number of executive directors (*Exec Dir*), and the share of independent directors (*Indep Dir%*). To mitigate the effect of the outliers, all continuous variables are winsorized at 1 and 99 percentiles. We also include Firm- and year-fixed effects (δ_{it}) to account for observed or unobserved firm characteristics and secular trends throughout the years, respectively. We cluster standard errors at the firm level to address potential serial correlation and correlation across observations within a given firm.

3.2. The impact of board gender diversity on asset liquidity

We report our results of how a gender-diverse board impacts firms' asset liquidity in Table 3. We find that gender diversity (*FemaleBoard*%) is negatively associated with all three measures of asset liquidity (*WAL1, WAL2, WAL3*), statistically significant at a 1% level. In addition, the magnitudes are considerable. For example, a one standard deviation increase in the share of female directors decreases asset liquidity by 0.023 (column 4), an 10% reduction relative to its sample

mean.[3] Our findings are consistent with the conjecture that female directors enhance corporate monitoring and reduce agency problems, leading to a decrease in asset liquidity. The reduction of liquidity is likely to mitigate opportunistic behaviors of managers, such as engaging in discretionary and personal expenditures. It is noteworthy that our results illustrate a non-linear association between board diversity and liquidity. This evidence is supplemented by Figure 1, which plots the linear and nonlinear effects of gender diversity on asset liquidity. While the coefficient of *FemaleBoard%*^{2} is positive, further analysis reveals an overall negative impact of board diversity as the marginal effect at P1, mean, and P99 remains negative and significant across all three liquidity measures (see Appendix 1A). For example, there demonstrates a net effect of -0.192 (P1) to -0.076 (P99) when our liquidity measure is *WAL1*.

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Table 3 about here

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Figure 1 about here

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3.3. Heterogeneity across different points of asset liquidity

As the evidence presented thus far is rather compelling, we delve deeper into the intricacies of the observed phenomenon and explore the potential heterogeneity across different liquidity conditions. Specifically, we examine the association between board diversity and liquidity at different points of asset liquidity. Doing this helps us to uncover the nuanced variations that may exist and to identify how the impact of gender diversity on asset liquidity varies under high or low asset liquidity.

[3] -0.192 (coefficient in Table 3 Column 4) x 0.12 (standard deviation of *FemaleBoard%* in Table 2)/0.226 (the mean of *WAL1 in Table 2*) = - 10.2%

We demonstrate our quantile analysis results in Figure 2 and Table 4. Figure 2 plots the estimated linear and non-linear effect of board gender diversity at quantile points of *WAL1* (top panel), *WAL2* (middle panel), and *WAL3* (bottom panel) using the bootstrapping methods. The left segments of each panel refer to *FemaleBoard%* and the right ones pertain to its squared term. The solid curves capture the point estimates with the shaded area representing the upper and lower bounds of the 95% confidence interval (CI). As is seen from this figure, we indeed find a heterogenous impact of gender diversity with the sign aligning with the corresponding variables in our baseline results. Table 4 further confirms such heterogeneity when we employ inter-quantile estimations. The inter-quantile analysis allows us to gain a better understanding of the differences in the relationship between board diversity and liquidity at these two quantiles in the distribution. We indeed find statistically significant differences in estimated coefficients between the two quartiles. This provides quantitative evidence of heterogeneity in the effect of gender on liquidity.

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Figure 2 about here

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Table 4 about here

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4. Moderation analysis

To further strengthen the causal inference of the relationship between board gender diversity and asset liquidity, in this section, we conduct a series of analyses regarding several important factors. Firstly, we investigate whether a firm's working capital strategies play a role. Secondly, we analyze the potential impact of market performance. Finally, we focus on two crucial macro factors—COVID-19 and investor sentiment and analyze their impact on the association between board diversity and liquidity.

4.1. The influence of working capital

Working capital, including inventory, receivables, and payables, is critical for a firm's day-to-day operations. It represents the firm's ability to effectively meet short-term obligations and maintain liquidity. Through the examination of the influence of working capital, we could gain a deeper understanding of how these financial management practices moderate the link between a gender-diverse board and asset liquidity.

Table 5 reports our regression estimations. Our working capital (*Trade*) is calculated as the sum of inventory and accounts receivables minus accounts payables. We find that despite the effect of working capital alone being negatively associated with asset liquidity, it has a counter effect on the link of board gender diversity and asset liquidity as the coefficient of the interaction term *Trade×FemaleBoard%* is positive. This reveals that rather than reinforcing, working capital weakens the negative impact of gender diversity. One possibility is that higher working capital provides stability in operations and serves as a buffer to absorb unexpected expenses. Consequently, it alleviates the concerns about excessive spending and agency issues, thereby diminishing the influence of a gender-diverse board. Despite this, the average net effect of gender diversity on liquidity is overall negative (Appendix A1). For example, at P1 and mean of *Trade*, the marginal effect of *FemaleBoard%* on *WAL1* is negative and statistically significant.[4] At the 99 percentile of *Trade*, while the positive impacts outweigh the negative influence, it is insignificant. Therefore, this confirms that the causal inference of our primary regressions in Table 3 is reliable.

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Table 5 about here

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[4] Table A1 reports that in the factor analysis of *Trade*, the marginal effects at P1 and mean for *WAL1* are -0.319 and -0.185, respectively.

4.2. The influence of market performance

Next, we focus on how firm performance influences the relationship between gender diversity and liquidity. The factor in this analysis, *HMKTPerf*, is an indicator equal to one if a firm's stock return is above the industry median and zero otherwise. Table 6 reports the results. We find that better market performance is positively associated with asset liquidity. This can be explained that in general, firms with strong stock performance tend to generate more cash flows. Furthermore, above-average stock returns signal a well-performing business, growth potential, and effective strategic decision-making, which will lead to increased investor interest and demand for the firm's shares. This heightened investor confidence can positively impact the firm's liquidity by facilitating easier access to capital markets, potentially increasing trading activity and enhancing liquidity levels. The coefficient of the interaction between market performance and board diversity (*HMKTPerf*×*FemaleBoard%*), however, is negative. This is also in line with our anticipation that high-performing firms are likely to strengthen the corporate governance role of a gender-diverse board. The marginal effect, as expected, is negative.[5] This suggests that the correlation between diversity and liquidity is robust.

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Table 6 about here
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4.3. The macro effects

In this section, we investigate two important macro factors that can considerably impact business and financial markets: COVID-19 and investor sentiment. One of the factors, COVID-19, has introduced unprecedented uncertainty and volatility, leading to substantial disruptions in

[5] As is shown in Table A1, the marginal effects are -0.209 (*WAL1*), -0.238 (*WAL2*), and -0.283 (*WAL3*), statistically significant at a 1% level.

financial markets, supply chains, and business operations. It has resulted in substantial changes in firms' liquidity positions. Therefore, our examination of COVID-19 allows us to better understand how firms with a diverse board manage liquidity in the face of unforeseen circumstances. Our second macro factor, investor sentiment, has attracted growing attention in behavioral finance and has widely impacted many aspects of the firms (Baker and Wurgler, 2007; Chue et al., 2019; Chung et al., 2012), including corporate decisions (Amin and Harris, 2022; Tarkom and Yang, 2023). Investor sentiment is investors' beliefs about future cash flows and firm performances that are not supported by rational expectations (Baker and Wurgler, 2006). For this reason, we include it as a significant macro-level factor and examine its impact on the targeted relationship. Altogether, these two macro factors merit further examination.

Table 7 shows our results. Panel A represents the estimates of the COVID-19 effect. We find that firms have increased their asset liquidity since the start of the pandemic, as the observed coefficients of *Post-COVID19* across all three measures of liquidity are positive. This implies that businesses and financial institutions prioritized risk management in response to the uncertainty and risks the pandemic has brought about. These risk management strategies include increasing cash holdings, reducing capital expenditures, or maintaining sufficient liquidity to withstand economic shocks. Interestingly, the interaction term *Post-COVID19×FemaleBoard%* is negatively correlated with asset liquidity. This suggests that a gender-diverse board mitigates financial stress in the aftermath of the pandemic, consistent with the prevailing understanding that females are effective monitors and adept at navigating challenging situations. The marginal effect of board diversity on liquidity undoubtedly remains negative and significant.

We report our analysis of investor sentiment in Table 7 Panel B. We find a positive association between investor sentiment and asset liquidity, indicating their movement in the same

direction. Our interpretation follows that an increase in investor sentiment leads to more buying and selling activities, resulting in higher market depth and trading volume. This in turn increases market liquidity and incentivizes firms to hold more liquid assets to facilitate their participation in the active market. However, we again find that the coefficient of the interaction *BW×FemaleBoard%* is negative, suggesting investor sentiment intensifies the negative link between board diversity and liquidity. The net effect of a diverse board across all three liquidity measures continues to be negative (See Table A1).

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Table 7 about here

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5. Robustness check

5.1. Propensity score matching (PSM)

To ensure that our results are not driven by observable differences for firms with high or low board diversity, we next implement the propensity score matching (PSM) method and construct a matched sample to estimate Eq. (1). The concept involves estimating the counterfactual asset liquidity by analyzing comparable subjects from the control group, where "comparable" is based on a set of observable characteristics (Imbens, 2004). The first step in the matching procedure is to use a Probit model to estimate the likelihood of firms having a top tercile diverse board. We include all the control variables with industry and year-fixed effects and report Probit estimation results in Table 8 Panel A. We match each firm located in the top tercile board gender diversity with another firm in the control group that has similar observable characteristics. We impose a tolerance level on the maximum propensity score distance (caliper) of 0.01 to avoid the risk of bad matches. This is further supported by Figure 3, which demonstrates that the matched sample exhibits similar propensity scores. Table 8 Panel B reports the summary statistics of the

matched sample. We find that across all the liquidity measures, the difference between firms in the top tercile diversity and firms in the control group is negative and statistically significant. Table 8 Panel C shows our regression estimations using the matched sample. We find in this table that our results remain hold, confirming a significant impact of board gender diversity on asset liquidity.

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Table 8 about here

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Figure 3 about here

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5.2. Instrumental variable analysis (IV)

Next, to ensure that our results are not confounded by the unobservable characteristics and to mitigate endogeneity concerns, we employ a Two-stage Least Squares (2SLS) method. We follow prior studies (Ellis et al., 2017; Rahman, 2023) and use the leave-one-out average (*LOO*) as our instrument variable. The *LOO* is calculated as the average board gender diversity by industry and year excluding that of the focal firm. Our instrument satisfies the relevance criterion, as the average level of gender diversity is expected to be highly correlated with the focal firm's diversity. Meantime, it plausibly meets the exclusion restriction since it is unlikely that other firms' board diversity is correlated with the focal firm's asset liquidity. We report our results in Table 9. The first stage estimation shows that *LOO* predicts our focal firm's board gender diversity with a very high level of economic and statistical significance (column 1). The second stage regressions illustrate that the predicted *FemaleBoard%* is negatively related to all three measures of liquidity (columns 2-4). The economic magnitudes are comparable to those from the baseline regressions in Table 2. Therefore, the observed negative relations between gender diversity and asset liquidity are unlikely to be driven by other omitted factors.

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Table 9 about here

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5.3. Alternative proxies and estimation approach

To further confirm the robustness of our findings, we employ: 1) three alternative proxies for *FemaleBoard%*; and 2) another essential estimation methodology for our baseline regressions. The additional three gender diversity measures are an indicator for having a female director (*Has Female*), the total number of female independent directors on the board (*Female Indep Dir*), and the total number of female directors (*Total Female*). We report our results in Table 10. We again find negative and significant correlations between three proxies and asset liquidity in every regression. Next, we adopt an alternative estimation technique in our analysis, the System Generalized Method of Moments (GMM). The System GMM is an important tool in addressing endogeneity and persistent heterogeneity in panel data settings, thus mitigating potential biases that stem from unobserved factors. The system GMM enables us to account for time-invariant unobserved factors that may influence asset liquidity while controlling for endogeneity issues arising from lagged dependent variables or omitted variables. Table 11 presents the results. We find that our results remain unchanged and statistically similar to our baseline findings, which further confirms the validity of the correlation between board gender diversity and asset liquidity.

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Table 10 about here

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Table 11 about here

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6. Conclusion

Given the importance of female directors in corporate strategies, in this paper, we particularly examine how board gender diversity influences corporate decisions in asset liquidity

management. We find compelling evidence that a gender-diverse board is negatively associated with asset liquidity, and their correlation is non-linear. Our results remain strong when we employ a series of economic specifications, an alternative methodology, and several other measures of gender diversity. Our findings are in line with the argument that board diversity enhances corporate governance and mitigates agency problems, leading to reduced liquidity.

Our study sheds light on the significant impact of board gender diversity, emphasizing the important role women in leadership positions play in corporate decision-making. Our research also has broad implications that other factors, such as board independence, can also play a role since board gender diversity alone is not a panacea for asset liquidity.

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Table 1 Variable definition

Variables	Definition and source
Board Size	The total number of board members. Source: BoardEx
BW	Baker and Wurgler (2006) index for investor sentiment. Source: https://pages.stern.nyu.edu/~jwurgler/
Capital Exp	Capital expenditure scaled by total assets. Source: Compustat
Cash Flow	Income before extraordinary items minus depreciation and amortization scaled by total assets (IB + DP/AT). Source: Compustat.
Exec Dir	The total number of executive directors. Source: BoardEx.
Female Indep Dir	The total number of female independent directors. Source: BoardEx.
FemaleBoard%	Number of female directors on the board divided by board size. Source: BoardEx.
FemaleBoard%^{2}	The squared term of *FemaleBoard%*. Source: BoardEx.
Has Female	An indicator equals 1 if the firm has a female on the board and 0 otherwise. Source: BoardEx
HFemale	An indicator equal to 1 if the firm's share of female directors is in the top tercile and zero otherwise. Source: BoardEx.
HHI	Sales-based Herfindahl-Hirschman index measure for market concentration based on two-digit SIC industry codes. Source: Compustat.
HMKTPerf	An indicator equal to 1 if the firm's industry adjusted stock return is above the sample median. Source: Compustat.
Indep Dir	The total number of independent directors. Source: BoardEx.
Indep Dir%	The total number of independent directors scaled by the board size. Source: BoardEx.
Leverage	Calculated as debt in current liabilities plus long-term debt scaled by total assets ((DLTT + DLC)/AT). Source: Compustat

LOO	The industry average share of female directors in a specific year excluding the focal firm's share of female directors. Source: BoardEx.
MB	Calculated as the book value of assets minus book value of common equity plus the market value of common equity scaled by total assets ((AT + (PRCC_F*CSHO) – CEQ)/AT). Source: Compustat.
MKTPerf	Calculated as the firm's industry-adjusted stock returns. Stock return is calculated below. Source: Compustat.
Post-COVID19	An indicator variable equals 1 for the sample year range 2020 to 2022.
Profit	Operating income after depreciation scaled by total assets (OIADP/AT). Source: Compustat.
R&D	Research and development expense scaled by total assets (XRD/AT). Source: Compustat
Return	Annual stock returns, calculated based on the fiscal year closing price (PRCC_F (t) / PRCC_F (t-1) - 1). Source: Compustat.
Total Female	The total number of female directors. Source: BoardEx
Trade	The sum of inventories and accounts receivables subtract payables, then scale this number by total assets ((RECT + INVT - AP)/AT). Source: Compustat
WAL1	Weighted asset liquidity, created by assigning a liquidity score of 1 to cash and equivalents and a score of 0 to all other assets. For details, see Gopalan, Kadan, and Pevzner (2012). Source: Compustat
WAL2	Weighted asset liquidity, created by assigning a liquidity score of 1 to cash and equivalents, a liquidity score of 1/2 to noncash current assets, and a score of 0 to all other assets of the firm. For details, see Gopalan, Kadan, and Pevzner (2012). Source: Compustat.
WAL3	Weighted asset liquidity, created by assigning a liquidity score of 1 for cash and equivalents, 3/4 for noncash current assets, 1/2 for tangible fixed assets, and 0 for the rest. For details, see Gopalan, Kadan, and Pevzner (2012). Source: Compustat.

Note: This table reports key variable definitions and sources.

Table 2 Summary statistics

	N	Mean	SD	P25	Median	P75
FemaleBoard%	37001	.116	0.120	0	.111	.2
FemaleBoard%^{2}	37001	.028	0.046	0	.012	.04
Has Female	37001	.595	0.491	0	1	1
Total Female	37001	1.029	1.126	0	1	2
WAL1	37001	.226	0.329	.042	.125	.301
WAL2	37001	.387	0.354	.195	.323	.487
WAL3	37001	.566	0.427	.364	.551	.71
Profit	37001	.027	0.258	.007	.068	.119
Capital Exp	37001	.047	0.057	.015	.029	.056
MB	37001	1.835	1.917	.873	1.298	2.101
Cash Flow	37001	-.065	0.321	-.076	-.003	.043
Return	37001	.218	1.072	-.226	.041	.349
HHI	37001	.27	0.209	.125	.204	.344
R&D	37001	.044	0.089	0	.004	.054
Leverage	37001	.233	0.247	.023	.192	.354
Board Size	37001	8.156	2.222	7	8	9
Indep Dir	37001	6.199	2.333	4	6	8
Female Indep Dir	37001	.931	1.093	0	1	2
Exec Dir	37001	1.425	0.772	1	1	2
Indep Dir%	37001	.752	0.157	.667	.778	.857
HMKTPerf	36513	.501	0.500	0	1	1
LOO	36513	.115	0.096	.03	.108	.176
Trade	37001	.177	0.148	.069	.154	.262
BW	264	.03	0.521	-.227	-.066	.142

Note: This table presents summary statistics of all key variables. Variable definitions and data sources are described in Table 1.

Table 3 Board gender diversity and asset liquidity

	(1) WAL1	(2) WAL2	(3) WAL3	(4) WAL1	(5) WAL2	(6) WAL3
FemaleBoard%	-0.178***	-0.201***	-0.242***	-0.192***	-0.210***	-0.240***
	(0.059)	(0.065)	(0.079)	(0.051)	(0.057)	(0.070)
FemaleBoard%²	0.223**	0.248**	0.368**	0.260***	0.279***	0.381***
	(0.113)	(0.126)	(0.147)	(0.091)	(0.100)	(0.124)
Profit				0.088	0.126*	0.218***
				(0.058)	(0.066)	(0.075)
Capital Exp				-0.366***	-0.317***	0.257***
				(0.055)	(0.058)	(0.080)
MB				0.021***	0.024***	0.026***
				(0.004)	(0.005)	(0.006)
Cash Flow				0.082*	0.106**	0.126**
				(0.044)	(0.050)	(0.057)
Return				0.022***	0.029***	0.035***
				(0.003)	(0.004)	(0.005)
HHI				0.026	0.024	0.060**
				(0.024)	(0.026)	(0.029)
R&D				-0.772***	-0.785***	-0.664***
				(0.125)	(0.135)	(0.144)
Leverage				-0.144***	-0.131***	-0.139***
				(0.021)	(0.023)	(0.029)
Board Size				-0.007**	-0.009***	-0.010**
				(0.003)	(0.003)	(0.004)
Indep Dir				0.000	0.001	-0.001
				(0.003)	(0.004)	(0.005)
Exec Dir				0.004	0.005	0.005
				(0.003)	(0.003)	(0.004)
Indep Dir%				0.025	0.013	0.042
				(0.036)	(0.038)	(0.049)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	37,001	37,001	37,001	37,001	37,001	37,001
Adj. R^2	0.513	0.480	0.447	0.561	0.537	0.502

Note: This table reports regression estimations of the impact of board gender diversity *FemaleBoard%* on asset liquidity. Columns 1-3 represent univariant analysis and columns 4-6 report regressions with all control variables. The dependent variables are *WAL1* (columns 1 and 4), *WAL2* (columns 2 and 5), and *WAL3* (columns 3 and 6). The other variables account for firm- and board-level controls. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4 Inter-quantile analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	WAL1				WAL2				WAL3			
Inter-quantile:	50^{th}-25^{th}	75^{th}-25^{th}	75^{th}-50^{th}	95^{th}-75^{th}	50^{th}-25^{th}	75^{th}-25^{th}	75^{th}-50^{th}	95^{th}-75^{th}	50^{th}-25^{th}	75^{th}-25^{th}	75^{th}-50^{th}	95^{th}-75^{th}
FemaleBoard%	-0.071***	-0.157***	-0.086***	-0.208**	-0.079***	-0.152***	-0.073**	-0.197**	-0.024	-0.109***	-0.085***	-0.266***
	(0.009)	(0.023)	(0.027)	(0.088)	(0.023)	(0.029)	(0.037)	(0.092)	(0.024)	(0.028)	(0.013)	(0.100)
FemaleBoard%²	0.130***	0.308***	0.177***	0.401*	0.187***	0.336***	0.149*	0.363	0.110	0.387***	0.278***	0.449**
	(0.028)	(0.050)	(0.068)	(0.224)	(0.065)	(0.076)	(0.078)	(0.250)	(0.067)	(0.060)	(0.039)	(0.211)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001
Ps. R^2	0.124/ 0.204	0.124/ 0.263	0.204/ 0.263	0.263/ 0.281	0.191/ 0.216	0.191/ 0.239	0.216/ 0.239	0.239/ 0.261	0.115/ 0.117	0.115/ 0.137	0.117/ 0.137	0.137/ 0.187

Note: This table presents inter-quantile estimations. Columns 1-4 report the results when the dependent variable is *WAL1*. Similarly, columns 5-8 and columns 9-12 present the results when the dependent variables are *WAL2* and *WAL3*, respectively. All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5 The influence of working capital

	(1) WAL1	(2) WAL2	(3) WAL3
FemaleBoard%	-0.279***	-0.325***	-0.383***
	(0.070)	(0.077)	(0.085)
Trade	-0.787***	-0.381***	-0.263***
	(0.054)	(0.052)	(0.056)
Trade×FemaleBoard%	0.532***	0.585***	0.669***
	(0.152)	(0.163)	(0.184)
FemaleBoard%²	0.258**	0.324***	0.442***
	(0.101)	(0.108)	(0.121)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	37,001	37,001	37,001
Adj. R^2	0.551	0.508	0.405

Note: This table presents the impact of working capital (*Trade*) on the link between board gender diversity and asset liquidity. The dependent variables are *WAL1* (column 1), *WAL2* (column 2), and *WAL3* (column 3). All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6 The impact of market performance

	(1) WAL1	(2) WAL2	(3) WAL3
FemaleBoard%	-0.171***	-0.177***	-0.202***
	(0.051)	(0.055)	(0.062)
HMKTPerf	0.011**	0.020***	0.029***
	(0.005)	(0.005)	(0.006)
HMKTPerf×FemaleBoard%	-0.038*	-0.062**	-0.081***
	(0.022)	(0.025)	(0.029)
FemaleBoard%^{2}	0.255***	0.271***	0.364***
	(0.090)	(0.100)	(0.113)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	36,513	36,513	36,513
Adj. R^2	0.533	0.504	0.404

Note: This table reports estimations of how a firm's stock performance (*HMKTPerf*) impacts the association between board gender diversity and asset liquidity. The dependent variables are *WAL1* (column 1), *WAL2* (column 2), and *WAL3* (column 3). All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7 The impact of macro factors

Panel A Does COVID-19 matter?	(1) WAL1	(2) WAL2	(3) WAL3
FemaleBoard%	-0.301***	-0.359***	-0.448***
	(0.053)	(0.058)	(0.072)
Post-COVID19	0.063***	0.058***	0.069**
	(0.020)	(0.022)	(0.028)
Post-COVID19×FemaleBoard%	-0.188***	-0.204***	-0.222**
	(0.070)	(0.077)	(0.096)
$FemaleBoard\%^2$	0.464***	0.533***	0.702***
	(0.118)	(0.131)	(0.161)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	37,001	37,001	37,001
Adj. R^2	0.560	0.535	0.498

Panel B Does investor sentiment matter?	(1)	(2)	(3)
	WAL1	WAL2	WAL3
FemaleBoard%	-0.244***	-0.304***	-0.402***
	(0.051)	(0.056)	(0.070)
BW	0.014***	0.027***	0.039***
	(0.005)	(0.005)	(0.007)
BW×FemaleBoard%	-0.064***	-0.101***	-0.134***
	(0.023)	(0.025)	(0.031)
(FemaleBoard%)²	0.358***	0.432***	0.609***
	(0.096)	(0.106)	(0.130)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	37,001	37,001	37,001
Adj. R^2	0.559	0.535	0.498

Note: This table reports estimations of how macro factors (e.g., *COVID19 and investor sentiment*) impact the association between board gender diversity and asset liquidity. The *Post-COVID19* in Panel A is an indicator for the year after 2020 and the *BW* in Panel B is the Baker and Wurgler (2006) index for investor sentiment. The dependent variables are *WAL1* (column 1), *WAL2* (column 2), and *WAL3* (column 3). All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 8 Propensity score matching

Panel A Probit Model	*HFemale*
Profit	0.217**
	(0.102)
Capital Exp	-0.547*
	(0.305)
MB	0.020***
	(0.007)
Cash Flow	-0.032
	(0.066)
Return	-0.017**
	(0.008)
HHI	0.093
	(0.103)
R&D	-0.045
	(0.219)
Leverage	-0.095
	(0.067)
Board Size	-0.079**
	(0.033)
Indep Dir	0.307***
	(0.041)
Exec Dir	-0.124***
	(0.026)
Indep Dir%	-1.502***
	(0.378)
Industry FE	Yes
Year FE	Yes
N	36993
Pseudo R-sq	0.228

Panel B Matched Sample Summary Statistics	High		Low		High - Low	
	N	Mean	N	Mean	Mean Diff	S.E.
WAL1	5241	0.250	5241	0.264	-0.0140**	(0.00711)
WAL2	5241	0.404	5241	0.429	-0.0252***	(0.00768)
WAL3	5241	0.551	5241	0.581	-0.0301***	(0.00924)
FemaleBoard%	5241	0.245	5241	0.057	0.188***	(0.00138)
Profit	5241	0.022	5241	0.015	0.00642	(0.00486)
Capital Exp	5241	0.041	5241	0.042	-0.00133	(0.000960)
MB	5241	1.954	5241	1.985	-0.0318	(0.0393)
Cash Flow	5241	-0.068	5241	-0.076	0.00784	(0.00592)
Return	5241	0.214	5241	0.233	-0.0193	(0.0212)
HHI	5241	0.252	5241	0.255	-0.00362	(0.00390)
R&D	5241	0.052	5241	0.052	-0.000692	(0.00180)
Leverage	5241	0.219	5241	0.218	0.00146	(0.00475)
Board Size	5241	7.855	5241	7.917	-0.0628	(0.0399)
Indep Dir	5241	6.007	5241	6.009	-0.00210	(0.0390)
Exec Dir	5241	1.350	5241	1.395	-0.0450***	(0.0143)
Indep Dir%	5241	0.764	5241	0.754	0.00971***	(0.00283)

Panel C PSM-matched sample regressions	(1) WAL1	(2) WAL2	(3) WAL3
FemaleBoard%	-0.085**	-0.134***	-0.161***
	(0.038)	(0.041)	(0.053)
Controls	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	10482	10482	10482
Adj. R-sq	0.252	0.241	0.187

Note: This table reports the construction of a propensity score matched sample and the baseline estimation results for the PSM sample. Panel A represents the results of the probit model. The dependent variable, *HFemale*, is an indicator of a firm's female board representation being in the top tercile and zero otherwise. Panel B illustrates the characteristics of the matched firms in the top tercile of gender diversity and those in the low tercile of gender diversity. We match each high board gender diversity firm with a low gender diversity firm within the same industry and year with no replacement. A tolerance level on the maximum propensity score distance (caliper) of 0.01 is imposed. Panel C shows the estimation results of the PSM-matched sample. The dependent variables are *WAL1* (column 1), *WAL2* (column 2), and *WAL3* (column 3). All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 9 Instrumental variable analysis (IV)

	(1)	(2)	(3)	(4)
	First	Second		
	FemaleBoard%	WAL1	WAL2	WAL3
LOO	0.027***			
	(0.010)			
FemaleBoard% (predicted)		-3.641**	-2.929*	-2.291
		(1.838)	(1.778)	(1.983)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	34,715	34,715	34,715	34,715
R^2		0.113	0.130	0.130

Note: This table presents the results using a two-stage least squares (2SLS) regression model. We follow previous literature (Ellis et al., 2017; Rahman, 2023) and compute the instrumental variable, leave-one-out average (LOO), as the average of board gender diversity by industry and year excluding the focal firm. Column 1 reports the first stage and columns 2-4 are the second stage estimations. All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 10 Alternative proxies for board gender diversity

VARIABLES	(1) WAL1	(2) WAL2	(3) WAL3	(4) WAL1	(5) WAL2	(6) WAL3	(7) WAL1	(8) WAL2	(9) WAL3
Has Female	-0.026***	-0.028***	-0.029***						
	(0.006)	(0.007)	(0.009)						
Female Indep Dir				-0.020***	-0.021***	-0.024***			
				(0.005)	(0.005)	(0.007)			
Female Indep Dir^2				0.003***	0.003***	0.003***			
				(0.001)	(0.001)	(0.001)			
Total Female							-0.024***	-0.026***	-0.030***
							(0.005)	(0.006)	(0.007)
Total Female^2							0.004***	0.004***	0.005***
							(0.001)	(0.001)	(0.001)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001	37,001
Adj. R^2	0.561	0.537	0.502	0.561	0.537	0.502	0.561	0.537	0.502

Note: This table reports the estimates using alternative measures of board gender diversity. In particular, we employ three different measures: *Has Female* (columns 1-3), *Female Indep Dir* (columns 4-6), and *Total Female* (columns 7-9). The *Has Female* is an indicator for the firm having one or more female directors. The *Female Indep Dir* measures the number of female independent directors and *Total female* is the total number of female directors. The dependent variables are *WAL1*, *WAL2*, and *WAL3*. All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 11 Alternative regression model

VARIABLES	(1) WAL3	(2) WAL3	(3) WAL3
FemaleBoard%	-0.139**	-0.173***	-0.271***
	(0.057)	(0.063)	(0.078)
FemaleBoard%^{2}	0.126	0.188	0.421**
	(0.135)	(0.149)	(0.185)
WAL1 (-1)	0.131***		
	(0.006)		
WAL2 (-1)		0.117***	
		(0.006)	
WAL3 (-1)			0.106***
			(0.006)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	29,831	29,831	29,831

Note: This table presents an additional robustness test using the system Generalized Method of Moments (GMM) proposed by Arellano and Bond (1991). All control variables are the same as those included in Table 3. Standard errors at the firm level are reported in parentheses. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Figure 1 Linear and nonlinear effect of gender diversity on asset liquidity

This figure plots the linear and nonlinear relationship between gender diversity and asset liquidity. The top panel shows the linear relationship, and the bottom panel represents the nonlinear effect. The dependent variables are three liquidity measures, *WAL1*, *WAL2*, and *WAL3*.

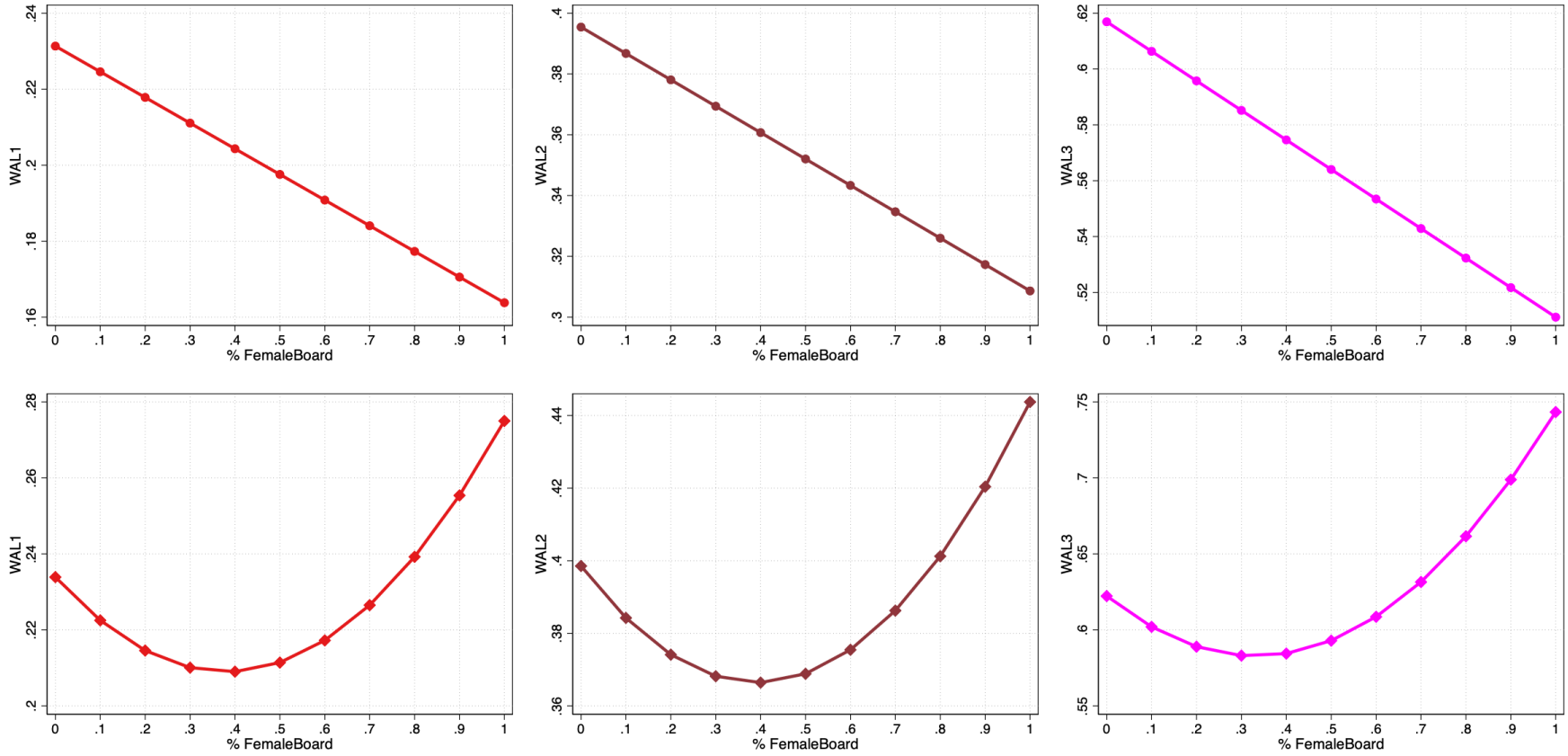
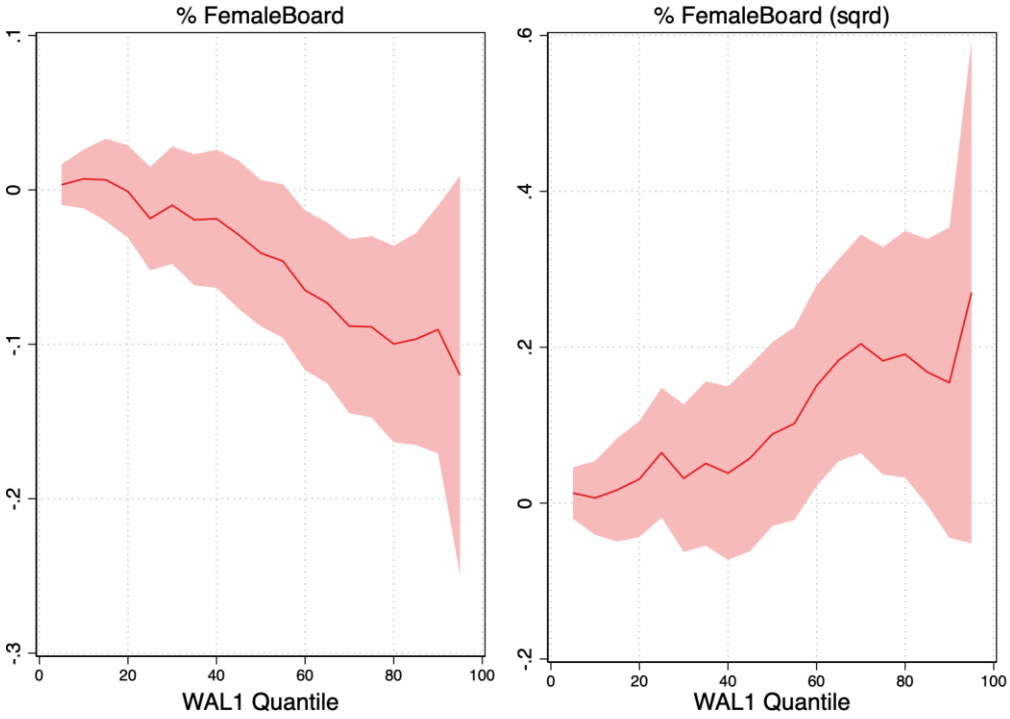


Figure 2 Quantile estimates at different levels of liquidity
This figure shows the quantile estimates of the relationship between gender diversity and asset liquidity. The top, middle, and bottom panels represent *WAL1*, *WAL2*, and *WAL3*, respectively. At different points of the corresponding dependent variable (e.g., *WAL1*), we estimate the impact of gender diversity using bootstrapping methods and include both the linear and nonlinear effects. The solid line captures the point estimates with the shaded area representing the 95% confidence interval.



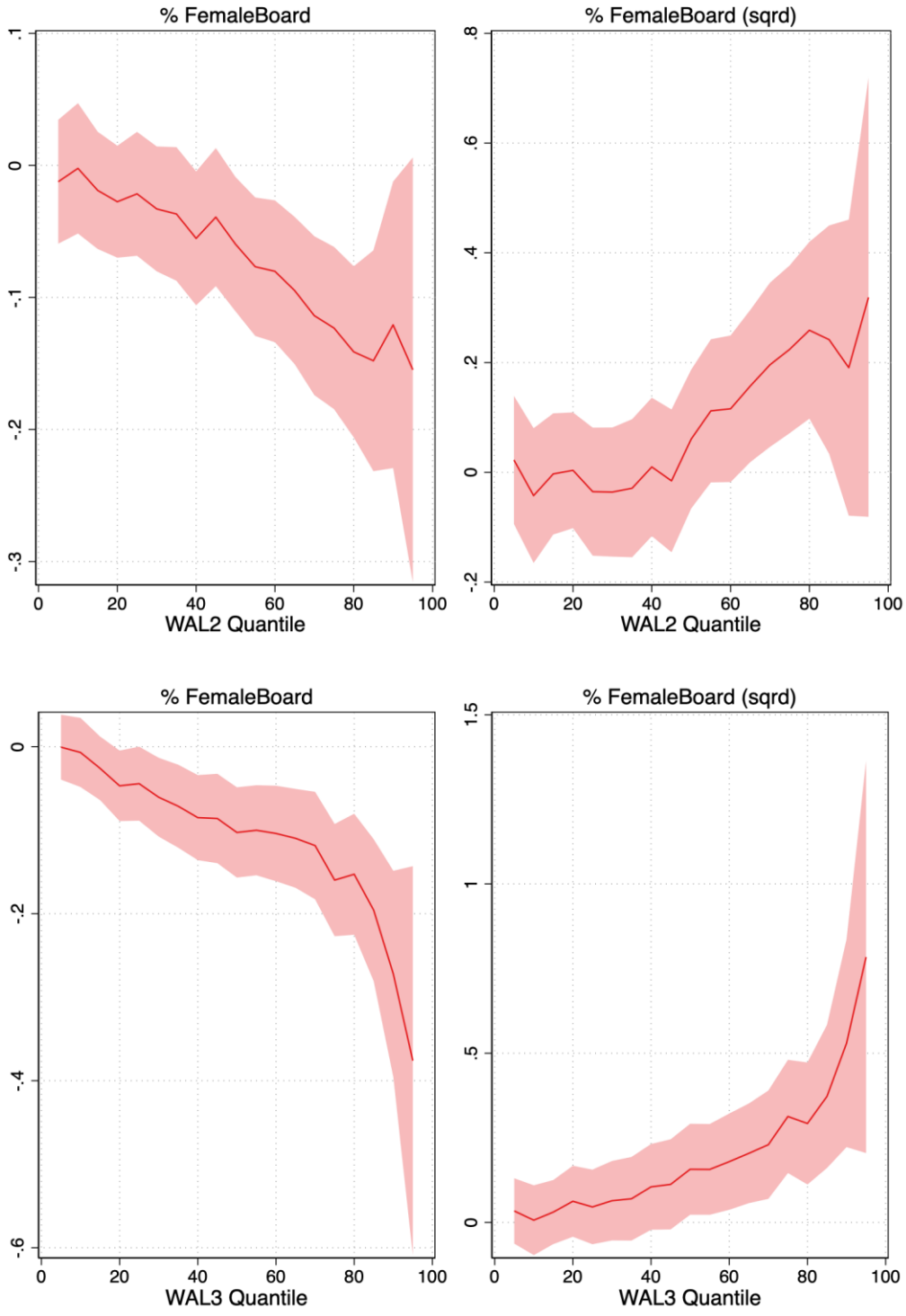

% FemaleBoard
.1
0
-.1
-.2
-.3
0
20
40
60
80
100
WAL2 Quantile
% FemaleBoard (sqrd)
.8
.6
.4
.2
0
-.2
0
20
40
60
80
100
WAL2 Quantile
% FemaleBoard
0
-.2
-.4
-.6
0
20
40
60
80
100
WAL3 Quantile
% FemaleBoard (sqrd)
1.5
1
.5
0
0
20
40
60
80
100
WAL3 Quantile

Figure 3 Balancing plot before and after PSM
This figure shows the balancing plot for the PSM approach. The left panel represents the scores of treated and control (untreated) firms before the match and the right panel reports that of the matched sample.

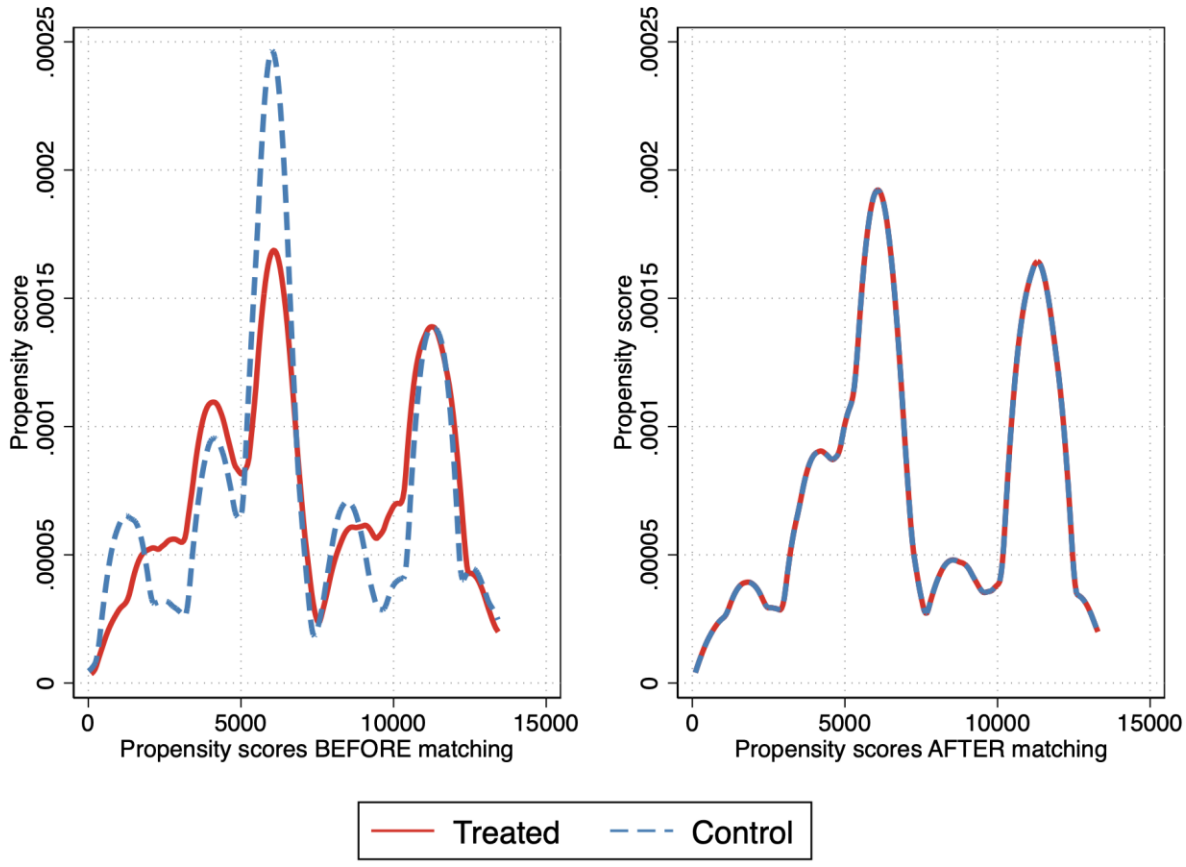


Table A1 Marginal effects

VARIABLES	WAL1	WAL2	WAL3
FemaleBoard%:			
P1	-0.192***	-0.210***	-0.2404***
	(0.051)	(.057)	(0.070)
Mean	-0.161***	-0.178***	-0.196***
	(0.042)	(0.047)	(0.058)
P99	-0.076***	-0.086***	-0.071***
	(0.025)	(0.027)	(0.034)
Trade			
P1	-0.319***	-0.368***	-0.433***
	(0.078)	(0.086)	(0.095)
Mean	-0.185***	-0.221***	-0.265***
	(0.053)	(0.059)	(0.065)
P99	0.035	0.022	0.013
	(0.062)	(0.0660	(0.077)
HMKTPerf:			
=1	-0.209***	-0.238***	-0.283***
	(0.054)	(0.060)	(0.067)
Post-COVID-19:			
=1	-0.489***	-0.563***	-0.670***
	(0.104)	(0.115)	(0.144)
BW:			
P1	-0.201***	-0.236***	-0.311***
	(0.050)	(0.055)	(0.067)
Mean	-0.246***	-0.307***	-0.406***
	(0.051)	(0.057)	(0.070)
P99	-0.370***	-0.502***	-0.664***
	(0.075)	(0.084)	(0.104)

Note: This table reports the marginal effects of board gender diversity in all key regressions. The symbols *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.