DOI: 10.1111/eufm.12352

ORIGINAL ARTICLE

EUROPEAN FINANCIAL MANAGEMENT WILEY

ETF ownership and corporate cash holdings

Izidin El Kalak | **Onur K. Tosun**

Cardiff Business School, Cardiff, UK

Correspondence
Onur K. Tosun, Cardiff Business School, Aberconway Bldg., Colum Dr., Cardiff, UK.
Email: TosunO@cardiff.ac.uk

Abstract

Do exchange-traded funds (ETFs) influence corporate cash holding decisions? Consistent with reduced managerial learning from the stock market and increased uncertainty due to higher ETF ownership, we show that firms included in ETF baskets have higher cash holdings as a precautionary response. We address endogeneity concerns through different natural experiments, namely, the reconstitution of the Russell 1000/2000 index and BlackRock's acquisition of iShares. We identify changes in revenue, external financing, share repurchases and net working capital as potential channels through which cash holdings increase due to higher ETF ownership, with cash holdings increases having a positive impact on firm value.

KEYWORDS
cash holdings, cash value, exchange traded funds, managerial learning, share price informativeness

JEL CLASSIFICATION
G14, G23, G32

We thank Professor John Doukas (the Editor), an anonymous reviewer, Woon Sau Leong, the discussant and participants at Cardiff-Newcastle-Xiamen Workshop (2019) and BAFA-SIG conference (2019) for their insightful comments. All remaining errors are ours.

1 | INTRODUCTION

Exchange-traded funds (ETFs) have grown significantly at the turn of the century,[1] enabling investors to participate in stock markets and hold diversified portfolios with fewer associated costs. However, this rapid increase of ETFs has raised concerns among policymakers, practitioners and researchers.[2] To assess the effect of these investment vehicles, the majority of studies focus on the asset pricing implications of ETFs on the stability of their underlying equity markets (e.g., Agarwal et al., 2018; Ben-David et al., 2018; Glosten et al., 2021; Israeli et al., 2017).

While ETFs are classified as passive funds, that is, following an index, they lend themselves to be unique financial instruments compared to other types of passive investors. Their uniqueness stems from their ability to provide investors with continuous access to the market at low trading costs, attracting short-term and uninformed traders and leading to high-frequency demand on their shares (Ben-David et al., 2017). This affects the share price informativeness and liquidity of the underlying stocks (Hamm, 2014; Israeli et al., 2017). In addition, unlike other passive investors, ETFs engage in arbitrage activities that have implications on the underlying stocks, such as changes in pricing efficiency and non-fundamental volatility (Agarwal et al., 2018; Ben-David et al., 2018; Bhattacharya & O'Hara, 2018). Further, a recent study by Easley et al. (2021) documents the growing role of active ETFs over time.

There is well-established literature examining the implications of passive ownership on firms' asset pricing and corporate policies (Appel et al., 2016; Boone & White, 2015; DeLisle et al., 2017; Kacperczyk et al., 2018). Considering how ETFs differ from passive ownership, there is a need to look at ETFs separately from other passive investors in relation to their effects on firms' corporate policies. In this paper, we contribute to the ETF literature by studying whether ETF ownership impacts corporate cash holdings policy.

Cash holdings management is at the core of firms' financial policies. Hoarding cash enables firms to secure the financing of future investments and reduce reliance on costly external financing (Acharya et al., 2007; Almeida et al., 2004). Further, cash has been the most easily accessible form of assets for the use of managers and major shareholders (Schauten et al., 2013). This, in turn, allows managers to strategically change the level of cash holdings in response to future changes in information flow from stock prices (Frésard, 2012).

A well-known channel through which managers learn about new information is the secondary financial markets via share prices (Bond et al., 2012; Subrahmanyam & Titman, 1999). Several studies find support for an informational channel from stock prices to managerial corporate decision-making (Q. Chen et al., 2007; de Cesari & Huang-Meier, 2015; Luo, 2005). Theory and economic intuition propose a wide range of useful information that managers can learn from and incorporate into their decision-making. For, example, managers learn new information from share prices about their firms' future investment and financing opportunities (Dow & Gorton, 1997), the value of new strategies (Foucault & Frésard, 2012) and unexpected cash flows and changes to discount rates (de Cesari & Huang-Meier, 2015). Most importantly,

[1]There were 1988 US-based ETFs, with $3.4 trillion in assets under management, at the end of April 2018, according to the 2019 Investment Company Yearbook. Ben-David et al. (2017) note that ETFs contribute around 10% to the market capitalization and 30% to the trading volume of securities traded on US stock exchanges.

[2]For example, a recent publication by the Financial Stability Board calls for 'closer surveillance of potential vulnerabilities' related to the growth in ETFs. See 'Potential financial stability issues arising from recent trends in Exchange-Traded Funds (ETFs)', available at https://tinyurl.com/yarwlbk2.

Frésard (2012) highlights the role of stock price informativeness on managerial decision-making concerning cash holding levels.

The growing investments of ETFs in the equity market have motivated researchers to investigate the effect of ETF ownership on the underlying firms' share price informativeness. This literature finds that increased ETF ownership is associated with the lower transmission of firm- and macro-specific information to managers. For, example, Israeli et al. (2017) show that the increase in ETF ownership is associated with lower levels of private information conveyed to managers through stock prices. Further, Ben-David et al. (2018) find that ETF ownership increases the nonfundamental volatility of their underlying stocks. Finally, in this study, we find evidence indicating that the increased investments of ETFs lead to the lower share price informativeness of their constituent firms, that is, higher informational uncertainty, where managers learn less information from their share prices.[3]

The level of cash holdings plays a key role in the determination of firm asset structure (Cortes, 2021). Hence, managers prefer to have sufficient information to help them identify their firms' optimal cash holding level, which is determined based on a trade-off between the benefits and costs of holding cash (Keynes, 1936). Therefore, despite the opportunity cost of holding cash, managers in firms with higher informational uncertainty, due to higher ETF ownership, could find holding cash as precautionary savings to be less costly, avoiding distortion in their future corporate investments (Myers & Majluf, 1984; Opler et al., 1999). Based upon these findings and in line with the precautionary motive of cash holdings, we conjecture to find a positive relation between ETF ownership and the cash holding levels of their constituent firms.

To test this hypothesis, we focus on the period from 2000 Q1 to 2019 Q4. The initial data set from ETF ownership calculations contains 454 ETFs and 168,083 firm–quarter observations. In further steps, we exclude financial and utility firms. We restrict our sample to firms with headquarters in the United States. We require total assets to have a greater value than capital expenditures and both to have positive values. We drop data where total liabilities are greater than total assets and where the sum of long- and short-term debt is greater than total assets. We also require firms to have an ETF ownership level greater than zero. This process reduces the sample to 143,659 firm–quarter observations only for the core variables. Omitting values missing for a small set of variables, we obtain a final sample with a full set of variables consisting of 47,183 observations across 2461 US-listed firms.

Our findings indicate that ETF ownership is associated with externality at the corporate level, in that it leads the managers to learn less information from stock prices and increases the informational uncertainty when they choose their cash holding policies. The association between ETF ownership and cash holdings is positive and significant. To allay concerns of endogeneity concerning reverse causality and omitted variables, we test our hypothesis using two different sets of natural experiments with instruments.

In robustness tests, we start by including several control variables to test whether our main results hold. First, we control for other types of institutional ownership individually in our model. In particular, we focus on active open-end mutual funds, index open-end mutual funds and closed-end mutual funds. Second, we control for other sources of public and private

[3]We find evidence indicating that managers learn less from their own firms' stock prices, even when ETF prices are available and the incremental information decreases; that is, informational uncertainty about firms' future cash flow grows as ETF ownership increases. For more details, see Section 4.2 and Table B.1 in the online Supporting Information Appendix.

information transmitted to managers through share prices, using analyst coverage, analyst forecasts, insider trading activity, idiosyncratic volatility, hedge fund ownership and stock price non-synchronicity. Third, we control for information transmitted to managers due to stock mispricing. We use the firm's issuance activity and future abnormal returns to proxy for market mispricing. Fourth, we control for the presence of corporate governance characteristics using a firm's dual-class shares, poison pills, restrictions on the ability to call for special meetings, the number of G-Index–related shareholder proposals, the fraction of outside directors on the board and the percentage of shares owned by blockholders. Then, we control for characteristics related to chief executive officers (CEOs), such as CEO duality, CEO tenure and CEO ownership. Finally, we control for the cost of external financing. Furthermore, as part of our robustness tests, we find that our main results hold (i) when examining the influence of ETF ownership on cash holding levels up to four quarters ahead and (ii) when excluding 'old economy firms' from our sample, which are larger firms with lower growth opportunities that tend to be preferred by ETFs.

In further analyses, we attempt to identify the channels through which cash holdings increase and whether this increase is value-destroying or -enhancing for shareholders. We identify four potential channels by which changes in cash holdings explain the relation between ETF ownership and corporate cash holdings: (i) an increase in revenue, (ii) an increase in new financing, (iii) a decrease in share repurchases and (iv) a decrease in net working capital. Further, we find that an increase in ETF ownership or the number of ETFs investing in a firm leads to an increase in the value of a dollar of cash, which consequently enhances firm value.

This paper contributes to two strands of literature. First, it adds to the rapidly growing literature on ETF ownership. Previous studies investigated the impact of ETF ownership on the volatility of the constituent securities (Ben-David et al., 2018), the comovement and commonality of the liquidity of the underlying securities (Agarwal et al., 2018; Da & Shive, 2018) and whether stock prices convey earnings information (Bhojraj et al., 2020; Israeli et al., 2017). A more closely related literature attempts to understand whether and how firms strategically respond to ETF-related investments in their shares. For, example, Antoniou et al. (2020) provide theoretical and empirical evidence that ETF ownership leads to an increase in the sensitivity of a firm's investment to its share price. We contribute to this literature by arguing that ETF ownership indirectly has a real effect on firms' policies, that is, their cash holdings policy, through decreased stock price informativeness.

Second, several papers attempt to find the main determinants of corporate cash holdings (Bates et al., 2009; Dittmar et al., 2003; Duchin, 2010). Our paper further extends this literature. Specifically, our paper adds to the strand of cash holdings literature investigating the relationship between corporate ownership structure and cash holdings, for example, the relation between firms' corporate cash holdings and inside ownership (Harford et al., 2008), state ownership (R. R. Chen et al., 2018), family ownership (Caprio et al., 2020), institutional ownership (Harford et al., 2008; Ozkan & Ozkan, 2004) and passive ownership (Appel et al., 2016).

The closest paper to ours is that of Appel et al. (2016). The authors investigate the effect of passive ownership, represented by index mutual funds, on corporate cash holdings. Consistent with the notion that passive investors lack the resources and motives to influence corporate policies (Ozkan & Ozkan, 2004), Appel et al. (2016) find relatively little evidence that index mutual funds affect corporate cash holdings. While their sample focuses on index mutual funds in general, ours concentrates on ETF ownership only. Similar to the findings reported by Appel

et al. (2016), we find that non-ETF index funds, as well as, closed-end mutual funds have a negative and statistically insignificant relationship with the firm's cash holdings. However, unlike their finding, we find that ETF ownership alone has a significant positive association with the underlying firms' cash holdings. This result highlights the distinct role of ETF ownership, as opposed to other types of passive institutional ownership, on firms' cash holding policies.

The remainder of this study is organized as follows. Section 2 explains the hypothesis development. Section 3 describes our sample and how we measure our variables and presents the empirical model used for hypothesis testing. Section 4 provides descriptive statistics and discusses the main results. Section 5 addresses endogeneity concerns. Section 6 reports the results of our robustness tests. Section 7 provides further analyses regarding the sources and value of cash. Section 8 concludes the paper.

2 | HYPOTHESIS DEVELOPMENT

The literature on the effects of secondary market stock prices on corporate financial decisions is well developed, both theoretically and empirically. From a theoretical perspective, stock price informativeness relies mainly on Hayek's (1945) idea that stock prices efficiently collect and combine information from a myriad of investors who contribute toward a more efficient allocation of resources. The aggregation of information is permitted by the trading activity of diverse speculators who transmit their private information into market prices via their trades (e.g., Grossman & Stiglitz, 1980; Kyle, 1985). This does not mean that managers are less informed, but it indicates that managers and outsiders have a comparative advantage in producing different types of information (Benhabib et al., 2019; Bond et al., 2012). Naturally, managers want to obtain incremental information produced by financial markets to make a more informed decision on corporate policies (Antoniou et al., 2020). Empirically, several studies find support for an informational channel from stock prices to managerial decisions. Prominent studies focus on investments (Q. Chen et al., 2007; Durnev et al., 2004), mergers and acquisitions (Luo, 2005), cash holdings (Frésard, 2012) and dividends (de Cesari & Huang-Meier, 2015). By and large, the literature emphasizes the existence of an informational channel through which managers 'listen to the market', as changes in corporate policies are sensitive to market reactions (Kau et al., 2008).

The growing investments by ETFs in the stock market and their unique mechanisms (i.e., arbitrage activities, intraday liquidity, high-frequency trading), compared to other types of passive ownership, have motivated researchers to investigate whether ETF ownership affects share price informativeness. The literature documents an overall ambiguous effect of ETF ownership on this informational channel.

One strand of literature argues that increased ETF ownership is associated with the lower transmission of firm- and macrospecific information to managers. The main argument is that an increase in ETF ownership leads to higher trading costs (for both informed and uninformed investors); hence, the acquisition of information and analyses about the underlying securities becomes less important for these investors. Consequently, over time, one would expect higher levels of ETF ownership to be associated with lower levels of private information conveyed to managers through stock prices (Israeli et al., 2017). This argument finds theoretical support in the study of Bhattacharya and O'Hara (2018), who show that the informational channel

between ETFs and their underlying securities could cause the propagation of nonfundamental shocks, causing financial instability.

Several empirical studies also support this argument. For, example, Israeli et al. (2017) and Ben-David et al. (2018) show that ETF ownership increases the non-fundamental volatility of stocks and their pricing inefficiency, respectively. Da and Shive (2018) document that higher ETF trading activity leads to excess return comovement among the underlying stocks. Hamm (2014) finds that ETFs can deteriorate liquidity for their investees. C. Dannhauser and Hoseinzade (2021) find that the unique features of corporate bond ETFs, that is, in-kind creation and redemption mechanisms and the exacerbation of the liquidity mismatch in periods of stress, that heighten the extent of liquidity transformation are a unique source of fragility for corporate bond markets.

The competing argument finds its justification from the theoretical work of Cong and Xu (2019) and Subrahmanyam and Titman (1999), who show that, while the initiation of basket securities could decrease speculators' willingness to acquire and trade on asset-specific information, it could facilitate trading on systematic information. Furthermore, a number of empirical studies, motivated by price discovery theory in market microstructure, find that trading associated with the ETF arbitrage mechanism can improve intraday price discovery for the underlying securities (G. Chen & Strother, 2008; Hasbrouck, 2003; Ivanov et al., 2013). The rationale for this argument is that investors can react to earnings news more quickly by trading the lower-cost ETF instrument. Consequently, the price of the ETFs can lead to the price of the underlying securities in integrating this type of news. This view also receives empirical support. Boehmer and Boehmer (2003) argue that ETF ownership increases the market's liquidity and quality. Glosten et al. (2021) show that the increase in ETF ownership is associated with higher pricing efficiency. On the basis of their high-liquidity characteristics, Antoniou et al. (2020) find that ETFs play a major role in relaxing short-sale restrictions, especially for stocks that are difficult to short. Focusing on corporate bond ETFs, C. D. Dannhauser (2017) finds that ETF activity is associated with a positive valuation effect on the underlying market and overall liquidity improvement due to investors' ability to transact in the highly liquid ETFs.

In this paper, we extend this literature by investigating whether ETF ownership influences managerial cash holding decisions. We focus on this topic for several reasons. First, determining the optimal level of firms' cash holdings is one of the crucial decisions for managers (El Kalak et al., 2020). Second, cash has been regarded as the most easily accessible form of asset for the use of managers and shareholders (Schauten et al., 2013). Third, there is a need to understand the trend in increasing corporate cash holdings over the past years (Bates et al., 2009; Bates et al., 2018). The above reasons, among many others, have motivated researchers to identify the determinants of the cash holding levels in firms (Bates et al., 2009; Opler et al., 1999), proposing several hypotheses to justify the findings.[4]

The trade-off theory of cash holdings argues that managers identify their optimal cash holding levels by weighting the benefits and costs of holding cash (Keynes, 1936). The rationale is that determining the optimal level of cash holdings is vital for several reasons, among them, planning the firm's various financial outcomes, such as investments, capital structure and payout policies. Hence, managers prefer to be sure they will be able to generate steady future

[4]Some of these hypotheses involve the following: (i) the transaction motive (Meltzer, 1963), (ii) the precautionary motive (Bates et al., 2009), (iii) the agency motive (Dittmar et al., 2003; Jensen, 1986), (iv) the financial constraint motive (Almeida et al., 2004), (v) the tax motive (Foley et al., 2007), (vi) the diversification motive (Duchin, 2010) and (vii) the product market competitiveness motive (Frésard, 2010).

cash flows. Otherwise, as a precautionary motive, firms can hold cash should they face higher cash flow uncertainty (Harford et al., 2008; Haushalter et al., 2007). In this study, we examine and show that ETF ownership decreases the underlying stock price informativeness. Hence, there is a decrease in managerial learning from the stock prices and an increase in informational uncertainty. So, if ETFs inversely affect price informativeness, this reduces managerial learning and increases uncertainty. Then, greater ETF ownership will attenuate managers' ability to learn whether cash flows will persist in the future. Therefore, as a precautionary motive, managers tend to increase the level of cash holdings due to increased uncertainty associated with the lower transmission of information from outsiders. Subsequently, we hypothesize the following.

H1: *There is a positive association between ETF ownership and corporate cash holdings.*

3 | DATA SELECTION AND EMPIRICAL DESIGN

3.1 | Data sample

Following Ben-David et al. (2018) and Glosten et al. (2021), we use the Center for Research in Security Prices (CRSP), Compustat, Bloomberg and OptionMetrics to determine the ETFs in our sample. First, we choose securities with a historical share code of 73 in CRSP. Then, we screen all US-traded securities in the Compustat and OptionMetrics databases and add these data to the CRSP ETF sample. We focus on physical ETFs that are listed on US exchanges and whose baskets contain only US stocks. We restrict our sample to the following Lipper Objective codes: CA, EI, G, GI, MC, MR, SG and SP. We also include sector funds that invest in US firms with codes BM, CG, CS, FS, H, ID, NR, RE, TK, TL, S and UT. Lastly, we match this sample of ETFs to the CRSP Mutual Fund and Thomson Reuters Mutual Fund Ownership databases and construct our quarterly ETF holdings data set. This final data set covers the period from 2000 Q1 to 2019 Q4 and contains 454 ETFs, similar to Ben-David et al. (2018) and Glosten et al. (2021), 454 ETFs and 447 ETFs, respectively. The final ETFs sample contains 168,083 firm–quarter observations.

The data sample of firms is obtained from Compustat and is based on all available data for US-listed firms on the American Stock Exchange, New York Stock Exchange and NASDAQ. To avoid any survivorship bias in the data, we include both active and inactive publicly traded firms. As is common in the literature (e.g., Antoniou et al., 2020; Q. Chen et al., 2007), we exclude financial and utility firms. We restrict our sample to firms with headquarters in the United States. We require total assets to have a greater value than capital expenditures and both to have positive values. We drop data where total liabilities are greater than total assets and where the sum of long- and short-term debt is greater than total assets. We use CRSP Mutual Fund, Thomson Reuters and FactSet databases for data on general institutional ownership. We merge the samples of firms and ETF ownership and institutional ownership and require the firms to have ETF ownership levels greater than zero to ensure that our results detect cross-sectional variation in ETF ownership and not just a difference between firms with zero and positive ETF ownership. To avoid the influence of outliers, all variables are winsorized at the first and 99th percentiles. While the sample with only core variables has 143,659 firm–quarter observations, the final sample with the full set of variables consists of 47,183 observations

across 2461 firms because we lose observations due to missing values in a small set of variables in our sample.

3.2 | Variable construction

The literature employs several alternative definitions of the cash ratio. Opler et al. (1999) use cash to net assets as their proxy variable for cash holdings. However, Bates et al. (2009) argue that, if firms hold most of their assets in cash, then the proxy generates extreme outliers and does not provide an accurate measure for cash holdings. Therefore, the authors use the cash-to-assets ratio and cash to sales. Foley et al. (2007) propose using the logarithm of the cash ratio to decrease the effect of extreme outliers. Following Bates et al. (2009) and Foley et al. (2007), we measure corporate cash holdings using *Ln(CashRatio)* as the dependent variable. This measure is the natural logarithm of *CashRatio*, that is cash and short-term investments scaled by net sales at the end of that quarter. In robustness tests, we also use other dependent variables to represent cash holdings, such as just *CashRatio* and *Cash/Asset*, that is, cash and short-term investments scaled by total assets.

We use two measures for ETF ownership as independent variables. Following Glosten et al. (2021), *ETFownership* is the sum of a firm's shares held by all ETFs invested in that firm at the end of that quarter, scaled by the total number of shares outstanding at the end of that quarter. The variable *Ln(ETFnum)* is the natural logarithm of the number of ETFs holding that stock at the end of that quarter. In further analysis, we also use *ETFown-BFM*, following the procedure in Ben-David et al. (2018). Specifically, *ETFown-BFM* in a given stock and quarter is the ratio of the dollar value of total ETF ownership in that stock divided by the stock's market capitalization. To obtain the total ETF ownership for a particular firm, we multiply the weight this firm receives in each ETF fund with the total value of that fund and then sum it across all ETFs.

Following the literature on cash and ETF ownership (e.g., Antoniou et al., 2020; Bates et al., 2009; Evans et al., 2019; Opler et al., 1999), we control for various firm-level attributes that could influence corporate cash holdings. The variable *Ln(FirmSize)* is the natural logarithm of net sales; *Investment* is capital expenditures scaled by net sales; *Leverage* is debt in current liabilities plus long-term debt, scaled by total assets; *CashFlow* is net income before extraordinary items plus depreciation and amortization expenses, scaled by total assets; *SalesGrowth* is the difference in net sales between the current and the previous quarter, scaled by the net sales of the previous quarter; *NWC* is the net working capital in millions of dollars, calculated as working capital minus cash and marketable security adjustments; *Dividend* is a dummy that is equal to one if a firm pays dividends and zero otherwise; *R&D* is the natural logarithm of one plus research and development (R&D) expenses; *Acquisition* is the value of acquisitions scaled by total assets; *IndustrySigma* is industry cash flow risk, defined as the mean of the ratio of the standard deviation of cash flows to the total assets over 10 quarters for firms in the same industry, according to two-digit Standard Industrial Classification (SIC) codes; and *Ln(Age)* is the natural logarithm of firm age in years. To ensure that our ETF variables do not proxy for institutional ownership in general, we control for non-ETF institutional ownership through *Non-ETF IO*, that is, the percentage of shares owned by institutional investors other than ETFs.

3.3 | Methodology

The period for the main analysis is 2000–2019. To test whether ETF ownership in firms increases corporate cash holdings by reducing information flow to managers, we use the following panel fixed effects (FE) ordinary least squares regression model:

$$Ln\,(CashRatio)_{i,t} = \alpha + \beta_1 ETFs\ Ownership\ Measure_{i,t-1} + \Theta X_{i,t-1} + \eta_i + \phi_t + \varepsilon_{i,t}, \quad (1)$$

where $Ln\,(CashRatio)_{i,t}$ is the cash holdings of firm i in quarter t; $ETFs\ Ownership\ Measure_{i,t-1}$ denotes two different variables for firm i in quarter t − 1, namely, *ETFownership* and *Ln (ETFnum)*; and $X_{i,t-1}$ is a vector of control variables (i.e., *Ln(FirmSize)*, *Investment*, *Leverage*, *CashFlow*, *SalesGrowth*, *NWC, Dividend*, *R&D*, *Acquisition*, *IndustrySigma*, *Ln(Age)* and *Non-ETF IO*). To control for any unobserved time-invariant firm-specific factors that could influence firm *i*'s cash holding decisions, we include firm FE in the model, indicated by η_i. The term ϕ_t denotes year–quarter FE, to control for any systematic variation in cash levels in any given quarter across all firms that are related to the macroeconomy. All explanatory variables and controls are lagged by one quarter. Standard errors are clustered by both firm and time (quarters). These econometric specifications are common among empirical corporate finance studies (e.g., Bates et al., 2009; Frésard, 2012; W. Huang & Mazouz, 2018).

4 | MAIN RESULTS

4.1 | Descriptive statistics

Table 1 reports summary statistics for our main sample. The average level of ETF ownership as a percentage of the total number of shares outstanding in the firm is 3.8%, consistent with Israeli et al. (2017) and Ben-David et al. (2018). The average stock in our sample is held by 16.36 ETFs. The average cash ratio in our sample is 4.17, with a standard deviation of 19%. An average firm in our sample has net sales of $758.115 million. On average, firms have a leverage ratio, an investment ratio and sales growth of 20.7%, 9.6% and 4.5%, respectively. Firms in our sample have an average age of 21 years.

Figure 1 depicts the trend in ETF ownership by plotting the average proportion of shares held by ETFs (bars), as well as average corporate cash holdings in millions of dollars (line). The figure shows an overall increase in both cash holding levels and ETF ownership over the sample period. On average, cash holding levels increased from just below $150 million in 2000 to around $450 million in 2019. Similarly, average ETF ownership rose from around 1% in 2000 to just above 8% in 2019. Figure 2 shows the distribution of corporate cash holdings across years for firms belonging to different *ETFownership* groups. A firm is in the high–ETF ownership (low–ETF ownership) group if the annual mean value of *ETFownership* of that firm is in the top (bottom) quartile of *ETFownership* across all firms for that year. During the first few years of our sample period, firms belonging to the low–ETF ownership group hold higher levels of cash compared to firms belonging to the high–ETF ownership group. However, after 2004, cash holding levels start to change for both groups. From 2005 up until the end of our sample period, firms in the high–ETF ownership group consistently hold higher levels of cash holdings relative to their low–ETF ownership

TABLE 1 Descriptive statistics

This table reports the descriptive statistics for the main variables. The sample contains firm–quarter observations for firms that are held by exchange-traded funds (ETFs). The time span for this study is between 2000 and 2019. There are 47,183 observations across 2461 firms. The variable *ETFownership* is the percentage ownership of all ETFs in a company, following Glosten et al. (2021); *ETFnumber* is the number of ETFs holding that stock at the end of a quarter; *CashRatio* is cash and short-term investments, scaled by net sales; *FirmSize* is net sales in millions of dollars; *Investment* is capital expenditures, scaled by net sales; *Leverage* is debt in current liabilities plus long-term debt, scaled by total assets; *CashFlow* is net income before extraordinary item plus depreciation and amortization expenses, scaled by total assets; *SalesGrowth* is the difference in net sales between the current and the previous quarter, scaled by the net sales of the previous quarter; *NWC* is net working capital in millions of dollars, calculated as working capital minus cash and marketable security adjustments; *Dividend* is a dummy that is equal to one if a firm pays dividends and zero otherwise; *R&D* is the natural logarithm of one plus R&D expenses; *Acquisition* is the value of acquisitions, scaled by total assets; *IndustrySigma* is industry cash flow risk, defined as the mean of the ratio of the standard deviation of cash flows to total assets over 10 quarters for firms in the same industry (by two-digit SIC code); *Age* is the firm age in years; and *Non-ETF IO* is the percentage of shares owned by institutional investors other than ETFs. For detailed definitions for these variables, see Table A.1.

	Mean	Standard deviation	25th percentile	Median	75th percentile
ETFownership	0.038	0.037	0.009	0.025	0.056
ETFnumber	16.363	14.558	4.000	13.000	25.000
CashRatio	4.167	19.226	0.129	0.464	1.529
FirmSize (in $M)	758.115	2172.960	28.630	116.349	462.792
Investment	0.096	0.245	0.015	0.032	0.068
Leverage	0.207	0.203	0.009	0.168	0.334
CashFlow	0.005	0.060	0.003	0.019	0.032
SalesGrowth	0.045	0.260	−0.051	0.022	0.100
NWC	130.931	648.268	−2.206	37.500	176.701
Dividend	0.330	0.470	0.000	0.000	1.000
R&D	1.836	1.587	0.459	1.647	2.774
Acquisition	0.006	0.023	0.000	0.000	0.000
IndustrySigma	0.123	0.262	0.019	0.040	0.098
Age	20.824	15.921	8.000	16.000	29.000
Non-ETF IO	0.599	0.288	0.364	0.663	0.845

counterparts. In 2019, the average difference in cash holdings between both groups reached $75 million ($175 minus $100).

4.2 | Main analysis

In this section, we proceed with our main analyses to test for the association between ETF ownership and firms' cash holding levels. Table 2 presents the main analysis. In Columns

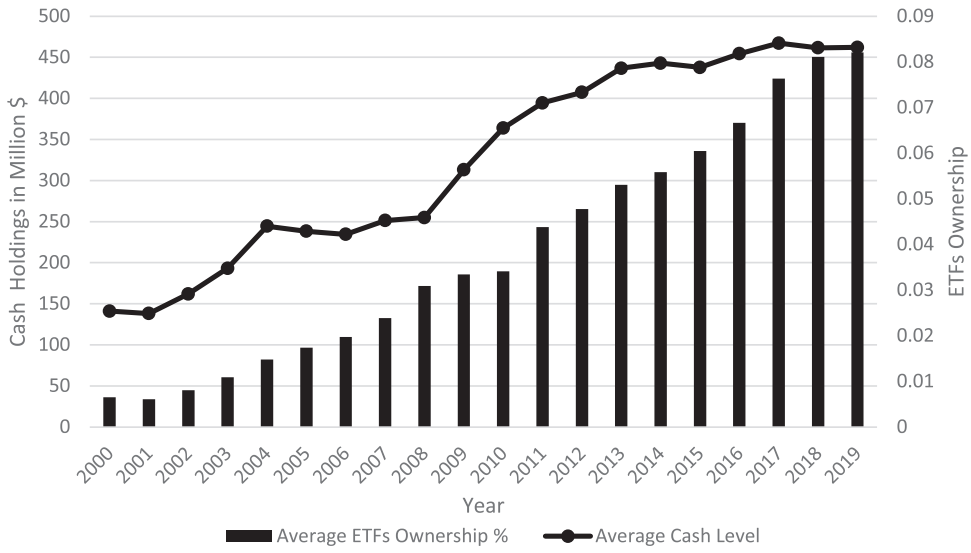

FIGURE 1 Trends in exchange-traded fund (ETF) ownership and corporate cash levels. This figure presents the yearly averages of corporate cash holdings in millions of dollars (line) and the percentage ETF ownership in a stock (bars). The variable definitions are given in Table A.1

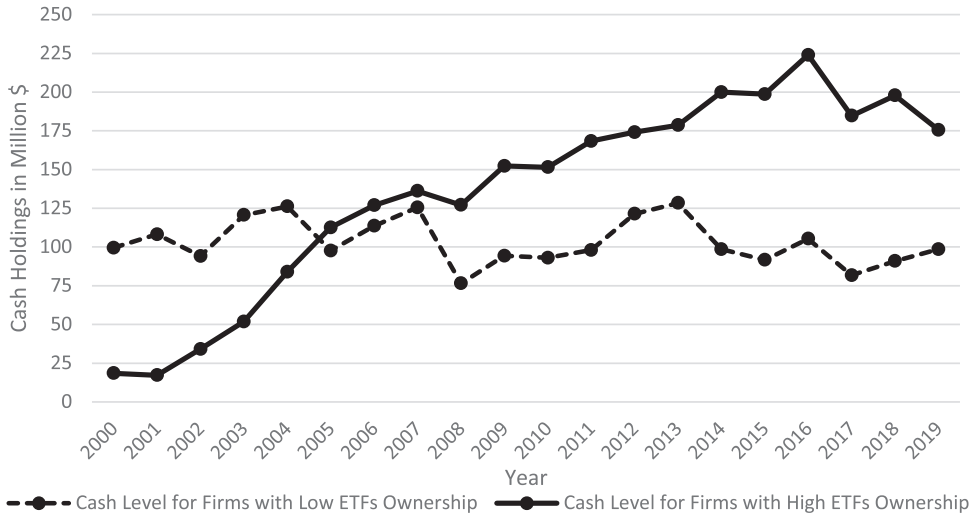

FIGURE 2 Corporate cash holdings for different exchange-traded fund (ETF) ownership groups. This figure presents the distribution of corporate cash holdings across years for firms belonging to different *ETFownership* groups. A firm is in the high-ETF ownership group (low-ETF ownership group) if the annual mean value of *ETFownership* of that firm is in the top (bottom) quartile of *ETFownership* across all firms for that year. The variable definitions are given in Table A.1

I–IV, both models with the core and full set of control variables provide statistically significant and positive estimates for *ETFownership* and *Ln(ETFnum)*. This finding indicates that cash holdings in firms increase as a higher percentage of their shares are owned by ETFs or as more ETFs invest in those firms, respectively. In particular, a one-standard-deviation

TABLE 2 Effect of exchange-traded fund (ETF) ownership on corporate cash holdings

This table reports estimates for *ETFownership* and *Ln(ETFnum)* along with *Ln(FirmSize), Investment, Leverage, CashFlow, SalesGrowth, IndustrySigma, NWC, Dividend, R&D, Acquisition, Ln(Age)* and *Non-ETF IO* as the control variables. The dependent variable is *Ln(CashRatio)*. An intercept is included in the model, but it is not reported in this table. The model is replicated using the following alternative measures: *Cash/Asset* (as the dependent variable), which is cash and short-term investments scaled by total assets and *ETFown-BFM* (as the independent variable), which is the percentage ownership of all ETFs in a company, following Ben-David et al. (2018). The variable definitions are given in Table A.1. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Main model				**Alternative measures**		
	Ln(CashRatio)				**Cash/Asset**		**Ln(CashRatio)**
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
ETFownership	2.357***	1.526***			0.145**		
	(0.506)	(0.560)			(0.074)		
Ln(ETFnum)			0.283***	0.207***		0.019***	
			(0.022)	(0.036)		(0.005)	
ETFown-BFM							1.739**
							(0.746)
Ln(FirmSize)	−0.423***	−0.448***	−0.478***	−0.467***	−0.041***	−0.044***	−0.442***
	(0.021)	(0.035)	(0.021)	(0.035)	(0.004)	(0.004)	(0.035)
Investment	0.190***	−0.004	0.124***	−0.030	−0.032***	−0.035***	0.002
	(0.044)	(0.059)	(0.043)	(0.058)	(0.007)	(0.006)	(0.059)
Leverage	−1.123***	−0.566***	−1.041***	−0.516***	−0.109***	−0.108***	−0.562***
	(0.085)	(0.092)	(0.083)	(0.092)	(0.013)	(0.013)	(0.092)
CashFlow	0.751***	1.153***	0.758***	1.143***	0.134***	0.134***	1.145***
	(0.147)	(0.230)	(0.147)	(0.231)	(0.028)	(0.027)	(0.231)
SalesGrowth	0.093***	0.125***	0.118***	0.135***	0.019***	0.020***	0.123***
	(0.017)	(0.021)	(0.016)	(0.021)	(0.003)	(0.002)	(0.021)
IndustrySigma	0.017	0.039	0.021	0.042	0.008	0.008	0.043
	(0.023)	(0.031)	(0.022)	(0.031)	(0.005)	(0.005)	(0.031)
NWC		0.010***		0.011***	0.021***	0.021***	0.011***
		(0.001)		(0.001)	(0.004)	(0.003)	(0.001)
Dividend		0.042		0.032	0.005	0.002	0.045
		(0.038)		(0.039)	(0.005)	(0.005)	(0.038)
R&D		0.102***		0.091***	−0.025***	−0.026***	0.108***
		(0.034)		(0.033)	(0.005)	(0.004)	(0.034)
Acquisition		−1.489***		−1.538***	−0.360***	−0.362***	−1.492***
		(0.134)		(0.133)	(0.019)	(0.019)	(0.135)

(Continues)

TABLE 2 (Continued)

	Main model				Alternative measures		
	Ln(CashRatio)				Cash/Asset		Ln(CashRatio)
	I	II	III	IV	V	VI	VII
Ln(Age)		−0.274***		−0.267***	−0.050***	−0.074***	−0.279***
		(0.088)		(0.085)	(0.013)	(0.012)	(0.088)
Non-ETF IO		0.516***		0.361***	0.038***	0.029**	0.572***
		(0.084)		(0.081)	(0.014)	(0.013)	(0.082)
Time FE	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.094	0.095	0.104	0.100	0.135	0.141	0.095
Observations	143,569	47,183	143,569	47,183	47,303	47,303	47,172

increase (about 3.7%) in *ETFownership* raises *Ln(CashRatio)* by 8.7% (2.357 × 0.037) and 5.6% (1.526 × 0.037) in Columns I and II, respectively. Similarly, corporate cash holdings increase by about 29% (0.283 × 1.025) and 21.2% (0.207 × 1.025), respectively, if *Ln(ETFnum)* increases by one standard deviation in those firms. To provide a clearer interpretation, we replace *Ln (ETFnum)* with *ETFnumber* and run the model in untabulated analyses. Similar robust results regarding the models with the core and full set of control variables, respectively, suggest that cash holdings in a firm rise by 1.7% and 1.4% if one more ETF invests in that particular firm. These findings support H1 and verify that ETF ownership is associated with higher levels of cash holdings.

In further analyses, we use different measures to represent cash holdings and ETF ownership. The measure *Cash/Asset* is cash and short-term investments scaled by total assets, proposed by Bates et al. (2009) and *ETFown-BFM* is the percentage ownership of all ETFs in a company, following the procedure of Ben-David et al. (2018). The statistically significant and positive results for *ETFownership* and *Ln(ETFnum)* in Columns V and VI in Table 2 are consistent with our original findings and support H1. Specifically, as *ETFownership* and *Ln (ETFnum)* increase by one standard deviation in a firm, the cash-to-assets ratio (*Cash/Asset)* also increases about 0.5% (0.145 × 0.037) and 1.9% (0.019 × 1.025) in that firm, respectively. Measuring ETF ownership through *ETFown-BFM*, we find that cash holdings in firms rise by about 3% (1.739 × 0.017) if ETFs own 1.7% more of that firm's shares. Overall, the findings confirm the effect of ETF ownership on the increase in corporate cash holdings potentially through conveying less efficient information to managers.

To confirm the reduction in managerial learning from the stock market due to increased ETF ownership, we investigate the relation between ETF ownership and stock price informativeness. In particular, we examine whether higher levels of ETF ownership are associated with lower price efficiency, which then leads to reduced managerial learning and, hence, increased informational uncertainty. We first consider firm-specific stock return variation as a measure of price informativeness. French and Roll (1986) and Roll (1988) show that market movements cannot explain a considerable portion of stock return variation. The authors suggest that firm-specific return variation measures the rate of private information incorporation

into prices via trading. We follow Q. Chen et al. (2007) and Tosun (2021) and estimate firm-specific return variation by performing the following regression, using daily data:

$$ret_t = \alpha + \beta_1 Market_t + \beta_2 Industry_t + \varepsilon_t, \quad (2)$$

where *ret* is the daily return of company *i, Market* is the CRSP value-weighted market index and *Industry* is the equally weighted return of a portfolio of firms that belong to the same industry (according to three-digit SIC codes) as firm *i*. For each firm–quarter, firm-specific return variation is estimated by $1 - R^2$ from the regression. We call it *Non-Synchronicity*. As our second measure of price informativeness, we follow Ferreira et al. (2011) and define *Ln(Non-Synchronicity Ratio)* as $\text{Ln}((1 - R^2)/R^2)$. We expect a negative relation between these measures and ETF ownership if higher levels of ETF ownership are associated with lower price efficiency.

Next, we consider Amihud's (2002) illiquidity ratio, *Amihud*, as an alternative measure of price informativeness. We follow Ferreira et al. (2011) and calculate *Amihud* as the quarterly average of the daily ratio of a stock's absolute return to its dollar volume (multiplied by 10^6). This measure is a proxy for the price impact of order flow. Kyle (1985) suggests that the magnitude of the price impact should be a positive function of the perceived amount of informed trading on a stock.[5] Hence, we expect a negative link between *Amihud* and our ETF ownership measures.

Lastly, we follow Lee (2011) and Lesmond et al. (1999) and use *ZERO* as an alternative measure of illiquidity to represent price informativeness, where *ZERO* is the proportion of zero-return days in a quarter for a firm. The economic intuition behind this variable is that informed traders will trade only when the gain from their private information overcomes the transaction cost. For stocks with low liquidity, the high transaction cost will deter informed investors' trading and hence prevent private information from being revealed. Therefore, a larger proportion of zero-return days should be observed for illiquid stocks. We expect a positive association between ETF ownership and *ZERO*.

The results are provided in Table B.1 in the online Supporting Information Appendix. The findings confirm our expectations. Specifically, they indicate that *ETFownership* and *Ln(ETFnum)* are statistically significantly and negatively (positively) related to *Non-Synchronicity*, *Ln (Non-Synchronicity Ratio), Amihud* (and *ZERO*). This result suggests that ETF ownership is linked to reduced price efficiency (and hence reduced managerial learning), leading to increased informational uncertainty.

5 | IDENTIFICATION TESTS

ETF ownership is sought to be largely exogenous to firm-specific characteristics. The goal of these investment vehicles, as passive investors, is to replicate the return of market indexes with minimum tracking errors. Therefore, ETFs do not base their investment decisions on fundamental value or the investment appeal of the underlying securities; hence, they have less motivation to intervene or monitor their investee firms.[6] Nevertheless, one could argue that our

[5]We acknowledge that illiquidity will also reflect the trading cost of order size.
[6]ETFs affect managerial financial decisions, that is, cash holdings, by changing the information environment surrounding their constituent firms.

results are driven by reverse causality, where cash holding levels signal the firm's quality and attract more traders (W. Huang & Mazouz, 2018) and thus affect ETFs' decisions to invest in this firm. Therefore, we use two natural experiments as an identification strategy to highlight the causal effect of ETF ownership on firms' cash holding decisions, namely, (i) BlackRock's purchase of iShares and (ii) the reconstitution of the Russell 1000/2000 index.

5.1 | Natural experiment with iShares ETFs

In this first IV model, our instrument is based on BlackRock's acquisition of Barclays Global Investors and its iShares unit at the end of 2009. At that time, Barclays wanted to avoid a possible bailout by the U.K. government and sold Barclays Global Investors to strengthen its position. Because BlackRock was in a better position to attract capital into its funds, due to a stronger brand name, a more specialized workforce and better distribution channels (Zou, 2019),[7] the assets under management for iShares ETFs increased by 19% after the acquisition (BlackRock, 2010). This acquisition resulted in a significant increase in inflows for iShares ETFs relative to ETFs not belonging to iShares. Hence, this event suggests that companies owned by iShares ETFs experienced an exogenous increase in ETF ownership after 2009. Thus, our instrument is *Post*iShares*, where *Post* is a dummy that equals one after 2009 and *iShares* is a dummy that flags whether a specific company is owned by iShares ETFs. The exclusion restriction is likely to be satisfied because there is no economic reason to expect companies owned by iShares ETFs to have different corporate firm policies after 2009, relative to companies not owned by iShares. A total of 615 firms (about 25%) in our sample have no iShares ETF ownership. Further, in untabulated analysis, we find that the fundamental characteristics, that is, size, investment, leverage and firm age, do not differ between firms with and without iShares ETF ownership and the industry distribution is also similar for these two groups of firms.[8]

The first-stage model of our IV estimation is shown below:

$$ETFs\ Ownership\ Measure_{i,t} = \alpha + \beta_1 Instrument_{i,t-1} + \Theta X_{i,t-1} + \eta_i + \phi_t + \varepsilon_{i,t}, \quad (3)$$

where *Instrument* is *Post*iShares*. We estimate this model using the full set of controls, as shown by Columns II and IV in Table 2. In the second stage, we estimate the model below, using the same controls and replacing *ETFs Ownership Measure* with the predicted value from the model in Equation (3):

$$Ln(CashRatio)_{i,t} = \alpha + \beta_1 \widehat{ETF}_{i,t-1} + \Theta X_{i,t-1} + \eta_i + \phi_t + \varepsilon_{i,t}. \quad (4)$$

[7]Zou (2019) uses this event to examine whether ETF ownership contributes to an overvaluation of the stocks included in ETF baskets.

[8]We acknowledge that 2009 also corresponds to the global financial crisis and the period afterward includes events such as the Dodd–Frank Wall Street Reform and Consumer Protection Act, which can potentially influence the model design and, hence, the results. Bearing this limitation in mind, we believe this should not be an issue for the exercise. These events would influence all firms without exception and would not result in firm differentiation that would intervene with the design of the analysis through iShares ETFs.

Similar to our previous analyses, all right-hand variables are lagged by one quarter and we include quarter and firm FE in all regressions in both stages.

Table 3 reports the results using *Post*iShares* as the IV. In Columns I and II, we provide the first-stage regression results using *ETFownership* and *ln(ETFnum)* as the dependent variables, respectively. The coefficients on *Post*iShares* are significant and positive at the 1% level. This result indicates that ETF ownership and the number of ETFs increase after 2009 for firms owned by iShares ETFs. Columns III and IV present the findings from the second-stage estimation. We find that, for both dependent variables *ETFownership* and *ln(ETFnum)*, the coefficient estimates remain consistently positive and statistically significant at the 1% level, supporting H1 on the positive association between ETF ownership and firm cash holdings. Specifically, a 1% increase in *ETFownership* and *Ln(ETFnum)* increases *Ln(CashRatio)* by 22.86% (22.860×0.01) and 0.36% (0.363×0.01), respectively.

Our instrument is not subject to the issues of weak instruments or under-identification. To address these issues, we first conduct the Cragg–Donald Wald *F*-test for weak instruments and find that all *F*-statistics are above the Stock–Yogo critical *F*-statistic value of 19.93; that is, our instruments pass the weak instrument test. Second, we perform Anderson's canonical χ^2 test for under-identification. The χ^2 values are statistically significant at the 1% level, which suggests that canonical correlation is different from zero and that under-identification is not an issue in our analyses.

5.2 | Natural experiment with the Russell 1000/2000 reconstitution

In this second IV model, we follow Appel et al. (2016), Ben-David et al. (2018) and Fich et al. (2015) and use the variation in ETF ownership that occurs around the cutoff point used to construct the Russell 1000 and Russell 2000 indexes. Regarding market capitalization, the Russell 1000 includes the largest 1000 US stocks and the Russell 2000 comprises the next largest 2000 stocks. The index assignment impacts the extent of ETF ownership in that stock, as the portfolio weights assigned to each stock within an index are value-weighted. Chang et al. (2015) show that the weights of the top stocks in the Russell 2000 are much larger than those of the bottom stocks in the Russell 1000.

We carry out a two-stage least-squares estimation and repeat the analysis for two separate samples of stocks: (i) those that, in May, before the index reconstitution, are in the Russell 1000 and (ii) those that are in the Russell 2000. For bandwidth, we consider 300 stocks on each side of the cutoff point.[9] In the first stage, we instrument ETF ownership with an indicator denoting whether the stock switches index membership in June and stays in that index until May of next year. For the Russell 1000 sample, the indicator variable flags stocks that switch to the Russell 2000 and vice versa for the Russell 2000 sample.

The first-stage model of the IV estimation is shown below:

$$ETFs\ Ownership\ Measure_{i,t} = \alpha + \beta_1 Switch_{i,t} + \Theta X_{i,t} + \eta_i + \phi_t + \varepsilon_{i,t}, \quad (5)$$

[9]Appel et al. (2016) use 250 stocks as the only bandwidth, while Ben-David et al. (2018) include several other bandwidths, namely, 100, 200, 300, 400 and 500. To be consistent with both papers, we pick 300 as the bandwidth; nevertheless, our results hold for other bandwidths as well.

TABLE 3 Natural experiment with BlackRock's purchase of iShares

This table reports the results from IV regression analysis with *Ln(CashRatio)* as the dependent variable in the second-stage model. An intercept is included in both the first- and second-stage models, but it is not reported in this table. Columns I and II show the coefficient estimates on the instrument (*Post*iShares*) from the first-stage regressions, where the dependent variables are *ETF ownership* and *Ln(ETFnum)*, respectively. The variable *Post* is a dummy that is equal to one for quarters starting in 2010 and zero otherwise; *iShares* is a dummy variable that is equal to one for firms with iShares ownership and zero otherwise; and *Post* and *iShares* are not included in the model individually, as they are subsumed by firm and time FE, respectively. The controls are included in the models. The variable definitions are given in Table A.1. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. For to test for weak instruments and under-identification, the Cragg–Donald Wald and Anderson canonical correlation likelihood ratio statistics are shown, respectively. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	First stage		**Second stage**	
	ETFownership	**Ln(ETFnum)**	**Ln(CashRatio)**	
	I	**II**	**III**	**IV**
Post × iShares	0.006***	0.354***		
	(0.001)	(0.017)		
ETFownership-fitted			22.860***	
			(7.241)	
Ln(ETFnum)-fitted				0.363***
				(0.106)
Ln(FirmSize)	0.004***	0.116***	−0.525***	−0.486***
	(0.001)	(0.010)	(0.044)	(0.036)
Investment	0.005***	0.160***	−0.116	−0.056
	(0.001)	(0.017)	(0.070)	(0.060)
Leverage	0.003	−0.211***	−0.638***	−0.482***
	(0.002)	(0.033)	(0.113)	(0.097)
CashFlow	−0.006*	−0.001	1.290***	1.143***
	(0.003)	(0.065)	(0.195)	(0.168)
SalesGrowth	−0.002***	−0.060***	0.160***	0.145***
	(0.001)	(0.006)	(0.026)	(0.022)
NWC	0.001	0.001	0.010***	0.011***
	(0.001)	(0.001)	(0.002)	(0.002)
Dividend	0.003***	0.065***	−0.026	0.025
	(0.001)	(0.013)	(0.050)	(0.039)
R&D	0.004***	0.079***	0.026	0.079**
	(0.001)	(0.012)	(0.048)	(0.034)

TABLE 3 (Continued)

	First stage		Second stage	
	ETFownership	Ln(ETFnum)	Ln(CashRatio)	
	I	II	III	IV
Acquisition	−0.001	0.224***	−1.492***	−1.576***
	(0.003)	(0.049)	(0.142)	(0.130)
IndustrySigma	0.002**	0.004	0.001	0.040
	(0.001)	(0.014)	(0.039)	(0.032)
Ln(Age)	0.009***	−0.042	−0.440***	−0.213***
	(0.002)	(0.036)	(0.134)	(0.081)
Non-ETF IO	0.047***	1.065***	−0.504	0.178
	(0.003)	(0.051)	(0.350)	(0.140)
Time and firm FE	YES	YES	YES	YES
Weak instrument test	185.732	410.894		
Under-identification test	40.296	198.311		
Adj. R^2	0.685	0.406	0.106	0.095
Observations	47,183	47,183	47,183	47,183

where *Switch* is the indicator, that is, either *Switch1000* or *Switch2000*. We use the first-degree (linear) polynomial of the ranking variable and estimate this model with our full set of controls and *Ln(Firm Size)*, as discussed by Ben-David et al. (2018). In the second stage, we estimate the following model, using the same controls and the predicted value from the model in Equation (5):

$$Ln(Cash\ Ratio)_{i,t} = \alpha + \beta_1 \widehat{ETF}_{i,t-1} + \Theta X_{i,t-1} + \eta_i + \phi_t + \varepsilon_{i,t}. \quad (6)$$

Similar to our previous analyses, all the right-hand variables are lagged by one quarter and we include quarter and firm FE in all regressions in both stages. Lastly, we believe the exclusion restriction for our instrument is likely to be satisfied, because there is no reason to expect that inclusion in the Russell 1000/2000 index should directly affect those firms' cash levels through its impact on passive ownership, after restricting the sample to stocks close to the Russell 1000/2000 cutoff and controlling for the relevant factors.

Table 4 reports the results for stocks that belonged to the Russell 1000 before index reconstitution (Columns I–IV) and stocks belonging to the Russell 2000 before the index reconstitution (Columns V–VIII). In Columns I and II (V and VI), we provide the first-stage regression results using *ETFownership* and *ln(ETFnum)* as the dependent variables, respectively. The coefficients on *Switch2000* (*Switch1000*) are significant and positive (negative) at the 1% level, which indicates that ETF ownership and the number of ETFs increase (decrease) in firms that are dropped to the Russell 2000 index (are raised to the Russell 1000 index). Columns III, IV, VII and VIII present the findings from the second-stage estimation. We find that, for both independent variables *ETFownership* and *ln(ETFnum)*, the coefficient estimates remain

TABLE 4 Natural experiment with the Russell 1000/2000 reconstitution

This table reports the results from IV regression analysis with *Ln(CashRatio)* as the dependent variable in the second-stage model. An intercept is included in both the first- and second-stage models, but it is not reported in this table. Columns I and II (V and VI) show the coefficient estimates on the instrument *Switch2000* (*Switch1000*) from the first-stage regressions, where the dependent variables are *ETF ownership* and *Ln(ETFnum)*, respectively. The variable *Switch2000* (*Switch1000*) is an indicator variable that flags stocks that switch to the Russell 2000 (Russell 1000). Columns III and IV (VII and VIII) give the coefficient estimates on the fitted values of *ETF ownership* and *Ln (ETFnum)* in the second-stage regressions, respectively. The controls are included in the models. The variable definitions are given in Table A.1. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. For weak and underidentification tests, the Cragg–Donald Wald and Anderson canonical correlation likelihood ratio statistics are shown, respectively. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Switch to Russell 2000, Bandwidth +/−300				**Switch to Russell 1000, Bandwidth +/−300**			
	First Stage		**Second Stage**		**First Stage**		**Second Stage**	
	ETFownership	**Ln(ETFnum)**	**Ln(CashRatio)**		**ETFownership**	**Ln(ETFnum)**	**Ln(CashRatio)**	
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
Switch2000	0.011***	0.107***						
	(0.001)	(0.018)						
Switch1000					−0.006***	−0.178***		
					(0.001)	(0.014)		
ETFownership-fitted			9.975***				10.510**	
			(3.503)				(4.102)	
Ln(ETFnum)-fitted				0.881***				0.552**
				(0.315)				(0.281)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time and firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Weak instr. test	42.686	109.875			9.447	13.887		
Under-ident. test	42.605	115.812			19.240	23.626		
Adj. R^2	0.782	0.558	0.162	0.163	0.770	0.601	0.161	0.159
Observations	13,368	13,368	13,368	13,368	13,368	13,368	13,368	13,368

consistently positive and statistically significant at least at the 5% level, supporting H1 about the positive relation between ETF ownership and firm cash holdings. In particular, a 1% increase in *ETFownership* and *Ln(ETFnum)* increases *Ln(CashRatio)* by 9.98% (9.975×0.01) and 0.88% (0.881×0.01), as well as, 10.51% (10.510×0.01) and 0.55% (0.552×0.01) for firms in the two different Russell index groups, respectively.

Our instruments pass the weak instrument test, as the *F*-statistics from the Cragg–Donald Wald *F*-test are above the Stock–Yogo critical *F*-statistic value of 19.93. Further, the statistically significant χ^2 values from Anderson's canonical correlation χ^2 test indicate that canonical correlation is different from zero and that underidentification is not an issue in these analyses.

6 | ROBUSTNESS TESTS

In this section, we discuss additional tests to check the validity of our baseline results. First, we provide additional controls that could be argued to drive the level of cash holdings. These controls relate to other types of institutional ownership, managerial learning, market mispricing, corporate governance and external financing costs. Second, we conduct additional analyses to test whether the effect of ETF ownership on cash holding levels provides consistent results over an extended period. We check whether our results hold after excluding old economy firms.

6.1 | Additional controls

Similar to ETFs, other institutional traders invest in the same firms, too. Active, index and closed-end mutual funds can also influence corporate cash holdings through their ownership. Although we control for aggregate non-ETF ownership in our analyses, including them individually in the model can provide further insight. Following Ben-David et al. (2018), we calculate separately the ownership by active open-end mutual funds, index open-end mutual funds and closed-end mutual funds, that is, *Active Ownership*, *Index Ownership* and *Closed-End Ownership*, respectively. We repeat the main analysis including these new variables individually, as well as all together. The findings are reported in Table 5. First, in Models (4) and (8), we find consistent results with those reported by Appel et al. (2016), that is, there appears to be a negative relationship, although insignificant, between cash holdings and non-ETF index funds, as well as, with closed-end mutual funds. These findings are in line with the notion that passive investors lack the resources necessary to research and influence corporate policies. Second and most importantly, the results in Table 5 show that even after controlling for ownership by other institutional investors separately, higher levels of ETF ownership and greater numbers of ETFs investing in firms are associated with an increase in firms' cash holdings. These results provide further support for H1.

So far, we have established a strong link between ETF ownership and cash holding levels. This evidence supports the notion of increased cash holdings as a precautionary motive for managers in firms owned by ETFs, because of the higher informational uncertainty through less efficient stock price information. Nevertheless, we have not ruled out the possibility that managers might already have acquired private or new information through different channels; hence, they decide on cash holding levels based on their acquired information rather than less efficient information transmitted through share prices from ETF ownership. It is not an easy task to identify the exact type of

TABLE 5 Additional controls—ownership by other institutional investors

This table reports the results from ordinary least squares panel regressions with *Ln(CashRatio)* as the dependent variable. Analyses are conducted with *ETFownership* and *Ln(ETFnum)*, along with control variables. An intercept is included in the model, but it is not reported in this table. Following Ben-David et al. (2018), we calculate separately ownership by active open-end mutual funds, index open-end mutual funds and closed-end mutual funds, that is, *Active Ownership*, *Index Ownership* and *Closed-End Ownership*, respectively. These additional controls are included in the model individually, as well as all together. The variable definitions are given in Table A.1. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Ln(CashRatio)							
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
ETFownership	1.325**	1.322**	1.511***	1.305**				
	(0.581)	(0.581)	(0.561)	(0.582)				
Ln(ETFnum)					0.203***	0.204***	0.207***	0.203***
					(0.036)	(0.036)	(0.036)	(0.036)
Active Ownership	2.000*			3.908	0.375			2.417
	(1.139)			(10.440)	(0.979)			(9.916)
Index Ownership		1.936*		−1.783		0.339		−1.919
		(1.115)		(10.260)		(0.962)		(9.749)
Closed-End Ownership			−6.382	−7.039			−6.848	−6.999
			(5.248)	(5.277)			(5.168)	(5.202)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time and firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.095	0.095	0.095	0.096	0.100	0.100	0.100	0.100
Observations	47,183	47,183	47,183	47,183	47,183	47,183	47,183	47,183

information possessed independently by managers from the information they learn from stock prices generated by ETF ownership. However, following the previous literature (Antoniou et al., 2020; Q. Chen et al., 2007; Frésard, 2012), we include several variables individually to our baseline model (1) to control for the additional managerial information channels.

First, following prior literature on pricing efficiency (Choi et al., 2011; Durnev et al., 2003; Piotroski & Roulstone, 2004), we measure the quantity of public information by using the variables *Analyst Coverage*, *Residual Analyst Coverage* and *Analyst Forecast*. The intuition behind these measures is that information conveyed by analysts to outsiders is unlikely to be new to managers. The variable *Analyst Coverage* is defined as $\log(1 + N)$, where N is the number of analysts issuing one-quarter-ahead earnings forecasts in quarter $t - 1$ for firm i. The residual analyst coverage variable *Residual Analyst Coverage* is measured using the residual from a regression of $\log(1 + N)$ on log(market value), following Hong et al. (2000). The variable *Analyst Forecast* is the median analyst forecast for long-term earnings growth, obtained from Institutional Brokers' Estimate System.

Second, we use insiders' trading activity to proxy for private information possessed by managers. Intuitively, managers are more likely to trade their stocks when they hold more private information compared to outsiders. The variable used is *Insiders*, which represents the number of transactions by insiders scaled by the total number of transactions during a quarter. Third, we use idiosyncratic volatility to control for the increase in noisy information transmitted through share prices. the variable *Ivolatility* is idiosyncratic volatility, calculated as the standard deviation of residuals from the market model, using the equally weighted CRSP index as the market portfolio. We then control for hedge fund ownership in the firm. Hedge funds are considered sophisticated institutional investors with better information processing skills relative to uninformed investors. Hence, the new information transmitted from share prices, that managers possess, could be driven by hedge funds' investments in these firms. The variable *HFownership* is the percentage of shares owned by hedge funds.

Finally, we use stock price non-synchronicity as a proxy for the amounts of private information embedded in stock prices. This proxy reflects the variation in the return on a stock that cannot be explained by either market or industry returns. As explained in Section 4.2, *Non-Synchronicity* is calculated following Q. Chen et al. (2007) and Tosun (2021).

The results reported in Table 6 indicate that, even after controlling for managerial learning proxies, the increase in ETF ownership and the number of ETFs holding a firm's stocks leads to an increase in the firm's cash holdings. In Panel (a), we use *ETFownership* as the dependent variable. For all models in Columns I to VII, the coefficient estimates remain consistently positive and statistically significant. Furthermore, we find the variable *Analyst Coverage* positively affects the firm's cash holding levels. In contrast, we find *Ivolatility* and *Non-Synchronicity* to have a significantly negative association with cash holding levels. The variables *Residual Analyst Coverage, Insiders, HFownership* and *Analyst Forecast* do not have a statistically significant association with firm cash holding levels. As shown in Panel (b), we use *Ln(ETFnum)* as the main dependent variable. The coefficients of *Ln(ETFnum)* remain positive and statistically significant. Overall, these findings still support our hypothesis, even after controlling for managerial private information.

So far, we confirm that, even after controlling for managerial private information, our results are driven by less efficient information being conveyed by ETF ownership, leading to higher informational uncertainty, which affects cash holding decisions. However, despite controlling for managerial information, mispriced stocks could be argued to transmit private information to managers who use it to alter their cash holding levels. Hence, the effect is not driven by ETF ownership, but, rather, by market mispricing. Stock markets consist of both informed and uninformed investors. So far, we assume that cash holding decisions are driven by ETF ownership through private information generated by rational trades in the market; hence, stocks are priced at their fundamental value. However, we cannot rule out the possibility that uninformed investors could alter stock prices and shift them from their true value.[10]

Baker and Wurgler (2002) and Baker et al. (2003) show that the managers of overvalued firms rely on irrational future cash flows and discount rates to issue stocks at a cheaper price. Therefore, our results could be due to information transmitted based on stock mispricing, rather than ETF ownership, which is driving the increase in cash holding levels. This notion is supported by Hertzel and Li (2010) and Kim and Weisbach (2008), who find that mispriced

[10]S. Huang et al. (2018) and Li and Zhu (2018) find that ETFs help in reducing the stock mispricing of the underlying securities. Even if this is the case, stock price anomalies can still exist.

TABLE 6 Additional controls—managerial Learning

This table reports the results from the ordinary least squares panel regressions with *Ln(CashRatio)* as the dependent variable. Analyses are conducted with *ETFownership* and *Ln(ETFnum)* in Panels (a) and (b), respectively. An intercept is included in the model, but it is not reported in this table. New control variables are included individually, to control for different channels of managerial learning, as follows: *Analyst Coverage*, defined as $\log(1+N)$, where N is the number of analysts issuing one-quarter-ahead earnings forecasts in quarter $t-1$ for firm i; *Residual Analyst Coverage*, measured using the residual from a regression of $\log(1+N)$ on log (market value), following Hong et al. (2000); *Insiders* represents the number of transactions by insiders scaled by the total number of transactions during a quarter; *Ivolatility* is idiosyncratic volatility, calculated as the standard deviation of residuals from the market model, using the equally weighted CRSP index as the market portfolio; *HFownership* is the percentage of shares owned by hedge funds; *Analyst Forecast* is the median analyst forecast for long-term earnings growth obtained from Institutional Brokers' Estimate System; and *Non-Synchronicity* is calculated following Q. Chen et al. (2007). Specifically, for each firm i and each quarter, we perform the following regression using daily data: $ret_t = \alpha + \beta_1 Market_t + \beta_2 Industry_t + \varepsilon_t$, where *ret* is the daily return of company i, *Market* is the CRSP value-weighted market index and *Industry* is the equally weighted return of a portfolio of firms that belong to the same industry as firm i (by three-digit SIC codes). The variable *Non-Synchronicity* for firm i in quarter t is one minus the R^2 value from this regression. The definitions for the remaining variables are given in Table A.1. All the control variables in Table 2 are included. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

(a) Analyses with *ETFownership*							
	Ln(CashRatio)						
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
ETFownership	1.385***	1.498***	1.205*	1.559***	1.442***	1.493***	1.515***
	(0.535)	(0.559)	(0.726)	(0.570)	(0.560)	(0.552)	(0.570)
Analyst Coverage	0.114***						
	(0.025)						
Res. Analyst Cov		0.068					
		(0.060)					
Insiders			−0.161				
			(0.120)				
Ivolatility				−2.143***			
				(0.486)			
HFownership					5.650		
					(4.473)		
Analyst Forecast						0.008	
						(0.012)	
Non-Synchronicity							−0.060*
							(0.033)
Controls	YES	YES	YES	YES	YES	YES	YES
Time and firm FE	YES	YES	YES	YES	YES	YES	YES

TABLE 6 (Continued)

(a) Analyses with *ETFownership*							
	Ln(CashRatio)						
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
Adj. R^2	0.106	0.104	0.102	0.096	0.095	0.104	0.095
Observations	42,944	42,480	27,129	46,819	47,183	42,944	46,830
(b) Analyses with Ln(ETFnum)							
	Ln(CashRatio)						
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**
Ln(ETFnum)	0.230***	0.253***	0.201***	0.212***	0.207***	0.247***	0.213***
	(0.039)	(0.039)	(0.039)	(0.037)	(0.036)	(0.039)	(0.036)
Analyst Coverage	0.083***						
	(0.024)						
Res. Analyst Cov		0.060					
		(0.060)					
Insiders			−0.107				
			(0.117)				
Ivolatility				−1.624***			
				(0.474)			
HFownership					7.237		
					(4.452)		
Analyst Forecast						0.002	
						(0.012)	
Non-Synchronicity							−0.012
							(0.031)
Controls	YES	YES	YES	YES	YES	YES	YES
Time and firm FE	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.111	0.111	0.106	0.101	0.100	0.110	0.100
Observations	42,944	42,480	27,129	46,819	47,183	42,944	46,830

firms accumulate higher levels of cash after issuing equities. To control for the potential effect of stock mispricing, we consider several measures of stock price overvaluation. Following Frésard (2012) and Hertzel and Li (2010), we control for firms' issuance activity and future abnormal returns, in addition to excluding firms that held their initial public offerings (IPOs) less than 1 year or 3 years ago. We use *Issuance* as a proxy for firms' issuance activity, which is defined as the quarterly change in equity plus the change in deferred taxes minus change in retained earnings, divided by the beginning-of-quarter equity stock. The rationale behind this measure is that firms could save the proceeds from their stock issuance in the form of liquid

cash, hence increasing the level of cash holdings. It could, therefore, be argued that our results relate to higher levels of issuance activities for overvalued securities.

Second, we use future abnormal return, that is, *FutureReturn*, to control for stock mispricing. This measure is calculated as the value-weighted market-adjusted returns cumulated over three quarters. The logic behind this measure is derived from the argument of Baker and Wurgler (2002), who find that firms with overvalued stocks exhibit negative returns as the mispricing is corrected. Finally, we remove firms that had their IPOs less than 1 or 3 years ago, for several reasons. First, according to Bates et al. (2009), young firms often hoard higher levels of cash and tend to engage in more equity issuance after their IPO date. Second, Frésard (2012) argues that new firms are more difficult to price due to their more complex valuation, which leads to larger pricing errors.

Table 7 reports the results. When controlling for firms' issuance activities, the coefficients of both ETF measures indicate positive and statistically significant results. In addition, the coefficient of *Issuance* is positive and significant at the 1% level, which means that firms hoard part of the issuance proceeds in their cash balances. These finding are in line with those of Frésard (2012). Overall, we find that the prices of overvalued stocks do not affect cash holdings only through stock issuance, but ETF ownership also plays a role. Similarly, after controlling for *FutureReturn*, we find that the coefficients on ETF measures remain positive and significant. The negative and significant coefficients on *FutureReturn* further support the notion that firms with overvalued stocks save more. Finally, our main results still hold and H1 is supported when we exclude firms that had their IPOs less than 1 or 3 years ago.

It is well established in the literature that firm corporate governance characteristics are important determinants of cash holding levels (Dittmar & Mahrt-Smith, 2007; Harford et al., 2008). Further, two recent studies document an association between increased levels of passive investors, including ETF ownership and a firm's corporate governance structure (Appel et al., 2016; Schmidt & Fahlenbrach, 2017). It could therefore be argued that firms change their cash holding levels due to changes in corporate governance triggered by increased ETF ownership. To provide a clear impact of ETF ownership on cash holdings, we test whether the corporate governance channel affects our main findings. First, we follow Appel et al. (2016) and Schmidt and Fahlenbrach (2017) and control for several corporate governance variables that are found to be affected by ETF ownership. These variables include *DualClass*, which controls for the presence of dual-class shares and is defined as a dummy variable that equals one if the firm has dual-class shares in that particular year–quarter and zero otherwise; *PoisonPill*, which represents the shareholders' antitakeover strategy and is defined as a dummy variable that is equal to one if the firm's poison pill is either withdrawn or allowed to expire and zero otherwise; *SpecialMeeting*, a dummy variable that is equal to one if the firm eliminates restrictions on the ability to call special meetings and zero otherwise; *Proposals*, the number of G-Index–related shareholder proposals; *Independence*, the fraction of outside directors on the board; and *BlockholderOwn*, the fraction of shares owned by blockholders who are investors holding at least 5% of the firm's outstanding shares.

In our second set of corporate governance variables, we include a set of CEO-related control variables considering the influence of institutional investors on the CEO (e.g., Tosun, 2020). These variables include *Duality*, which is an indicator that equals one if the CEO is also the chair of the board and zero otherwise; *CEOTenure*, which is the number of years the CEO has held that title in that firm; and *CEOOwn*, the fraction of outstanding shares owned by the CEO.

The results of these tests are provided in Table B.2 in the online Supporting Information. In Columns I and III, we only control for corporate governance characteristics, while, in Columns II

TABLE 7 Additional controls—market mispricing

This table reports the results from the ordinary least squares panel regressions of *Ln(CashRatio)* on *ETFownership* and *Ln(ETFnum)*, along with controls. These analyses are conducted to control for a potential effect of market mispricing. An intercept is included in the model, but it is not reported in this table. Columns I to IV include the following new control variables: *Issuance*, which is the quarterly change in equity plus the change in deferred taxes minus the change in retained earnings, divided by the beginning-of-quarter equity stock and *FutureReturn*, which is the future abnormal return, calculated as value-weighted market-adjusted returns cumulated over three quarters. Columns V–VIII exclude young firms, that is, firms that had an IPO less than 1 and 3 years ago, respectively. The definitions for the remaining variables are given in Table A.1. All the control variables in Table 2 are included. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	Ln(CashRatio)							
					IPO < 1 Year		**IPO < 3 Years**	
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
ETFownership	1.547**		1.320**		1.661***		1.407**	
	(0.602)		(0.660)		(0.590)		(0.630)	
Ln(ETFnum)		0.217***		0.204***		0.209***		0.193***
		(0.038)		(0.039)		(0.039)		(0.041)
Issuance	0.093***	0.094***						
	(0.019)	(0.018)						
FutureReturn			−0.032**	−0.029**				
			(0.014)	(0.013)				
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.095	0.100	0.087	0.092	0.089	0.094	0.086	0.090
Observations	41,599	41,599	40,402	40,402	44,893	44,893	41,568	41,568

and IV, we include the set of CEO-related control variables. Even after controlling for both sets of controls, we still find that the presence of ETF ownership, represented by *ETFownership* and *Ln (ETFnum)*, positively and significantly affects the level of cash holdings in ETFs' constituent firms. These findings show that our results are not driven by the corporate governance channel.

Finally, according to pecking order theory, the use of internal financing, that is, cash holdings depends on a firm's preference for external financing, namely, equity and debt financing. Since the cost of financing is the main determinant of whether a firm decides on internal over external financing, it could be argued that the level of cash is driven by the cost of external financing. To control for potential influence of the firm's external cost of financing on cash holdings, we follow Diether et al. (2002), Hall and Jorgenson (1967), Hennessy and Whited (2007), Krishnaswami and Subramaniam (1999), Lyandres (2007) and Tosun and Senbet (2020) and include new control variables individually. These variables are (i) *LTRate*, the long-term interest rate in terms of US government bonds maturing in 10 years; (ii) *ExtFinCost*, the

weighted sum of the earnings yield (as the real cost of equity), the prime rate and Moody's AAA corporate bond yield (both as real costs of debt) using weights of 60%, 25% and 15%, respectively; (iii) *InvFirmAge*, the inverse of firm age, which is the difference between the year of observation and the first year the firm appeared in Compustat; (iv) *ForecastDisp*, the dispersion of analysts' forecasts of a firm's earnings, that is, the ratio of the standard deviation of annual earnings forecasts to the absolute value of the mean earnings forecast in the year preceding the year of observation; and (v) *ForecastErrDum*, a dummy variable equal to one if the ratio of the forecast error in earnings to the earnings volatility of the firm is above the sample median and zero otherwise.[11] The results are provided in Table B.3 in the online Supporting Information. Overall, we find that, even after controlling for different proxies for the cost of external financing, our main results still hold and H1 is supported.

6.2 | Additional analyses

We investigate the persistence of ETFs' effect on cash holding levels. We examine whether ETF ownership at $t-1$ influences cash holding levels beyond one quarter ahead. For this test, the dependent variable is *Ln(CashRatio)* and we estimate three additional models, where *Ln (CashRatio)* is measured in quarters $t+1$, $t+2$ and $t+3$ (i.e., going out as far as one year). All right-hand variables in the models are measured as in our baseline model. The results are shown in Table 8. Columns I and V report our baseline results (Columns II and IV in Table 2) for ease of comparison. The results show that the coefficients on *ETFownership* and *Ln(ETFnum)* are positive in all the models. As expected, the magnitude of the coefficients on both ETFs measures decrease as we forecast farther out in the future, but remain statistically significant when *Ln(CashRatio)* is measured at $t+1$, $t+2$ and $t+3$. These findings suggest that the effect of ETFs on cash holding levels persists for about four quarters.

Next, we examine whether our results are driven by old economy firms, which are larger firms with lower growth opportunities that tend to be preferred by ETFs, such as the Standard & Poor's (S&P) 500. To eliminate any potential bias by large firms and old economy firms in our sample, we estimate our baseline model (1) using two subsamples that do not include S&P 500 companies or old economy firms, that is, firms operating in low-growth industries, based on the definitions of Eberhart et al. (2004) and Fama and French (2004). The results are provided in Table B.4 in the online Supporting Information. We find that the coefficients on *ETFownership* and *Ln(ETFnum)* are positive and significant in both subsamples, indicating that our main results are not driven by larger old economy firms.

7 | FURTHER ANALYSES

7.1 | Sources of cash

Our main results show a positive relation between ETF ownership and cash holding levels. This indicates that higher levels of ETF ownership lead to higher levels of cash holdings. In this

[11]We obtain data for the long-term interest rate, Moody's Seasoned AAA Corporate Bond Yield and WSJ prime rates, respectively, from (i) https://data.oecd.org/interest/long-term-interest-rates.htm, (ii) https://fred.stlouisfed.org and (iii) https://www.bloomberg.com/quote/PRIME:IND.

TABLE 8 ETF persistency and cash holdings

This table reports the results from ordinary least squares panel regressions with *Ln(CashRatio)* as the dependent variable. To measure the relation between *ETFownership, Ln(ETFnum)* and future *Ln(CashRatio)* values, consecutive future quarters of *Ln(CashRatio)* are used as the dependent variable in separate models. An intercept is included in the model, but it is not reported in this table. All explanatory variables are measured as in the baseline model from Table 2. The variable definitions are given in Table A.1. All explanatory variables and controls are lagged by one quarter. Year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	t	$t+1$	$t+2$	$t+3$	t	$t+1$	$t+2$	$t+3$
Ln(CashRatio):	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
ETFownership	1.526***	1.097**	0.955***	0.492**				
	(0.560)	(0.558)	(0.233)	(0.243)				
Ln(ETFnum)					0.207***	0.177***	0.170***	0.137***
					(0.036)	(0.038)	(0.038)	(0.038)
Ln(FirmSize)	−0.448***	−0.351***	−0.318***	−0.254***	−0.467***	−0.369***	−0.336***	−0.269***
	(0.035)	(0.035)	(0.010)	(0.011)	(0.035)	(0.035)	(0.039)	(0.036)
Investment	−0.004	0.032	−0.073***	−0.001	−0.030	0.007	−0.097	−0.022
	(0.059)	(0.066)	(0.027)	(0.028)	(0.058)	(0.065)	(0.062)	(0.058)
Leverage	−0.566***	−0.548***	−0.546***	−0.556***	−0.516***	−0.505***	−0.504***	−0.522***
	(0.092)	(0.095)	(0.036)	(0.038)	(0.092)	(0.095)	(0.100)	(0.107)
CashFlow	1.153***	0.991***	0.758***	0.692***	1.143***	0.982***	0.754***	0.687***
	(0.230)	(0.232)	(0.096)	(0.098)	(0.231)	(0.231)	(0.186)	(0.198)
SalesGrowth	0.125***	0.182***	0.184***	−0.0987***	0.135***	0.191***	0.194***	−0.0903***
	(0.021)	(0.024)	(0.013)	(0.013)	(0.021)	(0.024)	(0.029)	(0.027)
IndustrySigma	0.011***	0.010***	0.009***	0.007***	0.011***	0.010***	0.009***	0.007***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)

(Continues)

TABLE 8 (Continued)

	t	$t+1$	$t+2$	$t+3$	t	$t+1$	$t+2$	$t+3$
Ln(CashRatio):	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
NWC	0.042	−0.003	0.001	−0.004	0.032	−0.012	−0.009	−0.014
	(0.038)	(0.036)	(0.015)	(0.016)	(0.038)	(0.035)	(0.036)	(0.035)
Dividend	0.102***	0.062*	0.057***	0.040***	0.091***	0.052	0.047	0.031
	(0.034)	(0.034)	(0.013)	(0.014)	(0.033)	(0.034)	(0.038)	(0.035)
R&D	−1.489***	−1.345***	−1.135***	−0.917***	−1.538***	−1.388***	−1.173***	−0.947***
	(0.134)	(0.144)	(0.137)	(0.139)	(0.133)	(0.142)	(0.126)	(0.138)
Acquisition	0.039	0.033	0.007	−0.011	0.042	0.035	0.009	−0.010
	(0.031)	(0.035)	(0.017)	(0.017)	(0.031)	(0.035)	(0.037)	(0.037)
Ln(Age)	−0.274***	−0.268***	−0.236***	−0.197***	−0.267***	−0.264***	−0.233**	−0.196**
	(0.088)	(0.091)	(0.030)	(0.031)	(0.085)	(0.089)	(0.094)	(0.096)
Non-ETF IO	0.516***	0.477***	0.435***	0.347***	0.361***	0.334***	0.293***	0.221**
	(0.084)	(0.087)	(0.039)	(0.038)	(0.081)	(0.084)	(0.087)	(0.090)
Time FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.095	0.071	0.059	0.055	0.100	0.075	0.063	0.058
Observations	47,183	44,446	42,522	40,540	47,183	44,446	42,522	40,540

section, we examine which potential channels to cash can explain the positive relation between ETF ownership and corporate cash holdings. Following Tosun et al. (2022), we identify seven different ways that potentially explain the incremental effect of ETF ownership on cash holding levels. Dessaint and Matray (2017) and Jiang and Lie (2016) argue that the increase in cash holding levels could come from an increase in revenues (i.e., sales growth) or new financing (debt or equity) or from a decrease in dividends, share repurchases, net working capital requirements, debt requirements, or investments (i.e., capital expenditures, R&D). Antoniou et al. (2020) argue that firms held by more ETFs could be less financially constrained, as they have better access to external finance.

To this end, we study the impact of both ETF measures on the following variables: (i) changes in sales growth, defined as the difference in net sales between the current and the previous quarter, over the net sales of the previous quarter; (ii) changes in new financing, calculated as the issuance of long-term debt plus the sale of new stocks, scaled by the equity market value; (iii) changes in repurchases, defined as purchases of common and preferred stocks over last quarter's net income; (iv) changes in net working capital requirements, defined as working capital minus cash and marketable security adjustments; (v) changes in capital expenditures over total assets; (vi) changes in R&D expenditures over total revenues; (vii) changes in dividends over last quarter's income. All changes refer to the differences between the current and the previous quarter.

Panel (a) of Table 9 provides the results of analyses regarding changes in revenues, new financing, repurchases and net working capital. Columns I to IV show positive and statistically significant coefficients for both ETFs measures *ETFownership* and *Ln(ETFnum)*. This indicates that higher levels of ETF ownership in firms and firms being held by more ETFs tend to increase firms' revenues and their reliance on sources of external financing, which can lead to an increase in cash holding levels. On average, change in revenues increases by 1.21% (0.328×0.037) [5.02% (0.049×1.025)] with a one-standard-deviation increase in *ETFownership* [*Ln(ETFnum)*]. Next, we examine whether an increase in ETF ownership or being held by more ETFs increases cash holding levels through a decrease in share repurchases or net working capital. The coefficients of both ETFs measures, in Columns V to VIII, are negative and statistically significant. These results suggest that ETF ownership reduces share repurchases and net working capital in the firm, which can decrease the firm's cash holding levels.

Panel (b) of Table 9 shows the analyses reflecting firms' changes in capital expenditure, R&D expenditures and dividend policies. We find no evidence of an impact of ETF ownership on these potential channels increasing cash holding levels.

7.2 | Value of cash

In this section, we investigate whether the increase in ETF ownership is a source of value enhancement or destruction for shareholders. More specifically, we examine the effect of ETF ownership on the value of cash holdings. Various studies (e.g., Faulkender & Wang, 2006; Karpuz et al., 2020) research the value of cash. We use the valuation model of Faulkender and Wang (2006). This model tests whether a change in cash holdings leads to a change in firm value. We augment the authors' baseline model with ETF ownership variables (*ETFownership* and *Ln(ETFnum)*) and their interaction with change in the cash holding variable. Specifically, we estimate the following equation:

TABLE 9 Channels explaining the effect of exchange-traded fund (ETF) ownership on corporate cash holdings

This table reports the estimates for *ETFownership* and *Ln(ETFnum)*, along with control variables. An intercept is included in the model, but it is not reported. The analyses examine which potential channels to cash can explain the relation between ETF ownership and corporate cash holdings. In Panel (a), the analyses focus on changes in sales growth (the difference in net sales between the current and the previous quarter, over the net sales of the previous quarter), changes in new financing (issuance of long-term debt plus the sale of new stocks, scaled by the equity market value), repurchases (purchases of common and preferred stocks over last quarter's net income) and net working capital requirements (working capital minus cash and marketable security adjustments). Panel (b) includes capital expenditures over total assets, R&D expenditures over total revenues and dividends over last quarter's income. The changes refer to the differences between the current and the previous quarter. All explanatory variables and controls are lagged by 1 year. The remaining variable definitions are given in Table A.1. Control variables and year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

(a) Analyses regarding revenues, new financing, net working capital requirements and share repurchases

	Change in sales growth (ΔSalesGrowth)		Change in new financing (ΔNewFin)		Change in repurchases (ΔRepurchase)		Change in NWC requirements (ΔNWC)	
	I	II	III	IV	V	VI	VII	VIII
ETFownership	0.328**		0.144***		−0.464***		−0.044*	
	(0.155)		(0.026)		(0.097)		(0.026)	
Ln(ETFnum)		0.049***		0.011***		−0.036**		−0.004***
		(0.008)		(0.002)		(0.017)		(0.001)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time and firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	0.628	0.629	0.038	0.039	0.006	0.006	0.035	0.036
Observations	47,289	47,289	44,848	44,848	43,473	43,473	75,054	75,054

(b) Analyses regarding investments and dividends

	Change in capital expenditures (ΔCapEx)		Change in R&D expenditures (ΔR&DEx)		Change in dividends (ΔDividend)	
	I	II	III	IV	V	VI
ETFownership	0.002		0.009		0.087	
	(0.002)		(0.657)		(0.133)	
Ln(ETFnum)		0.001		−0.126		0.005
		(0.001)		(0.078)		(0.004)
Controls	YES	YES	YES	YES	YES	YES
Time and firm FE	YES	YES	YES	YES	YES	YES
Adj. R^2	0.061	0.061	0.095	0.095	0.011	0.011
Observations	47,303	47,303	44,345	44,345	47,114	47,114

TABLE 10 ETF ownership and the value of cash

This table reports the results from ordinary least squares panel regressions with *ExcessRet* on *ETFownership* and *Ln(ETFnum)*, along with control variables. An intercept is included in the model, but it is not reported in this table. Following Faulkender and Wang (2006) and Aktas et al. (2019), we define the dependent variable *ExcessRet* as a firm's excess return between the current and the previous quarter, which corresponds to the difference between the firm's stock return and the return of that firm's benchmark portfolio over the same period. Following Daniel and Titman (1997), we construct the benchmark portfolios as 25 Fama and French (1993) value-weighted portfolios by independently sorting stocks on size and book-to-market characteristics. The control variables are the following: *ΔCashRatio*, the change in cash holdings between the current and the previous quarter over the market value of equity at the end of the previous quarter; *ΔEarnings*, the change in earnings before extraordinary items over the market value of equity; *ΔNetAssets*, the change in net assets over the market value of equity; *ΔR&D*, the change in R&D expenses over the market value of equity; *ΔInterest*, the change in interest expenses over the market value of equity; *ΔDividend*, the change in common dividends over the market value of equity; *NetFinancing*, total equity issuance minus repurchases plus debt issuance minus debt redemption, scaled by the market value of equity; *CashRatio*, cash holdings over the market value of equity; and *Leverage*, the sum of long-term debt and debt in current liabilities over the sum of long-term debt, debt in current liabilities and the market value of equity. The definitions for the remaining variables are given in Table A.1. Year–quarter and firm FE are included. Standard errors are given in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

	ExcessRet	
	I	**II**
ETFownership × ΔCashRatio	0.740***	
	(0.282)	
ETFownership	−0.002	
	(0.003)	
Ln(ETFnum) × ΔCashRatio		0.017**
		(0.007)
Ln(ETFnum)		−0.001***
		(0.000)
ΔCashRatio	0.014**	0.004
	(0.006)	(0.008)
ΔEarnings	0.001	0.001
	(0.001)	(0.001)
ΔNetAssets	0.079***	0.082***
	(0.023)	(0.023)
ΔR&D	0.014**	0.015**
	(0.007)	(0.007)
ΔInterest	0.003	0.005
	(0.004)	(0.004)
ΔDividend	−0.035	−0.033
	(0.022)	(0.023)

(Continues)

TABLE 10 (Continued)

	ExcessRet	
	I	II
NetFinancing	0.003***	0.003***
	(0.001)	(0.001)
CashRatio	0.006***	0.006***
	(0.001)	(0.001)
Leverage	−0.007***	−0.007***
	(0.004)	(0.001)
CashRatio × ΔCashRatio	0.074***	0.062***
	(0.018)	(0.019)
Leverage × ΔCashRatio	−0.015	−0.019
	(0.014)	(0.013)
Time and firm FE	YES	YES
Adj. R^2	0.112	0.113
Observations	19,176	19,184

$$ExcessRet_{i,t} = \alpha + \beta_1 \Delta CashRatio_{i,t-1} + \beta_2 ETF\ Ownership\ Measure_{i,t-1} + \beta_3 \Delta CashRatio_{i,t-1} \times ETF\ Ownership\ Measure_{i,t-1} + \Theta X_{i,t-1} + \eta_i + \phi_t + \varepsilon_{i,t}, \quad (5)$$

where the dependent variable *ExcessRet* is defined as a firm's excess return between the current and the previous quarter, which corresponds to the difference between the firm's stock return and the return of that firm's benchmark portfolio over the same period. Following Daniel and Titman (1997), the benchmark portfolios are the Fama and French (1993) 25 value-weighted portfolios constructed by independently sorting stocks on size and book-to-market characteristics. The variable *ΔCashRatio* is the change in cash holdings between the current and the previous quarter over the market value of equity at the end of the previous quarter and $ETF\ Ownership\ Measure_{i,t-1}$ denotes two different variables for firm i in quarter $t-1$, namely, *ETFOwnership* and *Ln(ETFnum)*. The term $X_{i,t-1}$ is a vector of the following control variables: Δ*Earnings*, change in earnings before extraordinary items, over the market value of equity; Δ*NetAssets*, the change in net assets over the market value of equity; Δ*R&D*, the change in R&D expenses over the market value of equity; Δ*Interest*, the change in interest expenses over the market value of equity; Δ*Dividend*, the change in common dividends over the market value of equity; and *NetFinancing*, total equity issuance minus repurchases plus debt issuance minus debt redemption, scaled by the market value of equity. The model also includes *CashRatio*, which is cash holdings over the market value of equity and *Leverage*, which is the sum of long-term debt and debt in current liabilities over the sum of long-term debt, debt in current liabilities and the market value of equity. Both the variables *CashRatio* and *Leverage* are interacted with Δ*CashRatio*. Finally, we include year–quarter and industry FE to control for time and industry trends on excess returns, respectively.

Table 10 presents the results. The results show positive and significant coefficients on the interaction terms between both ETF measures and changes in cash holdings. These results indicate that an increase in ETF ownership, *ETFOwnership*, or in the number of ETFs investing in a firm, *Ln(ETFnum)*, significantly increases the value of a dollar of cash both economically and statistically. The coefficient estimate of the interaction term in Column I shows that the value that investors assign to a dollar of cash is \$0.027 (\$0.740 × 0.037) higher for each one-standard-deviation (about 4%) increase in ETF ownership. Similarly, in Column II, the corresponding value increase in a dollar of cash is \$0.017 (\$0.017 × 1.025) if *Ln(ETFnum)* increases by one standard deviation (about 1.025). Due to higher informational uncertainty generated by higher levels of ETF ownership, investors assign a higher dollar value for each dollar of cash held by managers, for precautionary reasons.

8 | CONCLUSION

A vast theoretical and empirical literature addresses how managers learn from stock prices in designing real corporate policies. A corollary to this finding is that any attribute that changes price informativeness will also alter the firm's cash holding levels. In this paper, we examine the latter conjecture in the context of the ETF industry. The ETF literature documents that trading associated with the ETF arbitrage mechanism can reduce the price discovery for the underlying securities. Further, we find results indicating that the increased investments of ETFs lead to the lower share price informativeness of their constituent firms, where managers learn less incremental information from their share prices. This, in turn, leads to higher informational uncertainty. Therefore, we aim to test whether ETF ownership has an impact on firms' cash holding decisions by influencing management's ability to obtain information from the secondary stock market through price efficiency.

Our results show strong evidence that firms included in ETFs baskets have higher cash holding levels. This finding remains consistent after addressing endogeneity concerns using different IV models. In addition, we conduct several tests to verify the robustness of our main findings. We rerun our baseline model after controlling for individual institutional ownership, managerial learning, market mispricing, corporate governance and the cost of external financing channels. We also test whether the effect of ETF ownership on cash holding levels provides consistent results over an extended period of four quarters and we finally check whether our results hold after excluding large and old economy firms. Our results remain robust to these tests. Further, we identify four channels of cash that help to explain the relation between ETF ownership and cash holdings; these channels are changes in revenue, external financing, share repurchases and net working capital. Moreover, we examine the effect of ETF ownership on the value of cash holdings and find that the cash holding increase due to ETF ownership is associated with a positive impact on firm value.

This study highlights the importance of ETFs not only in affecting market participants but also in the real sector, especially corporate cash holding decisions. As a firm's cash holding policy is related to its investment, payout and capital structure decisions, future research could examine the real effect of ETF investments on other corporate policies of their constituents.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the Center for Research in Security Prices (CRSP), CRSP Mutual Fund, Compustat, Bloomberg, OptionMetrics, Thomson Reuters and FactSet. Restrictions apply to the availability of these data, which were used under license for this study.

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SUPPORTING INFORMATION

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How to cite this article: El Kalak, I., & Tosun, O. K. (2022). ETF ownership and corporate cash holdings. *European Financial Management*, 28, 1308–1346. https://doi.org/10.1111/eufm.12352

APPENDIX A

Table A.1.

TABLE A.1 Variable definitions

Variables	Description
Ln(CashRatio)	Natural logarithm of *CashRatio*, that is, cash and short-term investments, scaled by net sales, at the end of that quarter.
ETFownership	Following Glosten et al. (2021), *ETFownership* is the sum of a firm's shares held by all ETFs invested in that firm at the end of that quarter, scaled by the total number of shares outstanding at the end of that quarter.
Ln(ETFnumber)	Natural logarithm of the number of ETFs holding that stock at the end of that quarter.
Ln(FirmSize)	Natural logarithm of net sales at the end of that quarter.
Investment	Capital expenditures, scaled by net sales, at the end of that quarter.
Leverage	Debt in current liabilities plus long-term debt, scaled by total assets, at the end of that quarter.
CashFlow	Net income before extraordinary items plus depreciation and amortization expenses, scaled by total assets, at the end of that quarter.
SalesGrowth	Difference in net sales between the current and the previous quarter, scaled by the net sales of the previous quarter.
NWC	Net working capital, calculated as working capital minus cash and marketable security adjustments at the end of that quarter.
Dividend	Dummy equal to one if a firm pays dividends at the end of that quarter and zero otherwise.
R&D	Natural logarithm of one plus R&D expenses at the end of that quarter.
Acquisition	Value of acquisitions, scaled by total assets, at the end of that quarter.
IndustrySigma	Industry cash flow risk, defined as the mean of the ratio of the standard deviations of cash flows to the total assets over 10 quarters for firms in the same industry (by two-digit SIC codes).
Ln(Age)	Natural logarithm of firm age in years.
Non-ETF IO	Percentage of shares owned by institutional investors other than ETFs at the end of that quarter.