



Freedom of choice impact on country-specific liquidity commonality

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Abstract

We use three facets of freedom of choice (opportunity, decisional autonomy, and immunity from interference) to develop a freedom of choice index for 46 countries and test its impact on commonality in liquidity. We find that the three aspects of individual freedom of choice are negatively related to country-specific market liquidity commonality. Building on Sen's (1993) theoretical framework, we document that in the presence of opportunities for making independent choices, immunity from encroaching activities, and decisional autonomy, investors tend to show less correlated trading decisions, measured by the levels of liquidity co-movement. To address possible endogeneity bias, we use 9/11 and country-level terrorist attacks as an exogenous source of variations to personal freedom of choice. We find that higher levels of perceived threats in a country restrain personal freedoms and tend to reduce freedom of choice effects on liquidity commonality. Our results are robust to alternative explanations, freedom of choice definitions, and model specifications.

Keywords Freedom of choice · Investor autonomy · Liquidity commonality · Liquidity co-movement · Systematic liquidity risk

JEL Classifications G04 · G14 · G15 · G18 · G41

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1 Introduction

We study intra-country individual stock market liquidity commonality and analyze differences and causes for idiosyncratic stock liquidity commonality across 46 countries. Liquidity commonality is the degree to which individual stock ‘market liquidity’ co-moves with intra-country aggregate stock market liquidity. We extend the liquidity commonality literature by examining the role of individuals’ freedom of choice on liquidity commonality. We find that all freedom of choice dimensions (individual opportunity, decisional autonomy, and immunity from interference) significantly influence liquidity commonality.

Lower levels of market commonality, as opposed to higher levels of country-specific liquidity commonality, are desirable since higher commonality levels imply not only greater systematic risk (Domowitz et al. 2005; Moshirian et al. 2017; Panagiotou et al. 2023) but also typify markets characterized by the prevalence of groupthink and herding. Independent individual stock market transactions, resulting in reduced liquidity commonality, tend to increase stock market efficiency, facilitate more accurate estimates of true intrinsic stock prices, and result in more efficiently allocated capital.¹

Previous literature suggests that liquidity commonality is primarily driven by correlated supply or demand for liquidity across market participants (Karolyi et al. 2012). Also, a recent study by Moshirian et al. (2017) suggests that liquidity commonality depends on country-specific cultural norms, including behavioral factors; however, the impact of each freedom of choice dimension remains unclear.

Individual stock market-liquidity commonality and individual stock price commonality are related. Eun et al. (2015) and Morck et al. (2013) focus on relationships between cultural individualism and *stock price* co-movement. In contrast, our study, as well as Moshirian et al. (2017), Dang et al. (2015), and Karolyi et al. (2012) focus explicitly on *liquidity commonality*. Although price and liquidity co-movements are related (Domowitz et al. 2005), liquidity co-movement and stock price co-movement may result from different market factors.² Specifically, liquidity commonality results from supply and demand co-movements likely due to cross-sectional correlation in order types (market and limit orders), while return commonality is commonly caused by correlation in order flow (order direction and size).

Our fundamental hypothesis is that higher country-specific freedom of choice levels results in lower liquidity commonality levels. Lower liquidity commonality levels may result from investors discounting biased information and relying less on the opinions of others, resulting in higher societal pluralism levels. Thus, we measure these multifaceted impacts on investor decisions by identifying and quantifying country-specific aspects of individual freedom of choice, which include freedom opportunities, decisional autonomy, and immunity for interference for individual decision making. We find that these are critical factors impacting country-specific stock market-liquidity commonality.

Our hypothesis is supported by Morck et al (2000) and Jin and Myers (2006) who find that countries with sound institutional environments and protection from property expropriation, display reduced stock price co-movement. Likewise, we show that personal

¹ Capital market history has shown that the sudden liquidity dries up in one asset may quickly spill over in different asset classes, resulting in a market wide crash as we witnessed during the 2008 financial crisis. Similarly, during mid-1998, the bond market seemed to undergo a global liquidity crisis.

² Liquidity commonality results from supply and demand co-movements most likely induced cross-sectional correlation in order types (market and limit orders), while return commonality is commonly caused by correlation in order flow (order direction and size).

freedoms are significant factors that reduce individual stock market commonality and for reducing systematic liquidity risk.³

We contribute to the literature by categorizing and quantifying individual aspects of freedom of choice for 46 countries, and documenting that the liquidity commonality is uniquely affected by differences in country-specific individual freedoms of choice. We combine literature threads from behavioral finance fields, behavioral finance, economics, and public policy and show that individual freedoms of choice enrich pluralism and motivate autonomous stock market trading, resulting in decreased country-specific systematic liquidity risk.

Finally, we contribute to existing investor behavior literature by demonstrating that investor perceived freedom of choice increases their incentives to explore and incorporate firm-specific information and discourage correlated trading behavior in the financial market. We find that investors with higher levels of perceived and/or actual freedom of choice increase their incentives to explore and incorporate firm-specific information and discourage correlated trading behavior in the financial market. Our results are robust after controlling various factors of country-specific institutional environment, different proxies for freedom and choice, and alternate model specifications.

The paper is organized as follows: Section II identifies freedom of choice measures and develops hypotheses, Section III covers related literature, Section IV describes Empirical Methodology and Data, Section V presents econometric results, Section VI describes robustness tests, and Section VII concludes.

2 Freedom of choice measures and hypotheses development

We hypothesize that perceived or tangible individual freedoms significantly reduce investor correlated trading behavior and liquidity co-movement. In addition to country-specific cultural differences, we test for other commonality determinants, including country-specific governmental policies that facilitate investor diversity of opinion and freedom of press to disseminate unbiased firm-specific news. Correlated transactions, conceivably resulting from herding or institutional factors, indicating undesirable market factors such as restricted, or biased information, stock prices failing to achieve equilibrium or stock prices failing to converge toward true intrinsic values (Sadka and Scherbina 2007). Thus, liquidity commonality, thought to result from correlated stock transactions and biased information, potentially results in stock market mispricing and inefficiency.

We apply three aspects of individual freedom of choice measures as previously proposed by Sen (1993): (i) individual opportunity, (ii) decisional autonomy, (iii) immunity from interference, positing that these measures affect country-specific liquidity commonality.⁴

Several social science studies investigate the role of country-specific respect for individual values on capital markets (Also see: Sen 1999; Friedman 2003; Taylor 2005; Ryan and Deci 2006). Generally, residents of countries with greater opportunity freedoms are more likely to act independently, be actively engaged and productive, generate greater

³ Morck et al (2000) and Jin and Myers (2006) focus on stock price co-movement but not liquidity co-movement. Acemoglu and Johnson (2005) show that countries with better institutional infrastructure experience higher levels of long-term economic growth, capital investment and stock market development.

⁴ Section IV presents detailed discussion of different proxies of freedom of choice and the construction of each measure, where, greater freedom of choice levels incentivizes investors to act independently, resulting in lower trading correlation and lower levels of liquidity co-movement.

human capital, and foster overall wellness for society (Gough and McGregor 2007; Frey and Stutzer 2010).⁵

The ‘individual opportunity’ aspect of freedom of choice can be proxied by economic freedoms, civil liberties and religious freedoms. It reflects the actual capability of individuals to achieve their objectives and what they value. We identify individual opportunity indices that reflect unique cultural and government policies, measuring the degree to which each country’s citizens have opportunities to choose their own economic actions, civic engagements and religious beliefs.

The literature documents that freedom of religion plays an important role in shaping peoples’ economic behaviors (Guiso et al. 2003). Also, Kumar (2009) and Klein et al. (2017) find that religious affiliation influences individual investor stock selection and security trading patterns. Also, Kumar et al. (2011) show that religion induced effects persist across institutional investors. Following this discussion, we test the following hypothesis:

H1 Freedom of country-specific individual opportunities reduces liquidity commonality.

Our second aspect of freedom of choice is country-specific decisional autonomy. Decisional autonomy is concerned with whether decisions are made by individuals, or rather by other people, groups of people or institutions.

Decisional autonomy—as measured by individualism—has received significant attention in the finance literature. Choi and Nisbett (2000) and Nisbett et al. (2001) find that country-specific individualism levels reduce herding and/or group think. Other studies (e.g., Beckmann et al. 2008; Eun et al. 2015; Moshirian et al. 2017) suggest that individuals residing in cultures stressing individualism, “self-concept” logic, that explains or predicts behaviors reflecting individual rather than group attributes.⁶ These investors are less likely to engage in herding behavior that results in higher levels of stock price co-movements as well as liquidity commonality for traded stocks.

However, a country’s decisional autonomy may not exist if rights to transact freely, without external interferences, are not protected by culture or statute. Therefore, we posit that higher levels of decisional autonomy contributes to societal pluralism, fosters independent decisions, and places less credence on opinions of others. Thus, we test the following hypothesis:

H2 Decisional autonomy reduces intra-country stock market liquidity commonality.

The ‘decisional autonomy’ aspect of freedom of choice is closely related to each country’s relative level of cultural individualism. Cultural individualism reflects reduced herding or groupthink mentality, where individuals are free to make independent decisions relative to their peers. While the majority of the literature focuses on the decisional autonomy aspect of culture, we show that this facet may not exist without the other two aspects of the freedom of choice.

⁵ For example, Deci and Ryan (1985) and Ryan and Deci (2000), find that social wellness is affected by the extent to which freedom and individual autonomy are publicly supported.

⁶ Recently, Mogha and Williams (2021) show that firms’ national culture influences their choices of short-term and long-term debt to book and market value of equity. Hoang et al. (2022) find that national cultural dimensions significantly moderate the negative relationship between stock returns and COVID-19.

The third aspect of freedom of choice, immunity from interference, is concerned with the extent to which personal decision-making is free or immune from encroachment or interceding of others. In a financial market context, an example of decisional interference may be where the media exerts significant influence on investors' stock trading decisions (Engelberg and Parsons 2011). Barber and Odean (2008) illustrate an example where individual investors tend to buy attention-grabbing stocks that are in the news. Supporting this aspect, Dougal et al. (2012) observe that WSJ columnist reportings explain 35% of excess Dow Jones Industrial Average returns daily variations. This indicates strong impacts of media coverage on investors behavior and stock performance.

Reuter and Zitzewitz (2006) and Tetlock (2007) offer other examples of media influencing investor financial decisions by providing biased opinions.⁷ Also, Burgess (2010) and Ghoul et al. (2019) opine that a free press, offers diverse and unrestricted perspectives, stimulating open information flows and reduced market commonality.

It should be the responsibility of a country's media to facilitate investors in making informed decisions by disseminating relevant, accurate and unbiased information (Griffin et al. 2011). If, instead, investors are influenced by biased information, disseminated by state-controlled, corrupt or special interest group media, lacking diversity of content, such information may negatively influence stock market participants. For example, investors in countries characterized by a government-controlled, servile press that censors or distorts information may be enticed to collectively engage in market-wide basket trading instead of exploring firm-specific stock information. Thus, we posit an inverse relationship between a country's press freedom and stock market liquidity commonality. This leads to our third hypothesis.

H3 Immunity from interference reduces liquidity commonality-co-movement.

We extend the literature in a novel direction by going beyond commonly used cultural variables, such as Hofstede's individualism. Our analyses include governmental policies aimed to protect economic, civic, and religious individual freedoms, as well as freedom of the press. We quantify these additional aspects of freedom of choice enabling a more comprehensive analysis of the role of freedom of choice in impacting liquidity commonality for each of the 46 countries.

Our study differs from Eun et al. (2015) and Moshirian et al. (2017) in two key aspects. First, both studies focus on the role of the nation's culture on stock price and liquidity. However, our study centers around the concept of an individual's freedom of choice instead of the country's national culture or institutional development. Building on Sen's (1993) framework to quantify different aspects of individual freedom, we document that in the presence of opportunities for making independent choices, immunity from encroaching activities, and decisional autonomy, investors tend to show less correlated trading decisions, measured by the levels of liquidity co-movement.

⁷ In his book, *Irrational Exuberance*, Robert Shiller (2015) highlights the role of media in driving investors' correlated trading behavior stating that: "Most investors ... do not fully realize that they themselves, as a group, determine the level of the market. ... Many individual investors think that institutional investors dominate the market and that these "smart money" investors have sophisticated models to understand prices—superior knowledge. Little do they know that most institutional investors are, by and large, equally clueless about the level of the market. In short, the price level is driven to a certain extent by a self-fulfilling prophecy based on similar hunches held by a vast cross section of large and small investors and reinforced by news media that are often content to ratify this investor-induced conventional wisdom".

Second, although Moshirian et al. (2017) provide a comprehensive analysis of different determinants of liquidity commonality, the study was silent on the channel through which cultural dimensions can impact liquidity commonality. In contrast, our study is grounded in the theatrical framework of Sen's (1993). Our study hypothesizes that higher levels of freedom of choice contribute to societal pluralism, fostering independent decisions, and place less credence on the opinion of others that result in lower levels of liquidity commonality.

Finally, our study not only establishes the relationship between various aspects of the freedom of choice and the commonality of liquidity, but also introduces a novel freedom of choice index. This newly proposed index is designed to comprehensively encapsulate different dimensions of freedom of choice and provides an alternative perspective of the impact the nation's environment and government policies on individuals' freedom of choice and their trading behavior in the stock market.

3 Related literature

Previous literature, in the context of stock markets, tends to be inconsistent regarding definitions for freedom of choice and its aspects, impeding clearly identifying freedom of choice impacts on stock market liquidity, liquidity commonality, effectiveness and efficiency. Thus, we more clearly define and quantify freedom of choice.

We contribute to existing investor behavior literature by demonstrating that investor actual and/or perceived freedom of choice increases their incentives to explore and incorporate firm-specific information and discourage correlated trading behavior in the financial market. We find that investors with higher levels of perceived and/or actual freedom of choices increase their incentives to explore and incorporate firm-specific information and discourage correlated trading behavior in the financial market. Our results are robust after controlling various factors of country-specific factors of institutional environment.

We also contribute to the existing investor behavior literature by demonstrating that investor perceived freedom of choice increases their incentives to explore and incorporate firm-specific information and discourages correlated trading behavior in the financial market. Our study provides valuable cross-sectional results on where correlated trading is more prevalent. These results are related to the findings of Barberis and Shleifer (2003), Dorn et al. (2008), Feng and Seasholes (2004), and Sias (2004) who conclude that most investors, including institutional investors, exhibit correlated trading behaviors. Our results are robust after controlling various factors of country-specific factors of institutional environment.

Several additional studies support the prevalence of liquidity commonality/co-movement in both the U.S. and international markets (Chordia et al. 2000; Brockman et al. 2009; Brockman et al. 2023; Dang et al. 2024; Son et al. 2023; and Kamara et al. 2008). Studies implying that liquidity commonality is driven either by liquidity supplier correlated trading include: Brunnermeier and Pedersen (2009), Coughenour and Saad (2004) and Hameed et al. (2010). Other studies imply that liquidity commonality results from correlated trading by stock market liquidity demanders include: Corwin and Lipson (2000), Kamara et al. (2008), Karolyi et al. (2012) and Koch et al. (2016).⁸ Both liquidity supplier and demander

⁸ The supply-side explanation suggests that liquidity commonality is driven by financial intermediary funding constraints. During periods of market decline or high volatility, because of funding constraints, intermediaries simultaneously reduce liquidity supply across many securities, hence increasing liquidity

explanations focus on the role of correlated trading behavior, albeit emphasizing different roles of liquidity supply versus demand in explaining liquidity commonality.

Brunnermeier and Pedersen (2009), Coughenour and Saad (2004) and Hameed et al. (2010) suggest that funding constraints provide a potential supply-side explanation for liquidity commonality, where, large market declines and/or high levels of uncertainty create illiquidity spirals. Illiquidity spirals may occur if financial intermediaries/market makers are unwilling or unable to supply sufficient liquidity to the market.

Corwin and Lipson (2000), Kamara et al. (2008) and Koch et al. (2016) opine that demand-side liquidity commonality may result from investor groups demanding synchronous market liquidity, either because they receive similar signals or because they follow analogous trading strategies. Both explanations suggest greater liquidity commonality levels, resulting from contemporaneous market buying/selling pressure for same securities.

Some studies, for example Colla and Mele (2010), posit that investors follow correlated trading patterns because they receive similar trading signals, while another body of literature (Engelberg and Parsons 2011; Grinblatt and Keloharju 2001; Guiso et al. 2006) suggests that correlated trading is driven by local cultural biases.

International evidence, including Beckmann et al. (2008), Eun et al. (2015) and Moshirian et al. (2017), find that correlated stock market trading results from impacts of culture aspects, in particular, collectivism versus individualism.

While prior literature supports the role of investor autonomy or Hofstede's individualism (used as a proxy for culture in prior literature) in reducing liquidity commonality, Sen (1993) argues that investor autonomy may fail to exist if rights to exchange information and transact freely, without external interferences, are unprotected.

We apply economic freedom indices to capture relative degrees that country-specific policies and institutions afford investors with opportunities to implement independent financial decisions. The importance of economic freedoms is supported by Gwartney and Lawson (2003) who reflect on the extent to which country-specific policies support personal choice, voluntary information exchange, free competition, market entry, and protection against external aggression.

Also, previous literature suggests that countries with greater financial markets liberalization are associated with reduced economic contractions and shorter recovery times during periods of financial crises. These studies include: Bjørnskov (2016), higher economic growth levels, Bekaert et al. (2005), financial market liberalization, and Chari and Henry (2004), lower cost of capital. These findings suggest economic freedom enhances the ability of investors to incorporate new, relevant information quickly and efficiently.

We emphasize the impact of diversity of a country's religious beliefs affecting correlated trading behavior, which is unrelated to impacts of specific religions on investor behavior. We posit that countries with higher religious freedom levels foster independent trading decisions that reduce systematic liquidity risk as measured by liquidity commonality.

Another recent study by Erdem (2020) includes country-specific civil liberties levels, showing that stock markets in countries with greater civil liberties tend to more effectively

Footnote 8 (Continued)

commonality across traded assets. Alternatively, the demand side explanation suggests that liquidity commonality is related to similarity across trading strategies of individual and institutional traders. Further, Asem, Baulkaran, Jain, and Sunderman (2022) document herding in institutional investors around the dividend announcements.

adapt to the systematic risk associated with the Covid-19 pandemic. Other studies support this finding that countries with greater civil liberty levels demonstrate increased economic development (Benyishay and Betancourt 2010), and cost of debt (Qi et al. 2010).

4 Data and methodology

We define and quantify each facet of freedom of choice by identifying established indices measuring each facet of freedom of choice.

4.1 Individual opportunity

Individual opportunity measures an individual's prospect of realistically achieving personal goals and objectives. One of these measures is the Fraser Institute Economic Freedom Index, measuring the degree that each country's policies and institutions support personal choice, voluntary exchange, the freedom to enter and exit markets, the freedom to compete, and the freedom to privately own property.

Also, as a substitute or in combination with the Fraser Institute Economic Freedom Index, we use the Freedom House Civil Liberties Index and Religious Freedom Index from the CIRI Human Rights Data Project.

The Civil Liberties Index assesses each country's support for individual freedoms of expression and belief, individual rights, associational and organizational rights, and the rule of law.

The Religious Freedom Index reflects the extent to which citizens are free to exercise and practice their religious beliefs without governmental restrictions. These variables used independently or collectively measure a country's support for individual opportunities that contribute to rich societal diversity and encourage independent investor decisions, resulting in reduce liquidity co-movement.

Economic freedom provides investors with greater personal choices enabling them to incorporate superior firm-specific information in trading decisions. Also, civil liberties reflect individual freedoms to develop independent views, independent institutions, and personal autonomy without government interference. Thus, we posit that countries that legislate and have statutes maintaining and protecting civil liberties, propagate autonomous investors, resulting in independent trading activities and lower liquidity commonality.

The CIRI Human Freedom Data Project's Religious Freedom Index, measuring the religious freedom aspect of individual opportunity, proxies for the freedom of citizens to practice personal religious beliefs. Although previous studies examine the impact of religious affiliation on corporate risk exposure,⁹ a paucity of awareness exists regarding religious freedom impacts on investor behavior. We observe that religious freedom enriches social pluralism, promotes autonomous trading, thus reducing liquidity commonality. These results support our hypothesis 1.

⁹ See: Hilary and Hui (2009), Kumar et al. (2011), regarding portfolio choices, and Stulz and Williamson (2003), on creditors' rights.

4.2 Decisional autonomy

Decisional autonomy relates to the extent to which a country exhibits a self-oriented culture and emphasizes individual initiatives as opposed to societal dependence on others or government. Cultural individualism, illustrated by Hofstede (2001), reflects the extent to which individuals focus on their own attributes and make decisions based on their individual knowledge and needs. In such cultures, individuals think and act independently from other people, institutions, and society. Thus, we use the Hofstede (2001) individualism index to assess each country's level of decisional autonomy.¹⁰

4.3 Immunity from interference

Immunity from interference is the extent to which personal decision-making is free or immune from encroachment and/or coercion by others, including government. We quantify country-specific decision interference levels, in terms of financial markets, by adopting the Press Freedom Index from Freedom House that measures media's influence on investor stock transactions. The Press Freedom Index, beginning in 1980, measures relative international press freedoms.¹¹

Social environments supported by a free press are critical for disseminating reliable, accurate, firm-specific information, resulting in better-informed and independent trading decisions. In contrast, investors in countries served by a servile press most likely are skeptical of perceived unreliable and possibly inaccurate and biased information, thus they are more likely to engage in market-wide basket trading, anticipating that additional diversification may reduce their exposure for individual stock information asymmetry. Basket trading results in correlated demand or supply for liquidity, resulting in a higher liquidity commonality.¹²

4.4 Liquidity commonality measure

For our liquidity measure, we calculate each stock's Amihud Illiquidity, Amihud (2002), for each of the 46 countries across our study period.¹³

Like Karolyi et al. (2012) and Moshirian et al. (2017), we use the coefficient of determination for least squares regressions, R^2 , as our measure for individual stock liquidity commonality. R^2 measures the extent to which each stock's liquidity moves together or displays commonality.

We use daily returns (RI; in local currency) to estimate each stock's liquidity commonality, R^2_{liq} . Other variables are daily trading volume (VO; in thousands of shares), adjusted stock price (P; in local currency), and market capitalizations at the beginning of

¹⁰ Prior literature finds that differences in cross-country individualism influence momentum strategy returns (Chui et al. 2010), investor decisions regarding stock holding and trading (Guiso et al. 2008), and market reaction to merger announcements (Ahern et al. 2015).

¹¹ The index ranges from 0 to 100, with higher values reflecting lower freedom of the press. We reverse the index, by deducting the press score from 100 to reach an increasing index of press freedom levels.

¹² Prior literature argues that press freedom improves market efficiency and decreases information asymmetry. See: La Porta, Lopez-de-Silanes, Shleifer and Vishny (2002) and Rajan and Zingales (1998).

¹³ Goyenko, Holden and Trzcinka (2009) observe that the Amihud (2002) Illiquidity measure is generally the most reliable and accurate liquidity proxy for stock returns in cross-section and time-series applications measuring price impacts. Thus, we adopt this as our liquidity measure.

each calendar year (MV; in U.S. dollars) as control variables, where, data are obtained from DataStream.

Our data include only stock exchanges in each of our selected 46 countries that list the majority of each country’s stock. Depository receipts (DRs), real estate investment trusts (REITs), preferred stocks, investment funds, and other stocks with special features are excluded from the sample. The sample includes delisted stocks to limit survivorship bias.

Similar to Ince and Porter (2006), daily returns are identified as missing if the total return index value for either the previous or the current day is below 0.01. To deal with non-synchronous trading, non-trading days are identified as the days during which 90% or more of the listed stocks on a given exchange have zero returns. Further, stocks with 80% or more zero-return trading days in each month are excluded from the estimation of R².

Amihud illiquidity is the ratio of daily absolute stock return to dollar volume. Amihud illiquidity, given previous empirical evidence, is strongly and positively correlated with other liquidity proxies, including bid-ask spreads, price impact and fixed trading costs (See: Fong et al. 2017; Goyenko et al. 2009).

Amihud liquidity is calculated as:

$$Liq_{i,d} = -\log \left[1 + \frac{|R_{i,d}|}{P_{i,d}VO_{i,d}} \right] \tag{1}$$

where $Liq_{i,d}$ is the Amihud’s measure for stock i on day d , $R_{i,d}$ is the return in local currency, $P_{i,d}$ is the price in local currency, and $VO_{i,d}$ is the trading volume. Amihud measure is multiplied by -1 to arrive at a variable that is increasing with liquidity.

We account for day of the week liquidity effects by adopting Hameed et al. (2010) filtering regression, for each stock i traded on domestic exchange d , based on observations on day t within each month:

$$Liq_{i,t,d} = \alpha_{i,t}^{liq} Liq_{i,d,t-1} + \sum_{\tau=1}^5 \beta_{i,t,\tau}^{liq} D_{\tau} + \gamma_{i,t}^{liq} HOLI_{t,d} + \omega_{i,t,d}^{liq} \tag{2}$$

where, D_{τ} ($\tau = 1, \dots, 5$) denotes Monday through Friday day of the week dummies. $HOLI_{t,d}$ is a dummy for trading days around non-weekend holidays. Each firm’s lagged liquidity, $Liq_{i,t-1,d}$, is included as an independent variable to measure the innovations in daily liquidity.

Using regression residuals, $\omega_{i,t,d}^{liq}$, from Eq. (2), we estimate monthly measures of each stock’s liquidity commonality. We obtain R², our measure of commonality in liquidity, R²liq, is determined from regression parameters resulting from Eq. (3). R²liq, is estimated for each stock, in each country, based on daily observations within each month m :

$$\omega_{i,t,d}^{liq} = \alpha_{i,t}^{liq} + \sum_{j=-1}^1 b_{i,t,j}^{liq} \hat{\omega}_{m,d,t+j}^{liq} + \varepsilon_{i,t,d}^{liq} \tag{3}$$

where, $\omega_{i,t,d}^{liq}$ is the residual from Eq. (2) and $\hat{\omega}_{m,d,t+j}^{liq}$ is the aggregated domestic market residual from Eq. (2) for country of stock i , obtained as the market value (at the end of previous year) weighted average of the residuals for all stocks in the country.

Similar to Chordia et al. (2000) and Coughenour and Saad (2004), we require a minimum of 15 daily observations in a given month to estimate an R² for each stock and to be included when calculating $\hat{\omega}_{m,d,t+j}^{liq}$. Each country’s monthly R² is constructed by equally

weighting average R^2 values across all stocks during each month. As in previous studies, we use R^2 log transformations, $\ln [R^2/(1-R^2)]$, in our regressions.

Generally, we find that investors residing in countries with relatively higher levels of freedom of choice, lower commonality levels, have higher likelihoods of exhibiting autonomous investment behaviors and lower levels of country-specific systematic liquidity risk.

4.5 Alternative determinants/explanations and control variables

As robustness tests, we examine for the possibility that our results are dependent on our using previously selected explanatory variables. Thus, we test for other possible demand-side and supply-side explanations of liquidity commonality.

Similar to Karolyi et al. (2012), we employ three different supply-side proxies: Market volatility (proxying for market maker funding illiquidity), stock market capitalization to GDP ratios, and total bank deposits to GDP ratios. These measures proxy for each country's relative level of financial sector maturity and liquidity.

Demand-side liquidity commonality may result from investor groups demanding synchronous market liquidity because they either receive similar signals or because they follow analogous trading strategies. We use mutual fund equity assets to GDP, foreign institutional ownership to market capitalization, and net percent of equity flows ratios to measure the relative prevalence of institutional investors in each country.

Some studies suggest that investor incentives trade individual stocks rather than baskets of stock, depend on country-specific institutional quality and/or quality of information. For example, both Jin and Myers (2006) and Morck et al. (2000) argue that stock return synchronicity is affected by relative levels of country-specific investor protection and information environment.¹⁴ We control for country-specific investor protection and information quality measures using government effectiveness and political stability estimates from worldwide governance indices, including the International Monetary Fund's (IMF) Financial Development Index, the Anti-self-Dealing Index from Djankov et al. (2008), each country's legal origin, and country-specific data whether a country requires International Financial Reporting Standards (IFRS) for publicly traded firms.

Also, we control for each firm's earning co-movement, industry specific Herfindahl indices, each country's number of publicly traded stocks in a country, geographical size, GDP growth and GDP per Capita.¹⁵ The standard errors in all our regressions are clustered at the country level. Variable descriptions and data sources are provided in Table 10 in the appendix.

¹⁴ These findings are also supported by a stream of literature that shows the importance of firm-specific information in driving the association between institutional environments and stock market characteristics; see: Bushman, Piotroski and Smith (2004), Dang et al. (2015), Eun et al. (2015), Fernandes and Ferreira (2009), Fox et al. (2003), Jin and Myers (2006); Karolyi et al. (2012), Lai et al. (2014), Li et al. (2004), Veldkamp (2006), and Wurgler (2000).

¹⁵ In an untabulated, we follow Karolyi et al. 2012 and control for R^2 turnover as an additional demand side variable. We find that our results are robust whether we include or exclude R^2 turnover from regressions.

5 Summary statistic and correlation matrix

Table 1 Panel A reports summary statistics from January 1995 through December 2017 for our liquidity commonality measure, R^2_{liq} , various freedom of choice measures, and institutional environment. Panel B reports summary statistics for the sample of stocks over the study period.

China has the highest level of liquidity commonality. Other relatively developed countries, Greece, Taiwan and Turkey, also demonstrate higher level of liquidity commonality. Alternatively, developed countries, including the Netherlands, Germany, France, Finland and Norway, demonstrate significantly lower average commonality levels.

China has the lowest freedom of choice index level (-4.35), followed by Pakistan (-3.62) and Russia (-3.43). The USA and Australia exhibit the highest index levels, (2.33) and (2.20), respectively.

Hong Kong and Singapore appear to have the highest ‘individual opportunity’ levels of economic freedom, while Canada, Denmark, and Australia demonstrate extraordinarily high civil liberties and religious freedom levels. The USA and Australia rank highest on ‘decisional autonomy’, as measured by individualism; whereas, Colombia, Indonesia, and Pakistan have the lowest levels. Norway is highest on ‘immunity from interference’, as measured by the press freedom index, whereas, China scores the lowest for both religious freedom and press freedom.

Table 2 reports summary statistics for key control variables, including different proxies for supply and demand-side liquidity commonality and other control variables. Overall, statistics suggest that less-developed countries tend to have higher market volatility levels, lower levels of GDP per capita and smaller stock market capitalization.

Table 3 presents the correlation matrix for relevant variables. Correlation coefficients between liquidity commonality, R^2_{liq} , and some freedom of choice proxies suggest predictive relationships, indicating a negative association between freedom of choice levels and liquidity co-movement. Similar patterns also are reported between country-specific institutional environments and liquidity commonality in univariate relationships.

6 Results

Table 4 displays key results indicating that freedom of choice measures negatively affects liquidity commonality. Supply-side explanations for commonality are shown in Columns 1–5 and demand-side explanations are shown in Columns 6–10. Independent variables, including proxies for freedom of choice: the Fraser Institute’s Economic Freedom Index, the Freedom House Civil Liberties Index, the CIRI Religious Freedom Index, Hofstede’s culture dimension of individualism and the Freedom House Press Freedom Index are statistically significant and consistent with expected signs. Other control variables that likely explain liquidity commonality are also included. All models control for year fixed effects and include time-invariant country-level variables, including country-specific country geographical size and include time-variant variables, such as the number of traded stocks, which effectively serve as country-level fixed effects.

In summary, we find that all freedom of choice proxies are statistically significant and have negative signs, as expected. Thus, we conclude that freedom of choice proxies, whether used in supply-side or demand-side measures, explain relative liquidity commonality differences across all 46 countries. We further explain these results below.

Table 1 Summary statistics

Country	R ² liq	Freedom of choice index	Economic freedom	Civil liberties	Religious freedom	Individualism	Press freedom	Government effectiveness	Political stability estimate	Financial development index	Anti-self-dealing	Legal origin	IFRS
<i>Panel A: Country-by-country statistics</i>													
Argentina	0.22	-0.59	6.11	5.70	2.00	46.00	56.50	-0.04	-0.08	0.34	0.76	2.00	0.27
Australia	0.20	2.20	8.12	7.00	1.91	90.00	82.89	1.72	1.05	0.85	0.64	1.00	0.52
Austria	0.21	1.11	7.73	7.00	1.42	55.00	81.09	1.78	1.19	0.65	0.67	4.00	0.47
Belgium	0.20	1.49	7.56	6.74	1.43	75.00	89.43	1.66	0.90	0.55	0.96	2.00	0.52
Brazil	0.22	-0.77	6.09	5.62	1.90	38.00	58.93	-0.08	-0.10	0.52	0.79	2.00	0.37
Canada	0.21	2.05	8.14	7.00	1.96	80.00	82.83	1.84	1.09	0.80	0.35	1.00	0.26
Chile	0.21	0.37	7.70	6.65	1.75	23.00	72.26	1.21	0.56	0.46	0.21	2.00	0.25
China	0.37	-4.35	6.01	1.94	0.00	20.00	16.70	0.06	-0.44	0.50	0.95	4.00	0.00
Colombia	0.23	-1.80	6.59	4.30	1.94	13.00	42.18	-0.10	-1.59	0.33	0.95	2.00	0.12
Denmark	0.21	2.01	7.94	7.00	1.95	74.00	89.74	2.07	1.22	0.67	1.00	5.00	0.44
Egypt	0.22	-	5.96	2.71	0.00	-	31.57	-0.47	-0.80	0.31	0.39	2.00	0.00
Finland	0.20	1.59	7.87	7.00	1.61	63.00	88.61	2.06	1.46	0.61	0.41	5.00	0.52
France	0.20	0.62	7.38	6.61	0.70	71.00	76.96	1.51	0.55	0.72	0.95	2.00	0.52
Germany	0.20	1.30	7.84	6.74	1.33	67.00	83.94	1.67	0.95	0.74	0.65	4.00	0.56
Greece	0.24	-0.95	6.90	5.68	0.37	35.00	67.63	0.62	0.36	0.55	0.34	2.00	0.49
Hong Kong	0.21	-	8.95	5.68	-	25.00	65.24	1.59	0.94	0.73	0.54	1.00	0.52
Hungary	0.20	0.99	7.12	6.22	1.96	80.00	70.67	0.78	0.89	0.46	0.14	4.00	0.53
India	0.23	-1.27	6.41	4.96	0.61	48.00	60.64	-0.06	-1.13	0.40	0.63	1.00	0.00
Indonesia	0.21	-2.60	6.51	4.27	0.22	14.00	45.37	-0.33	-1.19	0.33	0.57	2.00	0.00
Ireland	0.20	1.82	8.08	6.95	1.88	70.00	83.94	1.53	1.15	0.73	0.08	1.00	0.66
Israel	0.22	-0.43	7.01	5.66	0.52	54.00	70.43	1.19	-1.20	0.53	0.20	1.00	0.39
Italy	0.21	1.00	7.30	6.57	1.74	76.00	69.48	0.58	0.64	0.73	0.43	2.00	0.52
Japan	0.22	0.75	7.76	6.18	1.68	46.00	78.46	1.37	1.07	0.77	0.22	4.00	0.00

Table 1 (continued)

Country	R ² iq	Freedom of choice index	Economic freedom	Civil liberties	Religious freedom	Individualism	Press freedom	Government effectiveness	Political stability estimate	Financial development index	Anti-self-dealing	Legal origin	IFRS
Korea	0.23	-0.15	7.27	5.87	1.96	18.00	70.21	0.93	0.37	0.78	0.48	4.00	0.04
Malaysia	0.23	-2.74	6.92	3.78	0.00	26.00	33.87	0.98	0.23	0.60	0.56	1.00	0.22
Mexico	0.21	-1.75	6.66	4.95	0.69	30.00	46.52	0.21	-0.55	0.36	0.20	2.00	0.22
Morocco	0.22	-2.59	6.25	3.85	0.00	46.00	38.57	-0.12	-0.31	0.33	0.16	2.00	0.00
Netherlands	0.19	1.97	7.85	7.00	1.87	80.00	87.26	1.90	1.18	0.76	0.45	2.00	0.52
New Zealand	0.20	2.31	8.56	6.83	2.00	79.00	87.39	1.77	1.34	0.57	0.22	1.00	0.43
Norway	0.20	1.72	7.62	7.00	1.78	69.00	91.54	1.91	1.34	0.66	0.44	5.00	0.53
Pakistan	0.22	-3.62	5.83	3.09	0.00	14.00	38.59	-0.60	-1.97	0.28	0.44	1.00	0.00
Peru	0.22	-1.18	7.30	4.78	1.48	16.00	53.55	-0.23	-0.81	0.27	0.15	2.00	0.09
Philippines	0.22	-0.69	7.10	5.00	1.65	32.00	60.01	-0.04	-1.15	0.36	0.43	2.00	0.00
Poland	0.21	0.86	6.94	6.70	2.00	60.00	75.77	0.59	0.69	0.43	0.08	4.00	0.64
Portugal	0.21	0.82	7.42	6.98	2.00	27.00	83.87	1.09	1.09	0.66	0.18	2.00	0.44
Russia	0.21	-3.43	5.69	3.14	0.00	39.00	30.30	-0.46	-1.04	0.37	0.21	2.00	0.10
Singapore	0.21	-1.87	8.65	3.83	0.88	20.00	20.43	2.13	1.20	0.71	0.65	1.00	0.00
South Africa	0.21	0.38	6.67	5.82	2.00	65.00	70.09	0.55	-0.17	0.52	0.25	1.00	0.53
Spain	0.20	0.68	7.55	6.70	1.26	51.00	77.62	1.34	0.09	0.82	0.33	2.00	0.53
Sweden	0.20	1.79	7.66	6.83	2.00	71.00	89.96	1.94	1.26	0.71	0.18	5.00	0.52
Switzerland	0.21	1.85	8.42	7.00	1.39	68.00	89.13	1.96	1.37	0.93	0.50	4.00	0.00
Taiwan	0.24	0.25	7.51	6.26	2.00	17.00	76.00	1.02	0.79	-	0.47	4.00	0.00
Thailand	0.22	-1.92	6.79	4.19	1.00	20.00	48.50	0.27	-0.53	0.56	0.32	1.00	0.00
Turkey	0.24	-2.38	6.36	4.13	0.35	37.00	40.43	0.12	-1.06	0.43	0.29	2.00	0.52
UK	0.21	1.99	8.24	6.70	1.78	89.00	79.48	1.72	0.56	0.84	0.46	1.00	0.52

Table 1 (continued)

Country	R ² liq	Freedom of choice index	Economic freedom	Civil liberties	Religious freedom	Individualism	Press freedom	Government effectiveness	Political stability estimate	Financial development index	Anti-self-dealing	Legal origin	IFRS
USA	0.21	2.33	8.30	6.96	2.00	91.00	82.96	1.60	0.54	0.86	0.46	1.00	0.00
<i>Panel B: Whole sample</i>													
Mean	0.22	0.00	7.29	5.70	1.31	49.93	66.24	0.94	0.27	0.58	0.45	2.34	0.30
Median	0.20	0.52	7.44	6.00	2.00	48.00	72.00	1.09	0.52	0.59	0.44	2.00	0.00
SD	0.06	1.85	0.87	1.46	0.81	24.51	21.26	0.86	0.98	0.20	0.25	1.33	0.46
# Obs	10,571	11,526	12,040	12,040	11,776	11,790	11,956	12,040	12,040	11,777	12,040	12,040	12,040

Panel A reports country-level average values from January 1995 through December 2017 for our liquidity commonality measure (R²liq), various indices for freedom of choice, institutional environment, and cultural tightness. Panel B reports mean, median, standard deviation, and number of observations for each variable. Variable definitions are provided in Table 10 in the appendix

Table 2 Summary statistics II

Country	Market volatility	Bank deposits/GDP	MV/GDP	Equity mutual fund assets	Foreign mutual fund assets	Net equity flows	Earning co-movement	HHI industry	Number of stocks	Geographical size	GDP growth	GDP per capita
<i>Panel A: Country-by-country statistics</i>												
Supply-side												
Argentina	-0.37	18.68	14.83	2.09	-	20.07	-3.30	0.51	102	14.82	1.41	9.12
Australia	-0.74	78.75	96.54	88.77	7.57	22.89	-3.93	0.24	2875	15.85	1.82	10.79
Austria	-1.01	72.47	24.33	48.86	-	21.46	-3.21	0.27	176	11.32	1.46	10.70
Belgium	-0.46	91.36	64.06	30.81	13.55	22.47	-4.50	0.40	235	10.32	1.39	10.65
Brazil	0.44	48.63	44.91	40.35	19.53	22.67	-4.60	0.31	295	15.94	1.32	9.24
Canada	-0.44	108.46	122.49	54.86	17.22	23.13	-3.85	0.21	3528	16.02	1.80	10.74
Chile	2.32	44.08	96.29	11.12	5.70	20.61	-2.13	0.37	169	13.52	3.42	9.32
China	0.78	41.60	43.94	8.11	10.28	23.06	-2.22	0.12	3567	16.05	8.47	8.11
Colombia	3.24	19.32	38.60	0.14	2.03	19.97	-3.65	0.59	51	13.92	2.68	8.74
Denmark	0.03	52.84	57.41	26.78	13.35	21.75	-2.87	0.40	292	10.65	1.11	10.95
Egypt	-0.08	65.32	36.61	2.51	8.28	19.21	-1.06	0.38	203	13.81	2.45	7.74
Finland	-0.45	56.33	94.30	29.00	18.34	22.11	-3.60	0.42	232	12.63	2.01	10.68
France	-0.30	69.72	74.18	63.60	16.38	23.91	-5.73	0.29	1672	13.21	1.12	10.59
Germany	-0.05	70.84	45.17	43.22	21.34	23.74	-4.79	0.15	2186	12.76	1.42	10.62
Greece	-0.56	78.99	35.35	5.11	11.87	21.86	-4.77	0.30	432	11.77	0.77	10.12
Hong Kong	0.77	245.12	632.32	381.99	13.69	23.14	-3.50	0.21	1512	6.96	2.49	10.25
Hungary	1.36	42.26	20.79	9.96	-	19.88	-2.94	0.77	80	11.41	2.60	9.42
India	-0.13	52.24	56.69	6.33	11.03	22.54	-2.14	0.30	2904	14.91	5.06	7.03
Indonesia	3.82	34.72	31.69	4.50	10.56	21.02	-3.22	0.21	587	14.41	3.03	7.94
Ireland	-0.44	84.70	49.26	467.22	37.18	25.39	-2.04	0.67	72	11.14	3.23	10.86
Israel	-0.61	74.95	63.54	17.62	20.18	21.42	-3.83	0.39	716	9.98	1.58	10.28
Italy	0.19	62.13	36.73	18.22	12.17	23.02	-6.54	0.29	671	12.59	0.43	10.48

Table 2 (continued)

Country	Market volatility	Bank deposits/GDP	MV/GDP	Equity mutual fund assets	Foreign mutual fund assets	Net equity flows	Earning co-movement	HHI industry	Number of stocks	Geographical size	GDP growth	GDP per capita
Japan	2.07	202.38	75.26	21.51	8.44	24.36	-4.17	0.08	5028	12.81	0.90	10.69
Malaysia	2.99	77.86	71.66	24.47	11.48	22.69	-4.03	0.20	1511	11.48	3.88	9.92
Mexico	-0.31	110.00	139.70	22.98	7.05	21.44	-3.33	0.17	951	12.70	3.13	9.03
Morocco	0.78	23.12	28.02	6.94	18.25	21.55	-3.36	0.27	252	14.48	0.94	9.14
Netherlands	-0.18	70.47	48.47	17.52	-	17.71	-1.51	0.50	100	13.01	2.65	7.84
New Zealand	-0.18	88.40	95.09	58.16	31.42	23.09	-4.55	0.35	295	10.43	1.59	10.79
Norway	-1.13	93.19	33.10	17.15	9.69	20.25	-3.06	0.53	241	12.48	1.66	10.47
Pakistan	0.17	51.69	48.29	18.93	21.75	21.14	-3.72	0.32	523	12.81	1.30	11.36
Peru	0.68	28.99	20.99	1.38	-	18.99	-2.48	0.30	373	13.56	1.72	6.85
Philippines	-0.65	27.51	35.17	3.29	-	18.38	-2.24	0.32	109	14.06	3.45	8.37
Poland	1.04	51.00	62.68	1.36	12.06	20.15	-3.29	0.33	238	12.61	2.98	7.62
Portugal	-0.46	42.77	27.61	4.91	7.59	21.02	-3.52	0.35	983	12.63	4.00	9.34
Russia	-0.86	81.40	36.30	12.18	8.42	21.54	-2.41	0.45	135	11.42	1.22	9.98
Singapore	-0.86	23.71	40.91	1.04	14.33	20.74	-1.95	0.97	135	16.61	3.25	9.04
South Africa	-0.43	104.96	196.86	429.54	15.65	21.69	-3.48	0.23	658	6.54	3.12	10.65
South Korea	0.32	54.32	207.07	32.42	13.97	22.22	-3.88	0.29	788	14.01	1.31	8.83
Spain	0.04	82.42	72.46	23.40	10.59	22.91	-4.41	0.29	255	13.12	1.44	10.30
Sweden	0.25	52.21	98.32	50.64	13.00	21.76	-3.85	0.51	1058	12.92	2.03	10.80
Switzerland	-0.30	131.12	207.78	42.76	19.86	22.34	-3.83	0.41	493	10.58	1.00	11.17
Taiwan	1.21	-	-	-	11.73	-	-2.82	0.18	1148	10.50	-	-
Thailand	0.95	99.44	63.91	16.58	10.17	20.86	-3.70	0.24	1399	13.14	2.79	8.42

Table 2 (continued)

Country	Market volatility	Bank deposits/GDP	MV/GDP	Equity mutual fund assets	Foreign mutual fund assets	Net equity flows	Earning co-movement	HHI industry	Number of stocks	Geographical size	GDP growth	GDP per capita
Turkey	0.52	36.02	23.24	2.43	13.92	20.73	-3.14	0.38	497	13.55	3.50	9.22
UK	-0.51	-	122.09	32.79	-	24.16	-5.93	0.27	3292	12.40	1.64	10.55
USA	-0.62	70.70	125.27	81.68	6.00	25.24	-2.39	0.11	4129	16.03	1.52	10.76
<i>Panel B: Whole sample</i>												
Mean	0.25	70.58	82.82	53.43	13.73	21.95	-3.51	0.34	1048	12.77	2.25	9.67
Median	-0.08	60.97	55.87	21.70	12.17	22.09	-3.49	0.30	497	12.81	2.21	10.11
SD	1.28	45.84	110.37	111.90	6.37	2.01	2.00	0.16	1236	2.12	3.09	1.21
# Obs	12,010	10,356	10,673	8769	10,181	8547	11,926	11,965	12,010	12,040	11,776	10,920

Panel A reports country-level average values for alternative demand- and supply-side liquidity commonality explanatory variables, as well as control variables. The supply-side explanation for liquidity commonality controls for market volatility, bank deposits/GDP, and market capitalization of exchange (MV/GDP). Demand-side variables include, R2 turnover, equity mutual fund assets, foreign institutional ownership, and net equity flows. Panel B reports mean, median, standard deviation, and number of observations for each variable. Variable definitions are provided in Table 10 in the appendix.

Table 3 Correlation matrix

R ² liq	Freedom of choice index	Economic freedom	Civil liberties	Religious freedom	Individualism	Press freedom	Government effectiveness	Political stability estimate	Financial development index	Anti-self-dealing	Market volatility	Bank deposits/GDP
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1												
(2)	1											
(3)	-0.293***	1										
(4)	-0.468***	0.509***	1									
(5)	-0.263***	0.393***	0.578***	1								
(6)	-0.293***	0.573***	0.671***	0.463***	1							
(7)	-0.396***	0.449***	0.848***	0.596***	0.730***	1						
(8)	-0.272***	0.646***	0.478***	0.341***	0.539***	0.513***	1					
(9)	-0.244***	0.655***	0.522***	0.596***	0.440***	0.518***	0.725***	1				
(10)	-0.175***	0.683***	0.452***	0.363***	0.472***	0.390***	0.650***	0.503***	1			
(11)	0.164***	-0.135***	-0.089***	-0.201***	0.084***	-0.142***	0.061***	0.033***	0.143***	1		
(12)	0.054***	-0.120***	-0.080***	0.032***	-0.218***	-0.089***	-0.088***	-0.075***	0.075***	0.010***	1	
(13)	-0.188***	0.247***	0.528***	0.063***	0.129***	0.143***	0.542***	0.379***	0.539***	0.119***	0.005***	1
(14)	0.182***	-0.338***	-0.348***	-0.155***	-0.281***	-0.345***	-0.357***	-0.355***	-0.202***	0.077***	0.058***	-0.266***
(15)	-0.110***	0.040***	-0.096***	0.015***	0.015***	0.112***	0.146***	0.053***	-0.090***	0.103***	-0.009***	-0.053***
(16)	0.031***	0.222***	0.239***	0.085***	0.326***	0.129***	0.150***	0.036***	0.506***	0.367***	0.044***	0.114***
(17)	0.121***	-0.136***	-0.072***	-0.053***	-0.121***	-0.105***	-0.073***	-0.098***	-0.121***	-0.103***	0.012***	-0.093***
(18)	-0.107***	0.142***	0.139***	0.264***	-0.184***	0.185***	0.143***	0.338***	-0.141***	-0.405***	-0.101***	0.194***
(19)	0.087***	-0.637***	-0.323***	-0.400***	-0.730***	-0.632***	-0.369***	-0.348***	-0.310***	-0.240***	0.159***	-0.043***
(20)	0.188***	0.017***	0.152***	-0.137***	0.315***	-0.074***	0.067***	-0.105***	0.234***	0.361***	0.042***	-0.106***
(21)	0.242***	-0.002***	-0.053***	0.184***	0.190***	-0.122***	-0.169***	-0.109***	0.147***	0.359***	-0.037***	-0.244***
(22)	0.186***	-0.015***	-0.286***	0.080***	0.203***	-0.005***	-0.392***	-0.260***	-0.016***	0.203***	-0.024***	-0.491***
(23)	0.323***	-0.452***	-0.224***	-0.332***	-0.315***	-0.433***	-0.231***	-0.246***	-0.293***	0.125***	0.024***	-0.211***
(24)	-0.277***	0.683***	0.553***	0.403***	0.625***	0.572***	0.807***	0.659***	0.608***	0.082***	-0.083***	0.308***

Table 3 (continued)

R ² liq	Freedom of choice index	Economic freedom	Civil liberties	Religious freedom	Individualism	Press freedom	Government effectiveness	Political stability estimate	Financial development index	Anti-self-dealing	Market volatility	Bank deposits/GDP
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(25) -0.310***	0.697***	0.735***	0.600***	0.457***	0.563***	0.546***	0.815***	0.695***	0.694***	-0.022	-0.043**	0.415***
(26) 0.144***	-0.0419***	-0.225***	-0.017	0.103***	-0.163***	0.074***	-0.020	0.194***	-0.093***	-0.024	0.206	-0.346***
MV/GDP	Equity mutual fund assets	Foreign mutual fund assets	Net equity flows	Earning co-movement	HHI industry	Number of stocks	Geographical size	GDP growth	GDP per capita	Legal origin	MV/GDP	Legal origin
(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(29)	(30)
(14) 1	(15) 1	(16) 1	(17) 1	(18) 1	(19) 1	(20) 1	(21) 1	(22) 1	(23) 1	(24) 1	(29) 1	(30) 1
(15) 0.139***	-0.247***	-0.022	0.086***	0.053***	-0.356***	0.541***	0.795***	0.101***	-0.350***	0.864***	0.103***	1
(16) 0.024	0.086***	-0.398***	0.015	0.053***	-0.292***	0.496***	0.161***	0.220***	-0.449***	0.210***	0.052***	1
(17) -0.011	0.101***	-0.287***	0.159***	-0.686***	-0.405***	0.272***	0.161***	0.101***	-0.350***	0.864***	0.103***	1
(18) -0.101***	0.101***	-0.287***	0.159***	-0.686***	-0.405***	0.272***	0.161***	0.101***	-0.350***	0.864***	0.103***	1
(19) 0.309***	-0.383***	0.439***	0.159***	-0.686***	-0.405***	0.272***	0.161***	0.101***	-0.350***	0.864***	0.103***	1
(20) -0.157***	-0.338***	0.402***	0.224***	-0.405***	-0.296***	0.496***	0.795***	0.101***	-0.350***	0.864***	0.103***	1
(21) 0.189***	-0.381***	0.300***	0.211***	-0.466***	-0.296***	0.496***	0.795***	0.101***	-0.350***	0.864***	0.103***	1
(22) 0.229***	-0.186***	-0.030*	0.194***	-0.149***	0.139***	0.272***	0.161***	0.101***	-0.350***	0.864***	0.103***	1
(23) -0.015	0.296***	0.172***	-0.120***	0.045**	-0.391***	0.036	-0.093	-0.220***	-0.350***	0.864***	0.103***	1
(24) -0.196***	0.218***	0.173***	-0.234***	0.114***	-0.257***	-0.119***	-0.147***	-0.321***	-0.449***	0.864***	0.103***	1
(25) -0.166***	0.283***	-0.113***	-0.033*	0.001	-0.019	-0.062***	-0.226***	-0.055***	0.052***	0.210***	0.103***	1

Panel A reports country-level average values for alternative demand- and supply-side liquidity commonality explanatory variables, as well as control variables. The supply-side explanation for liquidity commonality controls for market volatility, bank deposits/GDP, and market capitalization of exchange (MV/GDP). Demand-side variables include, R2 turnover, equity mutual fund assets, foreign institutional ownership, and net equity flows. Panel B reports mean, median, standard deviation, and number of observations for each variable. Variable definitions are provided in Table 10 in the appendix

Table 4 Table measures the freedom of choice effect on liquidity commonality, reporting standardized regression estimates for different freedom of choice proxies on liquidity commonality, including control variables

	Supply-side			Demand-side						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Economic freedom	-0.227*** (0.071)					-0.209** (0.100)				
Civil liberties		-0.261** (0.093)					-0.263** (0.100)			
Religious freedom			-0.096* (0.022)					-0.118* (0.056)		
Individualism				-0.192*** (0.063)					-0.202*** (0.065)	
Press freedom					-0.234** (0.088)					-0.247** (0.102)
Market volatility	-0.010 (0.038)	-0.010 (0.037)	-0.001 (0.020)	-0.047 (0.043)	-0.014 (0.037)					
Bank deposits/GDP	0.008 (0.039)	-0.004 (0.040)	-0.013 (0.019)	-0.019 (0.041)	0.023 (0.042)					
MV/GDP	0.015 (0.032)	-0.015 (0.030)	-0.029 (0.018)	-0.028 (0.028)	-0.030 (0.030)					
Equity mutual fund assets						-0.027 (0.041)	-0.039 (0.044)	-0.038 (0.043)	-0.081* (0.040)	-0.048 (0.045)
Foreign institutional ownership						-0.029 (0.035)	-0.007 (0.036)	-0.004 (0.038)	0.048 (0.047)	0.013 (0.041)
Net equity flows						0.059 (0.046)	0.075* (0.043)	0.058 (0.044)	0.063 (0.043)	0.076* (0.044)
Earning co-movement	0.085* (0.048)	0.037 (0.033)	0.051 (0.017)	0.042 (0.043)	0.044 (0.033)	-0.027 (0.041)	-0.039 (0.044)	-0.038 (0.043)	-0.081* (0.040)	-0.048 (0.045)

Table 4 (continued)

	Supply-side					Demand-side				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
HHI industry	-0.113*** (0.052)	-0.097 (0.057)	-0.082 (0.021)	-0.005 (0.051)	-0.076 (0.056)	-0.029 (0.035)	-0.007 (0.036)	-0.004 (0.038)	0.048 (0.047)	0.013 (0.041)
# of stocks	0.125*** (0.058)	0.095* (0.048)	0.113* (0.025)	0.203*** (0.076)	0.120** (0.056)	0.059 (0.046)	0.075* (0.043)	0.058 (0.044)	0.063 (0.043)	0.076* (0.044)
Geographical size	-0.039 (0.030)	0.037 (0.046)	0.018 (0.017)	0.037 (0.040)	0.034 (0.057)	0.077 (0.048)	0.032 (0.031)	0.045 (0.039)	0.036 (0.038)	0.052 (0.034)
GDP growth	0.117* (0.065)	0.091* (0.047)	0.106 (0.025)	0.099 (0.060)	0.088* (0.048)	-0.147* (0.073)	-0.163* (0.077)	-0.162* (0.084)	-0.089 (0.069)	-0.121 (0.078)
GDP per capita	0.014 (0.050)	0.028 (0.055)	-0.085* (0.020)	-0.040 (0.047)	-0.018 (0.048)	0.096* (0.045)	0.039 (0.049)	0.026 (0.068)	0.162** (0.053)	0.092 (0.051)
Legal origin	0.083 (0.065)	0.108* (0.061)	0.099 (0.029)	0.100 (0.070)	0.128* (0.070)	-0.027 (0.037)	0.059 (0.043)	0.070 (0.064)	0.101 (0.054)	0.047 (0.047)
IFRS	-0.035 (0.060)	0.034 (0.063)	-0.018 (0.022)	0.011 (0.058)	0.032 (0.065)	0.215* (0.098)	0.159** (0.065)	0.190* (0.088)	0.177* (0.090)	0.148** (0.063)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Highest VIF	4.73	5.06	4.84	7.25	5.44	3.26	3.57	3.38	3.32	4.53
N	8865	8865	8630	8676	8783	5114	5114	4949	5053	5079
adj. R ²	0.090	0.104	0.084	0.092	0.101	0.148	0.170	0.150	0.153	0.166

Proxies for freedom of choice include the Fraser Institute's Economic Freedom Index, the Freedom House Civil Liberties Index, the CIRI Religious Freedom Index, Hofstede's culture dimension of individualism, and the Freedom House Press Freedom Index. The dependent variable is the country-level liquidity commonality average (R²liq), calculated as a monthly equally weighted average (R²liq) across individual stocks in each country. We used a log transformation of R² in [R²/(1-R²)]. Supply-side regressions control for market volatility, bank deposits, and a country's stock market capitalization to GDP ratio. Demand-side regressions control for aggregate market R² turnover, a country's equity mutual funds' assets, foreign institutional ownership, and net equity flows. Variable definitions are provided in Table 10 in the appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses

6.1 Individual opportunity freedom

Results for the individual opportunity proxy imply that liquidity commonality results from lower levels of economic freedom, civil liberties and religious freedom (shown in columns 1–3 and 6–8). Greater individual opportunity contributes to societal pluralism, which fosters independent investment decisions tend to reduce levels of liquidity commonality.

We use the Fraser Institute's Economic Freedom Index to measure country-specific Economic Freedom, and the Freedom House Civil Liberties Index to measure the impact of civil liberties on liquidity commonality. As posited, we find that both economic freedom and Civil Liberties have negative and statistically significant coefficients, suggesting that both motivate investors to make independent investment decisions, reducing the liquidity commonality.

The negative correlation between the opportunity aspect of freedom of choice and liquidity commonality suggests that countries that promote greater freedom opportunities observe resulting more independent trading activities and lower liquidity commonality. These results support our hypothesis 1.

6.2 Decisional autonomy freedom

Our second aspect of freedom of choice, 'decisional autonomy', concerns country-specific degrees of individual autonomy and is measured using the Hofstede (2001) 'individualism' index.

Table 4, Columns (4) and (9), summarize regression results for Hofstede's individualism index. Negative and statistically significant coefficients for individualism are consistent with our narrative that individualistic societies display lower levels of liquidity commonality. These results provide supporting evidence for hypothesis 2 that individualistic societies make independent trading decisions that mitigates systematic co-movement.

6.3 Immunity from interference: press freedom

Negative and statistically significant coefficients for 'Press freedom' in Table 4, Columns (5), and (10), suggest a negative correlation between country's relative immunity from interference, measured by press freedom, and liquidity commonality. Press freedom regression coefficients reflect the impact of each country's press in facilitating accurate, unrestricted and unbiased information, stimulating diverse individual perspectives. These coefficients are the highest of all variables measuring different aspect of Freedom of Choice for both demand-side and supply-side models. This indicates the dominate role of press freedom plays in liquidity commonality.

Our results are robust to alternative determinants for liquidity commonality when controlling for specific investor groups trading patterns (e.g., mutual funds, foreign institutional traders), market volatility and other proxies of financial market properties. These findings support our hypothesis that immunity from interference reduces liquidity commonality.

In general, our results indicate that the different aspects of freedom of choice reduce systematic liquidity commonality.¹⁶ However, we test for the significance of endogeneity bias that potentially may distort or bias our results and dispute causal relationships. We

¹⁶ In untabulated data, we include both supply and demand variables in the same regression. We observe that our findings remain robust for this model specification.

address endogeneity concerns by identifying exogenous shocks to freedom of choice to validate causal links with systematic liquidity commonality. Endogeneity concerns are later in Sect. 5.5.

6.4 Freedom of choice index: principal components analysis-composite index

Previous results illustrate the importance of all three aspects of freedom of choice; whereas indices used in previous studies tend to focus on a single aspect of freedom of choice. In this section, we apply a principal components analysis to identify country-level orthogonal components/factor of freedom of choice.

Beginning with our data matrix of freedom of choice proxies: the Fraser Institute Economic Freedom Index, the Freedom House Civil Liberties Index, the CIRI Religious Freedom Index, Hofstede's cultural dimension of individualism and the Freedom House Press Freedom Index, Table 5 identifies the number and identity of orthogonal components/factors that we use to facilitate a country-specific composite freedom of choice index. Determining a unique freedom of choice index for each country enables us to estimate the composite impact of freedom of choice on liquidity commonality.

Table 5, Panel A, reports that the component one, Economic Freedom, explains 68.8 percent of total variation with an eigenvalue greater than one (eigenvalue of 3.440); whereas all other component eigenvalues are less than one.¹⁷ All freedom of choice factors load highly with the first orthogonal principal component, where Civil Liberties and Press Freedom load the highest. Table 5, Panel B, shows statistically significant and negative coefficients for each country's unique freedom of choice composite index in explaining liquidity commonality.¹⁸ This is consistent with our hypotheses and previous results.

6.5 Endogeneity tests using personal freedom versus personal safety tradeoffs

We address possible endogeneity bias by assessing how perceived shocks to personal safety impact country-specific freedom of choice proxies and their impacts on liquidity commonality. Previous literature suggests a "sense of threat" may serve as a potential instrumental variable for freedom of choice. During such times, people may trade personal freedoms and civil liberties for greater perceived safety and security (Davis and Silver 2004; Huddy et al. 2005). Thus, to ensure that our results are not driven by spurious correlations or omitted variable, we use the total number of terrorism incidents in each country as an exogenous shock to personal freedom. We use the Global Terrorism Database (GTD) incidences of armed assault, hijacking, and kidnapping in each country as an instrumental variable for exogenous variations freedom of choice variations.¹⁹ We calculate the number of incidents per year in each country by adding the number of armed assaults, hijacking, and kidnapping in each country. We create a variable, "Attacks," which is defined as the number of

¹⁷ A factor with an eigenvalue greater than 1 suggests that the identified component has the greatest explanatory power as compared to any of the other freedom of choice proxies.

¹⁸ A unique composite index is calculated for each country based on the weighting from component loadings for each of the principal components, economic freedom, civil liberties, religious freedom, individualism and press freedom.

¹⁹ We exclude other types of terrorism attacks including bombing or infrastructure attacks to avoid incidents related to political unrest.

Table 5 The table presents the regression results of the relationship between the freedom of choice index and liquidity co-movement

	Economic freedom	Civil liberties	Religious freedom	Individualism	Press freedom
<i>Panel A: Principal component analysis</i>					
Loadings	0.755	0.929	0.732	0.789	0.922
Scores	0.407	0.501	0.395	0.425	0.497
Proportion explained of the first factor (Economic Freedom)		0.688	Eigenvalue of the first factor (Economic Freedom)		3.440
<i>Panel B: Freedom of choice index</i>					
		Main	Supply		Demand
Freedom of choice index		-0.298*** (0.094)	-0.297*** (0.097)		-0.311** (0.113)
Market volatility			-0.017 (0.041)		
Bank deposits/GDP			0.007 (0.041)		
MV/GDP			-0.021 (0.051)		
Equity mutual fund assets					-0.007 (0.046)
Foreign institutional ownership					-0.005 (0.040)
Net equity flows					0.063 (0.043)
Earning co-movement		0.063* (0.034)	0.064 (0.039)		0.068 (0.038)
HHI industry		-0.079 (0.059)	-0.083 (0.064)		-0.136 (0.084)
# of stocks		0.124** (0.052)	0.118** (0.049)		0.078 (0.053)
Geographical size		0.039 (0.047)	0.037 (0.046)		0.061 (0.056)
GDP growth		0.090* (0.051)	0.090* (0.047)		0.143** (0.063)
GDP per capita		0.074 (0.062)	0.072 (0.067)		0.051 (0.062)
Legal origin		0.107* (0.053)	0.112* (0.061)		0.140* (0.064)
IFRS		0.034 (0.053)	0.027 (0.050)		0.009 (0.052)
Fixed effects		Yes	Yes		Yes
Highest VIF		3.36	3.73		3.38
<i>N</i>		9137	8441		4888
adj. <i>R</i> ²		0.110	0.112		0.177

Panel A presents the principal components analysis applied to five freedom of choice proxies used to create the index. Factor loadings, scoring coefficients, eigenvalue, and proportion of variation explained by the first factor are presented. This table reports standardized regression estimates of the impact of the freedom of choice index on liquidity commonality. Variable definitions are provided in Table 10 in the appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses

incidents per year in each country, scaled by the average annual number of incidents for the entire sample of 46 countries.

Results, summarized in Table 6, Columns (1–6), show negative and statistically significant associations among country freedom of choice proxies and liquidity commonality. The coefficients for interaction terms between country-specific “Attacks” and freedom of choice proxies are positive and statistically significant, except for individualism. This suggests that increases in violent attacks, increases the personal risk, which, in turn, decreases the impact of freedom of choice to reduce liquidity commonality.²⁰ Additionally, coefficients for different aspect of freedom of choice are consistent with previous results, validating that previous results are unaffected by endogeneity.

Table 6 also reports the impact of the September 11, 2001 terrorist attack in the US on liquidity commonality. Prior literature suggests that the 9/11 terrorist attack altered religious freedoms, not only in the USA, but also internationally (Hutcheson et al. 2004; Poynting and Mason 2006). This single unexpected event represents an international exogenous shock to individual freedoms and is a second test for endogeneity bias.

We define “9/11” as a dummy variable that assumes 1 between September 2001 and December 2005 and 0 otherwise. Coefficients for the 9/11 dummy are statistically insignificant, suggesting no effect on liquidity commonality resulting from the 9/11 attacks. However, interaction terms between the 9/11 dummy and the Religious Freedom Index (column 7) and the dummy and the Freedom of Choice Index (column 8) are positive and statistically significant, implying that the impact of both, the religious freedom and the freedom of choice on liquidity commonality was affected during the 9/11 period.

Overall, we find that higher levels of perceived threats in a country restrain personal freedoms and tend to reduce freedom of choice effects on liquidity commonality.

7 Robustness

7.1 Institutional environment, culture and disclosure

A body of literature investigates relationships between institutional environments and financial market development and efficiency (La Porta et al. 2006, 1998, 2000). Prior literature, focusing on co-movement, finds a higher level of firm-level news co-movement in countries with a weaker institutional environment, driving more commonality in stock prices and liquidity (Dang et al. 2015).

To test the robustness of our results, we control for impacts of country-specific institutional environments by using government effectiveness and political stability estimates from Worldwide Governance Indicators (WGI), the Financial Development Index from the International Monetary Fund (IMF) and the Anti-self-dealing Index (Djankov et al. 2008).

Table 7, Columns (1–3) show the regression results.²¹ Though we acknowledge that there is an association between freedom of choice and country-specific institutional environments, results indicate that our findings are not merely a function of each country’s unique institutional infrastructure and market development.

²⁰ Results for control variables are consistent with the prior table. Thus, for brevity, we do not report those coefficients.

²¹ Due to the high multicollinearity between the institutional environment measures and GDP per capita, we remove GDP per capita from the regression analysis in Models 1–3. All other control variables are included in these models.

Table 6 Table adopts country-level terrorism attacks as an instrument as an exogenous variation in the freedom of choice

	Attacks					9/11	
	(1)	(2)	(3)	(4)	(5)	(7)	(8)
Economic freedom × Attacks	0.518** (0.631)						
Economic freedom	-0.294*** (0.073)						
Civil liberties × Attacks		0.263*** (0.364)					
Civil liberties		-0.360*** (0.105)					
Religious freedom × Attacks			0.069** (0.722)				
Religious freedom × 9/11							0.052* (0.046)
Religious freedom			-0.134** (0.060)				-0.112** (0.061)
Individualism × Attacks				-0.003 (0.022)			
Individualism				-0.190** (0.070)			
Press freedom × Attacks					0.269** (0.040)		
Press freedom					-0.370*** (0.112)		
Freedom of choice index × Attacks						0.124** (0.324)	

Table 6 (continued)

		Attacks				9/11			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Freedom of choice index × 9/11									
Freedom of choice index								0.031*	
								(0.020)	
								-0.313***	
								(0.051)	
Attacks		-0.575**	-0.283**	-0.102	-0.058	-0.268*			
		(4.369)	(1.927)	(1.098)	(0.888)	(2.231)			
9/11								0.036	-0.015
								(0.096)	(0.112)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N		6635	6635	6580	6492	6612	6437	9137	9326
adj. R ²		0.118	0.128	0.102	0.104	0.130	0.134	0.111	0.084

Reports standardized regression estimates of the impact of different proxies of freedom of choice interacted with the “Attacks” variable on liquidity commonality. The attacks variable is defined as the country’s total number of armed assaults, hijacking, and kidnapping incidents in each year, scaled by the total number of terrorist attacks in the same year in all countries in our sample. 9/11 is defined as an indicator dummy variable that takes value of 1 between September 2001 and December 2005, and a value of 0 otherwise. Variable definitions are provided in Table 10 in the appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses

Table 7 The table uses different proxies for the country-specific institutional environment and culture tightness, and reports standardized regression estimates of freedom of choice on liquidity commonality

	Institutional environment			Disclosure		
	Main	Supply-Side	Demand-Side	Main	Supply-Side	Demand-Side
	(1)	(2)	(3)	(4)	(5)	(6)
Freedom of choice index	-0.265*** (0.087)	-0.271*** (0.088)	-0.298** (0.114)	-0.146*** (0.043)	-0.160*** (0.044)	-0.117*** (0.040)
Government effectiveness estimate	-0.042 (0.065)	-0.037 (0.070)	-0.033 (0.085)			
Political stability estimate	0.061 (0.076)	0.033 (0.072)	0.082 (0.104)			
Financial development index	0.051 (0.051)	0.073 (0.060)	0.055 (0.063)			
Anti-self-dealing index	0.068 (0.041)	0.080* (0.043)	0.057 (0.042)			
Disclosure				-0.063 (0.049)	-0.047 (0.041)	-0.017 (0.036)
Account				-0.065* (0.038)	-0.065 (0.040)	-0.058 (0.037)
Market volatility		-0.014 (0.038)			0.013 (0.014)	
Bank deposits/GDP		0.019 (0.043)			0.050 (0.037)	
MV/GDP		-0.069 (0.060)			0.016 (0.046)	
Equity mutual fund assets			-0.052 (0.042)			-0.034 (0.029)
Foreign institutional ownership			0.016 (0.041)			-0.027 (0.023)

Table 7 (continued)

	Institutional environment			Disclosure		
	Main	Supply-Side	Demand-Side	Main	Supply-Side	Demand-Side
	(1)	(2)	(3)	(4)	(5)	(6)
Net equity flows			0.054 (0.052)			0.016 (0.021)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Highest VIF	7.10	7.79	6.58	3.46	3.67	3.68
<i>N</i>	9858	8441	4888	8229	6845	4364
adj. <i>R</i> ²	0.106	0.118	0.181	0.042	0.040	0.043

The dependent variable is country-level commonality. Models (1–3) control for country-specific government efficiency estimates, political stability estimates, financial development, and anti-self-dealing indexes. Models (4–6) control for country's disclosure requirements. Variable definitions are provided in Table 10 in the appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses

Table 7, Columns (6–9), includes “Financial disclosure” (Bushman et al. 2004) and “Account score” (La Porta et al. 1998) as additional control variables. Results confirm previous findings and suggest that our findings are not driven by country-specific disclosure requirements.

7.2 2007–2009 Financial crisis

Literature suggest that liquidity commonality tends to be higher during bear markets than bull markets, especially when funding liquidity is tight (Hameed et al. 2010). Thus, we study the period around the 2008 financial crisis by splitting the sample, representing pre- and post-financial crisis periods. The pre-crisis period covers 1995–2007 and the post-crisis period includes 2010–2017.

Table 8 shows larger coefficients for the freedom of choice index during the post-crisis period across different models. This indicates that the freedom of choice index had greater impact on reducing liquidity commonality during the post-crisis period relative to the pre-crisis period. Findings are robust after controlling for the regulatory actions attempting to mitigate economic downturn, central bank and regulatory changes, stock exchange rules and market fragmentation during 2010–2017. This finding is consistent with Cumming et al. (2011) and Jain et al. (2020).

7.3 Alternative measure of freedom of choice

It is possible that our previous findings are sensitive to using specific proxies of different facets of freedom of choice. In this case, our results may propose a biased measure of freedom of choice and lead flawed inference about its impact on commonality in liquidity.

We test for robustness of our model using alternative variable/definitions for each aspect of freedom of choice. In this test we use Tang and Koveos (2008) updated version of Hofstede’s culture dimension of individualism, the Heritage Foundation’s Economic Freedom Index, the Norris and Inglehart’s Freedom of Religion Index, the CIRI Human Rights Data Project’s Physical Integrity Index and the Freedom of Speech and Press Index.

Results, summarized in Table 9, shows that alternative proxies for freedom of choice yield similar results as those reported in Table 4. Our findings show that commonality is negatively related to all alternative measures of freedom of choice. These findings corroborate our previous findings are suggest that our inference is driven by specific proxies for aspects of freedom of choice.

7.4 Out of sample test, and the impacts of China

We validate previous findings by conducting an out of sample test, using the sample of countries from Karolyi et al. (2012).²² They estimates liquidity commonality for 40 countries for 1995–2009. For brevity, we do not report results for this sample; however, we find

²² The data is downloaded from van Dijk’s website (<http://www.mathijssavandijk.com/publications>) for the period from January 1995 through December 2009.

Table 8 The table identifies the pre– financial crisis period 1995–2007 and the post-financial crisis period 2010–2017, reports standardized regression estimates of freedom of choice on liquidity commonality in the pre– and post-financial crisis periods, controlling for different proxies of the country’s institutional environments and culture tightness

	Pre– financial crisis			Post-financial crisis		
Freedom of choice index	– 0.251*** (0.079)	– 0.248*** (0.082)	– 0.174** (0.067)	– 0.342*** (0.112)	– 0.342*** (0.116)	– 0.349*** (0.125)
Market volatility		– 0.052 (0.051)			0.027 (0.038)	
Bank deposits/GDP		0.028 (0.046)			– 0.001 (0.052)	
MV/GDP		– 0.011 (0.051)			– 0.032 (0.058)	
Equity mutual fund assets			0.045 (0.044)			– 0.080 (0.067)
Foreign institutional ownership			– 0.034 (0.030)			– 0.001 (0.052)
Net equity flows			– 0.005 (0.034)			0.113* (0.067)
Earning co-movement	0.031 (0.027)	0.020 (0.029)	– 0.015 (0.018)	0.094* (0.044)	0.110** (0.051)	0.121** (0.052)
HHI industry	– 0.061 (0.058)	– 0.063 (0.064)	– 0.077 (0.058)	– 0.098 (0.059)	– 0.096 (0.065)	– 0.054 (0.075)
# of stocks	0.117** (0.055)	0.105* (0.053)	0.125** (0.045)	0.123* (0.065)	0.127* (0.061)	0.135 (0.079)
Geographical size	0.004 (0.048)	0.012 (0.047)	– 0.004 (0.043)	0.078 (0.048)	0.060 (0.048)	0.052 (0.050)
GDP growth	0.072 (0.051)	0.075 (0.048)	0.106 (0.079)	0.080* (0.047)	0.075 (0.046)	0.075* (0.038)
GDP per capita	0.033 (0.054)	0.010 (0.064)	– 0.005 (0.053)	0.121* (0.073)	0.136* (0.082)	0.066 (0.097)
Legal origin	0.086* (0.049)	0.099* (0.054)	0.074 (0.039)	0.117* (0.055)	0.113 (0.071)	0.129* (0.057)
IFRS	0.017 (0.083)	0.014 (0.087)	0.021 (0.125)	0.057 (0.082)	0.058 (0.086)	0.023 (0.084)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Highest VIF	3.47	3.88	3.52	3.40	3.74	3.59
N	4795	4517	2219	3446	3063	2191
adj. R ²	0.080	0.083	0.057	0.130	0.135	0.230

Variable definitions are provided in Table 10 in the appendix. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses

consistent results for the impact of different aspects of freedom of choice on liquidity commonality further validating our finding that freedom of choice reduces liquidity commonality and may be generalizable to other samples and time periods.

Since China has an extremely high R²liq of 37% and other countries have an R²liq around 20%, we evaluate the results of this outlier to estimate China’s impact on our findings. To estimate China’s effect on our study, we exclude China from our sample countries and re-test the models. Unreported results confirm a consistent impact of freedom of choice reducing liquidity commonality, even after excluding China.

Table 9 The table uses alternative freedom of choice definitions and reports standardized regression estimates of freedom of choice on liquidity commonality

	Supply-side explanation					Demand-side explanation				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Economic freedom (Heritage)	-0.171** (0.066)					-0.174* (0.089)				
Physical integrity		-0.206** (0.076)					-0.212** (0.080)			
Religious freedom (Norris and Inglehart 2004)			-0.100** (0.044)					-0.108* (0.056)		
Individualism (TK)				-0.221*** (0.002)					-0.157*** (0.051)	
Freedom of speech					-0.136** (0.096)					-0.136** (0.064)
Market volatility	0.005 (0.045)	-0.035 (0.036)	-0.001 (0.047)	-0.008 (0.025)	0.003 (0.042)					
Bank deposits/GDP	0.003 (0.040)	0.014 (0.039)	-0.021 (0.043)	0.029 (0.040)	0.003 (0.043)					
MV/GDP	0.014 (0.030)	-0.030 (0.052)	-0.020 (0.028)	-0.036 (0.027)	-0.061* (0.062)					
Equity mutual fund assets						-0.008 (0.050)	-0.027 (0.040)	-0.044 (0.044)	-0.098** (0.037)	-0.072* (0.043)
Foreign institutional ownership						-0.012 (0.035)	-0.010 (0.037)	0.022 (0.045)	-0.009 (0.023)	-0.025 (0.036)
Net equity flows						0.029 (0.040)	0.044 (0.042)	0.067 (0.047)	0.038** (0.018)	0.088* (0.052)
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Highest VIF	4.01	3.58	3.27	5.76	3.04	4.30	4.49	3.36	6.87	3.31

Table 9 (continued)

	Supply-side explanation					Demand-side explanation				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>N</i>	8865	8630	8865	7658	8630	5114	4949	5114	4697	4949
adj. <i>R</i> ²	0.084	0.091	0.083	0.026	0.090	0.148	0.154	0.147	0.042	0.156

For a robustness check, we defined freedom of choice using alternative freedom of choice and press freedom measures. Individualism measure is Tang and Koveos' (2008) updated version of Hofstede's (2001) culture dimension of individualism. Financial Freedom is the Heritage Foundation's Financial Freedom Index. Religious Freedom is measured by Norris and Inglehart's Freedom of Religion Index. The Physical Integrity Index, the Freedom Speech and Press are CIRI Human Freedom Project Indices of physical integrity and freedom of speech. Variable definitions are provided in Table 10 in the appendix. , * , ** , and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Standard errors are reported in parentheses

8 Conclusion

We study the impacts of three aspects of personal freedom of choice (opportunity, decisional autonomy, and immunity from interference) across 46 countries for 1995–2017 on country-specific stock market-liquidity commonality, where, we defined each country's liquidity commonality as its relative level of individual stock liquidity co-movement. We find that all three aspects of freedom of choice effectively and statistically reduce commonality in liquidity. Further, in the absence one of the aspects of freedom of choice, the presence of the other two aspects of freedom of choice tend to mitigate its negative impact and effect on systematic liquidity risk. Hence, our study looks beyond each aspect of personal freedom of choice and demonstrates that all three facets of freedom of choice may work collectively or separately to reduce liquidity commonality and systemic and systematic liquidity risk.

We identify country-specific freedom of choice indices for each aspect of freedom of choice and estimate their singular and joint impacts on liquidity commonality for major stock markets in each of 46 countries.

Aspects of freedom of choice include: the 'individual opportunity', represented by economic freedom, religious freedom and civil liberty; 'decisional autonomy' proxied by Hofstede's individualism; and 'immunity from interference' captured by the Freedom House Press Freedom Survey. We find that each aspect, both jointly and independently, is a significant determinants of liquidity commonality.

Countries facilitating greater opportunities for citizens and investors to make independent decisions, free of coercion, without nullifying outside influences, countries that protect/legislate greater levels of personal decisional autonomy and immunity from interference through free press, experience significantly lower liquidity commonality.

Each freedom of choice aspect impact liquidity commonality in each of the 46 countries. We observe that government policies facilitating individual opportunities, individual autonomy, press freedom (reliable sources of information) and religious freedom improve stock market efficiency and liquidity.

Results are robust with respect to alternate model specifications, endogeneity, and alternate freedom of choice measures, including both supply-side and demand-side explanations, and country-specific institutional, accounting and financial environments explanations for stock liquidity commonality.

Appendix

See Table 10.

Table 10 Variables definition

Variable	Description	Source
$R^2\text{-liq}$	<p>Country-level liquidity commonality is measured as the equally-weighted average of $R^2\text{-liq}$ across individual stocks in a country. Liquidity commonality of individual stocks is measured by the R^2 of monthly regressions of daily innovations in liquidity of individual stocks on the lead, lag, and contemporaneous innovations in market liquidity at the country level. We multiply by a -1 constant and log the Amihud measure to reduce the impact of outliers and to construct an increasing variable in individual stock liquidity. Daily liquidity innovations are the residuals of the filtering regressions of each stock's daily Amihud liquidity on lagged liquidity, day-of-the-week dummies, and holiday dummies within the month. Daily market liquidity innovations are the value-weighted average of the daily innovations in the liquidity of each stock within each country, excluding the stock of interest</p>	Own calculation based on DataStream
<i>Freedom of choice</i>		
Economic freedom	<p>The index measures the degree of economic freedom present in five major areas: [1] Size of Government, [2] Legal System and Security of Property Rights, [3] Sound Money, [4] Freedom to Trade Internationally, and [5] Regulation. Within the five major areas, there are 24 components in the index. Many of those components are themselves made up of several sub-components. In total, the index comprises 42 distinct variables. Each component and sub-component is placed on a scale from 0 to 10 that reflects the distribution of the underlying data. In turn, the five area ratings are averaged to derive the summary rating for each country</p>	The Fraser Institute
Civil liberties	<p>The civil liberties are extracted from Freedom House's Civil Liberties survey, published every year. The survey questions are grouped into four subcategories: Freedom of Expression and Belief, Associational and Organizational Rights, Rule of Law, and Personal Autonomy and Individual Rights. The average of a country/territory's Civil Liberties ratings determines the country/territory's status of Free (1.0 to 2.5), Partly Free (3.0 to 5.0), or Not Free (5.5 to 7.0). In our analysis we use the reversed Civil Liberties Index to create an increasing index of civil liberties</p>	Freedom House

Table 10 (continued)

Variable	Description	Source
Religious freedom	This variable indicates the extent to which the freedom of citizens to exercise and practice their religious beliefs is subject to actual government restrictions. A score of 0 indicates that government restrictions on religious practices are severe and widespread. A score of 1 indicates such practices are moderate. A score of 2 indicates such practices are practically absent. For all years after 2011, we use the most recent value of the CIRI Religious Freedom Index for a given country	CIRI Human Rights Data Project
Individualism	The high side of this dimension, called individualism, can be defined as a preference for a loosely-knit social framework in which individuals are expected to take care of only themselves and their immediate families. Its opposite, collectivism, represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a group to look after them in exchange for unquestioning loyalty. A society's position on this dimension is reflected in whether people's self-image is defined in terms of "I" or "we."	Hofstede (2001)
Press freedom	This is a compendium of each country's press freedom status and scores as published in Freedom House's annual Press Freedom survey. The higher the press score, the less free a country's press is. We use the reversed version, deducting the press score from 100 to reach an increasing index of press freedom	Freedom House
Freedom of choice index	First principal component for the five different proxies of freedom of choice: 1) country's economic freedom, 2) civil liberties, 3) religious freedom, 4) individualism, and 5) press freedom	Own calculation
<i>Robustness</i>		
Economic freedom (Heritage)	The Economic Freedom Index measures economic freedom based on 12 different factors, grouped into four broad categories: rule of law (property rights, judicial effectiveness, and government integrity), government size (tax burden, government spending, and fiscal health), regulatory efficiency (business freedom, labor freedom, and monetary freedom), and market openness (trade freedom, investment freedom, and financial freedom)	The Heritage Foundation

Table 10 (continued)

Variable	Description	Source
Physical integrity	This is an additive index constructed from the Torture, Extrajudicial Killing, Political Imprisonment, and Disappearance indicators. It ranges from 0 (no government respect for these four rights) to 8 (full government respect for these four rights). Details on its construction and use can be found in Cingranelli and Richards (1999). For all years after 2011, we use the most recent value of the CIRI Religious Freedom Index for a given country	CIRI Human Rights Data Project
Religious freedom (Norris and Inglehart 2004)	Norris and Inglehart's Freedom of Religion Index, constructed by coding twenty indicators such as the role of the state in subsidizing churches, constitutional recognition of freedom of religion, and restrictions of certain denominations, cults, or sects	Pippa Norris Data webpage
Individualism (TK)	An updated version of Hofstede's (2001) Individualism variable by Tang and Koveos (2008)	Tang and Koveos (2008)
Freedom of speech	This variable indicates the extent to which freedoms of speech and press are affected by government censorship, including ownership of media outlets. Censorship is any form of restriction that is placed on freedom of the press, speech, or expression. The expression may be in the form of art or music. A score of 0 indicates that government censorship of the media was complete; a score of 1 indicates that there was some government censorship of the media; a score of 2 indicates that there was no government censorship of the media in a given year. For all years after 2011, we use the most recent value of the CIRI Religious Freedom Index for a given country	CIRI Human Rights Data Project
<i>Supply-Side</i>		
Market volatility	Logarithm of the monthly standard deviation (in %) of the daily market return of a country. Daily market returns are computed as the value-weighted average of the returns of all individual stocks in each country on a given day	Own calculation based on DataStream
Bank deposits / GDP	Demand, time, and saving deposits in deposit money banks as a share of GDP	World Bank
Stock market capitalization / GDP	Stock market capitalization of national stock exchange to GDP	World Bank
<i>Demand-Side</i>		

Table 10 (continued)

Variable	Description	Source
Equity mutual fund assets	Is defined as mutual fund assets to GDP (%). Data taken from a variety of sources such as the Investment Company Institute and various national sources	World Bank
Foreign institutional ownership	We extract foreign institutional ownership from Dyck et al. (2019). To reach to the foreign institutional ownership as a fraction of the market we multiply the total percentage of institutional ownership in each country (Table 1, Panel B) by the foreign ownership as a fraction of the total (Table 1, Panel B). For the USA, we use foreign institutional ownership (Table A3, Panel A) reported in Ferreira and Matos (2008)	Dyck et al. (2019) and Ferreira and Matos (2008)
Net equity flows	Logarithm of the net inflows of equity portfolio expressed in current U.S. dollars. Portfolio equity includes net inflows from equity securities other than those recorded as direct investment and including shares, stocks, depository receipts (American or global), and direct purchases of shares in local stock markets by foreign investors	World Bank
<i>Country's institutional environment, disclosure and culture</i>		
Government effectiveness estimate	Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies	Worldwide Governance Indicator
Political stability estimate	Political stability and absence of violence/terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism	Worldwide Governance Indicator
Financial development index	The financial development index is based on the aggregation of different aspects of financial institutions and financial markets in each country. The index summarizes how developed financial institutions and financial markets are in terms of their depth (size and liquidity), access (ability of individuals and companies to access financial services), and efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues and the level of activity of capital markets)	International Monetary Fund (IMF)

Table 10 (continued)

Variable	Description	Source
Anti-self-dealing index	Assembled with the help of Lex Mundi law firms, the index is calculated based on legal rules prevailing in 2003, and focuses on private enforcement mechanisms, such as disclosure, approval, and litigation, that govern a specific self-dealing transaction	Djankov et al. (2008)
Disclosure	Assessment of the prevalence of disclosures concerning research and development (R&D) expenses, capital expenditures, product, geographic segment data, subsidiary information, and accounting methods, on the basis of CIFAR's 1995 International Accounting and Auditing Trends. Lower scores indicate less disclosure	Bushman et al., (2004)
Account	The index was created by examining and rating companies' 1990 annual reports on their inclusion or omission of 90 specific accounting items, covering general information, income statements balance sheet, funds flow statement, stock data, and special items	La Porta et al., (1998)
<i>Control variables</i>		
Earnings co-movement index	Following Morck et al. (2000), the earnings co-movement index of country j is obtained as the average R^2 of annual regressions of the return on assets (ROA) of individual firms on the value-weighted average ROA of all firms in the same country (excluding firm j). In the regressions, we take the logistic transformation of this variable	Own calculation based on DataStream
HHI industry	Following Morck et al. (2000), the industry Herfindahl index of country j is defined as $H_j = \sum_k a_{kj}^2 / h_{kj}^2$, where h_{kj} is the combined value of the sales of all country j firms in industry k as a percentage of those of all country j firms	Own calculation based on DataStream
Ln (# of stocks)	Logarithm of the total number of stocks for each country in our sample	Own calculation based on DataStream
Geographical Size	Logarithm of the surface area of the countries in square kilometers	World Bank

Table 10 (continued)

Variable	Description	Source
GDP Growth	Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy, plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources	World Bank
GDP per capita	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy, plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars	World bank
Legal origin	Legal origin (legor07) as defined by Shleifer et al. (2008). Data is available at Shleifer's website. The variable is defined as 1 if the country's legal origin is English Common law, 2 if French civil law, 4 if German civil law, and 5 if Nordic law	Shleifer et al. (2008)
IFRS	Dummy variable that takes the value of one if IFRS Standards are required for domestic public companies in each country for a given year and a value of 0 otherwise	The IFRS Foundation

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