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Liquidity Spillovers: Evidence from Two-Step Spinoffs†

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Abstract

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JEL Classification: G12

Keywords*:* Two-Step Spinoffs; Liquidity Spillovers; Commonality in Liquidity; Information Efficiency of Stock Prices; Value Discovery; Value Spillovers; Order Flows; Lee-Ready and Holden-Jacobsen Algorithms; Trading Costs; Non-Information Component; Adverse-Section Component

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1. Introduction

The ease with which a firm's shares can be traded (i.e., liquidity) is of great interest to investors, regulators, and corporate managers. Liquid stocks result in a lower cost of capital (Amihud and Mendelson, 1986) and also allow the investing public to transact shares more efficiently, thereby promoting the efficacy of asset allocation. We know that there is commonality in liquidity across stocks (Chordia, Roll, and Subrahmanyam, 2000), which can occur because of macroeconomic events that affect a broad range of stocks at the same time: e.g., funding liquidity shocks studied by Brunnermeier and Pedersen (2009), the 2001 decimalization that reduced the minimum tick size, changes in trading systems or rules, or market-wide news on financial or macroeconomic policies. But a remaining question is whether *idiosyncratic* shocks to the liquidity of a firm can also cause commonality in liquidity and valuation changes. For example, does a firm-specific shock to General Motors' liquidity influence the liquidity and valuation of related firms such as Ford Motor Company? We investigate this issue by focusing on a unique corporate event, namely, a two-step spinoff.[1] The second stage of such spinoffs directly impacts a firm's stock liquidity by increasing the free float of an already-public firm. This event clearly raises the liquidity of the divested firm for non-informational reasons, facilitating a study on liquidity spillovers (and associated value changes) uncontaminated by information revelation.

Specifically, in a two-step spinoff, a parent company distributes to its shareholders (in the second-stage event) at least 80% of shares of the subsidiary whose stock has already been publicly traded for some time after an initial public offering (IPO) (the first-stage event) of 20% (or lower) of its outstanding shares.[2] In this case, the date of the second-stage event (i.e., the spinoff effective date (ED)) is announced in advance. The ED is thus publicly known, meaning that the actual completion of the spinoff on the ED is simply a non-informational event. By the ED, any fundamental information that might be associated with the spinoff should have already been incorporated in the stock prices of the spun-off subsidiary as well as its related firms.

[1] Our sample includes two different types of spinoffs. In one type, the parent company's shareholders receive the subsidiary's shares in proportion to their shareholdings in the parent. In the other (often called a splitoff), the parent company's shareholders swap their shares of the parent for the shares of the divested subsidiary. In our sample, divestitures through splitoffs account for 14.7%. For convenience, we term both types of divestitures "spinoffs."

[2] The condition of holding at least 80% by a parent firm in the pre-spinoff period provides tax benefits in dividend distributions and consolidation of income, as well as a tax-free status to the parent's shareholders in the subsequent spinoff. In one case in our sample, the second-stage distribution was 70% due to a special tax arrangement.

Therefore, two-step spinoffs provide a very useful laboratory for exploring the effect of an idiosyncratic shock to a firm's liquidity on the liquidity and value of other related firms. We motivate our study using Cespa and Foucault (2014), who state (p. 1616): "… cross-asset learning makes the liquidity of asset pairs interconnected: if the liquidity of one asset drops, its price becomes less informative for liquidity providers in another asset, and therefore the liquidity of this asset drops as well." This implies that changes in the liquidity of a stock affect the liquidity of other related stocks.[3] We test if such spillovers in liquidity (with associated value implications) take place in the stocks of firms related to the spun-off firms.

We collect 68 cases of corporate subsidiaries (or divisions) that were spun off between 1986 and 2017 by their parent firms through a two-step procedure. To examine the potential spillover effects, we construct two sets of 100 (or fewer) "related firms" matched with each of the 68 spinoff subsidiary firms. In the first set, 6,365 firms are matched based on the absolute value of return correlations (|*Corr*|) in the pre-ED period. In the second set, 2,300 firms are matched based on the product similarity scores of Hoberg and Phillips (2010, 2016) (HP-scores); this sample includes 43 spinoffs. We employ eight measures of daily (il)liquidity. Two measures are computed from the CRSP daily file: share turnover (*TURN*) and the Amihud (2002) measure (*ILLIQ*). The other six measures are estimated using intra-daily trading data and order flows processed from the ISSM/TAQ databases: proportional effective spread (*PESPR*), proportional quoted spread (*PQSPR*), as well as the fixed component ($\bar{\varphi}^{BS1}$ and $\bar{\varphi}^{BS2}$) and the variable component (λ^{BS1} and λ^{BS2}) of trading costs estimated in two different ways (using total and unexpected order flows) following Brennan and Subrahmanyam (BS, 1996).

We first investigate how the liquidity of parent firms changes after they spin off their subsidiaries. Our analyses show no consistent change in the liquidity of parent firms' stocks around the ED. The only noticeable aspect is a significant rise in the proportional effective spread (*PESPR*) and the proportional quoted spread (*PQSPR*). However, the increases in the spreads are simply mechanical changes driven by the declines in the stock prices (and hence quote midpoints) in the parent firms after the spinoffs.

[3] Bessembinder, Maxwell, and Venkataraman (2006) find that the introduction of the TRACE reporting system for corporate bond trading improved the liquidity of corporate bonds eligible for TRACE reporting, and that the benefit of the improvement in the reporting system spread to non-eligible corporate bonds as well. Yin (2011) documents that the issuers of TRACE-eligible bonds also experience improved liquidity in their stocks. Goyenko and Ukhov (2009) find that liquidity in the Treasury bond market affects liquidity in the stock market, and vice versa.

Next, we examine the effect of spinoffs on the stock liquidity of the spun-off firms themselves. We find that there are significant improvements in the liquidity of subsidiaries that are spun off from their parent firms. For example, the mean value of the Amihud measure (*ILLIQ*) falls significantly from 0.149 to 0.012 on average in the post-ED period, with 89.7% of the 68 spinoffs showing a decrease in illiquidity. The mean values of both fixed and variable components of trading costs ($\bar{\varphi}$ and λ) in the spun-off firms decrease significantly by more than 20% in the post-ED period.

The improved liquidity in the spun-off subsidiaries may be expected, however, given the surge in the free float in the post-ED period. So we next examine whether the improved liquidity of the spun-off firms spills over to other related firms. According to Amihud, Mendelson, and Lauterbach (1997, p. 378), "when the values of two securities, A and B, are correlated, an improvement in the trading mechanism for security A will have a positive effect on the liquidity of security B. The source of this improvement is that a more efficient trading mechanism improves value-discovery for A, allowing traders in B to use the (improved) observed prices of A for making a more informed inference on the value of B." Thus, when security A becomes more liquid, its price becomes more informative and thus traders can glean more information from A's price when they trade security B. This reduces information asymmetry in security B.

Our results show that there are significant liquidity spillovers flowing from the spun-off firms to their related firms after the second-step spinoffs. The effects are consistent across the eight (il)liquidity measures. For the related firms matched by |*Corr*| within the same industries, the mean of daily share turnover (*TURN*), for instance, increases significantly from 0.72% on average in the pre-ED period to 0.80% in the post-ED period. We find a similar effect in *ILLIQ*, which falls by 55.7% from 3.35 in the pre-ED period to 1.48 in the post-ED period. The two types of spreads (*PESPR* and *PQSPR*) decline by 4.7%-6.2% in the post-ED period. The positive liquidity spillover effects are also significant when illiquidity is measured by the decomposed components. In the post-ED period, the fixed components ($\bar{\varphi}^{BS1}$ and $\bar{\varphi}^{BS2}$) decline by 30.3% and 13.5%, respectively, and the variable components (λ^{BS1} and λ^{BS2}) fall by more than 45%.[4] The results are qualitatively similar in the related firms matched by the HP-score, although the

[4] In general, information asymmetry is captured by the variable component of trading costs (Brennan and Subrahmanyam, 1996; Amihud, 2002). As we point out in Section 6.1, however, if informed traders use minimum order sizes such as round lots, the fixed component may also respond to decreased information asymmetry. This observation accords with our finding that both fixed and variable components of trading costs decrease in the related firms following two-step spinoffs.

sample size is smaller.

For robustness checks, we use market-adjusted (il)liquidity measures (instead of the raw measures) to control for trends in liquidity, as in Chordia, Subrahmanyam, and Tong (2014). The results with these measures do not affect our main findings very much. For example, share turnover (*TURN*) adjusted for the market rises substantially from 0.16% to 0.24%. All our analyses confirm that the improved stock liquidity of the spun-off firms generally spills over to the stocks of related firms, regardless of matching methods or adjustments for the market.

A concern is that the improved liquidity of the related stocks in the post-ED period might occur because the parent firms simply time the spinoffs to take advantage of the improving liquidity expected in the industry of their subsidiaries and related firms. If this conjecture is true, we should observe that all the measures for the related firms have liquidity-improving trends in the pre-ED period. To address this concern, we split the sample of related firms into two groups for each of the eight (il)liquidity measures: one in which the firms show a deteriorating trend in liquidity during the pre-ED period; and the other showing an improving trend. About half of the related firms have deteriorating liquidity during the pre-ED period, suggesting that managers of the parent firms are not likely to time the spinoffs by predicting liquidity trends in the industries. More importantly, the pattern of positive liquidity spillovers after the ED is consistent among the related firms, regardless of whether their liquidity improves or deteriorates in the pre-ED period.

We conduct a placebo test to see if the spillover effects exist in the firms that are *least* related to spun-off firms in terms of |*Corr*| and the HP-score. Our test results show no evidence of liquidity spillovers in such firms, although those firms belong to the same industries or peer groups, confirming that the spillover effect is present only in the *highly* related firms. Given the liquidity spillovers to the related firms, we also investigate whether the liquidity spillovers affect the efficiency of stock prices in the related firms in the post-ED period. In the spirit of Fama (1976), we measure the price efficiency by the extent to which past returns can predict future returns. We find that there is a significant reduction in the degree of return predictability in the post-ED period. This supports the idea that the improved liquidity of related stocks causes their prices to become informationally more efficient after the two-step spinoffs.

Next, we investigate the changes in liquidity by analyzing the behavior of institutional investors. Studies document a positive correlation between stock liquidity and institutional holdings (Nagel, 2005; Rubin, 2007). Institutional investors prefer to trade liquid assets due to the costs associated with investments in illiquid securities. Therefore, changes in the variables related to institutional holdings can serve as an (indirect) indicator for changes in stock liquidity. Our analysis using data from the Thomson Reuters Institutional Holdings (13F) database shows that institutional ownership (*IO*) in the spun-off firms increases substantially in the post-ED quarter. The pattern is similar when we use other metrics: the market-adjusted *IO* ($IO_{mkt\text{-}adj}$), the number of institutions (*NInst*), and the breadth of institutional holdings (*Breadth*). More intriguingly, we find that the four metrics in the related firms also increase significantly after the spinoffs, albeit to a lesser degree than in the spun-off firms. In sum, institutional investors increase their investments in the spun-off subsidiaries as well as their related firms in the post-ED period, reflecting their preference for liquid assets.

Finally, we examine whether the liquidity improvement in the spun-off firms and their related firms has any effect on their equity valuations. Since improved liquidity is expected to lower the required return on stocks or the cost of equity capital, it should raise their stock prices (Amihud and Mendelson, 1986; Brennan and Subrahmanyam, 1996). Indeed, Albuquerque, Song, and Yao (2020) find that an exogenous increase in stocks' trading costs, caused by the SEC Tick-Size Pilot Program in 2016, significantly lowered the prices of affected stocks.[5]

We thus compute the cumulative abnormal returns (CARs) from days −5 to +60 relative to the ED. For the spun-off subsidiaries, we find that the CAR increases over time after the ED but with a time lag (up to day ED+5 on average). The reason is that a surge in the free float of the spun-off firms on the ED exerts a temporary selling pressure on their stock prices, which makes CAR(−5, +5) negative. After this period, however, the CAR for the spun-off firms eventually increases so that their CAR(−5,+60) reaches 6.93%-8.12%, reflecting the long-term benefit of the improved liquidity. On the other hand, the CAR for the related firms increases immediately following the ED, and thus their CAR(−5, +5) is significantly positive. This is because there is no initial selling pressure in the related firms. Notably, the magnitude of price changes in the related firms is relatively smaller than that in the spun-off firms, and their valuation effects remain for a shorter period of time, consistent with Amihud et al. (1997). In a placebo test that uses a pseudo-event date, however, we find no valuation effect. Overall, the

[5] Fang, Noe, and Tice (2009) find that illiquidity lowers firm value because it harms its performance.

evidence supports the idea that liquidity spillovers induce value spillovers from the spun-off firms to the related firms in the post-ED period after the two-step spinoffs.

As pointed out earlier, our paper is partly related to the studies on liquidity commonality in financial markets, such as Chordia et al. (2000), Hasbrouck and Seppi (2001), and Huberman and Halka (2001). This commonality is generally considered to be caused by macroeconomic events that simultaneously affect liquidity across a wide range of firms. However, little is known about the potential spillover effects of liquidity changes that are not related to common, market-wide shocks or events. Amihud et al. (1997), who propose the existence of liquidity spillovers, do not directly test it.[6] Our paper is different from the studies mentioned above in that we study the effects of an idiosyncratic (or firm-specific) event whose effect is confined to a certain group of related firms. Using the data on a unique corporate event, we provide the evidence of spillovers in liquidity and prices flowing from the treatment stocks to their related stocks.

In what follows, we develop our hypotheses in Section 2. In Section 3, we describe data, sample selection, and methods of matching the related stocks. Section 4 presents the (il)liquidity measures used in this study. In Section 5, we examine the effects of the spinoffs on the liquidity of the parent and spun-off firms. Our main analysis – liquidity spillovers to the related stocks – is presented in Section 6, which also investigates pricing efficiency. Section 7 examines the post-ED institutional holdings in the spun-off and related stocks. The effects of the spinoffs on stock prices of the spun-off and related firms are presented in Section 8. Section 9 concludes.

2. Hypothesis development

We study changes in liquidity caused by two-step spinoffs of corporate subsidiaries. While the announcement of a two-step spinoff is an information event, the actual completion of the spinoff on the effective date (ED) is a fully anticipated event, because the ED is announced in advance. The stock of the subsidiary is publicly traded prior to the ED with its price incorporating the information about its value. Investors who want to hold the stock can do so before the

[6] The authors study the transition of stocks on the Tel Aviv Stock Exchange from once-a-day call auction trading to more continuous trading, which increased their liquidity. They find that the improved liquidity of these stocks made their prices more informationally efficient, raising their own prices as well as the prices of the dual stocks (in the same company) that stayed in the call auction trading system. They do not test the presence of liquidity spillovers, since the effect cannot be measured in the auction market.

completion of the second-stage event (i.e., spinoff). What potentially changes on the ED is the liquidity of the spun-off subsidiary's stock, because its free float increases substantially.

For illustration, we describe a 1998 two-step spinoff by Ford Motor Company (Ford) of Associates First Capital Corp. (AFC), which became the largest public company in subprime consumer finance. Table 1 provides a timeline of this spinoff. On May 7, 1996, Ford sold 19.3% of AFC's shares in an initial public offering. On October 8, 1997, Ford announced that it would spin off the remaining 80.7% of AFC shares to Ford's shareholders, distributing 0.262085 shares of AFC for each share of Ford (Class A or B). On March 3, 1998, Ford announced that the spinoff ED would be April 7, 1998. On that day, the spinoff was completed and AFC's float increased by about four times.

On the spinoff ED, the trading volume in AFC shares was 92% higher than it was on April 6, 1998, the day before the ED. To illustrate the persistence of increased trading volume after the ED, we compare the average 10-day volume between days ED+6 and ED+15 (denoted by $VOL_{post\text{-}ED}$) to the average volume between days ED−6 and ED−15 ($VOL_{pre\text{-}ED}$) in AFC. We find that the ratio $VOL_{post\text{-}ED}/VOL_{pre\text{-}ED}$ is 3.62, indicating that the trading volume in AFC increased by 262% after the ED. We also calculate the average illiquidity of AFC's stock over the same periods around the ED using Amihud's (2002) measure, *ILLIQ*, computed as the average daily ratio, |return|/(volume*price). We find that the ratio ($ILLIQ_{post\text{-}ED}/ILLIQ_{pre\text{-}ED}$) is 0.422, implying that illiquidity declined by more than 50% after the ED.

We first compare the stock liquidity of the spun-off firms in the post-ED period to that in the pre-ED period by testing:

> ***Hypothesis 1****: Liquidity in the stocks of spun-off subsidiary firms increases following the ED of two-step spinoffs.*

Bolton and von Thadden (1998) propose that greater free float and ownership dispersion increase stock liquidity, while concentrated block-holding reduces it. This is because more float implies greater market capitalization available for trading, which can induce an increase in the number of market makers dealing in a stock, given the fixed set-up cost of market making.[7] Further, in a two-step spinoff, the ownership of a subsidiary moves from the parent firm, which is a large block holder owning usually at least 80% of the subsidiary's stock, to a large number of its (smaller) shareholders. According to Bolton and von Thadden (1988), this transfer of ownership should increase the spun-off subsidiary's stock liquidity.

In addition, we expect the liquidity of a spun-off firm to rise after the ED, partly because its investor base is likely to include more uninformed retail traders. Informed traders who want to hold the subsidiaries' stocks could do so after its IPO and before the spinoff ED. The completion of a spinoff on the ED is a non-information event, which may attract uninformed traders. The models of Glosten and Milgrom (1985) and Kyle (1985) suggest that a greater likelihood of uninformed trading increases liquidity. More uninformed trading subsidizes the investment in information acquisition, which reduces information asymmetry and increases liquidity (Admati and Pfleiderer, 1988). Indeed, there is evidence that stock liquidity does rise following changes in trading rules that raises the proportion of retail investors among the firm's stockholders (Amihud, Mendelson, and Uno, 1999). A study of stock exchanges in 55 countries finds that stocks with larger free float have higher liquidity after controlling for firm and country characteristics, as well as for potential endogeneity issues (Ding, Ni, and Zhong, 2016).

Besides the potential benefit of spinoffs for the subsidiary firms, we are interested in the spillover effect after the corporate event. Therefore, our main hypothesis is about liquidity spillovers to other related firms:

> ***Hypothesis 2****: Following the ED of two-step spinoffs, there is an increase in the stock liquidity of firms that are related to the spun-off subsidiary firms, given the increased liquidity of the spun-off firms.*

The rationale for Hypothesis 2 is discussed in the introduction. If Hypothesis 1 is supported, then improved liquidity and lower trading costs in a spun-off stock allow investors to trade the stock on finer information, increasing the investors' incentives to collect information and trade on it.

[7] Similarly, Amihud and Mendelson's (1980) model of market making with inventory shows that the bid-ask spread is lower when market makers can increase the limits on the long and short inventory positions. This is feasible when there is greater market capitalization available for trading.

Also, lower trading frictions due to higher liquidity reduce pricing noise in the spun-off stock, which in turn allows traders of related stocks to observe information more precisely about the spun-off stock. That is, the prices of the spun-off stock becomes more informative by incorporating relevant information that is finer and more precise, and this effect spills over to the related stocks. Indeed, previous studies provide evidence that improved stock liquidity enhances the value discovery of the associated stocks.[8]

An alternative to Hypothesis 2 is that the liquidity spillover effects are negative because the increased free float of spun-off subsidiaries attracts trades away from their related stocks in the post-ED period, lowering the liquidity of the related stocks. Our empirical tests will determine which of the hypotheses is supported.

As discussed above, the improved liquidity of the related stocks is expected to increase the efficiency of their stock prices as well. We thus test the following hypothesis:

> ***Hypothesis 3***: *Owing to the improved liquidity of related stocks, the price efficiency of related stocks also improves in the post-ED period.*

We test this hypothesis by examining the return predictability around the ED for the portfolios of related stocks. As Fama (1976) points out, if stock prices are efficient, past returns should not be useful to predict future returns.

Next, we use changes in institutional holdings as a means of inferring the changes in stock liquidity. Nagel (2005), Rubin (2007), Han and Lesmond (2011), and Blume and Keim (2017) find a positive relationship between stock liquidity and institutional holdings. Thus we can make indirect inferences about stock liquidity by observing the preferences of institutional investors: i.e., their stockholdings in the spun-off subsidiaries and their related firms. We thus propose the following hypothesis:

> ***Hypothesis 4***: *Given the improved liquidity in the post-ED period, institutional investors generally increase their holdings in the spun-off subsidiaries and the*

[8] Amihud, Mendelson, and Lauterbach (1997) and Hou and Moskowitz (2005) find that more liquid stocks have their prices adjust faster to information. Liu (2007) finds that a reduction in transaction taxes (hence lower trading costs) in Japan improved the efficiency of the price discovery process. Chordia et al. (2008) and Chordia, Subrahmanyam, and Tong (2014) find that the improved liquidity (decline of the bid-ask spreads) after the 2001 decimalization ameliorated the adjustment of stock prices to information and enhanced market efficiency by attenuating or eliminating market anomalies.

related firms after two-step spinoffs.

Finally, we examine the potential effect of liquidity changes on stock values. Since a stock's improved liquidity lowers the required return (or the cost of equity capital), it raises the stock price for a given level of cash flows (Amihud and Mendelson, 1988). Fang, Noe, and Tice (2009) find that illiquidity lowers firms' market-to-book ratio because it hinders the firm's efficient management. Albuquerque, Song, and Yao (2020) find that increased stock illiquidity, caused by the SEC's Tick-Size Pilot Program in 2016, significantly lowered the prices of the affected stocks, although the list of affected stocks and the effective date were announced in advance (i.e., the actual tick-size changes on the effective date were a non-informational event).

If Hypothesis 1 is supported (i.e., if the liquidity of spun-off stocks rises after the ED), their stock prices should also increase, as stockholders can benefit from the improved liquidity. And, if Hypothesis 2 is supported (i.e., if the liquidity of related stocks rises after the ED), so should their prices. That is, the liquidity spillovers should translate to value spillovers in related stocks. Because the liquidity improvement for the spun-off stocks after the ED is greater than that for the related stocks, we expect a greater price increase for the spun-off stocks, consistent with Amihud et al. (1997).[9] We thus propose:

Hypothesis 5: *Following the ED of two-step spinoffs, stock prices rise for both spun-off firms and their related firms, with the proportional price increases of the spun-off stocks being greater than those of the related stocks.*

If there is any value change or its spillover after the ED, it should not be because of new information about the firms, but because of the increased liquidity after the ED. The ED is announced beforehand and thus the actual restructuring on the ED pertains to liquidity, but not to unexpected information. Since the stock of the subsidiary (and its related firms) is traded in the post-IPO to pre-ED period, any material information should have already been incorporated in their stock prices before the ED. Therefore, the price increases described in Hypothesis 5 reflect

[9] Amihud et al. (1997) find that an increase in the liquidity of stocks that had dual stocks generates a price increase of 6% in the (own) stocks and 3% in their related (dual) stocks.

the additional benefit of the improved liquidity in the post-ED period.[10]

3. Sample selection and data presentation

3.1. Data for spinoff subsidiary firms

We examine the cases of corporate subsidiaries (or divisions) that were divested of their parents through a two-step spinoff (or splitoff). In these cases, the subsidiary has an IPO date that precedes the spinoff ED. The main data source is Thomson Reuters' SDC Platinum database. We select from the SDC Platinum database all spinoff deals that were made from 1986 to 2017 and identify two-step spinoffs, in which the parent firm first sold up to 20% of its subsidiary's common shares in an IPO, followed later by a spinoff. The spinoff ED is cross-checked for accuracy using SEC filings and press mentions of the event. If there a discrepancy, we use the announced date in the latter sources, which also serve to identify and confirm the fraction of spun-off shares. We then select the cases that satisfy the following criteria:

1. The spun-off firms have trading data for 100 trading days before the spinoff ED (with at least 65 trading days) and for 100 days after the spinoff ED.[11]
2. The share code (SHRCD in CRSP) of spinoff subsidiary firms is 10 or 11 (common stock), and the stock is listed on the NYSE, AMEX, or Nasdaq.
3. The spun-off fraction of common shares in subsidiaries is at least 80%.
4. The share price of the spun-off subsidiary one day before the spinoff ED is above $2.00 and its market capitalization is larger than $50 million.

Our sample consists of 68 deals that satisfy the above criteria. In Table A1 in the Appendix, we report these spinoff deals (subsidiaries and their parent firms) used in our sample. The summary statistics in Panel A of Table 2 show that the stock price of the spun-off firms on day ED−1, P_{ED-1}, is on average $22.5 with a median of $20.3, and the market capitalization, $MV_{ED-1,}$ is on average $3.06 billion with a median of $1.05 billion.

[10] Amihud, Lauterbach, and Mendelson (1997) find that after deep-in-the-money stock warrants are exercised (i.e., converted to ordinary shares) and trading of new shares is consolidated, there is an increase in both liquidity and stock prices, although the conversion date and amounts are fully anticipated. Albuquerque, Song, and Yao (2019) document a significant decline in the prices of stocks after the minimum tick size was raised by the SEC, and consequently their liquidity became worsened. This occurred after the actual tick-size changes on the effective date, which was known in advance.

[11] The requirement for 100 trading days after the ED excludes technical spinoffs that are designed to become acquisition targets.

3.2. Data for related firms matched with the spun-off firms

We construct two sets of related firms that are matched with each of the 68 spun-off firms. The first set of related firms uses the absolute value of the correlation, denoted by |*Corr*|, between the daily returns of a firm's stock and those of the spinoff subsidiary's stock over the 100 trading days from ED−100 to ED−1. The related firms are from the same industry as the spinoff subsidiary based on the Fama-French 48 industries. For each spinoff firm, we sort firms in the same industry by their |*Corr*| and pick 100 firms with the highest value of |*Corr*| as the matched sample of related firms. For a firm to be considered as one of the related firms, it should have at least 22 positive-volume days (about one month) in the pre-ED and post-ED periods. For some spun-off subsidiaries, the number of related firms matched based on |*Corr*| is fewer than 100.[12]

The second set of related firms uses the product similarity score of Hoberg and Phillips (2010, 2016) (termed the HP-score), which is based on the similarity of firms' products.[13] The HP-scores are available annually since 1996. We match each spun-off subsidiary with other firms that have the HP-scores in the year in which the spinoff is completed (based on the ED). We then sort the matched firms in descending order, and select the firms up to rank 100. The spun-off subsidiary firms often have fewer than 100 related firms, depending on the availability of the HP-scores. Given the limited availability of the HP-scores due to a shorter period (1996-2017) and a smaller universe, the related firms are available only for 43 subsidiary firms out of the total 68 spun-off subsidiaries.

Summary statistics for the related firms are presented in the last two panels of Table 2: Panels B and C for those based on their |*Corr*| and on the HP-score, respectively. For a portfolio of related firms corresponding to each of the 68 spinoff deals, we first calculate the average values of the variables across the firms included in that portfolio (deal) and then average the numbers across the portfolios. In Panel B, we match 6,365 related firms with the 68 spun-off firms; the number of related firms matched with each of the subsidiaries (*NFirm_Matched*) is 93.6 on average. The mean of the average stock prices ($AvgP_{ED-1}$) across the 68 portfolios on day ED−1 is $24.3, and the mean of the average market value ($AvgMV_{ED-1}$) for the related firms is $3.65 billion.

[12] Note that if any two spun-off firms belong to the same industry (with different EDs), related firms may be matched repeatedly but the time ranges of the data used in the analyses will be different.

[13] The HP-scores are available at http://hobergphillips.usc.edu/industryclass.htm.

Due to the limited availability of the HP-score, Panel C of Table 2 shows that the sample of the related firms matched (with the 43 spun-off firms) based on the HP-score consists of 2,300 firms. The average number of related firms matched with each subsidiary (*NFirm_Matched*) is also smaller (53.5) than in Panel B. The average of stock prices for the 2,300 related firms on day ED−1 in Panel C ($AvgP_{ED-1}$) is $27.7, which is comparable to those in Panel B. On the other hand, the average market value ($AvgMV_{ED-1}$) of the related firms in Panel C is larger ($8.77 billion) than that in Panel B, suggesting that the HP-scores are generally available for larger firms only. For these reasons, we employ the correlation-matched sample as our primary set of related firms, while the set of related firms matched based on the HP-score is used for robustness tests. The detailed list of the related firms matched via the two criteria and their summary statistics are reported in Table A2 in the Appendix.

4. Illiquidity measures

We employ eight (il)liquidity measures, as discussed in the introduction. They are estimated on a daily basis for each stock, and then the daily measures are averaged over the pre-ED and post-ED periods. The first four of the eight (il)liquidity measures are:

TURN: The daily share turnover, which is the daily share volume divided by the number of shares outstanding, in %. The data are from the daily CRSP file.

ILLIQ: The illiquidity measure of Amihud (2002), $|r|/dvol$, where $|r|$ is the daily absolute return and *dvol* is daily dollar volume (in $million). The data are from the daily CRSP file.

PESPR: The daily average of intra-daily proportional effective spreads (in %), defined as $100*2*(|P - midpt|/midpt)$, where P is the intra-daily transaction price, and *midpt* is the mid-point of the ask/bid quotes that precede the trade (the trade-quote matching process is described below).

PQSPR: The daily average of intra-daily proportional quoted spreads (in %), defined as $100*(Ask - Bid)/midpt$, where *Ask* and *Bid* are the ask and bid quotes associated with each trade (see below).

The next four illiquidity measures are based on the Kyle (1985)-type models and estimated as in Brennan and Subrahmanyam (1996, henceforth BS).[14]

$\bar{\varphi}^{BS1}$ and $\bar{\varphi}^{BS2}$: The fixed-cost component of trading costs, estimated each day from Eqs. (1) and (2) shown below, and then multiplied by 10^2 (set to zero if negative).

λ^{BS1} and λ^{BS2}: The variable (or price-impact) component of trading costs, estimated each day from Eqs. (1) and (2), and then multiplied by 10^6 (set to zero if negative).

To obtain the above four measures, the following two models are estimated each day for each stock using intraday order flows processed from transactions data. Eqs. (1) and (2) below are based on Glosten and Harris (1988) and Foster and Viswanathan (1993), respectively:

$$\Delta P_k = \lambda^{BS1} D_k V_k + \bar{\varphi}^{BS1}(D_k - D_{k-1}) + \xi_k \tag{1}$$

and

$$\Delta P_k = \lambda^{BS2} \tau_k + \bar{\varphi}^{BS2}(D_k - D_{k-1}) + \xi_k{}', \tag{2}$$

where ΔP_k is the price change at trade k, D_k is a buy/sell indicator (+1 if buyer-initiated and -1 if seller-initiated), V_k is dollar volume (and thus $D_k V_k$ is the signed volume or order flow), and τ_k is the residual (i.e., the unexpected order flow) obtained by filtering with an AR(5)-process, $D_k V_k = \delta + \sum_{i=1}^{5} b_i D_{k-i} V_{k-i} + \tau_k$, following Sadka (2006).

Computing *PESPR* and *PQSPR*, as well as estimating the four measures using Eqs. (1) and (2), requires us to first process intra-daily order flows. For this purpose, we match each trade with relevant ask/bid quotes for stocks listed on the NYSE/AMEX/Nasdaq over the 32-year period from 1986 to 2017. We use two databases: The Institute for the Study of Securities Markets (ISSM: 1986-1992) and the NYSE Trades and Automated Quotations (TAQ) database (1993-2017). After matching, we classify each trade into a buyer- or seller-initiated category via the Lee-Ready (1991) algorithm with a five-second delay rule up to 1992. For the remaining period, however, we employ the Holden and Jacobsen (2014) algorithms: a five-second-delay rule for 1993-1998, a two-second-delay rule for 1999-2000, a millisecond-delay rule for 2001-2009 using the monthly TAQ database (MTAQ), a millisecond-delay rule from 2010 to October 23, 2016 using the daily TAQ database (DTAQ), and a nanosecond-delay rule from October 24, 2016 to 2017 using DTAQ. After matching trades and quotes, if a trade occurs above (below) the

[14] For further details on estimating the components of trading costs, see Chung and Huh (2016).

quote midpoint, it is considered buyer-initiated (seller-initiated). We exclude trades and quotes that are out of sequence, recorded before the open or after the close, and involved in errors or corrections.

There have been significant changes in trading environments and the trading behavior of investors since the 2000s. For example, Stoll (2014) documents that since the 2000s, the number of daily trades has increased substantially while trade size has decreased, reflecting the prevalence of high-frequency trading (HFT). Arnuk and Saluzzi (2012) imply that the introduction of the NBBO concept and Regulation NMS have made the speed of execution critical in the U.S. stock market, triggering a surge of HFT. Some studies (e.g., Easley, Lopez de Prado, and O'Hara, 2012; Holden and Jacobsen, 2014) suggest that using the Lee-Ready (1991) algorithm for the MTAQ database, which is time-stamped only to the second (as opposed to the millisecond), could lead to substantial classification errors because of large HFT volume. To reduce the errors, Holden and Jacobsen (2014) propose a low-cost alternative, which is applicable to the MTAQ database, and show that their algorithm provides more accurate classifications than the Lee-Ready (1991) method. That is why we employ the Holden-Jacobsen algorithm for MTAQ, and this procedure is especially applicable for the 2001-2009 period during which DTAQ is not available to us.[15]

5. Changes in stock liquidity around the spinoff effective date for directly affected firms

In this section, we explore the impact of the two-step spinoffs on the liquidity of parent firms and spun-off subsidiaries. We consider liquidity spillovers in Section 6.

5.1. The effects on the parent firms' liquidity

There are conflicting hypotheses on the effect of a spinoff on the liquidity of its parent firm's stock. On the one hand, when the subsidiary firm's stock is distributed to the parent firm's shareholders, there is a mechanical increase in the proportional bid-ask spread after the ED due

[15] The main points of the Holden-Jacobsen (2014) algorithm, especially for the MTAQ database, are: (i) it adjusts for withdrawn quotes, (ii) makes time interpolation during each one-second period, (iii) matches trades with national best bid and offer (NBBO) quotes across different exchanges, and (iv) excludes crossed or locked NBBOs. Note that the Holden-Jacobsen (2014) algorithm uses all trades across different exchanges to find NBBO quotes and matches them with trades.

to the sharp decline in the parent firm's stock price on the ED.[16] For example, when Ford spun off its subsidiary Associated Capital (see Table 1), Ford's stock price fell by one-third from $65.0625 on April 7, 1998 to $43.3750 on the next trading day. If the bid-ask spread was quoted at the minimum possible tick size of $1/16, the decline in its stock price and hence its quote mid-point (*midpt*) would lead to an increase in the proportional quoted and effective spreads. In addition, the market capitalization or size of the parent firm declines on the ED, since part of it becomes an independent firm. Thus, a spinoff may reduce the liquidity of the parent firm's stock.

On the other hand, a spinoff enables investors to assess the core business activities of the parent firm more precisely, reducing information asymmetry, a major source of stock illiquidity (Glosten and Milgrom, 1985; Kyle, 1985). Krishnaswarmi and Subramaniam (1999) find that spinoffs mitigate the extent of information asymmetry in the parent firms. In particular, following spinoffs there is a decline in the analysts' earnings forecast errors, as well as in the dispersion of analysts' forecasts. This may improve the liquidity of parents' stocks after spinoffs.

To examine how the liquidity of parent firms is affected after spinoffs, we compute the mean values (*Means*) and the median values (*Medians*) of the daily (il)liquidity measures over the 100 trading days in each of the pre-ED and post-ED periods. We then average the means and the medians across the firms in the sample. The results are in Table 3, Panel A. We also calculate the change for each firm in these measures around the ED by subtracting the pre-ED value from the post-ED value.[17] We then compute the average of these changes across the firms. We report the *t*-statistics for testing whether the average change in the (il)liquidity measure is significantly different from zero. We also report the fraction of the number of firms that have negative changes in *Means* for the (il)liquidity measures relative to the total number of firms, as well as the *t*-value to infer whether the fraction is different from 0.5, the chance probability.

In Panel A of Table 3 we find no consistent pattern in the change of liquidity around the ED for the parent firms. As expected, the decline in the parent's stock price leads to a significant but mechanical increase in the proportional effective spread, *PESPR*, and the proportional quoted spread, *PQSPR*. There is a small, insignificant increase of 0.072% in liquidity measured by share turnover (*TURN*), and there is a small decrease in liquidity (an insignificant increase in

[16] In a few cases where a parent firm's stockholders could exchange the parent shares for the subsidiary shares, there was no decline in the parent company's stock price.
[17] The ISSM/TAQ databases do not have data on some 68 parent firms, hence the number of parent firms (*N*) for the ISSM/TAQ-based illiquidity measures is 64.

illiquidity) when measured by *ILLIQ*. The decomposed illiquidity measures, $\bar{\varphi}^{BS1}$, λ^{BS1}, $\bar{\varphi}^{BS2}$, and λ^{BS2}, tend to decline but the changes are not statistically significant. In sum, there is no consistent change in the (il)liquidity of the parents' stocks around the ED, except for the mechanical changes in the proportional spreads driven by price decreases in the post-ED period.

5.2. The effects on the spun-off subsidiary firms' liquidity

We test Hypothesis 1 that the stock liquidity of spun-off subsidiary firms increases following the ED of two-step spinoffs. The results in Panel B of Table 3 support this hypothesis.

Consider the first two measures that use lower-frequency data (CRSP-based daily volume and return). The mean and median values of daily share turnover (*TURN*) for the 68 spun-off firms increase substantially after the ED. The average mean values of *TURN* rises from 0.76% in the pre-ED period to 1.38% in the post-ED period, and the average of the median values increases from 0.47% to 0.90%. The respective *t*-values for the changes in *TURN* are 6.36 and 7.04, indicating a significant improvement in turnover after the two-step spinoffs. The fraction of negative changes in the mean values and the *t*-value suggest that, after the ED, share turnover increases in 91.2% of cases (62 out of the 68 spinoffs). This is far greater than 50%, the chance probability. Similarly, there is a significant decline in *ILLIQ*. The mean *ILLIQ* falls significantly from 0.149 to 0.012 on average, with 89.7% of the 68 spinoff cases showing decreases in *ILLIQ*. Its median value also declines from 0.027 to 0.006, with a *t*-value of −3.40 for its change.

Next, we examine the changes in the two spread measures that are constructed using high-frequency databases (ISSM/TAQ-based tick-by-tick data). There are significant declines in the proportional effective and quoted spreads, *PESPR* and *PQSPR*. The average of mean values in *PESPR* falls by nearly 28%, from 0.79% in the pre-ED period to 0.56% in the post-ED period, with the *t*-value of −2.91. The average median value of *PESPR* also declines by about 28% (t = −3.01). The results for *PQSPR* are similar.

Finally, we investigate the four illiquidity measures decomposed using intra-day order flows processed from the transaction-level databases. We find a similar decline in illiquidity when trading costs are decomposed into fixed-cost (non-information) and variable (price-impact) components, $\bar{\varphi}$ and λ, respectively. The mean value of $\bar{\varphi}^{BS1}$ falls significantly from 5.66 in the pre-ED period to 4.40 in the post-ED period, with t = −3.05. The decline applies to 63.2% of the

68 spinoffs, which is significantly greater than 50%, the chance probability. The decline in λ^{BS1} is more salient. Its mean value falls from 6.79 in the pre-ED period to 0.26 in the post-ED period, while the median value of λ^{BS1} falls from 0.23 to 0.07 with $t = -2.35$. The decline in λ^{BS1} applies for 95.6% of the cases. When estimating the two components by the BS2 method using unexpected order flows, the patterns are similar. The mean values of $\bar{\varphi}^{BS2}$ and λ^{BS2}decrease by more than 25%. For the median values of the two components, the changes around the spinoff event also exhibit a consistent pattern.

The results in Table 3 thus support our Hypothesis 1. There is a significant increase in the stock liquidity of subsidiaries that are spun off from their parent firms, which accompanies the sharp increase in the free float of the spun-off firms' shares. The large increases in the free float after the restructuring event, which facilitates active trading and broadens the investor base contribute to reducing information asymmetry, measured by λ^{BS1} and λ^{BS2}, among traders. Also, there is more room for competition among market makers, given the larger trading volume (*TURN*). This is consistent with the notion that firms with a broad and diverse shareholder base allow greater corporate transparency and lower costs of capital (e.g., Merton, 1987; Bodnaruk and Östberg, 2013).

6. Liquidity spillover effects: Changes in the liquidity of related firms

The improved liquidity of the spun-off subsidiaries examined in the previous section may be expected, given the increased free float after the spinoff ED. We next examine whether the improved liquidity of the spun-off firms spills over to other firms.

6.1 The basic liquidity spillover results

Hypothesis 2 proposes a positive spillover effect: following the ED of two-step spinoffs, there is an increase in the stock liquidity of firms that are related to the spun-off subsidiary firms. To test this hypothesis, we first match each spun-off firm with up to 100 other firms based on the absolute correlations of daily returns (|*Corr*|) or the HP-scores. The matched firms are either the companies in the same industry (by the Fama-French 48 industry classification) that have the highest |*Corr*| with the spun-off firms in the pre-ED period, or the firms that have the highest

HP-scores in the spinoff effective year. The pre-ED period is a 100-trading-day interval from days ED−100 to ED−1 and the post-ED period is an interval from days ED+1 to ED+100. Included stocks have at least 22 positive-volume days in the pre-ED and post-ED periods, and are ranked 100th or better among the firms matched based on the two criteria.

After matching, we obtain mean values of the (il)liquidity measures for the related firms over the pre- and post-ED periods, as well as the differences (i.e., changes) of the values between the two periods in the same way as we do for the spun-off firms. Then, the stocks of the matched firms related to each of the spun-off firms are aggregated into equally-weighted portfolios, for which we calculate the deal-level means in the (il)liquidity measures. Following Amihud et al. (1997) we then compute the relevant statistics across the 68 or 43 portfolios.[18] As presented in Table 4, the sample matched by |*Corr*| for the 68 portfolios (or deals) in Panel A includes between 6,250 and 6,365 firms, while the sample matched by the HP-score for the 43 deals in Panel B includes between 2,287 and 2,300 firms. The sample size depends on the availability of the (il)liquidity measures.

The results in Table 4 support Hypothesis 2: we find significant increases in stock liquidity of the related firms. The results are consistent across all eight (il)liquidity measures, regardless of the matching methods. For the related firms matched by |*Corr*| in Panel A, the mean value of daily share turnover (*TURN*) increases significantly from 0.72% in the pre-ED period to 0.80% in the post-ED period, a rise of 12%. We find a similar effect for *ILLIQ*, which falls by 55.7% from 3.35 in the pre-ED period to 1.48 in the post-ED period. Both types of spreads, *PESPR* and *PQSPR*, decline significantly by 5% to 6% in the post-ED period. The liquidity improvement is again apparent for the decomposed illiquidity measures, $\bar{\varphi}$ and λ. In the post-ED period, $\bar{\varphi}^{BS1}$ and $\bar{\varphi}^{BS2}$ decline by 30.3% and 13.5%, respectively, compared with the corresponding values in the pre-ED period; the variable components, λ^{BS1} and λ^{BS2}, also decline by 74% and 47%, respectively. The changes in the four parameters are all significant at conventional levels, although the decline of λ^{BS1} is statistically weaker (t = −1.90) than for the other three measures. The size difference between the two types of the adverse-selection components, λ^{BS1} vs. λ^{BS2}, is because λ^{BS2} is estimated with AR(5)-filtered order flows (τ_k in Eq. (2)) which reduces the estimation noise.

[18] Conducting the tests at a deal level accounts for cross-stock correlations among the matched stocks in a given deal.

Panel B of Table 4 presents the results for firms matched based on the HP-score, which provides information about how a firm is similar to other firm in terms of the two firms' products. The sample is smaller due to the limited availability of the HP-score. We observe that the levels of the measures in the pre- and post-ED periods are larger for turnover (*TURN*) and are much smaller for the other seven illiquidity measures than the corresponding values reported in Panel A. This is because the HP-scores are available for relatively larger firms and in the more recent years (since 1996), and hence the matched sample consists of more liquid firms. Nevertheless, the results in Panel B are qualitatively similar to those in Panel A. There are substantial improvements in the liquidity measures of the firms related to the spun-off firms after the ED. Share turnover of the firms significantly increases, whereas the seven illiquidity measures decline. The decline of λ^{BS2} is relatively weaker but still statistically significant with $p = 0.03$ ($t = -2.15$). Overall, we provide significant evidence that the improvement in stock liquidity of the spun-off firms spills over to the related firms after two-step spinoffs.

We have proposed that liquidity spillovers to related firms arise because there is less information asymmetry in related firms, due to the greater availability of information about the firms that experience the two-step spinoffs. Based on Kyle (1985), this aspect should show up in the measures related to price impact, such as the Amihud (2002) measure and the λ-type measures. We find that the fixed component of the spread ($\bar{\varphi}$) also decreases, which is interesting. Note however that the fixed component is valid for minimum share quantities such as round lots. If some informed traders use minimum order sizes, then $\bar{\varphi}$ should also be non-zero due to asymmetric information, and thus may drop post-spinoff.

6.2. Spillover tests using market-adjusted (il)liquidity

Each of the 68 spinoff deals occurred in a different time over the sample period. Studies such as Chordia, Roll, and Subrahmanyam (2007), Huh (2014), Chung and Huh (2016), and Chordia, Subrahmanyam, and Tong (2014) suggest that liquidity (illiquidity) in the U.S. stock markets has improved (decreased) over time since the 1980s. This implies that the improved liquidity in the post-ED period observed above may simply reflect trends in liquidity improvement over time. Corporate managers could time the ED by considering the market liquidity. We address this concern by conducting an analysis, controlling for overall market (il)liquidity as a benchmark (see Amihud et al., 1997).

We compute the averages of market-adjusted means (*Mkt-adj Means*) and of their changes across the 68 or 43 deals (or portfolios) for the eight (il)liquidity measures. We first obtain the mean of an (il)liquidity measure in the pre- and post-ED periods for each of the related firms and then subtract the respective mean of the market average (index) in each period, which results in the market-adjusted mean (il)liquidity for each firm in the pre- and post-ED periods. Using the market-adjusted values in the two periods, we obtain the change across the pre- and post-ED periods for each firm. We next aggregate the values for each of the 68 (43) portfolios consisting of 6,365 or 2,300 related firms. Finally, we compute the averages of the market-adjusted measures and their changes across the deals. The market indices consist of NYSE/AMEX/Nasdaq-listed firms. In computing the market (il)liquidity indices, each of the eight measures is winsorized for each day at the 1st and 99th percentiles and then the average is obtained across firms. For a firm to be eligible as a component, it should have non-missing values of a relevant measure for at least 142 trading days (about six months) within each year.

The results reported in Table 5 again support Hypothesis 2. In Panels A and B, the average level of the market-adjusted means (*Mkt-adj Means*) is negative for some illiquidity measures (e.g., for *PESPR* and *PQSPR*), because the market indices of those measures are subtracted from their raw values. Focusing on their changes around the ED, we find in Panel A that share turnover (*TURN*) adjusted for the market rises substantially from 0.16% to 0.24%. Similarly, all seven market-adjusted measures of illiquidity decline significantly in the post-ED period. Comparing the values with previous results in Table 4, we find that the differences between the post- and pre-ED periods in Panel A are similar to the values in the earlier table. For instance, the values for the average change in *ILLIQ* (−1.90) and λ^{BS2} (−2.27) in Panel A of Table 5 are close to the corresponding values (−1.87 and −2.26) in Panel A of Table 4. This indicates that the trends of the market indices around the ED do not change our main findings very much. When the related firms are matched based on the HP-score, the results in Panel B are also similar to those reported in Panel A. That is, the liquidity of common shares in the related (rival or competing) firms improves after the spinoffs of the subsidiary firms whose liquidity increases substantially in the post-ED period.

In summary, consistent with Hypothesis 2, our results show again that the improved stock liquidity of spun-off firms generally spills over to the stocks of related firms even after adjusting the (il)liquidity measures for their market indices.

6.3. Controlling for the pre-ED trends of the (il)liquidity measures

One could question whether the improved liquidity we observe in the related firms might be because the parent firm simply times the spinoff to piggyback on the liquidity increase expected in the industry to which the subsidiary as well as their related firms belongs, rather than because of the spillover effects caused by the post-ED liquidity improvement in the spun-off subsidiary firm. If this conjecture is true, then the (il)liquidity measures of the related firms in the pre-ED period should have improving trends in general.

To address the above concern, for each of the (il)liquidity measures we first split the related firms matched with each spun-off firm into two sub-sample groups: one in which the firms experienced a deteriorating trend in liquidity during the pre-ED period and the other in which the firms show an improving trend during the pre-ED period. The pre-ED trend (deteriorating or improving) in liquidity is determined by comparing the average value (*Avg of Pre-ED Means*) of the (il)liquidity measure during the five trading days (about a week) in the two pre-event intervals: days ED−100 to ED−96 (denoted by [−100, −96]) vs. days ED−5 to ED−1 (denoted by [−5, −1]). We then conduct similar analyses as in Table 5 for each group using the market-adjusted (il)liquidity measures. The analyses are reported in Table 6, Panels A and B for firms matched by |*Corr*|) and HP-score, respectively. Subpanels A1 and B1 contain results for the group of related firms whose liquidity show an improving trend in the pre-ED period, while Subpanels A2 and B2 do the same for the group of firms whose liquidity had a deteriorating trend in the pre-ED period.

In Subpanels A2 and B2, we observe that a substantial proportion of the related firms exhibit a deteriorating trend in liquidity during the pre-ED period. In Subpanel A2, for example, more than half (3,269 firms) of the 6,365 related firms have a decreasing trend in share turnover (*TURN*) in the pre-ED period, declining from 1.02% on days [−100, −96] to 0.50% on days [−5, −1]. Importantly, the improvement in the market-adjusted liquidity for the related stocks is qualitatively similar in Panels A1 and A2. The change in market-adjusted turnover (*TURN*) around the ED is positive and significant and the changes around the ED in the seven illiquidity measures are all negative and significant. The results are consistent for related firms that are selected by either |*Corr*| or the HP-score. The results suggest that managers of the parent firms are unlikely to have timed the restructuring event by predicting the liquidity trends in the industry when they set the EDs of spinoffs.

In particular, we note that liquidity improves in the post-ED period even for the group of related firms whose liquidity shows a deteriorating trend in the pre-ED period. In Subpanel A2, the market-adjusted share turnover (*TURN*) rises from 0.14% in the pre-ED period to 0.18% in the post-ED period, although its pre-ED trend is downward-sloping from 1.02% to 0.50%. Also, *ILLIQ* declines from 0.99 to 0.19, although it rises in the pre-ED period. The changes in the other seven illiquidity measures after the ED are all negative and statistically significant. For the group of firms matched by the HP-score in Subpanel B2, the patterns are virtually the same. (Naturally, the smaller sample size in each group lowers the power of the tests.) The non-information component of trading costs ($\bar{\varphi}^{BS2}$), for example, which increases from 4.45 to 7.25 in the pre-ED period, has its market-adjusted value declining significantly by 0.26 after the ED. This confirms that the liquidity of the related firms improves in the post-ED period, regardless of the trends of the (il)liquidity measures in the pre-ED period.

To summarize, our findings in Tables 4-6 suggest that the improvement in stock liquidity of the spun-off firms spills over to the related firms after two-step spinoffs, strongly supporting Hypothesis 2.

6.4. A placebo test: Analyses with lowest-ranked related firms

Given the liquidity spillovers to the related firms, we conduct a placebo test to check whether the spillover effects exist in the firms that are *least* related to spun-off firms in terms of |*Corr*| and the HP-score. To perform this test, the sample is limited. Nonetheless, the test is still available using the cases where the number of firms matched with each of the subsidiary firms is large enough (more than 100 firms). When we choose 100 firms that have the *lowest* |*Corr*| or HP-scores, the sample of matched firms for this test is still available: 4,952 firms when based on |*Corr*|, and 780 firms when based on the HP-score. Note that the matched firms are all from the same industries (or peer groups) as the spun-off subsidiaries (see Section 3 for details on matching methods). Using these firms, we replicate the analyses reported in Table 4.

The results in Panel A of Table 7 show no evidence of liquidity spillover to the matched firms with the lowest values of |*Corr*|, although these matched firms belong to the same industry as each of the spun-off subsidiary firms. For instance, the change in *ILLIQ* is significantly positive instead of negative as it is in Table 4. For the other (il)liquidity measures, the changes across the two periods are not statistically significant, and there is no consistency in the signs of the changes. In Panel B, where the HP-scores are used for matching, the results are again inconsistent with those in Table 4: most of the measures (except for $\bar{\varphi}^{BS2}$) show that their changes are insignificant, and for some (il)liquidity measures the sign of the change is the opposite of that reported in Table 4.

We conclude from the above test that the spillover effect is not a common phenomenon; rather, it is observed only in *highly* related firms within the same industries or peer groups.

6.5. Price efficiency around the effective date

By Hypothesis 3, we expect that the improved liquidity of the related stocks should improve the informational efficiency of their prices (Amihud et al., 1997; Chordia, Roll, and Subrahmanyam, 2008). We test whether the stock prices of related firms become more informationally efficient in the post-ED period. Our test is based on Fama's (1976, p. 44) suggestion that "if the market is efficient, there is no way to use any information available at time $t-1$ as the basis for a correct assessment of an expected value of R_t which is different from the assumed constant equilibrium expected return, $E(R)$."

In our test, we estimate a time-series regression of the daily portfolio returns of related stocks on their lagged returns. Market inefficiency and slower price adjustments to information[19] are indicated by a stronger explanatory power when future returns are predicted with past returns. We thus estimate the following equation:

$$R_{j,t} = a + \sum_{k=1}^{3} b_k R_{j,t-k} + \varepsilon_{j,t} \,, \tag{3}$$

where $R_{j,t}$ (j = 1, 2, … 68 or 43) is the daily average return on portfolio j consisting of the related firms matched with spun-off firm j. For each of the 68 or 43 portfolios, we estimate Eq. (3) using

[19] See Amihud and Mendelson (1987, 1989). The portfolio return diversifies away the effect of individual stocks' bid-ask spread that causes negative serial correlation in individual stock returns; see Roll (1984).

the portfolio average returns over the 100 trading days in the pre-ED period (t = ED−105 to ED−6) and over the 100 trading days in the post-ED period (t = ED+6 to ED+105). We exclude the five trading days in each period around the ED to get around any confounding effect or price shock. From the two regressions for portfolio j, we obtain the F-values for the pre- and post-ED periods. The F-value for each period is to test the null hypothesis: $b_1 = b_2 = b_3 = 0$. A higher F-value implies a greater likelihood of the null hypothesis being rejected. However, our goal here is not to test this hypothesis but to examine whether there is an improvement in the price efficiency for the related firms in the post-ED period. We thus examine $dF = F_{post\text{-}ED} - F_{pre\text{-}ED}$, the difference of the F-values between the two periods. If the stock prices of related firms become more efficient in the post-ED period, we expect dF to be negative on average.

In Table 8, we report the statistics for dF across the 68 (or 43) portfolios, denoting the mean difference by *Mean_dF*. We also report for each group of matched firms the proportion of cases with $dF < 0$. Panel A contains the results for the 68 portfolios of the 6,365 related firms matched based on |*Corr*|, and Panel B does that for the 43 portfolios of the 2,300 related firms matched based on the HP-score. For robustness, we use three different types of returns. The daily returns used in the first column in the two panels are CRSP-based raw returns. The returns in the second column are CRSP-based returns adjusted for non-synchronous trading, which are computed following Roll, Schwartz, and Subrahmanyam (2007).[20] The returns used in the third column are calculated from the quote mid-point prices processed using the ISSM/TAQ databases, in order to avoid serial correlations resulting from the bid-ask bounce.

We hypothesize that the stock prices of related firms become more efficient after the spinoffs, and hence past returns provide less information about future returns in the post-ED period. Our results in Table 8 support this hypothesis. For the returns calculated from observed (transaction) prices in column (1) of Panel A, *Mean_dF* is negative (−0.46) and statistically significant at the 5% level. The proportion of negative dF cases is 60%, which is greater than the chance probability. These results suggest that the stock prices of related firms become more efficient after the spinoffs of the subsidiaries. When using the returns adjusted for non-synchronous trading in column (2), the results are stronger. With the quote mid-point returns in column (3), we also find that *Mean_dF* is more negative (−0.80) and significant at the 1% level.

[20] For details on computing the returns adjusted for non-synchronous trading, see Appendix B (p. 2232) in Roll, Schwartz, and Subrahmanyam (2007).

Here the proportion of cases with $dF < 0$ is 0.62, significantly greater than 0.50 ($t = 1.98$). The results are qualitatively similar for the related firms matched by the HP-score in Panel B.

Overall, the above findings support Hypothesis 3, suggesting that stock prices of related firms become more informationally efficient after the two-step spinoffs.

7. Institutional holdings around the two-step spinoffs

We investigate whether changes in stock liquidity reflected in institutional investors' holdings. Illiquidity implies that it is harder for institutional investors to find counterparties to trade with, which means that they cannot rebalance their portfolios in a timely manner without making large price concessions. Also, it is costlier for institutions to trade a large block of stocks because of the market impact of such trade, which is higher for illiquid stocks. For these reasons, institutional investors should prefer holding and trading liquid securities, ceteris paribus. Therefore, changes in institutional holdings of a stock should be associated with changes in stock liquidity. Nagel (2005), Rubin (2007), Han and Lesmond (2011), and Blume and Keim (2017) document a positive relationship between stock liquidity and institutional holdings, implying that we can make inferences about stock liquidity by observing the revealed preferences of institutional investors: i.e., their stockholdings.

We examine whether the spillover effects on the liquidity of related firms are reflected in institutional investors' holdings of the affected stocks. As stated in Hypothesis 4, we posit that institutional ownership of the spun-off subsidiaries and their related firms increases in the post-ED period. We test this hypothesis using data from the Thomson Reuters Institutional Holdings (13F) database on quarterly institutional ownership (*IO*), the number of shares held by institutional investors in a quarter divided by the number of shares outstanding in that quarter. We also compute market-adjusted institutional ownership as $IO_{mkt\text{-}adj} = (IO - IO_{mkt})$, where IO_{mkt} is the average of *IO*s across all firms available in the database during the quarter. We also examine two other variables: the number of institutional investors holding the firm's stock during the quarter (*NInst*) and the breadth of institutional holdings (*Breadth*), defined as *NInst* divided by the total number of institutions available in the database during the quarter, following Chen, Hong, and Stein (2002). The values of the four variables are calculated in the pre-ED quarter (q-1) and the post-ED quarter (q+1), skipping quarter q in which the spinoffs occur.

The results are presented in Table 9, Panel A for the 68 spun-off subsidiaries. Institutional investors significantly raise their holdings in the spun-off firms as they become independent and their free float surges after the ED. We find that institutional ownership (*IO*) increases by 33.4 percentage points (ppts), from 29.2% in the pre-ED quarter to 62.7% in the post-ED quarter.[21] Similar results are found after accounting for the market trend in *IO*: $IO_{mkt\text{-}adj}$ rises by 32.6 ppts. The number of institutions (*NInst*) investing in the stocks of the subsidiaries increases by 114.8 institutions on average—from 83.6 in the pre-ED quarter to 198.5 in the post-ED quarter. *Breadth* measures the investor base more precisely because it accounts for the market trend over time. We find that *Breadth* rises by 6.8 ppts—from 4.8% to 11.6% after the ED. Overall, institutional investors strongly respond to the surge in the free floats of the spun-off companies in the post-ED period. The results thus support the view that an exogenous increase in stock liquidity attracts additional investments by institutional investors, reflecting their preference for liquid securities.

Panels B and C of Table 9 report the results for the related firms. We have data for 4,991 (2,012) related firms matched with the 68 (43) subsidiaries based on |*Corr*| (the HP-score, respectively). For these firms, we first obtain the values of the four variables in the pre- and post-ED quarters and the difference between the two periods. Next, the stocks of the related firms are matched with each of the subsidiaries and aggregated at the deal level into portfolios. We then compute the averages of the values and their differences across the 68 (in Panel B) or 43 (in Panel C) portfolios of the related firms. While the changes in Panels B and C are smaller than those in Panel A, there is a significant increase in the institutional holdings of related firms. Panel B shows that *IO* rises from 46.5% in the pre-ED quarter to 48.1% in the post-ED quarter with the t-value for the change being 8.25. When institutional ownership is adjusted for the overall market, the increase in $IO_{mkt\text{-}adj}$ (by 0.8 ppts in excess of the market) is significant (t = 4.83). The institutional shareholder base in the related firms also broadens in the quarter after the

[21] The mean of 29.2% for *IO* in the pre-ED period (exceeding 20% for some firms) can be explained by potential errors when shares sold short are counted in the database. For example, assume that Company XYZ has 20 million shares outstanding and Institution A owns all 20 million. Now a hedge fund B borrows 5 million of these shares from Institution A, and short sells them to Institution C. If both A and C claim ownership of the shares shorted by B, the institutional ownership of Company XYZ could be reported as 25 million shares, or 125%. That is, institutional holdings may be incorrectly reported as more than 100%. Short sales of spun-off stocks in the pre-ED period may be driven by the anticipated decline in their prices immediately after the ED due to selling pressure described in Section 8.

ED: the average increase in the number of institutions (*NInst*) is 3.3 with t = 3.83 and the scaled shareholder base (*Breadth*) increases by 0.1 ppts with t = 2.46. The changes in the four variables are generally larger in Panel C for the sample of 43 portfolios matched by the HP-score.

In summary, the results in Table 9 provide support for Hypothesis 4 that institutional investors increase their investments in the related firms as well as in the spun-off subsidiaries after two-step spinoffs, revealing the preference of these investors for liquid assets. The results are consistent with our hypothesis that the liquidity of the affected stocks, which is hard to observe directly, improves when measured indirectly by institutional holdings.

8. The effects of spinoffs on the valuation of the spun-off firms and their related firms

We expect that an exogenous shock (improvement) in stock liquidity raises stock prices, ceteris paribus. Amihud et al. (1997) find this effect after an increase in stock liquidity due to a reform in trading methods in the Tel Aviv Stock Exchange. Albuquerque, Song, and Yao (2020) find that an illiquidity shock lowers stock prices following the SEC tick-size pilot program. Given the liquidity improvements in the spun-off firms and in their related firms, stock prices are expected to rise for the affected firms in the post-ED period. Considering that the impact of spinoffs on liquidity is higher for spun-off firms than for related firms, we expect greater value increases for the spun-off stocks. We now test Hypothesis 5, examining the effects of the improved liquidity on stock prices in the two groups of firms.

For this purpose, we compute the cumulative abnormal return (CAR) around the ED. For each day d (ED−5 ≤ d ≤ ED+60), we first calculate the daily abnormal return $AR_{j,d} = (R_{j,d} - RM_d)$ where $R_{j,d}$ is the return of spun-off stock j (j = 1,…, 68) on day d, and RM_d is the NYSE/AMEX/Nasdaq value-weighted average return on day d obtained from CRSP. We do the same for the 6,365 related firms matched by |*Corr*|, and obtain the mean value of their abnormal returns for the corresponding portfolio j (j = 1,…, 68). We next compute the equally-weighted average (AR_d) of the means on each day across the 68 spun-off firms, as well as the 68 portfolios of the related firms. Then, we calculate the CAR as follows: $CAR_T = \Sigma^T_{d=\text{ED-5}} AR_d$, where T = ED−4, ED−3,…, ED+0, ED+1,…, ED+60 for the spun-off firms and their related firms. Thus, CAR_T is the summed CAR from day ED−5 to day T, where T can be any trading day between

ED−4 and ED+60 in the 66-day window. Similarly, we compute CARs for the 2,300 related firms matched by the HP-score, as well as the 43 spun-off firms associated with them.

Figure 1 presents the evolution of CARs over time. For the spun-off subsidiaries—the solid lines in Figures 1(A) and 1(B) for the 68 and 43 firms, respectively—the CAR increases over time after the ED but with a time lag up to ED+5. On the first several days after the ED, the CAR declines. This occurs probably because some shareholders of the parent firms sell immediately the subsidiary's shares that they receive.[22] That is, the surge in the free float (supply) of the shares in the spun-off firms on the ED exerts a temporary selling pressure on prices, akin to the price pattern observed for block sales (Kraus and Stoll, 1972). Market makers, who step in to absorb the selling pressure by buying the shares and selling them later, incur inventory risk and the cost of financial constraints,[23] for which they require a price discount. This explains the temporary decline in the CAR for the spun-off stocks immediately following the ED. After the initial selling pressure subsides, the CAR for the spun-off firms increases, reflecting the long-term benefit of the improved liquidity.

We next consider how stock prices in the related firms change around the ED. Given the spillovers of liquidity to the related firms, does their improved liquidity also affect their stock prices? As the dotted lines in Figures 1(A) and 1(B) show, the CAR for the related firms increases immediately following the ED, reflecting the benefit of their improved liquidity. In Figure 1(A), the CAR rises up to ED+19 and then stays constant thereafter at around 3%. In Figure 1(B) where the related firms are matched by the HP-score, the pattern is similar. We do not see any initial price decline for the related firms, consistent with the view that there is no selling pressure caused by the surge in the free float as observed in the spun-off firms. It is also notable that the magnitude of price changes in the related firms is relatively smaller than that in the spun-off firms, and the valuation effect remains for a shorter period of time for the related firms, consistent with Amihud et al. (1997).

To check if these findings are spurious, we conduct another placebo test by setting ED+90 as the ED (i.e., day 0) for the 68 spun-off firms, as well as for the 68 portfolios of the related firms matched by |*Corr*|. The results in Figure 1(C) show that the two types of CARs

[22] In a two-step spinoff, 20% or lower of a subsidiary's shares were held voluntarily before the ED. Investors wishing to hold the shares could have bought them in the secondary market in the pre-ED period.
[23] See Amihud and Mendelson (1980) and Ho and Stoll (1981).

fluctuate around 0% and the patterns do not resemble those observed in Figures 1(A) and 1(B).

The results in Figure 1 are different from the studies on the price/value effect caused by 'information' spillovers across stocks. In a given two-step spinoff, a sudden increase in the free float on the ED occurs only in the spun-off firm, and the ED is known in advance. Therefore, there is no disclosure of new material information (about the firms' cash flows) on the ED itself. Therefore, the value change of the related firm in the post-ED period can be attributed to the liquidity improvement that is spilled from the spun-off firm to the related firm in the post-ED period. The placebo test results in Figure 1(C) (especially, the dotted line for the related firms) provide support for this view.

In Table 10, we provide statistics on CARs. Since Figure 1 shows that CAR_T for the spun off firms decreases up to five trading days after the ED, we focus on the mean and median values of CARs at T = ED+5 [i.e., CAR(−5, +5)], as well as at T = ED+60 [i.e., CAR(−5, +60)]. In Subpanel A1, we find that the average of CAR(−5, +5) across the 68 spun-off firms is −4.33% (*t*-value = −2.06), consistent with the pattern in Figure 1(A). The median value of CAR(−5, +5) is less negative (−0.64%). The fraction of firms with a positive value (*%Positive*) in CAR(−5, +5) is 0.47, not significantly different from 0.5. These results imply that while many of the spun-off stocks tend to have negative CARs, the statistical significance of the mean value is driven mainly by a few stocks with volatile abnormal returns. Beyond T = ED+5, the mean of CARs increases over time, reaching up to 6.93% at T = ED+60 [see CAR(−5, +60) in Subpanel A1], which is statistically significant at 5%. The median (7.89%) is higher than the mean, whereas the fraction of positive CARs is 0.68 (*t*-value = 2.91). Given the relatively small sample and a potential heteroscedasticity issue, we also compute the weighted mean (*Wtd_Mean*) for CARs, where the weight is the reciprocal of the standard deviation of daily abnormal returns that constitute CARs. By this method, CARs with more volatile abnormal returns have smaller weights. We find that *Wtd_Mean* of CAR(−5, +60) is higher (7.16%), and it is significant at any conventional level.

For the 68 portfolios composed of 6,365 related stocks, Subpanel A2 in Table 10 shows that the mean of CAR(−5, +5) is positive at 1.83%, given that there is no selling pressure in the related firms after the ED. The fraction of portfolios with a positive value in CAR(−5, +5) is 0.69. In Figure 1(A), CAR_T for the related firms continues to rise up to T = ED+19 and then flattens thereafter at around 3%. Subpanel A2 confirms that at T = ED+60, the mean of CAR(−5,

+60) is 2.99% (*t*-value = 2.30). In this case, the fraction of positive CARs is 0.65, different from 0.5 at the 5% level. However, the weighted mean of CAR(−5, +60) is much higher (5.00%), which is significant at 1%. We conduct similar analyses for the 43 spun-off firms and their related stocks matched based on the HP-score. The results in Panel B are qualitatively similar to those in Panel A, although their statistical significance is lower due to the smaller sample.

We next examine the relationship between CARs of the spun-off stocks and their related stocks. We find that the correlation of CARs (−5, +60) between the 68 spun-off firms and the 68 portfolios of the related firms is 0.41. In a regression of the values of CAR(−5, +60) of the 68 portfolios of the related firms on those of the 68 spun-off firms, the slope coefficient is 0.157 (*t*-stat. = 3.99).[24] This suggests an association between the liquidity-induced CAR of the spun-off firms and that of the related firms.

It is important to reiterate that the value increases in the spun-off firms following the ED are not attributable to the economic benefits that emanate from separating the subsidiaries from their parent companies. By the time a spinoff is completed on the ED, the valuation benefit should have already been incorporated in the stock price of the subsidiary in the pre-ED period (since its stock was traded in the market during that period). Furthermore, because the ED of the second-stage event is announced in advance, the completion of the spinoff on the ED itself is unlikely to be associated with any material information about the spun-off firm. Therefore, the value increases in the spun-off firms are an additional benefit that is caused by the improvement in liquidity. The same logic applies to the value increases in their related firms.

9. Conclusion

Commonality in liquidity can result from macroeconomic events that affect a broad range of stocks at the same time, or material information that systematically affects the liquidity or firm value of multiple companies. In this study, we investigate whether there are liquidity or value spillovers across stocks around a unique corporate event: two-step spinoffs. The second stage of the event involves a surge in the free float of an already-public firm on the effective date (ED), thereby enhancing the liquidity of the spun-off firm. We examine whether such a firm-specific

[24] The *t*-statistic is computed based on the heteroscedasticity-consistent standard errors (White, 1980).

shock in the liquidity of one stock caused by a two-step spinoff affects the liquidity and/or prices of other related stocks that are not subject to the exogenous shock.

We show that there are significant improvements in the liquidity of subsidiary firms that are spun off from their parent firms. The improved liquidity of the spun-off firms is unsurprising, however, given the free-float increases following the ED. More importantly, we provide evidence that there are significant spillover effects in stock liquidity flowing from the spun-off firms to their (highly) related firms after the two-step spinoffs. The results are consistent across eight (il)liquidity measures, regardless of whether we use market-adjusted measures or control for the pre-ED trends of the measures. But there is no consistent spillover effect in the lowest-ranked related firms, although they belong to the same industries or peer groups. The liquidity spillovers to the related firms are also accompanied by increased price efficiency of the related firms in the post-ED period. Institutional investors generally increase their holdings in the related firms as well as in the spun-off subsidiaries after the event, in reaction to the improved liquidity in the post-ED period.

We also examine whether the liquidity improvements due to two-step spinoffs have any valuation effects. Our results show that the stock prices of the spun-off firms as well as the related firms increase following the effective date. In a placebo test, however, we find no price changes around a pseudo-event date. All in all, our findings suggest that liquidity spillovers lead to value spillovers from the spun-off firms to the highly related firms after the two-step spinoffs. In addition, our results lend strong support to the notion that the prices of the spun-off firms provide additional public information about the related firms, ameliorating information asymmetry in those firms.

The spillover effects documented in this study have important policy implications. For example, poor performance of corporate disclosure in a firm can affect not only the liquidity and price efficiency of that firm but also those of other related firms, which highlights the importance of regulating the quality of corporate disclosure across firms in financial markets.

References

Admati, A., and P. Pfleiderer, 1988, A theory of intraday patterns: Volume and price variability, *Review of Financial Studies* 1, 3-40.

Albuquerque, R., S. Song, and C. Yao, 2020. The price effects of liquidity shocks: A study of SEC's tick-size experiment. *Journal of Financial Economics* 138, 700-724.

Amihud, Y., 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5(1), 31-56.

Amihud, Y., B. Lauterbach, and H. Mendelson, 2003, The value of trading consolidation: Evidence from the exercise of warrants. *Journal of Financial and Quantitative Analysis* 38, 829-846.

Amihud, Y. and H. Mendelson, 1980, Dealership market: Market making with inventory, *Journal of Financial Economics* 8, 31-53.

Amihud, Y. and H. Mendelson, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics* 17, 223-249.

Amihud, Y., and H. Mendelson, 1987, Trading mechanisms and stock returns" An empirical investigation, *Journal of Finance* 42, 533-553.

Amihud, Y. and H. Mendelson, 1988, Liquidity and asset prices: Financial management implications, *Financial Management* 17, 5-15.

Amihud, Y., and H. Mendelson, 1989, The effects of beta, bid-ask spread, residual risk, and size on stock returns, *Journal of Finance* 44, 479-486.

Amihud, Y., Mendelson, H., 1989, Index and index futures returns, *Journal of Accounting, Auditing and Finance 4*, 415-431.

Amihud Y., H. Mendelson, and B. Lauterbach, 1997, Market microstructure and securities values: Evidence from the Tel Aviv Stock Exchange, *Journal of Financial Economics* 45, 365-390.

Amihud Y., H. Mendelson, and J. Uno, 1999, Number of shareholders and stock prices: Evidence from Japan, *Journal of Finance* 54, 1169-1184.

Arnuk S. and J. Saluzzi, 2012, Broken markets, FT Press/Upper Saddle River, NJ.

Bessembinder, H., W. Maxwell, and K. Venkataraman, 2006, Market transparency, liquidity externalities, and institutional trading costs in corporate bonds, *Journal of Financial Economics* 82, 251-288.

Blume, M. E., and D. B. Keim, 2017, The changing nature of institutional stock investing, *Critical Finance Review* 6, 1-41.

Bodnaruk, A. and P. Östberg, 2013, Shareholder base and payout policy, *Journal of Financial and Quantitative Analysis* 48, 729-760.

Bolton, P., and E.-L. von Thadden, 1998, Blocks, liquidity, and corporate control, *Journal of Finance* 53, 1-25.

Brennan, M., T. Chordia, A. Subrahmanyam, and Q. Tong, 2012, Sell-order liquidity and the cross-section of expected stock returns, *Journal of Financial Economics* 105 (3): 523-541.

Brennan, M., and A. Subrahmanyam, 1996, Market microstructure and asset pricing: On the compensation for illiquidity in stock returns, *Journal of Financial Economics* 41:441-64.

Brunnermeier, M. and L. Pedersen, 2009, Market liquidity and funding liquidity, *Review of Financial Studies* 22, 2201-2238.

Cespa, G., and T. Foucault, 2014, Illiquidity contagion and liquidity crashes, *Review of Financial Studies* 27 (6), 1615–1660.

Chen, J., H. Hong, and J.C. Stein, 2002, Breadth of ownership and stock returns, *Journal of Financial Economics* 66, 171-205.

Chordia, T., R. Roll, and A. Subrahmanyam, 2000, Commonality in liquidity, *Journal of Financial Economics* 56, 3-28.

Chordia, T., R. Roll, and A. Subrahmanyam, 2007, Liquidity and the law of one price: The case of the futures-cash basis, *Journal of Finance* 62, 2201-2234.

Chordia, T., R. Roll, and A. Subrahmanyam, 2008, Liquidity and market efficiency, *Journal of Financial Economics* 87, 249-268.

Chordia, T., A. Subrahmanyam, and Q. Tong, 2014, Have capital market anomalies attenuated in the recent era of high liquidity and trading activity?, *Journal of Accounting and Economics* 58, 41-58.

Chung, K.H., and S.W. Huh, 2016, The non-information cost of trading and its relative importance in asset pricing, *Review of Asset Pricing Studies* 6, 261-302.

Ding, X., Y. Ni, and L. Zhong, 2016, Free float and market liquidity around the world, *Journal of Empirical Finance* 38, 236-257.

Easley, D., M. Lopez de Prado, and M. O'Hara, 2012, Bulk classification of trading activity, Working Paper, Cornell University.

Fama, E., 1970, Efficient capital markets: A review of theory and empirical evidence, *Journal of Finance* 25, 383-417.

Fama, E., 1976, *Foundations in Finance*, New York: Basic Books.

Fang, V. W., T. Noe, and S. Tice, 2009, Stock market liquidity and firm value, *Journal of Financial Economics* 94, 150-169.

Foster, F. D., and S. Viswanathan, 1993, Variations in trading volume, return volatility, and trading costs: Evidence on recent price formation models, *Journal of Finance* 48(1), 187-211.

Glosten, L.R., and L.E. Harris, 1988, Estimating the components of the bid/ask spread, *Journal of Financial Economics* 21(1), 123-142.

Glosten, L.R., and P. Milgrom, 1985, Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders, *Journal of Financial Economics* 13, 71–100.

Goyenko, R.Y., and A.D. Ukhov, 2009, Stock and bond market liquidity: A long-run empirical analysis. *Journal of Financial and Quantitative Analysis* 44, 189-212.

Han, Y., and D. Lesmond, 2011, Liquidity biases and the pricing of cross-sectional idiosyncratic volatility, *Review of Financial Studies* 24, 1590-1629.

Hasbrouck, J., and D. Seppi, 2001, Common factors in prices, order flows, and liquidity, *Journal of Financial Economics* 59, 383-411.

Ho, T., and H. Stoll, 1981, Optimal dealer services under transactions and return uncertainty, *Journal of Financial Economics* 9, 47-73.

Hoberg, G., and G. Phillips, 2010, Product market synergies and competition in mergers and acquisitions: A text-based analysis, *Review of Financial Studies* 23, 3773-3811.

Hoberg, G., and G. Phillips, 2016, Text-based network industries and endogenous product differentiation, *Journal of Political Economy* 124, 1423-1465.

Holden, C. and S. Jacobsen, 2014, Liquidity measurement problems in fast, competitive markets: Expensive and cheap solutions, *Journal of Finance* 69:1747–85.

Hou, K. and T. Moskowitz, 2005, Market frictions, price delay, and the cross-section of expected returns, *Review of Financial Studies* 18, 982-1020.

Huberman, G., and D. Halka, 2001, Systematic liquidity, *Journal of Financial Research* 24, 161-178.

Huh, S.W., 2014, Price impact and asset pricing, *Journal of Financial Markets* 19, 1-38.

Kraus, A., and H. R. Stoll, 1972, Price impacts of block trading on the New York Stock Exchange, *Journal of Finance* 27, 569-588.

Krishnaswami, S., and V. Subramaniam, 1999, Information asymmetry, valuation, and the corporate spinoff decision, *Journal of Financial Economics* 53, 73-112.

Kyle, A., 1985, Continuous auctions and insider trading, *Econometrica* 53:1315–335.

Lee, C., and M. Ready, 1991, Inferring trade direction from intraday data, *Journal of Finance* 46, 733–47.

Liu, S., 2007, Securities transaction tax and market efficiency: evidence from the Japanese experience, *Journal of Financial Services Research* 32, 161-76.

Merton, R., 1987, A simple model of capital market equilibrium with incomplete information, *Journal of Finance* 42, 483-510.

Nagel, S., 2005, Short sales, institutional investors and the cross-section of stock returns, *Journal of Financial Economics* 78, 277-309.

Roll, R., 1984, A simple implicit measure of the effective bid-ask spread in an efficient market, *Journal of Finance* 39, 1127–1139.

Roll, R., E. Schwartz, and A. Subrahmanyam, 2007, Liquidity and the law of one price: The case of the futures-cash basis, *Journal of Finance* 62, 2201-2234.

Rubin, A., 2007, Ownership level, ownership concentration and liquidity, *Journal of Financial Markets* 10, 219–248.

Sadka, R. 2006, Momentum and post-earnings-announcement drift anomalies: The role of liquidity risk, *Journal of Financial Economics* 80, 309–349.

Stoll, H, 2014, High speed equities trading: 1993-2012, *Asia-Pacific Journal of Financial Studies* 43, 767-797.

White, H., 1980, A heteroskedasticity-consistent covariance matrix and a direct test for Heteroscedasticity, *Econometrica* 48, 817–838.

Yin, H., 2011, Liquidity externalities and information spillover between the equity and corporate bond markets: An empirical study, *International Journal of Economics and Finance* 3, 65-75.

Table 1
An Example of a Two-Step Spinoff

This table reports an example of a two-step spinoff (divestiture) procedure for Associates First Capital Corp. (AFC) spun off by Ford Motor Company (Ford), which announced its spinoff plan on October 8, 1997 and completed the spinoff on April 7, 1998.

Timeline	**IPO Date**	**Spinoff Announcement Date**	**Spinoff Effective Date (ED)**
Date	May 7, 1996	October 8, 1997, 5:04 p.m.	April 7, 1998
	Ford Motor Co. (Ford) conducts an initial public offering of its fully-owned Associates First Capital Corp. (AFC), selling 19.3% of its shares.	Ford announces that it will spin off its 80.7% of the AFC shares to Ford's shareholders: 0.262085 shares of AFC stock for each share of Ford's stock (Class A or B shares).	Ford distributes all (80.7%) of the common shares of AFC that it owns to its shareholders of record as of March 12, 1998. The spinoff effective date (ED) has been announced on March 3, 1998.

Table 2

Descriptive Statistics for Two-Step Spinoff Subsidiary Firms and their Related Firms

Descriptive statistics for the sample firms. Each subsidiary firm in the sample was spun off (or split off) and its shares were transferred to its parent firm's shreholders after part (less than 20%) of its common stock had been publicly traded. We include firms with SHRCD = 10 or 11 in CRSP. For a firm eligible as a subsidiary, its price one day before the spinoff effective date (ED) should exceed $2.00, its market value should exceed $50 million, and it should have return data for 100 trading days before the ED (with at least 65 trading days) and 100 trading days after the ED. All subsidiary firms are listed on the NYSE/AMEX/NASDAQ. The study period is from 1986 to 2017 based on the ED. Each spinoff subsidiary firm is matched with a set of related firms selected based on either of two criteria: (i) The firm is in the same industry as the spinoff subsidiary firm (using Fama and French's 48 industries) and is among the 100 firms with the highest absolute value of their return correlations (|*Corr*|) with the spun-off subsidiary firm calculated over 100 days before the ED (an eligible stock has at least 22 days with positive trading volume during the pre-ED and post-ED periods); or (ii) The firm is among the 100 firms with the highest product similarity scores of Hoberg and Phillips (2010, 2016) (HP-scores) in the year of the spinoff's ED; annual data on such firms are available from 1996. Panel A includes the statistics for the spinoff subsidiary firms. P_{ED-1} and MV_{ED-1} (in $million) in Panel A are, respectively, the stock price and the market value (price times the number of shares outstanding, in $million) of subsidiary firms on day ED−1. Panels B and C present the statistics for the portfolios of related firms matched with one of the 68 and 43 spun-off subsidiary firms based on |*Corr*| and the HP-score, respectively. For each portfolio of related firms, we first calculate the average of the variables across the firms included in each portfolio and then average those values across the 68 and 43 portfolios. $AvgP_{ED-1}$ and $AvgMV_{ED-1}$ (in $million) in Panels B and C are, respectively, the average stock price and the average market value of the related firms on day ED−1. The panels also include *Avg|Corr|* for the portfolios that match 68 spun-off firms and *AvgHP-Score* for the portfolios that match 43 spun-off firms. *NFirm_Matched* is the average number of related firms matched with each of the spun-off subsidiary firms. *NPortfolio* is the number of the spun-off subsidiary firms for which related firms are available. *N* is the total number of spun-off subsidiary firms or their related firms.

Item	Mean	Median	Quartile 1	Quartile 3	NPortfolio	N
	Panel A: Spun-off Subsidiary Firms					
P_{ED-1}	22.49	20.28	11.19	29.87	-	68
MV_{ED-1}	3058.75	1050.73	401.02	3345.12		
	Panel B: Related Firms Matched Based on |Corr|					
$AvgP_{ED-1}$	24.28	22.13	18.59	27.88	68	6365
$AvgMV_{ED-1}$	3647.90	2604.65	1207.39	5356.92		
Avg|Corr|	0.2281	0.2049	0.1448	0.2686		
NFirm_Matched	93.60	100.00	100.00	100.00		
	Panel C: Related Firms Matched Based on the HP-Score					
$AvgP_{ED-1}$	27.72	24.48	19.79	31.97	43	2300
$AvgMV_{ED-1}$	8771.27	2454.33	1253.69	6331.00		
AvgHP-Score	0.0334	0.0270	0.0230	0.0389		
NFirm_Matched	53.49	47.00	11.00	100.00		

Table 3

(Il)liquidity Changes around the Effective Date for the Parent Firms and their Spun-off Subsidiaries

This table reports the average values of (il)liquidity measures and their changes around the spinoff effective date (ED) for the parent firms (in Panel A) and the 64 subsidiary firms (in Panel B) that underwent a two-step spinoff; see Table 2 for the details on sample selection. For each firm, the mean and median values of the daily (il)liquidity measures are first calculated in the pre-ED period (days ED−100 to ED−1) and the post-ED period (days ED+1 to ED+100). Reported in the table are the averages of the means, medians, and their differences (the values in the post-ED period minus the value in the pre-ED period) across the sample firms. The variables are defined as follows. *TURN* is daily share turnover (share volume/number of shares outstanding) in %. *ILLIQ* is the daily Amihud (2002) measure of illiquidity (the ratio of daily absolute return to daily volume in $mill). The following six variables are constructed using the ISSM/TAQ databases. *PESPR* is the daily average of intra-daily proportional effective spreads (effective spread/quote midpoint) in %. *PQSPR* is the daily average of intra-daily proportional quoted spreads (quoted spread/quote midpoint) in %. $\bar{\varphi}^{BS1}$ and $\lambda^{BS1}$are, respectively, the fixed and variable components of trading costs estimated by the Glosten and Harris (1988) model following Brennan and Subrahmanyam (1996). $\bar{\varphi}^{BS2}$ and λ^{BS2} are the respective components of trading costs using the Brennan and Subrahmanyam (1996) method that employs intra-daily unexpected dollar order flows as proposed by Foster and Viswanathan (1993). $\bar{\varphi}^{BS1}$ and $\bar{\varphi}^{BS2}$ are multiplied by 10^2 (set at zero if negative), while λ^{BS1} and λ^{BS2} are multiplied by 10^6 (set at zero if negative). The classification of each trade into buyer-initiated or seller-initiated follows the Lee-Ready (1991) algorithm (with a 5-second delay rule) up to 1992 and the Holden-Jacobsen (2014) algorithm (that use time-interpolation and match trades with national best bid and offer (NBBO) quotes across all exchanges) for the 1993-2017 period. *N* is the number of observations that are available to compute the cross-sectional average values. The *t*-values for the mean or median differences are to test if the difference is equal to zero, and those for the fraction are to test if the fraction equals 0.5, the chance result. The values significantly different from zero or 0.50 at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

(Table 3: continued)

Panel A: Changes in (Il)liquidity around the ED for the Spinoff Parent Firms

Measures of (Il)liquidity	Average of				Average Change of						Fraction of Negative Changes in Means			N
	Means		Medians		Means			Medians						
	Pre-ED	Post-ED	Pre-ED	Post-ED	Difference		*t*-value	Difference		*t*-value	Fraction		*t*-value	
TURN	0.762	0.834	0.618	0.665	0.072		*1.33*	0.048		*1.13*	0.471		*-0.49*	68
ILLIQ	0.231	0.333	0.091	0.109	0.103		*1.15*	0.018		*1.60*	0.412		*-1.46*	68
PESPR	0.475	0.688	0.451	0.625	0.213	***	*3.24*	0.175	***	*3.66*	0.328	***	*-2.75*	64
PQSPR	0.593	0.867	0.580	0.836	0.275	***	*2.70*	0.256	**	*2.47*	0.328	***	*-2.75*	64
$\bar{\varphi}^{BS1}$	4.693	4.540	3.409	3.142	-0.153		*-0.19*	-0.267		*-1.55*	0.594		*1.50*	64
λ^{BS1}	0.420	0.630	0.080	0.045	0.210		*0.59*	-0.035		*-1.56*	0.531		*0.50*	64
$\bar{\varphi}^{BS2}$	5.554	3.794	4.777	3.227	-1.760		*-1.60*	-1.549		*-1.51*	0.547		*0.75*	64
λ^{BS2}	0.390	2.819	0.098	2.713	2.429		*0.92*	2.614		*0.99*	0.531		*0.50*	64

(Table 3: continued)

Panel B: Changes in (Il)liquidity around the ED for the Spun-off Subsidiaries

Measures of (Il)liquidity	Average of: Means		Average of: Medians		Average Change of: Means		Average Change of: Medians		Fraction of Negative Changes in Means		N
	Pre-ED	Post-ED	Pre-ED	Post-ED	Difference	*t*-value	Difference	*t*-value	Fraction	*t*-value	
TURN	0.762	1.377	0.465	0.897	0.616 ***	*6.36*	0.432 ***	*7.04*	0.088 ***	*-6.79*	68
ILLIQ	0.149	0.012	0.027	0.006	-0.138 **	*-2.34*	-0.020 ***	*-3.40*	0.897 ***	*6.55*	68
PESPR	0.785	0.563	0.733	0.529	-0.222 ***	*-2.91*	-0.204 ***	*-3.01*	0.779 ***	*4.61*	68
PQSPR	1.033	0.705	0.985	0.666	-0.328 ***	*-3.07*	-0.319 ***	*-3.21*	0.824 ***	*5.34*	68
$\bar{\varphi}^{BS1}$	5.656	4.395	4.515	3.974	-1.261 ***	*-3.05*	-0.541 *	*-1.71*	0.632 **	*2.18*	68
λ^{BS1}	6.791	0.264	0.234	0.069	-6.528 *	*-1.79*	-0.165 **	*-2.35*	0.956 ***	*7.52*	68
$\bar{\varphi}^{BS2}$	5.896	4.420	4.810	3.985	-1.477 ***	*-3.44*	-0.825 ***	*-3.07*	0.662 ***	*2.67*	68
λ^{BS2}	2.661	0.253	0.121	0.070	-2.409 *	*-1.71*	-0.052 ***	*-2.76*	1.000 ***	*8.25*	68

Table 4

(Il)liquidity Changes around the Effective Date for the Related Firms Matched Based on |*Corr*| and the HP-Score

This table reports the average values of (il)liquidity measures and their changes around the spinoff effective date (ED) for the portfolios of firms that are related to the spun off firms. For each of the 68 (or 43) spun off subsidiaries, we select a portfolio of 100 (or fewer) related firms using the two criteria described above. See Table 2 for the details on how we select the sample subsidiary firms and how we match each of the subsidiaries with its related firms. For the portfolios of related firms, we calculate the mean value of the measure at a deal level. The table presents the mean values across the 68 or 43 portfolios of related firms of the (il)liquidity measures in the pre- and post-ED periods as well as the difference between the portfolio mean values for the two periods. Panel A contains the results for the 68 portfolios of related firms (consisting of up to 6,365 firms) matched based on |*Corr*|, and Panel B does the same for the 43 portfolios of related firms (consisting of up to 2,300 firms) matched based on the HP-scores. The (il)liquidity measures are defined in Table 3. *NFirms* is the total number of the related firms matched with each of the spun-off subsidiary firms. The values significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Measures of (Il)liquidity	Panel A: Related Firms Matched Based on |Corr|					Panel B: Related Firms Matched Based on the HP-Score				
	Average of Means		Average Change of Means			Average of Means		Average Change of Means		
	Pre-ED	Post-ED	Difference	*t*-value	NFirms	Pre-ED	Post-ED	Difference	*t*-value	NFirms
TURN	0.715	0.801	0.086 ***	*4.02*	6365	0.908	0.987	0.079 ***	*2.78*	2300
ILLIQ	3.349	1.483	-1.866 **	*-2.42*	6365	0.458	0.234	-0.224 **	*-2.42*	2300
PESPR	1.499	1.428	-0.071 **	*-2.51*	6365	1.006	0.886	-0.119 ***	*-3.51*	2300
PQSPR	1.939	1.818	-0.121 ***	*-3.03*	6365	1.217	1.079	-0.138 ***	*-3.26*	2300
$\bar{\varphi}^{BS1}$	8.125	5.662	-2.463 ***	*-5.65*	6365	6.040	4.407	-1.633 ***	*-5.53*	2300
λ^{BS1}	73.398	19.099	-54.298 *	*-1.90*	6365	6.245	1.250	-4.995 ***	*-3.57*	2300
$\bar{\varphi}^{BS2}$	7.099	6.140	-0.959 ***	*-3.80*	6250	5.958	4.542	-1.416 ***	*-4.56*	2287
λ^{BS2}	4.829	2.565	-2.264 ***	*-4.07*	6250	2.062	0.724	-1.338 **	*-2.15*	2287

Table 5
Market-Adjusted (Il)liquidity and the Spillover Effect for the Related Firms

This table reports the results that are similar to those in Table 4, except that here the (il)liquidity measures are market-adjusted. The averages of market-adjusted means (*Avg of Mkt-adj Means*) are calculated by first subtracting the market's mean of the measure in the same period from each stock's value of the (il)liquidity measure. The market mean is calculated across all NYSE/AMEX/NASDAQ-listed firms that satisfy data filter requirements. Panel A contains the results for the 68 portfolios of 6,365 related firms matched based on |*Corr*|, and Panel B does the same for the 43 portfolios of 2,300 related firms matched based on the HP-scores. The (il)liquidity measures are defined in Table 3. *NFirms* is the total number of the related firms matched with each of the spun off subsidiary firms. The values significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

	Panel A: Changes in Market-adjusted (Il)liquidity for the Related Firms Matched Based on |Corr|						**Panel B: Changes in Market-adjusted (Il)liquidity for the Related Firms Matched Based on the HP-Score**					
Measures of	Avg of Mkt-adj Means		Avg Change of Mkt-adj Means				Avg of Mkt-adj Means		Avg Change of Mkt-adj Means			
(Il)liquidity	Pre-ED	Post-ED	Difference		*t*-value	NFirms	Pre-ED	Post-ED	Difference		*t*-value	NFirms
TURN	0.159	0.237	0.078	***	*3.82*	6365	0.277	0.353	0.076	***	*2.95*	2300
ILLIQ	1.921	0.020	-1.901	**	*-2.49*	6365	-0.760	-1.054	-0.293	***	*-3.00*	2300
PESPR	-0.045	-0.142	-0.097	**	*-2.47*	6365	-0.512	-0.621	-0.109	***	*-3.33*	2300
PQSPR	-0.004	-0.162	-0.158	**	*-2.71*	6365	-0.675	-0.779	-0.104	**	*-3.03*	2300
$\bar{\varphi}^{BS1}$	3.192	1.016	-2.176	**	*-5.06*	6365	1.385	0.103	-1.281	***	*-4.57*	2300
λ^{BS1}	73.563	19.348	-54.215	*	*-1.90*	6365	6.719	1.758	-4.961	***	*-3.44*	2300
$\bar{\varphi}^{BS2}$	2.153	1.529	-0.624	**	*-2.59*	6250	1.463	0.437	-1.026	***	*-3.48*	2287
λ^{BS2}	4.852	2.584	-2.268	***	*-3.99*	6250	2.146	0.427	-1.719	**	*-2.38*	2287

Table 6

Pre-ED Trends in the (Il)liquidity Measures and the Spillover Effect in the Related Firms

This table reports the results that are similar to those in Table 5, except that the sample related firms are split into two subgroups based on the pre-ED period trends in the (il)liquidity measures. The pre-ED trend (deteriorating or improving) in liquidity is determined by comparing the averages of the mean values (*Avg of Pre-ED Means*) of the (il)liquidity measures during the five trading days (about a week) in the two intervals: days ED−100 to ED−96 (denoted by [−100, −96]) vs. days ED−5 to ED−1 (denoted by [−5, −1]). The averages of market-adjusted means (*Avg of Mkt-adj Means*) is calculated by subtracting the market's mean of the measure in the same period from each stock's value of the (il)liquidity measure. The market mean is calculated across all NYSE/AMEX/NASDAQ-listed firms that satisfy data filter requirements. Panel A contains the results for the 68 portfolios of 6,365 related firms matched based on |*Corr*|, and Panel B does the same for the 43 portfolios of 2,300 related firms matched based on the HP-scores. Subpanels A1 and B1 present the results for the related firms whose liquidity improves in the 100-day pre-ED period, while Subpanels A2 and B2 do the same for the related firms whose liquidity deteriorates in the 100-day pre-ED period. The (il)liquidity measures are defined in Table 3. *NFirms* is the total number of the related firms matched with each of the spun off subsidiary firms. The values significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Panel A: Changes in Market-adjusted (Il)liquidity for the Related Firms Matched Based on |Corr|

Measures of (Il)liquidity	Avg of Pre-ED Means [-100, -96]	Avg of Pre-ED Means [-5, -1]	Avg of Mkt-adj Means Pre-ED	Avg of Mkt-adj Means Post-ED	Avg Change of Mkt-adj Means Difference	Avg Change of Mkt-adj Means *t*-value	NFirms
A1: Firms with Improving Liquidity in the Pre-ED Period							
TURN	0.511	0.998	0.174	0.309	0.134 ***	*4.22*	2945
ILLIQ	0.004	0.001	0.960	-0.492	-1.452 **	*-2.50*	3014
PESPR	1.478	0.982	-0.309	-0.418	-0.109 ***	*-3.09*	3445
PQSPR	1.912	1.297	-0.350	-0.493	-0.144 ***	*-3.23*	3462
$\bar{\varphi}^{BS1}$	9.302	4.070	2.516	0.613	-1.904 ***	*-3.18*	3557
λ^{BS1}	195.303	0.871	86.641	20.303	-66.337 *	*-1.74*	3054
$\bar{\varphi}^{BS2}$	7.818	4.353	1.323	0.469	-0.854 ***	*-4.15*	3331
λ^{BS2}	9.196	0.707	3.732	2.117	-1.615 ***	*-3.64*	2843
A2: Firms with Deteriorating Liquidity in the Pre-ED Period							
TURN	1.015	0.499	0.139	0.183	0.044 **	*2.17*	3269
ILLIQ	0.001	0.004	0.988	0.185	-0.804 ***	*-2.78*	3170
PESPR	1.260	1.805	0.012	-0.059	-0.071 *	*-1.90*	2521
PQSPR	1.655	2.337	0.073	-0.031	-0.104 *	*-1.97*	2428
$\bar{\varphi}^{BS1}$	4.324	15.425	3.946	1.677	-2.269 ***	*-2.67*	2305
λ^{BS1}	1.532	118.211	49.908	7.973	-41.935 *	*-1.93*	2755
$\bar{\varphi}^{BS2}$	4.664	8.593	1.879	1.586	-0.293 *	*-1.80*	2119
λ^{BS2}	0.993	6.200	3.417	2.061	-1.356 **	*-2.56*	2578

(Table 6: continued)

Panel B: Changes in Market-adjusted (Il)liquidity for the Related Firms Matched Based on the HP-Score

Measures of (Il)liquidity	Avg of Pre-ED Means [-100, -96]	Avg of Pre-ED Means [-5, -1]	Avg of Mkt-adj Means Pre-ED	Avg of Mkt-adj Means Post-ED	Avg Change of Mkt-adj Means Difference		Avg Change of Mkt-adj Means *t*-value	NFirms
B1: Firms with Improving Liquidity in the Pre-ED Period								
TURN	0.645	1.247	0.324	0.449	0.125	***	*3.99*	1131
ILLIQ	0.001	0.000	-0.724	-1.063	-0.339	***	*-3.16*	1061
PESPR	1.023	0.688	-0.662	-0.777	-0.116	***	*-3.18*	1249
PQSPR	1.255	0.845	-0.836	-0.969	-0.133	***	*-3.05*	1218
$\bar{\varphi}^{BS1}$	6.795	3.764	0.857	-0.309	-1.166	***	*-3.71*	1416
λ^{BS1}	37.424	0.369	8.764	2.019	-6.745	***	*-2.70*	1115
$\bar{\varphi}^{BS2}$	6.564	3.961	0.647	-0.125	-0.772	***	*-3.90*	1383
λ^{BS2}	1.965	0.381	1.187	0.381	-0.806	***	*-2.80*	1051
B2: Firms with Deteriorating Liquidity in the Pre-ED Period								
TURN	1.220	0.624	0.262	0.333	0.071	**	*2.05*	1099
ILLIQ	0.000	0.000	-0.739	-1.095	-0.356	**	*-1.97*	1122
PESPR	0.909	1.326	-0.358	-0.463	-0.104	*	*-1.81*	925
PQSPR	1.114	1.606	-0.517	-0.601	-0.084	*	*-1.93*	958
$\bar{\varphi}^{BS1}$	4.159	8.581	1.218	0.727	-0.491	**	*-2.45*	755
λ^{BS1}	0.441	3.307	3.578	1.512	-2.066	***	*-3.66*	1050
$\bar{\varphi}^{BS2}$	4.450	7.252	1.003	0.747	-0.255	**	*-2.34*	707
λ^{BS2}	0.348	1.640	1.765	0.437	-1.327	**	*-2.46*	1033

Table 7

A Placebo Test with the Lowest-Ranked Related Firms Matched Based on |*Corr*| and the HP-Score

This table reports the average values of (il)liquidity measures and their changes around the spinoff effective date (ED) for the portfolios of lowest-ranked firms that are related to the spun off firms. For each of the 55 (or 15) spun-off subsidiaries, we select a portfolio of 100 (or fewer) lowest-ranked related firms using the two criteria (|*Corr*| and the HP-score). For the portfolios of related firms, we calculate the mean value of the measure at a deal level. The table presents the mean values across the portfolios of related firms of the (il)liquidity measures in the pre- and post-ED periods as well as the difference between the portfolio mean values for the two periods. Panel A contains the results for the portfolios of lowest-ranked related firms (consisting of up to 4,952 firms) matched based on |*Corr*|, and Panel B does the same for the portfolios of lowest-ranked related firms (consisting of up to 780 firms) matched based on the HP-scores. The (il)liquidity measures are defined in Table 3. *NFirms* is the total number of the related firms matched with each of the spun-off subsidiary firms. The values significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

	Panel A: Related Firms with the Lowest |Corr|					**Panel B: Related Firms with the Lowest HP-Scores**				
Measures of	Average of Means		Average Change of Means			Average of Means		Average Change of Means		
(Il)liquidity	Pre-ED	Post-ED	Difference	*t*-value	NFirms	Pre-ED	Post-ED	Difference	*t*-value	NFirms
TURN	0.582	0.549	-0.033	*-1.51*	4951	0.972	0.815	-0.157	*-1.53*	780
ILLIQ	9.130	13.883	4.754 **	*2.17*	4952	2.229	2.814	0.585 **	*2.21*	780
PESPR	2.990	3.833	0.843	*1.06*	4727	1.872	2.152	0.281 **	*2.12*	777
PQSPR	3.667	3.706	0.039	*0.37*	4727	2.387	2.577	0.190	*1.24*	777
$\bar{\varphi}^{BS1}$	54.879	85.536	30.657	*0.41*	4715	12.887	8.544	-4.344	*-1.35*	777
λ^{BS1}	1406.765	1185.293	-221.471	*-0.27*	4715	29.726	18.643	-11.083	*-0.80*	777
$\bar{\varphi}^{BS2}$	10.651	10.822	0.171	*0.14*	4522	10.008	8.522	-1.486 **	*-2.48*	760
λ^{BS2}	20.005	23.398	3.394	*1.38*	4522	4.882	5.198	0.316	*0.84*	760

Table 8
Changes in *F*-values Around the Effective Date for the Related Firms

This table reports the results of tests on changes in the *F*-values from auto-regressive regressions around the effective date (ED) for the portfolio returns of the related firms. For each portfolio, *F*-values are first obtained from AR(3)-regressions using the portfolio average daily returns over the 100 trading days in the pre-ED period (ED-105 to ED-6) and in the post-ED period (ED+6 to ED+105). Then the difference of the two *F*-values, $dF = F_{post\text{-}ED} - F_{pre\text{-}ED}$, is computed for each portfolio. *Mean_dF* is the average (across the portfolios) of the differences in the *F*-values between the post-ED and pre-ED periods. The proportion of the cases where $dF < 0$ is also reported in the table along with the *t*-values (in parentheses) of whether the proportion is different from 0.50, the chance result. Panel A contains the results for the 68 portfolios of the 6,365 related firms matched based on |*Corr*| and Panel B does the same for the 43 portfolios of the 2,300 related firms matched based on the HP-score. See Table 2 for the details on sample selection. The daily returns used in column (1) are the CRSP-based raw returns, and those used in column (2) are the CRSP-based returns that are adjusted for non-synchronous trading (computed following Roll, Schwartz, and Subrahmanyam (2007)). The returns used in column (3) are the quote mid-point returns calculated from the ISSM/TAQ databases. The *t*-values under Mean_dF test if the difference is equal to zero. The values significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

	Returns Based on Transaction Prices		Returns Based on Quoted Prices
	Raw Returns	Returns Adjusted for Non-Synch. Trading	Quote Mid-Point Returns
	(1)	(2)	(3)
Item	**Panel A: 68 Portfolios of the 6,365 Related Firms Matched Based on |Corr|**		
Mean_dF	-0.4599**	-0.3534**	-0.7970***
(*t*-value)	(-2.02)	(-2.43)	(-2.67)
Proportion of Cases of dF < 0	0.60* (1.65)	0.62** (1.98)	0.62** (1.98)
	Panel B: 43 Portfolios of the 2,300 Related Firms Matched Based on the HP-Score		
Mean_dF	-0.6887**	-0.4447*	-0.7216**
(*t*-value)	(-2.19)	(-1.94)	(-2.26)
Proportion of Cases of dF < 0	0.67** (2.30)	0.60 (1.31)	0.70*** (2.62)

Table 9

Changes in Institutional Ownership around the Effective Date for the Subsidiaries and their Related Firms

This table reports the average values of variables related to institutional investors' ownership in the quarters straddling the quarter of the subsidiary's spinoff effective data (ED). The variables are computed using the quarterly Thomson Reuters Institutional Holdings (13F filers) database. *IO* is the institutional ownership (i.e., the number of the firm's shares held by institutional investors divided by the firm's number of shares outstanding at the end of that quarter). $IO_{mkt\text{-}adj}$ is the market-adjusted *IO*, computed as ($IO - IO_{mkt}$), where IO_{mkt} is the average of *IO*s across all firms available in the database during the quarter. *NInst* is the number of institutional investors that hold the stock in the quarter. *Breadth* is *NInst* divided by the total number of institutions available in the database during the quarter. The values of the above four variables are calculated in the pre-ED and the post-ED quarters, denoted by *q*-1 and *q*+1, respectively, skipping the quarter of the ED. Panel A contains the results for the spun off subsidiary firms. Panels B and C contain the results for the related firms which are aggregated at a deal level into portfolios. We first calculate the mean value for each portfolio and then average those values across portfolios. Panel B presents the results for 68 portfolios of firms matched by |*Corr*|, and Panel C presents results for 43 portfolios of firms matched by their HP-scores; see Table 2 for the details on sample selection. *NFirms* is the number of observations (firms) for which the quarterly variables related to institutional investors are available in the database. The *t*-values for the average differences are to test if the difference is equal to zero. The values significantly different from zero at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Panel A: Institutional Investors Ownership around the ED for the Spun-off Subsidiaries

Item	Pre-ED (*q* - 1)	Post-ED (*q* + 1)	Difference		*t*-value	NFirms
IO	0.292	0.627	0.334	***	*8.86*	68
$IO_{mkt\text{-}adj}$	-0.048	0.278	0.326	***	*8.61*	68
NInst	83.63	198.46	114.82	***	*9.01*	68
Breadth	0.048	0.116	0.068	***	*7.87*	68

(Table 9: continued)

	Panel B: Institutional Investors Ownership for the Related Firms Matched Based on |Corr|						Panel C: Institutional Investors Ownership for the Related Firms Matched Based on the HP-Score					
Item	Pre-ED (*q*-1)	Post-ED (*q*+1)	Difference		*t*-value	NFirms	Pre-ED (*q*-1)	Post-ED (*q*+1)	Difference		*t*-value	NFirms
IO	0.465	0.481	0.016	***	*8.25*	4975	0.528	0.550	0.023	***	*4.12*	2011
$IO_{mkt\text{-}adj}$	0.125	0.133	0.008	***	*4.83*	4975	0.162	0.176	0.014	**	*2.42*	2011
NInst	123.46	126.78	3.31	***	*3.83*	4991	156.99	161.59	4.61	***	*3.31*	2012
Breadth	0.073	0.074	0.001	**	*2.46*	4421	0.077	0.078	0.001	**	*2.15*	1738

Table 10
Value Changes around the Effective Date for the Spun-off Firms and their Related Firms

This table reports the cumulative abnormal returns (CARs) around the spinoff effective date (ED). Panel A contains the results for the 64 spun off subsidiary firms, as well as for the 64 portfolios consisting of 6,098 related firms matched based on |*Corr*|. Panel B does the same for the 39 spun off subsidiary firms, as well as for the 39 portfolios consisting of 1,984 related firms matched based on the HP-score. The sample period and the methods of matching the related firms are explained in Tables 2 and 3. For each day *d* (ED−5 ≤ *d* ≤ ED+60), the daily abnormal return (AR) is computed as $AR_{j,d} = (R_{j,d} - RM_d)$ where $R_{j,d}$ is the return of spun off stock *j* (*j* = 1,…, 64) on day *d*, and RM_d is the NYSE/AMEX/NASDAQ value-weighted average return on day *d* obtained from CRSP. For the 6,098 related firms matched by |Corr|, AR is calculated for each firm and then the mean value of their abnormal returns is obtained for corresponding portfolio *j* (*j* = 1,…, 64). The same process is applied for the 39 portfolios consisting of 1,984 related firms matched by the HP-score. Now the cumulative abnormal return for firm or portfolio *j* is calculated as $CAR_{j,T} = \Sigma^{T}_{d=\text{ED-5}} AR_{j,d}$, where *T* = ED+5 [i.e., CAR(−5, +5)] and *T* = ED+60 [i.e., CAR(−5, +60)] for each spun off firm and for each portfolio of the related firms. Reported in the table are the mean and median of CAR(−5, +5) and CAR(-5, +60) across the 64 (or 39) spun off firms and the portfolios of the related firms. The table also reports the fraction of positive CARs (*%Positive*), the *t*-test of whether the above fraction is different from 0.50 (the chance probability), and the weighted mean (*Wtd_Mean*) of CARs, where the weight is proportional to the reciprocal of the standard deviation of *ARs* that constitute CARs. The values different from zero (for *Mean* and *Wtd_Mean*) or 0.5 (for *%Positive*) at the significance levels of 1%, 5%, and 10% are indicated by ***, **, and *, respectively.

Panel A: 68 Spun-off Firms and Portfolios of Related Firms Matched Based on |Corr|

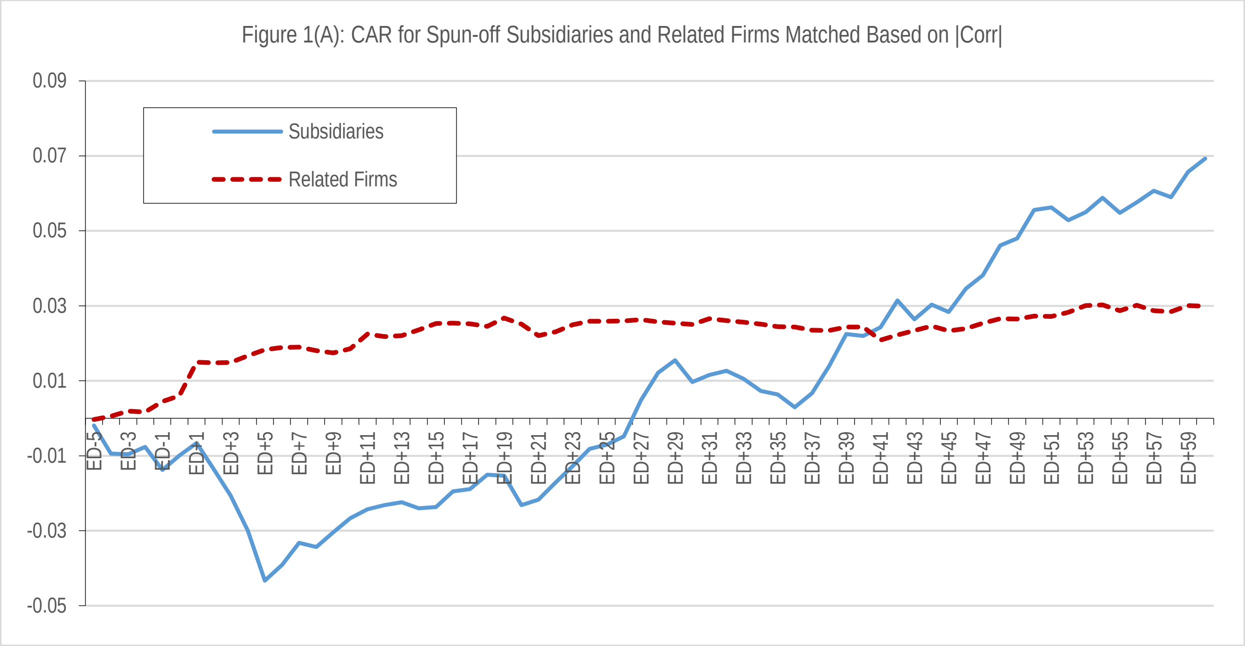
	A1: Spun-off Firms		**A2: Related Firms Based on |Corr|**	
Statistics	CAR(-5, +5)	CAR(-5, +60)	CAR(-5, +5)	CAR(-5, +60)
Mean (%)	-4.33**	6.93**	1.83***	2.99**
t-value	*-2.06*	*2.02*	*3.67*	*2.30*
Median (%)	-0.64	7.89	2.02	3.18
%Positive	0.471	0.676***	0.691***	0.647**
t-value	*-0.49*	*2.91*	*3.15*	*2.43*
Wtd_Mean (%)	-0.67	7.16***	1.68***	5.00***
t-value	*-0.66*	*3.93*	*4.75*	*5.04*

Panel B: 43 Spun-off Firms and Portfolios of Related Firms Matched Based on the HP-score

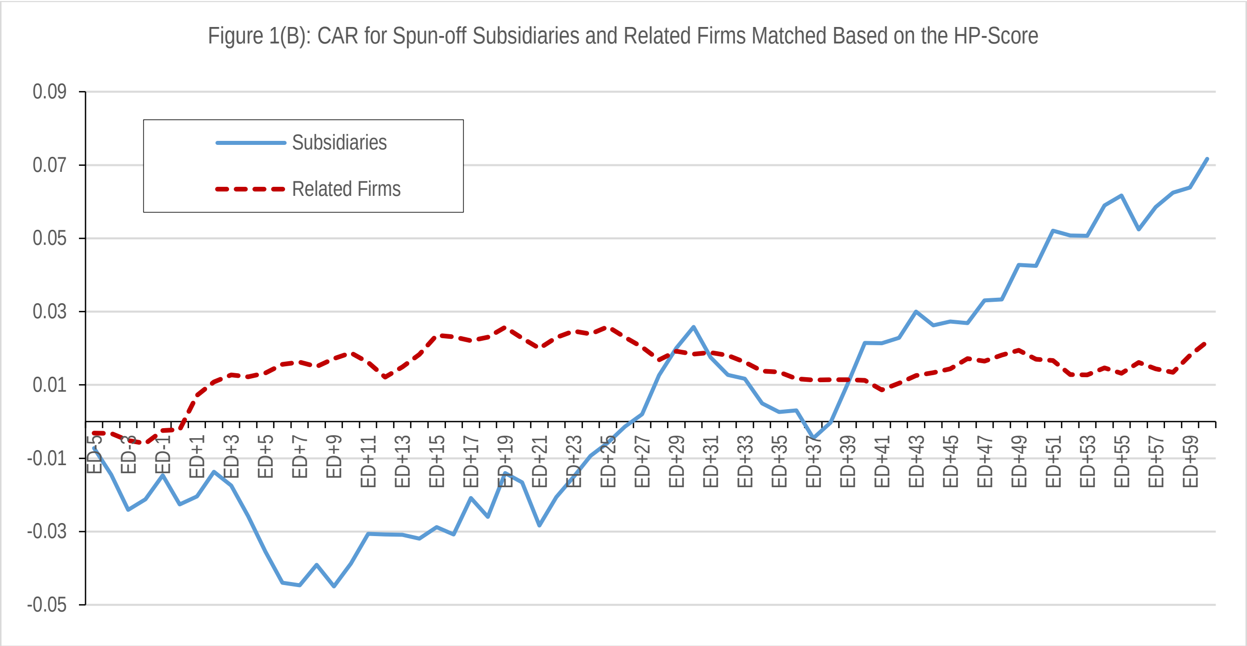
	B1: Spun-off Firms		**B2: Related Firms Based on |Corr|**	
Statistics	CAR(-5, +5)	CAR(-5, +60)	CAR(-5, +5)	CAR(-5, +60)
Mean (%)	-3.68	8.12*	1.33	2.18
t-value	*-1.28*	*1.86*	*1.49*	*0.99*
Median (%)	-0.01	6.34	1.58	2.74
%Positive	0.488	0.651**	0.628*	0.535
t-value	*-0.15*	*1.98*	*1.68*	*0.46*
Wtd_Mean (%)	0.30	6.72***	2.03***	4.12**
t-value	*0.23*	*2.83*	*3.71*	*2.56*

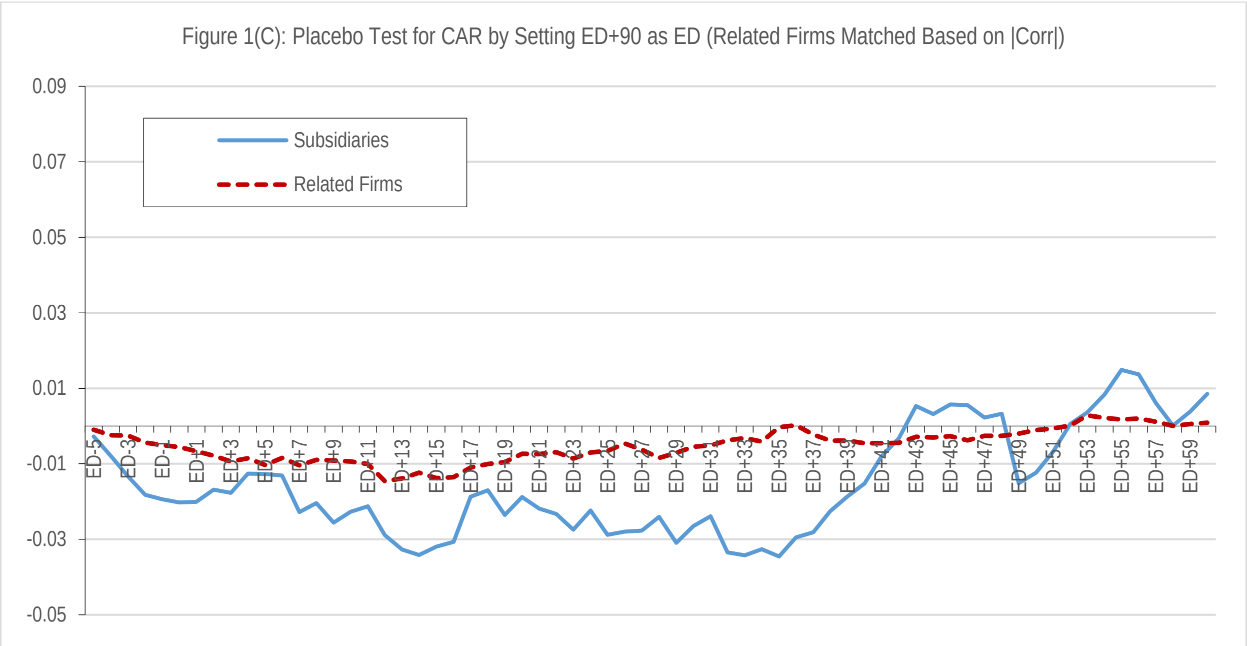
Figure 1. Cumulative Abnormal Returns (CARs) over Time around the ED for the Spun-off Subsidiaries and their Related Firms

In Figure 1(A), we plot the cumulative abnormal returns (CARs) over time around the spinoff effective date (ED) for the spun-off subsidiaries, as well as their related firms matched based on the absolute return correlations (|*Corr*|). The sample consists of the 68 spun-off firms as well as the 68 portfolios composed of 6,365 related firms. For each day *d* (ED−5 ≤ *d* ≤ ED+60), the daily abnormal return (AR) is computed as $AR_{j,d} = (R_{j,d} - RM_d)$ where $R_{j,d}$ is the return of spun-off stock *j* (*j* = 1,…, 68) on day *d*, and RM_d is the NYSE/AMEX/NASDAQ value-weighted average return on day *d* obtained from CRSP. For the 6,365 related firms matched by |*Corr*|, AR is calculated for each firm and the mean value of their abnormal returns is obtained for corresponding portfolio *j* (*j* = 1,…, 68). Next, the equally-weighted average (AR_d) of the means is computed on each day across the 68 spun-off firms as well as the 68 portfolios of the related firms. Finally, the CAR is calculated as $CAR_T = \Sigma^{T}_{d=\text{ED-5}} AR_d$, where *T* = ED−4, ED−3,…, ED+0, ED+1,…, ED+60 for the spun-off firms and their related firms. The solid line is the CAR for the 68 spun-off subsidiary firms, and the dotted line is the CAR for the 68 portfolios of related firms. Figure 1(B) does the same for the 43 spun-off subsidiary firms as well as for the 43 portfolios composed of 2,300 related firms matched based on the HP-scores. In Figure 1(C), we plot the placebo test results by setting ED+90 as ED for the 68 spun-off firms as well as for the 68 portfolios of related firms matched based on |*Corr*|. The sample period for the two-step spinoffs is from 1986 to 2017 based on the ED.



(Figure 1: continued)





Appendix

Table A1
The List of the Two-Step Spinoff Subsidiaries and their Parent Companies

This table reports the list of 64 subsidiary firms spun off through the two-step procedure and their parent firms. The sample includes subsidiaries that were spun off (more than 80% of shares) to the parent company's shareholders, after part of the stock (less than 20%) had been traded in the market for a while. For a spinoff subsidiary to be eligible as a sample firm, the price of the subsidiary firm one day before the spinoff effective date should be above $2.00 and its market value larger than $50 million. *Effective Date* (ED) is the date on which the spinoff was completed. The sample period is from 1986 to 2017 based on the effective dates of spinoffs.

No.	Parent Company Name	Spinoff Subsidiary/Target Name	Effective Date
1	Kay Corp	Kay Jewelers Inc	12/31/1986
2	Burlington Northern (BNI)	Burlington Resources	12/31/1988
3	Kaufman & Broad Inc	Kaufman & Broad Home Inc	3/7/1989
4	Smith Kline & French Labs (Smithkline Beckman Corp)	Beckman Coulter Inc	7/26/1989
5	Santa Fe Pac Corp	Santa Fe Energy Resources Inc	12/4/1990
6	Burlington Resources	El Paso Natural Gas Company	6/30/1992
7	Ethyl Corp	First Colony Corp	7/1/1993
8	Kmart Corp (Sears Roebuck & Co)	Dean Witter Discover & Co	7/12/1993
9	Pacific Telesis Group	Pactel	4/4/1994
10	Santa Fe Pacific (SFP)	Santa Fe Pacific Gold Corp	10/3/1994
11	Signet Banking	Capital One Financial (co)	2/28/1995
12	Healthdyne Inc	Healthdyne Technologies Inc	5/22/1995
13	Sears Roebuck & Co	Allstate Corp	7/12/1995
14	Eli Lilly	Guidant	9/25/1995
15	First Mississippi Corp	First Miss Gold Inc	10/20/1995
16	AT&T Corp	Lucent Technologies Inc	9/30/1996
17	Sterling Software Inc	Sterling Commerce Inc	10/7/1996
18	Union Pacific Corp	Union Pacific Res Group Inc	10/15/1996
19	Lockheed Martin	Martin Marietta Materials	10/22/1996
20	Tridex Corp	Transact Technologies Inc	3/31/1997
21	Trinity Industries Inc	Halter Marine Group Inc	3/31/1997
22	Communications Satellite Corp	Ascent Entertainment Group Inc	6/27/1997
23	Enserch Corp	Enserch Exploration Inc	8/5/1997
24	Mego Financial Corp	Altiva Financial Corp	9/2/1997
25	Odetics Inc	ATL Products Inc	10/31/1997
26	WMS Industries Inc	Midway Games Inc	4/6/1998
27	Ford Motor Co	Associates First Capital Corp	4/7/1998
28	Limited Inc	Abercrombie & Fitch	5/14/1998
29	Fingerhuts Companies INC	Metris Companies INC	9/25/1998
30	Bindley Western Industries INC	Priority Healthcare Group	12/31/1998
31	Cincinnati Bell Inc	Convergys Corp	12/31/1998
32	Creative Computers Inc	uBid	6/8/1999

(Table A1: continued)

No.	Parent Company Name	Spinoff Subsidiary/Target Name	Effective Date
33	ei dupont de nemours	Conoco	8/9/1999
34	AMR Corp	Sabre Holdings Corp	3/15/2000
35	Daisytek International Corp	PFSWEB	7/6/2000
36	3Com Corp	Palm Inc	7/27/2000
37	HNC Software	Retek	9/29/2000
38	Cabot Corp	Cabot Microelectronics Corp	10/2/2000
39	Deluxe Check Printers	Efunds Corp	12/29/2000
40	Eaton Axel & Spring Co	Axcelis Technologies Inc	12/29/2000
41	Southern Co	Mirant Co	4/2/2001
42	Sara Lee Corp	Coach	4/5/2001
43	Williams Cos	Williams Communications Group Inc	4/23/2001
44	Methode Electronics Inc	Stratos Lightwave Inc	4/30/2001
45	Cabletron	Riverstone Networks Inc	8/6/2001
46	Thermo Electron Corp	Kadant	8/9/2001
47	FMC Corp	FMC Technologies	12/31/2001
48	Millipore Corp	Mykrolis Corp	2/27/2002
49	Lucent Technologies Inc	Agere Systems Inc	6/1/2002
50	L-3 Communications Holdings	Surebeams Corp (Titan Corp)	8/5/2002
51	Pharmacia Corp	Monsanto Co New	8/13/2002
52	Reliant Energy Inc	Reliant Resources Inc	9/30/2002
53	Allete	Adesa Inc	9/20/2004
54	Viacom	Blockbuster	10/5/2004
55	E-Z-EM	AngioDynamics	10/30/2004
56	PC Mall Inc	Ecost Com Inc	4/11/2005
57	Wendy's International Inc	Tim Hortons Inc	9/29/2006
58	Fidelity National Financial Inc	Fidelity National Title Group Inc	10/24/2006
59	Altria Group Inc	Kraft Foods Inc	3/30/2007
60	Halliburton	KBR Inc	4/5/2007
61	Synovus Financial Corp	Total System Services Inc	12/31/2007
62	Time Warner Inc New	Time Warner Cable Inc	3/27/2009
63	Bristol Myers Squibb	Mead Johnson Nutrition	12/23/2009
64	Forest Oil Corp	Lone Pine Resources Inc	9/30/2011
65	Sunoco Inc (Sunoco)	Suncoke Energy Inc (Suncoke)	1/17/2012
66	Pfizer	Zoetis	6/24/2013
67	Compuware Corp	Covisint Corp	10/31/2014
68	Ashland Global Holdings Inc	Valvoline Inc	5/12/2017

Table A2

Statistics on the Related Firms Matched Based on Absolute Return Correlations and the Hoberg-Phillips Scores

This table reports the statistics on the related firms matched with each of the 64 spinoff subsidiary (or target) firms based on the absolute value of return correlations (|*Corr*|) and the product similarity scores of Hoberg and Phillips (2010, 2016) (HP-Scores). For a subsidiary to be eligible as a sample firm, it should be spun off to its parent company's shareholders after part (less than 20%) of its common stock (SHRCD = 10 or 11 in CRSP) has been traded in the stock market for a while, and its price one day before the effective date (ED−1) should be above $2.00 and its market value larger than $50 million. To match a subsidiary firm with related firms, return correlations between the subsidiary firm and other firms in the same industry (within one of the 48 industries classified by Fama and French) are computed over the days in the pre-ED period. The pre-ED period is a 100-trading-day interval from days ED−100 to ED−1. The firms in the same industry are ranked in descending order of the absolute value of the correlations, and firms (as *Related Firms*) are selected (up to rank 100) in Panel B. For a firm to be eligible as one of the related firms in Panel B, the firm in the same industry should have at least 22 positive-volume days (one month) in the pre-ED and post-ED periods, and the rank in the pre-ED absolute return correlation should be 100 or lower. For each subsidiary firm, another set of related firms is selected (in Panel C) in a similar way using the HP-scores, which are available from 1996 on an annual basis. The variables are defined as follows. *Effective Date*: the day on which a spinoff is completed (ED); *PERMNO*: the permanent number of a firm; P_{ED-1}: the stock price of a subsidiary firm on day ED−1; MV_{ED-1}: the market value (price*the number of shares outstanding, in $million) of a subsidiary firm on day ED−1; *NFirm_Matched*: the number of related firms matched with one of the subsidiary firms; $AvgP_{ED-1}$: the stock price averaged across related firms matched with each of the 68 (or 43) spun off firms on day ED-1; $AvgMV_{ED-1}$: the market value (price*the number of shares outstanding, in $million) averaged across related firms matched with each of the 68 (or 43) spun off firms on day ED−1; *Avg*|*Corr*|: the return absolute correlations (between a subsidiary firms and its related firm in the pre-ED period) averaged across related firms matched with each of the 68 spun off firms; and *AvgHP-Score*: the product similarity scores of Hoberg and Phillips (2010, 2016) averaged across related firms matched with each of the 43 spun off firms. The sample includes the 68 NYSE/AMEX/NASDAQ-listed firms that were spun off between 1986 and 2017 (based on the ED) and the related firms matched with the subsidiary firms.

(Table A2: continued)

No.	Effective Date	Panel A: Spinoff Subsidiaries			Panel B: Related Firms Matched Based on |Corr|				Panel C: Related Firms Matched Based on HP-Scores			
		PERMNO	P_{ED-1}	MV_{ED-1}	NFirm_Matched	$AvgP_{ED-1}$	$AvgMV_{ED-1}$	Avg|Corr|	NFirm_Matched	$AvgP_{ED-1}$	$AvgMV_{ED-1}$	AvgHP-Score
1	12/31/1986	67627	20.00	127.50	52	18.50	440.39	0.1133	-	-	-	-
2	12/31/1988	75333	32.63	4880.70	100	24.80	1084.08	0.2486	-	-	-	-
3	3/7/1989	70092	15.75	429.85	34	14.88	206.40	0.0813	-	-	-	-
4	7/26/1989	75383	18.13	516.56	25	16.51	714.42	0.0973	-	-	-	-
5	12/4/1990	76122	16.38	1045.22	100	21.59	2873.65	0.1681	-	-	-	-
6	6/30/1992	77481	23.75	865.02	100	27.10	2003.71	0.1335	-	-	-	-
7	7/1/1993	78787	28.13	1386.56	100	28.18	1022.70	0.1736	-	-	-	-
8	7/12/1993	78946	36.75	6088.56	100	30.34	2390.09	0.3132	-	-	-	-
9	4/4/1994	80094	20.88	10103.50	100	20.47	870.89	0.2397	-	-	-	-
10	10/3/1994	80694	17.38	2282.31	84	9.66	498.55	0.1916	-	-	-	-
11	2/28/1995	81055	17.00	1123.14	100	20.99	898.58	0.2423	-	-	-	-
12	5/22/1995	79269	11.00	135.72	100	12.70	348.62	0.1319	-	-	-	-
13	7/12/1995	79323	31.75	14264.45	100	25.01	1118.88	0.1694	-	-	-	-
14	9/25/1995	81126	26.00	1868.36	100	12.56	675.60	0.1281	-	-	-	-
15	10/20/1995	11849	21.88	397.75	86	7.19	391.16	0.0852	-	-	-	-
16	9/30/1996	83332	43.63	27774.38	100	23.14	2653.59	0.2532	100	25.80	2227.68	0.0245
17	10/7/1996	83229	29.63	2221.88	100	21.47	1610.43	0.2022	100	21.57	1481.52	0.0224
18	10/15/1996	82308	28.75	7165.82	100	29.94	4686.19	0.2075	100	22.24	1396.40	0.0631
19	10/22/1996	80204	24.25	1117.42	100	13.26	415.48	0.1448	9	32.19	676.52	0.0314
20	3/31/1997	83910	12.13	81.52	100	18.49	1949.06	0.1831	-	-	-	-
21	3/31/1997	83990	16.63	306.73	100	22.10	861.73	0.1224	11	11.44	229.72	0.0235
22	6/27/1997	82703	8.63	256.63	100	18.62	2555.72	0.1448	38	20.61	2706.99	0.0237
23	8/5/1997	67491	9.81	1238.61	100	36.01	6078.71	0.2756	100	19.58	1318.78	0.0743
24	9/2/1997	84235	11.75	144.53	100	26.63	2308.47	0.1791	100	27.31	787.99	0.0705
25	10/31/1997	84598	10.63	102.58	100	19.46	2949.18	0.2145	100	19.04	1133.94	0.0524
26	4/6/1998	84031	23.63	909.56	100	14.89	1292.13	0.0954	15	13.94	431.45	0.0354
27	4/7/1998	83440	83.00	7529.01	100	52.28	5150.40	0.2819	100	40.01	6558.87	0.0208
28	5/14/1998	83976	43.63	350.13	100	25.54	4129.35	0.2022	39	24.87	1696.95	0.0378
29	9/25/1998	84107	46.25	889.16	100	40.89	5537.82	0.4019	100	20.17	1151.21	0.0763
30	12/31/1998	85495	39.75	91.46	100	16.29	719.61	0.2267	91	16.98	861.05	0.0364
31	12/31/1998	86305	19.50	2973.81	100	21.27	6187.51	0.2662	45	21.00	2115.60	0.0222
32	6/8/1999	86514	34.00	311.00	100	24.41	5887.79	0.1642	100	26.59	1307.62	0.0270
33	8/9/1999	86368	25.88	4933.95	100	27.78	7757.01	0.3203	-	-	-	-
34	3/15/2000	84036	47.25	1044.56	100	49.17	5215.45	0.2485	7	54.00	77446.67	0.0267
35	7/6/2000	87510	4.38	78.18	100	44.56	6772.76	0.3125	100	31.51	4087.24	0.0260

(Table A2: continued)

No.	Effective Date	Panel A: Spin-off Subsidiaries			Panel B: Related Firms Matched Based on |Corr|				Panel C: Related Firms Matched Based on HP-Scores			
		PERMNO	P_{ED-1}	MV_{ED-1}	NFirm_Matched	$AvgP_{ED-1}$	$AvgMV_{ED-1}$	Avg|Corr|	NFirm_Matched	$AvgP_{ED-1}$	$AvgMV_{ED-1}$	AvgHP-Score
36	7/27/2000	87800	36.69	20727.08	100	33.29	15268.12	0.2612	100	41.67	16735.63	0.0370
37	9/29/2000	87412	47.00	2225.73	100	43.22	7207.27	0.3527	100	41.18	6697.84	0.0254
38	10/2/2000	88152	48.00	1132.32	86	18.64	1236.89	0.0877	34	37.00	3559.36	0.0250
39	12/29/2000	88338	10.75	489.13	100	15.70	1877.16	0.2177	8	25.52	1199.76	0.0137
40	12/29/2000	88417	7.88	764.27	100	22.17	2342.08	0.2376	-	-	-	-
41	4/2/2001	88601	35.50	12023.96	100	32.35	4428.26	0.2409	-	-	-	-
42	4/5/2001	88661	28.49	1208.15	71	18.96	3120.08	0.1408	-	-	-	-
43	4/23/2001	87295	5.37	498.65	100	21.64	5342.97	0.3861	-	-	-	-
44	4/30/2001	88377	7.44	476.84	100	21.92	3529.21	0.4680	80	18.52	5592.05	0.0283
45	8/6/2001	88913	14.26	1532.81	100	24.28	7827.76	0.5409	100	13.79	5482.33	0.0400
46	8/9/2001	78077	13.50	165.74	100	20.42	1257.84	0.1010	1	20.01	501.31	0.0098
47	12/31/2001	89004	16.25	1056.25	100	24.41	1973.62	0.2399	5	26.67	56596.00	0.0240
48	2/27/2002	89132	10.18	402.11	85	13.76	878.69	0.0867	47	23.65	1960.70	0.0369
49	6/1/2002	88917	3.12	2269.67	100	17.52	6381.70	0.3725	55	15.05	6502.89	0.0410
50	8/5/2002	48696	11.25	868.63	100	12.58	3275.73	0.2580	27	24.65	4574.68	0.0375
51	8/13/2002	88668	16.51	4308.57	78	18.72	1979.30	0.1382	15	21.76	2764.60	0.0182
52	9/30/2002	88992	2.19	636.06	100	23.32	2532.38	0.2822	76	20.85	2454.33	0.0420
53	9/20/2004	90197	16.00	1517.60	100	21.65	980.89	0.1813	3	23.13	1541.21	0.0640
54	10/5/2004	87134	7.68	285.04	59	19.03	2878.92	0.1643	-	-	-	-
55	10/30/2004	90179	9.15	104.70	100	21.61	2666.32	0.1418	100	15.25	1140.83	0.0335
56	4/11/2005	90315	6.37	111.25	100	27.37	7407.26	0.2497	-	-	-	-
57	9/29/2006	91151	26.35	5093.53	95	23.74	2428.80	0.1782	19	29.50	2560.53	0.0149
58	10/24/2006	90925	21.60	672.78	100	45.22	8092.10	0.3070	-	-	-	-
59	3/30/2007	89006	31.52	14372.27	57	24.26	3931.54	0.1711	-	-	-	-
60	4/5/2007	91579	20.56	3446.74	53	39.54	1969.22	0.1453	11	54.75	71355.01	0.0224
61	12/31/2007	76639	28.12	5565.26	100	24.81	3478.70	0.3595	4	40.92	4730.38	0.0366
62	3/27/2009	91883	27.80	8358.65	100	17.14	5398.76	0.5779	49	10.38	7203.54	0.0483
63	12/23/2009	92890	43.09	3311.25	100	15.37	3610.43	0.1385	3	14.03	542.60	0.0257
64	9/30/2011	12743	7.04	598.53	100	30.73	10238.95	0.4223	100	31.82	7083.81	0.0654
65	1/17/2012	12905	12.63	884.18	100	35.91	9834.03	0.4514	62	32.29	6159.10	0.0266
66	6/24/2013	13788	30.60	3029.86	100	26.68	11143.65	0.1864	11	24.48	38686.46	0.0062
67	10/31/2014	14150	2.96	112.72	100	29.48	1958.58	0.2634	34	32.12	12460.25	0.0173
68	5/12/2017	16338	23.02	4708.30	100	29.15	11323.85	0.1984	1	104.05	1463.26	0.0003
Average (or Sum)			22.49	3058.75	93.60 (6365)	24.28	3647.90	0.2281	53.49 (2300)	27.72	8771.27	0.0334