What Happened in 1998? The Demise of the Small IPO and the Investing Preferences of Mutual Funds

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Abstract

The decline of the small initial public offering (IPO) occurred abruptly. In 1997, the number of IPOs raising less than the inflation-adjusted mean proceeds of 1990 was nearly half of all IPOs. By 1999, this percentage had fallen to just 10%, remaining below this level for most of the ensuing decade.

This paper presents a novel demand-side theory for the sudden and prolonged demise of small IPOs that focuses on the investment preferences of large mutual fund investors. We theorize that the rapid increase after 1990 in assets under management among the largest funds induced portfolio managers to take larger investment positions, heightening concerns about liquidity risk within their investment portfolios—concerns that naturally implicated smaller IPOs in light of their greater illiquidity. When global events in 1998 sparked a dramatic "flight to liquidity" and a surge in mutual fund redemptions, the amplified attention to liquidity risk caused demand for small IPOs to drop precipitously among the largest funds, prompting a vicious cycle of illiquidity-begets-illiquidity which has continued well past 1998.

To test this theory, we examine mutual fund investments in 6,110 IPOs between 1990 and 2014 using portfolio-level position information for 37,052 individual mutual funds. Our central identification strategy exploits the sudden increase in liquidity concerns brought about by the "Panic of 1998": an abrupt collapse in the demand for illiquid equities triggered by Russia's debt default in August 1998. Using a difference-in-difference strategy, we find that the largest quartile of mutual funds invested in more IPOs than smaller funds both before and after 1998. However, after 1998 the largest mutual funds invested in significantly fewer small IPOs and IPOs having a higher measure of illiquidity relative to investments by smaller funds, consistent with large funds being more sensitive to the liquidity risk of smaller offerings. Additionally, conditional on investing in an IPO, the largest funds also demonstrated a decisive shift towards purchasing larger, more liquid IPOs after 1998 than did smaller funds. In light of recent regulatory efforts to reinvigorate the small IPO market, our results highlight the need to consider more than "supply side" considerations such as regulatory burdens facing new issuers. Without first addressing the growing liquidity concerns of large institutional investors, efforts to revive the small IPO are unlikely to succeed

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I. Introduction

The decline of the small initial public offering (IPO) has been well-documented (Gao, Ritter and Zhu 2013; Doidge, Karolyi and Stulz 2013; Doidge, Karolyi and Stulz 2015). It has been less noted that this decline happened in the space of a few years. In 1997 there were 464 non-financial IPOs and 46% were small IPOs, which we define as an IPO raising proceeds of less than the inflation-adjusted mean in 1990 of $30 million. By 1998, this percentage declined to 30%, which would decline further to just 10% in 1999. Small IPOs—once a mainstay of U.S. corporate finance—were quickly relegated to the margins.

Given its implication for the financing of emerging enterprises, the sharp and persistent decline in the market for small IPOs has made the small IPO market a primary area of concern for policy makers since the turn of the century. Ranging from the formation in 2011 of the SEC's Advisory Committee on Small and Emerging Companies and the IPO Task Force at the prompting of the U.S. Treasury Department, to the Congressional enactment of the JOBS Act of 2012, the past decade has witnessed a multitude of approaches to reinvigorating the small IPO market. A common theme in all of these efforts has been a near exclusive focus on altering the cost-benefit calculation of smaller firms considering a public equity offering in hopes of increasing the supply of smaller firms conducting an IPO. A primary example is Title I of the JOBS Act of 2012. By exempting "emerging growth companies" from a variety of disclosure and audit requirements of the Securities Act of 1933, the JOBS Act sought to reduce the fixed costs of being a publicly-listed firm, costs which were believed to disproportionately burden smaller firms. More recent proposals to make an IPO appealing for smaller issuers have focused on dedicated "venture exchanges" which would similarly offer a lighter regulatory touch.[1]

In this article we put forth a new "demand" side theory for the decline in small IPOs since the late 1990s which focuses on the investment preferences of large mutual fund investors. Our demand side theory posits that a principal reason for the persistent absence of small IPOs stems from a significant decrease in the demand for small IPOs commencing in 1998 among the largest quartile of equity mutual funds—a group that collectively controls more than 90% of mutual fund assets. While our theory is complementary to other explanations, our demand side theory emphasizes that reform efforts aimed at addressing only the supply of smaller firms seeking an IPO are unlikely to result in a meaningful change in the number of small IPOs.

We theorize that the sharp drop in small IPOs in 1998 initially reflected a sudden shift in investment preferences among all mutual funds away from IPO risk in general. Beginning with the Asian financial crisis in 1997 and culminating with Russia's devaluation of the Ruble and subsequent debt default in August 1998, what we refer to as the "Panic of 1998", volatility within the global economic market prompted a wholesale flight to liquidity that had acute ramifications for investor demand for newly public firms. However, these events also had special

[1] *See* Stephen Luparello, Director, Division of Trading and Markets, *Testimony on Venture Exchanges and Small-Cap Companies*, Before the United States Senate Subcommittee on Securities, Insurance, and Investment, Committee on Banking, Housing, and Urban Affairs (Mar. 10, 2015).

significance for how large funds assessed small IPOs. Consequently, when mutual fund investors returned to the IPO market in subsequent years—in particular, from 1999 to 2000, from 2004 to 2007, and from 2012 to the present—a critical difference would be the noticeable absence of large mutual funds from the small IPO marketplace.

When the volatility scare of 1998 subsided, why did large mutual funds fail to return to the small IPO market? Our central hypothesis is that while mutual funds' general appetite for IPO risk was sharply diminished in 1998, the events of 1998 also prompted a fundamental reconsideration among mutual fund portfolio managers about the liquidity risk of investing in small IPOs. In particular, the accelerated growth of the largest quartile of mutual funds throughout the 1990s and 2000s made liquidity risk ever more salient for portfolio managers given that, as shown in Pollet & Wilson (2008), portfolio managers typically deployed new fund inflows towards taking larger individual investment positions. In such an environment, the limited public float of small IPOs enhanced the challenge of moving efficiently into and out of large positions in these transactions making it more difficult and more costly for portfolio managers at large funds to trade and manage small IPO investments. Moreover, given the sharp rise in large funds' assets under management (AUM), a large fund's position in even a successful small IPO would require considerable effort to trade efficiently yet yield a vanishingly small absolute contribution to the fund's return.

Against this backdrop, when the Panic of 1998 induced a flight to liquidity and a related surge in mutual fund redemptions, these liquidity risks were thrown into stark relief as portfolio managers grappled with liquidating large investment positions while witnessing a collapse in the market for small capitalization equities. The extreme volatility of 1998 was also quickly followed by the technology bubble and a push to invest in large capitalization internet stocks. The combined result was a swift and prolonged exodus of large mutual funds—once a core source of demand for smaller IPOs—from the small IPO marketplace, which only enhanced the real and perceived illiquidity of small IPOs.

To test this theory, we examine mutual fund investments in 6,110 IPOs between 1990 and 2014. For these purposes we segregate IPOs into small IPOs based on an IPO raising gross proceeds of less than $30 million in 1990 inflation-adjusted dollars (or $54.4 million in 2014 inflation-adjusted dollars).[2] We focus on this cut-off as it was approximately the mean offering size for IPOs conducted in 1990—the first year of our sample and a time period generally viewed as having a robust small IPO market. Because we lack reliable data on direct investments in IPOs by individual investors, we proxy for IPO investments by mutual funds using the Thomson-Reuters Mutual Fund (S12) Database (formerly CDA/Spectrum) which tracks mutual fund portfolio holdings on a bi-annual or quarterly basis.[3] Using this database, we examine portfolio-level data for 37,052 mutual funds using their approximately 582,000 position reports between

[2] We use the Consumer Price Index to make annual adjustments.

[3] Mutual funds have been required to disclose portfolio holdings once every quarter since 2004. Prior to 2004, mutual funds were required to disclose portfolio holdings once every six months. *See generally* Final Rule: Shareholder Reports and Quarterly Portfolio Disclosure of Registered Management Investment Companies Securities and Exchange Commission 17 CFR Parts 210, 239, 249, 270, and 274 [Release Nos. 33-8393; 34-49333; IC-26372; File No. S7-51-02], *available at* https://www.sec.gov/rules/final/33-8393.htm.

1990 and 2014. Assuming that any mutual fund holding an IPO security within six months of the IPO date represents a purchase by the fund in the IPO, we find an instance of an IPO investment in 64,044 (approximately 11%) of these position reports.

Our primary empirical tests focus on several difference-in-difference estimators of how mutual fund size affected annual IPO investments following the events of 1998. In particular, we classify mutual funds into annual size quartiles to examine how fund size affected IPO participation levels over time. Holding constant year fixed effects and fixed effects for individual mutual funds, we first find that the largest quartile of mutual funds invested in more IPOs per year than smaller funds both before and after 1998. Indeed, across all size quartiles, an increase in fund size is associated with more annual purchases of IPOs throughout the sample period. These findings are consistent with the basic fact that larger funds have more investment capital than smaller funds to deploy towards IPO investments.

In contrast, separate analysis of mutual fund investments in small IPOs reveals a distinctly different pattern across the four size categories of mutual funds. Whereas prior to 1998 larger funds acquired more small IPOs than smaller funds, our difference-in-difference estimator reveals a reversal of this pattern following 1998, as predicted by our demand-side theory. More specifically, compared to their purchases of small IPOs in the period prior to 1998, we estimate that mutual funds in the first, second, third, and fourth size quartiles reduced their average annual investments in small IPOs after 1998 by approximately 23%, 73%, 89% and 100%, respectively. Overall, these estimates suggest a complete collapse in the demand for small IPOs among what had previously been a key component of the market for these offerings.

To isolate better the role of IPO illiquidity on mutual fund demand, we similarly examine how mutual fund size was associated with fund investments in illiquid IPOs. Using an interrupted time series analysis, we find that the peak of the Panic of 1998 resulted in a sudden, virtually discontinuous drop in the illiquidity of IPOs calculated using Amihud's (2002) measure of illiquidity. We attribute this finding to the withdrawal of issuers from the IPO market except for those likely to generate significant after-market trading interest. Notwithstanding this overall decline in IPO illiquidity, however, our difference-in-difference estimator indicates that after 1998, smaller funds significantly outpaced larger funds in their acquisition of IPOs ranking in the top quartile of illiquid IPOs for the year. We similarly find that, among funds that invested in IPOs in a given year, no significant difference existed among different size funds in the average illiquidity of their IPO acquisitions prior to 1998. After this date, however, we find a statistically significant decline in the average illiquidity of IPO acquisitions among funds in the largest quartile relative to that of the three smaller fund quartiles.

We further test our demand-side theory by examining investor demand for those IPOs that were completed during the sample period. If the absence of small IPOs after 1998 were driven primarily by supply-side considerations, standard economic theory would predict heightened demand among mutual fund investors for those small IPOs that actually made it to market.[4]

[4] Assuming, of course, a downward sloping demand curve for IPOs. While such a demand curve is arguably inconsistent with the Capital Asset Pricing Model, it is far from clear whether the assumptions of CAPM apply to IPOs. On the contrary, the standard

However, using the number of large fund investors in an IPO as a proxy for demand among the largest funds, we find instead that after 1998, the largest quartile of mutual funds displayed a dramatic increase in the demand for non-small IPOs rather than small IPOs. Likewise, we similarly find a significant shift among the largest quartile of investors toward the most liquid IPOs after this point in time. Both findings are consistent with the notion that the largest funds—to the extent they invested in IPOs at all after 1998—were increasingly drawn to larger, more liquid transactions.

Finally, we examine why the Panic of 1998 might have had such long-lasting effects on the small IPO market. We theorize that the flight away from small IPOs in 1998 due to concerns about small IPO illiquidilty likely contributed to a vicious cycle of illiquidity-begets-illiquidty for small issuers. That is, becaue liquidity itself is a function of investor demand, the rapid withdrawal from this market of funds controlling over 90% of mutual fund assets could only aggravate the illiquidity of small IPOs, further deterring large fund investors. In combination with the fact that illiqudity among non-IPO securities declined between 1990 and 2014, the result should have been an increase in small IPOs' relative illiquidity within the overall market. Consistent with this theory, we find that while the median illiquidty of small IPOs declined with the overall market through 1998, this pattern reverses itself in subsequent years. By early 2002 the median small IPO had moved from being in the third quartile of market illiquidity to being solidly in the fourth quartile, thereby representing some of the most illiquid exchange-traded securities. The median illiquidity of larger IPOs, in contrast, generally reflected the decline in illiquidity within the general equities market since 1990.

At their most general level, these findings provide compelling evidence that policy proposals aimed at reversing the sustained absence of small IPOs since 1998 are unlikely to succeed without careful attention to the diminished demand for small IPOs among the largest mutual fund investors. These findings also highlight the considerable hurdles standing in the way of any such policy enterprise. That is, the accelerated rate at which the largest mutual funds have grown in AUM since the 1990s has only heightened for these funds the liquidity risk associated with investing in small IPOs. As such, secular changes in the structure of the mutual fund industry may accordingly impede anything resembling the pre-1998 market for small IPOs. Nonetheless, our findings suggest that "supply-side" reforms to the small IPO market are likely to be most effective when coupled with reforms that encourage large fund investment in small IPOs despite the liquidity risks they pose. For similar reasons, they also emphasize how pending efforts to enhance the liquidity of mutual funds, such as the SEC's September 2015 proposal to require Liquidity Risk Management Programs for open-end mutual funds, may inadvertently impose significant barriers for small company capital formation.[5]

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book-building process used by underwriters for pricing new issues suggests that investors place a premium on the idiosyncratic risk associated with IPOs.

[5] *See* Proposed Rule: Open-End Fund Liquidity Risk Management Programs; Swing Pricing; Re-Opening of Comment Period for Investment Company Reporting Modernization Release 17 CFR Parts 210, 270, 274 [Release Nos. [Release Nos. 33-9922; IC-31835; File Nos. S7-16-15; S7-08-15], available at https://www.sec.gov/rules/proposed/2015/33-9922.pdf. The proposed rule would require each registered open-end mutual fund (including open-end ETFs) to establish a liquidity risk management program to ensure a fund can meet redemption requests without materially affecting the fund's net asset value. Among other things, the

This paper proceeds as follows. Section II reviews the existing literature on the demise of the market for small IPOs. Section III discusses the theoretical motivation for our demand-side theory. With this background in place, Section IV describes our data and provides summary statistics, and Section V presents the empirical tests and the results. Section VI offers a brief conclusion.

II. Existing Theories for the Demise of the Small IPO

The demise of the small company IPO has generated significant interest and debate. Many observers attribute the decline to regulatory and market changes which occurred around the turn of the millennium, including the passage of the Sarbanes-Oxley Act, decimalization, Regulation FD, and the Global Research Analyst Settlement. We note that some of the theories suggest that regulatory changes created a lack of supply of small IPOs by making it more difficult and costly for smaller companies to become and stay public companies, while other theories suggest that regulatory changes affected demand for small IPOs by undermining the incentives of key intermediaries, including investment banks and broker-dealers. We label these "supply-side" and "demand-side" explanations, respectively, and describe the most prominent of these theories in the following sections.

A. Supply-Side Theories

Supply-side theories typically link the decline in small IPOs directly to federal regulatory changes. Most prominent among these are those focusing on the increased regulatory burdens smaller public companies face due to the Sarbanes-Oxley Act of 2002 (Sarbanes-Oxley). A 2007 report commissioned by New York Senator Chuck Schumer and New York City Mayor Michael Bloomberg, for example, attributes a decline in the relative competitiveness of U.S. equity markets, particularly for smaller firms, in part to the "undue burden" of Sarbanes-Oxley Section 404 compliance costs.[6] The Committee on Capital Markets Regulation (2006) also argued that Sarbanes-Oxley's compliance costs negatively impacted U.S. competitiveness, particularly for smaller firms.

Numerous studies have analyzed the impact of Sarbanes-Oxley on smaller companies' incentive to become or remain publicly-traded firms. For instance, Kamar, Karaca-Mandic and Talley (2007) find proportionately higher auditing costs for smaller firms post Sarbanes-Oxley, and Ahmed, McAnally, Rasmussen and Weaver (2010) find Sarbanes-Oxley was associated with a decrease in average firm cash flows of 1.3% of total assets. A number of studies have also

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proposal would require funds to classify and disclose for each position "the number of days within which a fund's position in a portfolio asset would be convertible to cash at a price that does not materially affect the value of that asset immediately prior to sale." To the extent mutual funds seek to minimize disclosure of mutual fund liquidity risk, the proposal may bias firms against taking positions in smaller issuers given their greater illiquidity. As stated by the SEC in its proposal, "if a fund holds a significant position in a small-capitalization security, this could indicate that its position is relatively illiquid."

[6]Michael R. Bloomberg & Charles E. Schumer, *Sustaining New York's and the U.S.' Global Financial Services Leadership* 97 (2007), http://www.nyc.gov/html/om/pdf/ny_report_final.pdf.

examined whether Sarbanes-Oxley caused firms to leave public equity markets through acquisitions and other going-private transactions. For instance, Engel, Hayes, and Wang (2007) find that Sarbanes-Oxley compliance costs weigh more heavily on smaller firms, causing them to go-private more frequently after the Act was passed. Kamar, Karaca-Mandic and Talley (2009) find that small firms were 53% more likely to be acquired by private firms than by public firms following the passage of Sarbanes-Oxley. Bartlett (2009) similarly finds that, to the extent the regulatory costs of Sarbanes-Oxley influenced firms to go private, the effects were largely limited to smaller firms. In particular, Bartlett finds that while going-private transactions increased in the years after Sarbanes-Oxley, so too did firms' reliance on high-yield debt to finance these transactions, particularly among larger firms. Because high-yield debt financing required private firms to subject themselves to the most costly provisions of Sarbanes-Oxley, Bartlett concludes that this evidence "strongly suggest[s] that non-SOX factors were the primary impetus for the 'name brand' buyouts commonly evoked as evidence that SOX has harmed the competitiveness of U.S. capital markets." (Bartlett 2009).

B. Demand-Side Theories

Without necessarily refuting these supply-side theories, a separate set of theories (of which we include our own) have focused on the diminished demand for small IPOs as the primary culprit for the reduced quantity of small offerings. As with supply-side theories, many focus on the effect of regulatory interventions around the turn of the millennium and their adverse effect on investor demand for IPOs. Of particular focus has been the effect of reforms such as Regulation FD (enacted in 2000), the Global Research Analyst Settlement (reached in 2003), and decimalization (completed in 2001) on the incentive on market intermediaries to promote and market IPO securities. For instance, following revelation that research analysts of the largest investment banks were pressured to render positive reports on IPOs underwritten by their investment banking colleagues, several investment banks, FINRA, the SEC, and the New York Attorney General agreed to police conflicted reporting in the Global Research Analyst Settlement (the Settlement). According to Morten (2011), the Settlement, by mandating the separation of investment banking and investment research, "reduced substantially the resources available to support sell-side research at a time when those resources were already declining due to industry consolidation and a downward trend in commission rates (driven in recent years by a shift to electronic trading, decimalization, and by increasing regulatory scrutiny of how investment managers were using their clients' commission [a.k.a. 'soft'] dollars)."

Likewise, several studies have examined the effect of the SEC's order-handling rules and decimalization on the provision of analyst coverage for smaller firms. Both reforms reduced trading costs for investors but at the cost of eroding brokerage profitability, thereby impairing the ability of broker-dealers to cross-subsidize sell-side analyst support for smaller firms. Consistent with this theory, Kadapakkam, Krishnamurthy, and Tse (2005) find that brokers have less incentive to promote stocks after decimalization, while Weild, Kim and Newport (2013) claim

wider tick sizes were associated with more robust market-making and analyst support for small IPOs. Jegadeesh and Kim (2006) also find that both the number of analysts and the number of companies covered by analysts has declined since 2002. However, Gao, Ritter and Zhu (2013) find that analyst coverage has not declined for IPO firms and that the downward trend in small company IPOs began prior to many of the regulations often cited as harming the incentive to provide analyst coverage for smaller firms, suggesting other factors were at work.

Other demand-side theories have focused less on regulatory changes since 1990 and more on why small firms in general may have become increasingly unappealing investment opportunities. For instance, Rose and Davidoff Solomon (Forthcoming 2016) examine firm lifecycles from 3,081 IPOs during the years 1996–2012, and find that small companies are less likely to remain listed on a public exchange compared to middle- and large-capitalized companies. Most notably, they find these companies provide fewer opportunities to realize a control premium as smaller companies are more likely to exit the market through voluntarily or involuntarily delisting, as opposed to the takeover transactions more typically used by middle-and large-capitalized companies. Additionally, they find evidence that small companies tend to stay small, rather than growing organically over time.

Two influential studies further address these issues. Gao, Ritter and Zhu (2013) study small-company IPOs between 1980 and 2009 and find that small companies tend to perform poorly post-IPO, and have performed particularly poorly in recent years. In the period from 1980 to 2000, 58% of the firms studied reported negative profits, increasing to 73% in 2001 to 2009. They also find that small company returns underperform a style-matched benchmark by an average of 17.3% in the three years following an IPO. They posit these findings are indicative of broader challenges confronting smaller firms since the early 1990s—namely, "the importance of getting big fast has increased over time due to an increase in the speed of technological innovation in many industries, with profitable growth opportunities potentially lost if they are not quickly seized." As such, they propose an "economies of scope hypothesis" for the demise of the small IPO in which the low rate of small-firm IPO activity is due to the fact that it has become more efficient for small firms to be acquired than to grow on their own with funds obtained from public offerings. In this regard, the paper highlights how the same factors that can contribute to diminished investor demand for small offerings can have simultaneous effects on the incentive of smaller firms to go public.

Using a panel of global IPOs, Doidge, Karolyi and Stulz (2013) find that while small IPOs in the US have been in decline, small IPO activity has increased globally, suggesting that the reach of the economies of scope theory may be limited to the U.S. (perhaps because of U.S. industry composition). As with Gao, Ritter and Zhu (2013), however, they dismiss supply-side explanations for the decline of the small U.S. IPO that focus on regulatory events such as Sarbanes-Oxley or the Global Settlement given that the decline in small IPOs in the U.S. relative

to the rest of the world occurred prior to these events.[7] Instead, they speculate that a more likely explanation is the declining liquidity of small stocks since the 1990s.

Determining which type of theory provides the better explanation for the decline of smaller company IPOs is critical. If, for example, excessive regulation is not to blame for the decline in IPOs, then deregulatory efforts designed to increase the supply of small companies may have the unintended consequence of reducing investor protections while providing no appreciable improvement in capital formation. We propose that the explanation lies less in the way that smaller companies are regulated than in the needs and demands of large institutional investors. In this regard, we view our theory as complementary to those theories such as Gao, Ritter and Zhu (2013) and Doidge, Karolyi and Stulz (2013) who show that the regulatory events of the 2000s are unlikely to explain fully the demise of the small IPO in the U.S. Moreover, we seek to provide a formal basis for why the illiquidity of small IPOs should translate into diminished demand for these transactions.

III. Theoretical Motivation

We theorize that a key reason for the sudden and sustained decline in the demand for small IPOs in the late 1990s stems from the growth of the mutual fund industry and its related effect on funds' preference for larger, more liquid IPOs. Due in part to the movement of employers from direct benefit pension plans to direct contribution plans, the assets under management by domestic equity mutual funds grew by a factor of 16 between 1990 and 2000, increasing from approximately $211 billion in aggregate AUM to nearly $3.4 trillion (Investment Company Institute, 2015). Equally important, this growth in aggregate AUM was also accompanied by increasing concentration of mutual fund assets among the largest funds. Pollet & Wilson (2008), for instance, find that the share of mutual fund assets controlled by the largest quintile of mutual funds increased from 73% in 1980 to nearly 90% in 2000. Likewise, while the size of funds in the bottom quintile increased by less than a factor of 5 from 1980 to 2000, the size of funds in the top quintile increased by more than a factor of 10 over the same time period.

The rapid growth in AUM during the early 1990s among the largest funds had significant ramifications for how these fund managers designed their portfolios. As noted by Pollet & Wilson (2008), a fund that grows in AUM poses an important choice for a fund manager: Should it research a larger universe of investment ideas or should it continue to invest, to the extent feasible, in the same portfolio of stocks? Based on their analysis of mutual fund portfolio data from 1975 to 2000, Pollet & Wilson (2008) conclude managers have largely chosen the latter option and that "funds overwhelmingly respond to asset growth by increasing their ownership shares rather than by increasing the number of investments in their portfolio."

In light of this finding, we posit that the largest funds can be expected to avoid smaller firms and, consequently, smaller IPOs, for several reasons. For one, to the extent a fund manager

[7] Consistent with our theory, Doidge, Karolyi and Stulz (2013) find that 1997 represented the last year in which the level of small IPOs in the U.S. was abnormally high relative to small IPOs occurring elsewhere in the world.

prefers to deploy new inflows toward fewer, larger positions, Section 5(b)(1) of the Investment Company Act of 1940 (the 1940 Act) should bias a large fund manager against portfolio allocations to smaller firms. Under Section 5(b)(1), a mutual fund can qualify as "diversified" only if no more than 5% of its assets is invested in any one company's securities and it holds no more than 10% of the voting shares in any single company. As such, a growing, diversified fund that invests in smaller companies would be forced to diversify into a broader number of firms given that simply investing new inflows into an existing small firm position will more readily cause the fund to breach this 10% position limit.

In addition, liquidity concerns associated with investing in smaller firms can be expected to weigh more heavily on funds as they grow in AUM. As summarized by Harris (2003), a stock's liquidity represents "the ability to trade large size quickly, at low cost, when you want to trade." A fund that grows by investing more capital in its existing portfolio must accordingly worry about whether its growing investment positions will become increasingly difficult to trade without significant price impact. This is especially true in light of how the 1940 Act regulates redemptions of open-end mutual funds. Under Section 22(e) of the 1940 Act, mutual funds must stand ready to redeem fund shares and must pay redeeming shareholders within seven days of receiving a redemption request—a timeline that in practice is often reduced to just three business days.[8] A large wave of redemption requests could accordingly force a mutual fund to liquidate large positions on a rapid basis, accentuating the risk of price impact.

Consistent with this theory, Pollet & Wilson (2008), Yan (2008) and Edelen, Evans, and Kadlec (2013) find that increases in fund AUM adversely affect transaction costs, which they posit explains why large funds generally underperform smaller funds. Using portfolio microdata, however, Busse, Chordia, Jiang & Tang (2014) find that large fund managers do not necessarily absorb the higher transaction costs of trading larger positions but select their portfolios so that they can grow individual positions with minimum price impact. In particular, larger funds hold larger, more liquid stocks than smaller funds, causing smaller funds to outperform through earning extra return premia associated with investing in stocks characterized by lower market cap, greater book-to-market, and higher price momentum. Thus, in addition to explaining why funds are subject to diseconomies of scale, these findings highlight how a growing fund's aversion for illiquid stocks can translate into an associated aversion for smaller firms, regardless of whether a fund seeks to remain diversified under the 1940 Act.

Finally, we build on a scholarly literature finding that these liquidity-based concerns are amplified for mutual funds during periods of market volatility. For instance, in work related to our hypothesis, Rzenznik (2015) studies mutual fund holdings from January 1999 to December 2013, and finds that mutual funds exhibit a "flight-to-liquidity" when faced with market volatility by selling less liquid shares and buying more liquid shares. Ben-Raphael (2014)

[8] For example, Rule 15c6-1 under the Exchange Act establishes three business days as the standard settlement period for securities trades effected by a broker-dealer. Consequently, the rule effectively requires most funds to pay redemption proceeds within three business days after receiving a redemption request, because a broker or dealer will be involved in the redemption process.

similarly documents a flight to liquidity during periods of market uncertainty. Reviewing ten periods of uncertainty during 1986-2008, he finds that illiquid stocks experience a larger price decline relative to liquid stocks, and that mutual funds as a group tend to reduce their holdings of illiquid stocks.

In light of these factors, we hypothesize that the Panic of 1998 represented a particularly important period of market uncertainty for mutual funds, which triggered a wholesale reassessment of the liquidity risk of small firm investments among the largest funds. While returns to small capitalization investments were robust through the early 1990s, growing market uncertainty associated with the Asian financial crisis in 1997 had an especially acute effect on this sector of the market. In contrast to other periods of severe market turmoil such as the 2008 financial crisis, market commentators at the time emphasized that the primary result of the market turbulence was to prompt a flight to liquidity, rather than a simple flight to safety. As a result, returns to small cap firms relative to large cap firms began to diverge significantly during this time, as investors reallocated towards larger equities. Within this context, Russia's abrupt currency devaluation and debt default in August 1998 added considerable momentum to this flight to liquidity, resulting in an historically unprecedented divergence between returns to small cap and large cap equities.

To illustrate the singularity of this flight to liquidity, Figure 1 presents a line graph of the rolling 12-month return to the Russell 2000 (an index of the smallest 2,000 publicly traded firms), less the same return of the Russell 1000 (an index of the largest 1,000 publicly traded firms). In addition, Figure 1 also includes a scatterplot of the end-of-month level of the widely-followed VIX index, representing the market's expectation of stock market volatility.[9] As shown by the line graph of the Russell 2000's excess returns, no other period in recent history witnessed the same level of divergence between returns to large cap stocks and returns to small cap stocks due to this unique flight to liquidity. Moreover, as highlighted by the vertical line superimposed at August 1998, this divergence reaches its greatest at precisely the time Russia's debt default reverberates throughout global markets. At the same time, the VIX, which began in 1990, also crossed above 40 in August 1998 for the first time in its history—a feat that would not occur again until the 2008 financial crisis. Indeed, its 78% increase from the end of July 1998 to the end of August 1998 is second only to its 90% increase in September 2008 following the collapse of Lehman Brothers. Meanwhile, redemptions of domestic equity funds in August 1998 experienced their first net monthly outflow since the Gulf War in 1990, with fund shareholders requesting net redemptions of approximately $6.5 billion for the month (Engen & Lehnert, 2000). Combined with the market's flight away from small firm illiquidity, this rush of redemptions undoubtedly underscored for fund managers the liquidity risk of significant small cap positions, particularly in their initial public offerings.

Within this context, mutual fund demand for small IPOs should accordingly be expected to drop precipitously, particularly among the largest funds. Moreover, given that liquidity itself is a function of investor demand, any drop in demand for small IPOs among the largest funds would

[9] The CBOE commenced the VIX index in 1990, making data unavailable for dates prior to this year.

itself be expected to further enhance the illiquidity of these transactions, potentially creating a vicious cycle of illiquidity-begets-illiquidity. As such, while Figure 1 indicates that small cap returns and market volatility eventually normalized, we posit that this one-time shock to the demand for small IPOs likely contributed to the sustained collapse in demand for small IPOs among the largest mutual fund investors.

IV. Sample Construction and Summary Statistics

A. Data Collection

We collect data on initial public offerings, including information on proceeds and underwriters, from Thomson Reuters Securities Data Corporation (SDC). We include in our sample all IPOs listed in SDC as closing between January 1, 1990 and December 31, 2014 and as having been conducted by a non-financial U.S. corporation whose primary trading market was in the United States. These filters result in an initial sample of 6,110 IPOs. We supplement SDC's data on IPO characteristics by cross-checking this IPO information with Capital IQ data as well as from Professor Jay Ritter's personal website.[10]

We obtain information on mutual fund investment in these IPOs from the Thomson-Reuters Mutual Fund (S12) Database (formerly CDA/Spectrum) which tracks mutual fund portfolio holdings on a bi-annual or quarterly basis. The S12 dataset includes portfolio-level position information for 48,968 individual mutual funds during our sample period, covering a total of approximately 760,000 fund reporting periods. For each fund reporting period, we use the reported position-level information to calculate the value of the funds' total equity portfolio as of the reporting date using daily stock prices from the Center for Research in Security Prices (CRSP).[11] Because we are interested in mutual funds that are actively investing in U.S. equities, we exclude from our sample any fund having an equity portfolio of less than $1 million in a given reporting period.[12] Applying this filter results in a sample of 37,052 mutual funds which provide approximately 582,000 position reports from 1990 to 2014.[13]

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[10] This website is located at http://site.warrington.ufl.edu/ritter/ipo-data/.

[11] While the S12 database includes a data field for the stock price of a reported position, recording of this variable is inconsistent, thus requiring the use of CRSP data to calculate equity portfolio values. Where CRSP data is missing (e.g., because a security trades in the over-the-counter market), we use the stock value provided in the S12 database if one is reported.

[12] It is common in studies using the S12 database to filter the database using a fund's reported investment code objective (IOC) to isolate funds focused on U.S. equities (see Ali et al. (2008), Barras et al. (2010), Wermers (1999, 2000) and Kacperzczyk et al. (2008)). However, inconsistent coding of IOCs in the S12 database calls into question the reliability of this approach as many funds lack an IOC code altogether (with upwards of 80% of fund observations lacking an IOC after 2005). Accordingly, we match IPOs across the entire S12 database but exclude funds that have a de minimis equity portfolio. Visual inspection of funds that are excluded by this filter indicates that it primarily affects funds focused on bonds and foreign equities.

[13] Within the sample, the median fund reports nine times—a number that is skewed downward by a large number of funds that report for only one (N=4,097) or two (N=3,172) periods. Inspection of the dataset reveals that some of these instances are the result of liquidated or merged funds, but many arise primarily because of the variety of data sources used to compile the S12 database. For instance, while a primary source of data are the periodic Forms N-30 required to be filed by registered investment companies, the dataset also includes information obtained directly from mutual fund sponsors. As a result, funds within the S12 dataset represent a combination of mutual funds registered under the Investment Company Act that are subject to mandatory, periodic reporting (e.g., open-end funds marketed to retail and/or institutional investors) as well as those that are not (e.g., foreign

We assume that any mutual fund holding the securities in the 6,110 IPOs and that first reports the position within six months of the offering date represents a purchase by the fund in the IPO. Across the 582,000 position reports, we find an instance of an IPO investment in 64,044, or approximately 11% of all fund reporting periods. These investments occur across 5,022 of our initial 6,110 IPOs.

Finally, we obtain data on the post-IPO liquidity of each issuer from the daily stock price files at CRSP. Among our sample of IPOs, CRSP includes trading data commencing with the month of the IPO for 5,561 of the IPOs in our full sample of IPOs.[14] We use these securities to calculate our primary liquidity measure as described below.

B. Summary Statistics

Table I provides an overview of the rate and size of IPOs during our sample period for both our full sample of IPOs and for our matched sample of IPOs where we identified at least one mutual fund investor in the S12 dataset. As shown in Column 1, the number of IPOs per year has declined over the years from a high of 706 in 1996 to 197 in 2014. As one would expect, the decline has been nonlinear, generally tracking the state of the overall economy. For instance, the peak rate of IPOs in 1996 was followed by a sharp decline through the 2001 recession, a recovery during the lead-up to the 2008 financial crisis, and a decline to its lowest level in 2008. The years since the 2008 financial crisis have witnessed yet another recovery of the IPO market, though IPO levels are well below those of the late 1990s.

Columns 2 through 6 highlight the growing size of IPOs since 1990 with all figures being inflation-adjusted to reflect 2014 prices. During this period, mean (median) proceeds for IPOs increased from $54.8 million ($29.0 million) in 1990 to $186.4 million ($98.8 million) in 2014. Of particular note is the declining incidence of the small IPO shown in Column 2. In 1990, nearly 70% of all IPOs met our definition of a small IPO in that they raised less than $54.4 million (in 2014 inflation-adjusted dollars). In contrast, just 14% of all IPOs raised less than this amount in 2014. Moreover, while median proceeds increased 340% since 1990, the twenty-fifth percentile of IPOs proceeds increased over five-fold, highlighting a general shift upwards in the distribution of IPO proceeds, particularly among smaller issuers. As with the rate of IPOs, however, this overall increase in IPO proceeds has fluctuated over time, with maximums occurring in 2001 (M=$513 million; Mdn=$144 million) and 2009 (M=$400 million; Mdn=$197 million) as the IPO rate declined to local minimums. These trends are consistent with the notion that a tight IPO market is limited to offerings by larger, more established firms, while a robust IPO market is more accommodating of smaller issues.

Columns 7 through 12 of Table I illustrate that these overall patterns also appear when we match IPOs to our sample of mutual fund investors. Depending on the year, anywhere from 65%

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funds and funds sold exclusively to institutional clients). To avoid introducing survivorship bias, we refrain from imposing on funds a minimum reporting threshold for inclusion in the sample.

[14] CRSP includes market data for securities listed on the NYSE, Nasdaq, or the American Stock Exchange (now NYSE MKT), thereby omitting data for IPO securities that trade over-the-counter.

to 97% of IPOs were acquired by a fund in our investor sample. As shown in Columns 9 through 12, mutual funds generally invested in IPOs that were larger than the average IPO, indicating that most of the IPOs without a mutual fund investor were smaller transactions. For instance, 25th, 50th, and 75th percentile proceeds were higher for the matched sample in every year from 1990 to 2014, indicating a general preference among mutual funds for larger transactions. This preference also appears in the incidence of small IPOs within the matched sample. As with the full sample of IPOs, the number of small IPOs in the matched sample declines significantly over time, with mutual funds investing in fewer small IPOs every year of the sample period.

Table II provides descriptive statistics showing how our sample of mutual funds grew in size during the late 1990s and early 2000s, again using inflation-adjusted 2014 dollars. In general, the table highlights how the sample reflected the significant growth of the mutual fund industry during our sample period. As shown in Columns 1 and 2, both the overall number and average size of funds increased from 1990 to 2000, with the number of active funds increasing more than seven-fold and the average size of funds nearly doubling. The number of funds and the size of funds show a more modest increase between 2000 and 2010; however, this partly reflects the effects of the financial crisis which caused mutual fund inflows and mutual fund assets to contract sharply.

Figure 2 breaks mutual funds into annual size quartiles and plots each quartile mean over the course of the sample period. As the figure shows, mutual funds—particularly those within the largest size quartile—continued to increase in size after 2000 before declining in 2008 and 2009, after which they resumed growing. As highlighted in Table II and Figure 2, an important consequence of the growth of mutual fund assets during the sample period has been to increase significantly the positive skew in the distribution of fund sizes. This was particularly true in the first decade of the sample period where the growing number of small funds caused the median to decrease from $47 million to $31 million. Evidence of increased positive skew also appears in the breakdown of funds by size quartile, which highlights how the industry's growth during this time period was reflected in both an increasing number of smaller funds as well as an expanding number of extremely large funds. For instance, while the mean and median size of funds within the 25th percentile declined by approximately one-half between 1990 and 2000, the mean size of funds in the 75th percentile jumped from $866 to more than $1,800 million while the median increased more modestly from $405 million to $475. For similar reasons, the percentage of mutual fund assets within the largest quartile of funds increased from 87% to 95%, underscoring the increasing concentration of mutual fund assets among the largest funds.

In light of the growth of funds' AUM, Columns 5 through 8 present the number and size of funds' reported investment positions to examine how funds' growing AUM might raise heightened concerns about the liquidity of their equity investments. As noted by Pollet & Wilson (2008), if an increase in a funds' AUM results in larger individual positions, portfolio managers will incur a greater risk of price impact in trading them if the security is thinly traded or otherwise illiquid. Consistent with these concerns, Columns 5 and 6 indicate larger funds had more investment positions than smaller funds within a given year, and funds generally increased

their overall number of investment positions with the increase in average fund size after 1990. Moreover, the slight decline in the median value of funds' equity positions across all size categories from 1990 to 2000 suggests that most funds managed to grow in size without increasing the size of their average equity investments. However, the doubling of the mean position value for funds in the fourth quartile from 1990 to 2000 and again from 2000 to 2010 indicates that this controlled growth did not apply to the largest funds in the sample.[15] Overall, these findings are consistent with the finding in Pollet & Wilson (2008) that large funds diversify more slowly than smaller funds in response to growth.

The final two columns of Table II examine the extent to which mutual funds in our sample invested in IPOs over time. Column 9 indicates that, except for the smallest quartile of funds, mutual funds were more likely to participate in an IPO in 2000 than in 1990, as one might expect given that 2000 represented the height of the dot-com IPO wave. However, consistent with the drop in IPO activity after 2000 shown in Table I, participation in IPOs dropped considerably for all investors by 2010. Participation rates in small IPOs, in contrast, declined in both 2000 and 2010.

To examine whether heightened concerns about IPO liquidity after 1998 might account for this diminished interest in small IPOs, we next assess the liquidity characteristics for IPOs during the sample period. As noted previously, small firms pose inherent liquidity challenges for investors seeking to make large dollar-sized investments in their securities given the enhanced likelihood these investments will move the market, particularly for firms that are thinly-traded. At the same time, while small IPOs might on average be more illiquid than large IPOs, not every small IPO is necessarily illiquid. If declining investor interest in illiquid IPOs was driving the decline in small IPOs, we should accordingly observe a decrease in IPO illiquidity immediately after the Panic of 1998 as issuers and their advisors responded to changing investor tastes. In particular, declining demand for illiquid IPOs should induce IPO self-selection such that only those smaller issuers likely to have more liquid IPOs commence a public offering.

We assess empirically whether this was the case by turning to the widely-used measure of illiquidity developed in Amihud (2002), which estimates the expected price impact incurred in trading a given security.[16] In general, the measure is calculated as the absolute value of a stock's daily return-to-volume ratio, thereby yielding a daily measure of estimated price impact. Because we are interested in the expected illiquidity of an IPO firm in the months following its IPO, we use this daily measure to construct a six-month forward-looking moving average as of the end of

[15] For instance, in unreported results, the median position value for the largest tenth decile of funds increased from $13.7 million to $19.6 million between 1990 and 2000, and from $19.6 million to $27.3 million between 2000 and 2010.

[16] In general, Amihud's measure of illiquidity is in the spirit of Kyle's (1985) lambda in that it measures the price impact associated with trading a security. In contrast to Kyle's lambda, however, Amihud's measure of illiquidity relies on daily trading data rather an intraday microdata, thereby making it computationally feasible to analyze a large sample of securities over an extended time frame. A number of studies have found that Amihud's measure of illiquidity is closely correlated with intra-day measures of price impact. Hasbrouck (2009), for instance, compares price impact measures estimated from daily data and intraday data and finds that the Amihud (2002) measure is most highly correlated with trade-based measures, having a correlation with Kyle's lambda of 0.82. Likewise, Goyenko, Holden, and Trzcinka (2009) compare various measures of liquidity and conclude that Amihud's measure is comparable to intraday estimates using Kyle's lambda in its ability to capture the price impact of a trade.

the month of the IPO. Formally, we calculate *Amihud Illiquidity* for stock *i* with IPO in month *m* as:

$$Amihud\ Illiquidity_{i,m} = \frac{1}{6}\sum_{m=2}^{6}\frac{1}{D_m}\sum_{d=1}^{D_m}\frac{|R_{i,d,m}|}{DVOL_{i,d,m}} \qquad (1)$$

where $R_{i,d,m}$ is the daily return on stock *i* on day *d* for month *m*, $DVOL_{i,d,m}$ is its daily trading volume for the same day, and D_m is the number of days for which data are available for stock *i* in month *m*. As an example, for an IPO closing in June, our measure provides an estimate of the firm's average monthly illiquidity from July through the following December.[17] To facilitate comparison between the illiquidity of IPOs and non-IPO firms, we calculate the measure across all IPOs occurring in any month between 1990 and 2014 as well as for all non-IPO securities with CRSP trading data for that same month.

In Figure 3A we first present a basic scatterplot of the mean monthly moving average for small IPOs less the monthly mean for non-small IPOs. As shown in the figure, average monthly illiquidity for small IPOs was virtually always higher than that of non-Small IPOs. Overall, the figure confirms that small IPOs issued during any month of the sample were, on average, more illiquid than non-small IPOs issued during that same month.

We examine whether declining interest in illiquid IPOs induced issuer self-selection in Figure 3B where we present a scatterplot of the mean moving average for IPOs and non-IPOs during the full sample period. With the exception of a brief spike in illiquidity surrounding the 2008 financial crisis, the scatterplot for non-IPO firms highlights how the expected price impact of trading a randomly-selected security has declined steadily since 1990. The scatterplot for IPO firms reveals a similar overall trend; however, a sharp, seemingly discontinuous drop in illiquidity occurs in the late 1990s, which persists for the duration of the sample period. The vertical line super-imposed at August 1998 highlights how this sudden drop in the illiquidity of IPO firms coincided with the flight to liquidity triggered by Russia's currency devaluation and debt default. Because CRSP data are limited to securities traded on a U.S. stock exchange, the sharp distinction in the level of illiquidity before and after August 1998 would appear to confirm a fundamental change in the liquidity profile of those companies willing and able to go public on a U.S. exchange at this point in time.

We test formally the hypothesis that the events of August 1998 represented a distinct change in the liquidity profile of IPO firms by conducting an interrupted time series analysis. To account for autocorrelation in the time series, our regression model assumes the following form:

$$Y_t = \beta_0 + \beta_1 POST_t + \beta_2 Month_t + \beta_3 POST_t \times Month_t + \epsilon_t \qquad (2)$$

where Y_t is the overall six-month moving average for *Amihud Illiquidity* in a month during the sample period, *POST* is an indicator variable set to 1 for each month following August 1998, *Month* is a month trend, and *POST x Month* is an interaction term. The parameter β_1, our main

[17] We commence our moving average in the month after the IPO due to the fact that IPO firms commence trading on different days within their first trading month.

parameter of interest, estimates the change in the level of Amihud Illiquidity that occurs in the period immediately following August 1998, while β_2 estimates a monthly time trend and β_3 estimates any difference in the slope of the time trend following August 1998. We run the model separately for IPOs, small IPOs, and all other securities in CRSP to explore how changes in the illiquidity of IPOs and small IPOs compared to the rest of the market during this time period. All three regressions were run using Newey-West standard errors calculated with five lags for IPOs and small IPOs and with nine lags for non-IPOs determined using Cumby-Huizinga tests for autocorrelation.

Panel A of Table III presents the results. The first two columns provide estimates for IPOs and small IPOs, respectively, and confirm that IPOs completed after August 1998 were significantly less illiquid than those completed in prior months. In particular, the negative coefficient on *POST* indicates an estimated drop of .55 in the measure of Amihud Illiquidity for IPOs in general and a drop of .797 for small IPOs immediately after August 1998. Moreover, the combined effect of *POST*, *Month*, and *POST* x *Month* for both models indicates that the decline in illiquidity for these IPOs during the full period after August 1998 was isolated almost entirely to the sharp drop occurring in the late summer of 1998. In contrast, while all other securities showed a steady decline in illiquidity during the sample period, the positive coefficient on *POST* suggests an increase in illiquidity for the market as a whole at August 1998, although the coefficient is insignificant. In combination with the drop in small IPOs around this time period, these findings further confirm that the flight to liquidity in the Panic of 1998 was associated with a structural change in the market for IPOs in which less liquid IPOs quickly receded from conducting equity offerings on U.S. exchanges, with the results being particularly pronounced for small IPOs.

Because the data used in Panel A covers only exchange-listed securities, Panel B of Table III supplements this analysis by summarizing the listing venues for IPO firms during the sample period. To the extent Panel A reveals a shift in demand away from illiquid IPOs, evidence of this shift should also appear in the extent to which firms chose to list on exchanges compared to the historically less liquid pink sheets or over-the-counter (OTC) markets. Specifically, a fall-off in demand for illiquid IPOs after 1998 should appear in a decline in the percent of IPOs conducted on the pink sheets/OTC market relative to a conventional stock exchange.

Accordingly, Columns 3 through 7 of Panel B shows the percent of small IPOs listed on the three primary stock exchanges (the Nasdaq, the NYSE, and the American Stock Exchange), as well as on the OTC market or the Pink Sheets during the sample period.[18] Columns 10 through 14 presents the same information for all other IPOs. As one would expect, small IPOs have

[18] Throughout the 1990s, Nasdaq operated as an inter-dealer quotation system managed by what was then the National Association of Securities Dealers (NASD). It was eventually re-organized in 2000 as a publicly-listed company and began operating as a registered stock exchange in 2006. During the sample period, the NASD (which today operates as the Financial Industry Regulatory Authority, Inc., or FINRA) also operated the OTC Bulletin Board or OTCBB as an inter-dealer quotation system that permits the quotation of an issuer's equity securities so long as the issuer is compliant with specific requirements. In addition to this interdealer quotation service, a second "over-the-counter" market was facilitated through the Pink Sheets (now OTC Markets, Inc.), which operated an interdealer quotation service for equity securities that were not listed on OTCBB, Nasdaq, or a national stock exchange. We classify an IPO as traded on OTC/Pink Sheets if its primary trading venue after the offering is OTCBB or the Pink Sheets/OTC Markets.

always been more likely to trade in the over-the-counter markets than larger IPOs given exchanges' listing requirements imposing minimum revenue and market capitalization levels. Consistent with diminished investor appetite for all but the most liquid small IPOs after 1998, the percent of small IPOs conducted on non-exchange venues decreases from 39% from 1990 through 1998 to 21.9% from 1999 through 2009. Non-exchange IPOs similarly decline from 4.1% to 1.7% during these same periods for all other IPOs. However, while this flight away from non-exchange IPOs continues for larger IPOs after the 2008 financial crisis, the trend is the opposite for small IPOs: During the post-2008 financial crisis IPO recovery, nearly 70% of all small IPOs were traded on non-exchange venues. Given that many institutional investors and mutual funds are restricted from investing in non-exchange listed securities, this transition to the OTC markets for small IPOs would appear to reflect an awareness among smaller issuers that institutional appetite for small IPOs is likely to be diminished even in a strong IPO market.

Finally, because the decision to conduct an IPO is undertaken jointly with an underwriter, Panel C of Table III presents summary statistics on IPO underwriters during the sample period. Column 1 summarizes the aggregate number of underwriters that participated in a small IPO each year from 1990 to 2014, while Column 2 provides the total number of underwriters that participated in all other IPOs. In keeping with the sharp drop in small IPOs shown in Table I, the overall number of underwriters working on small IPOs showed a similarly sharp decline from a mean of 100 during the period 1990 to 1998, to 19 from 1998 through 2009, falling to just 11 in the period following the 2008 financial crisis. In contrast, column 2 shows a more modest decline for all other IPOs between the first two periods, and a slight increase during the post-2008 financial crisis IPO recovery.

More notable than these overall numbers, however, is the distinction that emerged in the late 1990s between banks that underwrote small IPOs and those that did not. Columns 3 and 4 summarize both the number and percentage of investment banks that underwrote at least one small IPO and one non-small IPO in a given year. While the percentage of banks that did both types of transactions hovered above 40% in the early 1990s, the percentage drops sharply by the end of the 1990s where it remains for the duration of the sample period. To the extent this pooling of banks meant small IPOs were left to smaller, less experienced banks, this trend could theoretically have adverse effects on small IPO illiquidity. At the same time, however, if banks seek to underwrite those deals where there is likely to be significant demand, the drop in interest in small IPOs among more experienced banks could itself reflect declining demand for small offerings among mutual funds due to growing awareness of the liquidity risks of investing in these transactions. Overall, these data are thus consistent with declining interest in illiquid IPOs undermining the incentive to provide small IPO underwriting, potentially contributing to the decision of smaller, illiquid issuers to abstain from the IPO market after 1998. The shift of investment banks towards focusing on larger transactions also highlights how a drop in demand for small IPOs might itself facilitate small IPO illiquidity. We return again to the possibility for such an illiquidity-begets-illiquidity phenomenon after presenting more formal tests of our demand hypothesis.

V. Empirical Tests and Results

A. Mutual Fund Size and Small IPO Investing

Our initial test of our demand hypothesis focuses on the relation between mutual fund size and IPO investment activity surrounding the Panic of 1998. As noted previously, our central hypothesis builds on the finding of Pollet & Wilson (2008) that the sudden growth of funds' AUM during the early 1990s induced the largest funds to seek larger investment positions across their portfolios. We conjecture that these larger positions exposed fund managers to enhanced liquidity risk, which was magnified by the Panic of 1998. In this context, the liquidity risk of investing in small IPOs should have been particularly salient for managers of the largest funds, resulting in a sharp and sustained drop in these funds' demand for small IPOs.

As a preliminary matter, support for our demand-side theory of the decline in the small IPO market would appear to follow from the summary investment statistics presented in Table III. As shown in Column 10 of Table III, the largest quartile of mutual funds decreased their participation rate in small IPOs from 12.1% to 4.8% between 1990 and 2000, notwithstanding the fact that their participation rate for all IPOs rose 34% to 56.4% during the same period. In light of the significant growth in AUM among the largest funds in this quartile, this evidence is certainly consistent with an enhanced concern about the liquidity risk a growing fund faces when investing in small issuers. However, the fact that the three other fund quartiles saw a decline in small IPO participation rates despite a decline in mean and median fund sizes highlights the possibility for alternative interpretations. Among other things, the growth in the number of funds from 1990 to 2000 could account for the overall decline in small IPO participation rates while efforts to participate in large, over-subscribed dot-com offerings might account for the increase in the overall IPO participation rate.

In light of this identification challenge, we leverage the panel structure of our data to isolate better the effect of fund size on IPO participation rates. Specifically, the fact that the typical fund in our sample reports positions multiple times per year permits the use investor- and time-fixed effects. These fixed effects allow us to examine the relation between a fund's growth in AUM and its investment in IPOs while controlling for investor-specific preferences for particular types of investments as well as for yearly changes in IPO investing that are unrelated to changes in fund size.

To permit comparison of fund investments in small IPOs and all other IPOs, we estimate two specifications of the following regression equation:

$$Y_{it} = \alpha_0 + \alpha_i + \beta POST_t \times SIZE_i + \delta_t + \varepsilon_{ist} \qquad (3)$$

where the subscript *i* indexes a mutual fund, and *t* indexes a year during the sample period. In the first specification, the dependent variable of interest, Y_{it}, represents the annual number of IPO investments by fund *i* during year *t*, while in the second specification, Y_{it} represents the annual number of investments by fund *i* in small IPOs. In each case, the intercept has two primary

components: α_0, which is common to all investors and α_i, which is specific to each mutual fund. The primary independent variables of interest are *POST*, a dummy variable coded as 1 for each year following 1998 and zero otherwise and its interaction with *SIZE,* which represents the size quartile of fund *i* in year *t.* The interaction term, β, accordingly estimates the difference after 1998 in the average annual purchases in IPOs that a fund in the second, third, or fourth size quartile makes relative to average annual purchases made by a fund in the first size quartile. Yearly fixed effects, δ_t, are included to control for the number of IPO issues each year, the number of funds each year, as well as unobserved time fixed effects. Overall, comparing the two specifications of this model allows us to evaluate how mutual funds of varying sizes invested in small IPOs relative to all IPOs in the years surrounding 1998.

Table IV presents the results. In Column 1, we provide the results for the specification modeling investments in all IPOs in our sample. As indicated in the table, the increasing size of the coefficient on each size quartile indicates that larger funds on average invested in more IPOs than smaller funds through 1998, as one might expect given the larger capital they have available to deploy. The positive, strongly significant coefficient of 2.184 on *POST* indicates that the smallest quartile of funds (the omitted category) increased their annual IPO investments after 1998, while the increasingly negative coefficient on each interaction of *POST* x *SIZE* indicates that this post-1998 increase in annual IPO investments was smaller for larger funds. However, even after 1998, the combined effect of *SIZE*, *POST* and *POST x SIZE* indicates that larger funds continued to invest in more IPOs than smaller funds.[19]

In contrast, the results of the second specification presented in Column 2 reveal a different pattern with regard to investments in small IPOs. As with the first specification, expected IPO investments increased with each size quartile through 1998. However, in contrast to model (1), the coefficient on POST becomes negative and loses its significance, indicating that the smallest quartile of funds showed no statistical evidence of any change in their annual purchases of small IPOs after 1998, holding constant investor- and year-fixed effects. Moreover, while the other three size categories reveal a decrease in small IPO investments after 1998, the increasing magnitude of the negative coefficient on the POST interaction term across all size quartiles indicates that the move away from small IPOs after 1998 was strongest among the largest funds. Indeed, while the size of the positive coefficient on each uninteracted size quartile indicates larger funds invested in more small IPOs through 1998, this ordering reverses in the period after 1998. For instance, compared to their purchases of small IPOs through 1998, the model indicates that the second, third, and fourth size quartiles reduced their average annual investments in small IPOs after 1998 by approximately 73%, 89% and 100%, respectively. Overall, these estimates suggest a complete collapse in the demand for small IPOs among the largest group of funds—a class of funds that controlled over 90% of mutual fund assets by 2000.

[19] Given the decline in IPOs after 1998, it may seem surprising that annual IPO investments increased after 1998 for all size categories. This result is due to the inclusion of year fixed-effects, which control for the number of annual IPOs. In unreported regressions where we omit year fixed-effects, annual IPO investments across all four size categories decline following 1998. However, even in this regression framework, each size quartile keeps its ordinal ranking before and after 1998 (i.e., larger funds invest in more IPOs than smaller funds both before and after 1998).

To examine how the decline in mutual fund demand for small IPOs related to the greater illiquidity of small IPOs, we run two additional analyses focusing on changes in the illiquidity profile of funds' IPO portfolios. Both use an IPO's six-month moving average of Amihud Illiquidity as a proxy for the liquidity risk posed by investing in an offering. In the first analysis, we classify an IPO as *Illiquid* if this measure of Amihud Illiquidity ranks within the highest quartile of Amihud Illiquidity among all IPOs in a year. We then run a regression using equation (3) in which Y_{it} represents a fund's annual number of investments in illiquid IPOs. We present the results in Column 1 in Panel B of Table IV. As one would expect, given that the largest quartile of funds had significantly more capital to deploy than smaller funds, larger funds on average invested in more illiquid IPOs than smaller funds in both the pre- and post-98 periods.

However, Table IV also highlights how the sensitivity of funds to the liquidity risk of IPOs changed following 1998. First, the significant, positive coefficient of 0.169 on POST indicates that, conditional on investing in an IPO, investors after 1998 were generally more likely to invest in an illiquid IPO than before 1998. While this finding might at first blush indicate an enhanced willingness to invest in illiquid IPOs, it is important to keep in mind the sharp decline after 1998 in the average illiquidity of IPOs shown in Figure 3B. As such, IPOs that fell within the classification of an illiquid IPO after 1998 were accordingly less illiquid than IPOs that fell within this classification before then. The fact that funds were more likely to invest in an IPO ranking within the most illiquid quartile after 1998 is therefore consistent with funds' enhanced sensitivity to an offerings' illiquidity during this time period.

Moreover, the coefficients on the interaction of POST with each size category is consistent with this sensitivity to IPO illiquidity growing with fund size. Although funds' average investments in illiquid IPOs continued to scale with fund size, the increasing size of the negative coefficient on the interaction term for each size category highlights how this scaling effect diminished after 1998. For instance, whereas prior to 1998 the largest quartile of funds purchased over 5 times the number of illiquid IPOs as funds in the second size quartile, this ratio declined to just .13 in the period after 1998. In other words, average annual investments in illiquid IPOs after 1998 failed to keep pace with the growing difference in AUM between funds in the largest quartile and the second quartile, even though illiquid IPOs were more liquid after 1998 in absolute terms.

Finally, large funds' enhanced concern with the liquidity of IPOs after 1998 is also supported by Column 2 of Table IV. There, we present the results of a regression using equation (3) in which Y_{it} represents the average annual Illiquidity Quartile of a fund's IPO investments, conditional on a fund investing in an IPO in a year. As in the prior regression, we use an IPO's six-month measure of Amihud Illiquidity to classify IPOs by illiquidity quartile for each year such that the most illiquid IPOs are in fourth quartile. Notably, the coefficients on the uninteracted size categories indicate that prior to 1998 no statistically significant differences existed between the average illiquidity quartile of IPOs acquired by funds within different size categories. Moreover, the negative, strongly significant coefficient on POST highlights an overall decline in the average illiquidity of IPOs purchased by funds. However, while this post-

1998 decline in IPO illiquidity was not statistically different between funds in the first, second, and third quartiles, the interaction of POST with the fourth size quartile reveals a moderately significant coefficient of -0.08. Given our hypothesis that this size quartile faced uniquely severe liquidity risks because of the growing concentration of AUM among the largest funds, we view this finding as especially telling of how AUM growth has diminished the appetite of the largest funds for potentially illiquid small IPOs.

B. Estimating Mutual Fund Demand for Individual IPOs

We also examine how mutual fund size affects the demand for small IPOs by looking separately at the level of fund investments in individual IPOs between 1990 and 2014. While the foregoing results indicate the retreat from small IPOs was especially strong among the largest mutual funds, they say little about how individual issuers and underwriters might have perceived the small IPO market. For instance, even if individual funds lowered their annual purchases of small IPOs, IPO issuers and their advisers might nonetheless view the small IPO market as robust if this decline was offset by a larger number of funds making small IPO investments. Such a finding would also point towards the importance of a supply-side explanation for the persistent decline in small IPOs since 1998. In the face of strong demand for small IPOs, only diminished interest among issuers in seeking a public listing could account for the absence of small IPOs.

The possibility that the growth in the number of mutual funds might offset the diminished interest in small IPOs among individual funds is given some support by Figure 4A, which provides a simple scatter plot of the annual number of small IPOs relative to the number of funds reporting each year in the sample. Consistent with Table I, the superimposed line at 1998 highlights the significant drop in small IPOs surrounding the Panic of 1998. However, as shown by the scatterplot of active funds, this decline occurred during a secular increase in the overall number of mutual funds in the market. To the extent a meaningful portion of these funds sought small IPO investments after 1998, the combination of these factors may have meant more investors were chasing any individual small IPO.

To examine this possibility in more detail, we calculate the mean number of mutual fund investors in each IPO in the sample, focusing in particular on the number of fund investors within the largest fund size quartile. To present the overall trend, we first plot in Figure 4B the mean number of fourth quartile investors per year for small IPOs relative to all other IPOs. Figure 4C presents a similar scatter plot for illiquid IPOs and liquid IPOs.[20] Each figure highlights that the significant decline in IPOs after 1998 did in fact result in an increase in the average number of large fund investors per IPO; however, the effect was limited to larger IPOs and those IPOs that had the lowest measure of six-month Amihud Illiquidity. Small and illiquid IPOs, in contrast, experienced no notable increase in the mean number of large investors.

[20] As in our prior analyses, we classify an IPO as *Illiquid* if its measure of Amihud Illiquidy ranks within the highest quartile of Amihud Illiquidity among all IPOs in a year. We classify an IPO as *Liquid* if this measure ranks within the lowest quartile of Amihud Illiquidity among all IPOs in a year.

In Table V, we analyze the number of large investors in small and illiquid IPOs surrounding 1998 using a multivariate framework. We first estimate the number of large fund investors in a small IPO relative to all other IPOs using the following equation:

$$Y_i = \alpha_i + \beta_1 POST_t \times Small_i + \beta_2 OneDayR_i + \beta_3 SmallerInvestors_i + \beta_4 Industry_i + \beta_5 IPOs_t + \beta_6 Funds_t + \delta_t + \varepsilon_i \qquad (4)$$

where Y_i represents the average number of mutual fund investors from the fourth size quartile in *IPO i* , *POST* is a dummy variable coded as 1 for each year following 1998, and *Small* is a dummy variable coded as 1 for an IPO meeting our definition of a small IPO. The interaction of *POST* and *Small* accordingly represents the marginal difference in the estimated number of investors in the fourth size quartile in small IPOs vs. all other IPOs after 1998. To account for the existence of "hot issues" and other business- and industry-related factors that could influence the number of investors in an IPO, we include controls for the first day return of the IPO (*OneDayR*), the total number of mutual funds investing in the IPO that rank in size quartiles 1-3 (*SmallerInvestors*), and industry fixed-effects (*Industry)* using one-digit SIC codes. To account for the overall state of the IPO market, the number of active mutual funds, and other unobserved time fixed effects, we include controls for the number of IPOs occurring for the year (*IPOs*), the number of funds reporting in the sample for the year (*Funds*), and yearly fixed effects (δ_t).

We use this same regression framework to estimate the number of investors in liquid and illiquid IPOs surrounding 1998, substituting for *Small*, the variable *IlliquidityRank*. This latter variable represents the Illiquidity quartile for IPO *i* based on its six-month Amihud Illiquidity measure relative to the illiquidity of all IPOs for the year. We assign the first, most liquid quartile to be the omitted category in our regression specification. Therefore, the interaction of *POST* and *IlliquidityRank* represents the marginal difference in the estimated number of investors in the fourth size quartile between an IPO in the second, third, or fourth illiquidity quartile relative to one in the first quartile.

Panel A of Table V presents the results. Column 1 provides the estimates for our initial specification analyzing the number of large investors for small and non-small IPOs. As one might expect, estimates for our controls indicate that IPOs with strong first day returns and IPOs with a greater number of mutual fund investors ranked in size categories 1-3 were associated with more fourth quartile fund investors. IPOs occurring in years with more active mutual funds were also associated with having more of these investors, as were IPOs occurring in years with more IPOs. Notably, even after controlling for these factors, the negative, strongly significant coefficient on *Small* highlights how small IPOs had on average fewer large fund investors, while the interaction of *POST x Small* highlights how this difference widened dramatically after 1998. Overall, these findings are consistent with Figure 4B's depiction of large fund investors moving decisively to larger IPOs after 1998, to the extent they invested in IPOs at all.

Column 2 presents our estimates based on an IPO's illiquidity, which similarly confirm the simple scatterplot shown in Figure 4C. The negative, strongly significant coefficients on each of the three illiquidity quartiles highlight how the estimated number of large mutual fund investors

diminished in step-like fashion for IPOs assigned to less liquid quartiles. Moreover, as with Column 1, the difference between the estimated number of large fund investors in the most liquid quartile of IPOs widens dramatically after 1998 for IPOs in any of the three highest illiquidity quartiles. As with the shift toward larger IPOs, these results are consistent with a significant shift among large fund investors to the most liquid segment of the IPO market, even after controlling for other business and time-specific factors likely to affect the number of large fund investors in a transaction.

Finally, in Panel B of Table V we test more formally the hypothesis that the demand for small IPOs was mediated by their perceived illiquidity. To do so, we modify equation (4) to include a three way interaction of *POST*, *Small,* and *IlliquidityRank*:

$$Y_i = \alpha_i + \beta_1 POST_t \times Small_i \times IlliquidityRank_i + \beta_2 OneDayR_i + \beta_3 SmallerInvestors_i + \beta_4 Industry_i + \beta_5 IPOs_t + \beta_6 Funds_t + \delta_t + \varepsilon_i \qquad (5)$$

Our central intuition was that if the Panic of 1998 made large investors more sensitive to the liquidity risk of small IPOs, large investors should have been, at the margin, more deterred after 1998 from investing in small IPOs with more expected illiquidity than small IPOs with less expected illiquidity.

Overall, the results in Panel B are consistent with this intuition. As in Panel A, the negative, significant coefficients on *Small* and the increasingly negative, significant coefficients on each *IlliquidityRank* indicate that small IPOs and IPOs with greater six-month Amihud illiquidity were associated with fewer large fund investors through 1998. Likewise, the magnitude of these negative coefficients increase significantly after 1998, as shown by their interaction with *POST*. Notably, however, the three-way interaction of *POST, Small*, and *IlliquidityRank* indicates that this decline in large fund investors for small IPOs after 1998 was marginally less for more liquid small IPOs. For instance, while a small IPO in the first illiquidity quartile after 1998 was associated with approximately 23 fewer large fund investors than a similarly liquid non-small IPO prior to 1998, the estimated number of large fund investors declined by 26 investors for a small IPO in the fourth illiquidity quartile after 1998. To be sure, the cross-sectional nature of these results complicates causal inference. However, they are nevertheless consistent with the hypothesis that the Panic of 1998 highlighted for large funds the liquidity risks of investing in smaller companies given the significant growth of AUM within this segment of funds.

VI. Small IPO Demand and IPO Illiquidity Since 1998

In light of the foregoing results, a lingering question remains why the Panic of 1998 should have had such long-lasting effects on the demand for small IPOs. Even if the events of that year highlighted the liquidity risk small IPOs pose for large mutual funds, theory would suggest such a negative shock to demand would eventually result in more aggressive pricing of small IPOs as opposed to the collapse of the market for large mutual fund investors. While such pricing might deter some founders from selling securities in an IPO, a small IPO market should nevertheless

have continued to function, especially when the liquidity concerns of 1998 subsided. Moreover, aggressive pricing of small IPOs would presumably enhance expected returns for any given offering, offsetting some of the liquidity concerns of investing in these transactions.

Notwithstanding this possibility, the sharp decline in small IPOs in the late 1990s likely impaired any revived interest in these offerings among large fund investors for at least two reasons. First, the continuing growth in AUM among the largest funds after 2000 made it increasingly unlikely that a small IPO investment would have a meaningful effect on these funds' overall returns. For instance, even a fund willing to purchase 10% of an offering would be limited to an investment of approximately $5 million in a $50 million IPO—roughly the upper limit for a small IPO in 2014. Considering that in 2014 the median fund in the fourth size quartile had $1 billion of AUM, such an investment would have to triple in value to produce even a 1% gross return on a median fund's portfolio. Of course, a large fund portfolio manger could in theory seek to construct a broad portfolio of these investment stakes; however, such a strategy would depend on the existence of a robust supply of small IPOs. As such, even if small IPOs were offered with a significant liquidity discount after 1998, the diminished number of transactions itself likely undermined the incentive of even those large fund managers willing to pursue such opportunities.

A second, related challenge impairing a recovery of the demand for small IPOs among the largest fund investors is the underlying relation between IPO illiquidity and IPO demand. Fundamentally, a central dilemma facing the small IPO market since 1998 has been that demand for small IPOs has been increasingly linked to concerns about their illiquidity, while their illiquidity is itself a function of IPO demand. As the largest quartile of funds pulled away from the market, our demand-side theory would suggest that the small IPO market would accordingly fall into a vicious spiral in which illiquidity-begets-illiquidity. Moreover, as shown in Figure 3B, this illiquidity spiral would occur at the very time that the overall equities market was experiencing a secular decline in illiquidity, thus enhancing the illiquidity of any given small IPO relative to other investment opportunities in the market.

To examine more closely this possibility, Figure 5A presents a scatterplot of the natural log of the median measure of six-month illiquidity for small IPOs issued during each month of the sample relative to the market as a whole.[21] In particular, this median measure is juxtaposed with the natural log of the 25th, 50th, and 75th percentile of the same monthly measure for all other securities in CRSP. By presenting the illiquidity of a median small IPO for each month next to the illiquidity of a security sitting at 25th, 50th and 75th percentile of the monthly distribution of illiquidity for all non-IPOs, the figure permits visualization of where the majority of small IPOs fell in the market's overall illiquidity distribution during the sample period.

Consistent with Figure 3B, Figure 5A shows that the monthly measure for the 25th, 50th, and 75th percentile of six-month Amihud illiquidity for all non-IPO securities fell steady during the sample period, with the exception of a few notable spikes such as during the 2008 financial crisis. Comparing these three plots with the hollow circles representing the median illiquidity of

[21] We use natural logs to minimize the effect of outliers.

all small IPOs issued in a month highlights how small IPOs became increasingly illiquid relative to the market as a whole. To facilitate analysis of how this change related to the Panic of 1998, a vertical black line is superimposed at August 1998. Additionally, two local linear regression lines are modeled on either side of it to highlight how illiquidity changed before and after this date. For both regression lines, we use the Epanechnikov kernel and the asymptotically optimal constant bandwidth described in StataCorp (2012).

As shown in the figure, the local linear regression line to the left of August 1998 displays a slight downward trend, consistent with the overall decline in illiquidity within the market prior to 1999. Similar to Figure 3B, the period immediate following August 1998 reveals a sharp drop in small IPO illiquidity as all but the most liquid small IPOs ventured into the public equity markets. Following this initial drop, however, median small IPO illiquidity displays a modest positive trend until the 2008 financial crisis, notwithstanding an overall decline in illiquidity within the market as a whole. As a result, by 2004 the median small IPO had moved from being in the third quartile of market illiquidity to being solidly in the fourth quartile, thereby representing some of the most illiquid exchange-traded securities.

In Figure 5B, we conduct an identical analysis of the relative illiquidity of all other IPOs. As shown in the figure, the median illiquidity of non-small IPOs generally fell within the second quartile of market illiquidity until August 1998, followed by a sharp, discontinuous drop in the ensuing months. While this overall trend resembles that of small IPOs, a notable difference is that, aside from some evidence of mean reversion following the discontinuous drop in 1998, the trend continues downward, generally tracking the overall decline in market illiquidity.

This downward trend in non-small IPO illiquidity suggests these transactions have suffered less of the illiquidity-begets-illiquidity vicious cycle apparent in Figure 5A. Yet even for non-small IPOs, Figure 5B shows that the decline in illiquidity failed to keep pace with the overall decline of illiquidity within the market: By 2005, median illiquidity of non-small IPOs had risen from being solidly in the second quartile of market illiquidity to being largely in the third quartile, highlighting how even non-small IPOs have experienced an increase in illiquidity relative to the market as a whole. To the extent this is the case, our demand side theory would indicate that even larger IPOs might experience diminished investment interest from mutual funds as their growing AUM continues to pressure managers to avoid illiquid positions, further weakening the liquidity of these larger IPOs.

Finally, in Figure 6A and 6B we present additional evidence of the growing illiquidity of both small IPOs and non-small IPOs by calculating the annual percentage of IPOs that fell into each quartile of market illiquidity as of the date of the offering. For instance, if an IPO's measure of six-month Amihud illiquidity placed it within the lowest quartile in the monthly distribution of illiquidity for all of CRSP, we classified the IPO as being in quartile 1; if an IPO's measure of illiquidity placed it within the highest quartile of illiquidity for all of CRSP, we classified the IPO as being in quartile 4; and so on. We present results separately for small IPOs and all other IPOs in Figures 6A and 6B, respectively.

As with Figures 5A and 5B, these individual IPO classifications further confirm the growing illiquidity of small IPOs, and increasingly, non-small IPOs. Of particular note are the two darkest portions of each annual bar, which represent the percentage of IPOs classified as among the most illiquid half of all CRSP securities at the time of the offering. In Figure 6A, these two bars show a gradual increase through most of the 1990s, but decline sharply in 1998 and 1999. As noted previously, we attribute this notable decline in IPO illiquidity to issuer self-selection following the Panic of 1998: Given market concerns about liquidity, only those IPOs likely to generate significant after-market trading completed an offering. Following this initial response, however, virtually no small IPOs were classified within the most liquid half of the market for the remainder of the sample period, with the vast majority being classified as among the most illiquid quartile of securities by 2005.

Figure 6B indicates that Panic of 1998 had less of an affect on the illiquidity of non-small IPOs, with the exception of the brief decline in illiquidity in 1999. Overall, less than 40% of non-small IPOs were classified as among the most illiquid half of CRSP upon their issuance through 2002. After 2002, however, the percentage gradually increases, with a notable increase in the percentage of non-small IPOs being classified as among the most illiquid quarter of securities after 2005. The primary exception is following the financial crisis in 2009 when, as in 1998, the "IPO window" appears to have been limited to only those firms expected to generate considerable trading interest notwithstanding highly volatile market conditions.

While our primary research inquiry has focused on the demise of the small IPO, we view these final findings as potentially alarming for the health of the IPO market more generally. In particular, to the extent funds' growing AUM has prompted concerns about IPO liquidity, the increasing illiquidity of non-small IPOs over time may reflect the fact that funds' ever growing amounts of AUM has meant a larger portion of IPOs have become undesirable liquidity risks for large funds. In short, given the continued growth of fund AUM, our illiquidity-begets-illiquidity hypothesis may have begun to implicate larger transactions. To be sure, the time series nature of the data leave open other explanations as well for the increasing illiquidity of larger IPOs. Among other things, for instance, the Global Analyst Settlement occurred at roughly the time the illiquidity of non-small IPOs began to tick upward, underscoring the possibility for multiple causal factors. Even so, whatever the underlying reasons for the increase in non-small IPO illiquidity, its very increase nevertheless underscores why IPOs in general might be losing their appeal among large mutual fund investors, representing a key obstacle facing regulatory efforts to revitalize the IPO market.

VII. Conclusion

1998 was a seminal year in the history of IPOs. It not only marked the ascent of the technology bubble, it also marked the decline of the small IPO—a decline that we attribute in large part to diminished demand among the largest mutual fund investors triggered by the Panic of 1998. Using a difference-in-difference approach, we find that following 1998, the largest quartile of mutual funds significantly reduced their investments in small IPOs relative to smaller

funds. Additionally, conditional on investing in an IPO, the largest funds also demonstrated a decisive shift towards purchasing larger, more liquid IPOs after 1998.

Overall, we view this evidence as consistent with larger funds being more sensitive to IPO liquidity risk due to the rapid increase after 1990 in assets under management among the largest funds. In light of recent regulatory efforts to reinvigorate the small IPO market, these results highlight the need for reform efforts to focus on enhancing IPO liquidity as opposed to prevailing "supply side" considerations that emphasize regulatory burdens facing new issuers. Indeed, to the extent such supply side reforms result in ad hoc deregulation, their ultimate effect may simply contribute to the illiquidity of IPOs, further undermining the market for new issues.

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Figures and Tables

Figure 1:
Russell 2000 / Russell 1000 and Market Implied Volatility (VIX), 1990-2014

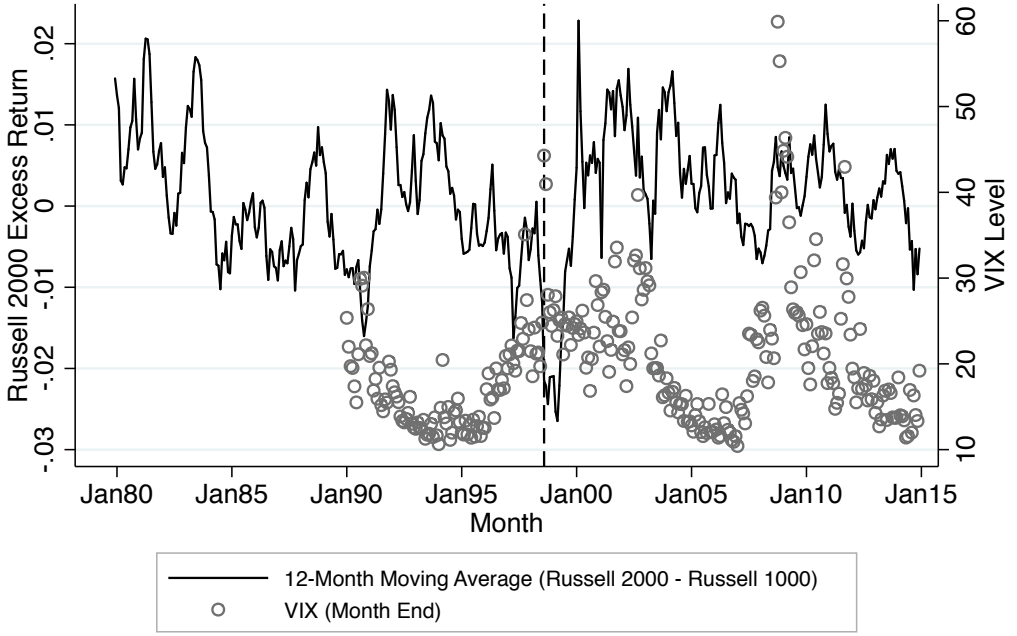

Figure 2:
Mean Size of Mutual Funds by Quartile, 1990-2014

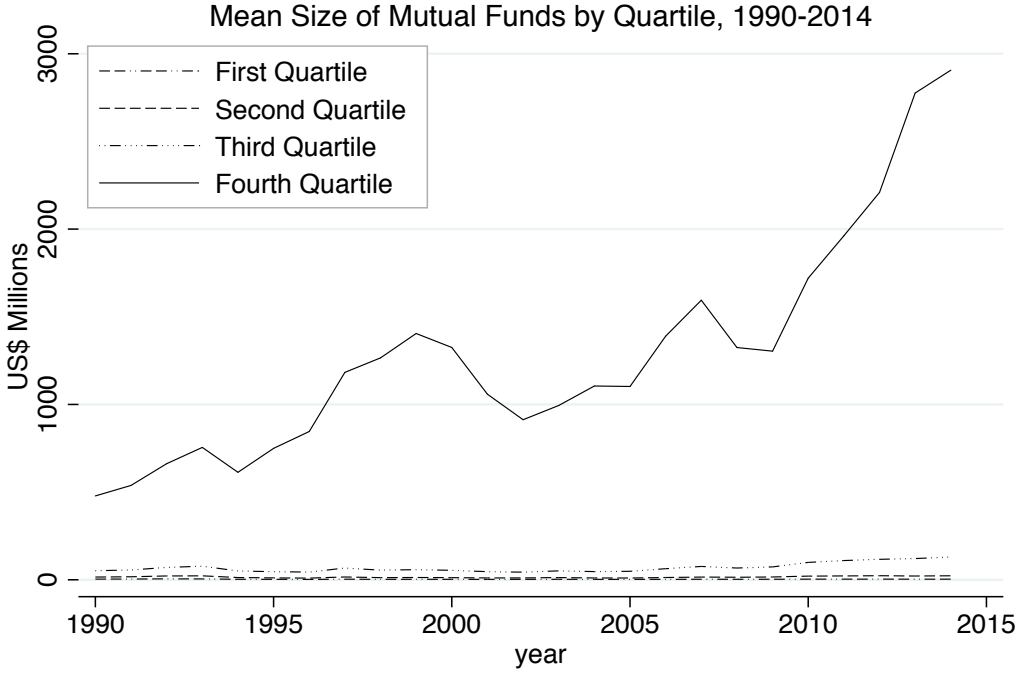

Figure 3A:
Illiquidity of Small IPOs in Month of Issue vs. Non-Small IPOs, 1990-2014

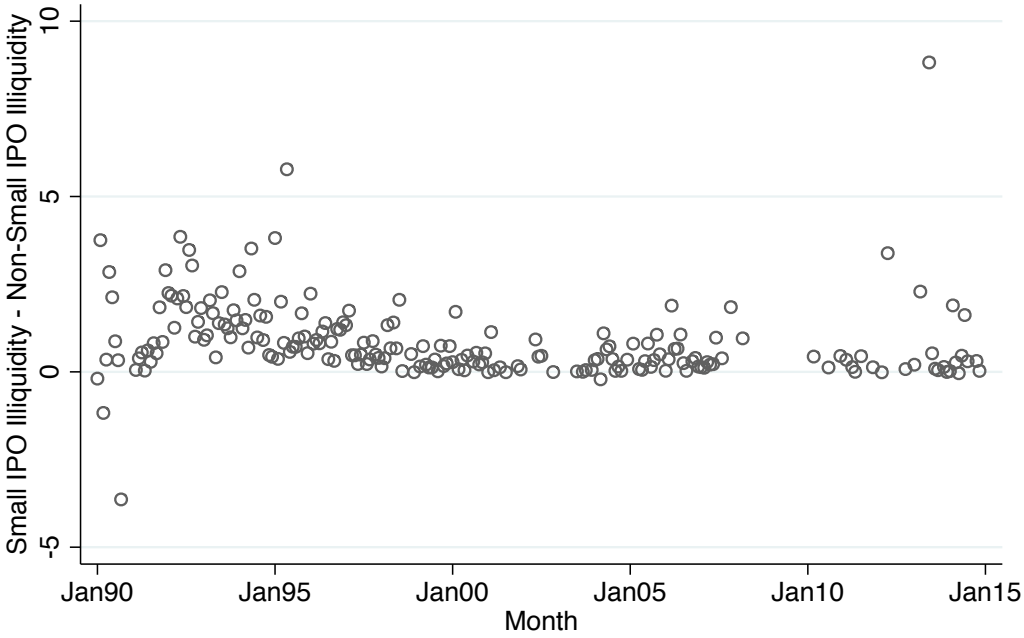

Figure 3B:
Illiquidity of IPOs in Month of Issue vs. Entire Market, 1990-2014

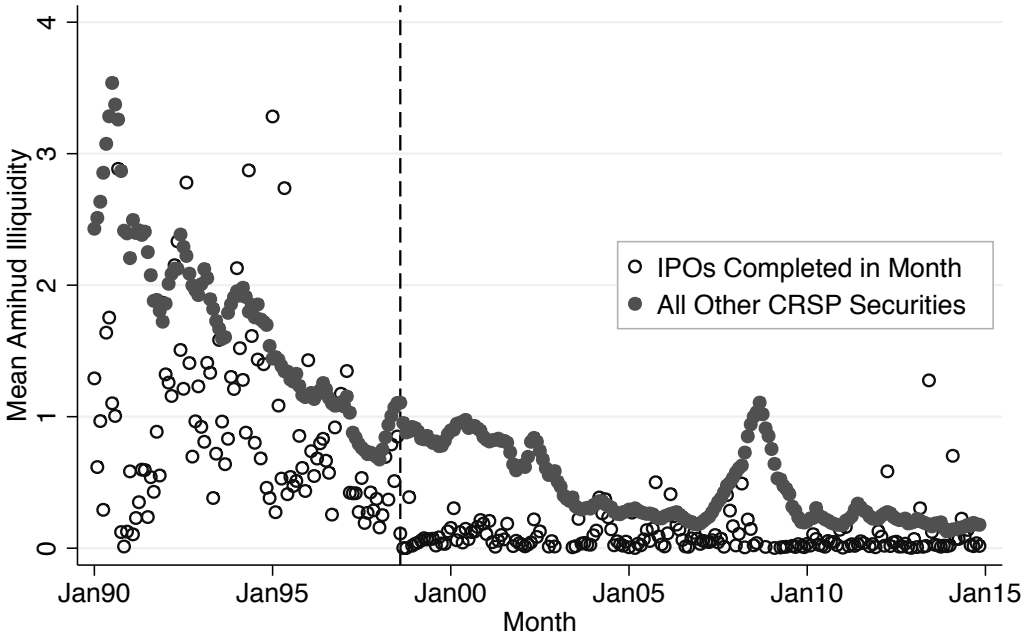

Figure 4A:
Small IPOs Vs. No. of Mutual Funds in Sample, 1990–2014

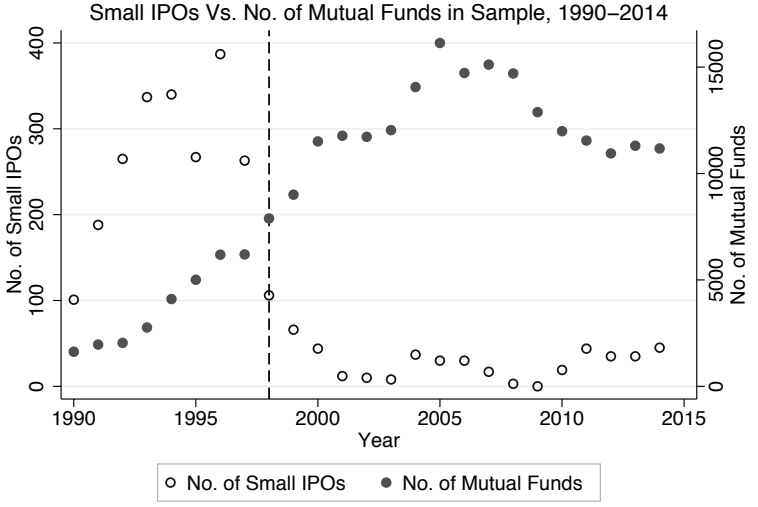

Figure 4B:
Number of Large Fund Investors Per IPO, 1990–2014

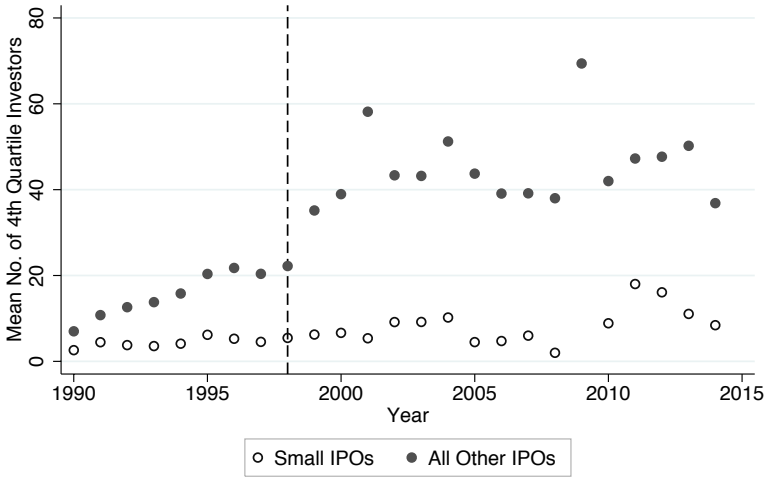

Figure 4C:
Number of Large Fund Investors Per IPO, 1990–2014

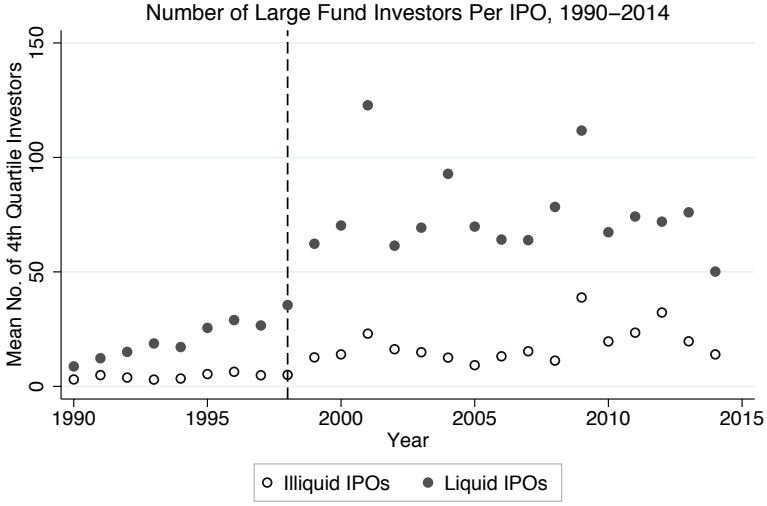

Figure 5A:
Illiquidity of Small IPOs in Month of Issue vs. Entire Market, 1990-2014

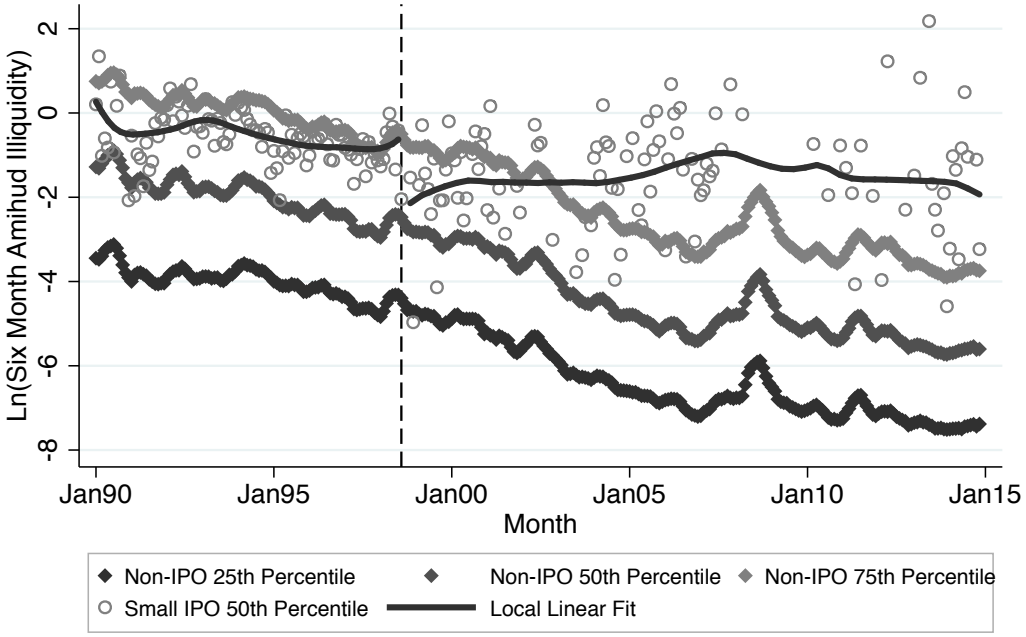

Figure 5B:
Illiquidity of Non-Small IPOs in Month of Issue vs. Entire Market, 1990-2014

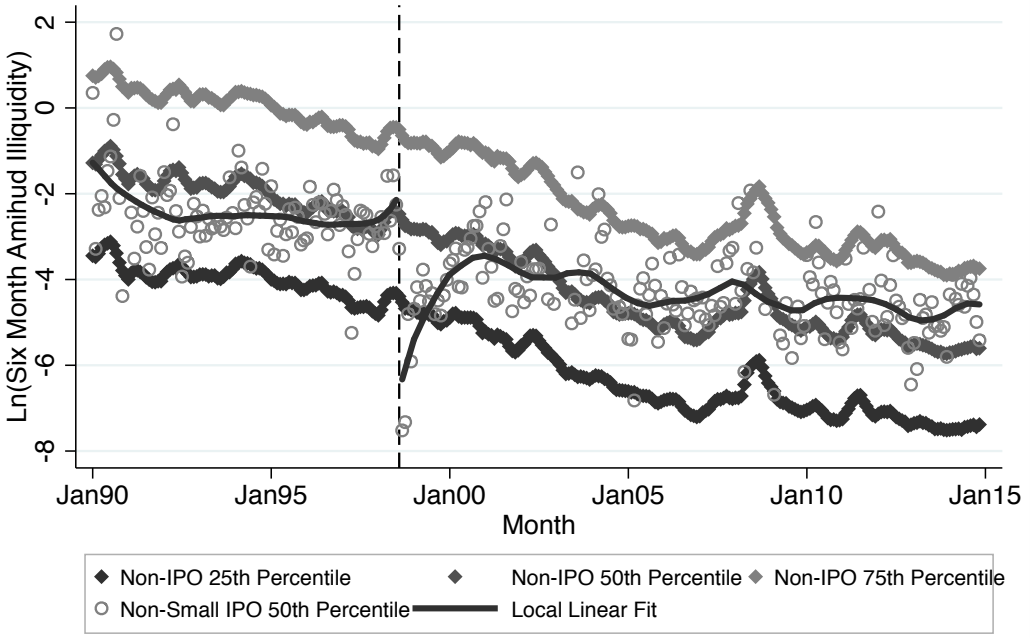

Figure 6A:
Illiquidity Classification of Small IPOs Within Entire Market, 1990-2014

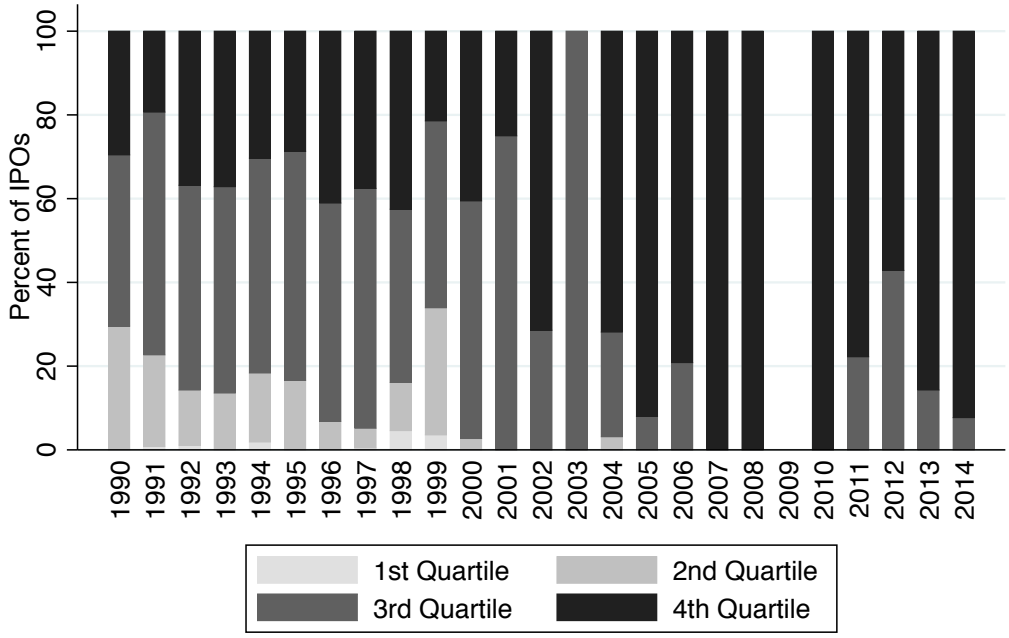

Figure 6B:
Illiquidity Classification of Non-Small IPOs Within Entire Market, 1990-2014

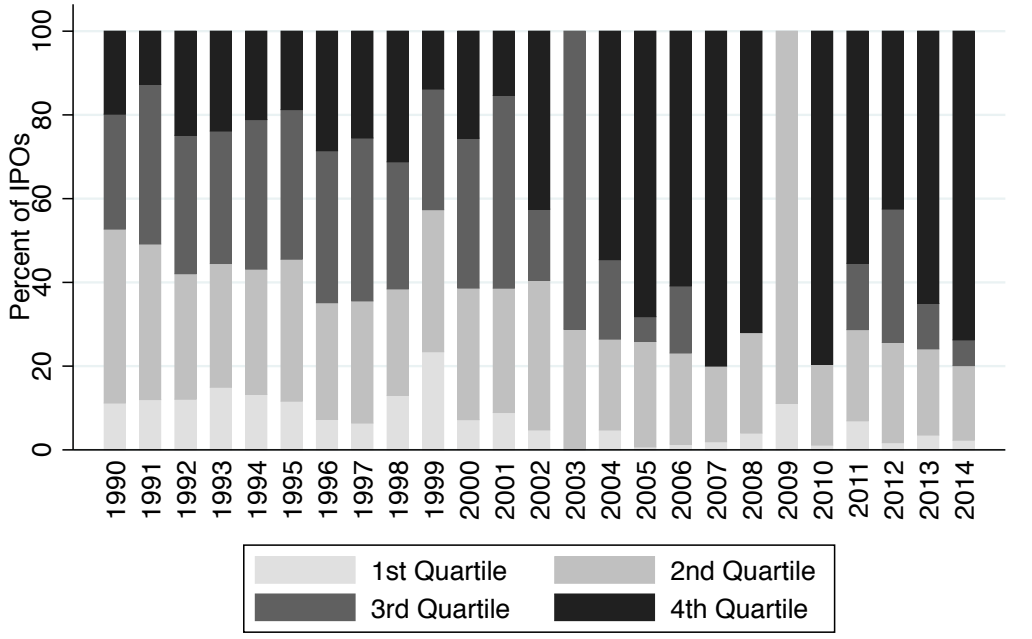

Table I: IPO Proceeds and Mutual Fund Investing (1990-2014)

Descriptive statistics for 6,110 initial public offerings from the period 1990 through 2014 within the full sample and for a reduced sample where we require a match to at least one mutual fund investment in the S12 dataset. *Small IPO* references an IPO which received less than $54.4 million in net proceeds using 2014 dollars. *25%, 50%*, and *75% IPO Proceeds* reflect the size of IPOs at the 25th, 50th, and 75th percentile of the overall size distribution of IPOs in a given year. All dollar figures are inflation adjusted to 2014 dollars.

	Full IPO Sample						Matched S12 Sample					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Year	**Total # of IPOs**	**% Small IPOs**	**Mean Proceeds**	**25% IPO Proceeds**	**50% Proceed**	**75% IPO Proceeds**	**IPOs with at least 1 Fund Investor**	**% Small IPOs**	**Mean Proceed**	**25% IPO Proceeds**	**50% Proceeds**	**75% IPO Proceeds**
1990	147	69%	$54.8	$10.2	$29.0	$67.8	95	48%	$62.4	$29.0	$48.9	$79.2
1991	309	59%	$72.4	$18.3	$45.0	$80.0	237	42%	$81.0	$34.8	$54.0	$90.4
1992	422	60%	$75.7	$13.4	$38.3	$74.2	274	36%	$107.9	$36.8	$59.2	$94.3
1993	543	57%	$75.5	$18.1	$39.3	$79.1	404	38%	$87.7	$33.9	$54.1	$94.4
1994	465	68%	$57.7	$13.4	$28.8	$55.9	307	48%	$73.6	$26.9	$44.8	$76.3
1995	482	49%	$83.9	$17.7	$47.5	$77.2	380	31%	$102.8	$37.3	$56.5	$89.3
1996	706	47%	$85.7	$21.9	$48.6	$84.5	584	31%	$99.4	$33.2	$57.5	$97.7
1997	464	46%	$88.1	$23.7	$47.7	$84.9	389	34%	$99.4	$33.4	$53.4	$94.0
1998	258	30%	$170.8	$36.3	$62.9	$110.2	228	20%	$200.1	$47.8	$73.1	$125.3
1999	437	10%	$193.1	$68.0	$98.0	$161.8	423	7%	$184.8	$71.1	$102.3	$164.1
2000	344	6%	$218.9	$73.1	$115.8	$181.6	333	2%	$235.1	$77.0	$119.7	$189.7
2001	75	13%	$513.6	$73.5	$144.1	$230.6	71	8%	$505.6	$79.4	$144.1	$209.8
2002	64	8%	$226.9	$69.6	$138.7	$296.8	58	3%	$252.7	$80.1	$151.6	$326.9
2003	52	8%	$194.7	$79.6	$130.2	$244.7	50	4%	$216.0	$84.9	$145.0	$323.9
2004	154	10%	$208.9	$59.1	$102.9	$195.2	150	9%	$226.2	$60.3	$107.2	$195.8
2005	138	16%	$220.4	$63.8	$131.2	$269.7	130	10%	$217.0	$68.4	$143.0	$272.7
2006	144	10%	$215.1	$68.3	$129.2	$230.5	140	3%	$219.2	$73.5	$129.7	$237.8
2007	145	7%	$207.3	$78.8	$123.3	$243.3	138	1%	$225.5	$89.3	$137.0	$256.9
2008	22	14%	$297.4	$67.9	$191.5	$377.6	20	0%	$282.7	$103.9	$191.5	$377.6
2009	38	0%	$400.1	$135.4	$197.3	$482.8	28	0%	$460.6	$144.2	$211.3	$644.2
2010	92	15%	$372.3	$61.1	$100.9	$219.8	76	3%	$532.9	$72.6	$113.6	$234.1
2011	118	30%	$249.2	$2.5	$105.0	$224.6	81	2%	$313.3	$98.0	$181.0	$294.2
2012	125	22%	$289.0	$42.7	$96.9	$193.8	100	1%	$453.9	$88.8	$135.8	$270.9
2013	169	15%	$278.8	$66.1	$122.7	$288.7	148	3%	$279.8	$72.9	$135.6	$288.7
2014	197	14%	$186.4	$57.5	$98.8	$185.6	177	6%	$188.6	$64.3	$104.6	$191.0
Mean	244	27%	$201.5	$49.6	$96.5	$189.6	201	16%	$228.3	$65.7	$110.2	$212.8

Table II: Mutual Fund Sample Summary Statistics

Descriptive statistics for the sample of mutual fund investors for the years 1990, 2000 and 2010 broken down by size quantiles. The first three columns set forth the number of funds in each quantile in terms of aggregate fund size as of year-end as well as the mean and median size within the quantile. *% of All Fund Assets* represents the percentage of fund assets for each quantile as a percentage of total assets for all funds. *Mean No. Equity Positions* and *Median No. Equity Positions* refer to the mean and median number of equity investments held by funds within each quantile. *Mean Position Value* and *Median Position Value* are the mean and median dollar value of all equity positions disclosed by funds within a quantile. *% of Funds Investing IPOs* and *% of Funds Investing in Small IPOs* are the percentage of funds in column 1 that disclose at least one investment in the sample of all IPOs and small IPOs for the given year, respectively. All dollar figures are inflation adjusted to 2014 dollars.

Year	Size Quantile	(1) Number of Funds	(2) Mean Fund Size	(3) Median Fund Size	(4) % of All Fund Assets	(5) Mean No. Equity Positions	(6) Median No. Equity Positions	(7) Mean Position Value	(8) Median Position Value	(9) % of Funds Investing in IPOs	(10) % of Funds Investing in Small IPOs
1990											
	1	406	$6.6	$6.0	0.66%	26.6	20.1	$0.5	$0.3	18.5%	6.4%
	2	406	$28.1	$26.8	2.82%	40.6	36.0	$1.2	$0.8	22.9%	9.4%
	3	406	$93.2	$86.7	9.38%	55.8	44.1	$2.5	$1.9	28.6%	14.5%
	4	406	$866.0	$405.6	87.13%	94.6	65.1	$11.5	$7.3	34.0%	12.1%
	Overall:	*1,624*	*$248.5*	*$47.9*	*100.00%*	*54.4*	*40.0*	*$3.9*	*$1.3*	*26.0%*	*10.6%*
2000											
	1	2,878	$3.6	$3.2	0.19%	23.5	13.1	$0.7	$0.2	16.8%	0.4%
	2	2,877	$16.5	$15.5	0.86%	50.3	30.5	$1.2	$0.5	26.5%	0.9%
	3	2,878	$74.2	$65.1	3.87%	82.5	48.0	$2.5	$1.4	38.1%	2.1%
	4	2,877	$1,821.5	$476.9	95.08%	140.6	74.0	$21.2	$7.0	56.4%	4.8%
	Overall:	*11,510*	*$478.9*	*$31.4*	*100.00%*	*74.2*	*38.4*	*$6.4*	*$1.1*	*34.5%*	*2.1%*
2010											
	1	2,997	$3.9	$3.3	0.19%	21.6	5.0	$1.3	$0.6	3.1%	0.1%
	2	2,997	$22.6	$20.7	1.13%	53.3	24.0	$3.4	$0.9	7.3%	0.3%
	3	2,997	$107.5	$96.5	5.37%	100.5	47.0	$5.9	$2.2	14.8%	0.6%
	4	2,997	$1,867.6	$624.6	93.30%	164.2	66.5	$42.4	$10.2	25.7%	1.7%
	Overall:	*11,988*	*$500.4*	*$44.5*	*100.00%*	*84.9*	*31.1*	*$13.3*	*$2.0*	*12.7%*	*0.7%*

Table III: IPO Liquidity, 1990-2014

Descriptive statistics of the liquidity of IPO and non-IPO firms between 1990 and 2014. Panel A reports results from three interrupted-time series regressions examining the illiquidity of IPOs, small IPOs, and all non-IPO securities, respectively, surrounding the flight to liquidity that peaked in August 1998. The unit of observation is the mean six-month forward moving average of Ahmihud Illiquidity for each month between 1990 and 2014. *POST* is a dummy variable coded as one for all months in the sample period following August 1998. *MONTH* is a time trend for months. Newey-West standard errors (in parentheses) were calculated with five lags in models 1 and 2 and with 9 lags in model 3 determined using Cumby-Huizinga tests for autocorrelation. Panel B provides descriptive statistics of IPO trading venue from 1990-2014 based on data from SDC. Panel C provides statistics for lead underwriters of IPOs based on data from SDC. ***, **, and * indicate statistics are significant at the 1%, 5%, and 10% levels, respectively

Panel A. Illiquidity of IPOs, Small IPOs, and All Other CRSP Securities, 1990-2014

	All IPOs	Small IPOs	All Other Firms
	(1)	(2)	(3)
Post	-0.553***	-0.797***	0.157
	(0.136)	(0.214)	(0.103)
Month	-0.005*	-0.008*	-0.020***
	(0.003)	(0.004)	(0.002)
Post x Month	0.005*	0.011**	0.017***
	(0.003)	(0.005)	(0.002)
N	284	209	299

Panel B. Choice of Trading Venue Among IPO Firms, 1990-2014

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Year	**Total # of Small IPOs**	**% of All IPOs**	**% Nasdaq**	**% NYSE**	**% Amex**	**% Nasdaq, NYSE, AMEX (Combined)**	**% OTC/ Pink**	**Total # of Other IPOs**	**% of All IPOs**	**% Nasdaq**	**% NYSE**	**% Amex**	**% Nasdaq, NYSE, AMEX (Combined)**	**% OTC/ Pink**
1990	74	50.3%	60.8%	2.7%	5.4%	68.9%	31.1%	73	49.7%	67.1%	23.3%	4.1%	94.5%	5.5%
1991	110	35.6%	70.0%	0.0%	4.5%	74.5%	24.5%	199	64.4%	72.9%	19.1%	2.5%	94.5%	5.5%
1992	177	41.9%	65.5%	1.7%	2.8%	70.1%	29.4%	245	58.1%	71.8%	20.8%	2.0%	94.7%	5.3%
1993	215	39.6%	56.3%	1.9%	3.7%	61.9%	37.7%	328	60.4%	76.2%	18.6%	0.9%	95.7%	4.3%
1994	242	52.0%	62.4%	0.8%	3.3%	66.5%	32.6%	223	48.0%	72.6%	21.5%	1.3%	95.5%	4.5%
1995	165	34.2%	45.5%	0.0%	2.4%	47.9%	51.5%	317	65.8%	81.7%	14.2%	1.3%	97.2%	2.8%
1996	229	32.4%	45.4%	0.0%	3.1%	48.5%	51.1%	477	67.6%	78.4%	15.7%	2.7%	96.9%	3.1%
1997	142	30.6%	40.1%	0.0%	8.5%	48.6%	51.4%	322	69.4%	76.4%	17.7%	2.8%	96.9%	3.1%
1998	57	22.1%	36.8%	0.0%	14.0%	50.9%	47.4%	201	77.9%	73.6%	22.9%	1.0%	97.5%	2.5%
1999	31	7.1%	54.8%	0.0%	12.9%	67.7%	32.3%	406	92.9%	88.7%	7.9%	0.7%	97.3%	2.7%
2000	18	5.2%	61.1%	0.0%	22.2%	83.3%	16.7%	326	94.8%	89.9%	5.8%	0.3%	96.0%	4.0%
2001	8	10.7%	25.0%	0.0%	12.5%	37.5%	62.5%	67	89.3%	59.7%	37.3%	0.0%	97.0%	3.0%
2002	4	6.3%	50.0%	25.0%	0.0%	75.0%	0.0%	60	93.8%	56.7%	40.0%	0.0%	96.7%	3.3%
2003	4	7.7%	0.0%	0.0%	50.0%	50.0%	25.0%	48	92.3%	77.1%	20.8%	2.1%	100.0%	0.0%
2004	12	7.8%	58.3%	0.0%	25.0%	83.3%	8.3%	142	92.2%	71.1%	26.1%	1.4%	98.6%	1.4%
2005	17	12.3%	47.1%	5.9%	35.3%	88.2%	11.8%	121	87.7%	60.3%	38.8%	0.0%	99.2%	0.8%
2006	14	9.7%	64.3%	7.1%	21.4%	92.9%	7.1%	130	90.3%	72.3%	26.2%	0.8%	99.2%	0.8%
2007	9	6.2%	66.7%	11.1%	0.0%	77.8%	22.2%	136	93.8%	69.9%	27.9%	1.5%	99.3%	0.7%
2008	3	13.6%	66.7%	0.0%	0.0%	66.7%	33.3%	19	86.4%	47.4%	52.6%	0.0%	100.0%	0.0%
2009	0	0.0%						38	100.0%	50.0%	50.0%	0.0%	100.0%	0.0%
2010	14	15.2%	28.6%	0.0%	0.0%	28.6%	57.1%	78	84.8%	50.0%	48.7%	1.3%	100.0%	0.0%
2011	35	29.7%	2.9%	0.0%	0.0%	2.9%	91.4%	83	70.3%	50.6%	48.2%	1.2%	100.0%	0.0%
2012	28	22.4%	21.4%	0.0%	0.0%	21.4%	75.0%	97	77.6%	43.3%	53.6%	0.0%	96.9%	3.1%
2013	26	15.4%	30.8%	0.0%	0.0%	30.8%	69.2%	143	84.6%	49.7%	49.0%	0.0%	98.6%	1.4%
2014	27	13.7%	55.6%	0.0%	0.0%	55.6%	44.4%	170	86.3%	57.6%	41.8%	0.0%	99.4%	0.6%
Mean ('90-'98)	157	37.7%	53.7%	0.8%	5.3%	59.7%	39.6%	265	62.3%	74.5%	19.3%	2.1%	95.9%	4.1%
Mean ('99-'09)	12	7.9%	49.4%	4.9%	17.9%	72.2%	21.9%	146	92.1%	69.3%	28.3%	0.7%	98.3%	1.7%
Mean ('10-'14)	26	19.3%	27.8%	0.0%	0.0%	27.8%	67.4%	114	80.7%	50.2%	48.2%	0.5%	99.0%	1.0%

Panel C. IPO Underwriters, 1990-2014

	(1)	(2)	(3)	(4)
	# I-Banks IPOs < 30MM	# I-Banks IPOs > 30MM	Overlap	Overlap % (% of Banks Doing Large IPOs also Doing Small IPOs)
1990	45	24	7	29.17%
1991	79	38	23	60.53%
1992	111	48	24	50.00%
1993	113	59	29	49.15%
1994	135	60	30	50.00%
1995	101	52	18	34.62%
1996	138	60	37	61.67%
1997	106	75	23	30.67%
1998	69	48	9	18.75%
1999	58	42	6	14.29%
2000	26	45	2	4.44%
2001	9	28	3	10.71%
2002	13	28	5	17.86%
2003	6	35	0	0.00%
2004	19	42	4	9.52%
2005	25	49	6	12.24%
2006	16	48	5	10.42%
2007	13	53	3	5.66%
2008	3	18	0	0.00%
2009	7	21	4	19.05%
2010	12	31	3	0.00%
2011	10	46	3	6.52%
2012	12	36	3	8.33%
2013	8	52	4	7.69%
2014	15	48	5	10.42%
Mean ('90-'98)	100	52	22	42.7%
Mean ('99-'09)	19	39	3	8.5%
Mean ('10-'14)	11.4	42.6	3.6	8.2%

Table IV: Mutual Fund Investment in IPOs

This table examines investment in IPOs between 1990 and 2014 by mutual fund investors in a sample of 37,052 funds where the unit of observation is a fund's annual investments across 6,110 IPOs. Panel A presents regression results where the dependent variable is either the annual number of IPO investments by a fund (column 1) or the annual number of *small IPO* investments by a fund (column 2). Panel B presents regression results where the dependent variable is either the annual number of *Illiquid IPO* investments by a fund (column 1) or the average *Illiquidity Quartile* of those IPOs acquired by a fund in a given year (column 2). In Panel A, a *Small IPO* is defined as an IPO raising net proceeds of $30 million or less in 1990 inflation adjusted dollars. In Panel B, an *Illiquid IPO* is defined as an IPO whose six-month Amihud Illiquidity places it in the fourth quartile of IPOs in a year when ranked by six-month Amihud Illiquidity, while *Illiquidity Quartile* represents an IPO's quartile according to the same ranking. *POST* is a dummy variable coded as 1 for each year following 1998 and zero otherwise. *Size Quartile* represents the size quartile of a fund during the year. All models include year-fixed effects. Robust standard errors clustered on individual funds are in parentheses, with ***, **, and * denoting statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: IPO Investing by IPO Size

	(1)	(2)
Second Size Quartile	0.230***	0.096***
	(0.042)	(0.012)
Third Size Quartile	0.677***	0.277***
	(0.075)	(0.025)
Fourth Size Quartile	1.530***	0.486***
	(0.175)	(0.052)
POST	2.184***	-0.013
	(0.147)	(0.032)
POST x Second Size Quartile	-0.200***	-0.097***
	(0.044)	(0.012)
POST x Third Size Quartile	-0.505***	-0.284***
	(0.077)	(0.025)
POST x Fourth Size Quartile	-1.219***	-0.533***
	(0.180)	(0.054)
Year effects	Y	Y
Obs.	238,441	238,441

Panel B: IPO Investing by IPO Liquidity

	(1)	(2)
Second Size Quartile	0.025***	0.020
	(0.006)	(0.035)
Third Size Quartile	0.083***	0.022
	(0.012)	(0.037)
Fourth Size Quartile	0.157***	-0.022
	(0.024)	(0.037)
POST	0.169***	-0.283***
	(0.021)	(0.067)
POST x Second Size Quartile	-0.020***	-0.048
	(0.007)	(0.049)
POST x Third Size Quartile	-0.063***	-0.052
	(0.012)	(0.049)
POST x Fourth Size Quartile	-0.135***	-0.080*
	(0.025)	(0.048)
Year effects	Y	Y
Obs.	238,441	40,822

Table V: Mutual Fund Demand for Individual IPOs

This table examines the demand for IPOs among the largest quartile of mutual fund investors between 1990 and 2014. In both panels, the unit of observation is an individual IPO and the dependent variable is the number of mutual fund investors in the transaction that rank among the largest quartile of mutual funds for the year. Panel A examines how the number of large fund investors changed after 1998 as a function of the size of an IPO (column 1) and the illiquidity of an IPO (column 2). Panel B examines how this number changed after 1998 as a function of the interaction of IPO size and IPO illiquidity. *Small* and *POST* have the definitions given in Table IV. *IlliquidityRank* is an IPO's illiquidity quartile based on its six-month Amihud Illiquidity relative to all IPOs for the same year. *OneDayReturn* is an IPO's first day stock price return as reported by SDC. *SmallerInvestors* is the number of mutual fund investors in the sample that invested in an IPO but which did not rank among the largest quartile of mutual funds for the year. *IPOs* and *Funds* are the total number of IPOs and the total number of reporting mutual funds in the year of the transaction, respectively. All models include industry-fixed effects using one digit SIC codes and year fixed-effects. Robust standard errors clustered on individual funds clustered on IPOs are in parentheses, with ***, **, and * denoting statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Large Fund Investors by IPO Size and IPO Illiquidity

	(1)	(2)
Small	-1.911***	
	(0.491)	
Post x Small	-10.072***	
	(0.978)	
IlliquidityRank 2		-2.029***
		(0.586)
IlliquidityRank 3		-3.247***
		(0.700)
IlliquidityRank 4		-3.931***
		(0.800)
POST x IlliquidityRank 2		-9.358***
		(1.581)
POST x IlliquidityRank 3		-11.698***
		(1.698)
POST x IlliquidityRank 4		-16.883***
		(1.939)
OneDayReturn	0.304***	0.201***
	(0.050)	(0.038)
SmallerInvestors	0.884***	0.823***
	(0.079)	(0.075)
IPOs	0.012***	-0.000
	(0.004)	(0.005)
Funds	0.001***	0.002***
	(0.000)	(0.000)
Year Fixed Effects	Y	Y
Industry Fixed Effects	Y	Y
N	4,880	4,662

Panel B: Large Fund Investors by IPO Size x IPO Illiquidity

	(1)
Small	-4.146***
	(0.931)
IlliquidityRank 2	-1.700***
	(0.644)
IlliquidityRank 3	-2.848***
	(0.724)
IlliquidityRank 4	-3.322***
	(0.873)
Small x IlliquidityRank 2	1.233
	(0.881)
Small x IlliquidityRank 3	2.220**
	(0.873)
Small x IlliquidityRank 4	2.453**
	(0.960)
POST x Small	-18.723***
	(4.660)
POST x IlliquidityRank 2	-10.021***
	(1.642)
POST x IlliquidityRank 3	-12.206***
	(1.777)
POST x IlliquidityRank 4	-15.712***
	(1.972)
POST x Small x IlliquidityRank 2	12.160**
	(5.116)
POST x Small x IlliquidityRank 3	12.219**
	(4.843)
POST x Small x IlliquidityRank 4	12.975***
	(4.627)
OneDayReturn	0.178***
	(0.036)
SmallerInvestors	0.816***
	(0.074)
IPOs	-0.000
	(0.005)
Funds	0.002***
	(0.000)
Year Fixed Effects	Y
Industry Fixed Effects	Y
N	4,662