
Report to Congress on Decimalization

**As Required by Section 106 of the
Jumpstart Our Business Startups Act**



This is a report of a study by the Staff of the U.S. Securities and Exchange Commission. The Commission has expressed no view regarding the analysis, findings, or conclusions contained herein.

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Introduction

On April 5, 2012 Congress passed the Jumpstart Our Business Startups Act (the JOBS Act). Section 106(b) of the JOBS Act requires the Commission to conduct a study within 90 days of enactment examining the effects of decimalization on initial public offerings (IPOs) and small and middle capitalization companies. Specifically, Section 106(b) provides as follows:

(6) TICK SIZE¹

(A) **STUDY AND REPORT** - The Commission shall conduct a study examining the transition to trading and quoting securities in one penny increments, also known as decimalization. The study shall examine the impact that decimalization has had on the number of initial public offerings since its implementation relative to the period before its implementation. The study shall also examine the impact that this change has had on liquidity for small and middle capitalization company securities and whether there is sufficient economic incentive to support trading operations in these securities in penny increments. Not later than 90 days after the date of enactment of this paragraph, the Commission shall submit to Congress a report on the findings of the study.

(B) **DESIGNATION**.—If the Commission determines that the securities of emerging growth companies should be quoted and traded using a minimum increment of greater than \$0.01, the Commission may, by rule not later than 180 days after the date of enactment of this paragraph, designate a minimum increment for the securities of emerging growth companies that is greater than \$0.01 but less than \$0.10 for use in all quoting and trading of securities in any exchange or other execution venue.²

In March 2011, the Treasury Department sponsored a conference, entitled the *Access to Capital: Fostering Growth and Innovation for Small Companies*, in order to solicit recommendations from conference participants on how to restore effective access to capital for emerging companies, including public capital through the IPO market. As an outgrowth of that conference, a small group of professionals formed the IPO Task Force “in order to 1) examine the challenges that emerging growth companies face in pursuing an IPO and 2) develop recommendations for helping such companies access the additional capital they need to generate jobs and growth for the U.S. economy and to expand their businesses globally.”³ The IPO Task

¹ A tick is the minimum pricing increment that can be used to trade securities. Decimalization is setting the tick size at penny increments.

² JOBS Act § 106(b), 15 U.S.C. § 78(k)-1(c)(6) (2012).

³ IPO Task Force, 2011, Rebuilding the IPO On-Ramp, presented to U.S. Dept. of Treasury.

Force generated a report summarizing its findings and recommendations (hereafter “IPO Task Force Report”).⁴

One of the IPO Task Force’s conclusions is that changes in the market structure of U.S. capital markets toward a low-cost, frictionless environment characterized by electronic trading has favored highly liquid, very large capitalization stocks at the expense of smaller capitalization stocks. According to the IPO Task Force Report, the impact of decimalization has been twofold. First, market structure changes associated with decimalization favor short-term trading strategies over long-term fundamental strategies.⁵ For smaller public company stocks with lower liquidity, the lack of fundamental strategies results in trading volume that is too low “to make money for the investment bank’s trading desk.”⁶ The IPO Task Force Report argues that this lack of profitability undermines the incentive for underwriters to take smaller companies public.⁷

Second, the IPO Task Force Report states that “decimalization . . . put the economic sustainability of sell-side research departments under stress by reducing the spreads and trading commissions that formerly helped to fund research analyst coverage.”⁸ The IPO Task Force Report also argues that analyst coverage has significantly shifted away from smaller capitalization stocks towards highly liquid, larger capitalization stocks, reflecting the change in financial institution focus.⁹ In particular, the IPO Task Force Report suggests that analyst coverage of smaller public companies has become unprofitable both because of the Global Analyst Research Settlement in 2003, which prohibited the direct compensation of research analysts through investment banking revenue, and the advent of decimalization, which reduced spreads that formerly helped fund analyst coverage.¹⁰ Thus, the IPO Task Force Report concludes, less analyst coverage of smaller capitalization companies means that less information on these stocks is generated, which, in turn, reduces market interest in these stocks.¹¹

Decimalization has faced criticism on other fronts. Prior to the IPO Task Force Report, in a paper released in June 2010, Grant Thornton also concluded that decimalization has had a

⁴ Id.

⁵ Id. at 13.

⁶ Id. at 14.

⁷ The IPO Task Force Report, however, ultimately concludes that the benefits from decimalization outweigh its costs. The report states that decimalization is part of “the new market reality” and should not be repealed, arguing that “investors have benefitted from greater market access and reduced trading costs.” Id. at 17.

⁸ Id. at 14.

⁹ Id.

¹⁰ Id. The Global Analyst Research Settlement was a settlement of enforcement actions against twelve investment banking firms arising from an investigation of research analyst conflicts of interest. The firms reached the settlement with the Commission, NASD Inc. (now FINRA), the New York Stock Exchange, Inc., the Attorney General of the State of New York, and other state regulators. The U.S. District Court for the Southern District of New York approved the settlement on October 31, 2003. The Global Analyst Research Settlement requires firms subject to the terms of the settlement to adhere to certain rules designed to address conflicts of interest abuses in research analyst activities. The Global Analyst Research Settlement has subsequently been amended by the parties and such amendments have been approved by the court.

¹¹ Id.

negative effect on the equity markets, and characterized decimalization as a “death star.”¹² The paper argues that decimalization almost eliminated the economic incentive to trade in small capitalization stocks, taking “96 percent of the economics from the trading spread of most small cap stocks – from \$0.25 per share to \$0.01 per share.” The paper also asserts that decimalization, combined with other innovations such as an increase in online brokerage, was significantly more damaging to the IPO market than oft-criticized provisions from the Sarbanes-Oxley Act of 2002. As with the IPO Task Force Report, the Grant Thornton paper argues that increasing the tick size for smaller capitalization stocks will encourage financial institutions to spend more resources to analyze these stocks.

Scope of the Study

The Staff has taken a three-pronged approach for the completion of the study within the 90-day time frame specified in the JOBS Act. This approach comprises (a) a review of empirical studies regarding tick size and decimalization, (b) participation in, and a review of the materials prepared in connection with, discussions concerning the impact of market structure on small and middle capitalization companies and on IPOs held as part of a meeting of the SEC Advisory Committee on Small and Emerging Companies, and (c) a survey of tick-size conventions in non-U.S. markets.¹³ In both the IPO Task Force Report and the Grant Thornton paper, the channel by which the IPO market is affected is through the long-term effects of decimalization on the trading of small and middle capitalization companies.¹⁴ This study focuses on the academic literature that examines the effect of decimalization on the market generally, and also on the securities of small and middle capitalization companies.¹⁵ These economic impacts of the change in tick size may be informative with respect to the willingness of smaller companies to conduct an IPO.

The format of the study first presents a review of the regulatory history of decimalization. Next, the study presents a literature review on the effect of decimalization with an emphasis on small

¹² Weild and Kim (2010). For full citations, see the References section at the end of the study.

¹³ On June 8, 2012, the SEC Advisory Committee on Small and Emerging Companies held a discussion of market structure issues and their impact on IPOs that featured presentations by David Weild, one of the co-authors of the Grant Thornton paper, and Professor Jeffrey Harris, a leading academic on issues of market structure and IPOs. Mr. Weild is the Chairman and CEO of Capital Markets Advisory Partners and is also affiliated with Grant Thornton’s Capital Markets group. Mr. Harris is a Professor of Finance at Syracuse University. Materials presented by Messrs. Weild and Harris are available at <http://www.sec.gov/info/smallbus/acsec.shtml>.

¹⁴ IPO Task Force Report, at 14 (arguing that insufficient revenue generated from trading in emerging growth companies “undermines the incentive for investment banks to underwrite and make markets for newly public companies”); Weild and Kim (2010), at 11 (stating that decimalization removed “96 percent of the economics from the trading spread of most small cap stocks” and that this was “too great a shock for the system to bear”).

¹⁵ There are no academic papers that directly examine the relationship between decimalization and the number of IPOs.

and middle capitalization companies and offers a summary of the discussion and views expressed at the Advisory Committee on Small and Emerging Companies' meeting on market structure and IPOs. The study also includes a comparison of U.S. equity market tick size policies to equity market tick size policies in other countries. Finally, the study concludes with a discussion of preliminary conclusions that can be drawn from the literature review and comparison of the U.S. market to other foreign markets. This section also includes a discussion of policy implications and general SEC Staff recommendations for the Commission's consideration as potential next steps.

Regulatory History of Decimalization

Prior to implementing decimal pricing in April 2001, the U.S. equity market used fractions as pricing increments, and had done so for hundreds of years. The Commission started examining the prudence of the fraction pricing structure in the mid 1990s. In the SEC Staff's 1994 report on the equities markets, the Staff expressed concern that $1/8^{\text{th}}$ of a dollar tick sizes were "caus[ing] artificially wide spreads and hinder[ing] quote competition," leading to excessive profits for market makers.¹⁶ The report also expressed concern that $1/8^{\text{th}}$ fraction pricing put U.S. equity markets at a competitive disadvantage to foreign equity markets that used decimal pricing increments. The Commission used these findings as part of a public discussion on whether the U.S. equities markets should adopt a lower fraction for minimum tick size or whether to adopt decimal pricing.

In light of this public discussion and even prior to the Staff's report on how tick sizes affected the competitiveness of U.S. equity markets, the exchanges and NASDAQ started implementing lower tick sizes. In 1992, the Commission approved an American Stock Exchange (AMEX)¹⁷ rule that lowered its tick size for stocks priced between \$0.25 and \$5 to $1/16^{\text{th}}$ of a dollar.¹⁸ A subsequent rule in 1997 applied this tick size to all AMEX stocks trading at or above \$0.25.¹⁹ Also in 1997, the New York Stock Exchange (NYSE) and NASDAQ promulgated rules to use $1/16^{\text{th}}$ as tick sizes.²⁰ The Commission, the exchanges and NASDAQ believed that the

¹⁶ SEC. & EXCH. COMM'N, MARKET 2000: AN EXAMINATION OF CURRENT EQUITY MARKET DEVELOPMENTS 18 (1994). See also Ball and Chordia (2001), which shows that tick size is a binding constraint on spreads in the pre-decimalization period.

¹⁷ The American Stock Exchange was acquired by the New York Stock Exchange in 2008 and is now called NYSE MKT.

¹⁸ Self-Regulatory Organizations; American Stock Exchange, Inc.; Order Approving Proposed Rule Change Relating to Amendments to Rule 127-Minimum Fractional Changes, 57 Fed. Reg. 40484 (Sept. 3, 1992). Stocks below \$0.25 were priced in $1/32^{\text{nd}}$ of a dollar ticks.

¹⁹ Self-Regulatory Organizations; American Stock Exchange, Inc.; Order Granting Approval to Proposed Rule Change Relating to Trading in One Sixteenth of a Dollar, 62 Fed. Reg. 25682 (May 9, 1997).

²⁰ Self-Regulatory Organizations; New York Stock Exchange, Inc.; Order Granting Approval to Proposed Rule Change Relating to Trading Differentials for Equity Securities, 62 Fed. Reg. 42847 (Aug. 8, 1997). The NYSE

reductions would provide multiple benefits to the equities markets, including better pricing and greater liquidity.

Congressman Michael Oxley advanced the discussion on decimal pricing in March 1997 when he introduced a bill in the U.S. House of Representatives that would have directed the Commission to adopt decimal pricing for all equity securities.²¹ After he introduced this bill, several exchanges and NASDAQ announced that they would implement decimal pricing by January 2000.²² Shortly thereafter, the Commission communicated with the exchanges and NASDAQ in greater detail on how decimal pricing would be implemented, including the rules and electronic systems that would need to be modified.²³ The exchanges and NASDAQ stated that they needed to adopt a coordinated plan to implement the changes and that the changes should be phased-in rather than implemented all at once in order to give the Commission and market participants time to observe how decimalization worked in the market and to impose less stress on the trading venues' computer systems.²⁴

In January 2000, the Commission ordered the exchanges and NASDAQ to develop a phase-in plan for implementing decimal pricing that would include preparation of necessary rule changes. The Commission mandated that the exchanges start implementing decimal pricing in September 2000 and finish implementation by April 2001.²⁵

The exchanges and NASDAQ started the phase-in on time and finished implementing decimalization by April 2001.²⁶ In 2004, the Commission proposed, and then repropoed, Rule

previously allowed 1/16th of one dollar for stock priced between \$0.50 and \$1.00, and 1/32nd of one dollar for stock priced below \$0.50. In Exchange Act Release No. 38678, the Commission approved NASD's request to change NASDAQ tick sizes from 1/8th to 1/16th of one dollar for all stock worth \$10 or more, and tick sizes for all stock priced below \$10 to 1/32nd of one dollar. Self-Regulatory Organizations; National Association of Securities Dealers, Inc.; Order Granting Approval to Proposed Rule Change To Decrease the Minimum Quotation Increment for Certain Securities Listed and Traded on The NASDAQ Stock Market to 1/16th of \$1.00, 62 Fed. Reg. 30363 (June 3, 1997). These tick sizes were not binding on other markets. Some Electronic Communication Networks (ECNs) allowed prices in increments of 1/256th. See Request for Comment on the Effects of Decimal Trading in Subpennies,

66 Fed. Reg. 38390, 38392 (July 24, 2001).

²¹ Also known as the "Common Cents Stock Pricing Act of 1997," H.R. 1053, 105th Cong., 1st Sess. (1997).

²² Order Directing the Exchanges and the National Association of Securities Dealers, Inc. To Submit a Decimalization Implementation Plan Pursuant to Section 11A(a)(3)(B) of the Securities Exchange Act of 1934 65 Fed. Reg. 5003, 5004 (Feb. 2, 2000).

²³ Id. at 5004-05.

²⁴ Id.

²⁵ Commission Notice: Decimals Implementation Plan for the Equities and Options Markets (July 24, 2000), available at <http://www.sec.gov/rules/other/decimalp.htm>. The Commission gave NASDAQ until March 2001 to start implementing decimal pricing, but required that it finish implementing decimal pricing alongside the exchanges in April 2001.

²⁶ "On June 8, 2000, we issued an order directing the securities exchanges and the Nasdaq Stock Market ("Nasdaq") to phase-in decimal pricing beginning no later than September 5, 2000, and ending no later than April 9, 2001. As a result of the careful planning, preparation, and coordination among regulators, the markets, clearing agencies, vendors, and the securities industry, I am able to report that the phasing-in of decimal pricing was completed on schedule and without significant operational problems or trading disruptions." Laura Unger, Acting Chairman, Sec.

612 of Regulation NMS to establish a minimum price variation (“MPV”) of one penny.²⁷ Several commenters on the original proposal had recommended an MPV of greater than one penny. In response, the Commission noted that proposed Rule 612 would “set a floor for the MPV, not determine an optimal MPV.”²⁸ It further stated that the move to a penny MPV had “reduced spreads, thus resulting in reduced trading costs for investors entering orders – particularly for smaller orders – that are executed at or within the quotations,”²⁹ and that therefore the Commission had not initially proposed a higher MPV. It added, however, that “if the SROs in the future believe that an increase in the MPV is necessary or desirable, they may propose rule changes to institute the higher MPV”³⁰ and that the Commission would evaluate them at that time. In 2005, the Commission adopted Regulation NMS Rule 612. The one penny MPV specified in Rule 612 essentially applies to all listed stocks at all price levels.³¹ This is the pricing structure in place today.

Literature Review

The advent of decimalization changed the tick size for most stocks from 1/16th and 1/32nd of a dollar to one penny. There are a number of academic studies that examine the effect of the change in tick size on markets. This review discusses the findings of the effects of the change to decimal pricing on overall market quality, and, where possible, the impact on small and middle capitalization stocks.³² Specifically, this review summarizes the academic literature, including research conducted by current and former SEC Staff members, on the theoretical and empirical effects that decimalization has had on the market.

& Exch. Comm’n, Testimony Before the Senate Subcommittee on Securities and Investment Committee on Banking, Housing, and Urban Affairs (May 24, 2001), available at <http://www.sec.gov/news/testimony/052401tslu.htm>.

²⁷ Regulation NMS, 69 Fed. Reg. 77424 (Dec. 27, 2004).

²⁸ Id. at 77458.

²⁹ Id.

³⁰ Id.

³¹ One part of Regulation NMS is Rule 612, which specifies minimum pricing increments for NMS stocks. In general, Rule 612 prohibits market participants from displaying, ranking, or accepting quotations, orders, or indications of interest in any NMS stock priced in an increment smaller than \$0.01 if the quotation, order, or indication of interest is priced equal to or greater than \$1.00 per share. If the quotation, order, or indication of interest is priced less than \$1.00 per share, the minimum pricing increment is \$0.0001. 17 CFR 242.612 (2012).

³² The definition of small, middle and large capitalization is generally study specific. For example, Bessembinder (2003) uses \$3.3 billion to \$336 billion as large capitalization, \$398 million to \$3.1 billion as middle capitalization, and \$18.5 million to \$336 million as small capitalization. The break points in capitalization sizes are a function of the sample selection criteria used in the study. See Bessembinder (2003), at 775. As noted in the introduction, the academic literature reviewed for this report does not speak directly to the effect of decimalization on initial public offerings.

Theoretical Literature

The limited theoretical literature on tick sizes focuses on how they affect market maker profits. Market maker profits are related to the transaction costs paid by investors, which in turn, depend on the size of the spread and any profits a market maker may make from price movements in the stock. In theory, larger tick sizes encourage dealers to make a market in a security because the tick represents the minimum round-trip profit to a dealer who can buy at a lower bid price and sell at a higher offer price.³³ However, larger tick sizes also could increase transaction costs for investors because the tick size represents a floor on the quoted bid – ask spread. Hence, according to one analysis, the optimal tick size for a stock reflects the tradeoff between the incentive that a larger relative tick size provides to liquidity providers (or market makers) and the cost that a larger tick size imposes on investors (Angel (1997)).³⁴ Because tick sizes outside the U.S. are often based on stock price, Angel (1997) argues that companies can strategically split their stocks so that an institutionally-mandated minimum tick size is optimal relative to their stock price. He argues that tick size can explain why a company may prefer a specific price range for its stock.

Other theoretical literature describes how tick size reductions affect the trading process. Angel (1997) notes that a larger tick size reduces the number of possible price outcomes, and thereby reduces the time required for buyers and sellers to negotiate and complete a trade. For example, he states, trading in eighths results in only seven price outcomes between \$10 and \$11, while trading in pennies would permit 99 outcomes. Harris (1991) argues that a discrete tick size reduces the cost of renegotiation between traders because it limits the number of possible price points. Thus, he concludes that the trade-off in reducing tick sizes is an increase in time to trade but a decline in transaction costs. Huang and Stoll (1994) argue that a tick size rule arises to facilitate orderly trading and give time priority meaning. They argue that time priority has little meaning if the market maker who is first to quote the best bid can lose that position to another who quotes only a penny more.

Main theoretical finding of the academic literature: *Tick sizes involve trade-offs between the incentives for market makers to make a market in the security and the cost of trading for investors. A reduction in tick sizes increases the number of possible price outcomes which may increase trade time.*

³³ Strictly speaking, this is only true if there are no price movements between the two transactions of a round-trip. In reality, there are price movements and often realized spreads are used to account for them. The realized spread is defined as the (signed) difference between the price of a transaction and the price that is observed a given period of time after the transaction, e.g., five minutes, thirty minutes, or the close of the day.

³⁴ For full citations, see the References section at the end of the study.

Empirical Findings

1. Spreads

Section 106(b) of the JOBS Act requires the Commission to examine how decimalization has impacted the liquidity for small and middle capitalization company securities. Though there are many definitions of liquidity, for equity investors, the liquidity of a market is generally associated with the ability of investors to trade a given size of a security quickly, and at a low cost (including any impact of the trade on the price of the security). Because liquidity has multiple dimensions, the academic studies of decimalization contain a variety of liquidity measures. The measures summarized here are those related to spreads, depth, and execution speed.

Spreads are related to liquidity because they represent the round-trip cost of trading. Depth measures how much liquidity is being supplied by investors and market makers. Execution speed is an evaluation of whether investors are able to execute orders relatively quickly. Generally, lower spreads and greater depth are characteristics of a more liquid market.

Numerous studies have found that, on average, both quoted and effective spreads declined with the advent of decimalization (e.g., Chakravarty, Harris, and Wood (2001); Bacidore, Battalio, and Jennings (2003); Bessembinder (2003)).³⁵ These findings are consistent with market improvements in liquidity associated with decimalization. These studies also find that smaller transactions have larger declines in effective spreads than larger transactions, indicating stronger liquidity effects for smaller transactions.

In one of the few studies that focus on company market capitalization, Bessembinder (2003) analyzes the effects of decimalization separately for small, middle, and large capitalization stocks using a matched sample of 300 NYSE and 300 NASDAQ companies. He compares the spread on each trading venue before and after decimalization.³⁶

Bessembinder finds that the average *quoted* bid-ask spreads for all companies declined from pre- to post-decimalization in both NYSE and NASDAQ stocks. His study results showed that large capitalization stocks' equally-weighted quoted spreads on the NYSE declined from 11 cents to 6 cents and on the NASDAQ from 10 cents to 4 cents. Middle capitalization stocks' equally-weighted quoted spreads on the NYSE declined from 16 cents to 10 cents and on the NASDAQ

³⁵ The quoted spread is the difference between the national best ask price and the national best bid price. Because trades often do not occur at the quoted prices, quoted spreads tend not to measure trading costs very well and are thus a less than perfect gauge of liquidity. By contrast, effective spreads, as measured by twice the difference between the midpoint of the bid-ask spread and the price paid (or received) by investors, account for trading that occurs at prices other than the quoted prices. Securities with lower effective spreads are more liquid than securities with higher spreads because it costs less to trade them.

³⁶ The time period before decimalization is defined as the three weeks before the NYSE decimalized and the time period after decimalization is the 21 weeks after the NASDAQ decimalized.

from 17 cents to 13 cents. In comparison, small capitalization stocks' equally-weighted quoted spreads declined from approximately 23 cents to 18 cents on the NYSE, and from 26 cents to 23 cents on the NASDAQ.³⁷ He found that the corresponding decline, as a percentage of trading price for small capitalization stocks, is from 1.75% to 1.16% on the NYSE and from 1.84% to 1.58% on the NASDAQ.³⁸

He finds similar effects of decimalization on the average *effective* bid-ask spreads. His study showed that large capitalization stocks' equally-weighted effective spreads on the NYSE declined from 8 cents to 4 cents and on the NASDAQ from 10 cents to 4 cents. Middle capitalization stocks' equally-weighted effective spreads on the NYSE declined from 10 cents to 6 cents and on the NASDAQ from 15 cents to 10 cents. In comparison, small capitalization stocks' equally-weighted effective spread declined from approximately 15 cents to 11 cents on the NYSE, and from 19 cents to 17 cents on the NASDAQ.³⁹ He found that the corresponding declines as a percentage of trading price for small caps are from 1.2% to 0.76% on the NYSE and from 1.4% to 1.2% on the NASDAQ. According to the study, all of the declines are statistically significant except for the decline in both quoted and effective spreads of the small capitalization NASDAQ stocks. In other words, the change in spreads for the smallest capitalization stocks before and after decimalization is not statistically significant. The direction of the results remains robust to volume weighting instead of equally weighting.

Chakravarty, Panchapagesan, and Wood (2005) also find evidence that institutional trading costs declined for all market capitalization quartiles and confirm the Bessembinder (2003) finding that the decline in the smallest market capitalization group on the NASDAQ is not statistically significant.

A number of studies examine the effect of decimalization on institutional trading. Chakravarty, Harris, and Wood (2001) show that effective spreads for large trades, an indicator of institutional trades, do not change with decimalization. In contrast, Bacidore, Battalio, and Jennings (2003) find a decrease in effective spreads for large trades. Using institutional order data, Chakravarty, Panchapagesan, and Wood (2005) and Werner (2003) find that institutional transaction costs declined, on average, following decimalization. They also find, however, at least one situation in which institutional costs increased. By comparing orders worked for more than a day with orders executed within a day, the Chakravarty, Panchapagesan, and Wood (2005) study finds that orders executed within a day saw increases in transaction costs.⁴⁰ They state "our results suggest that decimalization appears to have benefited patient institutions willing to work their orders

³⁷ See Table 1 from Bessembinder (2003).

³⁸ We discuss the Bessembinder (2003) paper at greater length than other papers referenced in this study because the paper has unique empirical data on how decimalization has affected the market for small, medium, and large capitalization stocks, which is one of the central focuses of the study in Section 106(b) of the JOBS Act.

³⁹ See Table 3 from Bessembinder (2003).

⁴⁰ When institutions break up large orders into smaller orders for execution this is termed "working the order."

through their trading desk or brokers, and might have hurt those seeking quick executions.” Werner (2004) finds that institutions experienced an increase in the transaction costs for non-marketable limit orders.

These results are contrary to the argument in both the Grant Thornton paper and the IPO Task Force Report that the spreads of small stocks declined significantly. Bessembinder (2003) shows declines of only \$0.03 to \$0.05 in quoted spreads and \$0.02 to \$0.04 in effective spreads and neither of these declines are statistically significant. It is important to note, however, that the empirical analyses cited in this paper focus primarily on the time period surrounding the adoption of decimalization. Longer term effects have not been documented in the literature.

Main empirical finding of the academic literature: Both effective and quoted spreads declined after decimalization. However, there is some evidence that, at least for NASDAQ small capitalization stocks, the decline is not statistically significant. The effect of decimalization on institutional transaction costs is mixed.

2. Depth

Trading depth attempts to measure the supply of liquidity at a given price and point in time. Liquidity is supplied by both investors who submit limit orders and by market professionals who trade when liquidity is needed. While the academic literature finds that quoted depth declined with decimalization (e.g., Bessembinder (2003); Chakravarty, Harris, and Wood (2001)), the cumulative depth within 15 cents of the quote midpoint did not change (Bacidore, Battalio, and Jennings (2003)). Those findings mean that just as much liquidity is available within 15 cents of the quote midpoint under decimalization as was available under fractions. Bacidore, Battalio, and Jennings (2003) found a decline in depth at less competitive prices.

A limitation of these studies is that neither quoted depth nor cumulative depth captures undisclosed or “hidden” liquidity, and therefore cannot fully measure the supply of liquidity. Jones and Lipson (2001) affirm previous research into NYSE trading volume that found in 1999 that only one-fourth of “NYSE executed volume . . . executed against the limit order book.” The paper states that “specialists and the floor account for much of the additional liquidity supply.”

One way to measure actual supply of liquidity, both displayed and hidden, is to measure the effective spread. Even though the effective spread does not measure depth directly, it does measure the cost to trade against the actual supply of liquidity. For example, if the depth at the National Best Bid and Offer (both displayed and hidden) is insufficient to execute the order in its entirety, the effective spread will be larger than the National Best Bid and Offer. Hence, effective spread incorporates total depth indirectly, and is able to measure the actual supply of liquidity better than any of the depth variables discussed above. As noted in the section above, the studies show that the effective spread declined for all types of companies but the decline for the smallest market capitalization companies was not statistically significant.

Main empirical finding of the academic literature: Quoted depth, on average, declined after decimalization, but cumulative depth at competitive prices did not change.

3. Execution Speed

As stated above, execution speed is an evaluation of whether investors are able to execute orders relatively quickly, and it is a measurement of liquidity. Chakravarty, Panchapagesan, and Wood (2005) find an increase in the time needed to fill institutional orders of a given size after decimalization. Further, this paper and Werner (2003), find that it takes longer to work an order after decimalization. The authors attribute this to a reduction in the quoted depth for most stocks, which provides an incentive for institutional investors to break up their large orders into smaller orders. However, the study does not analyze the execution speed of retail and other non-institutional investors.

Main empirical finding of the academic literature: The total time to work institutional orders appears to have increased after decimalization.

4. Trade Size

Trade size is often used to distinguish institutional trading from retail trading, with larger trade sizes attributed to institutional trading.⁴¹ However, institutional trading behavior is dynamic, and institutions may reduce order size to lower costs after decimalization (see Chakravarty, Panchapagesan, and Wood (2005)). Moreover, reductions in quoted depth after decimalization⁴² may also decrease trade sizes, if traders use the quoted depth as a guide when setting their order size.

Analyzing trade size, Bacidore, Battalio, and Jennings (2003) find that limit order investors are more likely to use smaller sized orders after decimalization. Chakravarty, Harris, and Wood (2001) find that overall transaction sizes fall. Chakravarty, Panchapagesan, and Wood (2005) find a decline in institutional order size, and this decline is larger for more liquid stocks. Werner (2003) finds that institutional order size fell with decimalization.

Main empirical finding of the academic literature: Trade sizes generally fell after decimalization, particularly for more liquid stocks.

5. Specialist/Market Maker Participation and Profitability

The decline in effective spreads after decimalization has raised concerns about reduced profitability and incentives for market makers and other liquidity providers to participate in the market for small-cap stocks. Indeed, the IPO Task Force Report and the Grant Thornton paper

⁴¹ For evidence that institutional investors are more likely to use larger size trades than individuals, see Chakravarty (2001).

⁴² See Bessembinder (2003) and Chakravarty, Harris, and Wood (2001).

arguments on the impact of decimalization on smaller company listings are based on the premise that market making in smaller company stocks is no longer profitable.

Some academics have suggested that decimalization could cause specialists to get more involved in trading, which would lead to less depth as liquidity providers placed fewer limit orders for fear of the specialist stepping ahead of those orders.⁴³ They posit that decimalization may make specialist participation more likely because it both decreases the costs of stepping ahead and creates more opportunities for stepping ahead since there are more tick levels to choose from.

Studies by Edwards and Harris (2003) and Battalio and Jennings (2001) conclude that more trades and quotes that are one tick better than prevailing quotes occur under decimal pricing. According to Coughenour and Harris (2004), specialists started participating more after decimalization for all size groups. They find that specialist trade participation⁴⁴ increased by 8%, 5.3% and 5.7% for small, medium and large capitalization stocks, respectively. (They also find that the number of shares traded by the specialist as a fraction of the total volume increased by 5.9%, 2.6%, and 1.4% for small, medium and large capitalization stocks, respectively.) According to the study, all the increases are statistically significant. They conclude that these gains are more pronounced for low-priced stocks (where the prior 1/16th of one dollar trading increment made stepping ahead of the order expensive), and for actively traded stocks.

Given that specialist participation increased, it is worthwhile to examine if it was accompanied by an increase in specialist profits. If the specialist was using his position to step ahead, then the specialist may profit at the expense of other market participants. Ronen and Weaver's (2001) study of the AMEX finds an increase in specialists stepping ahead, but no change in overall specialist profits.

Edwards and Harris (2003) state that the incentive specialists have to step ahead under decimalization is limited by the traders' ability to take their business elsewhere if the specialist steps ahead for his own profit. They also find that limit orders do suffer when the specialist steps ahead, but this cost is offset by the lower spread afforded by decimalization. They conclude that the increased specialist participation can be attributed to specialists seeking to maintain orderly markets, rather than to stepping ahead. Coughenour and Harris (2004) find that specialist profits did not decrease significantly for small, medium and large capitalization stocks. They attribute this to the offsetting effects of decimalization in which the gains to specialists from an increase in trading opportunities (since it is cheaper to step ahead) are balanced by the decrease in spreads.

⁴³ Stepping ahead is the submission of limit orders with marginally better prices, so as to gain priority over limit orders previously submitted by other investors. Lowering the tick size reduces the cost of stepping ahead, and thereby exacerbates this problem.

⁴⁴ Specialist trade participation is the fraction of all trades in which the specialist either buys or sells.

Main empirical finding of the academic literature: Market maker participation increased after decimalization across all market capitalization categories, but decimalization does not appear to have reduced profitability.

6. Market Versus Limit Orders

When investors decide to trade, they must also decide whether to submit a market order or a limit order. Because limit orders are an important supply of liquidity in the markets, understanding the tradeoff between market and limit orders allows a better understanding of how decimalization affects the supply of liquidity. With a market order, investors are guaranteed an execution at the prevailing market price. With a limit order, investors have more control over the execution price and are likely to receive better prices, but they are not guaranteed an execution. Hence, investors trade off the price advantage of limit orders with the execution certainty advantage of market orders.

The tradeoff between market orders and limit orders after decimalization could have changed in several ways. Because effective spreads declined with decimalization, the price advantage of limit orders declined. Further, the execution certainty advantage of market orders may be greater because others can more cheaply obtain price priority over limit orders resulting in less execution certainty for limit orders. Therefore, some investors may choose to submit market orders under a penny tick when they would have submitted a limit order under a larger tick size regime.

In addition, some investors may prefer limit orders after decimalization to avoid information leakage and associated market impact costs. A limit order may be better at camouflaging the trading direction of an investor. This is particularly important for larger orders that are broken up into small executions, which is more common after decimalization due to the decreased depth sizes.

Although Werner (2003) finds that the costs of non-marketable limit orders went up, Bacidore, Battalio and Jennings (2003) find that traders do not substantially reduce their use of limit orders in favor of market orders. However, Bacidore, Battalio and Jennings found that traders do reduce the size of limit orders after decimalization, which results in lower displayed liquidity.

Edwards and Harris (2003) find that specialists' stepping ahead does not seem to have discouraged limit order submission. Edwards and Harris (2003) find that while stepping ahead (also called penny jumping) increased, limit orders are actually less likely to be penny jumped. According to that study, while stepping ahead increases the costs incurred by limit order investors, these costs do not increase with decimalization and limit orders are less likely to be penny jumped following decimalization.

The strategy behind setting the limit price should optimally change with the tradeoffs between market and limit orders. Therefore, the strategy should change with decimalization. For example, decimalization might lead to limit order investors engaging in penny jumping to

improve their execution priority, using more marketable limit orders to control price, or canceling their limit orders more often to adjust their price. In addition, investors placing large orders can limit the extent that their orders “walk up the book” by submitting marketable limit orders instead of market orders. Bacidore, Battalio, and Jennings (2003) find that limit orders are cancelled more frequently.

Main empirical finding of the academic literature: Decimalization does not seem to have reduced the use of limit orders, but it does appear to have decreased the size of limit orders and increased the frequency of cancellation.

7. Routing of Orders

Traders can also control the execution quality of their orders through the selection of execution venue and routing method. Around the time of decimalization, traders could route orders to specialists on the NYSE floor directly through its electronic order routing system, or they could work the order on the floor through a floor broker. The order could also be routed to the NYSE through a regional exchange.

Theory suggests that traders may adjust their strategies for routing orders after tick sizes are reduced to account for lower quoted depths and the risk of penny jumping. Traders may have greater incentives to route orders through floor brokers, market makers, and other means of placing orders that do not require displayed interest. At the time of decimalization, using floor brokers allowed traders to access hidden liquidity and to avoid others stepping ahead of their orders. This was particularly true for large institutional orders.

Bacidore, Battalio, and Jennings (2003) find that traders do not “dramatic[ally] shift away from system orders” in favor of floor orders after decimalization. However, the authors also find that execution quality does not decrease after decimalization and they suggest that traders may be able to make up the difference in reduced displayed depth through floor orders in greater volume. Werner (2003) studies order flow on the NYSE and finds that market orders and floor broker orders can receive price improvement through access to non-displayed liquidity. Werner concludes that floor brokers and off-floor clients have better information than traders who use the NYSE’s electronic system for submitting orders.

Chakravarty, Panchapagesan, and Wood (2005) find that decimalization provides trading cost benefits for institutional investors who can work their orders on the floor. They also argue that traders will adapt to regulatory changes in the trading environment to reduce costs that those changes initially impose.

Chung, Chuwonganant, and McCormick (2003) find that order preferencing is prevalent both before and after decimalization but does decline with decimalization.⁴⁵ Further, they find that preferencing is associated with larger transaction costs both before and after decimalization.

Main empirical finding of the academic literature: Decimalization has not caused substantial changes to order routing practices, but it may have prompted traders, particularly large institutions, to seek more volume through floor orders.

8. Volatility

The Grant Thornton paper cites Chakravarty, Wood, and Van Ness (2004) as evidence that decimalization caused an increase in market volatility. While the authors find that volatility increases in the short-run, they also document a significant decline in volatility over time, which the authors attribute to trader learning, or traders becoming accustomed to the new market structure. Another paper, Ronen and Weaver (2001)'s study of stocks traded on AMEX, argues that volatility actually declined after decimalization. They find that the switch to decimalization decreased both daily and transitory measurements of volatility. Bessembinder's (2003) study of the NYSE and NASDAQ market quality finds that intraday return volatility for all market capitalizations decreased after decimalization.

Main empirical finding of the academic literature: Decimalization increased volatility in the short-run but decreased volatility in the long-run.

9. Incentives for Broker Promotion

As stated above, Section 106 of the JOBS Act asks "whether there is sufficient economic incentive to support trading operations" in small and middle capitalization companies after decimalization. Both the IPO Task Force Report and the Grant Thornton paper argue that because brokerage analysts have to depend on revenue from trading commissions, they have an incentive to cover only high volume stocks. They conclude that small and middle capitalization stocks do not have such trading volume, and hence, do not offer enough profitability to enhance analyst coverage. According to the reports, this, in turn, leads to a decline in investor interest. The Grant Thornton paper states that almost all market maker and dealer benefits from trading in the stock before decimalization (96%) were lost, which led to a decline in brokers promoting and providing research coverage for small companies.

Some research exists on the connection between tick size and broker promotion. Schultz (2000) examines trading behavior after stock splits, and hypothesizes that "[t]ick size may matter because a larger tick size may result in more profitable market making, providing brokers with additional incentives to promote or 'sponsor' the newly split stock." Schultz finds an increase in

⁴⁵ Order preferencing refers to the practice on NASDAQ at the time of decimalization that allowed broker-dealers to route orders to specific market makers.

both small buy orders following stock splits and in trading costs, and concludes that splits provide brokers with an incentive to promote stocks.

Kadapakkam, Krishnamurthy, and Tse (2005) build upon Schultz's work by looking at whether the promotion of stock split shares to small investors declined after decimalization. They find that the increase in relative spread (after a stock split) was greater in the 1/8th tick period than it was in the 1/16th tick period, which was greater than the increase in relative spread after decimalization. As a result, they conclude, brokers had greater incentive to promote a stock (after splits) in the 1/8th tick period than they had in the 1/16th tick period. And they further posit there was had greater incentive in the 1/16th tick period than they had after decimalization. The authors use the number of small trades (one-lot trades) as a proxy to measure broker promotion of stocks to retail clients. Consistent with broker incentives to promote stocks when relative spreads are large, they find that the increase in the number of small trades in the 1/8th period (11.6% increase) is greater than the increase of small trades in the 1/16th period (9.7% increase), which is greater than the increase after decimalization (8.2% increase).

Main empirical finding of the academic literature: After decimalization, the reduction in relative spreads may have reduced broker incentives to promote stocks.

Advisory Committee Meeting

On June 8, 2012, the SEC Advisory Committee on Small and Emerging Companies held a public meeting, at which the Advisory Committee discussed market structure issues and their impact on small and medium sized companies and on IPOs.⁴⁶

The meeting included presentations from David Weild⁴⁷ and Jeffrey Harris.⁴⁸ During the discussion that followed the presentations, members of the Advisory Committee commented that it may be hard to disentangle the impact of decimalization on small company IPOs from several concurrent events such as the enactment of the Sarbanes-Oxley Act in 2002, the Global Analyst Research Settlement in 2003, and the more recent emergence of high frequency trading and dark

⁴⁶ See SEC Advisory Committee on Small and Emerging Companies meeting, June 8, 2012 <http://www.sec.gov/news/press/2012/2012-109.htm>. A video replay of the meeting of the Advisory Committee can be found at <http://www.sec.gov/info/smallbus/acsec.shtml>.

⁴⁷ Mr. Weild's presentation to the Advisory Committee can be found at http://www.sec.gov/news/otherwebcasts/2012/weild_060812.pdf. Mr. Weild also testified on June 20, 2012 at the hearing of the House of Representatives' Committee on Financial Services entitled "Market Structure: Ensuring Orderly, Efficient, Innovative and Competitive Markets for Issuers and Investors," and his testimony can be found at <http://financialservices.house.gov/UploadedFiles/HHRG-112-BA16-WState-DWeild-20120620.pdf>.

⁴⁸ Mr. Harris' presentation to the Advisory Committee can be found at http://www.sec.gov/news/otherwebcasts/2012/harris_060812.pdf.

pools.⁴⁹ The members of the Advisory Committee also discussed whether poor performance of many companies following an IPO should be considered more closely and asked whether some companies are going public before they are “ready.” Participants at the Advisory Committee meeting also pointed out that decimalization did not mandate the size of the spread, but merely permitted the minimum change and level of spreads to be one penny. Participants noted that the effective spread is determined by market forces, and has declined more significantly for large, liquid companies than smaller companies.⁵⁰

International Tick Sizes

To assess international practice, this study surveys tick sizes in a variety of countries that have significant smaller company IPO activity. International practice provides a useful context for comparing and evaluating the U.S. tick size regime for the stocks of small and middle capitalization companies.

In the United States, the one penny minimum tick size specified in Rule 612 of Regulation NMS essentially applies to all listed stocks at all price levels. While Rule 612 specifies a \$0.0001 tick size for stocks with prices less than \$1, the overwhelming majority of listed U.S. stocks trade at prices greater than \$1. Because the average price level for smaller company stocks in some other countries is much lower, solely examining absolute tick sizes in countries other than the United States can give a misleading impression of their percentage levels, which are more economically significant. Accordingly, this study examines both absolute and percentage tick sizes.

In contrast to the United States, with its essentially flat, “one size fits all,” tick size regime, many other countries have adopted tiered regimes that provide greater variability for tick sizes based on the price level of a stock. These include Hong Kong (11 price levels), Japan (11 price levels), Taiwan (6 price levels), South Korea (4 or more price levels), United Kingdom (4 or more price levels), Germany (4 price levels), Australia (3 price levels), and Singapore (3 price levels). Such

⁴⁹ See generally, Concept Release on Equity Market Structure, 75 Fed. Reg. 3594 (Jan. 21, 2010). See pg. 3606-07 for a discussion of high frequency trading and pg. 3599 for a discussion of dark pools.

⁵⁰ Executives from three financial services companies submitted letters to the Co-Chairs of the SEC Advisory Committee on Small and Emerging Companies in which they each stated that allowing smaller capitalization companies to use larger tick sizes would revive market interest in these companies. See Jeffrey Solomon, Chief Executive Officer, Cowen and Company, LLC (June 4, 2012), available at <http://www.sec.gov/comments/265-27/26527-27.pdf>. (“By increasing the tick size for small-cap companies, investment banks would be appropriately incentivized to provide increased after-market support for these issuers by committing firm capital to support market-making in these securities.”); Phil Johnston, Partner, Think Equity LLC (June 8, 2012), available at <http://www.sec.gov/comments/265-27/26527-28.pdf>. (“Wider quote increments are essential to help revive support for the IPO and small capitalization markets.”); James Fehrenbach, Managing Director, and Bradford Pleimann, Managing Director, Piper Jaffray & Co. (June 8, 2012), available at <http://www.sec.gov/comments/265-27/26527-29.pdf> (“We believe that there is . . . an ample number of companies that could qualify to go public if the aftermarket support problem was solved through adequate economic incentives (increases in tick sizes).”).

tiered tick size regimes allow stocks to trade at percentage tick sizes that are believed to be more consistent across a whole range of price levels.

In the United Kingdom, tick sizes also are tiered based on the type of stock. For example, stocks included in the FTSE 100 Index, the FTSE 250 Index, and those outside those indexes have different tick tables with progressively wider tick sizes as average capitalization and trading volume decreases.

To enable a more focused comparison of the absolute and percentage tick sizes that apply to the stocks of smaller companies internationally, Table 1 below sets forth the specific tick sizes that apply to smaller company IPOs in 12 countries. In particular, Table 1 sets forth the average IPO price for IPOs of less than \$50 million in proceeds over the years 2005-2007 (in local currency), the tick size that currently would apply to such average IPO price (in local currency), and the tick size as a percentage of the IPO price.

Table 1
Survey of Tick Sizes and IPOs in Other Countries

| Country | Average offer price for IPOs \$50 million or below (local currency) 2005-2007 | Applicable tick size | Percentage tick size | Percentage of IPOs \$50 million or below | | Total Number of IPOs 1995-2007 |
|----------------|---|----------------------|----------------------|--|-----------|--------------------------------|
| | | | | 1995-2001 | 2002-2007 | |
| Singapore | 0.27 | 0.005 | 1.85% | 92% | 81% | 438 |
| Australia | 0.40 | 0.005 | 1.25% | 84% | 89% | 1,339 |
| Hong Kong | 1.29 | 0.010 | 0.78% | 80% | 59% | 756 |
| Canada | 2.12 | 0.010 | 0.47% | 84% | 78% | 1,599 |
| United Kingdom | 57.72 | 0.250 | 0.43% | 75% | 73% | 1,676 |
| Taiwan | 50.48 | 0.100 | 0.20% | 68% | 92% | 461 |
| China | 8.48 | 0.010 | 0.12% | 98% | 86% | 1,109 |
| United States | 8.62 | 0.010 | 0.12% | 58% | 26% | 3,300 |
| South Korea | 9740.00 | 10.000 | 0.10% | 90% | 95% | 923 |
| Japan | 207101.00 | 100.000 | 0.05% | 82% | 85% | 1,934 |
| Germany | 13.10 | 0.005 | 0.04% | 64% | 57% | 581 |
| India | 187.55 | 0.050 | 0.03% | 86% | 72% | 291 |

Source: IPO offer price and number of IPOs from Bloomberg.

Table 1 indicates that the average U.S. percentage tick size based on the offer price of smaller IPOs is relatively narrow compared to many other countries with significant smaller company IPO activity. Specifically, many countries have percentage tick sizes that are four or more times wider than the United States. On the other end of the spectrum, a few countries have percentage

tick sizes that are less than half the size of the United States percentage tick size. The existence of considerable variation in tick sizes in markets in other countries suggests that the U.S. market would benefit from a broad review of tick sizes, and such a review would be informed by the experience in these countries.

The last three columns of the table present the percentage of IPOs in each country that have proceeds of \$50 million or less (converted using end of year currency rates) over two time periods before and after decimalization, 1995 to 2001 and 2002 to 2007, and in total. As shown in the Grant Thornton paper, the table documents a sharp decline in smaller company IPOs in the United States in the 2002 to 2007 period. There does not appear to be a similarly precipitous decline in other countries, even for those countries with smaller tick sizes. The decline in smaller public company IPOs, and IPOs in general, coincides with the implementation of decimalization. As discussed in the next section, a number of other economic events also occurred during this time period that make it difficult to distinguish the specific impact decimalization may have had on the number of companies going public.

Discussion

The spread at which a given security trades is driven by various market forces. These market forces range from the supply-and-demand pressures of fundamental investors, to the risk appetite of market intermediaries, to the volatility of the market itself. Though regulatory decimalization in the market lowered the minimum allowable tick size to \$0.01, it did not mandate that market participants quote narrower spreads. Rather, the quoting of narrower spreads appears to have been a result of continued market forces. In general, lower spreads tend to be associated with equity securities that are considered to be more, rather than less, liquid.

The academic literature documents not only lower spreads after decimalization but also a decline in quoted depth, smaller trade sizes, decreased volatility in the long run and no apparent reduction in market maker profitability. These findings suggest that the initial effect of decimalization was improved market quality, most notably for large capitalization securities. For those papers that examine smaller and middle capitalization securities, the effect, particularly for spreads, appears to be relatively minor.

There are important caveats, however, to relying solely on these academic studies for assessing the effects of decimalization on smaller public companies and using their conclusions for policy decisions. First, as mentioned previously, few studies focus on differing effects related to market capitalization. Thus, many of the findings are presented for an average firm rather than a firm of a specific market capitalization. Second, to date, the effect of decimalization on capital formation has not been explored in the literature. It is, therefore, difficult to quantify the mechanism by which, if at all, decimalization may have hindered capital formation. Third, many of these studies examine only the time period surrounding the implementation of decimalization and do not examine its longer term effects. In this regard, market structure has changed

significantly since the advent of decimalization and the findings of the literature may not be as applicable today given the current and continuously evolving nature of equity markets. It is, therefore, difficult to draw any strong conclusions from available studies with respect to potential adverse effects of the change to decimals a decade ago on small and middle capitalization companies today.

At the same time, the discussion and material presented at the meeting of the SEC Advisory Committee on Small and Emerging Companies on market structure issues highlighted many of the concerns raised in the IPO Task Force Report and the Grant Thornton paper, and pointed to additional factors that may have also contributed to the decline of smaller company IPOs. Some have stated that the ease with which companies can raise money privately, and the existence of some level of liquidity for securities of issuers that are not public, has contributed to a decline in smaller company IPOs.⁵¹ This study also surveyed tick size practices in foreign countries. A comparison of the average percentage tick size to the average offer price of a smaller IPO (less than \$50 million in proceeds) indicates that many countries have a wider percentage tick size. Unlike many other countries, the United States employs a “one size fits all” approach to tick size. The Staff recognizes that such an approach may not necessarily be optimal for smaller capitalization securities in all contexts.⁵²

It has been argued, however, that for the securities of smaller capitalization companies, including those that formed the majority of IPOs prior to 1997, market participants have collectively driven spreads to such narrow levels that those participants are no longer economically incentivized to provide secondary market liquidity to, or otherwise promote these securities to, the public.⁵³ It has further been posited that the decline in IPOs observed since the burst of the tech bubble is, in significant part, a result of this lack of secondary market liquidity and promotion.⁵⁴ Based on

⁵¹ See Statement of Professor Jay R. Ritter, Cordell Professor of Finance, University of Florida, before the Senate Committee on Banking, Housing, and Urban Affairs on Spurring Job Growth Through Capital Formation While Protecting Investors, Part II (March 6, 2012), at 8. http://banking.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=a5ded25c-135d-484a-943a-bfa52fba3206, and see Vlad Ivanov and Scott Baugess, Capital Raising in the U.S. on the significance of unregistered offerings used the Regulation D exemption. (In 2010 Regulation D offering surpassed public debt offerings as the dominant offering method in terms of aggregate amount of capital raised in the U.S. of \$905 billion).

⁵² One commenter suggested that issuers should be allowed to pick their own tick size because “issuers are in the right position to assess the tradeoffs [and] [t]hey have the right incentives to take the actions that will maximize value for their shareholders.” James J. Angel, Assoc. Professor of Finance, Georgetown University, to Sec. & Exch. Comm’n, at 5 (June 19, 2012), available at <http://www.sec.gov/comments/jobs-title-i/tick-size-study/tick-size-study-1.pdf>.

⁵³ See David Weild’s slides presented at the SEC Advisory Committee on Small and Emerging Companies meeting, June 8, 2012, available at <http://www.sec.gov/news/press/2012/2012-109.htm>.

⁵⁴ The IPO Task Force Report argues that insufficient revenue generated from trading in emerging growth companies “undermines the incentive for investment banks to underwrite and make markets for newly public companies.” *Id.* at 14. Weild and Kim (2010) compare the pre-decimalization era with the post-decimalization era. *Id.* at 16 (see table). They explain that pre-decimalization, it is profitable for specialists to make markets, and “research coverage helps attract order flow, profitably supporting sales, trading and research of common stocks”.

these assumptions, it has been argued that increasing the minimum tick size for the securities of smaller capitalization companies would provide market intermediaries with greater profits that would (a) cause them to increase their provisions of liquidity and promotion of the securities of smaller capitalization companies and (b) result in more smaller capitalization companies going public.⁵⁵

As noted above and at the Advisory Committee meeting, decimalization may be just one factor attributable to the recent decline of smaller public company IPOs. Recent studies on the IPO market have attributed the decline in U.S. IPOs to greater globalization of financial markets and to the increase in the use of global IPOs for capital raising (Doidge, Karolyi and Stulz (2011)). Gao, Ritter and Zhu (2012) argue that the advantages of selling to large organizations outweigh the benefits of going public. These studies document a decline in small company productivity over time relative to large company productivity. Furthermore, they follow companies for the first three years after the IPO and, unlike the Grant Thornton paper or the IPO Task Force Report, document no significant drop in analyst coverage over time.⁵⁶ Thus, it is difficult to separate the many possible factors for the decline in small company IPOs from the direct effect of decimalization. Further study to assess the impact of tick size as distinct from other potential factors is warranted.

Policy Implications and Recommendations

As discussed above, though there is literature on the types of benefits that lower spreads bring to the market, there is less available information related to how lower spreads may have negatively impacted capital formation, especially with respect to the complex, competitive dynamics and

Furthermore, they go on to say that post-decimalization, it is no longer profitable for specialists to make markets, research coverage of small stocks is reduced, leading to lower liquidity, higher volatility and lower valuations for small stocks, and ultimately fewer small cap IPOs.

⁵⁵ Weild and Kim (2010) recommend the creation of an alternative public market segment (into which small companies can opt-in) where the minimum quote increment would be 10 cents (for shares below \$5) and 20 cents (for shares greater than \$5), which would “bring sales support back to stocks and provide the economics to support equity research independent of investment banking.” *Id.* at 19.

⁵⁶ In addition to these just discussed, the costs of being a public company, including ongoing reporting requirements and compliance with the auditor attestation of internal controls requirements included in Sarbanes-Oxley Act, 15 U.S.C. 7201 *et. seq.*, to name just two, have also been suggested as factors in the decline of initial public offerings. Some papers argue, however, that disclosure requirements and other capital markets regulations enhance, rather than impede, capital formation, and that regulatory compliance costs are not likely to be the principal cause of the decline in IPO activity over the past decade. For a review of the literature on the effect of disclosure see Dye (2001), Healy and Palepu (2001) and Verrecchia (2001). More specifically on the value of regulatory mandated disclosure, see Cross and Prentice (2006), Fox, Morck, Yeung and Durnev (2003), Greenstone, Over and Vissing-Jorgensen (2006) and Ferrell (2007) to name a few. See also Statement of Professor Jay R. Ritter, Cordell Professor of Finance, University of Florida, before the Senate Committee on Banking, Housing, and Urban Affairs on Spurring Job Growth Through Capital Formation While Protecting Investors, Part II (March 6, 2012), at 8, available at http://banking.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=a5ded25c-135d-484a-943a-bfa52fba3206. Other concerns such as high frequency trading and the Global Analyst Research Settlement have also been named as reasons for why companies may find it difficult to go public.

economic incentives of market intermediaries who provide liquidity. More so, as discussed among participants at the Advisory Committee meeting, there are a number of other factors that have influenced the IPO market in addition to decimalization.

Additionally, the effects of decimalization on IPOs have not been isolated from these other factors in any of the academic literature we have reviewed. Therefore the impact of mandating an increase in the minimum tick size for small capitalization companies on the structure of our markets, and on the willingness of small companies to undertake initial public offerings is, at best, uncertain. Although mandating an increase in tick sizes to levels greater than those that are presently dictated by market forces may provide more incentives to market makers in certain stocks, the full impact of such a change, including whether or not an increased tick size would indeed result in more IPOs, and whether there would be other significant negative or unintended consequences, is difficult to ascertain.

The Staff notes that rules regarding decimalization were implemented over a decade ago. Since then, the nature of our equity markets has evolved significantly⁵⁷, and any consideration of tick sizes must be done in light of a market structure now characterized by highly-dispersed venues and high-speed automated trading. More so, other countries, as discussed above, use multiple tick sizes, in contrast to the “one size fits all” approach in the United States. This suggests there may be viable, and perhaps preferable, alternatives to uniform decimalization rules.

After considering the information gathered in connection with the preparation of this study, along with the information presented and views expressed at the Advisory Committee meeting, the Staff is also recommending that:

The Commission should not proceed with the specific rulemaking to increase tick sizes, as provided for in Section 106(b) of the JOBS Act, but should consider additional steps that may be needed to determine whether rulemaking should be undertaken in the future.

The Staff believes that the Commission should solicit the views of investors, companies, market professionals, academics, and other interested parties on the broad topic of decimalization, how to best study its effects on IPOs, trading, and liquidity for small and middle capitalization companies, and what, if any, changes should be considered. There are a number of avenues available to the Commission to gather additional views and data to help inform the Commission. For example, a roundtable with opportunity for public comment would provide a venue to present recommendations on the best method to generate useful data on these issues, including specific recommendations on how a pilot study could be best conducted. The roundtable

⁵⁷ See generally, Concept Release on Equity Market Structure, 75 Fed. Reg. 3594 (Jan. 21, 2010).

participants and commenters could address: (1) the economic consequences (including the costs and benefits) that might accompany alternative methods for analysis, (2) the types of data that should be collected and used to assess the effects of an increase in or variation of tick size for companies of different capitalizations, including how best to gather the data, and (3) whether other policy alternatives might better address the concerns animating Section 106(b) of the JOBS Act.

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