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Journal of Financial Markets 7 (2004) 27–51

Journal of FINANCIAL MARKETS

www.elsevier.com/locate/econbase

Specialist performance and new listing allocations on the NYSE: an empirical analysis ☆

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Abstract

This study analyzes the criteria used to allocate stocks to specialist firms on the NYSE. Non-performance variables play a predominant role in the allocation process, with large specialist firms receiving the majority of new listings. Controlling for size, more-profitable and less-profitable listings tend to be equitably distributed across specialist firms and specialists are more likely to receive allocations if they have not received a recent allocation or have recently had stocks delisted. Preference is also given to specialist firms that already trade other stocks in the same industry or stocks of the same type (funds and non-U.S. securities). Changes to the Allocation Policy in 1997 appear to have resulted in a subset of specialist firms being repeatedly awarded allocations, while others are repeatedly denied allocations.

JEL: G10; G20

Keywords: New York Stock Exchange; Specialist; Performance; Allocation policy; Exchange listing

1. Introduction

Events such as rule changes by exchanges and the Securities and Exchange Commission (SEC) and the emergence of Electronic Communication Networks

☆I am grateful to an anonymous referee for valuable suggestions. I also thank Paul Schultz, Jeff Bacidore, Jeff Benton, Stephen Buser, Michael Goldstein, Jeff Harris, Brian Hatch, Marc Lipson, Tim Loughran, David Mayers, John Persons, Paul Seguin, George Sofianos, and seminar participants at the NYSE and the University of Notre Dame for helpful comments. Jim Hester and Brian Winkler provided excellent research assistance. Some data were provided by the New York Stock Exchange. Any remaining errors are my own.

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1386-4181/03/$ - see front matter
doi:10.1016/S1386-4181(03)00017-X

(ECNs) have focused critical attention on the structure of securities markets. Much of this attention relates to differences between the specialist system on the New York Stock Exchange (NYSE) and trading systems on other markets.[1] Despite this focus, however, little is known about the composition of specialist portfolios or the process by which they are created. I address this issue by analyzing the criteria used in the NYSE's new-listing allocation process.

The basic structure of the current allocation process on the NYSE was established in 1976. Throughout subsequent revisions, the objectives of the process have consistently included spreading reward and risk across specialist firms, rewarding specialist performance, and providing the best possible match between specialist unit and stock. In fact, the allocation process is the primary tool used by the NYSE to enforce specialist performance. For example, the NYSE's *Allocation Policy* (1998) states:

> Because specialists can expand their business only by increasing the number of their specialty stocks, allocation criteria and procedures and the performance evaluations on which they rely focus critical attention on customer service and ongoing improvement in the level of specialists' performance.

Cao et al. (1997) and Corwin (1999) provide evidence of significant differences in performance across specialist firms.[2] If viewed as important by the NYSE, these performance differences should be reflected in subsequent allocation decisions. However, non-performance factors may also be considered. For example, large specialist firms with more resources may be more likely to apply for and/or receive allocations. The NYSE may also rely on a queuing system or may diversify or concentrate specialist portfolios with respect to industry and security type. The methodology used in this paper allows us to test the relative importance of these alternative criteria.

The results suggest that non-performance variables play a predominant role in the NYSE's allocation process, with large specialist firms receiving the majority of new listings. After controlling for size, I find that more-profitable and less-profitable listings tend to be equitably distributed across specialist firms, and that specialists are more likely to receive allocations if they have not received a recent allocation or have recently had some stocks delisted. These findings are consistent with the objective to spread reward and risk across specialist firms.

I also find that the NYSE tends to allocate stocks to specialist firms that already trade other stocks in the same industry and to allocate non-U.S. securities and investment funds to specialist firms that already trade a relatively high proportion of these securities. These findings may reflect the NYSE's objective to seek a match between specialist unit and stock. The results are also consistent with the

[1] For a recent example, see "A Nation Challenged: The Exchange: Feeling Vulnerable At Heart of Wall St." (New York Times, 12 October 2001).

[2] Both studies identify differences in execution costs across specialist firms and Corwin finds that the level of noise in security prices and the use of nonregulatory trading halts differ significantly across specialist firms. See Smidt (1971) and Barnea (1974) for early discussions of differences in specialist performance.

informational advantages of trading related securities modeled in Strobl (2001) and the mitigation of intra-exchange competition described in Pirrong (1999).

The results provide only weak evidence that specialist performance affects allocations. While I find significant differences across specialist firms in several performance measures, only price improvement is significantly related to allocation decisions. This finding is inconsistent with the importance placed on specialist performance in the NYSE's Allocation Policy and suggests that the allocation process may not serve as an effective tool for monitoring performance.[3] Alternatively, the lack of results may suggest that the NYSE considers performance measures other than those studied here.

In March of 1997, the NYSE changed its Allocation Policy giving listing firms the option to choose their specialist from a subset of units selected by the Allocation Committee. The increased role of listing firms after 1997 appears to have resulted in a subset of specialist firms being repeatedly awarded allocations, while others are consistently denied allocations. In addition, while industry concentration is an important factor prior to 1997, its effects are diminished after the policy change. This suggests that listing firms either do not consider industry characteristics, or prefer to be traded apart from related securities.

The paper is organized as follows. Section 2 describes the allocation process on the NYSE and related theories of market design. In Section 3, I describe the data, the sample of new listings, and the characteristics of specialist-firm portfolios. In Section 4, I outline the discrete-choice logit model for allocation decisions. Section 5 presents the results and Section 6 concludes.

2. Stock allocation and market design

2.1. The NYSE's allocation policy

When a new security is going to be listed on the NYSE, the Exchange invites specialist firms to apply for the allocation. From among the applicants, a single specialist must then be selected based on the guidelines established in the Exchange's *Allocation Policy and Procedures*. Prior to 1997, the allocation decision was made solely by the Exchange's Allocation Committee. In March of 1997, however, the Allocation Policy was revised to give listing firms an additional option for selecting their specialist. Under this option, the *listing firm* chooses their specialist from among three to five specialist units selected by the committee.[4]

The selection of specialist units is based on the "professional judgment" of the Allocation Committee in applying several criteria. These include ratings on the

[3] See, Oesterle et al. (1992) for a critical discussion of the NYSE's allocation process and its role in performance monitoring.

[4] This change was approved by the SEC as a seven-month pilot program on March 7, 1997. The SEC permanently approved the revised policy and related amendments on January 20, 1998 (see SEC, 1998 and NYSE, 1998). In 2001, the SEC approved an additional change allowing listing firms to submit a letter indicating the role a particular specialist unit played in the firm's listing decision. Specialist units identified in this manner are then included in the pool selected by the committee (NYSE, 2001).

Specialist Performance Evaluation Questionnaire (SPEQ), objective performance measures, and several non-performance factors. The SPEQ is filled out quarterly by floor brokers and includes questions that rate specialist firms on particular market-making functions. Objective performance measures include quoted bid-ask spreads, quoted depth, price continuity, participation, stabilization, capital utilization, timeliness of regular openings, and timeliness of DOT turnaround.[5] To reflect these measures, I analyze spreads, depth, price improvement, time at the inside quotes, price continuity, opening delays, and trading halt use. Data on participation, stabilization, capital utilization, and SPEQ ratings are not publicly available.

The allocation committee may also take into consideration various non-performance factors. According to the allocation policy, for example, the committee may consider listing-company requests, previous allocations received, capital violations, and disciplinary actions against the firm. The committee may also consider the characteristics of the new listing relative to other stocks traded by the specialist firm. In the analysis to follow, I provide tests related to previous allocations, recent delistings, industry characteristics, non-U.S. and investment-fund listings, and listing profitability. Data on listing company requests and capital violations are not readily available.

I note that the sample includes allocations made under both the pre-1997 policy and the revised policy. Ideally, I would analyze separately the specialist firm's application decision, the Allocation Committee's selection decision, and the listing firm's selection decision. However, due to data limitations, I am not able to identify either the subset of specialist firms that apply for a listing or the subset of three to five specialist firms selected by the Allocation Committee (post 1997). The criteria that I analyze should therefore be interpreted as reflecting the combined interests of the specialist, the Exchange, and the listing firm. To determine whether specialist firm application decisions affect the conclusions, I provide separate analysis for a subsample of large new listings. I do not expect the application decision to be a factor for these listings, since most specialist firms are likely to apply for these allocations. To determine whether increased listing-company input has a major impact on allocation decisions, I test for differences in allocation criteria before and after the 1997 policy change.

2.2. Specialist portfolios and optimal market design

While several studies analyze the potential benefits of the specialist system (e.g., Glosten, 1989; Benveniste et al., 1992; Leach and Madhavan, 1993), the allocation of stocks to specialists has only recently attracted attention. My analysis is closely related to three recent studies.

Gehrig and Jackson (1998) analyze bid-ask spreads in a market with indirect competition between specialists. In their model, increased monopoly power allows

[5] Since the implementation of the NYSE's Near Neighbor program in 1995, measures such as spread, depth, and price continuity are evaluated relative to a set of up to 20 benchmark securities referred to as "near neighbors". These securities are similar (based on a statistical measure) to the given security with respect to price, non-block volume, float and daily price range (SEC, 1995).

the specialist to set wider spreads. However, the monopolist is also able to internalize cross-security demand effects when securities trade as complements. Given this tradeoff, Gehrig and Jackson show that diversified specialist portfolios (independent ownership) are optimal when securities trade as substitutes and concentrated specialist portfolios are optimal when securities trade as complements. They also show that whether stocks trade as substitutes or complements depends on both return correlations and trade correlations (initial endowments). For example, positively correlated stocks that trade in tandem (e.g., basket trading) may act as complements, while stocks that trade due to portfolio rebalancing may act as substitutes. As a special case, Gehrig and Jackson show that if stocks trade as substitutes within industry and complements across industry, it is best to have multiple specialists diversified across industries. In this case, specialists compete within industry, but adjust spreads downward for complementarities across industries.

Strobl (2001) examines the optimal allocation of stocks to specialists in a model with adverse selection. This model incorporates the trade off between monopoly power and the increased information precision that results from trading highly correlated assets. Strobl finds that specialists always prefer portfolios of highly correlated assets. Investors also prefer this outcome if the benefits from indirect competition are weak and the informational advantage of the monopolist specialist is large, but prefer competing specialists as the correlation between stocks increases.

These models lead to several testable implications related to stock allocations. If we assume that stocks within industries trade as substitutes, Gehrig and Jackson's (1998) results suggest that specialist portfolios should be diversified with respect to industry in order to maximize indirect competition. Similarly, non-U.S. securities and investment funds should be diversified across specialist firms if these securities trade as substitutes. Strobl's (2001) model points to potentially different effects before and after 1997. Allocations prior to the policy change are likely to reflect primarily the interests of the specialist and the exchange (though the allocation committee may also consider investor interests). During this period, Strobl's model suggests that specialist portfolios will be concentrated with respect to industry and security type. After the policy change, when issuing firms were given greater influence over the choice of their specialist, the model suggests that industry concentration will become less important.

Finally, Pirrong (1999) develops a model of financial exchange organization and shows, among other things, that exchanges offering a variety of products may restrict the trading rights of members to only certain classes of products. While this analysis may not apply directly to NYSE allocations, one possible interpretation is that the exchange will concentrate security types (e.g., industries, ADRs, funds) with particular specialist firms rather than spreading them across specialists. In contrast to Strobl (2001), this concentration is motivated by a desire to mitigate intra-exchange competition rather than to gain an informational advantage. Pirrong's results also point to a potential conflict between the exchange's motives and the social benefits from indirect competition described by Gehrig and Jackson (1998).

3. Data and sample characteristics

I use the Center for Research in Security Prices (CRSP) tapes to identify the sample of NYSE-listed common stocks as of December 31st each year from 1992 to 1998. I then use the *NYSE Specialist Directory* from December of that year (or, if necessary, January of the following year) to identify the specialist firm assigned to each security. The *Specialist Directory* is updated approximately once each month and identifies the specialist firm assigned to each security, as well as the location of the security on the trading floor. For each security, I also collect price, market capitalization, and volume data from CRSP, and intraday trade and quote data from the NYSE's TAQ files. Only those stocks that can be identified in both CRSP and the *Specialist Directory* are included in the sample.

Table 1 lists the number of stocks and specialist firms by year and provides summary statistics for specialist firm portfolios. Panel A shows that the number of stocks increased from 2,051 at the end of 1992 to 2,859 at the end of 1998. During this same period, the number of specialist firms dropped from 40 to 32 as a result of mergers and acquisitions. Consistent with these trends, Panel B shows that the number of stocks traded by the median specialist firm increased from 40 in 1992 to 59 in 1998. The range in specialist-firm size also increased during this period. In 1992, the smallest specialist firm traded 11 stocks and the largest specialist firm traded 215 stocks, a range of 204. By 1998, this range had increased to 316, with the largest specialist firm trading 336 stocks.

Panel B shows that security characteristics differ significantly across specialist firms in every sample year. In 1992, for example, five specialist firms traded no non-U.S. stocks while the maximum specialist firm traded 22.9 percent. By 1998, only two firms traded no non-U.S. securities and the maximum firm traded 33.8 percent. Investment funds as a fraction of securities traded ranged from 10.5 to 73.1 percent in 1992 and from 14.1 to 52.0 percent in 1998. The median market value across specialist stocks ranged from $130 million to $1.6 billion in 1992 and from $199 million to $858 million in 1998. Finally, average daily share volume for the median stock ranged from 19,800 to 112,200 across specialist firms in 1992 and from 32,000 to 150,000 in 1998.

I identify new listings from 1993 to 1998 using the *NYSE Fact Book*. I then identify the specialist firm that received each allocation using the first version of the *Specialist Directory* dated after the new listing and collect market capitalization and price data from CRSP. Only new listings that can be identified in CRSP, the *NYSE Fact Book*, and the *Specialist Directory* are included in the sample.

Table 2 lists the number of new listings allocated to each specialist firm by year. There were a total of 1,518 new listings during the sample period, with the annual number of listings ranging from 178 in 1995 to 302 in 1993. As the table shows, new listings are not evenly distributed across specialist firms. In 1993, for example, the number of allocations averaged 7.6 per specialist firm and ranged from zero for Stuart, Scotto, & Cella to 16 for La Branche. While the minimum number of allocations received by a specialist firm was zero in every year, the maximum ranged from 11 for Mercator Partners in 1995 to 31 for La Branche in 1997. Among

Table 1
Summary statistics for sample stocks and specialist firm portfolios.
The table lists summary statistics for sample stocks and specialist-firm portfolios by year. Results are based on the complete sample of NYSE-listed stocks as of December 31st of each year. Panel A lists the number of sample stocks and specialist firms. Panel B lists summary statistics for specialist-firm portfolios. For each variable in Panel B, the table lists the value for the median, minimum and maximum specialist firms, ranked according to that characteristic. *Number of Sample Stocks* is the number of stocks traded by a specialist firm. Median values of price, market value, and average daily volume are calculated across all stocks in the specialist's portfolio. *Price* and *Market Value* are as of December 31st. Average daily share volume is calculated for each security across all trading days during the year. *Proportion Funds* is the proportion of a specialist firm's stocks that are closed-end funds, real estate investment trusts (REITs), or Units. *Proportion non-U.S.* is the proportion of a specialist firm's stocks that are non-U.S. securities. $^{+++}$, $^{++}$, and $^{+}$ indicate that proportions are significantly different across specialist firms at the 1, 5 and 10 percent levels, respectively, based on a χ^2-test. ***, **, and * indicate that medians are significantly different across specialist firms at the 1, 5 and 10 percent levels, respectively, based on a Kruskal–Wallis test.

	1992	1993	1994	1995	1996	1997	1998
Panel A—sample stocks and specialist firms							
Sample stocks	2,051	2,309	2,493	2,574	2,769	2,848	2,859
Specialist firms	40	40	39	36	37	35	32
Panel B—Specialist firm portfolios							
Number of sample stocks:							
Median specialist firm	40.00	47.00	54.00	55.00	57.00	60.00	59.00
[Min, max specialist firm]	[11, 215]	[13, 220]	[14, 270]	[10, 272]	[8, 304]	[10, 293]	[20, 336]
Proportion funds (%):							
Median specialist firm	20.71^{+++}	23.67^{+++}	25.00^{+++}	23.59^{+++}	22.22^{+++}	23.33^{+++}	23.01^{+++}
[Min, max specialist firm]	[10.5, 73.1]	[13.7, 74.2]	[14.8, 65.7]	[10.0, 67.6]	[6.3, 60.5]	[15.3, 58.1]	[14.1, 52.0]
Proportion non-U.S. (%):							
Median specialist firm	5.24^{+++}	6.81^{+++}	7.96^{+++}	9.09^{+++}	10.71^{+++}	12.61^{+++}	12.10^{+++}
[Min, max specialist firm]	[0.0, 22.9]	[0.0, 19.1]	[0.0, 22.2]	[0.0, 22.2]	[0.0, 29.8]	[0.0, 35.0]	[0.0, 33.8]
Median price ($):							
Median specialist firm	18.25***	19.47***	17.88***	20.13***	21.13***	23.72***	18.50***
[Min, max specialist firm]	[12.1, 35.3]	[13.0, 27.6]	[10.9, 30.3]	[12.6, 28.1]	[14.0, 32.0]	[14.7, 30.0]	[12.8, 28.9]
Median market value ($ mil.):							
Median specialist firm	359.6***	382.02***	340.88***	389.56***	414.33***	503.84***	465.17***
[Min, max specialist firm]	[130, 1617]	[183, 983]	[172, 1160]	[150, 680]	[133, 773]	[211, 932]	[199, 858]
Median average daily volume (000):							
Median specialist firm	45.70***	55.90***	49.69***	50.61***	57.15***	64.93***	60.05***
[Min, max specialist firm]	[19.8,112.2]	[19.4, 114.0]	[26.1, 149.8]	[27.5, 79.6]	[29.8, 94.6]	[29.8, 124.3]	[31.9, 150.0]

Table 2
NYSE new listings by specialist firm.
The table lists the number of new listings allocated to each NYSE specialist firm from 1993 to 1998. The sample includes all new listings that were listed in the *New York Stock Exchange Fact Book* (1993–1998) and could be identified in both CRSP and the *NYSE Specialist Directory* (1993–1998). The footnotes to the table provide descriptions of merger and acquisition events affecting the number of specialist firms operating on the exchange.

Specialist firm		New listing allocations						
Unit no.	Name	1993	1994	1995	1996	1997	1998	Total
20	M.J. Meehan & Co.	8	5	5	12	10	6	46
34/1022[a]	Walter N. Frank & Co.	6	7	2	6	6	7	34
104[b]	Fagenson/Frankel/Streicher/Cohen	10	9	7	5	6	10	47
137	Benjamin Jacobson & Sons	10	8	5	9	14	9	55
138/1726[c]	Lawrence, O'Donnell, Marcus & Co.	11	9	6	11	10	4	51
202[d]	MMS & N	13	9	2	—	—	—	24
210	La Branche & Co.	16	14	8	13	31	17	99
215	Henderson Brothers, Inc.	12	8	5	12	9	6	52
233/1679[e]	Ernst/Ware & Keelips/Homans	3	6	8	5	1	—	23
240	RSF Partners	7	6	5	9	5	0	32
280/1280[f]	Buttonwood Specialists, L.P.	3	8	3	5	4	0	23
298/1032[g]	Mercator Partners	10	6	11	11	14	7	59
364	Einhorn & Co.	7	8	6	5	7	6	39
403	RPM Specialist Corp.	10	8	4	5	15	11	53
412[h]	AC Partners	10	5	—	—	—	—	15
473[i]	Marcus Schloss and Co., Inc.	2	0	0	—	—	—	2
501	Spear, Leeds & Kellogg	11	19	10	12	14	10	76
512[j]	Fernandez, Bartsch & Mirra	8	1	—	—	—	—	9
520	Stern & Kennedy	11	3	3	5	0	1	23
551[g]	Wagner, Stott & Co.	8	5	0	—	—	—	13
1010[k]	Stuart, Scotto, Cella & Co.	0	0	1	0	0	4	5
1027[l]	JHSI/R. Adrian/RPM Specialist	—	—	1	10	4	2	17
1034[m]	Susquehanna/RPM Specialist Corp.	—	—	8	4	3	7	22
1148	Gavin, Benton & Co.	9	6	0	2	1	3	21
1225	Scavone, McKenna, Cloud & Co.	11	7	6	8	11	9	52
1227	JJC Specialist Corp.	11	8	8	14	10	13	64
1229	Surnamer, Weissman & Co.	4	5	3	5	5	4	26
1240[l]	Purcell, Graham/R. Adrian	2	1	1	—	—	—	4
1246[n]	KV Specialist	—	—	—	—	13	8	21
1266	Bocklet & Co.	9	7	6	7	7	3	39
1314[o]	Scholl & Levin Corp.	2	2	0	—	—	—	4
1319[p]	E.A. Sheslow Inc.	—	—	—	6	4	0	10
1341	Corroon, Lichtenstein & Co.	4	7	5	6	3	1	26
1401[q]	Foster, Marks, Natoli, Safir L.P.	8	0	—	—	—	—	8
1418	Bear Specialists/Hunter Specialists	6	7	3	8	13	8	45
1424[b]	M. & J. Cohen & Co.	—	—	1	7	2	6	16
1687	Nick, Lyden & Co.	7	11	9	11	9	12	59
1746[r]	Weiskopf Silver Specialists/O. Gruss	10	7	5	6	4	2	34
1903[s]	Merrill Lynch Specialists, Inc.	7	13	5	9	8	5	47
1910	Benton, Corcoran, Leib	5	4	0	8	5	9	31
1941[h]	CMJ Partners, L.P.	—	—	8	15	10	10	43
1966[t]	Stern Bros.	4	4	5	5	1	—	19
2022/583[u]	Fowler, Rosenau & Geary L.P.	4	4	4	10	7	1	30

Table 2 (*continued*)

Specialist firm		New listing allocations						
Unit no.	Name	1993	1994	1995	1996	1997	1998	Total
2090	Webco Securities Inc.	5	1	4	5	6	2	23
3011[v]	ABD-NY, Inc.	10	10	2	4	0	—	26
3174	Equitrade Partners	8	5	3	11	12	12	51
Total New Listings		302	253	178	286	284	215	1518

[a] Walter N. Frank & Co. clears through #551 as of 7/97. The unit's number changes from #34 to #1022.

[b] M. & J. Cohen & Co. withdrew from its joint account with Fagenson/Frankel/Streicher (#104) and formed its own specialist unit (#1424) on 10/23/95.

[c] Lawrence O'Donnell became self-clearing as of 9/94 and the firm's unit number changed from #138 to #1726.

[d] MMS&N ceased as a member organization on 10/5/95 and its specialist business was acquired by #1227.

[e] Ernst/Ware & Keelips/Homans started clearing through Lawrence O'Donnell as of 8/94 and the firm's unit number changed from #233 to #1679. The firm merged into LaBranche & Co. (#210) as of 8/1/97.

[f] The firm's unit number changed from #280 to #1280.

[g] Wagner, Stott & Co. (#551) combined its specialist business with Mercator Partners (#298) on 8/1/95. The new unit is Wagner Stott/Mercator Partners (#298). The firm began clearing through #551 as of 6/97 or 7/97, changing its unit number from #298 to #1032.

[h] AC Partners was acquired by a new specialist unit, CMJ Partners (#1941), as of 1/95.

[i] Marcus Schloss & Co. withdrew as a member firm and merged into Bear/Hunter Specialists (#1418) on 4/3/95.

[j] Fernandez, Bartsch & Mirra merged with and into RPM Specialist Corp. (#403) on 1/3/95.

[k] Stuart, Scotto, Cella & Co. formed a joint account (remaining unit # 1010) with M. J. Meehan as of 10/97.

[l] Purcell, Graham & Co. withdrew as a member firm and from its joint account with R. Adrian (#1240) on 4/10/95. Its business was acquired by RPM Specialist Corp. and John Hancock Specialists, Inc. which continued a joint account with R. Adrian (#1027).

[m] Susquehanna Brokerage Services started a specialist business and formed a joint account with RPM Specialist Corp. (#1034) on 1/3/95. The new unit took over the stocks previously traded by #512. The joint account was dissolved and Susquehanna Brokerage Services registered as the sole specialist in the stocks as of 1/5/98.

[n] KV Specialist L.L.C. registered as a specialist in five stocks on 1/20/97 following the dissolution of its joint account with RSF Partners (which began on 1/2/96).

[o] Scholl & Levin withdrew as a member organization and its specialist business was acquired by (#3174) on 5/1/95.

[p] E. A. Sheslow (#1319) started operating as a specialist firm on 6/3/96. E. A. Sheslow withdrew from the specialist business as of 5/15/98 and the firm's stocks were assigned to Walter N. Frank & Co. (#1022).

[q] Foster, Marks, Natoli & Safir was acquired by Spear, Leeds & Kellogg (#501) as of 3/94.

[r] Weiskopf Silver Specialist's joint account with Oscar Gruss was dissolved on 12/27/96 when O. Gruss's sole registered specialist withdrew from the firm to join Weiskopf.

[s] Merrill Lynch Specialists merged its specialist operation with and into JJC Specialists (#1227) as of 12/21/98.

[t] Stern Bros. dissolved its specialist business as of 7/1/97 and its stocks were transferred to #210, #1418, and #20.

[u] Fowler, Rosenau & Geary's unit number changed to #583 as of 11/96. The firm withdrew as a member organization and merged into LaBranche & Co. (#210) as of 7/1/98.

[v] Dresdner-NY (#3011) merged with and into Equitrade Partners (#3174) as of 5/5/97.

specialist firms operating during the entire period, total allocations ranged from five for Stuart, Scotto and Cella to 99 for La Branche.

The footnotes to Table 2 describe mergers and acquisitions among NYSE specialist firms. Of the 14 events during the sample period, eleven involved existing specialist firms and three were acquisitions of existing units by new specialist firms. There was also one new specialist firm formed during the period and two specialist firms that split from joint accounts to form their own specialist units.

4. The discrete choice model

In this section, I describe the discrete-choice logit model used to analyze the allocation process.[6] Let i index new listings and j index specialist firms, where $i = 1, \ldots, N$ and $j = 1, \ldots, J$. In this framework, the exchange will allocate each of N new listings to one of J specialist firms. Suppose that the net benefits of assigning listing i to specialist j can be expressed as

$$U_{ij} = \beta' z_{ij} + \varepsilon_{ij}, \tag{1}$$

where z_{ij} includes specialist firm and listing security characteristics, and β_{ij} is a vector of coefficients. If the exchange assigns security i to specialist firm j, we assume that U_{ij} is the maximum value of U_i across the J alternatives. If the disturbance terms are assumed to be independently distributed with an extreme-value (Gumbel) distribution, the discrete-choice model takes the following form:

$$Pr(Y_i = j) = \frac{e^{\beta' z_{ij}}}{\sum_{j=1}^{J} e^{\beta' z_{ij}}}, \tag{2}$$

where $Pr(Y_i = j)$ is the probability that listing i is allocated to specialist j. The explanatory variables are described below.

4.1. Specialist performance

To examine the effects of specialist performance on allocation decisions, I incorporate measures of quoted and effective bid-ask spread, quoted depth, frequency of price improvement, time at the inside quotes, price continuity, average opening delay, and order-imbalance halt use.[7] Together, these performance measures reflect characteristics monitored by the exchange and factors of interest to investors and floor brokers. If good performance is rewarded through the allocation process, I expect depth, price improvement, time at the inside, and price continuity to be positively related to future allocations, and spreads, opening delays, and halt frequency to be negatively related to future allocations.

[6] See Greene (1995, 1997) for a complete discussion of the discrete-choice logit model.

[7] To be consistent with measures utilized by the NYSE, I report results based on dollar bid-ask spreads. Results based on percentage spreads are similar. I consider only order-imbalance halts because, unlike news halts, order-imbalance halts are initiated by the specialist (see Corwin, 1999). Days that begin with a halt are excluded when calculating average opening delay.

Both quoted bid-ask spread and quoted depth are measured as a time-weighted average across all quotes posted during the day. The quoted spread reflects the cost of a round-trip transaction assuming trades take place at the quotes. Quoted depth, defined as the sum of bid and ask depth, reflects liquidity provided by the specialist and other market participants. I define the frequency of price improvement as the proportion of NYSE trades executed inside the best available quotes. The effective spread is then defined as the average of $2*|Price\text{-}Midpoint|$ across all trades during the day. This measure reflects transaction costs after accounting for price-improved trades.[8] I define time at the inside as the proportion of the trading day for which the specialist posts both the best bid and best ask across all markets. Following the NYSE, I define price continuity as the proportion of NYSE trades that occur within \$0.125 of the previous trade. Finally, I measure the total number of order-imbalance halts called by the specialist and the average opening delay, where opening delay is defined as the number of seconds from 9:30 a.m. to the opening quote.

For each variable, I utilize the regression methodology of Corwin (1999) to calculate residual performance measures for each specialist firm.[9] These measures are updated quarterly and reflect differences in performance that cannot be explained by security characteristics.[10] To test for statistical significance of performance differences across specialist firms, I create an empirical distribution for each test statistic each quarter based on Monte Carlo simulations with 500 replications. The regression methodology and Monte Carlo simulations are described in more detail in the appendix.

Table 3 presents a summary of the specialist performance tests. Consistent with previous research, several performance measures differ significantly across specialist firms. Most notably, effective spreads, price improvement, price continuity, and opening delay differ significantly across specialist firms in all 24 quarters, and time at the inside differs significantly in 12 quarters. For comparison, I report results from both the Monte Carlo simulation and standard test statistics. In general, the results are similar. However, for order-imbalance halt use, the χ^2-test rejects too frequently the null hypothesis of no difference in performance. Significant differences in halt use are evident in 18 of 24 quarters based on a χ^2-test, but in only six quarters based on the simulated distribution.

[8] Numerous researchers have documented a lag in the reporting of trades (see Lee and Ready, 1991). Blume and Goldstein (1997) report a median lag of 16 s for NYSE trades during 1994 and 1995. To be consistent throughout, I account for this lag by matching each trade to the quotes posted 16 s prior to the trade time.

[9] This regression framework is similar in spirit to the "Near Neighbor" analysis used by the NYSE. One benefit of the methodology used here is that it does not necessitate the selection of benchmark securities. In addition, this methodology provides an average measure of residual performance based on the full sample of stocks traded by each specialist firm.

[10] I utilize quarterly estimates to focus on recent specialist performance and to be consistent with NYSE performance measures, such as SPEQ ratings, which are updated at least quarterly. Quarterly estimates may not capture historical performance effects that could be considered by the Allocation Committee. In an earlier version of the paper, I estimated rolling six-month performance for a limited number of measures and obtained similar results.

Table 3
Specialist firm performance tests.
The table provides a summary of quarterly specialist-firm performance tests from 1993 through 1998. Residual performance measures are estimated based on the methodology outlined in the appendix. The *Number of Order-Imbalance Halts* is the total number of order-imbalance halts called during the quarter. All other performance measures are estimated daily and then averaged across days during the quarter. *Quoted Spread* and *Quoted Depth* are time-weighted averages across all valid quotes during the day. Depth is the sum of bid and ask depth and is stated in thousands of shares. *Effective Spread* is the average of 2*|*Price-Midpoint*| across all trades during the day. *Frequency of Price Improvement* is the proportion of all trades executed at prices inside the best quotes. *Time at the Inside* is the proportion of time during which the specialist has both the best bid and best ask across all markets. *Price Continuity* is the proportion of trades that are executed within \$0.125 of the previous trade. *Opening Delay* is the number of seconds from 9:30 to the opening quote. Columns one and two list the mean performance measure and mean difference between maximum and minimum specialist firms across all quarters analyzed. For all variables except number of halts, the difference between maximum and minimum specialist firms is defined from specialist-firm dummy-variable coefficients in the OLS regressions. For number of halts, the difference between maximum and minimum specialist firms is estimated based on the mean coefficients from the Poisson regressions and mean values of explanatory variables across the 24 quarters analyzed. Columns three and four list the number of quarters during the sample period (out of 24) for which equality of performance across specialist firms is rejected at the five percent level. Results in column three are based on an F-test of the restriction that dummy-variable coefficients are equal across specialist firms (a χ^2-test is used for *Number of Order-Imbalance Halts*). Results in column four are based on a simulated distribution of the test statistic from a Monte Carlo analysis with 500 replications per quarter.

	Performance		Quarters with significant performance differences	
	Average across 24 quarters	Average difference between max and min specialist firms	F-distribution (5% level)	Monte Carlo distribution (5% level)
Quoted spread (\$)	0.1908	0.0926	19	16
Effective spread (\$)	0.1347	0.0323	24	24
Quoted depth (000)	15.56	12.79	1	3
Frequency of price improvement (%)	22.05	13.25	24	24
Time at the inside (%)	93.60	4.91	12	12
Price continuity (%)	96.62	4.78	24	24
Opening delay (s)	207.15	134.44	24	24
Number of order-imbalance halts	0.1220	0.1729	18	6

To determine the economic significance of performance differences, I compare the mean difference between the best and worst performing specialist firms to the overall sample mean. The results, reported in columns 1 and 2, suggest that differences in bid-ask spreads and price improvement are both economically and statistically significant. Across all stocks and all quarters, the mean quoted and effective spreads are 19.08 cents and 13.47 cents, respectively. After controlling for security characteristics, the mean difference in quoted spreads between the maximum and minimum specialist firms is 9.26 cents, or 48.5 percent of the sample mean. The mean difference in effective spreads is 3.23 cents, or 24.0 percent of the sample mean. The

proportion of price improved trades averages 22.05 percent across the entire sample period, with a mean difference between the maximum and minimum specialist firms of 13.25 percent, or 60.1 percent of the sample mean.

The average opening delay also varies substantially across specialist firms, with a cross sectional mean of 207 s and a mean difference across specialists of 143 s. However, for even the maximum specialist firm, the average delay is less than 15 min and may not be regarded as important by the Exchange or market regulators. Similarly, while differences in price continuity and time at the inside are statistically significant, the economic importance of these differences may be limited; both variables average 90 percent or higher regardless of the specialist firm assigned to the stock. Finally, differences in halt use and quoted depth appear economically large, but are not statistically significant.

The reader may wonder whether alternative performance measures are compatible or whether there are tradeoffs between the various measures.[11] To address this issue, Table 4 reports correlations for the performance measures. Correlations are calculated quarterly and averaged across the 24 quarters during the sample period. The results provide little evidence of tradeoffs between performance measures. The one notable substitution effect is that higher quoted spreads are associated with more frequent price improvement, while more frequent price improvement leads to lower effective spreads. The results also show that lower quoted and effective spreads are associated with lower quoted depth, more time at the inside, and smaller trade-to-trade price moves (higher continuity).

4.2. Specialist firm size

Conversations with specialists suggest that size plays an important role in the allocation process, with large, prestigious listings being more likely to go to large specialist firms. This size effect may reflect a preference by the NYSE to allocate listings to large, well-capitalized specialist firms. Large specialist firms may also apply for more listings, since they are less likely to face resource constraints. Given these arguments, I expect specialist-firm size to be positively related to the likelihood of receiving an allocation, especially for large listings. To test this hypothesis, I include in the model the aggregate market value of stocks traded by the specialist firm as of the listing date.[12]

As a first look at the relation between allocations and specialist-firm size, Table 5 lists allocation frequencies across specialist-firm size quartiles, where quartiles are

[11] For example, Bhattacharya and Yavas (1993) present a model of intermediation in which two commonly used evaluation criteria, low bid-ask spreads and low inventory holding costs, may be inconsistent. They show that when investors utilize an intermediary only as a last resort, market makers with low inventory holding costs may set wider (rather than narrower) bid-ask spreads.

[12] Complete data on specialist firm capitalization are not available. To test the validity of the size proxy, I estimate correlations between various size measures at the end of 1993 using voluntarily provided data from the Securities Industry Yearbook. Capitalization data are available for six of the 40 specialist firms and number of employees is available for 17 firms. Based on these data, the correlation between the size proxy and specialist firm capital is 0.925 and the correlation with number of employees is 0.789. The results are similar if the number of stocks traded by a specialist firm is used as a proxy for size.

Table 4
Correlations between specialist firm performance measures.
The table lists mean correlations for the performance measures used in the discrete choice logit model. Correlations are calculated quarterly and then averaged across the 24 quarters during the sample period. Residual performance measures for each specialist firm are calculated quarterly using the method outlined in the Appendix. Halt Use is the total number of order-imbalance halts called during the quarter. All other performance measures are estimated daily and then averaged across days during the quarter. *Quoted Spread* and *Quoted Depth* are time-weighted averages across all valid quotes during the day. Effective Spread is the average of 2*|*Price-Midpoint*| across all trades during the day. Price Improvement is the proportion of all trades executed at prices inside the best quotes. *Time at the Inside* is the proportion of time during which the specialist has both the best bid and best ask across all markets. *Quoted Depth* is the sum of bid and ask depth and is stated in thousands of shares. *Price Continuity* is the proportion of trades that are executed within \$0.125 of the previous trade. *Opening Delay* is the number of seconds from 9:30 to the opening quote.

	Quoted spread	Effective spread	Price improvement	Time at inside	Quoted depth	Price continuity	Opening delay
Effective spread	0.581	—	—	—	—	—	—
Price improvement	0.423	−0.090	—	—	—	—	—
Time at inside	−0.231	−0.110	−0.034	—	—	—	—
Quoted depth	0.115	0.154	0.113	0.169	—	—	—
Price continuity	−0.580	−0.838	−0.006	0.129	−0.182	—	—
Opening delay	0.130	0.201	0.021	−0.065	0.122	−0.082	—
Halt use	0.078	0.004	0.087	−0.082	−0.050	0.001	0.080

Table 5
Frequency of new listings by size category.
The table lists the number (proportion) of new listings allocated to specialist firms in various size categories. Frequencies are based on the complete sample of 1,518 new listings on the NYSE from January 1993 through December 1998. Specialist-firm size quartiles are based on the number of stocks traded as of the listing date. New listings are categorized based on market value quartiles for all NYSE-listed firms as of December 31st in the year prior to listing.

New listing size	*N*	Specialist firm size quartiles				χ^2
		1 (Small)	2	3	4 (Large)	(*p*-value)
Quartile 1 (Small)	420	68	80	113	159	47.371
		(16.2%)	(19.0%)	(26.9%)	(37.9%)	(0.000)
Quartile 2	542	93	126	143	180	29.026
		(17.2)	(23.2)	(26.4)	(33.2)	(0.000)
Quartile 3	430	47	82	128	173	83.916
		(10.9)	(19.1)	(29.8)	(40.2)	(0.000)
Quartile 4 (Large)	126	9	20	34	63	51.968
		(7.1)	(15.9)	(27.0)	(50.0)	(0.000)
Total new listings	1518	217	308	418	575	187.671
		(14.3)	(20.3)	(27.5)	(37.9)	(0.000)

defined by number of stocks traded. New listings are categorized based on market value quartiles for all NYSE-listed firms as of December 31st in the year prior to listing. In all listing-size categories, large specialists receive a significantly higher proportion of allocations than small specialists and this result is most pronounced

for the largest listings. For listings in the top quartile of NYSE firms, for example, large specialist firms received 50.0 percent of allocations, whereas small specialist firms received only 8.1 percent.

4.3. Queuing and replacement stocks

If multiple specialists are eligible based on other criteria, the Exchange may give consideration to specialists that have not received any recent allocations or that have recently had some of their stocks delisted. To test these hypotheses, I include two variables in the discrete-choice model. *Queue* is defined as the number of new listings that have occurred since the specialist last received an allocation.[13] *NDelist* is defined as the number of stocks from the specialist's portfolio that delisted during the 12 months prior to the current listing. If securities are allocated based on a queuing system and to replace delisted stocks, *Queue* and *NDelist* will be positively related to the likelihood of receiving allocations.

4.4. Industry characteristics

It could be argued that diversification of specialist portfolios reduces portfolio risk and increases competition. For example, Gehrig and Jackson (1998) suggest that allocating related securities across specialist portfolios results in indirect competition and reduces the specialist's monopoly power. Alternatively, one could argue that specializing in particular types of securities decreases the adverse selection problem of the specialist and reduces market-making costs (see Strobl, 2001). Whether stocks are diversified or concentrated within specialist portfolios is therefore an empirical question.

To test whether the NYSE considers these factors, I define a measure of relative industry concentration. I first calculate the proportion of each specialist firm's portfolio and the proportion of *all* sample stocks that are in the same industry as the new listing, where proportions are based on aggregate capitalization. *MktShr_Industry* is then defined as the ratio of the specialist firm's proportion to the market-wide proportion and represents the relative concentration of a specialist's portfolio in the industry of the new listing.[14] If the NYSE allocates securities based on diversification (specialization), the coefficient on *MktShr_Industry* will be negative (positive).

4.5. Non-U.S. securities and investment funds

Trading other types of securities, such as investment funds and non-U.S. securities, may also lead to security-specific expertise and/or indirect competition.

[13] Initial values of *Queue* are defined based on new listings from 1992. For new specialist firms, the initial value of *Queue* is set equal to the maximum value of *Queue* across existing specialist firms.

[14] All market-share measures described in this section are recalculated after each new listing. For the industry market share calculation, I define eight broad industry groups based on two-digit SIC codes: Agriculture, Fishing and Forestry (01-09), Mining (10-14), Construction (15-17), Manufacturing (20-39), Transportation, Communication, Electric and Gas (40-49), Wholesale and Retail Trade (50-59), Finance, Insurance and Real Estate (60-67), and Services (70-89).

For example, making a market in non-U.S. stocks may require the specialist to build relationships with non-U.S. securities firms and to develop an understanding of international markets. Thus, the NYSE may allocate non-U.S. securities to specialist firms that have already developed this expertise. Alternatively, the NYSE may view these securities as indirect substitutes and diversify them across specialists to promote indirect competition. To examine these possibilities, I provide separate results for the subsamples of non-U.S. and investment-fund listings. For non-U.S. listings, I include a measure of relative concentration in non-U.S. securities. *MktShr_Non-U.S.* is based on the proportion of non-U.S. securities in a portfolio and is defined in the same manner as *MktShr_Industry*. Similarly, the investment-fund model includes a measure of relative investment fund concentration, *MktShr_Fund*. If specialist portfolios are concentrated by security type, the coefficients on these variables will be positive.

4.6. More-profitable and less-profitable listings

One of the objectives of the Allocation Policy is to spread reward and risk throughout the specialist system. Sofianos (1995) examines specialist trading revenues and shows that in a sample of 200 stocks, the 60 most active stocks account for almost all trading revenues, while less active stocks actually result in trading losses. These results suggest that, in order to distribute reward and risk, the NYSE may choose to allocate large, actively-traded issues to specialist firms that trade relatively few large stocks and small, less-profitable listings to specialist firms that trade relatively few small stocks.[15]

I define two variables that represent the relative concentration of specialist portfolios in large and small stocks. *MktShr_Large* and *MktShr_Small* are defined in the same manner as the market-share variables described above and are based on the proportions of stocks in the top and bottom quartiles of market capitalization across all NYSE-listed stocks. If specialists that trade a relatively high proportion of large stocks are less likely to receive new listings, then the coefficient on *MktShr_Large* will be negative. Similarly, if specialists that trade a relatively high proportion of small stocks are more likely to receive new listings, then the coefficient on *MktShr_Small* will be positive.

4.7. Allocation policy changes

Revisions to the NYSE's Allocation Policy in March of 1997 gave listing firms a more significant role in the allocation decision. To examine the impact of this change, I create interaction terms by multiplying each explanatory variable by a dummy variable that equals one if the new listing occurred after the policy change and zero otherwise. While I cannot observe the actual decisions of listing firms, this

[15] I use market capitalization as a proxy for expected trading activity. While previous trading activity may provide a better proxy, this variable is not observable for the initial public offerings included in the sample.

analysis provides a test of whether the increased role of the listing firm significantly affects the relative importance of alternative allocation criteria.

5. Results

5.1. All new listings

Table 6 lists coefficients from the discrete-choice logit model estimated for the full sample of 1455 new listings from April 1993 through December 1998. Allocations from the first quarter of 1993 are excluded since prior quarter performance is not defined for these listings. Results for specialist-firm portfolio characteristics are presented in Panel A. For each specification, the table also lists a pseudo-R^2 (or Likelihood Ratio Index). This measure is analogous to an R^2 from a standard regression and is equal to one minus the ratio of the computed log likelihood to the log likelihood for a model in which all slopes equal zero. The maximum pseudo-R^2 for the full sample tests is 4.0 percent and, for every specification, a χ^2-test easily rejects the hypothesis that the independent variables have no explanatory power.[16]

The coefficient on market capitalization is positive and significant in every specification. This result is consistent with the hypothesis that the NYSE is more likely to allocate new listings to larger, better-capitalized specialist firms. Alternatively, this coefficient may reflect the fact that large specialist firms are more likely to apply for any new listing. These alternative explanations are examined further in Section B. The policy-change interaction term for market capitalization is positive but insignificant, suggesting that the policy change did not diminish the importance of specialist-firm size.

New allocations are also related to recent allocations and recent delistings. The delistings variable is positive and significant in all specifications and the policy-change interaction term for this variable is not significant. This suggests that, both before and after the policy change, listings were allocated as replacement for delisted stocks. The coefficient on the queuing variable is positive and significant prior to the policy change and negative and significant after. The pre-1997 coefficient suggests that new listings during this period were more likely to be allocated to specialist firms that had not received a recent allocation. One possible explanation for the post-1997 effect is that the increased role of listing firms in the allocation process resulted in a subset of specialist firms being consistently awarded allocations, while other specialist firms were repeatedly denied allocations.

After controlling for specialist-firm size, I find that specialist firms that trade a relatively high proportion of large (small) stocks are less (more) likely to receive any new listing. If listing size is related to trading profits, these results are consistent with the objective of spreading reward and risk across specialist firms. The effects of these

[16] Although not shown, I also examined correlations among the explanatory variables. Large specialist firms tend to be concentrated in large rather than small stocks, have more delistings, and wait less time between allocations. Correlations among performance measures are discussed in Section 4.1 above.

Table 6
Allocation criteria for new listings on the NYSE.
The table lists coefficient estimates from a discrete-choice logit model of the allocation decision. Results are based on the sample of 1455 new listings on the NYSE from 4/1/93 to 12/31/98. The discrete-choice model is of the following form:

$$Pr(Y_i = j) = \frac{e^{\beta} z_{ij}}{\sum_j e^{\beta} z_{ij}},$$

$Pr(Y_i = j)$ is the probability that new listing i is allocated to specialist firm j. The independent variables, z_{ij}, include specialist firm and new listing characteristics defined as follows: $MarketCap_j$ is the aggregate market capitalization of stocks traded by the specialist firm at the time of the new listing. Market capitalizations for individual securities are updated as of December 31 each year. $Queue_j$ is the number of new listings that have occurred since the specialist firm last received an allocation. $MktShr\_Industry_j$ is the proportion of specialist firm j's stocks in the same industry as the new listing divided by the proportion of sample stocks in that industry. $MktShr\_Small_j(MktShr\_Large_j)$ is the proportion of specialist firm j's stocks in the smallest (largest) quartile of NYSE stocks relative to the proportion of sample stocks in that quartile. Proportions in the above calculations are based on the aggregate market capitalization of stocks. Residual performance measures are defined as in Table 3. D_{Policy} is a dummy variable equal to one if the listing occurred after the March 1997 change in the allocation policy and zero otherwise. Panel A lists results for specialist-firm portfolio characteristics. Panel B lists results for specialist-firm performance measures. The specifications in Panel B include the full set of variables from Panel A, though the coefficients are not shown. The pseudo-R^2 (or likelihood ratio index) equals one minus the ratio of the computed log-likelihood to the log-likelihood of a model in which all slopes equal zero. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively.

Variable	1	2	3	4	5	6	7	8
Panel A—Specialist firm portfolio characteristics								
Ln(*MarketCap*)	0.277***	—	—	—	—	—	0.361***	0.349***
Ln(1+*Queue*)	—	−0.101***	—	—	—	—	−0.012	0.045*
Ln(1+*NDelist*)	—	—	0.472***	—	—	—	0.210***	0.263***
MktShr_Industry	—	—	—	0.112	—	—	0.015	0.027**
MktShr_Small	—	—	—	—	−0.418***	—	0.031**	0.007
MktShr_Large	—	—	—	—	—	0.685***	−0.757***	−0.830***
D_{Policy}* Ln(*MarketCap*)	—	—	—	—	—	—	—	0.009
D_{Policy}* Ln(1+*Queue*)	—	—	—	—	—	—	—	−0.167***
D_{Policy}* Ln(1+*NDelist*)	—	—	—	—	—	—	—	−0.130
MktShr_Industry	—	—	—	—	—	—	—	−0.033
MktShr_Small	—	—	—	—	—	—	—	0.026
MktShr_Large	—	—	—	—	—	—	—	0.021
N	1455	1455	1455	1455	1455	1455	1455	1455
Log likelihood	−5191.19	−5245.51	−5188.28	−5257.83	−5248.62	−5242.87	−5159.94	−5151.29
Pseudo-R^2	0.0328	0.0227	0.0334	0.0204	0.0221	0.0232	0.0386	0.0403

Panel B—Specialist firm performance measures								
Portfolio characteristics included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quoted Spread	−0.041	—	—	—	—	—	—	—
D_{Policy}* *Quoted Spread*	−0.961	—	—	—	—	—	—	—
Effective Spread	—	−0.348	—	—	—	—	—	—
D_{Policy}* *Effective Spread*	—	0.384	—	—	—	—	—	—
Price Improvement	—	—	0.023**	—	—	—	—	—
D_{Policy}* *Price Improvement*	—	—	0.024	—	—	—	—	—
Time at the Inside	—	—	—	0.026	—	—	—	—
D_{Policy}* *Time at the Inside*	—	—	—	0.061	—	—	—	—
Quoted Depth	—	—	—	—	0.025**	—	—	—
D_{Policy}* *Quoted Depth*	—	—	—	—	−0.039	—	—	—
Price Continuity	—	—	—	—	—	0.028	—	—
D_{Policy}* *Price Continuity*	—	—	—	—	—	0.008	—	—
Opening Delay	—	—	—	—	—	—	0.001	—
D_{Policy}* *Opening Delay*	—	—	—	—	—	—	0.002	—
Likelihood of Halts	—	—	—	—	—	—	—	−0.002
D_{Policy}* *Likelihood of Halts*	—	—	—	—	—	—	—	−0.006
N	1455	1455	1455	1455	1455	1455	1455	1455
Log likelihood	−5151.23	−5151.28	−5145.78	−5149.83	−5148.91	−5150.65	−5149.03	−5151.05
Pseudo-R^2	0.0403	0.0403	0.0413	0.0405	0.0407	0.0404	0.0407	0.0403

variables do not appear to change significantly after 1997. However, the coefficient on *MktShr_Small* is not significant when the interaction term is included.

The coefficient on industry market share is insignificant over the full sample period. However, the results in column eight show that industry concentration had a significantly positive effect prior to 1997 and this effect was reduced after the policy change. These results are consistent with Strobl (2001) and suggest that specialist firms and/or the allocation committee value the informational advantage of industry concentration, whereas listing firms either do not consider this factor or prefer to be traded apart from their competitors. Alternatively, these results may reflect a desire by exchange participants to mitigate intra-exchange competition, as in Pirrong (1999), and a counteracting desire by issuing firms (post-1997) to increase indirect competition, as in Gehrig and Jackson (1998).

Panel B of Table 6 lists results for specifications including specialist-firm performance. Each model includes the set of explanatory variables shown in column 8 of Panel A. The results for these variables are similar to those in Panel A and are not reported. I find only weak evidence of a reliable relation between previous-quarter specialist-firm performance and allocations. Of the variables that differ significantly across specialist firms, only *frequency of price improvement* is significantly related to subsequent allocations. Setting all other variables to their sample means, the coefficient on price improvement suggests that moving from the worst to best performing specialist firm at the end of 1998 would increase the likelihood of receiving an allocation from 2.65% to 3.55% (a 34% increase). In comparison, moving from the smallest to the largest specialist firm at the end of 1998 increases the likelihood of receiving an allocation from 1.07% to 6.02% (a 464% increase) and equal allocations across specialists would result in a likelihood of 3.03% (1/33). These results confirm the earlier finding that size is an important factor in the allocation process, while performance plays at most a limited role.

5.2. Large and small listings

To examine whether specialist firm application decisions affect the conclusions, I provide separate results for large and small new listings. Because most specialist firms are likely to apply for large listings, results for this subsample should be less affected by any potential selection bias. I define listing size relative to the median market capitalization across all NYSE-listed stocks on the December 31st prior to the listing. Based on this categorization, the sample includes 536 large listings and 919 small listings. The results are reported in columns 1–4 of Table 7. Results for performance measures are similar to those reported in Table 6 and are not shown.

The results for large listings are consistent with the full-sample results. I interpret this as evidence that application decisions and selection biases do not drive the results. In particular, the results confirm the finding that large listings are more likely to be allocated to large specialist firms. In addition, specialist firms are more likely to receive a large allocation if they trade a relatively small proportion of large stocks or have recently had a stock delisted. As in the full sample, the coefficient on *Queue* is significantly positive prior to the allocation policy change and significantly negative

Table 7
Subsample analysis.
The table lists coefficient estimates from a discrete-choice logit model of the allocation decision. Results for large and small listings are presented in columns 1–4, where listings are categorized as small (large) if their market capitalization is less than (greater than) the median market capitalization of NYSE-listed firms at the end of the year prior to the listing. Columns 5–7 list results for the sample of non-U.S. listings and columns 8-10 list results for investment fund listings. $MarketCap_j$ is the aggregate market capitalization of stocks traded by the specialist firm at the time of the new listing. Market capitalizations for individual securities are updated as of December 31 each year. $Queue_j$ is the number of new listings that have occurred since the specialist firm last received an allocation. $MktShr\_Industry_j$ is the proportion of specialist firm j's stocks in the same industry as the new listing divided by the proportion of sample stocks in that industry. $MktShr\_Small_j$ is the proportion of specialist firm j's stocks in the smallest quartile of NYSE stocks relative to the proportion of sample stocks in that quartile. $MktShr\_Large_j$ is the proportion of specialist firm j's stocks in the largest quartile of sample stocks relative to the proportion of NYSE stocks in that quartile. $MktShr\_Non-U.S._j$ is the proportion of non-U.S. stocks in specialist firm j's portfolio divided by the proportion of non-U.S. stocks in the complete sample. *MktShr_Fund* is the proportion of investment funds (closed-end funds, REITs and units) in specialist firm j's portfolio divided by the proportion of investment funds in the complete sample. Proportions in the above calculations are based on the aggregate market capitalization of stocks. D_{Policy} is a dummy variable equal to one if the listing occurred after the March 1997 change in the allocation policy and zero otherwise. The pseudo-R^2 (or likelihood ratio index) equals one minus the ratio of the computed log-likelihood to the log-likelihood of a model in which all slopes equal zero. ***, **, and * indicate significance at the 1, 5 and 10 percent levels, respectively.

Variable	Large listings		Small listings		Non-U.S. listings			Investment fund listings		
	1	2	3	4	5	6	7	8	9	10
Ln(*MarketCap*)	0.556***	0.524***	0.246***	0.243***	0.390***	0.465***	0.467***	0.260**	0.324***	0.332**
Ln(1 + *Queue*)	0.067*	0.133***	−0.057**	−0.004	−0.066	−0.051	−0.004	−0.027	−0.015	0.081
Ln(1 + *NDelist*)	0.303***	0.363***	0.149**	0.199**	0.288**	0.236*	0.230	0.249**	0.287***	0.469***
MktShr_Industry	0.016	0.033	0.150	0.024	−0.001	−0.006	0.022	0.026	0.020	0.013
MktShr_Small	0.038	−0.049	0.026	0.023	−0.024	−0.010	−0.004	0.077***	0.069**	−0.060
MktShr_Large	−1.250***	1.560***	−0.475	−0.478	−1.535***	−1.415***	−1.423**	−0.256	0.505	0.095
D_{Policy}* Ln(*MarketCap*)	—	0.022	—	−0.004	—	—	0.047	—	—	−0.124
D_{Policy}* Ln(1+*Queue*)	—	−0.187**	—	−0.160***	—	—	−0.146	—	—	−0.342***
D_{Policy}* Ln(1 + *NDelist*)	—	−0.116	—	−0.135	—	—	−0.008	—	—	−0.467*
D_{Policy}**MktShr_Industry*	—	−0.043	—	−0.028	—	—	−0.078	—	—	0.020
D_{Policy}* *MktShr_Small*	—	0.098	—	0.001	—	—	−0.013	—	—	0.113
D_{Policy}* *MktShr_Large*	—	0.178	—	0.037	—	—	−0.103	—	—	0.015
MktShr_NonU.S.	—	—	—	—	—	0.165***	0.121**	—	—	—
D_{Policy}* *MktShr_NonU.S.*	—	—	—	—	—	—	0.185	—	—	—
MktShr_Fund	—	—	—	—	—	—	—	—	0.141***	0.207**
D_{Policy}* *MktShr_Fund*	—	—	—	—	—	—	—	—	—	−0.121
N	536	536	919	919	287	287	287	280	280	280
Log likelihood	−1856.17	−1850.52	−3289.36	−3284.80	−1005.58	−999.21	−997.08	−1005.01	−998.96	−991.23
Pseudo-R^2	0.0612	0.0641	0.0297	0.0311	0.0502	0.0551	0.0582	0.0270	0.0325	0.0403

after, suggesting that queuing effects are either eliminated or counteracted by the decisions of listing firms.

The results for small listings are also consistent with those from the full sample, with two notable exceptions. First, the queuing variable is negative and insignificant prior to 1997. In contrast, to the full sample results, this finding suggests that small listings were not allocated based on a queuing system prior to 1997. Second, the large and small market share variables are not significant for small listings. This result suggests that listing profitability is not an important determinant of small listing allocations.

5.3. Non-U.S. security and investment fund listings

Results for the subsamples of non-U.S. and investment-fund listings are listed in columns 5–10 of Table 7. Again, the findings are generally consistent with those for the full sample. In both subsamples, allocations are more likely to go to large specialist firms and specialist firms that have recently had some of their stocks delisted. In addition, the large market-share variable is negative and significant for non-U.S. listings and the small market-share variable is positive and significant for investment-fund listings. The coefficient on *Queue* is insignificant for both subsamples prior to 1997, but is negative and significant for investment fund listings after the policy change.

The coefficients on *MktShr_NonU.S.* and *MktShr_Fund* are positive and significant in the non-U.S. and investment fund subsamples, respectively. These results suggest that either the NYSE is more likely to allocate non-U.S. stocks and investment funds to specialists that already trade a relatively high proportion of these securities or these specialist firms are more likely to apply for non-U.S. and investment-fund listings. Like the industry results discussed above, these findings suggest that the advantages of focused specialists outweigh any potential benefits from indirect competition.

6. Conclusion

Every security listed on the NYSE is allocated to a single specialist firm following guidelines in the Exchange's *Allocation Policy and Procedures*. Using the sample of new listings from 1993 to 1998, I analyze the relative importance of various factors in the NYSE's allocation decision.

The results are generally consistent with the NYSE's objectives to spread reward and risk across specialist firms and to seek a match between specialist unit and stock. Although large specialist firms receive the majority of new listings, I find that more-profitable and less-profitable listings tend to be equitably distributed across specialist firms, and specialists are more likely to receive allocations if they have not received a recent allocation or have recently had some stocks delisted. The NYSE also tends to allocate stocks to specialist firms that already trade other stocks in the same industry and to allocate non-U.S. securities and investment funds to specialist firms that already trade these securities.

I find only weak evidence that specialist firm performance affects allocations. This finding is inconsistent with the allocation process as an effective tool for monitoring performance. One potential explanation for this weak performance effect is that the NYSE may use alternative performance measures that have low correlations with the measures analyzed here. In particular, the NYSE's Allocation Committee may place significant weight on SPEQ ratings assigned by floor brokers. The importance of SPEQ ratings in the allocation process and the correlation between SPEQ ratings and other performance measures provide interesting areas for future research. Unfortunately, data related to SPEQ ratings are currently unavailable.

While the Allocation Committee plays a central role in the allocation process, the role of listing firms was increased substantially in March of 1997. At that time, the NYSE implemented changes to its Allocation Policy giving listing firms the option to choose their specialist from a subset of units selected by the committee. This change has forced specialist firms to develop new skills and increase capital, since they must now market themselves in order to "win" allocations. My results suggest that the policy change has resulted in a subset of specialist firms being repeatedly awarded allocations, while others are repeatedly denied allocations. This competition for listings has been cited as one of the motivations for the substantial consolidation among NYSE specialist firms since 1997.[17]

Appendix A. Measuring specialist performance

I calculate quarterly performance measures for each sample security as follows. First, I identify from CRSP the set of stocks listed on the NYSE at the end of March 1993. For each security, I then calculate daily performance measures and average performance during the previous quarter.[18] I repeat this process iteratively, updating the sample to reflect new listings, delistings, and specialist firm mergers during each subsequent quarter. This process results in 24 non-overlapping quarterly performance measures from the first quarter of 1993 through the fourth quarter of 1998.

I estimate residual performance measures for each specialist firm following Corwin (1999). These measures are calculated quarterly by regressing individual stock performance measures on a set of explanatory variables and specialist-firm dummy variables.[19] The explanatory variables are based on models of dealer pricing and

[17] As of June 2002, there were seven specialist firms trading common stocks on the NYSE and three additional specialist firms trading only exchange-traded funds. See "'Specialist' Unit Merger Wave Sweeps Floor of the Big Board" (*Wall Street Journal*, November 10, 1998) for a discussion of the driving forces behind the increased specialist-firm merger activity.

[18] Unlike other performance measures that are averaged across days, number of imbalance halts is defined based on the total number of halts called during the quarter.

[19] To remove the effects of outliers, I exclude stocks with average quote midpoints less than $1.00 or greater than $500.00 and require stocks to have at least 10 days of trade and quote data during a quarter. In addition, securities involved in specialist-firm mergers are excluded from performance calculations during the quarter of the merger. See Hatch and Johnson (2002) for an analysis of the impact of specialist-firm mergers on market quality.

price discreteness (e.g., Ho and Stoll, 1981; O'Hara and Oldfield, 1986; Copeland and Galai, 1983; Glosten and Milgrom, 1985; and Harris, 1994). The dummy-variable coefficients reflect residual performance that cannot be explained by security characteristics. The regressions take the following form:

$$\begin{aligned} Performance = {} & \gamma_0 + \gamma_1 \cdot \ln(Midpoint) + \gamma_2 \cdot \ln(Volume) + \gamma_3 \cdot \ln(Market\ Cap.) \\ & + \gamma_4 \cdot Standard\ deviation + \gamma_5 \cdot Fund + \gamma_6 \cdot Non\ U.S. \\ & + \sum_{i=1}^{I} \lambda_i \cdot Industry_i + \sum_{j=1}^{J-1} \delta_j \cdot Spec_j + \varepsilon. \end{aligned} \tag{A.1}$$

Midpoint and *Volume* are the average closing quote midpoint and daily share volume during the quarter. *Market Capitalization* is measured as of December 31st of the most recent year. *Standard Deviation* is calculated based on daily closing midpoint-to-midpoint returns during the quarter. *Fund* is a dummy variable which equals one if the security is a closed-end fund, REIT or Unit, and zero otherwise. *Non-U.S.* is a dummy variable which equals one for non-U.S. securities and zero otherwise. I also include dummy variables to identify firms in the financial, utility, telecommunication, technology, and energy sectors, respectively, as defined by Fama and French (1997). $Spec_j$, $j = 1, \ldots, J-1$, are dummy variables which equal one if the stock is traded by specialist firm j and zero otherwise. To allow estimation, the dummy variable for specialist #3174 is excluded. A Poisson regression is estimated for the number of order imbalance halts. OLS regressions are estimated for all other performance measures.

To test for differences in performance across specialist firms, I perform an F-test (or χ^2-test) of the hypothesis that all specialist firm dummy-variable coefficients are jointly equal to zero. I then perform a series of Monte Carlo simulations to create an empirical distribution for each test statistic each quarter. I randomly allocate stocks to specialist firms each quarter, subject to the constraint that the number of stocks allocated to each specialist firm is equal to the actual number of stocks traded by that firm. I then estimate the performance regressions and record the related test statistics. I repeat this process 500 times each quarter to create an empirical distribution and determine the associated p-value for each test statistic.

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