

Συμπαιγνία στην αγορά NASDAQ  
Christie and Schultz, 1994

# Χαρακτηριστικά του NASDAQ (1994)

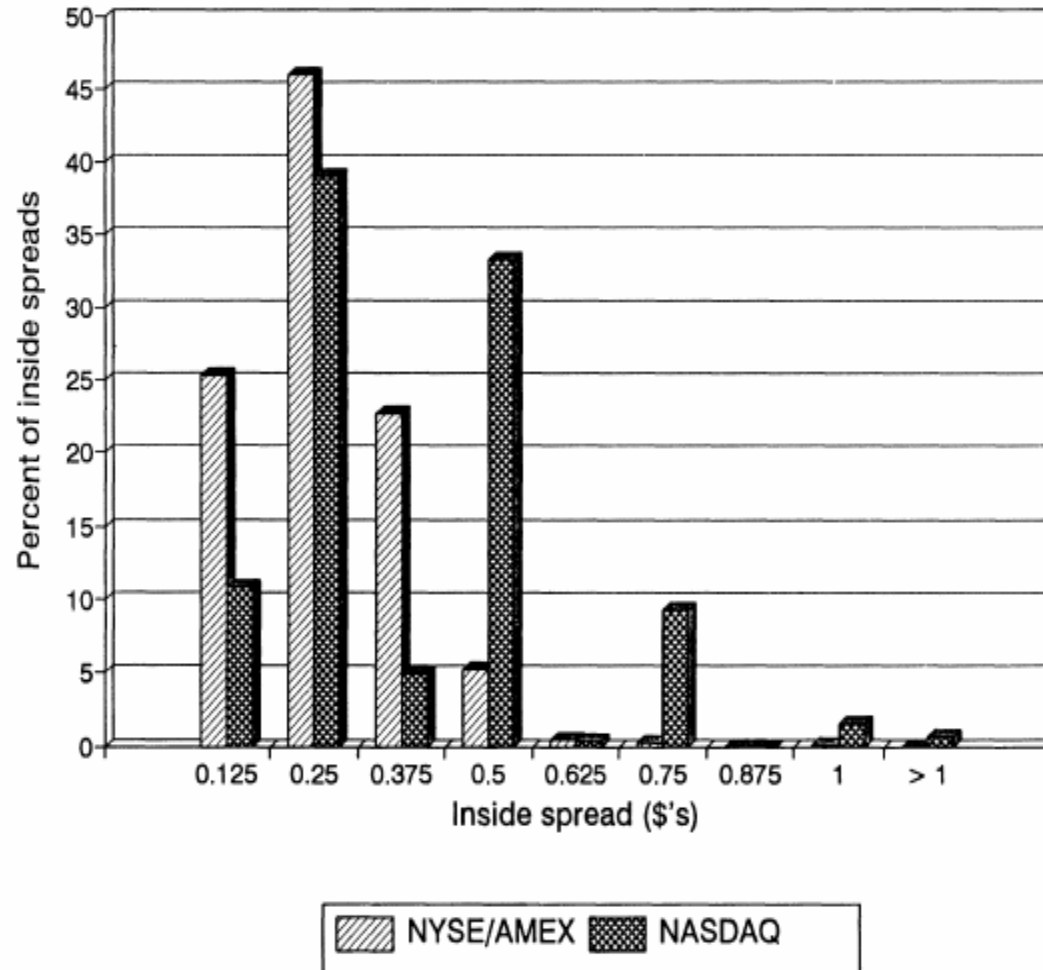
- Μεγαλύτερο μέσο εύρος από ανάλογες αγορές
- Παραδοσιακά το NASDAQ ήταν αγορά με πολλούς ΕΔ (dealers / market makers)
- Προστασία προέκυπτε [?] από ανταγωνισμό μεταξύ ΕΔ
- Δεν υπήρχε μηχανισμός προστασίας για τις εντολές ορίου από
  - Through trading
  - Front running

# Λογική της μελέτης Christie & Schultz

- Επιλογή 100 δραστήριων μετοχών NASDAQ το 1991
- Σύγκριση με μετοχές παρόμοιας τιμής και κεφαλαιοποίησης στο NYSE / AMEX

Παρατηρήσεις για το εύρος

# Το εύρος στην NASDAQ είναι μεγαλύτερο απ' ότι NYSE/AMEX



**Figure 1.** The distribution of inside spreads (in dollars) for 100 NASDAQ and 100 NYSE/AMEX securities of similar price and end-of-year market capitalization. The distributions are computed using all inside quotes for all stocks in 1991. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. The horizontal axis shows the dollar inside spread. The vertical axis represents the percentage of all inside quote revisions that produce the specified spreads.

# Συμπεριφορά εύρους διαφέρει ανά μετοχή

**Table II**  
**The Distribution of Dollar Spreads, Odd-Eighth Bid and Ask**  
**Quotes, and the Percentage of Large and Small Trades**  
**Executed on Odd Eighths for Selected NASDAQ Stocks**

The table provides summary statistics for Apple Computer, Lotus Development, and MCI Communications. The distributions are calculated using all intraday quote updates posted in 1991. In Panel C, the percentages are calculated using all intraday trades executed in 1991 between 9:30 A.M. and 4:00 P.M. Large trades are defined as those trades exceeding 1,000 shares, while small trades are defined as those of 1,000 shares or less.

Panel A: The Proportion of \$0.125, \$0.250, \$0.375, and \$0.500 Spreads				
Stock	Dollar Spread			
	\$0.125 (%)	\$0.250 (%)	\$0.375 (%)	\$0.500 (%)
Apple Computer	1.2	49.3	1.8	47.7
Lotus Development	1.3	49.3	2.0	47.3
MCI Communication	50.3	48.7	1.0	0.0

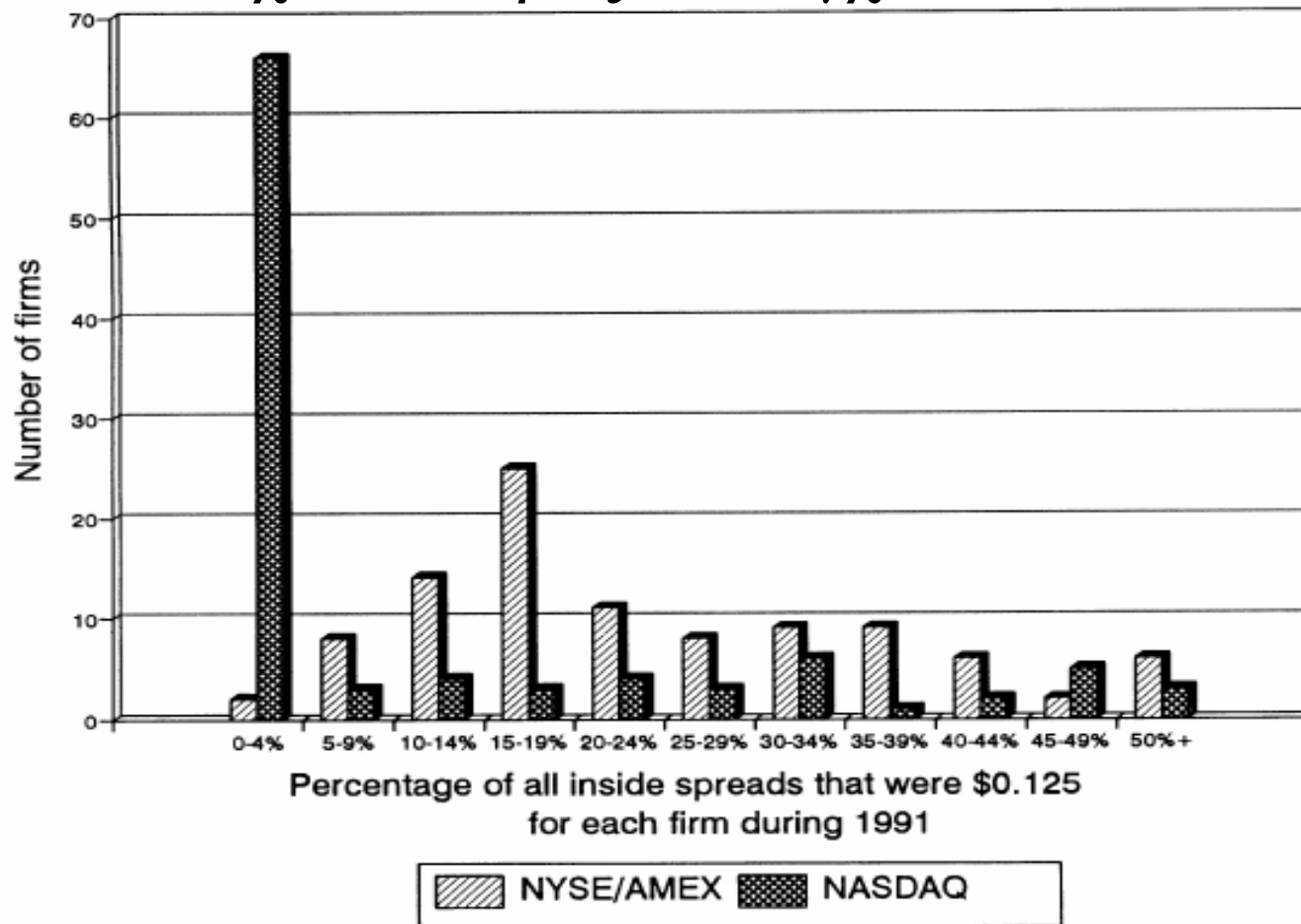
  

Panel B: The Percentage of All Bid and Ask Quotes with Odd-Eighth Price Fractions		
Stock	Percentage of Bid Quotes at Odd Eighths	Percentage of Ask Quotes at Odd Eighths
Apple Computer	1.4	1.7
Lotus Development	1.7	1.6
MCI Communication	51.0	51.4

Panel C: The Percentage of Large and Small Trades that Are Executed at Odd Eighths		
Stock	Small Trades (%)	Large Trades (%)
Apple Computer	9.2	23.6
Lotus Development	9.4	28.0
MCI Communication	47.2	49.3

## Το ελάχιστο εύρος επιτυγχάνεται σπάνια



**Figure 2. The percentage of inside spreads that are \$0.125 for 100 NASDAQ and 100 NYSE/AMEX securities of similar price and end-of-year market capitalization.** This figure contrasts the frequency of one-eighth spreads for stocks listed on the NYSE/AMEX versus stocks listed on NASDAQ in 1991. For each firm, we compute the percentage of quote revisions that produce a spread of \$0.125 using all inside quotes. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. The height of the bar represents the number of firms whose frequency of one-eighth spreads corresponds to the percentages denoted on the horizontal axis. For example, for 66 of the 100 NASDAQ firms in our sample, fewer than 4 percent of all inside spreads are \$0.125. In contrast, this small fraction of \$0.125 spreads is shared by only 2 NYSE/AMEX stocks.

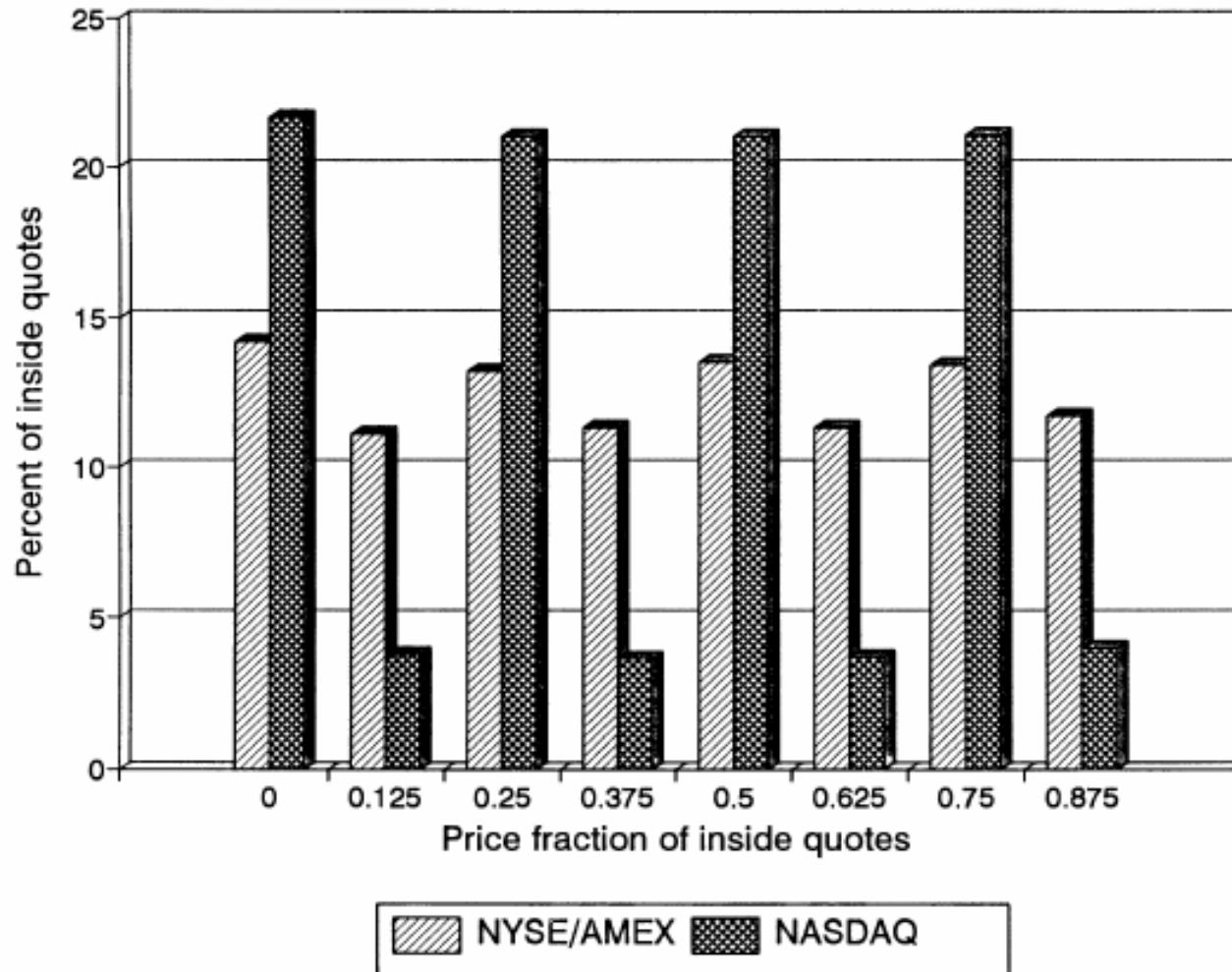
# Εύρος διάφορων αγορών

- Goldstein, 1993 –
  - Εύρος NASDAQ = NYSE + \$[0.15-0.18]
- Christie & Huang, 1994 –
  - Μετάβαση από NASDAQ σε AMEX => μείωση \$0.31
  - Μετάβαση από NASDAQ σε NYSE => μείωση \$0.06
  - Μείωση πριμ ρευστότητας \$0.05
- Αμφίβολο ότι οφείλονται σε μεγαλύτερες ασυμμετρίες πληροφορίας η κόστος θέσεων



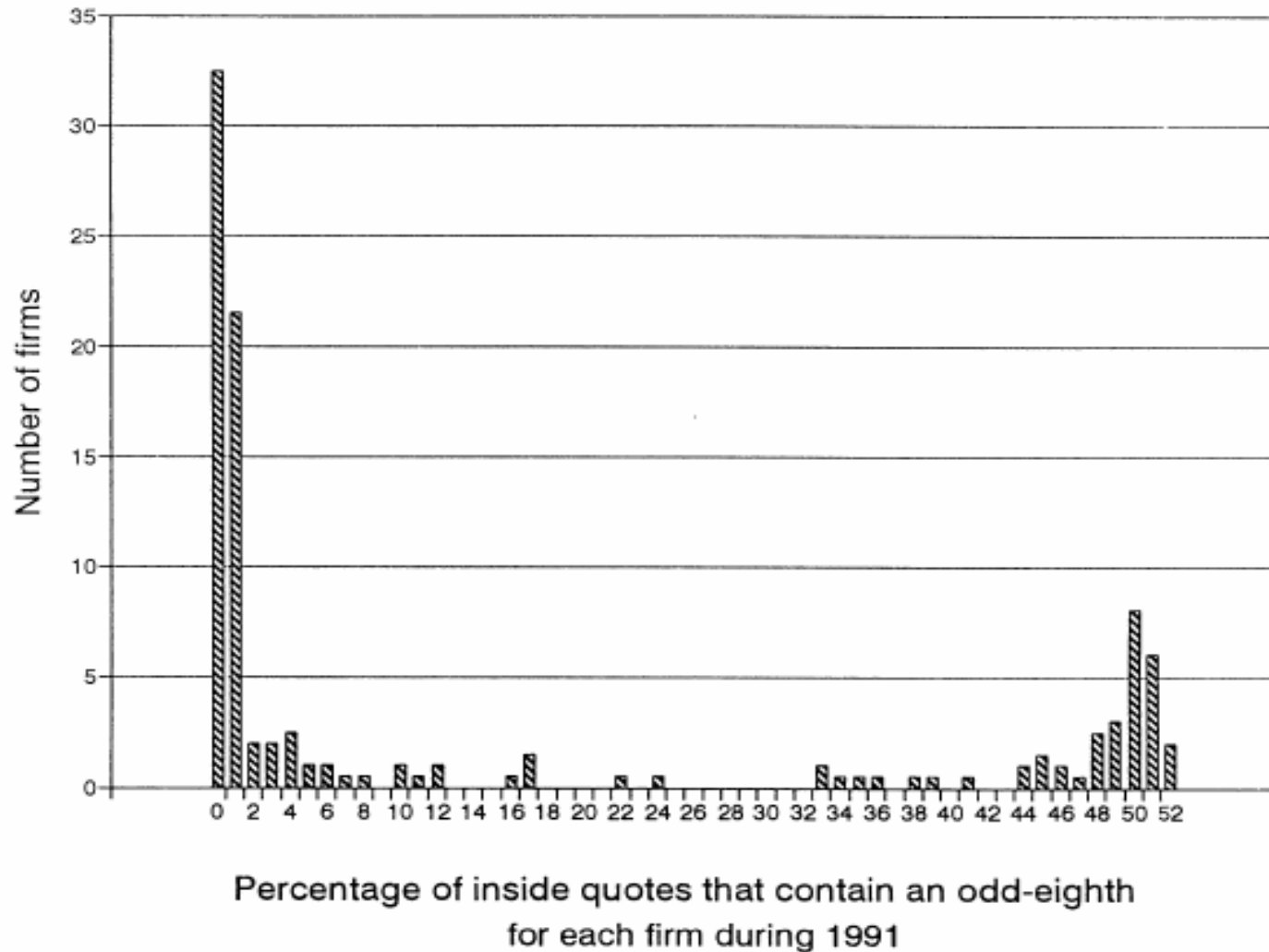
Παρατηρήσεις για την μορφή των τιμών

# Οι τιμές σπάνια είναι μονά όγδοα



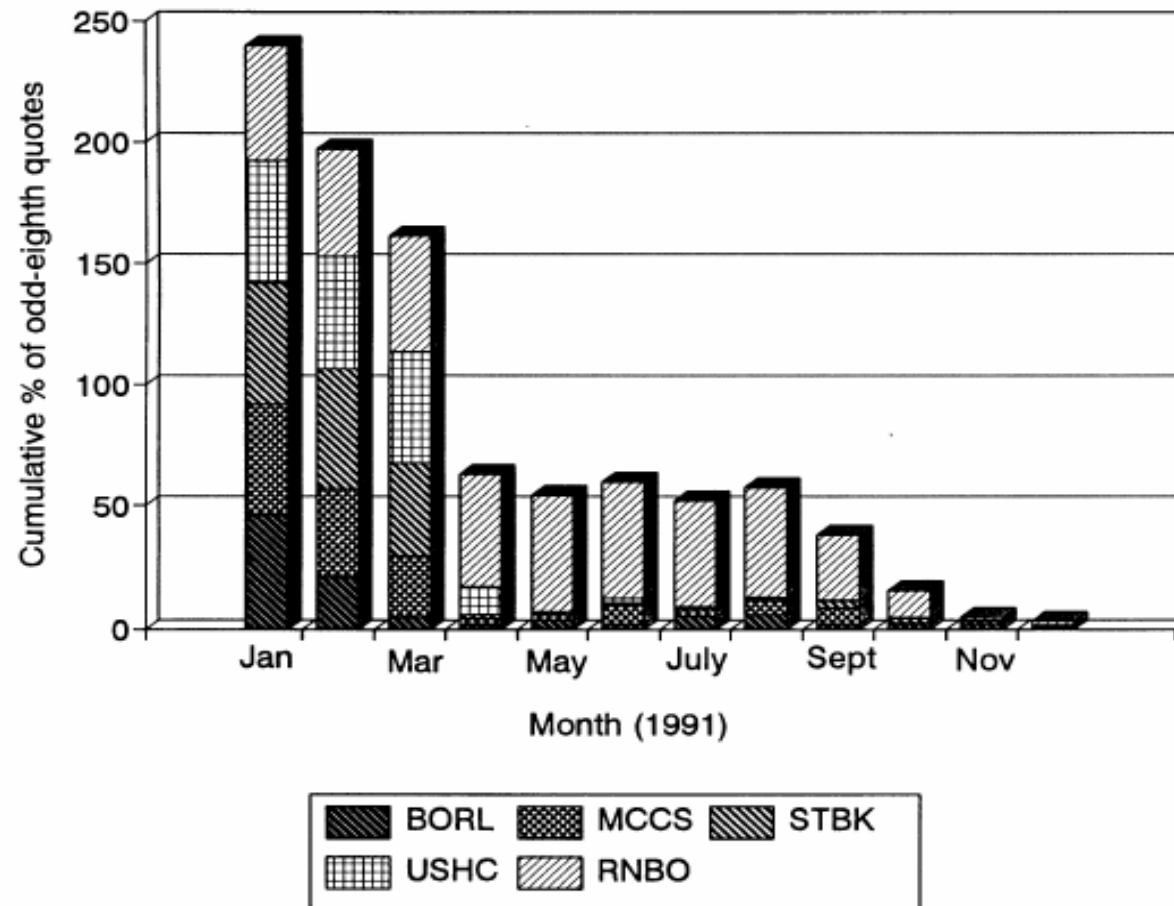
**Figure 3.** The distribution of price fractions across all inside quotes for 100 NASDAQ and 100 NYSE/AMEX securities of similar price and end-of-year market capitalization. The figure contrasts the percentage of price fractions that fall on each eighth for firms listed on the NYSE/AMEX versus firms listed on NASDAQ. The percentage is an average of the frequencies at the bid and ask, computed using all inside quotes for all stocks throughout 1991. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day.

# Ελάχιστες μετοχές έχουν τιμές σε μονά όγδοα



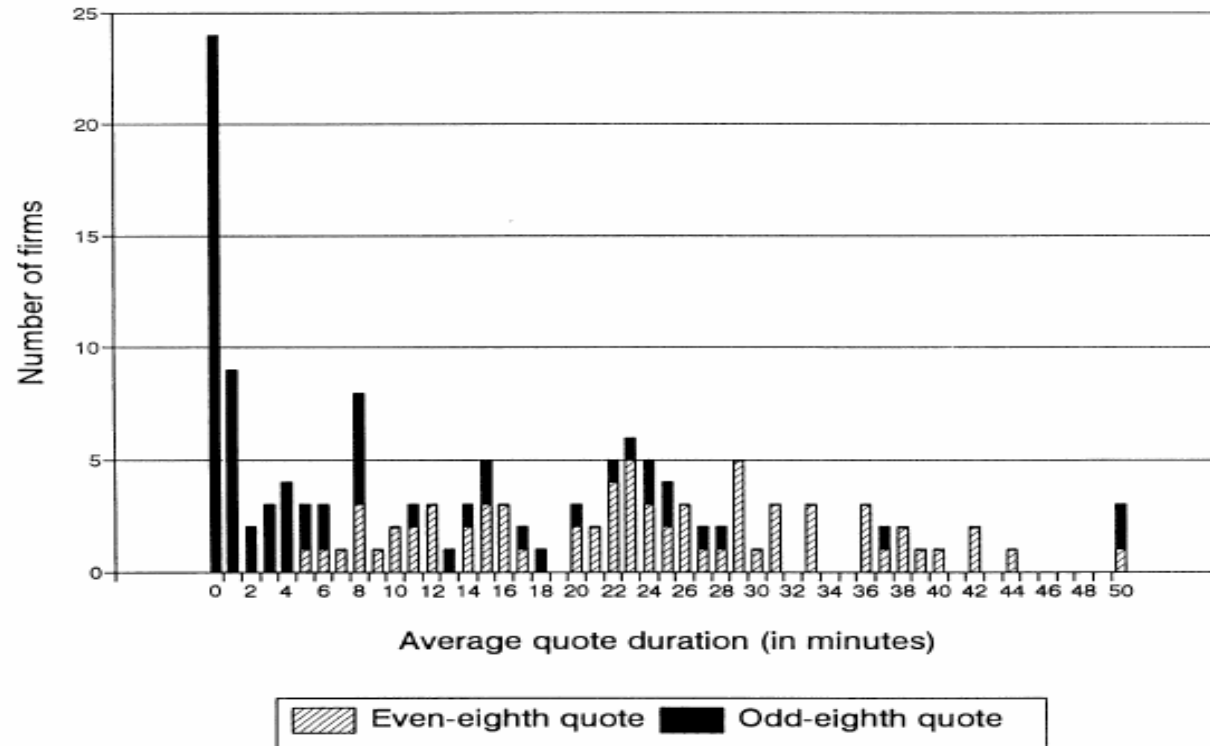
**Figure 4. The frequency of odd-eighth quotes across the sample of 100 NASDAQ securities.** The frequency of odd-eighth quotes is computed as an average of the frequencies at the bid and the ask, using all inside quotes throughout 1991. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. The horizontal axis represents the percentage of all quotes that result in an odd-eighth quote. The height of the bar represents the number of firms with the specific percentage of odd-eighth quotes in 1991.

# Οι ΕΔ μειώνουν σταδιακά την χρήση μονών όγδων



**Figure 5. The monthly frequency of odd-eighth quotes for 5 NASDAQ firms whose market makers ceased using odd eighths in 1991.** The percentage of odd-eighth quotes represents an average of the frequency of odd-eighth quotes at the inside bid and inside ask. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. The firms used in the figure are: Borland International Inc. (BORL), Medco Containment Services (MCCS), United States Healthcare Inc. (USHC), State Street Boston Corp. (STBK), and Rainbow Technologies Inc. (RNBO). The vertical axis represents the cumulative frequency of odd-eighth quotes summed across the 5 firms. Thus, the cumulative frequency of close to 250 percent in January indicates that odd-eighth quotes represented close to 50 percent of the price fractions for each of these firms at the start of the year. This cumulative frequency collapses to near zero by December 1991.

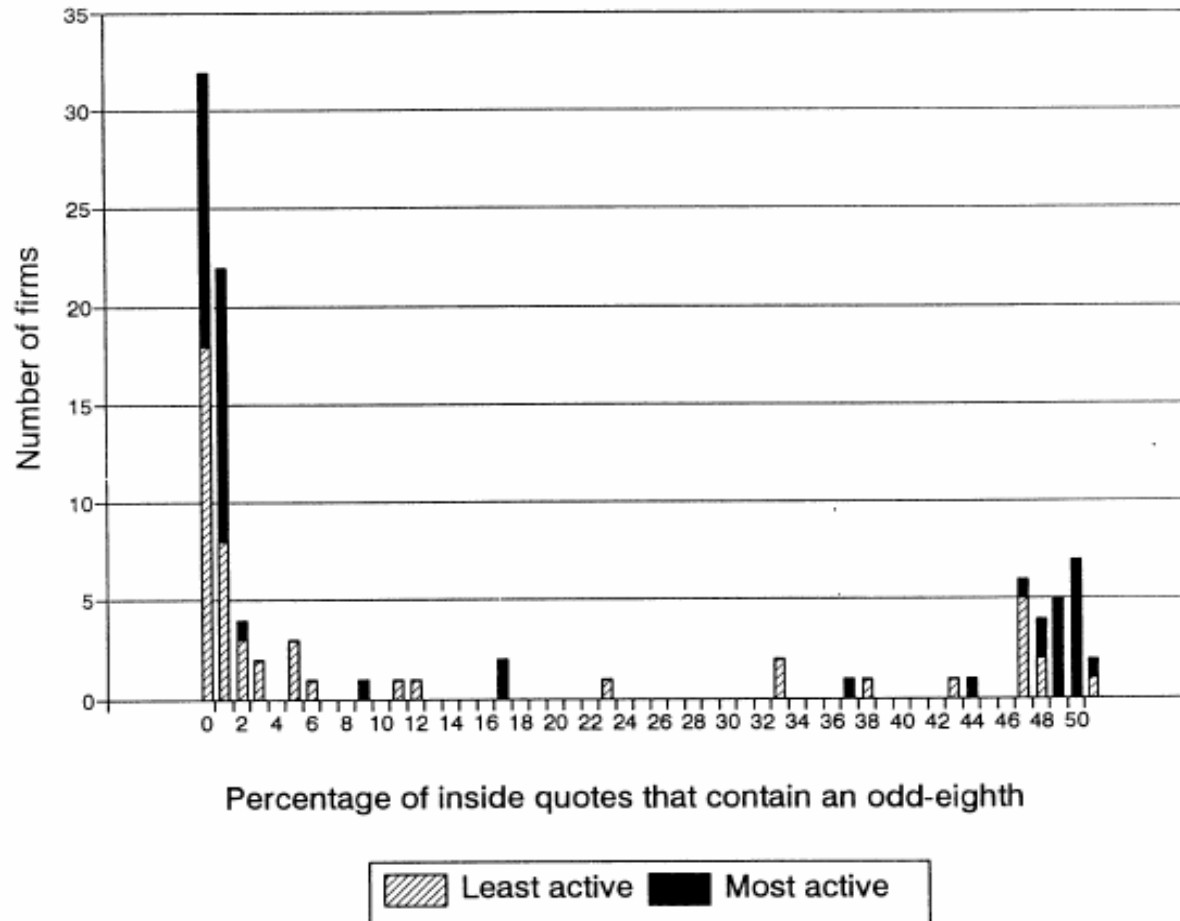
Σε όσες μετοχές μονά όγδοα είναι **σπάνια** (<25%)  
είναι και μικρής διάρκειας



(A)

**Figure 6. The distribution of the average duration of standing quotes for the sample of 100 NASDAQ stocks.** The figure presents the distribution across firms of the average time (in minutes) that inside quotes remain unchanged for odd-eighth and even-eighth quotes during 1991. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. An even-eighth quote is defined as a quote where both the inside bid and inside ask fall on an even eighth. An odd-eighth quote contains an odd eighth at the inside bid and/or inside ask. The average quote duration for even-eighth and odd-eighth quotes is computed for each stock. Panel A (B) presents the distribution of quote durations across the 70 (30) NASDAQ stocks whose market makers avoid (use) odd eighths. Market makers are designated as avoiding odd eighths if fewer than 25 percent of inside quotes include an odd eighth in 1991. The height of the bar indicates the number of firms whose even-eighth or odd-eighth quote durations correspond to the values indicated on the horizontal axis. For example, the distribution in Panel A indicates that the average quote duration for odd-eighth quotes was less than 3 minutes for 35 of the 70 firms. In comparison, the average quote duration for even-eighth quotes was never less than 3 minutes for any of these 70 stocks.

# Συχνότητα μονών όγδοων δεν σχετίζεται με την δραστηριότητα συναλλαγών



**Figure 7. The frequency of odd-eighth quotes for the 50 most active and 50 least active NASDAQ stocks in our sample.** The frequency of odd-eighth quotes is computed for each firm using all inside quotes throughout 1991. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. The horizontal axis represents the percentage of all inside quotes that result in an odd-eighth price fraction. The height of the bar represents the number of firms with the specific percentage of odd-eighth quotes. Trading activity is measured by the total number of trades in 1991.

# Πιθανές εξηγήσεις έλλειψης τιμών $(2n+1)/8$

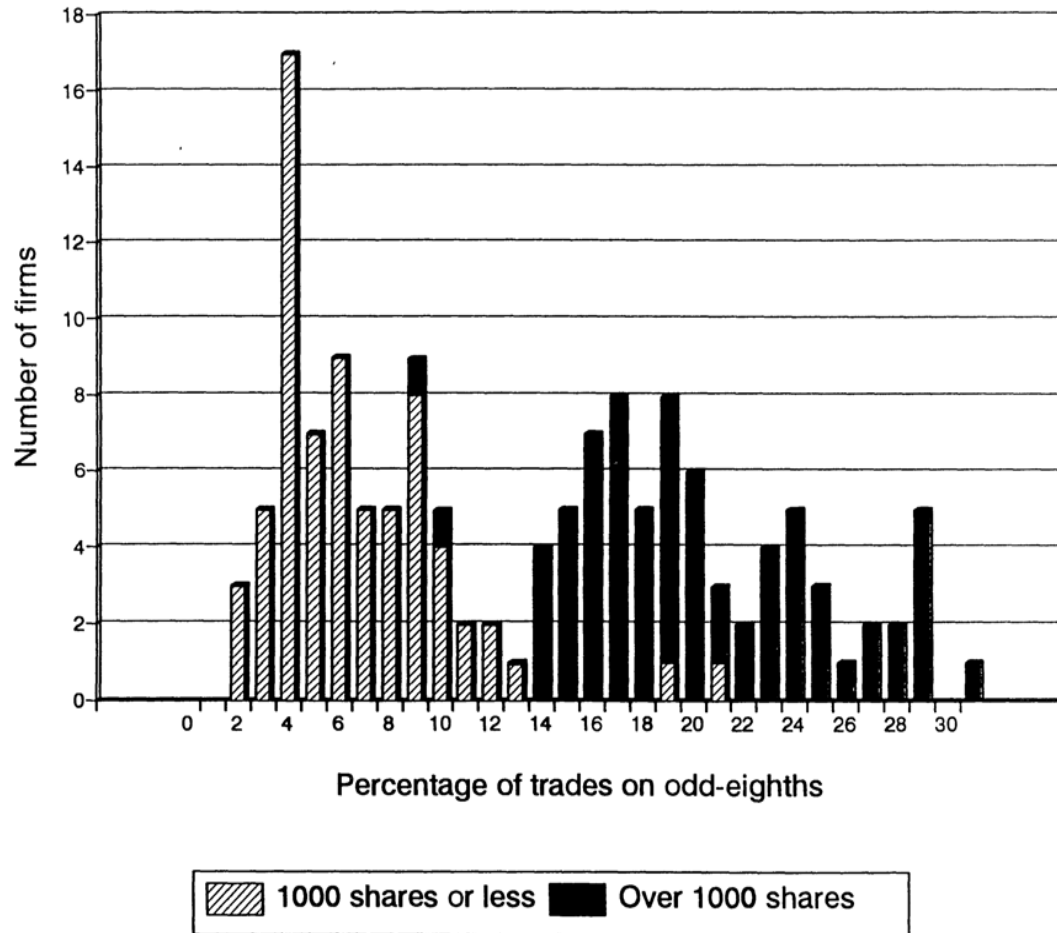
- Χρήση λιγότερων τιμών για μείωση κόστους διαπραγμάτευσης (Harris, 1991)
- Κόστος Ειδικής Διαπραγμάτευσης
- Συμπαιγνία

# Κόστος Διαπραγμάτευσης

- Κόστος = Χρόνος, πιθανότητα λάθους
- Ανταγωνισμός οδηγεί σε χαμηλό κόστος => λιγότερες τιμές
- Όμως
  - Οι τιμές διαπραγματεύονται μόνο για μεγάλες συναλλαγές (>1,000 μετοχές)
  - ... Οπότε διαδικασία ελέγχου είναι προφανής



# Μεγάλες συναλλαγές γίνονται σε μονά **πιο συχνά**



(A)

**Figure 8. The distribution of the percentage of large and small trades executed on odd eighths across the sample of 100 NASDAQ stocks.** We include all trades that are executed between 9:30 A.M. and 4:00 P.M. for the NASDAQ sample throughout 1991. Small trades are defined as 1,000 shares or fewer, whereas large trades exceed this threshold. The horizontal axis represents the percentage of all trades that were executed on an odd eighth, while the height of the bar represents the number of firms sharing the specific percentage of odd-eighth trades. Panel A (B) presents the evidence for the 70 (30) NASDAQ stocks whose market makers avoid (use) odd eighths. Market makers are designated as avoiding odd eighths if fewer than 25 percent of inside quotes include an odd eighth in 1991.

# Κόστος ΕΔ

- Συχνότητα μονών όγδοων **δεν επηρεάζεται από:**
  - όγκο συναλλαγών,
  - μετοχική αξία
  - αριθμό ΕΔ
- Επηρεάζεται από:
  - Τιμές
  - Διακύμανση
  - Συχνότητα χρήσης παλιότερα στην ίδια αγορά

**Table III**  
**Results of Logistic Regressions that Predict the Probability that Stocks are Quoted Using**  
**Odd Eighths**

We classify stocks as being quoted in odd eighths if the average monthly proportion of quotes on odd eighths is at least 25 percent. The dependent variable takes a value of 1 for stocks that are quoted in odd eighths. The independent variables used in the logistic regression are as follows. Volume is in 100,000s of shares, daily. Size is measured as the equity capitalization in multiples of \$1 million. Variance is measured using daily returns calculated from the midpoint of the closing bid-ask spread. Price is defined as the average of the bid-ask midpoint measured over all quotes. Number of Dealers during 1991 is computed by weighting the number of market makers by the proportion of days that number appeared in 1991. Volume, Size, Variance, Price, and the number of market makers are obtained from the Center for Research in Securities Prices NASDAQ tape. Listed Options is a dummy variable that takes the value of 1 for firms with listed options during 1991. Dual listed is a dummy variable that equals 1 for firms whose shares were traded on the regional exchanges. Past is a dummy variable that takes the value of 1 if the firm had been quoted using odd eighths in January. The regression estimates are presented in Panel A. The logistic regressions estimate a probability that a stock will be quoted in odd eighths. We define stocks as being correctly classified by the model in Panel B if the stock is (is not) quoted in odd eighths and the model assigns a probability of at least 0.5 (less than 0.5) that the stock is quoted in odd eighths. na means not applicable.

Panel A: Coefficient Estimates

Regression	Sample Period (1991)	Regression Coefficient and Standard Errors (in parentheses)							
		<i>Price</i>	<i>Size</i> (\$ millions)	<i>Volume</i> (100,000s)	<i>Variance</i>	<i>Number of Dealers</i>	<i>Listed Options</i>	<i>Dual Listed</i>	<i>Past</i>
1	Full year	-0.157** (0.042)	-0.00010 (0.00046)	-0.00017 (0.00159)	-8.573** (3.370)	0.127 (0.073)	1.326 (1.040)	-0.588 (1.048)	na
2	July-December	-0.173** (0.044)	-0.00012 (0.00042)	-0.00016 (0.00165)	-9.014* (3.524)	0.117 (0.069)	1.418 (1.055)	-0.462 (1.104)	na
3	July-December	-0.252* (0.111)	0.000943 (0.000864)	-0.00109 (0.00262)	-9.373 (5.811)	-0.014 (0.164)	2.608 (2.171)	0.369 (2.377)	13.138** (3.686)

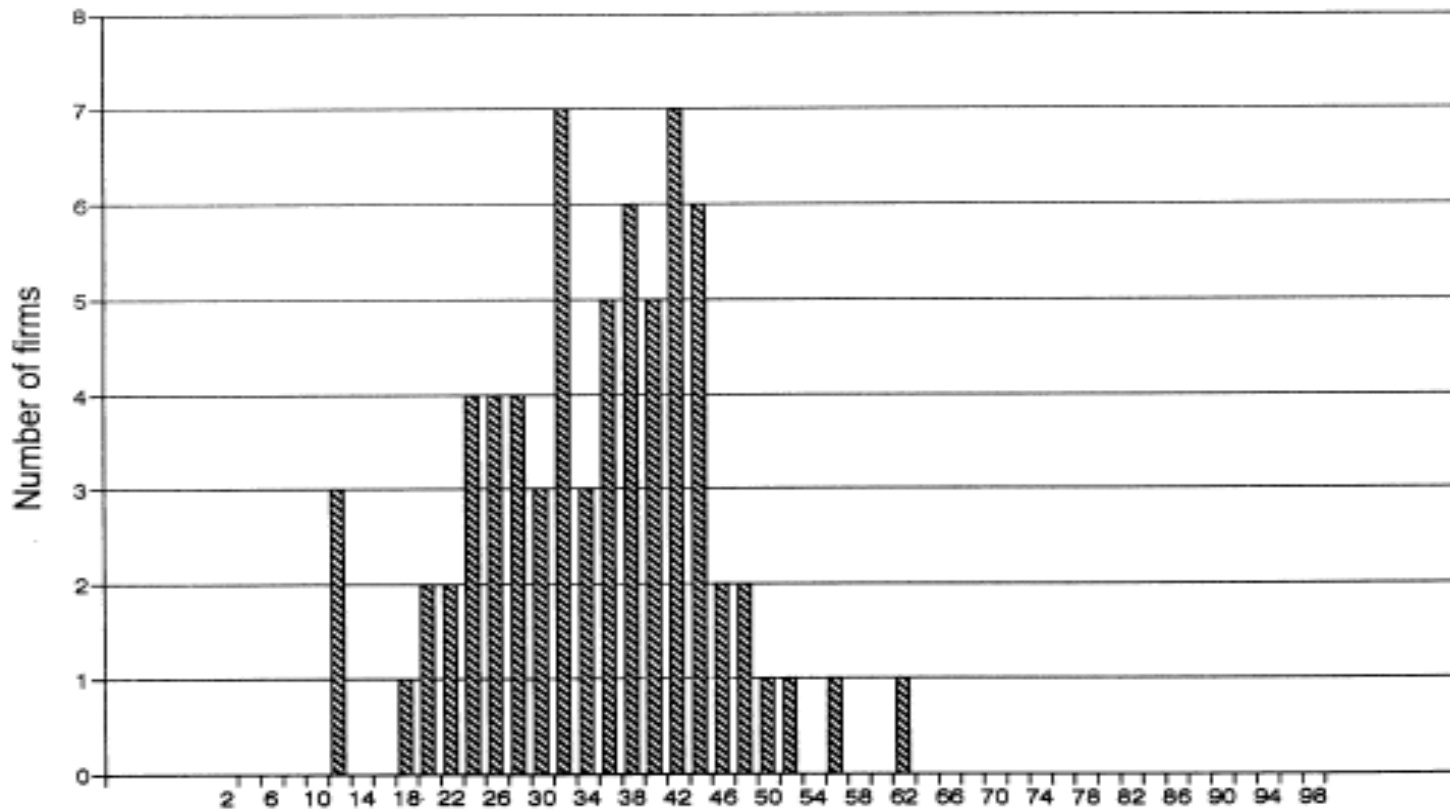
Panel B: Classification Accuracy

Regression	Sample Period (1991)	Stocks Not Quoted in Odd Eighths		Stocks Quoted in Odd Eighths	
		Correctly Classified	Incorrectly Classified	Correctly Classified	Incorrectly Classified
1	Full year	65	6	15	14
2	July-December 1991	64	7	15	14
3	July-December 1991	64	7	24	5

\* Significantly different from 0 at the 5 percent level.

\*\* Significantly different from 0 at the 1 percent level.

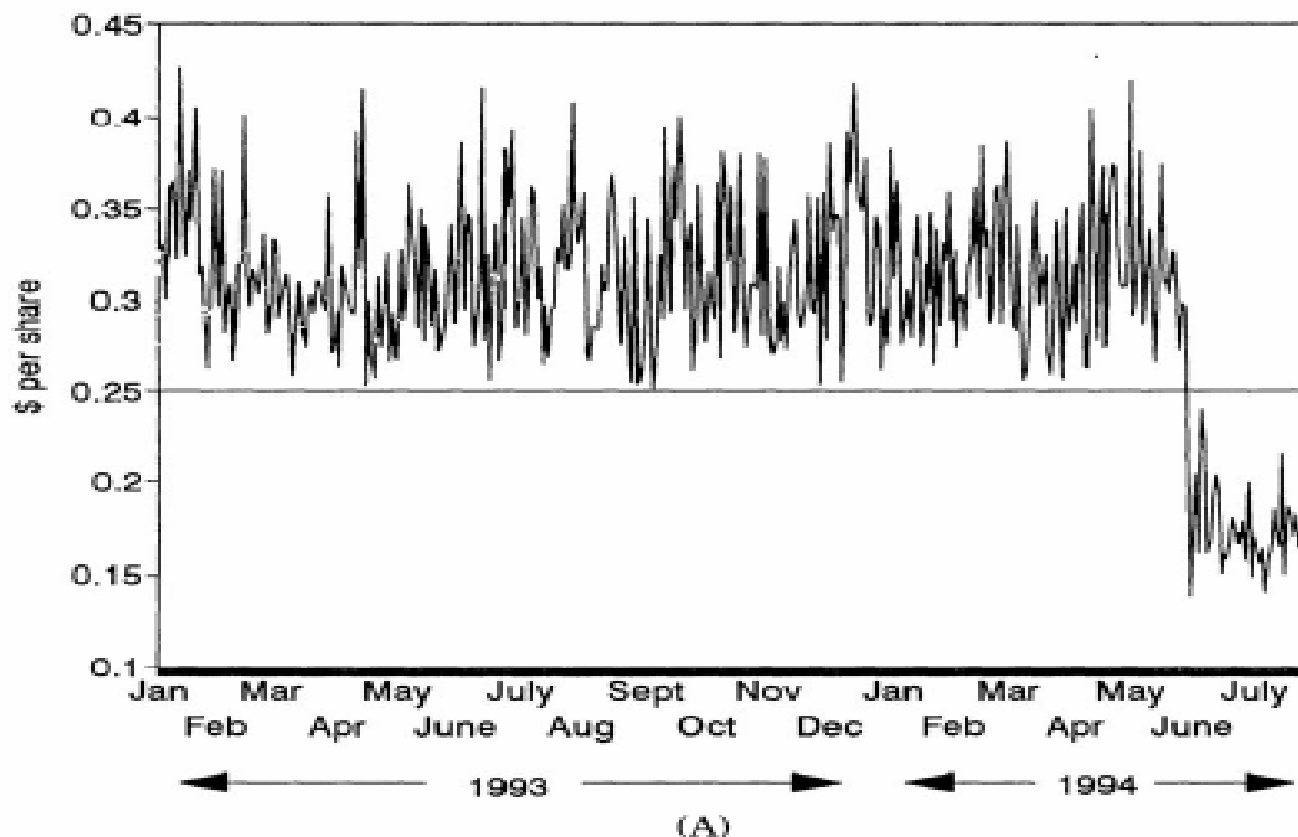
# Συμπαιγνία



Percentage of odd-eighth spreads that are narrower than the previous inside spread

**Figure 9.** The distribution of the percentage of odd-eighth spreads that are narrower than the previous spread across the sample of 70 NASDAQ stocks whose market makers avoid odd-eighth quotes. Market makers are designated as avoiding odd eighths if fewer than 25 percent of inside quotes include an odd eighth. The figure depicts the percentage of odd-eighth spreads of at least \$0.375 that are narrower than the previous spread. The frequency of odd-eighth spreads is computed for each firm using all inside quotes throughout 1991. We exclude quotes where the inside bid and inside ask are unchanged from the previous inside quote within the same trading day. The horizontal axis represents the percentage of all quotes that result in an odd-eighth spread of at least \$0.375. The height of the bar represents the number of firms with the specific percentage of odd-eighth spreads.

# Πρόσφατες εξελίξεις στην NASDAQ



**Figure 1. The time series of daily average inside spreads.** For each stock, we obtain all the inside spreads during regular trading hours between January 1, 1993 and July 29, 1994, excluding July 15, 1994 when NASDAQ experienced difficulties installing new operating software that resulted in numerous locked and crossed quotes. The daily average inside spread is calculated by multiplying each inside spread by the proportion of the trading day that the spread is in effect. Panel A: Amgen, Inc.; Panel B: Apple Computer, Inc.; Panel C: Cisco Systems, Inc.; Panel D: Intel Corporation; and Panel E: Microsoft Corporation.

- Αποζημιώσεις \$1δισ (1999)
- Έλεγχος και ρύθμιση αγοράς από ξεχωριστή εταιρεία (NASD-R)
- Απαγόρευση front-running (Manning rules)
- Απαγόρευση through trading (SEC rules)
- Δεκαδικοποίηση τιμών (decimalisation)
- Έντονος ανταγωνισμός ιδιαίτερα από Ηλεκτρονικά Δίκτυα Επικοινωνίας (ECNs)

# Βιβλιογραφία μαθήματος

- Christie and Schultz, 1994
- Hasbrouck, Appendix
- Περαιτέρω αρθρογραφία:
  - Christie and Schultz, 1995
  - Woodward, 1996