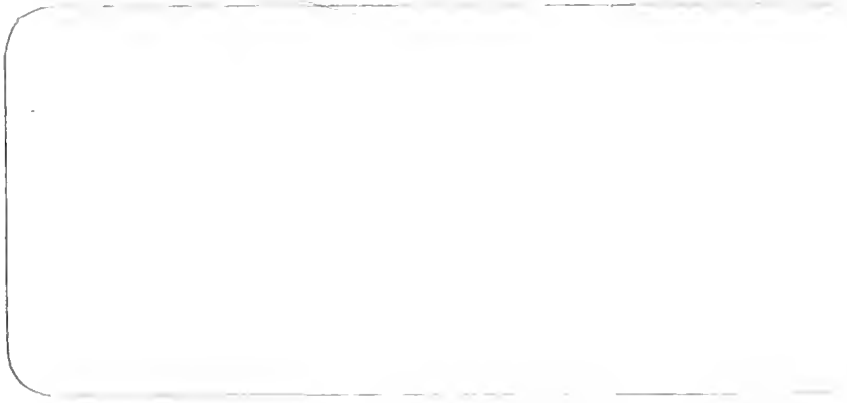# Faculty Working Papers

STOCK MARKET SEGMENTS REVISITED:
NEW AND UPDATED EVIDENCE

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#404

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This paper updates several prior studies that examined the differential short-run and long-run price changes for the New York Stock Exchange, the American Stock Exchange, and the Over-the-Counter Market. Besides updating the analysis through 1976 there is consideration of several new stock market series that are more comparable and comprehensive.

STOCK MARKET EFFICIENCY REVISITED:

NEW AND UPDATED EVIDENCE

This paper updates several earlier studies that examined the ... short-run and long-run price ... for ... the American ... Market, Review ... now ... NYSE ...

STOCK MARKET SEGMENTS REVISITED:
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INTRODUCTION

Several years ago several studies examined stock price indicator

series for the three major segments of the secondary equity market--the

New York Stock Exchange (NYSE), the American Stock Exchange (ASE), and

the Over-the-Counter Market (OTC). An analysis of the short-run relationships

examined daily and weekly percent price changes for the period 1960-68.[1]

A subsequent study considered longer-run price changes during calendar

years and over market cycles.[2] Both studies indicated that there were

significant differences in the price changes for the alternative market

segments. Since the original studies several major changes have occurred

that deserve consideration and justify an updated analysis of the data.

The first change is that in February, 1971 the National Association of

Securities Dealers (NASD) developed a new stock price indicator series

for the OTC market using all the securities listed on the NASD quotation

system (NASDAQ). These new series differ substantially from the prior

OTC series published by the National Quotation Bureau (NQB). The NQB

[1]Frank K. Reilly, "Evidence Regarding a Segmented Stock Market,"
Journal of Finance, Vol. 27, No. 3 (June, 1972), pp. 607-625.

[2]Frank K. Reilly, "Price Changes in NYSE, AMEX and OTC Stocks Compared,"
Financial Analysts Journal, Vol. 27, No. 2 (March-April, 1971).

series was a price weighted series (similar to the DJIA) and included
35 OTC blue-chip industrial firms. The new NASDAQ series are value-weighted
indexes computed similarly to the S & P series and the NYSE series. In
addition, the NASDAQ series include all the stocks quoted on the NASDAQ
system. The sample size has ranged from about 2,300 to over 3,000 stocks.
Therefore, one of the changes is the introduction of a much more comprehensive
series for the OTC that is computed in a manner similar to most other market
series.[3]

A second change has been the introduction of a new market indicator
series for the ASE. The original ASE Price Change Index began in 1966
with figures presented back to October 1, 1962.[4] The beginning value for
the index was the average price of all securities on the ASE. Subsequent
changes in the index were based upon the average absolute change for all
securities on the Exchange. Each day the Exchange added all changes (positive
and negative) and divided the sum by the total number of issues listed.
The resulting figure (the average change) was then added to or subtracted
from the previous day's figure to derive the new Index value.

A problem arose with the old series because, over time, the actual
average price of stocks on the Exchange declined due to stock splits, mergers,
and the loss of higher priced stocks to the New York Stock Exchange (NYSE).
As a result, the actual average price of stocks on the ASE became much
lower than the Price Change Index value. Unfortunately, there was no way

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[3]A detailed discussion and analysis of the NASDAQ series is included
in Frank K. Reilly, "A Report on the NASDAQ Over-the-Counter Stock Price
Indicators," University of Wyoming, Research Paper No. 1 (August, 1973).

[4]For a detailed discussion and description of the series, see B. Alva
Schoomer, Jr., "American Stock Exchange Index System," Financial Analysts
Journal, Vol. 23, No. 3 (May-June, 1967), pp. 57-61.

to adjust the daily absolute changes for this decline in actual price.
Consequently, the average absolute price changes, which were naturally
influenced by the average level of prices, were less than they would be
otherwise. When these small absolute price changes (either up or down)
were related to the prevailing large index values, the percent price changes
seriously understated the actual results and a less volatile series resulted.[5]
In fact, the ASE Price Change series went from the most volatile series
before 1968, to the least volatile series by 1972.

Because of the obvious shortcomings of the original price indicator
series, the ASE commissioned the development of a new series similar in
construction to the bulk of existing price indicator series--a market value
index series. The new American Exchange Market Value Index was introduced
on September 1, 1973 with an index value of 100 as of August 31, 1973.
Subsequently, the series was computed back to January 1, 1969. As shown
in a paper by Reilly, there was a substantial difference in price changes
over time for the two series and the differences increased over time even
though the samples were the same--all stocks and warrants listed on the
Exchange.[6]

Therefore, because of these two significant changes in the price
indicator series for two of the market segments it seems that it would

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[5]An extensive discussion of the construction of the ASE Index and
its inherent bias was contained in Stephen C. Leuthold and C. Edward Gordon II,
"Margin for Error," Barrons, March 1, 1971, pp. 1, 13, 15. This analysis
was extended and updated in, Stephen C. Leuthold and Keith F. Blaich,
"Warped Yardstick," Barrons, September 18, 1972, pp. 9, 16, 18, and 30.

[6]Frank K. Reilly, "The Original and New American Stock Exchange Price
Indicator Series," University of Wyoming Research Paper No. 68, (March,
1975).

be useful to re-examine the relationship between the market segments.
The changes in the series should definitely enhance a comparison of price
changes because the various series are more comprehensive, but also because
the method of computation is the same for most of the series.[7] Therefore,
any significant differences in the relationships can only be attributed
to the differences in the sample companies.

ANALYSIS OF SHORT-RUN PRICE CHANGES

This section contains a discussion of the differential price movements
for the alternative series in the short-run (daily). The emphasis is on
the differential results for alternative segments of the total equity
market, i.e., the NYSE, ASE, and the OTC market.

Daily Percent Changes

Table 1 contains a matrix of the correlation coefficients between
the daily percent price changes for alternative market inidcator series
during the period January 4, 1972 through December 31, 1976 (1,261 observations).
This recent five-year period was selected because data were available
for all the major series including the new ASE Market Value Series and
the two NASDAQ series initiated in February, 1971.

The results are notable because almost all the differences in the
correlations of daily percent price changes are apparently attributable
to the differences in the sample of stocks, i.e., differences in the types
of firms listed on the alternative segments. Specifically, as noted previously,
all the series with the exception of the DJIA are now total market value
indexes that include a large number of stocks. Therefore, the computational

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[7]Currently, the only one of the seven series to be considered that
is not a value-weighted series is the Dow-Jones Industrial Average.

procedure is the same, the sample sizes are all quite large (from 425 to 2,400), and the samples represent either a large segment of the total population in terms of value or actually all members of the population. Thus the only notable difference between several of the series is the members of the population, i.e., the stocks are from different segments of the aggregate stock market (the NYSE, the ASE, or the OTC).

The results reported in Table 1 are quite comparable to those discussed in prior paper by Reilly that examined daily stock price changes during the period 1960-1968.[8] Specifically, in both instances the results indicated that there is very high positive correlation between the alternative series that include only NYSE stocks, i.e., the DJIA, S & P 425; S & P 500; and the NYSE composite. Notably, although there has been criticism of the DJIA because of its sample size and weighting, its correlation with the other major NYSE series ranges from about .91 to .94. This would indicate that on a short-run basis the DJIA is a very adequate indicator of price movements on the NYSE.

In contrast to the very high correlations among alternative NYSE series, there is a significantly lower correlation between each of these NYSE series and the ASE series, i.e., from an average of about .93 among NYSE series to about .74 between the ASE series and the various NYSE series.[9] It is just such a set of results that leads one to think in terms of a segmented market between the two Exchanges where segmentation is concerned with significant differences in the relationship among price movements.

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[8] Reilly, "Evidence Regarding . . .," Op. Cit.

[9] For the test of significant differences in correlation coefficients see, Ya-lun Chou, Statistical Analysis 2nd Ed., (New York: Holt, Rinehart and Winston, 1975), pp. 602-606.

The correlation results with the NASDAQ Industrial Index indicate a further difference in price movements. In this case the average correlation with the NYSE series is about .66, which is again significantly lower than the correlation among alternative NYSE series. In addition, the relationship between the NASDAQ and the ASE series is actually lower than the NASDAQ relationship with any of the NYSE series. This can probably be explained by the inclusion of some very large firms on the NASDAQ system such as Anheuser Busch, American Express, Coors Co., Tampax Co., and Roadway Express. Several of these companies and some financial firms that will be discussed are larger than the largest firms on the ASE. Therefore, in some respects this OTC index is more closely related to the NYSE than to the ASE.

The final row of the table is initially a surprise because it indicates a fairly strong correlation between the NASDAQ Composite Index and the alternative NYSE series. Upon further reflection this can be explained by the differential sample. The NASDAQ Composite series as of December 31, 1976 contained 1,641 industrial issues, 82 bank stocks, 135 insurance stocks, 402 other financial company stocks, 56 transportation stocks, and 79 utility stocks. The 750 non-industrial stocks obviously have a substantial impact on the Composite index because they make up a third of the sample in terms of number of issues, but have a much larger impact because of size. As noted, the NASDAQ series are value-weighted and some of the very largest OTC companies are in the non-industrial group including Christiana Securities, American International Group, Connecticut General Insurance Corp., General Reinsurance Corp., St. Paul Co., Inc., and First Bank System, Inc. These firms obviously have a large impact on the NASDAQ Composite series and also are in many cases more like NYSE companies. Notably, almost all of

these firms would qualify for listing on the NYSE but have chosen to remain
on the OTC as a matter of tradition. The impact of size and differential
movement can be seen from the correlation of .73 between the NASDAQ Industrial
and NASDAQ Composite series.

In summary, these results confirm prior results that indicate that
there is a very high correlation between daily percent price changes for
alternative NYSE price indicator series irrespective of sample size, weighting,
and computational procedure. In contrast, there is significantly lower
correlation between the various NYSE series and comparable series for the
ASE or the OTC market. Finally, there is a significant difference between
the ASE and the OTC industrial series and a higher correlation between
the OTC Composite and the NYSE series because of a different sample.
Almost all of these differences can be explained by the differences in
the sample of companies for the various indicator series.

ANALYSIS OF LONG-RUN PRICE CHANGES

Annual Price Changes

The annual percent price changes for the alternative price indicator
series are contained in Table 2. The comparison between market segments
cannot be made for all the years 1960 through 1975 because the ASE series
is not available before 1969 while the two OTC series were not available
prior to February, 1971.

The results for the four NYSE series can be analyzed for the full
seventeen-year period. A priori, one would expect the DJIA series to
generally be less volatile and also to have lower average returns in line
with the lower volatility. The average annual returns were generally consistent
with the expectation. The average of the DJIA annual returns was lower

than the S & P 400 and the NYSE Composite series, and the average annual compound rate of change for the DJIA was definitely lower than the other three series. In contrast, all the standard deviations were similar.

For the seven-year period 1969-1976 it is possible to compare the results for the alternative NYSE series to the ASE series. In this comparison one would expect a higher return and higher risk for the ASE series because of the nature of the stocks on this Exchange, i.e., smaller, more volatile companies. The total period results confirmed these expectations since the risk was higher as indicated by a larger standard deviation of annual changes. Regarding the average of the annual price changes, they likewise indicated higher risk since the ASE average was a small negative price change compared to a small positive change for the four NYSE series. Clearly, the very poor results for the ASE during the bear markets in 1969, 70, 73, and 74 overpowered some large gains in other years.

The results for the four-year period 1972-1975 included all three market segments. The results were quite consistent with expectations. Specifically, one would expect the ASE to be higher risk than the NYSE and the OTC to be somewhat riskier than the ASE because there are some rather small firms included on NASDAQ. The standard deviation of annual changes for the five-year period generally confirmed the risk expectations. The four NYSE series all had lower standard deviations than either the ASE or the OTC market. Further, the ASE series was less volatile than the NASDAQ Industrial series which is consistent with expectations. Alternatively, the ASE was slightly more volatile than the NASDAQ Composite series, which can be explained by the additional companies in the NASDAQ series as discussed previously. The rates of return were consistent with this risk ranking because the average for the NYSE series were very low positive values

(0.50 to 2.44 percent), while the compound rates of change returns for the ASE was a small negative value and the OTC return was a larger negative value. Also, the individual annual results were as expected except during 1972. During 1973 and 1974 the ASE and the OTC had larger negative price changes and during 1975 and 1976 these segments had larger positive price changes. Notably during 1976 the OTC returns were below the ASE.

In summary, the annual price changes were generally consistent with expectations and with prior results on the basis of price changes and price change volatility.[10] Based upon the sample one would expect the DJIA to have both low risk and return, and for returns and risk to increase for the ASE and then the OTC industrial series. When all comparisons were possible this pattern emerged with the ASE and OTC being more volatile and having larger negative returns during falling markets and larger positive returns during rising markets.

Market Period Results

Table 3 contains price changes for the alternative series during major market swings since October, 1962. The market swings are determined by major peaks and troughs in the DJIA. The use of other series for the dating would have little or no effect.

As before, one would expect the low risk series to be less volatile on the upswing and decline. Prior to 1970 only the NYSE series were available and the results for the alternative NYSE series were generally equal during market swings with small changes in rankings. During the two market swings

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[10]Reilly, "Price Changes . . .," Op. Cit.

in 1970 and 1971 that included the ASE series, the results for the ASE were consistent with expectations, i.e., the ASE series increased more than the NYSE series during the market rally and declined more during the falling market. During the bull market from November, 1971 to January, 1973, all segments increased but the ASE fell behind--possibly due to the tiered trading market that became rather prominent during this period. During the 1973-1974 decline the results were again consistent with the ASE and OTC experiencing larger declines. Finally, during the 1975-76 rally the increases were as hypothesized except that the DJIA did better than one might expect.

In summary, the price changes for the alternative market series during major market swings from peaks to troughs and back to peak were consistent with expectations based on the risk posture of the series. The NYSE series typically had smaller increases and declines than the ASE or OTC.

SUMMARY AND CONCLUSION

Summary

The subject of alternative segments of the stock market was examined rather extensively for the period 1960-1970. The results generally indicated that there were unique segments based upon differences in short-run price changes, long-run price changes, and price variability. Since these original studies two significant changes have taken place. First, a new comprehensive series for the OTC market has been developed that is computed similarly to most other series. The second change is a new series for the ASE that is likewise comparable to the other series in terms of the computation. The result of these changes is that it is possible to directly determine

the effect of the different samples (i.e., types of companies) because
all the series are computed the same and all include very large comprehensive
samples from the various segments. Therefore, any differences are almost
completely attributable to the different samples.

The results for short-run price changes were similar to prior results.
Specifically, the correlation between price changes for the various NYSE
series were very high--from about .91 to .94. This is even true for the
DJIA which is criticized for having a small, biased sample and a different
computational method. The correlations between the NYSE series and the
new ASE series were all significantly lower than the correlations among
the various NYSE series. The correlations with the NASDAQ Industrial series
were even lower and likewise significantly lower than the correlations
among NYSE series. These results were consistent with the results of
the prior studies using different series for the ASE and OTC. Although
the absolute value of the correlations were somewhat higher, all differences
were significantly different.

The results with the NASDAQ Composite series were initially surprising
because the correlations were consistently higher than those with the
ASE and NASDAQ Industrial. This was because the composite contains many
large banks and utilities that are similar to NYSE firms.

The annual price change results were likewise consistent with expectations.
The DJIA typically had the lowest returns of the NYSE series. Further,
the ASE and OTC series were riskier in terms of variability of returns
and during the recent period of adverse stock prices, they experienced
larger declines.

Finally, the price changes during market swings were consistent with expectations. The NYSE series typically increased and decreased less than the ASE and OTC. The ASE was less volatile than the OTC industrial series but had mixed results with the OTC composite series.

Conclusion

The updated analysis of differences between price movements for stocks in the different segments generally confirmed the prior results that there is evidence of different segments within the U.S. market based upon significant differences in short-run and long-run price movements. These results are even stronger because they are not influenced by differences in the computation of the series or major differences in sample size. Therefore, the only significant difference is the makeup of the sample which means the companies are different. As stated in an earlier study--these differences should be of importance to portfolio managers concerned with maximum diversification. It is also important to be aware of this difference when discussing a "market" portfolio of risky assets. Specifically, one should be concerned about using a "market" series that only includes common stocks from one of the market segments.

TABLE 1

CORRELATION COEFFICIENTS BETWEEN
DAILY PERCENT PRICE CHANGES FOR ALTERNATIVE
MARKET INDICATOR SERIES

January 4, 1972-December 31, 1976

(1,261 Observations)

	DJIA	S & P 425	S & P 500	NYSE Comp	ASE V.Ind.	NASDAQ Ind.	NASDAQ Comp
DJIA	--						
S & P 425	.9336	--					
S & P 500	.9141	.9375	--				
NYSE Comp.	.9214	.9414	.9201	--			
ASE Value Index	.7366	.7386	.7389	.7580	--		
NASDAQ Ind.	.6637	.6738	.6619	.6779	.6162	--	
NASDAQ Comp.	.8154	.8285	.8156	.8401	.7659	.7297	--

TABLE 2

PERCENT CHANGES IN STOCK PRICE INDICATOR SERIES
1960-1976

YEAR	DJIA	S & P 400	S & P 500	NYSE COMP.	ASE V. Ind.	NASDAQ INDUST.	NASDAQ COMP.
1960	- 9.34	- 4.67	- 2.97	- 3.89	(1)	(2)	(2)
1961	18.71	23.14	23.13	24.08	(1)	(2)	(2)
1962	-10.91	-13.00	-11.81	-11.95	(1)	(2)	(2)
1963	17.12	19.37	18.89	18.07	(1)	(2)	(2)
1964	14.57	13.96	12.97	14.35	(1)	(2)	(2)
1965	10.88	9.88	9.06	9.53	(1)	(2)	(2)
1966	-18.94	-13.60	-13.09	-12.56	(1)	(2)	(2)
1967	15.20	23.53	20.09	23.10	(1)	(2)	(2)
1968	5.24	8.47	7.66	10.39	(1)	(2)	(2)
1969	-15.19	-10.20	-11.36	-12.51	-28.98	(2)	(2)
1970	4.82	- 0.58	0.10	- 2.52	-18.00	(2)	(2)
1971	6.11	11.71	10.79	12.34	18.86	(2)	(2)
1972	14.58	16.10	15.63	14.27	10.33	13.63	17.18
1973	-16.58	-17.38	-17.37	-19.63	-30.00	-36.88	-31.06
1974	-27.57	-29.93	-29.72	-30.28	-33.22	-32.44	-35.11
1975	38.34	31.92	31.55	31.86	38.40	43.38	29.76
1976	17.86	18.42	19.15	21.50	31.58	23.68	26.10

Average of Annual Changes

1960-1976	3.82	5.13	3.16	5.07	(1)	(2)	(2)
1969-1976	2.79	2.52	2.46	1.88	- 1.38	(2)	(2)
1972-1976	5.32	3.85	3.85	3.54	3.42	2.27	1.37

Standard Deviation of Annual Changes

1960-1976	16.93	16.24	16.46	17.19	(1)	(2)	(2)
1969-1976	20.20	19.39	19.34	20.22	27.58	(2)	(2)
1972-1976	24.06	23.42	23.31	24.17	30.08	31.67	28.46

Total Percent Change

1960-1976	47.95	85.21	74.43	80.03	(1)	(2)	(2)
1969-1976	6.45	5.70	3.47	- 1.73	-34.99	(2)	(2)
1972-1976	12.80	5.98	5.26	2.57	- 6.09	-14.08	-14.23

Average Annual Compound Rate of Change

1960-1976	2.31	3.68	3.48	3.50	(1)	(2)	(2)
1969-1976	0.78	0.69	0.43	0.22	- 5.52	(2)	(2)
1972-1976	2.44	1.17	1.03	0.50	- 1.26	- 3.08	- 3.11

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*S & P 425 prior to July, 1976.

(1) Not available. Market Value Index started on August 31, 1973 with data back to January 1, 1969.

(2) Not available. Index started on February 5, 1971 with no prior data available.

TABLE 3

PRICE CHANGES ON THE NYSE, THE ASE AND OTC

DURING PERIODS OF RISING AND FALLING STOCK PRICES

OCTOBER 1, 1962–DECEMBER 31, 1976

Dates		Number of Months		Percent Change in Stock Price Indicator Series						
		Rising	Declining	DJIA	S&P400	S&P500	NYSE COMP.	ASE V. IND.	NASDAQ IND.	NASDAQ COMP.
10/1/62* –2/9/66	(P)	40.0		73.2	73.3	69.5	N/A	(1)	(2)	(2)
2/9/66 –10/7/66	(T)		8.0	-24.9	-22.4	-22.2	-22.7	(1)	(2)	(2)
10/7/66 –12/3/68	(P)	26.0		32.4	51.2	47.6	55.2	(1)	(2)	(2)
12/3/68 –5/26/70	(T)		18.0	-35.9	-35.8	-35.9	-38.3	(1)	(2)	(2)
5/26/70 –4/28/71	(P)	11.0		50.2	53.1	51.2	52.9	68.6	(2)	(2)
4/28/71 –11/23/71	(T)		7.0	-15.8	-14.1	-13.9	-13.8	-17.9	(2)	(2)
11/23/71 –4/28/71	(P)	14.0		31.8	35.4	33.4	32.0	30.6	39.6	36.4
1/11/73 –12/6/74	(T)		24.0	-45.1	-46.2	-45.9	-47.4	-54.7	-59.8	-57.5
12/6/74 –12/31/76*		25.0		73.9	65.1	65.3	68.0	85.8	82.2	68.2

*The beginning and ending dates are neither troughs or peaks but were selected on the basis of availability of data.

(1)Not available. Figures available beginning on January 1, 1969.

(2)Not available. Figures available beginning on February 1, 1971.