



Volume and autocovariance in short-horizon stock returns Evidence from 1992 to 1998 in Chile

Franco Parisi^{a,*}, Carlos Acevedo^b

^a*Department of Finance, Universidad de Chile, Santiago, Chile*

^b*Finance Department, Citibank, Santiago, Chile*

Abstract

This research investigates the relationship between volume and subsequent return patterns in individual securities' short-horizon returns. Using a variant of Lehmann's [Q. J. Econ. 105 (1990) 1.] contrarian trading strategy, we found strong evidence of a relationship between trading activity and subsequent autocovariances in weekly returns. Specifically, most of the relationship observed by Conrad et al. [J. Finance 49 (1994) 1305.] were validated in the Chilean capital market but not for highly traded winner securities. This result is explained by the presence of institutional investors and the low liquidity of the Chilean capital market. Similar to Conrad et al. [J. Finance 49 (1994) 1305.], we can conclude that the information on trading activity appears to be an important predictor of the returns of individual securities. © 2001 Elsevier Science Inc. All rights reserved.

JEL classification: G10; G14; G15

Keywords: Contrarian trading strategy; Winners; Losers

1. Introduction

This paper studies the short-horizon relationship between traded volume and stock returns, as suggested by Blume, Easley, and O'Hara (1994), Campbell, Grossman, and Wang (1993), and Conrad, Hameed, and Niden (1994), and more specifically for the Chilean market by Gregoire (1985), Parisi and Vásquez (1999), Saatcioglu and Starks

* Corresponding author. Departamento de Administracion y Finanzas, Universidad de Chile, Diagonal Paraguay 257, oficina 1102, Santiago, Chile. Tel.: +56-2-678-3366; fax: +56-2-222-0639.

E-mail address: fparisi@zeus.facea.uchile.cl (F. Parisi).

(1998), and Urrutia (1994). To do so, we employ a variation of the contrarian trading strategy proposed by Lehmann (1990), adding information contained in the lags of the traded volume.

Lo and MacKinlay (1989) found that weekly returns of stock portfolios show positive autocorrelation, whereas Conrad, Kaul and Nimalendran (1991) and Lehmann (1990) found a significant autocorrelation in the returns of individual stock, providing evidence that suggests that price trends contain important information to predict future returns. Blume et al. (1994) also investigate the informational role of volume and its application in technical analysis, showing that volume provides information that may not be inferred only on the basis of price. These authors reached the conclusion that brokers who use information contained in trading statistics obtain better results than those who do not.

In turn, Campbell et al. (1993) explore the relationship between volume¹ and returns, modeling the interaction between investors' liquidity and their degree of risk aversion. These authors study the relationship between traded volume in stock market indices and the serial correlation of returns on individual stocks, concluding that in the case of stock indices and individual stocks, the first-order autocorrelation in daily returns tends to decrease as volume increases. One conclusion of this model is that price changes coming with high trading volume tend to revert. This reversion will be lower when changes occur in days when the volume is lower, thereby suggesting, as a behavior of the stock market in the short-term, that the first-order daily autocorrelation of stock returns is lower in days with high volume as compared to days with low volume. Since this phenomenon was observed in stock indices and individual stocks, it is concluded that it is not due to nonsynchronized transactions.

In turn, Gregoire (1985) applied an efficiency test to the Chilean stock market. He concluded that the Chilean stock market features market efficiency but in its weak form. Furthermore, the random walk hypothesis, as a purely generalized statistical model, finds no support in the Chilean market, where results seem to be compatible with a submartingale model. The author's results indicate that the Chilean stock market features a substantially slower adjustment to the new information by comparison with more developed markets. The market's low liquidity and infrequent transactions are elements accounting for the phenomenon observed, but ultimately, the efficient market weak hypothesis cannot be rejected. Urrutia (1994) also investigates the random walk hypothesis in the case of four Latin American markets, rejecting the hypothesis for the Chilean case. In turn, Parisi and Vásquez (1999) put forth evidence regarding the convenience of resorting to traditional technical analysis in the case of the Chilean stock market but at the level of the stock portfolio. Also, Saatcioglu and Starks (1998) document a positive relationship between price and volume in Latin American capital markets, including Chile.

¹ The original empirical paper resorts to the number of transactions; however, the model is also estimated using volume. Though results were qualitatively and quantitatively similar, a significant difference in the autocovariances of highly and lowly traded stock occurred, yet the benefit in lowly traded stock was not significant. This suggests that through our method, the measures of volume or the number of transactions lead to similar results.

Therefore, on the basis of international evidence and the specific characteristics of the Chilean stock market, we may expect that highly traded winners² will present a negative covariance in their short-horizon returns, whereas highly traded losers will present a mean reversion in their returns, owing to the relative importance of Chilean institutional investors. These investors, represented by pension funds and life insurance companies, are regular buyers of fixed and variable income securities in Chile during the period analyzed, restructuring their portfolios periodically by taking advantage of stock liquidity in every week. In addition, a positive price trend is expected in the case of stocks with low trading levels, for both highly and lowly traded securities, due to the high volatility prevailing in the Chilean stocks as the market takes time to revert its trend in the face of scant information, based on Basch and Eudnevich (1994) and Parisi (1998).

We find evidence regarding the relationship between trading activities and patterns of returns in individual stock. Specifically, the autocovariance of returns is negative (or overreaction in the stock) when the trading level of loser stock increases, and it is positive if the trading level declines the previous week, for both winner and losers, validating our hypothesis. Our results confirm part of the evidence arrived at by Campbell et al. (1993).

This paper is divided into three parts. The first offers an explanation of the strategy used to detect a relationship between volume and returns. The second part addresses the results obtained, and finally, the third one presents our conclusions.

2. Methodology and models

In order to analyze the relationship between autocovariance in returns and trading volume, we will use a variation of the contrarian trading strategy proposed by Lehmann (1990) and Lo and MacKinlay (1989). These authors suggest weights that involve buying losers and selling winners of the previous week in the following proportions [Eq. (1)]:³

$$W_{i,t} = -(1/N)(R_{i,t-1} - R_{m,t-1}) \quad (1)$$

where

$$R_{m,t-1} = \sum_{i=1}^N R_{i,t-1}/N$$

Lo and MacKinlay (1989) show that the use of deviations from the market index as weights implies that a great portion (close to 50%) of the measure of the contrary “gains” responded to the presence of negative autocorrelation in the individual stock. Consequently, we have

² A winner is defined as that stock that shows a positive return, while a loser is stock showing a negative return during the previous week.

³ These are the weights used by Lo and MacKinlay (1989). The weights used by Lehmann (1990) are similar, but he uses a proportionality factor that determines that the investment in both winner and loser portfolios is 1. Lehmann denotes that his results do not change his proportionality factor.

removed the positive autocorrelation as a source of gains by selecting a different strategy for the weights of returns. In this strategy, the weight given to stock i at moment t is the following:

$$W_{P_{it}} = R_{i,t-1} / \sum_{i=1}^{N_p} R_{i,t-1} \quad P = W, L \quad (2)$$

where N_p is the number of stocks in the winner (W) or loser (L) portfolio (P).

A stock is considered a winner if $R_{i,t-1}$ is higher than zero and a loser if $R_{i,t-1}$ is less than zero.⁴ Since the denominator adds only positive (negative) returns for the winner (loser) stocks, it is worth noting that all weights are positive and that both the weights for the winners as well as the weights for the losers add up to a total of 1. A combined portfolio with zero investment is formed as in Eq. (2), so any benefit obtained from this strategy is the result of autocovariance in individual stock. Investment portfolios may be conformed by buying losers and selling winners, just as in the strategy developed by Lehmann (1990).

To analyze whether autocorrelation in the returns is related to the level of stock trading, some measure is needed to indicate whether trading level is high or low. With this objective, we use the following measure of abnormal transactions in stock i at moment t :

$$u_{i,t} = (T_{i,t} - T_{i,t-1}) / T_{i,t-1} \quad (3)$$

where $T_{i,t}$ is the trading volume in stock i in week t [Eq. (3)]. A positive $u_{i,t-1}$ implies a positive trading shock or means a stock with a higher trading level in week $t-1$. A negative $u_{i,t-1}$ means a stock with a lower trading level in week $t-1$. We observe some important characteristics in this measure of abnormal trading. In fact, it only uses data for amounts traded of individual stocks. However, just as in the case of a weighting based on returns, the properties of the $u_{i,t}$ time series are affected only by the properties of the $T_{i,t}$ time series and are not contaminated by the properties of the time series of an index of aggregated transactions. Using these weights, we can ascertain the existence of relationships between trading and returns in individual stock, allowing us to conclude that the volume traded provides information regarding subsequent returns. To do so, we combine the weights for transactions and returns to form four portfolios, classifying the stock in each week as:

Winners if $R_{i,t-1} > 0$ Losers if $R_{i,t-1} < 0$

High volume if $u_{i,t-1} > 0$ Low volume if $u_{i,t-1} < 0$

The weights for each one of the four portfolios are:

$$W_{i_{p,t}} = (R_{i,t-1}(1 + u_{i,t-1})) / \sum_{i=1}^{N_p} R_{i,t-1}(1 + u_{i,t-1}) \quad P = W, L \quad (4)$$

where N_p is the number of stock in each portfolio.

⁴ Using zero as a benchmark to select winners and losers is equivalent to assuming that the expected weekly returns in an individual stock are zero.

These weights are all positive and the sum of each portfolio is 1. The measure of trading used, $u_{i,t}$, also ensures that the weights based on both returns and transaction as well as the weights based only on returns (the minimum $u_{i,t}$ being -1) are always the same sign. Even when the weights for the transactions are considered, we are buying losers and selling winners.

A combined portfolio is formed by buying losers and selling winners. Higher weights are assigned to the extremes of both losers and winners. However, the weight assigned to an extreme loser or winner stock is compounded if an abnormal trading level accompanies the price movement of the stock in the previous week. Hence, if there is a relationship between price movement in week t in the individual stock and its trading level in week $t - 1$, the gains of this portfolio strategy should be different than the returns obtained based only on the returns strategy.

In order to verify our hypothesis with respect to autocorrelation in returns of individual stock related to the transaction, our methodology suggests study a sequence of trading rules. First, we examine the benefits of a portfolio strategy based only on returns using the weighted portfolio described in Eq. (2). Next, we analyze the differences in returns based on strategies of stock groupings with high and low trading levels. Finally, we form new portfolios using both returns as well as trading level to calculate the weights according to Eq. (4). There are several advantages in the methodological procedure used here. First, given that this technique measures benefits, it may provide both economic and statistical measures of the volume–return relationship. Second, the benefits of this contrarian trading strategy are directly related to autocovariances in returns, which are particularly important according to what is suggested by Campbell et al. (1993). Third, this strategy operates with autocovariances in volume and returns of individual stocks rather than portfolios. Finally, the benefits of the use of a contrarian portfolio strategy, with its predictions of price reversion followed by a price movement, may be ascertained through our methodological approach. Furthermore, this trading rule captures the notion of overreaction that suggests a high trading volume in the stock, as well as a great response in price in the Chilean case, an aspect reported by Gregoire (1985), Parisi and Vésquez (1999), and Urrutia (1994).

3. Data and results

The data consist of weekly returns and trading volume for 300 individual companies on the Santiago Stock Exchange between the years 1992 and 1997. The stocks included in the final sample for week t are those that were traded each of the 2 previous weeks and whose returns can be calculated for the last period Wednesday–Wednesday; 68 firms met this selection rule.⁵

Panel A in Table 1 shows the returns of a contrarian trading strategy, based only on past returns, according to what was pointed out in Eq. (2). It is worth mentioning that the returns reported in the winner and loser portfolios are positive investments, with which the price reversion in the winner (loser) portfolio is reported as negative (positive). The average return

⁵ Closing prices are used to determine returns.

Table 1

Contrary benefits using weights based on returns of a sample of the Santiago Stock Exchange, weekly returns 1992–1997

Portfolio	Mean (X)	Standard deviation (S)	Minimum	Maximum	t test
Panel A					
W	0.009476	0.136393	-0.752	0.487	1.23
L	0.038392	0.270799	-0.374	2.655	2.51*
C	0.010788	0.450975	-3.984	4.901	0.42
Panel B					
W-H	-0.011711	0.409614	-4.424	0.979	-0.51
W-L	0.090842	0.606092	-1.464	7.955	2.65*
L-H	0.091646	0.777553	-1.577	8.855	2.09*
L-L	0.083875	0.858286	-5.513	7.932	1.73**
C-H	-0.01077	2.480208	-32.735	22.893	-0.72
C-L	-0.032277	0.406445	-2.587	2.487	-1.40

X is the average of the sample (in percentage) of the winner and loser portfolios in week t or the average benefit of the sample (in percentage) in the combined portfolio. S is the standard deviation of the return of the portfolio (W and L) or combined (C) in percentages. The sample consists of 311 observations.⁶ Portfolios consist of winners (W), losers (L), and combined (C). Winners are defined as stock with positive returns in week $t-1$, and losers show negative returns in week $t-1$. In the winner and loser portfolios, the weights are calculated as:

$$W_{i,t} = R_{i,t-1} / \sum_{i=1}^{N_p} R_{i,t-1}$$

where N_p is the number of stocks in each portfolio in particular. The combined portfolio is long in losers and short in winners. In Panel B, two variables are used to describe the portfolios. The first variable determines if the portfolio is a winner (W), loser (L), or combined (C). The second variable denotes whether the portfolio is highly traded (H) or lowly traded (L). This categorization is effected by calculating the change in the percentage of the trading volume in the stock in week $t-1$. If this percentage is positive, the stock will be highly traded. If it is negative, it will be lowly traded. Hence, the stock will be selected in their groupings for week t .

* Significant at the level of 5%.

** Significant at the level of 10%.

of the combined portfolio (which consists on buying the losers and selling the winners, both of the previous week) shows a weekly return of 0.011%, which is not statistically significant. The winners of the previous week show a weekly return of 0.009%, which is also not statistically significant; however, the sign would indicate that the mean reversion does not occur. When we look at the losers of the previous week, we observe evidence of price reversion, because the losers of the previous week actually have a positive return of 0.038% in the following week, a result that is statistically significant. This result is as was expected; however, according to Conrad, Gultekin, and Kaul (1991) and Lehmann (1990), this economic benefit is small in comparison to the transaction costs.

⁶ 311 observations were used, because the stock had to be traded in the 2 previous weeks in order to include the observations in the sample; the sample begins the third week of January 1992, involving 311 weeks as from that date until the end of 1997.

Table 2

Contrary benefits using weights based on returns/transactions of a sample of the Santiago Stock exchange, weekly returns 1992–1977

Portfolio	Mean (\bar{X})	Standard deviation (S)	Minimum	Maximum	t test
W-H	-0.015283	0.429216	-4.424	1.098	-0.63
W-L	0.096289	0.620897	-1.412	7.955	2.74*
L-H	0.087058	0.715487	-1.836	6.469	2.15*
L-L	0.086225	0.780582	-3.657	7.713	1.95**
C-H	-0.088535	10.69585	-15.570	14.263	-1.46
C-L	0.006167	0.055271	-0.375	0.605	1.97*

\bar{X} is the average of the sample (in percentage) of the winner and loser portfolios in week t or the average benefit of the sample (in percentage) in the combined portfolio. S is the standard deviation of the return of the portfolio (W and L) in percentages. The sample consists of 311 observations. Four portfolios are formed using the percentage change of the previous week both in price ($R_{i,t-1}$) and trading volume ($u_{i,t-1}$). Stocks are categorized as (a) winners in week t if they have positive returns in week $t-1$, (b) losers if they have negative returns in week $t-1$, (c) highly traded if the percentage change in the trading volume between weeks $t-2$ and $t-1$ ($u_{i,t-1}$) is positive, and (d) lowly traded if the trading volume between weeks $t-2$ and $t-1$ ($u_{i,t-1}$) is negative.

In each one of the four portfolios, the weights are given as:

$$W_{i,t} = (R_{i,t-1}(1 + u_{i,t-1})) / \sum_{i=1}^{N_p} (R_{i,t-1}(1 + u_{i,t-1}))$$

where N_p is the number of stocks in each portfolio. Combined portfolios are formed by both highly and lowly traded stock, where losers in the previous week will go long, while the winners of the previous week will go short. Two variables are used to describe the portfolios. The first variable considered denotes whether it is a winner (W), loser (L), or combined (C). The second variable denotes whether the portfolio is highly traded (H) or lowly traded (L).

* Significant at the level of 5%.

** Significant at the level of 10%.

Our second investment strategy is based on returns that use the same type of weights as those suggested in Eq. (2) but separately for stock classified as highly and lowly traded, thereby giving rise to the use of four portfolios using weights based on returns. Panel B in Table 2 presents the benefits of the contrary strategy when the stocks are grouped according to the trading activity of the previous week. When we form an arbitrage portfolio long in highly traded losers and short in highly traded winners (portfolio C-H in Table 1), we obtain a weekly return of -0.0101% , which is not statistically significant. Likewise, when we form an arbitrage portfolio long in lowly traded losers and short in lowly traded winners (portfolio C-L in Table 1), we obtain a weekly return of -0.032% , a result that is not statistically significant. When we study lowly traded winners and losers independently, both should experience a positive autocovariance in week t , according to our expectation. The loser portfolio (L-L) gains a significant positive return 0.084% in week t , while the return of the winner portfolio (W-L) presents a weekly return⁷ of 0.091% , which indicates that the autocovariance is positive.

⁷ Both results are statistically significant at 5%.

By contrast, the combined portfolio of short in highly traded winners and long in highly traded losers (C-H) should gain a positive return, but the results indicate a weekly return of -0.101% , which is also not significant in statistical terms. The benefits should come, just as the theory states, from the highly traded losers (L-H) that gain a statistically significant return of 0.092% in week t . Highly traded winners (W-H) are associated with neither a positive nor negative autocovariance, as their result is not statistically significant, yielding a weekly return of -0.012% . When these returns are contrasted with those of lowly traded stock, the evidence clearly shows that the price reversion tends to occur more in stocks that have simultaneously experienced a great change in price and an abnormally high trading level.⁸ Panel B in Table 1 offers strong evidence of a difference in the sign of the returns for highly and lowly traded stock due to autocovariance. Thus, we conclude that there is a significant relationship between the autocovariance in returns and trading activity of the previous week. Specifically, with the contrarian trading strategy, the use of information may lead to significant differences in the benefits, which supports the conclusions put forth by Campbell et al. (1993).

Finally, for lowly and highly traded stock, we form portfolios using the weights analyzed in Eq. (4). This strategy assigns greater weight to the stocks that experience great price movements and an abnormally high trading level. The benefits derived from a portfolio built with this methodology stem from two sources: autocovariance in returns and a significant relationship between trading level and autocovariance in returns. To study this, it is useful to resort to the method used by Lehmann (1990) and Lo and MacKinlay (1989) that decomposes the benefits of the combined portfolio of week t . Total returns of the combined portfolio ([Eq. 5]; long in losers and short in winners) in week t are:

$$R_t = \sum_{i=1}^N W_{i,t} R_{i,t} \quad (5)$$

$$R_t = \sum_{i=1}^N (-(1 + u_{i,t-1}) R_{i,t-1}) R_{i,t} \quad (6)$$

$$R_t = - \sum_{i=1}^N R_{i,t-1} R_{i,t} - \sum u_{i,t-1} R_{i,t-1} R_{i,t} \quad (7)$$

The negative sign in Eq. (6) points to the fact that losers are being bought and winners sold. Using standard contrarian trading strategy, positive returns are obtained if the

⁸ Besides, we averaged the $u_{i,t}$ across weeks for each individual stock and then formed a great average of those individual stocks (in this manner, we are creating the “representative” stock). Given that each stock is weighted on an equivalent basis regardless of how many weeks it has appeared in the sample, this second average is more weighted to the smaller stocks, lowly traded stock in our sample. The mean of the distribution of this great abnormal measure of average volume is slightly higher, and the distribution features greater skewness as compared to the measure weighted on an equivalent basis presented previously.

autocovariance on individual stocks is negative⁹ in the first term in Eq. (7). When we include the abnormal trading level in the calculation of the weight of the portfolio, the benefits are affected if the magnitude of the autocovariance in returns of individual stock are related to the magnitude of the abnormal trading level in the stock in the previous week ($u_{i,t-1}$).

In particular, the autocovariances in highly traded stocks (positive $u_{i,t-1}$) are more negative, while the autocovariances in lowly traded stock (negative $u_{i,t-1}$) are positive or closer to zero, as Campbell et al. (1993) suggest that the returns are going to increase by including measures of trading in the construction of weights of the portfolios. Empirically, this happens because the weight terms of highly traded stocks experiencing price reversion are increased in relative terms, while there is a decrease in the weight of stocks with a low trading level, whose prices follow the prevailing trend.

Table 2 presents the returns of a portfolio strategy using the weights of Eq. (7). When the stocks have abnormally high trading levels, they are assigned with greater weights in the portfolio being studied. The return of a combined portfolio or an arbitrage portfolio of highly traded stocks goes up from -0.101% to -0.885% per week (see C-H in Panel B in Tables 1 and 2), a result that is not robust due to the lack of its statistical significance. The literature states that both lowly traded winners and losers should separately experience positive autocovariance in week t . The loser portfolio (L-L) yields a significant positive return of 0.086% in week t , which is in accordance to what is expected. In turn, the return of the winner portfolio of lowly traded (W-L) presents a statistically significant mean of 0.096% , higher than that obtained in Table 1.

Now, turning to highly traded stocks, we see that highly traded winners (W-L) have a negative return of -0.015% in week t but not statistically significant. Finally, in the case of highly traded losers (L-H), international evidence is validated, because the portfolio shows a statistically significant weekly return of 0.087% , evidencing a price reversion in this portfolio.

4. Conclusions

We have proven the existence of relationships between measures of trading and stock return in the Chilean stock market using a variation of the contrarian trading strategy suggested by Lehman (1990). Our results show that the autocovariance of highly and lowly traded stocks differ in sign and magnitudes, i.e., highly traded stocks experience price reversion or negative autocovariance in returns, in the case of losers. On the other hand, lowly traded stock experiences positive autocovariance in the returns.

Our hypothesis related to the relationship between volume and autocovariance in Chilean stock returns is validated to a great extent. The behavior observed in the case of highly traded winners is not consistent with international evidence (Conrad et al., 1994).

⁹ In this interpretation, we are assuming that the expected returns for each stock are zero.

This phenomenon is explained by the presence of institutional investors, who, though avid buyers of securities during the period studied, kept their investments within the maximum levels permitted by the regulatory authority, whereby they were not able to sell winners in a significant manner, explaining the not significant price reversion. However, in the case of highly traded losers, the institutional investors were willing to buy these securities, taking advantage of the high liquidity and reinforcing the price reversion. In turn, the lowly traded stocks do behave in accordance to our hypothesis and the international evidence. In the case of lowly traded stocks, the institutional investors do not participate in the transactions, given the low liquidity of small capital markets as the Chilean one, based on Chowdhry and Nanda (1991).

Unfortunately, the benefits attributable to contrary trading strategies are very poor and disappear when transaction costs are considered for average investors but not so for stock exchange brokers, who face lower transaction costs. However, as the number of shares traded and the industries represented in the Chilean security market increase and the predominance of institutional investors decrease, the relationship between volume and return should be more according to the international evidence in the case of highly traded winners.

Acknowledgments

We wish to thank Lance Nail, Jorge Gregoire, Antonino Parisi, Andres Toledo, Gonzalo Chavez, Laura Campbell, Ivonne Moya, Alejandra Vasquez, and participants at the seminars at the Business School of Universidad Adolfo Ibáñez and in the Department of Management and Finance, Universidad de Chile.

References

- Basch, M., & Budnevich, C. (1994). Volatilidad y eficiencia en el mercado accionario: evidencia reciente para el caso chileno. *Cuadernos de Economía*, 92, 59–85.
- Blume, L., Easley, O., & O'Hara, M. (1994). Market statistics and technical analysis: the role of volume. *Journal of Finance*, 48, 153–181.
- Campbell, J. Y., Grossman, S. J., & Wang, J. (1993). Trading volume and serial correlation in stock returns. *Quarterly Journal of Economics*, 108, 905–940.
- Chowdhry, B., & Nanda, V. (1991). Multimarket trading and market liquidity. *The Review of Financial Studies*, 4, 483–511.
- Conrad, J., Gultekin, M., & Kaul, G. (1991). *Profitability and riskiness of contrarian portfolio strategies*. Working paper. The University of Michigan.
- Conrad, J., Hameed, A., & Niden, C. (1994). Volume and autocovariances in short-horizon individual security returns. *Journal of Finance*, 49, 1305–1329.
- Conrad, J., Kaul, G., & Nimalendran, M. (1991). Components of short-horizon individual security returns. *Journal of Financial Economics*, 29, 365–384.
- Gregoire, J. (1985). El Ajuste de los precios accionarios a la información: Resultados empíricos. *Paradigmas en Administración*, 7, 121–131.
- Lehmann, B. (1990). Fads, martingales, and market efficiency. *Quarterly Journal of Economics*, 105, 1–28.

- Lo, A., & MacKinlay, C. (1989). Stock market prices do not follow random walks: evidence from a simple specification test. *Review of Financial Studies*, 1, 41–66.
- Parisi, F. (1998). Los ADRs Chilenos y sus implicancias en sus activos subyacentes. *Cuadernos de Economía*, 103, 120–140.
- Parisi, F., & Vásquez, A. (1999). *Simple trading simple technical trading rules of stock returns: evidence from 1987 to 1998 in Chile*. Working Paper, Universidad de Chile, Finance Department.
- Saatcioglu, K., & Starks, L. (1998). The stock price–volume relationship in emerging stock markets: the case of Latin America. *International Journal of forecasting*, 14, 215–225.
- Urrutia, J. (1994). Time series properties of four Latin American equity markets: Argentina, Brazil, Chile and Mexico. *Estudios de Administración*, 2, 1–8.