DYNAMIC RETURN-ORDER IMBALANCE RELATIONSHIP RESPONSE TO LEVERAGED BUYOUT ANNOUNCEMENTS

Han-Ching Huang, Chung Yuan Christian University
Yong-Chern Su, National Taiwan University
Yao-Hsuan Chang, National Taiwan University

ABTRACT

Many researches indicate informed trading during Leveraged buy-out (LBO) processes. In this study, we examine intraday dynamic relations between order imbalance, volatility and stock returns. The dynamic relation between volatility and order imbalances by a time-varying GARCH model is insignificant, suggesting that market makers have a good ability to mitigate volatility of LBO firms on event dates. Our imbalance-based trading strategy earns a positive profit but cannot beat a buy-and-hold return.

JEL: G14, G34

KEYWORDS: Leveraged-buyout, Order Imbalance, Return, Volatility

INTRODUCTION

Leveraged buyouts (LBO) are an important issue in corporate restructuring activities. During a LBO process, a financial sponsor acquires a controlling equity interest and a significant percentage of the purchase price is financed through leverage. Assets of the acquired company are used as collateral for the borrowed capital, sometimes with assets of the acquiring company. The bonds or other papers issued for leveraged buyouts are commonly considered not to be investment grade because of the significant risks involved.

Companies of all sizes and industries have been the target of leveraged buyout transactions. Of interest is the importance of debt and the ability of the acquired firm to make regular loan payments after the completion of a leveraged buyout. Some features of potential target firms make them for attractive leveraged buyout candidates. These features include: low existing debt loads; hard assets (property, plant and equipment, inventory, receivables) that may be used as collateral for lower cost secured debt; the potential for new management to make operational or other improvements to the firm to boost cash flows; market conditions and perceptions that depress the valuation or stock prices.

Several papers document that LBOs create real wealth gains and improvements in operating performance, perhaps because of a more efficient ownership structure and allocation of residual claims under private ownership (e.g. Alperovych et al., 2013). In contrast, others argue that leveraged buyouts mainly affect wealth transfers (Arthur and Ivo, 1993; Baran and King, 2010) from bond-holders or tax authorities to shareholders, or transfers from selling stockholders to manager-insiders rather than wealth creation.

Degeorge and Zeckhauser (1993) indicated the reverse LBO might include asymmetric information and managers use their private information to time the Initial Public Offering (IPO) and manipulate performance. Therefore, we examine informed trading during the LBO process. According to Chordia and Subrahmanyam (2004), order imbalances are strongly positively auto-correlated in their sample stocks and the relation between lagged imbalances and returns is significantly positive. In addition, contemporaneous imbalances strongly relate to current returns, but the positive relation between lagged imbalances and current returns disappears after controlling for the contemporaneous imbalances. Following Chordia and Subrahmanyam (2004), we examine intraday LBO convergence process.

Chordia and Subrahmanyam (2002) found that the price impact of the contemporaneous imbalance is highest for the largest firms as is the reversal in the lagged imbalances. We employ a time-varying GARCH (1,1) model to examine dynamic relations between volatility and order imbalances. Based on our empirical evidence, we develop an imbalance-based trading strategy to investigate whether our trading strategies are able to beat the market at different time intervals. Finally, we investigate dynamic causality relations between order imbalances and returns to explore intraday dynamics in convergence process.

We have two marginal contributions. First, announcement day LBO trading could mainly be initiated by uninformed traders. If the information cannot be incorporated into the price immediately, the uninformed traders could develop a trading strategy, which yields a positive return. Second, on the LBO announcement day, market maker behavior plays a very important role in mitigating volatility from discretionary trades through inventory adjustments.

The remainder of this paper is organized as follows. In literature review section, we review some papers about LBO and information asymmetry. In the data and methodology section, we describe the data and methods. In the results section, we present the empirical results, and we provide our conclusions in section concluding comments.

LITERATURE REVIEW

Many scholars have studied information asymmetry in LBO's, finding that stockholders and managements benefit from the LBO process. Kaplan (1989) indicated that management could take advantage of the LBO process to realize tax benefits. Muscarella and Vetsuypens (1990) and Ippolito and James (1992) found that operating efficiency after the LBO process is significantly better. Chou, Gombola, and Liu (2006) studied the sample of 247 reverse LBOs in America. Their evidence further supported previous findings. Cumming and Zambelli (2010) examined LBOs within the Italian private equity market, whose transactions were only recently legalized. They found that laws prohibiting LBOs result in less efficient LBO arrangements. Palepu (1990) summarized the LBO literature and offers some observations as follows: First, stockholders of firms undergoing LBOs earn substantial returns from the transactions. Second, LBOs appear to have two opposing effects on firm risk. Although the leverage increases financial risk, the increases in operating efficiency reduces business risk. The net result is that LBO investors bear significantly lower risk than comparably levered investments in public corporations.

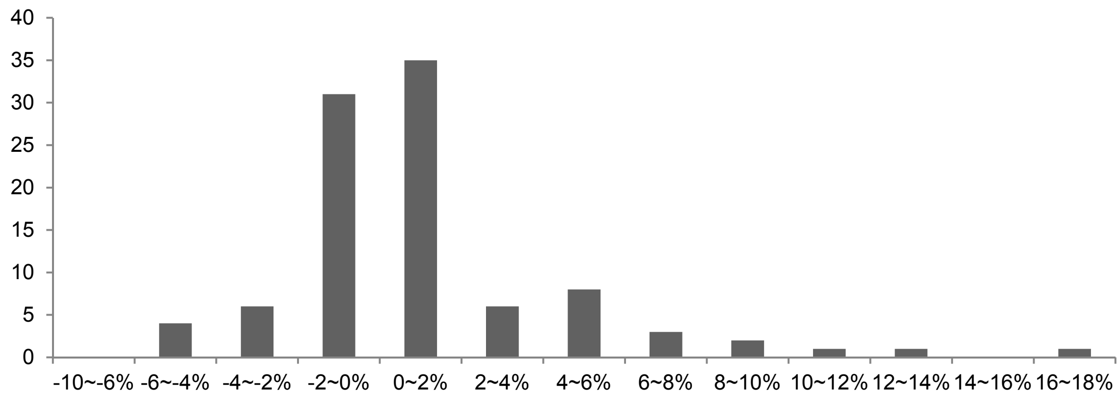
Grossman (1976) indicated that uninformed traders could detect the implications in informed traders' trading behaviors by observing the stock price change patterns. He also found that participation of noise traders who tend to imitate behaviors of informed traders increase trading volume of the stock. Kyle (1985) built a dynamic model of insider trading with sequential auctions. He stated that insiders place orders according to their monopolistic information and make positive profits. However, the noise trading provided some "camouflage" concealing insider trading. Holden and Subrahmanyam (1994) extended Kyle's model into a multi-period auction model and concluded that all private information is revealed immediately when market depth is gets larger. Foster and Viswamathan (1994) also extended Kyle's assumption to provide a dynamic model of strategy trading of two asymmetrically informed traders. They found that common information is released quickly to the market while private information spreads slowly. Wang (1993) indicated that information asymmetry among investors can increase price volatility and cause negative autocorrelation in returns and less-informed investors might be like price chasers.

DATA AND METHODOLOGY

All LBO samples are from the SDC database from 1998 through 2008. We obtain intraday trading data on the announcement day of LBO stocks from TAQ (Trade and Automated Quotations). Stock are included or excluded depending on the following criteria. First, the firm shall be included in both SDC and the TAQ. Finance and Real estate firms are excluded. Second, the stock shall be liquid and be traded frequently, and the daily trading volume is above 200,000. Third, the stock trading characteristics might differ from certificates American Depository Receipts, shares of beneficial interest, units, companies incorporated outside the U.S, closed-end funds, Americus Trust components, preferred stocks and REITs. For these reasons we expunge these kinds of securities. Fourth, if there are any stock splits, reverse splits, stock dividends, repurchases or a secondary offerings, the firm is deleted from our sample. To avoid noise trading, we delete those transactions recorded within the first 90 seconds after the market opens. Fifth, we dropped those quotes with an abnormally-large bid-ask spread and a negative bid-ask spread.

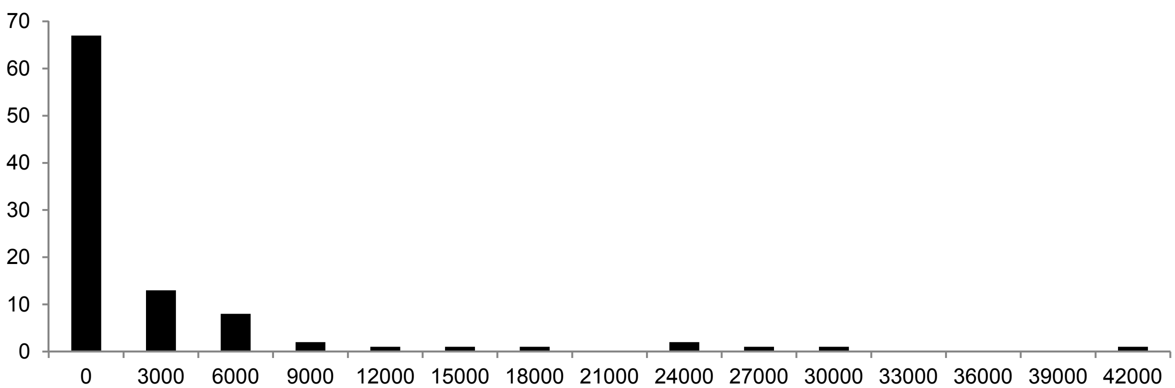
After processing the data, 99 firms remain in our sample. The average open-to-close return of our sample stock is 0.99%, with a median 0.16%. The standard deviation of return is 3.63%, with a maximum of 16.83% and a minimum of -5.72%. The distribution of sample open-to-close returns is graphed in Figure 1. As can be seen, 84.8% of the return is limited below 4%, whereas only 3% of the firms have a return above 10%. The distribution of market capitalization is demonstrated in Figure 2. The average market capitalization of the sample is $4,455.13 million, with a median of $1,880.98 million. The standard deviation of market capitalization is $7,556.91 million, with a maximum of $44,372.38 million and a minimum of 126.265 million. The distribution of market capitalization is a rightward skewed distribution.

Figure 1: Distribution of Open-to-close Return of the Sample Stocks



This figure shows the distribution of open-to-close return of all LBO samples in 1998 through 2008.

Figure 2: Distribution of Market Capitalization of the Sample Stocks



This figure shows the distribution of market capitalization of all LBO samples in 1998 through 2008.

In addition, we use the Lee and Ready (1991) procedure to assign buyer-initiated or seller-initiated orders. First, we examine an unconditional lagged order imbalances regression as follows:

$$R_t = \alpha_0 + \alpha_1 OI_{t-1} + \alpha_2 OI_{t-2} + \alpha_3 OI_{t-3} + \alpha_4 OI_{t-4} + \alpha_5 OI_{t-5} + \varepsilon_t \quad (1)$$

where R_t is the stock return in period t, defined as $\ln(P_t)-\ln(P_{t-1})$, OI_t is lagged order imbalance at time t of each stock.

We expect a positive relation between return and lagged order imbalances. We also include contemporaneous imbalance and four lags of order imbalance to examine conditional return-imbalance relations. We expect a significantly positive current imbalance, and negative relations between return and lagged imbalances. In addition, we examine dynamic relations between volatility and order imbalance. Intuitively, we expected a high order imbalance following a large volatility. A time varying GARCH(1,1) model is employed as follows:

$$\begin{aligned} R_t &= \alpha + \varepsilon_t \\ \varepsilon_t \mid \Omega_{t-1} &\sim N(0, h_t) \\ h_t &= A_t + B_1 h_{t-1} + C_1 \varepsilon_{t-1}^2 + \gamma * OI_t \end{aligned} \qquad (2)$$

where R_t is the stock return in period t, defined as $\ln(P_t)-\ln(P_{t-1})$, OI_t is the order imbalance, γ is the coefficient describing the impact of order imbalance on stock volatility, ε_t is the residual of the stock return in period t, h_t is the conditional variance in the period t, Ω_{t-1} is the information set in period t-1

RESULTS

We use a multi-regression model to examine the unconditional lagged return-order imbalance OLS relation. We present the empirical results in Table 1. The significantly positive percent of lagged-one imbalance at the 5% significant are 9.12%, 10.1%, and 6.11% for 5-, 10-, and 15-min time intervals respectively.

Table 1: Unconditional Lagged Return-Order Imbalance OLS Relation

	Average Coefficient	Positive	Positive and significant	Negative and significant
Panel A: 5-minute interval				
OI_{t-1}	16.23**	50.0%	9.12%	5.12%
OI_{t-2}	-23.18*	52.5%	11.10%	7.12%
OI_{t-3}	25.68	54.0%	6.11%	1.01%
OI_{t-4}	-3.82	36.9%	2.02%	7.19%
OI_{t-5}	-19.18	56.6%	7.14%	8.19%
Panel B: 10-minute interval				
OI_{t-1}	5.97**	51.5%	10.10%	4.02%
OI_{t-2}	-13.28*	34.3%	4.03%	11.10%
OI_{t-3}	-24.14	50.5%	3.02%	3.01%
OI_{t-4}	29.08	49.5%	6.15%	5.19%
OI_{t-5}	-8.82	47.5%	5.17%	3.09%
Panel C: 15-minute interval				
OI_{t-1}	23.68*	47.5%	6.18%	5.12%
OI_{t-2}	-26.25**	42.4%	4.04%	6.12%
OI_{t-3}	38.48	48.5%	3.05%	3.01%
OI_{t-4}	-42.38	54.0%	7.12%	5.19%
OI_{t-5}	4.35	52.0%	5.16%	1.09%

*This table shows regression estimates of the equation: $R_t=\alpha_0 + \alpha_1 OI_{t-1}+\alpha_2 OI_{t-2}+\alpha_3 OI_{t-3}+\alpha_4 OI_{t-4}+\alpha_5 OI_{t-5}+\varepsilon_t$, where R_t is the current stock return of the individual stock, and OI_t is lagged order imbalance at time t for each individual stock. Panels A, B and C present the results in 5, 10 and 15 minute intervals respectively. The average coefficients are multiplied by 10^9. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively.*

The result of our empirical study is consistent with Chordia and Subrahmanyam (2004). The possible reason for our lower prediction power is that either the time interval is too short to reveal information timely or the LBO market is efficient. Another possible reason is that market makers have information advantages. Market markers are accommodated before LBO announcements to reduce inventory risk.

Next, we include contemporaneous order imbalance into the regression. Table 2 shows the percentage of significantly positive contemporaneous imbalances are 21.2%, 16.2%, and 16.2% for 5-, 10-, and 15-min intervals respectively. Although most coefficients of lagged-one imbalance are negative for all time intervals, the percentage of negative and significant coefficients are only 6.14%, 6.14%, and 7.19 % at 5-, 10-, and 15-min intervals.

Table 2: Conditional Contemporaneous Return-Order Imbalance OLS Relation

	Average Coefficient	Positive	Positive and significant	Negative and significant
Panel A: 5-minute interval				
OI_{t-1}	77.88**	60.6%	21.20%	11.10%
OI_{t-2}	-9.97*	46.5%	5.16%	6.14%
OI_{t-3}	15.38	53.5%	9.17%	3.07%
OI_{t-4}	7.39	57.6%	8.18%	3.08%
OI_{t-5}	22.28	33.3%	3.05%	12.10%
Panel B: 10-minute interval				
OI_{t-1}	8.98**	66.7%	16.20%	6.14%
OI_{t-2}	-7.52**	53.5%	11.10%	6.14%
OI_{t-3}	-38.58*	37.4%	7.19%	10.10%
OI_{t-4}	-23.32	52.5%	4.04%	3.08%
OI_{t-5}	30.23	52.5%	8.14%	3.08%
Panel C: 15-minute interval				
OI_{t-1}	93.86**	54.5%	16.20%	4.04%
OI_{t-2}	-32.31*	43.4%	4.04%	7.19%
OI_{t-3}	-34.77	37.4%	3.05%	6.14%
OI_{t-4}	44.42	54.5%	3.05%	3.05%
OI_{t-5}	-51.68	46.5%	3.05%	5.16%

*This table shows the regression estimates of the equation: $R_t=\alpha_0 + \alpha_1 OI_t+\alpha_2 OI_{t-1}+\alpha_3 OI_{t-2}+\alpha_4 OI_{t-3}+\alpha_5 OI_{t-4}+\varepsilon_t$ where R_t is the current stock return of the individual stock, and OI_t is lagged order imbalance at time t for each individual stock. Panels A, B and C present the results in 5, 10 and 15 minute interval respectively. The average coefficients are multiplied by 10^9. *, ** and *** indicate significance at the 10, 5 and 1 percent levels respectively.*

Our empirical results from LBO market are consistent with Chordia and Subrahmanyam (2004) information overweighing argument. We employ a time varying GARCH to examine dynamic relation between volatility and order imbalance. The empirical results are reported in Table 3. We expected a positive relationship between order imbalance and volatility. However, our empirical results show a different picture. At the 5% significant level, only 12.3%, 6.17%, and 1.23% of order imbalance variables have significant positive impact on volatility for 5-min, 10-min, and 15-min interval respectively.

Table 3: Dynamic Volatility-Order Imbalance GARCH(1,1) Relation

	Percent positive and significant	Percent negative and significant
5-min interval	12.30%	1.23%
10-min interval	6.17%	2.47%
15-min interval	1.23%	1.23%

This table shows the regression estimates of the equation: $R_t = \alpha+ \varepsilon_t$, ε_t / $\Omega_{t-1} \sim N(0, h_t)$, $h_t = A + Bh_{t-1} + C\varepsilon_{t-1}^2 +\gamma^* OI_t$ where R_t is the return in period t, and is defined as $\ln(P_t/P_{t-1})$, OI_t is the explanatory variable, order imbalance, γ is the coefficient describing the impact of order imbalance on stock volatility, ε_t is the residual value of the stock return in period t, Ω_{t-1} is the information set in period t-1.

We explain the empirical results by market makers behaviors as follows. Market makers have a good capability to mitigate volatility during secondary market making. While in an LBO announcement, discretionary investors try to take advantage of the information. Market makers have sufficient inventories on hand to stabilize the market.

Given the significantly positive relation between contemporaneous order imbalance and returns, we develop an intra-day trading strategy based on order imbalances. First, we trim off 90% noisy trades. Then, we buy at the ask when there is a positive order imbalance, and sell at a negative imbalance. The performances show negative average daily return of -0.017, -0.018, and -0.017 respectively for 5-, 10-, and 15-min time intervals on quotes. We perform three hypothesis tests to evaluate this strategy. First, we use the z-test presented in Panel A of Table 4 to examine whether the trading strategy can earn a positive return. We cannot reject the null hypothesis. Second, we use a paired t-test in Panel B of Table 4 to test whether our strategy can beat the original open-to-close return. Obviously, the strategy is unsuccessful in beating the original open-to-close return (the p-value of 0.0001, 0.0001, and 0.0002 respectively for 5-, 10-, and 15-min interval). Finally, we use another paired t-test to examine the difference between returns of the three intervals. Panel C of Table 4 shows the p-values of each interval equal 0.4673, 0.6918, and 0.6274 respectively. Thus, we cannot find any significant difference among the three strategies.

Table 4: Trading Profit under the Basis of Quote price

Panel A: Returns compared with zero			
	Mean		P-value
5-min return strategy	-0.017		0.9999
10-min return strategy	-0.018		0.9998
15-min return strategy	-0.017		0.9997
Panel B: Returns compared with returns of buy-and-hold strategy			
	Mean		P-value
Original open-to-close returns	0.0099		
5-min return strategy	-0.0170		0.0001
10-min return strategy	-0.0183		0.0001
15-min return strategy	-0.0174		0.0002
Panel C: Differences in returns among the three intervals			
P-value	5-min return	10-min return	15-min return
5-min return			
10-min return	0.4673		
15-min return	0.6918	0.6274	

We define μ_i as the trading strategy return. *i denotes 5-, 10-, and 15-min intervals The Panel A specification is:* $\begin{cases} H_0 : \mu_i \le 0 \\ H_1 : \mu_i > 0 \end{cases}$.

The Panel B specification is: $\begin{cases} H_0 : \mu_i \ge \mu_0 \\ H_1 : \mu_i < \mu_0 \end{cases}$ *where* μ_0 *is the original open-to-close return* .

The Panel C specification is: $\begin{cases} H_0 : \mu_i = \mu_j \\ H_1 : \mu_i \ne \mu_j \end{cases}$, *i≠j*

In addition, we modify the imbalance-based trading strategy on trade price. We earn an average daily return of 0.0048 0.0044, and 0.0034 respectively for 5-, 10-, and 15-min intervals. Obviously, the strategy on trade price is better than on quote. We perform three hypothesis tests to evaluate this strategy. The z-test reported in Panel A of Table 5 shows the p-values in 5-, 10-, and 15-min intervals are 0.0724, 0.1750, and 0.2553 respectively. We find that at 10% significant level, the 5-min trading strategy implemented by trade prices is able to earn a significantly positive return. Similarly, we use a paired t-test to investigate whether our strategy, after switching from quote prices to trade prices, can beat the original open-to-close returns. The results are presented in Panel B of Table 5. The one-tail p-values are 0.1675, 0.2170, and 0.1181 respectively for 5-, 10-, and 15-min intervals, respectively. We cannot reject the null hypothesis.

Finally, we test whether this strategy brings significantly different profits among 5-, 10-, and 15-min intervals, after switching quotes prices to trade prices. The two-tail p-values of the t-test in Panel C of Table 5 display 0.9466, 0.7622, and 0.8394, meaning that there is no significant difference among the three intervals.

Table 5: Trading Strategy under the Basis of Trade Price

Panel A: Returns compared with zero			
	Mean	P-value	
5-min return strategy	0.0048	0.0724	
10-min return strategy	0.0044	0.1750	
15-min return strategy	0.0034	0.2553	
Panel B: Returns compared with returns of buy-and-hold strategy			
	Mean	P-value	
Original open-to-close returns	0.5264		
5-min return strategy	0.0048	0.1675	
10-min return strategy	0.0044	0.2170	
15-min return strategy	0.0034	0.1181	
Panel C: Differences in returns among the three intervals			
P-value	5-min return	10-min return	15-min return
5-min return			
10-min return	0.9466		
15-min return	0.7622	0.8394	

We define μ_i as the trading strategy return. *i denotes 5-, 10-, and 15-min intervals The Panel A specification is:* $\begin{cases} H_0 : \mu_i \le 0 \\ H_1 : \mu_i > 0 \end{cases}$.

The Panel B specification is: $\begin{cases} H_0 : \mu_i \ge \mu_0 \\ H_1 : \mu_i < \mu_0 \end{cases}$ *where* μ_0 *is the original open-to-close return .*

The Panel C specification is: $\begin{cases} H_0 : \mu_i = \mu_j \\ H_1 : \mu_i \ne \mu_j \end{cases}$, *i≠j*

CONCLUDING COMMENTS

Previous literature suggests that information asymmetry plays an important role in the LBO process. There are two main theories to explain the LBO transactions. First, LBOs create real wealth gains and improvements in operating performance, perhaps because of a more efficient ownership structure and allocation of residual claims under private ownership. Second, LBOs mainly effect wealth transfers from bond-holders or tax authorities to shareholders, or transfers from selling stockholders to manager-insiders rather than creating wealth. Stockholders in the target firms often enjoy high returns after the LBO process. In addition, evidence shows that order imbalance is a good indicator to capture some information asymmetries. The central purpose of our study is to investigate whether order imbalance is a good indicator to forecast stock price movements on the LBO announcement day.

We collect the LBO firms from 1998 through 2007, including 99 samples. Following Chordia and Subrahmanyam (2004), we perform two OLS regression models, with and without contemporaneous order imbalances. From the unconditional lagged return-order imbalance OLS model, our result is consistent with Chordia and Subrahmanyam (2004). The lagged-one imbalances have a positive impact on returns, but the predictive powers of lagged-one imbalances on returns in our results are lower than their findings.

We find a positive relation between contemporaneous order imbalances and returns, which is consistent with Chordia and Subrahmanyam (2004). After controlling for contemporaneous order imbalance, lagged order imbalances are negatively related to current price movements. This result is also consistent with Chordia and Subrahmanyam (2004).

From the volatility-order imbalance GARCH (1,1) model, our result shows that the relation between volatility and order imbalances is insignificant. We infer that market makers have good capability to mitigate volatility either from accommodated inventory or inside information.

Finally, we develop an imbalance based trading strategy. We use two definitions of prices, quote prices and trade prices, to implement our strategy. Only the return earned by our strategy implemented by trade prices is significantly positive at 10% significant level, and neither beats the original open-to-close return.

REFERENCES

Achleitne , A-Kristin., R. Braun, B. Hinterramskogler and F. Tappeiner (2012)"Structure and Determinants of Financial Covenants in Leveraged Buyouts," *Review of Finance* , vol.16 (3),p.647-684.

Alperovych. Y., K. Amess and M. Wright (2013) "Private Equity Firm Experience and Buyout Vendor source: What is their impact on efficiency? " *European Journal of Operational Research,* vol 228(3-1, August) , p. 601–611.

Arthur, W., and I.Welch (1993) "Bondholder Losses in Leveraged Buyouts," *The Review of Financial Studies,* vol.6(4), p. 959-982.

Baran, L.C., and T.H.D. King (2010) "Going Private Transactions, Bondholder Returns and Wealth Transfer Effects," *Journal of Banking & Finance,* vol. 34(8, August), p.1856-1872.

Brown, P., D.Walsh and A. Yuen (1997) "The Interaction Between Order Imbalance and Stock Price," *Pacific-Basin Finance Journal*, vol.5(5, December), p.539-557.

Chen, C., and C. Wu (1999) "The Dynamics of Dividends, Earnings and Prices: Evidence and Implications for Dividend Smoothing and Signaling," *Journal of Empirical Finance*, vol. 6(1 ,January), p.29-58.

Chou, D.W., M.Gombola and F.Y.Liu (2006) "Earnings Management and Stock Performance of Reverse Leveraged Buyouts," *Journal of Financial and Quantitative Analysis*, vol.41(2 ,June) ,p.407-438.

Chordia, T., R.Roll and A.Subrahmanyam (2002) "Order Imbalances, Liquidity, and Market Returns," *Journal of Financial Economics*, vol.65(1,July), p. 111-130.

Chordia, T., and A.Subrahmanyam (2004) "Order Imbalances and Individual Stock Returns: Theory and Evidence," *Journal of Financial Economics,* vol.72(3 ,June), p. 486-518.

Cumming, D., and S. Zambelli (2010) "Illegal Buyouts," *Journal of Banking & Finance,* vol.34(2 ,February), p.441-456.

Degeorge, F., and R.Zeckhauser (1993) "The Reverse LBO Decision and Firm Performance: Theory and Evidence," *Journal of Finance,* vol.48(4,September), p.1323-1348.

Foster, D.F., and S. Viswanathan (1994) "Strategic Trading With Asymmetric Information Traders and Long-Lived Information," *Journal of Financial and Quantitative Analysis,* vol.29(4,December), p. 499-518.

Grossman, S., (1976) "On the Efficiency of Competitive Stock Markets Where Traders Have Diverse Information," *Journal of Finance*, vol.31(2), p.573-85.

Holden, C., and A. Subrahmanyam (1994) "Risk Aversion, Imperfect Competition, and Long-Lived Information," *Economics Letters*, vol.44(1, February), p. 181-90.

Ippolito, R.A., and W.H. James (1992) "LBOs, Reversions and Implicit Contracts," *Journal of Finance*, vol.47(1,March), p.139-167.

Kaplan, S., (1989) "Management Buyouts: Evidence on Taxes as a Source of value," *Journal of Finance*, vol.44(3, June), p.611-632.

Kyle, A.S., (1985) "Continuous Auctions and insider Trading," *Econometrica,*vol.53(6 ,November), p.1315-1335.

Lee, C.M.C., amd M.J. Ready.(1991) "Inferring Trade Direction From Intraday Data," *Journal of Finance*, vol.46(2,June), p. 733-747.

Llorente, G., R Michaely, G. Sarr, amd J. Wang (2002) "Dynamic Volume-Return Relation of Individual Stocks," *Review of Financial Studies*, vol.15(4), p.1005-1047.

Man, K.,and C. Chen (2009) "On a Stepwise Jypotheses Testing Procedure and Information Criterion in Identifying Dynamic Relations between Time Series," J*ournal of Data Science*, vol.7, p. 139-159.

Muscarella, C.J., and M.R. Vetsuypens (1990) "Efficiency and Organizational Structure: A Study of Reverse LBOs," *Journal of Finance*, vol.45(5, December), p.1389-1413.

Palepu, K.G., (1990) "Consequences of Leveraged Buyouts," *Journal of Financial Economics*., vol.27(1, September), p. 247-262.

Wang, J., (1993) "A model of Intertemporal Asset Prices Under Asymmetric Information," *Review of Economic Studies*, vol.60(2), p.249-282.

BIOGRAPHY

Han-Ching Huang is Associate Professor of Finance and Director of International Master of Business Administration at the Chung Yuan Christian University. His research appears in journals such as *Journal of Banking and Finance, and Applied Economics.* He can be reached at Chung Yuan Christian University, 200, Chung Pei Road, Chung Li, Taiwan, 32023, samprass@cycu.edu.tw.

Yong-Chern Su is Professor of Finance at National Taiwan University. His research appears in journals such as *Journal of Banking and Finance, and Applied Economics.* He can be reached at National Taiwan University, 50 Lane 144 Sec. 4, Keelung Road, Taipei, Taiwan, ycsu@ntu.edu.tw.

Yao-Hsuan Chang is Master of Finance at National Taiwan University. He can be reached at National Taiwan University, 50 Lane 144 Sec. 4, Keelung Road, Taipei, Taiwan, r96723050@ntu.edu.tw.