How to Invest in Stocks of Family Business Groups? Case Study of WALSIN Group in Taiwan

Yu-Wei Lan[1*], Dan Lin[1] & Lu Lin[2]

[1] Department of Banking and Finance, Takming University of Science and Technology, Taipei, Taiwan

[2] Department of Public Finance and Taxation, Takming University of Science and Technology, Taipei, Taiwan

[*] Yu-Wei Lan, E-mail: ywlan@takming.edu.tw

Abstract

The impact of family business groups on the industry has drawn different views. A major challenge for investors is to understand the business model of enterprises and enhance the trading performance in the financial market. Using the data of WALSIN family group, this article adopts generalized autoregressive conditional heteroscedasticity model (EGARCH) to investigate the volatility of stock prices of WALSIN family group.

The overall evidence suggests that the relationship between the leverage effect after including the leading company variable and the absence of the leading company appears to be significant at the 1% level. Therefore, the leverage effect after including the leading company has a certain effect on the financial operation of the family business group. In other words, it is helpful to include the leverage effect of the leading company in the portfolio, which can stabilize the trading performance of the WALSIN family group.

Furthermore, this study adopts Granger causality and program trading to test the strategy of following the leader of WALSIN family group. The net trading profit during this period is 71.03%. The results show that the technical analysis tested in this study can lead to trading profits and investors can increase their trading profits by following the leader in the family owned business.

Keywords

family business, EGARCH, herd effect, Granger causality test, symmetric trading

1. Introduction

Since 2012, Taiwan family businesses were included in the global investigation by the Family Business Survey. The survey showed that Taiwan family businesses were more conservative in comparison to other global family businesses when considering passing on the business to the next generation. The

results in 2016 showed that 58% of Taiwan family businesses were reluctant to pass on the management role to external professionals whereas the global statistic was only 39%. This suggests that the corporate governance of Taiwan family businesses is facing a great challenge (Note 1).

La Porta et al. (1999) use a control index as a standard for deciding whether a company is a family business. However, the dividing point of 10%~40% is debatable. Once the final controlling family or person holds more than that percentage, this company is classified as a family business group. Johannisson and Huse (2000) believe that the founder of family business can enhance the cohesion in the company and improve the operational efficiency of the organization, thereby lowering the management cost. Family business tends to use "enterprise group" as a way of controlling their related businesses. For example, by being the chairman of board of directors or managing director, the founder can ensure that the family possesses a certain number of seats on the board. Other ways of ensuring the control include pyramid holding, cross holding and equity pledge. It can, on the one hand, reduce the risks by lowering the transparency of the company and, on the other hand, enhance the external resources and gain the complementary effect. The enterprise groups have some potential advantages compared to individual companies, such as more capital and internal trading. This business model is mimicked by many businesses. Apart from controlling the number of management roles, Finkelstein (1992) finds that family members use a number of different ways to consolidate their power. For example, they will extend the tenure to enhance their power structure and focus more on the business' long-term development.

Jain and Kini (2000) argue that if the board members are occupied by family members, it is likely to limit the company's resource network. La Porta et al. (1999) investigate the top 20 companies of 27 countries and find that the controlling stockholders of the enterprise group like to use pyramid holding structure to control companies within the group and drain funds from the bottom companies to exploit small stockholders. Johnson et al. (2000) also find that controlling stockholders of the enterprise group have strong motives to transfer internal company resources to outside in order to increase their own wealth. Moreover, Bae et al. (2002) and Baek et al. (2004) find that controlling stockholders of the enterprise group tend to use insider trading or take the advantage of asset restructuring to transfer company resources to controlling stockholders. These acts are likely to affect the company's stock prices. Therefore, rather than focusing on corporate governance issues, this study looks directly at the stock performance of enterprise groups to search for good investment opportunities.

The case company investigated in this study is WALSIN. The founder is Jiao, Ting Biao who was the factory director of PEWC and chairman of WALSIN board. Jiao used the money made from his main business, WALSIN, and reinvested in stock markets, real estates and other subsidiary companies. Jiao had four sons and one daughter and the family table is presented in the Appendix (Note 2).

According to the statistics by Financial Supervisory Commission (Taiwan), individual investors' holdings in Taiwan's stock market have fallen from around 70% to less than 50%. This is because individual investors have lost their confidence. They often "buy high and sell low" and make a loss.

106

Therefore, this study adopts the behavioral finance theory to simulate program trading strategies. This can help individual investors trade the stocks of family groups. The organization of the paper is as follows. Section 2 is the literature review. Section 3 discusses the EGARCH model, Granger causality and the estimation method for program trading. Section 4 describes that data source. Section 5 presents that empirical results and analyses. Finally, the conclusion is presented in the last section.

2. Literature Review

The literature on stock market predictions can trace back to the random walk theory proposed by Bachelier (1900) who argues that the stock market volatility is similar to the Brownian motion in Physics. Later, Samulson (1965) from the perspective of Modern Economics suggests that stock prices are unpredictable if all information and anticipations of the market participants are included. Fama (1965) proposes that stock market prices are random. Fama (1970) then summaries the past literature and formally proposes an Efficient Market Hypothesis (EMH); that is, a weak form, semi-strong form and strong form of market efficiency.

After 1980s, empirical evidence shows anomalies exist in the market. For example, Shiller (1981) finds that the results from NYSE listed companies are inconsistent with the CAPM model of Sharp (1964); that is, the equity premium puzzle and over-reaction puzzle. Other anomalies include the size effect (Banz, 1981), season effect (Lakonishok et al., 1988), calendar effect (Cadsby, 1989) and IPO underpricing puzzle (Reilly et al., 1969). In addition, there are anomalies caused by investors' perception bias, such as anchoring effect, availability heuristics, intuitive heuristics, confirmation bias and framing dependence bias, and investors' psychological characteristics, such as overconfidence, ambiguity aversion, loss aversion, disposition effect and herding effect. Therefore, according to the behavior finance, investors have "bounded rationality".

Compared with the traditional financial theory, behavioral finance does not have well-structured pricing and investment portfolio theory. Some important breakthroughs in the field include the BAPM (behavior asset pricing model) of Shefrin and Statman (1994). Barberis, Shleifer and Visney (1998) argue that investors often over- or under-react. This changes the predictability of nonsystematic risks and therefore, gives rise to a predictable investment return model (that is, the BSV model). Daniel, Hirsheifer and Subrahmanyam (1998) divide investors into informed and uninformed groups and investigate the continuity in short-term stock returns and the long-term reversion (that is, the DHS model). Moreover, William and Huang (1995) examine two basic benchmarks in herding effect, stock market returns and dispersion in investment portfolio returns. The smaller the dispersion, the more prominent the herding effect. Investors often conduct noise trading or positive feedback trading. The latter is caused by herding trading behavior, extrapolative expectation and technical analyses. As institutional investors are more informed about their industry partners and have higher ability in prediction, they are more likely than individual investors to have herding trading behavior. In the situation of a lack of information, mimicking the trading behavior of others can reduce the costs of

107

gathering information. Also, when making losses, investors can shirk responsibility, blame others and have less regrets. As herding behavior involves many investors, it has great impacts on the market stability and efficiency (Kim & Wei, 1999). Previous studies on herding effect include Lakonishok et al. (1992) who study stock funds in the US between 1985 and 1989, Froot et al. (1994) who study the herding behavior of institutional investors and Werners (1999) who studies the herding behavior of mutual funds using a larger sample (between 1975 and 1994).

To investigate the complex behavior of financial markets that emerge from decisions made by many traders, Alanyalil et al. (2013) explore past issues of the Financial Times during the period 1992-2004 and quantify the relationship between decisions taken in financial markets and developments in financial news. They find a positive correlation between the number of times a company is mentioned in the Financial Times and the daily transaction volume of the company's stock. Their results provide quantitative supports for the links between the movements in financial markets and financial news. Furthermore, using transaction data of Ashland Inc. (listed on NYSE) in 1995, Cipriani (2014) builds a model of informational herding to examine herd behavior in financial markets. In the model, rational herding arises when there is information-event uncertainty. Herding occurs very often and is particularly pervasive on some days. On average, the proportion of herd buyers is 2%; the proportion of herd sellers is 4%. Herding also causes informational inefficiencies, accounting to four percent of the asset's expected value which might be the potential source of profits. Utilizing a time-varying transition probability Markov-switching model, Balcilar et al. (2015) examine the role of global risk factors on investor behavior in Borsa Istanbul, which is dominated largely by foreign investors. The results show that U.S. market-related factors are found to dominate regime transitions and contribute significantly to herd behavior in all market sectors with the exception of industrials. The results suggest that industrials are relatively immune to global shocks.

As for the mean reversion effect, some investors mistake that this effect exists in a short and mid-term period. De Bondt et al. (1985) find that good performing stocks in the previous year also perform better than the bad performing stocks in the following year. They also find a revision effect in stock market returns in the long-run. Fama and French (1988) analyze the NYSE listed stocks between 1926 and 1985 and find that in the long-term, stocks are negatively serial correlated, but positively serial correlated in the short-term. Poterba and Summers (1988) also find similar results using a different sample period and data from more countries. Moreover, Jegadeesh and Timan (1993) report momentum effects in the short and mid-term. Rouwenhourst (1998) adopts Jegadeesh et al.'s (1993) methods and find similar results in 12 European countries. Further, Conrad and Kaul (1988) show that adopting a reversion trading strategy in the long-term and a momentum strategy in the mid-term is a successful trading strategy.

All the above suggests that anomalies exist in the market. Hence, this study proposes a new testing method. Specifically, we use econometric models and optimized program trading and the trading strategy proposed by behavioral finance to conduct two stages of tests in order to find an investment

108

strategy for investing family-owned business groups. The hypothesis tested is as follows:

After selecting a leading company in the industry, we can use technical analyses to enhance the trading performance of family-owned business groups.

3. Research Methods

3.1 Theoretical Models and Estimation Methods of VAR and Granger Causality

Sim (1980) applies the vector autoregression model in econometrics to ensure that all variables in the model have causal relationships and to avoid the identification problem in simultaneous structural equations. In the following program trading model, the three variables included are the stock prices of HannStar Board (Code: P5469), Taiwan 50 ETF (Code: P50) and WALSIN (Code: P1605). The variable in time t is formed by the variable in the prior time k and the error term. For example, VAR (1) (i.e., k = 1) can be presented as:

$$P5469_t = \alpha_1 + a_{11}P5469_{t-1} + a_{12}P50_{t-1} + a_{13}P1605_{t-1} + \varepsilon_{1t}$$
$$P50_t = \alpha_2 + a_{21}P5469_{t-1} + a_{22}P50_{t-1} + a_{13}P1605_{t-1} + \varepsilon_{2t} \tag{1}$$
$$P1605_t = \alpha_2 + a_{31}P5469_{t-1} + a_{32}P50_{t-1} + a_{33}P1605_{t-1} + \varepsilon_{2t}$$

where $E(\varepsilon_t) = 0, \forall t, E(\varepsilon_t \varepsilon_s') = \begin{cases} \Omega, s = t \\ 0, s \neq t \end{cases}, \Omega = E(\varepsilon_t \varepsilon_t'),$ The error term ε_t is white noise; m is the constant, a is the coefficient and Ω is the positive definite variable and covariance matrix. Granger (1969, 1988) and the application of Granger causality analysis proposed in Lan et al. (2017) can be used to clarify the relationship between the two.

3.2 Theoretical Model and Estimation Method of EGARCH

The Generalized Autoregressive Conditional Heteroscedasticity Model (GARCH) is developed by Bollerslev (1986) based on a modification of Engle's (1982) autoregressive conditional heteroscedasticity model (ARCH) (Note 3). The ARCH model describes the random error distribution of information gathering $\psi_{t-1} = \{y_{t-1}, x_{t-1}, y_{t-2}, x_{t-2}, ...\}$ in the previous period t-1. The model is as follow:

$$\varepsilon_t | \psi_{t-1} \sim N(0, h_t)$$

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2$$

where $\alpha_0 > 0, \alpha_i \geq 0, i = 1, ..., n$ and GARCH (p, q) model overcome the condition of non-negative α. Therefore, the model can be presented as below:

$$y_t = x_t'\beta + \varepsilon_t \tag{2}$$

$$\varepsilon_t = \sqrt{h_t} v_t \tag{3}$$

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j}$$

(4)

where h_t is the conditional variance of the GARCH model, p is the order of GARCH terms h^2 and q is the order of ARCH terms ε^2. As in finance, negative news often has greater impact on stock prices than positive news. The conditional variance of EGARCH model becomes:

$$\ln(h_t) = \alpha_0 + \sum_{j=1}^{p} \beta Ln(h_{t-j}) + \sum_{i=1}^{q} (\alpha_i \left| \frac{\varepsilon_t}{\sqrt{h_t}} \right| + \gamma \frac{\varepsilon_t}{\sqrt{h_t}})$$

(5)

If the coefficient of leverage effect r $\neq$ 0, it implies that there is an asymmetric response of conditional variance on positive error term and negative error term. From the volatility viewpoint, this study compares the impact on stock market when the data of WALSIN is included and excluded.

This study follows the method in Lan et al. (2014) and draws the news impact curve. The method is briefly described below:

1) Let $z = \dfrac{\mu}{\sigma}$. From the EGARCH model, we estimate the conditional variance series σ^2 and take the square root, which is then divided by the error term to derive z.

2) Rank z from the lowest to the highest and structure a new series containing z.

3) Use the coefficients of the EGARCH model to derive s:

$$\log(s) = \alpha * abs(z) - \gamma * z$$

(6)

4) Plot z and s on a graph to draw the news impact curve and to observe the impact on the stock market. If the curve tilts upwards to the left with a large angle, it suggests a high degree of panic.

3.3 Experimental Design and Estimation Method

In traditional behavioral finance, there are two research methods in experimental designs. One is the Structural Equation Modeling (SEM) and the other is experimentation method. This study adopts a different method using Multi Charts to simulate a model for following leading company. In this study, the leading company is WALSIN in model 1 and HannStar Board in model 2. Data 2 is the price of 0050; Data 3 is the price of leading company. In addition, the trading strategy using RSI technical index in this study is based on the closing price and the breakthrough by the 20-day moving average. Three conditions of a "system buy" are: (1) today's closing price of data 2 is greater than 20-day moving average price of data 2; (2) today's closing price of data1 is greater than the 20-day moving average price of data1; and (3) the RSI of today's stock prices is higher than the best buying point's RSI (the simulation interval is 50~80). Conversely, three conditions of a "system sell" are: (1) today's closing price of data2 is lower than 20-day moving average price of data 2; (2) today's closing price of data1 is lower than the 20-day moving average price of data1; and (3) the RSI of today's stock prices is lower than the best selling point's RSI (the simulation interval is 20~40). We use the optimized trading to find the optimal number of days in moving average. The position is closed out if the profit is greater than

110

500 points or the loss is greater than 100 points.

4. Data

Based on the information provided by Unique Business Weekly (Issue 1016, p. 14), WALSIN family business group includes WALSIN (1605), HannStar Board (5469), Walsin Technology (2492), HannStar (6116), gbm (6191), Winbond (2344), HannsTouch (3049), Walton Advanced Engineering (8110), PSA (6173), and Nuvoton (4919). As Nuvoton became public on 27 September 2010, the sample period for this study covers from 2010.9.27~2017.1.19 (i.e., a total of 2289 data sample). The data are obtained from daily stock price database of TEJ.

In order to ensure that the model is completed, the experiment is divided into two stages. The first stage covers from 2010.9.27~2013.10.31 and the second stage covers from 2010.9.27~2017.1.19. The second stage adopts optimal parameters from the first stage. The trading cost in the simulated models is assumed to be about 1% of the stock price.

5. Results

5.1 Granger Causality Test of WALSIN

5.1.1 Unit Root Test of VAR Model Variables of WALSIN

To ensure the validity of empirical results, we need to ensure that the series are stationary. Based on the testing steps of VAR model, we test for minimal AIC value. Taking WALSIN (P1605) as an example, the results show that when intercept is included (-3.1170 (0)), it is a I(0) stationary series. However, when intercept and trend are considered (-2.7740(0)) or when no intercept and trend are considered (-1.3614(0)), null hypotheses are not rejected in both cases. That is, the series are not stationary, have fat tail and have autocorrelation. Therefore, I(0) is not stationary. After taking a difference, I(1) becomes stationary and rejects the null hypothesis (Table 1). Therefore, we can proceed with VAR and Granger causality test.

Table 1. Unit Root Test of VAR Model Variables of WALSIN

Model	Original Value			First Order Difference		
Variables Mode	Intercept	Intercept and Trend	No Intercept	and Intercept	Intercept and Trend	No Intercept and Trend
P1605	-3.1170(0)**	-2.7747(0)	-1.3614(0)	-47.2318(0)*	-47.2562(0)*	-47.2370(0)*
P5469	-2.5494(1)**	-2.3368(1)	-1.5413(1)	-43.5161(0)*	-43.5408(0)*	-43.5166(0)*
P2492	-0.8564(0)	-1.4997(0)	-0.2062(0)	-46.5976(0)*	-46.8184(0)*	-46.6070(0)*
P6116	-2.0749(0)	-1.8877(0)	-1.3369(0)	-47.2366(0)*	-47.2667(0)*	-47.2415(0)*
P6191	-4.6240(1)*	-4.0104(1)*	-3.8080(1)*	-44.8956(0)*	-45.0290(0)*	-44.8369(0)*
P2344	-2.1561(0)	-2.9155(0)	-0.5451(0)	-47.8588(0)*	-47.8801(0)*	-47.8692(0)*
P3049	-1.8261(1)	-2.1614(1)	-0.8733(1)	-44.4680(0)*	-44.4593(0)*	-44.4777(0)*
P8110	-2.6305(0)**	-2.6008(0)	-1.1342(0)	-48.8262(0)*	-46.8405(0)*	-46.8317(0)*

111

P6173	-1.7045(1)	-1.6676(1)	-0.9318(1)	-43.5456(0)* -43.5388(0)*	-43.5546(0)*
P50	--1.8478(0)	-3.6836(0)**	-0.2406(0)	-47.8322(0)* -47.8667(0)*	-47.8427(0)*

Note: According to Mackinnon (1991), *, **, *** shows significance level at 1%, 5% and 10%. (0) shows that when the lag period is 0, it has the minimal AIC. Sample code is as provided in Section 4.

5.1.2 Lag Period Test of WALSIN's VAR Model

Before proceeding with VAR model estimation, we must first test the lag period. The results show that the AIC, SC, HQ and FPE of WALSIN are at their minimum when the data is lagged one period (Table 2). Therefore, the VAR is estimated using lag period of one. According to AR roots graph, the reciprocals of the variables' unit roots are all within the circle (Figure 1). Therefore, the model is proven to be stationary.

Table 2. Lag Period Estimation of WALSIN's VAR Model

Included observations: 1562

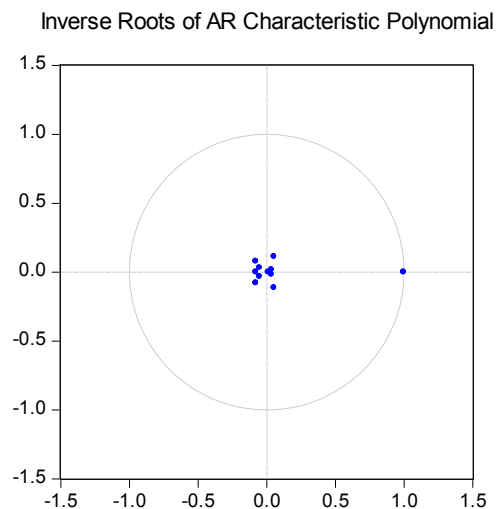| Lag	LogL	LR	FPE	AIC	SC	HQ
0	-37759.61	NA	27929884	48.36186	48.39956	48.37587
1	-3956.786	67086.27	5.21e-12*	5.235321*	5.687748*	5.403525*
2	-3840.475	229.1955	5.24e-12	5.241325	6.108478	5.563716
8	-3263.612	183.4872*	6.35e-12	5.432282	8.787784	6.679795

Inverse Roots of AR Characteristic Polynomial

Figure 1. Stationary Test of AR Roots

5.1.3 Granger Causality Test of WALSIN

As VAR model can be used to investigate the relationship between variables that are unknown based on economic theories, this study includes the trading information of ten companies and Taiwan 50 ETF in

the VAR model and conducts Granger causality test. The results show that when lagging one period, apart from Taiwan 50 ETF (7 times) and the undifferentiated P6191 (5 times) (Note 4), WALSIN (4 times) which has the highest average stock price is the Granger cause of other companies most often. Also, the investment behavior of four companies obviously includes the WALSIN's information as its endogenous variable (Table 3). In other words, the optimal investment behavior of four companies in the WALSIN business group refuses to reject the information of Taiwan 50 ETF and WALSIN. The information of Taiwan 50 ETF and WALSIN is the Granger cause of other companies and causes herding behavior in other companies.

Table 3. Granger Causality Test of WALSIN

Dependent variable: D(P1605)			Dependent variable: D(P6173)			Dependent variable: D(P2492)		
Excluded	**Chi-sq**	**Prob.**	**Excluded**	**Chi-sq**	**Prob.**	**Excluded**	**Chi-sq**	**Prob.**
D(P2344)	2.047688	0.1524	D(P1605)	3.717566	0.0538	D(P1605)	0.042188	0.8373
D(P3049)	1.904618	0.1676	D(P2344)	2.337512	0.1263	D(P2344)	0.356078	0.5507
D(P4919)	2.027552	0.1545	D(P3049)	19.49493	0.0000	D(P3049)	0.205285	0.6505
D(P5469)	0.861197	0.3534	D(P4919)	0.823400	0.3642	D(P4919)	0.035937	0.8496
D(P6116)	0.280854	0.5961	D(P5469)	3.681953	0.0550	D(P5469)	0.139992	0.7083
D(P6173)	0.042791	0.8361	D(P6116)	2.769121	0.0961	D(P6116)	0.018198	0.8927
D(P8110)	0.001917	0.9651	D(P8110)	0.529163	0.4670	D(P6173)	0.759208	0.3836
D(P50)	19.92865	0.0000	D(P50)	7.332551	0.0068	D(P8110)	1.223315	0.2687
D(P2492)	0.523706	0.4693	D(P2492)	3.253310	0.0713	D(P50)	0.936548	0.3332
P6191	4.926773	0.0264	P6191	14.69339	0.0001	P6191	7.071177	0.0078
All	37.91533	0.0000	All	69.62772	0.0000	All	13.11135	0.2175
Dependent variable: D(P2344)			Dependent variable: D(P8110)			Dependent variable: P6191		
Excluded	**Chi-sq**	**Prob.**	**Excluded**	**Chi-sq**	**Prob.**	**Excluded**	**Chi-sq**	**Prob.**
D(P1605)	0.514558	0.4732	D(P1605)	1.596865	0.2063	D(P1605)	0.007712	0.9300
D(P3049)	0.752793	0.3856	D(P2344)	0.133447	0.7149	D(P2344)	0.029267	0.8642
D(P4919)	0.001336	0.9708	D(P3049)	0.344086	0.5575	D(P3049)	3.995918	0.0456
D(P5469)	1.824436	0.1768	D(P4919)	0.038957	0.8435	D(P4919)	0.449158	0.5027
D(P6116)	0.894587	0.3442	D(P5469)	0.363386	0.5466	D(P5469)	1.113326	0.2914
D(P6173)	0.382586	0.5362	D(P6116)	0.146233	0.7022	D(P6116)	0.054568	0.8153
D(P8110)	0.320010	0.5716	D(P6173)	1.156281	0.2822	D(P6173)	0.010712	0.9176
D(P50)	15.87387	0.0001	D(P50)	8.820565	0.0030	D(P8110)	2.531024	0.1116
D(P2492)	0.427161	0.5134	D(P2492)	4.828526	0.0280	D(P50)	6.555826	0.0105
P6191	2.265528	0.1323	P6191	1.405306	0.2358	D(P2492)	0.718960	0.3965
All	21.40737	0.0184	All	19.05748	0.0395	All	23.51882	0.0090

Dependent variable: D(P3049)			Dependent variable: D(P50)			Dependent variable: D(P4919)		
Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.
D(P1605)	4.914727	0.0266	D(P1605)	0.531514	0.4660	D(P1605)	8.099220	0.0044
D(P2344)	0.119022	0.7301	D(P2344)	1.195931	0.2741	D(P2344)	0.010030	0.9202
D(P4919)	2.046498	0.1526	D(P3049)	0.106021	0.7447	D(P3049)	0.042009	0.8376
D(P5469)	0.012617	0.9106	D(P4919)	0.764814	0.3818	D(P5469)	2.968646	0.0849
D(P6116)	0.320503	0.5713	D(P5469)	3.835505	0.0502	D(P6116)	0.004209	0.9483
D(P6173)	2.080687	0.1492	D(P6116)	0.019747	0.8882	D(P6173)	29.67604	0.0000
D(P8110)	1.067859	0.3014	D(P6173)	0.237914	0.6257	D(P8110)	0.819910	0.3652
D(P50)	5.941374	0.0148	D(P8110)	0.123380	0.7254	D(P50)	0.185112	0.6670
D(P2492)	1.175038	0.2784	D(P2492)	0.094969	0.7580	D(P2492)	0.640024	0.4237
P6191	2.592389	0.1074	P6191	0.980967	0.3220	P6191	2.184068	0.1394
All	24.22809	0.0070	All	13.23183	0.2110	All	48.75191	0.0000

Dependent variable: D(P5469)			Dependent variable: D(P6116)					
Excluded	Chi-sq	Prob.	Excluded	Chi-sq	Prob.			
D(P1605)	3.544183	0.0598	D(P1605)	1.148385	0.2839			
D(P2344)	0.109250	0.7410	D(P2344)	1.299603	0.2543			
D(P3049)	5.762871	0.0164	D(P3049)	0.247668	0.6187			
D(P4919)	0.039044	0.8434	D(P4919)	0.162043	0.6873			
D(P6116)	0.764693	0.3819	D(P5469)	0.000105	0.9918			
D(P6173)	3.466009	0.0626	D(P6173)	0.575153	0.4482			
D(P8110)	0.079882	0.7775	D(P8110)	1.399276	0.2368			
D(P50)	8.516380	0.0035	D(P50)	0.890884	0.3452			
D(P2492)	3.731499	0.0534	D(P2492)	1.247815	0.2640			
P6191	5.933953	0.0149	P6191	1.413015	0.2346			
All	30.70604	0.0007	All	9.859693	0.4529			

Note: Prob. means probability. Chi-sq is the χ^2 statistics. Sample code is the same as Table 1. D means taking the first difference.

5.2 Granger Causality Test of HannStar Board, Taiwan 50 ETF and WALSIN

5.2.1 Lag Period Test of HannStar Board, Taiwan 50 ETF and WALSIN

Due to page limit, in this study we only include HannStar Board (p. 5469), Taiwan 50 ETF (p. 50) and WALSIN in the VAR model estimation. The first step is to examine the lagging period. The results show that the AIC and PFE of HannStar Board, Taiwan 50 ETF and WALSIN are at their minimum when lagging two periods (Table 4). Therefore, this model is estimated using a lag period of two.

Table 4. Lagging Period Estimation of VAR Model of HannStar Board, Taiwan 50 ETF and WALSIN

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1075.789	NA	0.000799	1.381292	1.391574*	1.385115
1	-1053.940	43.58712	0.000786	1.364839	1.405969	1.380131*
2	-1042.045	23.68339	0.000783*	1.361133*	1.433110	1.387892
3	-1035.093	13.81316	0.000785	1.363756	1.466580	1.401984
4	-1025.657	18.71664*	0.000785	1.363197	1.496868	1.412893

5.2.2 Granger Causality Test of HannStar Board, Taiwan 50 ETF and WALSIN

The Granger causality test of HannStar Board, Taiwan 50 ETF and WALSIN shows that when lagging two periods, HannStar Board and Taiwan 50 ETF are the Granger cause of each other and are endogenous variables (Table 5). Taiwan 50 ETF is the Granger cause of WALSIN. WALSIN is the Granger cause of HannStar Board. In other words, these two variables refuse to reject the information of each other. Therefore, we can proceed with the next step of investment simulations.

Table 5. Granger Causality Test of HannStar Board, Taiwan 50 ETF and WALSIN

Dependent variable: D(P5469)			
Excluded	Chi-sq	df	Prob.
D(P50)	10.09950	2	0.0064
D(P1605)	9.104602	2	0.0105
All	18.14123	4	0.0012
Dependent variable: D(P50)			
Excluded	Chi-sq	df	Prob.
D(P5469)	4.994850	2	0.0823
D(P1605)	1.152025	2	0.5621
All	8.048565	4	0.0898
Dependent variable: D(P1605)			
Excluded	Chi-sq	df	Prob.
D(P5469)	3.111109	2	0.2111
D(P50)	20.58868	2	0.0000
All	28.30917	4	0.0000

Note: Samples codes are the same as in Table 1.

5.3 EGARCH Model Estimation and News Impact Response

5.3.1 Estimation Results of EGARCH Model (Excluding WALSIN)

The model in this section does not include WALSIN and shows that all variables are significant at the 1% level where $\alpha = 1.458280$, $\beta = 0.865143$ and $\gamma = -0.234075$. This suggests that the leverage effect has greater impacts on psychological panicking reaction when there is bad news. The leverage effect from good news can be presented as: 1.224205 = (1.458280 - 0.234075). The leverage effect from bad news can be presented as: 1.692355 = (1.458280 + (-0.234075) * (-1) (Table 6).

Table 6. Estimation Results of EGARCH Model (Excluding WALSIN)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
@SQRT(GARCH)	-0.372128	0.030766	-12.09548	0.0000
P6116	-0.004633	0.002479	-1.868877	0.0616
P6191	0.492524	0.005446	90.44460	0.0000
P8110	0.267639	0.005704	46.92427	0.0000
P6173	-0.102232	0.002378	-42.98555	0.0000
P4919	0.187096	0.001350	138.5390	0.0000
P50	0.039990	0.000911	43.88554	0.0000
P2344	-0.148788	0.009148	-16.26409	0.0000
P2492	-0.078444	0.001497	-52.39310	0.0000
P3049	0.020748	0.003742	5.544330	0.0000
	Variance Equation			
C(11)	-1.406555	0.077633	-18.11796	0.0000
C(12)	1.458280	0.090918	16.03943	0.0000
C(13)	-0.234075	0.064198	-3.646144	0.0003
C(14)	0.865143	0.021562	40.12338	0.0000
R-squared	0.714064	Mean dependent var		13.49570
Adjusted R-squared	0.712406	S.D. dependent var		3.140465
S.E. of regression	1.684162	Akaike info criterion		2.133134
Sum squared resid	4402.094	Schwarz criterion		2.181119
Log likelihood	-1651.978	Hannan-Quinn criter.		2.150974
Durbin-Watson stat	0.029878			

The next step is to draw the news impact curve from the EGARCH results (excluding WALSIN) (Figure 2). The Figure shows that when the news impact is less than 0, the bad news impact curve is steeper and the good news impact curve is more flat. The results suggest that bad news will cause stock prices to become more volatile. That is, the sample without WALSIN faces greater risks.
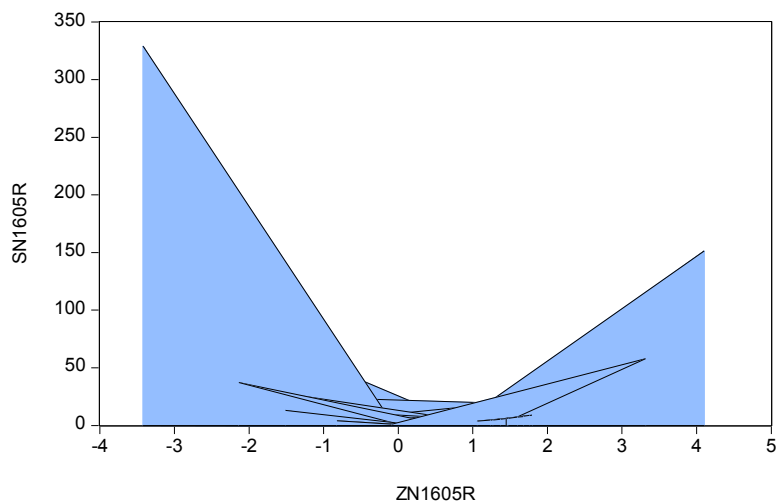
Figure 2. News Impact Curve Excluding WALSIN

5.3.2 Estimation Results of EGARCH Model (Including WALSIN)

The model including WALSIN is significant at the 1% level, where $\alpha = 1.252025$, $\beta = 0.814752$ and $\gamma = 0.167008$. The results show that the leverage effect does not have greater impacts on the psychological panicking reaction when there is bad news. The leverage effect from good news can be presented as: $1.419033 = (1.252025 + 0.167008)$. The leverage effect from bad news can be presented as: $1.085017 = (1.252025 + (0.167008) * (-1))$ (Table 7).

Table 7. EGARCH Model Results (Including WALSIN)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
@SQRT(GARCH)	0.265210	0.041131	6.447954	0.0000
P5469	-0.031578	0.005148	-6.134397	0.0000
P6116	0.034685	0.002614	13.26881	0.0000
P6191	0.269533	0.006918	38.95860	0.0000
P8110	0.182703	0.006454	28.30828	0.0000
P6173	0.182697	0.002466	74.09076	0.0000
P4919	0.076752	0.001439	53.33047	0.0000
P50	0.017471	0.001146	15.24369	0.0000
P2344	-0.067861	0.008920	-7.607506	0.0000
P2492	-0.007024	0.001391	-5.049683	0.0000
P3049	-0.034723	0.003713	-9.352007	0.0000
	Variance Equation			
C(12)	-1.434912	0.130201	-11.02077	0.0000
C(13)	1.252025	0.110015	11.38052	0.0000

C(14)	0.167008	0.058182	2.870434	0.0041
C(15)	0.814752	0.030797	26.45571	0.0000
R-squared	0.944651	Mean dependent var	10.28562
Adjusted R-squared	0.944294	S.D. dependent var	2.788817
S.E. of regression	0.658221	Akaike info criterion	1.147801
Sum squared resid	671.9774	Schwarz criterion	1.199214
Log likelihood	-881.4329	Hannan-Quinn criter.	1.166916
Durbin-Watson stat	0.086912		

Similarly, we can draw the news impact curve of EGARCH model (including WALSIN) (Figure 3). The Figure shows that when the news impact is less than 0, the bad news impact curve is more flat and the good news impact curve is steeper. The results suggest that good news will cause stock prices to become more volatile. That is, the sample with WALSIN faces lower risks.
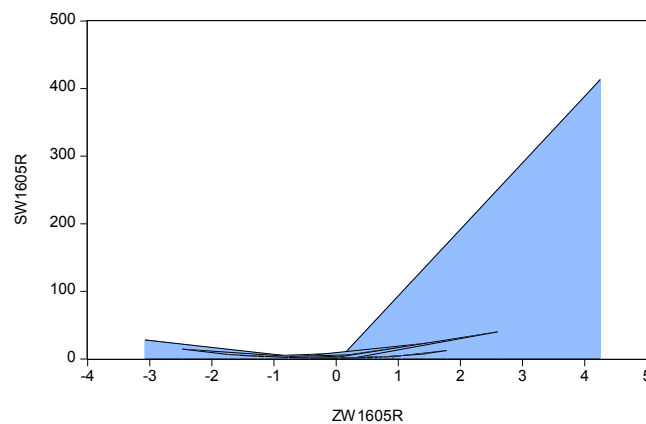

Figure 3. News Impact Curve Including WALSIN

5.4 Comparison of WALSIN's Trading Strategy and Investment Performance

This model is composed of the stock prices of the leading company and other individual stocks. That is, Data1 is individual stock prices. Data 2 is the prices of Taiwan 50 ETF. Data 3 is the stock prices of the leading company, which is WALSIN in model 1 and HannStar Board in model 2. The results suggest that in model 1, only one company reduces the investment returns in stage two. If the investment portfolio includes the ten WALSIN business group companies, the trading is profitable (Table 8). Between 27 September 2010 and 31 December 2013, the profit from the investment portfolio is $62.47. When the sample period is extended to 19 January 2017, the profit increases by $44.37 (50.35%), which is better than the overall market of 8.2%. The results show that this program trading is profitable.

118

Table 8. Investment Returns of Model 1 Where the Leading Company is WALSIN (Unit: Dollar, Times, %)

Company Code	2010.9.27-2013.12.31			2010.9.27-2017.1.19			Changes in Profits	Total Profits
	Net Profit	No. Transaction	of Winning Probability	Net Profit	No. Transaction	of Winning Probability		
P1605	-	-	-	-	-	-	-	
P5469	8.06	4	50	14.82	9	44	6.76	
P2492	8.33	13	69	6.94	39	38	-1.39	
P6116	11.68	11	54	14.14	27	51	2.46	
P6191	4.06	13	46	12.8	31	48	8.74	44.37
P2344	14.47	10	80	19.39	27	59	4.92	
P3049	10.93	10	40	17.92	18	38	6.99	
P8110	4.05	15	33	7.86	34	32	3.81	
P6173	0.89	12	50	10.19	30	16	9.3	

Note: The first stage covers the period 2010.9.27~2013.12.31. The second stage covers the period 2010.9.27~2017.1.19. Changes in profits cover the period 2013.12.31~2017.1.19.

The results show that only two companies in model 2 reduce investment returns in the second stage. If the investment portfolio includes ten WALSIN business group companies, the trading is profitable (Table 9). Between 27 September 2010 and 31 December 2013, the profit from the investment portfolio is $78. When the sample period is extended to 19 January 2017, the profit increases by $19.36 (21.97%), which is better than the overall market of 8.2% but worse than model 1 (50.35%). The results suggest that the model with WALSIN as the leading company is better than the model with HannStar Board as the leading company.

Table 9. Investment Returns of Model 2 Where the Leading Company is HannStar Board (Unit: Dollar, Times, %)

Company Code	2010.9.27-2013.12.31			2010.9.27-2017.1.19			Changes Profits	in Total Profits
	Net Profit	No. Transactions	of Winning Probability	Net Profit	No. Transactions	of Winning Probability		
P1605	5.23	3	100	8.75	9	60	3.52	
P5469	7.69	4	75	11.47	12	41	3.78	
P2492	7.55	16	50	5.65	45	33	-1.9	19.36
P6116	16.78	8	75	18.22	23	52	1.44	
P6191	-	-	-	-	-	-	-	
P2344	9.1	12	66	12.01	37	45	2.91	

119

P3049	12.97	15	40	9.1	28	35	-3.87
P8110	5	1	100	14.18	10	40	9.18
P6173	13.22	18	44	17.52	43	34	4.3

Note: The first stage covers the period 2010.9.27~2013.12.31. The second stage covers the period 2010.9.27~2017.1.19. Changes in profits cover the period 2013.12.31~2017.1.19.

6. Conclusion and Discussion on Investment Strategy

Researchers have different views on the impact of family businesses on the industry. For investors, they must understand business models of enterprise groups in order to enhance their trading performance. This study analyses the impact of WALSIN family business group on the industry and examines the influences of leading company on the related family business companies.

The news impact curve based on the EGARCH model (including the leading company WALSIN) shows that when the news impact is less than 0, the curve is more flat in the case of bad news. On the other hand, good news impact curve is steeper, suggesting that good news will cause greater volatilities in stock prices. That is, the risks are lower when WALSIN is included. The results suggest that including the leading company, WALSIN, in the investment portfolio is good for the stability of market trading.

Further, when including WALSIN and HannStar Board as the leading company in model 1 and 2, respectively and extending the examination period to 19 January 2017, the net profits increase by 50.35% and 21.97%, respectively. The increment is larger than the overall market of 8.2%. The results suggest that this program trading can lead to profits and model 1 is better than model 2. Therefore, investors can employ the property of leading company to enhance their trading performance in financial markets. Due to the space and time limit, future research could study the stocks of other family groups in Taiwan to conduct optimal back testing and run the simulations.

References

Alanyali1, M., Moat, H. S., & Preis, T. (2013). Quantifying the relationship between financial news and the stock market. *Scientific Reports*, *3*. https://doi.org/10.1038/srep03578

Bachelier, L. (1900). Theory of speculation. In P. H. Cottner (Ed.), *The Random Character of Stock Market Prices* (pp. 17-78). MIT Press.

Bae, K., Kang, J., & Kim, J. (2002). Tunneling or value added? Evidence from mergers by Korean business groups. *Journal of Finance*, *56*(6), 2695-2740. https://doi.org/10.1111/1540-6261.00510

Baek, J., & Kang, J. (2004). Corporate governance and firm value: Evidence from the Korean financial crisis. *Journal of Financial Economics*, *71*(2), 265-313. https://doi.org/10.1016/S0304-405X(03)00167-3

Balcilar, M., & Demirer, R. (2015). Effect of global shocks and volatility on herd behavior in an emerging market: Evidence from Borsa Istanbul. *Emerging Markets Finance and Trade*, *51*(1),

140-159. https://doi.org/10.1080/1540496X.2015.1011520

Banz, R. W. (1981). The relation between return and market value of common stocks. *Journal of Financial Economics*, *9*, 3-8. https://doi.org/10.1016/0304-405X(81)90018-0

Barberis, N., Shleifer, A., & Vishny, R. (1998). A model of investor sentiment. *Journal of Financial Economics*, *49*, 307-345. https://doi.org/10.1016/S0304-405X(98)00027-0

Bollerslev, T. (1986). Generalized autoregressive conditional heteroscedasticity. *Journal of Economics*, *31*, 307-327. https://doi.org/10.1016/0304-4076(86)90063-1

Cadsby, C. B. (1989). Canadian calendar anomalies and the capital asset pricing model. In R. M. C. Guimarães, B. G. Kingsman, & S. J. Taylor (Eds.), *A Reappraisal of the Efficiency of Financial Markets* (Vol. 54). NATO ASI Series (Series F: Computer and Systems Sciences), Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-74741-0_11

Cipriani, M., & Guarino, A. (2014). Estimating a structural model of herd behavior in financial markets. *The American Economic Review*, *104*(1), 224-251. https://doi.org/10.1257/aer.104.1.224

Conrad, J., & Kaul, G. (1989). Time-variation in expected returns. *Journal of Business*, *61*(4), 409-425. https://doi.org/10.1086/296441

Daniel, K., Hirshleifer, D., & Subrahmanyam, A. (2001). Overconfidence, arbitrage and equilibrium asset pricing. *Journal of Finance*, *56*, 921-965. https://doi.org/10.1111/0022-1082.00350

De Bondt, W. F. M., & Thaler, R. H. (1985). Does the stock market overreact? *Journal of Finance*, *40*(3), 793-805. https://doi.org/10.1111/j.1540-6261.1985.tb05004.x

De Long, J. B., Shleifer, A., Summers, L. H., & Waldmann, R. J. (1990). Noise trader risk in financial markets. *Journal of Political Economy*, *98*(4), 703-738. https://doi.org/10.1086/261703

Engle, R. F. (1982). Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation. *Econometrica*, *50*, 987-1008. https://doi.org/10.2307/1912773

Fama, E. F. (1965). The behavior of stock-market prices. *Journal of Business*, *38*(1), 34-105. https://doi.org/10.1086/294743

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *Journal of Finance*, *25*(2), 383-417. https://doi.org/10.2307/2325486

Fama, E. F., & French, K. R. (1988). Dividend yields and expected stock returns. *Journal of Financial Economics*, *22*(1), 3-25. https://doi.org/10.1016/0304-405X(88)90020-7

Finkelstein, S. (1992). Power in top management teams: Dimensions, measurement, and validation. *Academy of Management Journal*, *35*(3), 505-538. https://doi.org/10.2307/256485

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993). Risk management: Coordinating corporate investment and financing policies. *Journal of Finance*, *48*(5), 1629-1658. https://doi.org/10.1111/j.1540-6261.1993.tb05123.x

Granger, C. W. J. (1969). Investigating causal relations by econometric model and cross-spectral methods. *Econometrica*, *37*, 24-36. https://doi.org/10.2307/1912791

Granger, C. W. J. (1988). Some recent development in the concept of causality. *Journal of*

Econometrics, *39*, 199-211. https://doi.org/10.1016/0304-4076(88)90045-0

Jain, B. A., & Kini, O. (2000). Does the presence of venture capitalists improve the survival profile of IPO firms? *Journal of Business Finance and Accounting*, *27*(9-10), 1139-1183. https://doi.org/10.1111/1468-5957.00350

Jegadeesh, N., & Timan, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, *48*, 65-91. https://doi.org/10.1111/j.1540-6261.1993.tb04702.x

Johannisson, B., & Huse, M. (2000). Recruiting outside board members in the small family business: An ideological challenge. *Entrepreneurship and Regional Development*, *12*(4), 353-378. https://doi.org/10.1080/08985620050177958

Johnson, S. R., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2000). Tunneling. *American Economic Review*, *90*, 22-27. https://doi.org/10.1257/aer.90.2.22

Kim, W., & Wei, S. (2002). Foreign portfolio investors before and during a crisis. *Journal of International Economics*, *56*(1), 77-96. https://doi.org/10.1016/S0022-1996(01)00109-X

La Porta, R., Lopez-de-Silanes, F., & Shleifer, A., (1999). Corporate ownership around the world. *Journal of Finance*, *54*(2), 471-518. https://doi.org/10.1111/0022-1082.00115

Lakonishok, J., & Smidt, S. (1988). Are seasonal anomalies real? A ninety-year perspective. *Review of Financial Studies*, *1*(4), 403-425. https://doi.org/10.1093/rfs/1.4.403

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1992). The impact of institutional trading on stock prices. *Journal of Financial Economics*, *32*(1), 23-43. https://doi.org/10.1016/0304-405X(92)90023-Q

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. *Journal of Finance*, *49*(5), 1541-1578. https://doi.org/10.1111/j.1540-6261.1994.tb04772.x

Lan, Y., Lin, D., & Lin, L. (2014). How to invest safely in emerging markets during the global financial crisis: A case study of Taiwan. *Global Journal of Management and Business Research*, *14*(4 Version 1.0), 29-41.

Lan, Y., Lin, D., & Lin, L. (2017). The investment strategy of Taiwan futures market after quantitative easing monetary policy. *Archives of Business Research*, *5*(3), 262-278. https://doi.org/10.14738/abr.53.2966

Poterba, J. M., & Summers, L. H. (1988). Mean reversion in stock prices: Evidence and implications. *Journal of Financial Economics*, *22*(1), 27-59. https://doi.org/10.1016/0304-405X(88)90021-9

Reilly, F. K., & Hatfield, K. (1969). Investor experience with new stock issues. *Financial Analysts Journal*, *25*(5), 73-80. https://doi.org/10.2469/faj.v25.n5.73

Rouwenhourst, G. (1998). International momentum strategies. *Journal of Finance*, *53*, 267-284. https://doi.org/10.1111/0022-1082.95722

Samulson, P. (1965). Proof that properly anticipated prices fluctuate randomly. *Industrial Management Review*, *6*, 41-49.

Shiller, R. J. (1979). The volatility of long-term interest rates and expectations models of the term

structure. *Journal of Political Economy*, *87*(6), 1190-1219. https://doi.org/10.1086/260832

Shiller, R. J. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? *American Economic Review*, *71*, 421-498.

Shiller, R. J. (1981). The use of volatility measures in assessing market efficiency. *Journal of Finance*, *36*(2), 291-304. https://doi.org/10.1111/j.1540-6261.1981.tb00441.x

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, *48*, 1-48. https://doi.org/10.2307/1912017

Wermers, R. (1999). Mutual fund herding and the impact on stock prices. *Journal of Finance*, *54*(2), 581-622. https://doi.org/10.1111/0022-1082.00118

William, G. C., & Huang, R. D. (1995). Following the Pied Piper: Do Individual Returns Herd around the Market? *Financial Analysts Journal*, *54*(4), 31-37.

Williams, L. (1999). *Long-Term Secrets to Short-Term Trading*. John Wiley & Sons, Inc.

Notes

Note 1. Harvard Business Review (the global Chinese edition), May 2017, "Family asks: Are professional managers trust worthy?"

Note 2. Unique Business Weekly (2015/11/27), issue 1016, "Market trend during account settlement of enterprise group" (http://www.ettoday.net/news/20120218/25765.htm).

Note 3. This model solves the non-linear relationship in the variance of financial data that changes over time and the high kurtosis and fat tail volatility clustering problem.

Note 4. As some variables of the EGARCH model (exclusive of gbm (6191)) are not significant, we do not conduct chart analyses.

Appendix 1

Members of WALSIN Family Group

Company (Code)	Chairman	Going public	Share capital (hundred million)	Stock price ($)	Market value (million)	Main products
WALSIN (1605)	JIAO, YOU LUN	1972	339.6	13.75	46695	bare copper wire, stainless steel coil, sticks, cable
HannStar Board (5469)	JIAO, YOU HENG	2001	45.04	16.9	7612	printed circuit board, EMS
Walsin Technology (2492)	JIAO, YOU HENG	2001	51.8	56.6	29319	laminated capacitors, chip resistance
HannStar (6116)	JIAO, YOU QI	2001	323.39	8.13	26292	TFT-LCD
gbm (6191)	JIAO, YOU HENG	1991	53.15	12.1	6432	PCBA, printed circuit board

Winbond (2344)	JIAO, YOU JUN	1995	358	17.2	61576	DRAM, non-DRAM memory, logic products
HannsTouch (3049)	MA, WEI XIN	2002	73.69	9.99	7362	touch products
Walton Advanced Engineering (8110)	JIAO, YOU HENG	2006	48.28	14.4	6952	semiconductor package and test
PSA (6173)	JIAO, YOU HENG	2002	18.51	24.8	4591	chip capacitors, resistance, dielectric powder, coil
Nuvoton (4919)	JIAO, YOU JUN	2010	20.76	42.85	8894	general IC, wafer foundry

Note: Stock prices are as at 2017.4.21. MA, WEI XIN is the wife of JIAO, YOU QI.

Source: XQ World Winners.