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AGGREGATE FACTOR, SECTORAL FACTOR AND TAIWANESE STOCK RETURN

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Abstract. This paper explores the nature of Taiwanese stock return fluctuation from 1992-2013. We employ a dynamic latent factor model that decomposes stock return fluctuations into aggregate, sectoral and granular components. In the full sample period we find that the aggregate factor contributes 45 percent of the stock return volatility, whereas the granular factor on average accounts for another 45 percent of stock return variation. When sub-sample analysis is executed, we again fail to reject the importance of aggregate and granular factors. These results are closer to the aggregate (and granular) paradigm rather than the sectoral paradigm.

INTRODUCTION

Understanding stock price behavior is fundamental to understanding capital market operation. Exploring the behavior of stock prices and identifying the factors that affect their dynamics have important implications for central bank policy makers and businesses. For stock market participants deeper and better understanding of the individual stock level dynamics within a newly industrialized economy (NIE), such as Taiwan, can provide useful policy implications for investment strategies.

In theory, the value of a stock is equal to the sum of discounted expected future cash-flows (Campbell and Shiller, 1988; Campbell, 1991). These discounted cash-flows reflect economic conditions (interest rates, economic growth, inflation, stock market development and investor sentiment). Empirical evidence from investigating the influence of factors on stock prices, returns and volatilities is abundant, thus far consensus has not yet been reached. For details about previous studies, see the work of Lucas (1978), Chen and Ross (1986), Campbell and Shiller (1988), Fama and French (1988, 1992, 1993), Campbell (1991), Bekaert and Harvey (1997), De Santis and Imrahoroglu (1997), Caner and Onder (2005), Degiannakis and Floros (2013), Gupta and Modise (2013), Canepa and Ibnrubbian (2014), Chang et al. (2014), Yuan and Gupta (2014), Aissia (2015), Huang et al. (2015), Hung et al. (2015), Quayes and Jamal (2015) provided in-depth information on the theoretical and empirical aspects regarding the source of stock return fluctuation.

A decomposition exercise will help us to further understand the stock return generating process over time given that a variety of factors influence the stock market. This study constructs a dynamic latent factor model to decompose stock returns into aggregate, sector-specific and individual-specific factors. A large volume of works in the literature show that aggregate factors, such as monetary policies, oil prices and consumer confidence, have significant effects on stocks. For example, Thorbecke (1997) and Bernanke and Kuttner (2004) both found a significant relation between monetary policies and stocks in the United States. O'Neil et al. (2008) found that the oil price and the stock returns were negatively correlated for the U.S., UK and France. Park and Ratti (2008) detected a similar result for U.S. and twelve European oil importing countries. Statman and Fisher (2002) and Chen (2011) found a significant impact on consumer confidence in stock returns.

In contrast, relatively a few attempts have been made to study sector-specific factors behind stock return fluctuation. A wide range of factors, including capital structure, mode of production and government policy, contribute to distinct patterns in sectoral stock dynamics. For example, the automobile sector relies heavily on energy and steel materials, therefore energy and steel prices certainly have significant influence on the automobile sector, but may not be so significant in other sectors. Some policies or legislation are related specifically to a sector and hence will

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significantly affect that particular sector but not others. For example, opening-up traffic would have considerable effect on the transportation sector; the "electronic paper" trend may influence the paper and pulp sector and food safety scandals may affect the food sector.

Another stream of literature has explored the individual-specific factors that explain the sources of fluctuations in stock returns. Xavier (2011) recently emphasized that modern economies are dominated by large firms and idiosyncratic firm-level shocks can lead to nontrivial aggregate movements. Xavier (2011) suggested that "granular" (rather than aggregate) shocks might account for GDP fluctuations. The granular (individual-specific) factor, for instance M&A (mergers and acquisitions) will evidently affect the two firms involved; the release of a novel technology or product may stimulate a firm's prospects and naturally its stock price.

This paper extends the extant literature into two important dimensions. First of all, how much on average could these three factors explain the stock fluctuation over the entire market? Secondly, how could these three factors provide for the fluctuation change over time? In comparison with other methodologies, such as vector auto-regressions (VARs), structural vector autoregression (SVAR) model, generalized autoregressive conditional heteroskedasticity (ARCH/ GARCH) model, the dynamic factor model has two main advantages. First, it is able to handle a large number of dynamic factors. Second, the dynamic factor model works well with a large cross section of data (Kose et al., 2003, 2008). Kose et al. (2003, 2008) showed that the dynamic latent factor model has the distinctive advantage to simultaneously characterize contemporaneous shock spillovers as well as the dynamic propagation of business cycles without a priori restriction on the directions of spillovers or the structure of the propagation mechanism. The Bayesian techniques for estimating the dynamic latent factor model have the advantage of straightforward measure posterior coverage interval for parameter functions

This paper is organized in the following way. Section 2 reviews the relative literature and develops the hypotheses. Section 3 provides the specifications for the dynamic latent factor model. Section 4 reports the empirical results. Section 5 synthesizes the key elements of this paper.

LITERATURE REVIEW AND DEVELOPMENT OF HYPOTHESES

Aggregate-Factor Hypothesis

Economy-wide shocks (e.g. oil shocks, monetary policy and investor sentiment) are no doubt important. In the literature most studies found a significant effect between oil price shocks and stocks, not only in the industries that need crude oil as production input, but in most industries. Bernanke (1983) and Pindyck (1991) claimed that changes in oil price create uncertainty about future production costs, income and economic growth. Firms may postpone irreversible investments to obtain short-run profits, and in this way, oil price fluctuations may influence stock returns. The sources of oil price shocks, the effect on inflation, the degree of dependence on oil imports and the oil-related sectors are the relevant factors between the oil price and the stock returns. Sadorsky (1999) and Papapetou (2001) found a negative relation between oil price shocks and aggregate stock returns in the U.S. and Greece. Kilian and Park (2009) indicated that the relationship between oil price shocks and stock prices is based on the effect on the final demand for goods and services. Wang et al. (2013) recently showed that positive aggregate and precautionary demand leads to a higher degree of co-movement among stock markets in oil-exporting countries than in oil-importing countries. The oil price significantly influences economic output performance for an oil exporting country, thereby strongly affecting its stock market. In contrast, Apergis and Miller (2009) found no significant effect between structural oil price shocks and stock prices in developed countries.

The literature also indicated that stock returns are affected by the monetary policy. The main theoretical mechanism for the monetary policy impact on stock returns is the balance sheet channel and the bank lending channel (Bernanke and Gertler, 1989; 1990; 1995; Thorbecke, 1997). The balance sheet channel emphasizes that a tight monetary policy shock increases the information and agency costs associated with external finance and decreases the value of the firms' assets that act as collateral for new loans. This decreases access to bank loans and external finance in general, forcing the firm to decrease its level of investment and ultimately reduces cash flow and stock returns. In contrast, the bank lending channel emphasizes that a tight monetary policy shock causes banks to simultaneously decrease the supply of loans and charge higher interest rates for new loan contracts, causing a decline in firms' cash flows and stock returns. As a result, from both channels a tight monetary policy has a negative impact on firm cash flow. A number of empirical studies have found that monetary policy actions have a significant impact on stock market returns (Patelis, 1997; Rigobon and Sack, 2003; Gali and Gambetti, 2015; among others). For example, Hussain (2011) utilized high frequency data to investigate whether the return and volatility of major U.S. and European equity indices will respond to monetary policy announcements. The results show that new monetary policy decisions significantly influence the stock index return and volatility, both in European and U.S. markets.

The classical theory indicates that competition among rational investors will result in an equilibrium in which prices equal the rationally discounted value of expected cash flows. Even if some investors are irrational, classical theory emphasizes that their

demands are offset by arbitrageurs, counteracting the effect of irrational investors on prices. Despite practical effective factors, the mental condition of the society is also significantly relative to stock returns. Baker and Wurgler (2006) explored how investor sentiment affects the cross-section of stock returns. They argued that investor sentiment has a significant impact on stock returns in two distinct channels. In the first channel the sentiment drives the propensity to speculate among investors. Thus, the subjectivity of unsophisticated investors value stocks from much too low to much too high. The second channel emphasizes that the difficulty of arbitrage varies across stocks but sentiment is generic. A number of researches have shown that arbitrage tends to be particularly risky and costly for young, extreme growth, or distressed stocks. In other words, those stocks that are the hardest to arbitrage also tend to be the most difficult to value. Baker and Wurgler (2006) constructed a composite proxy for investor sentiment (including the closed-end fund discount, NYSE share turnover, number and first-day returns of IPOs, and the dividend premium) and also employed an orthogonalized index that eliminates potential systematic risk factors due to macroeconomic fundamentals. They found significant predictive capacity for both indices for stock selections (such as small stocks, young stocks, high volatility stocks, non-dividend-paying stocks, extreme growth stocks).

Using consumer sentiment as a proxy for individual investor sentiment, Schmeling (2009) found significant negative correlations to market-wide returns for a sample of 18 industrialized countries. In contrast, Kling and Gao (2008) found causation from Shanghai stock market returns on sentiment but not vice versa. Based on the results from the above work, we propose:

H_1: Aggregate factors, such as monetary policy, oil price and investor sentiment partly explain the fluctuations in stock returns fluctuation in Taiwan.

Segmented Sectoral Factor Hypothesis

The stock market is not a monolithic entity composed of perfectly uniform sectoral markets. Little attention has been given to the notion that a number of factors, including the dynamics of industry specialization, capital structure, mode of production and government policy contribute to the distinct patterns in sectoral stock return fluctuation. A few studies have found that the nature and sensitivity of stock return reaction to oil price shocks change considerably across sectors. For example, Lee et al. (2012) investigated the relationship between stocks and oil prices in the G7 countries. They found that stock returns were affected by oil price shocks mostly in the information technology and the consumer staples sectors, followed by the financial, utilities and transportation sectors. Ratti and Hasan (2013) investigated the interaction between oil prices and Australian stock returns. They investigated the oil price effect on different stock sectors and concluded that the result is mostly ascribed to the overall indices, except for the energy and material sectors. The material and consumer staples sectors' stock price variables are affected mostly by the oil price variables, with the transportation, financial, energy, health care, utilities, information technology and telecommunication sectors, with the consumer discretionary sector excluded. Degiannakis et al. (2013) found that the correlation level between oil price changes and sector indices differed over different industries, and moreover, over time. They concluded that both the cause of the oil shock and the type of industry significantly affected the correlation level between oil price changes and sector indices in a specific industry.

In spite of the energy factors, some studies pointed out that official policy has an effect on specific stock sectors. For example, Akella and Chen (1990) indicated that long-term U.S. government security return and innovation are positively associated with bank stock return. Evrensel and Kutan (2007) studied the daily financial sector stock returns in Indonesia, Korea and Thailand during the Asian crisis. They found that the IMF's program negotiation and approval news increased the stock returns in Indonesia and Korea, while only program approval was significantly related to high returns in Thailand. Given the fact that these different market sectors might have fundamental distinguishing economic characteristics, this study proposes the following:

H_2: The segmented sectoral-factor plays an important role behind the heterogeneous nature of stock market return fluctuation.

Granular (Individual-Specific) Hypothesis

Based on the individual-specific perspective, Several studies explored the relationship between new product announcement, dividend policies and lawsuits with stock price performances based on the individual-specific hypothesis. Paul et al. (1997) found that the preannouncements (rather than announcement) about new products have a significantly positive effect on stock prices, but the signaling effect is sectoral-specific. Lei et al. (2013) found the degree of effect to be negatively related to the branding capability. They speculated the reason for this phenomenon is that people may have higher expectations of famous brands. Mark et al. (1984) presented evidence that stock prices have a positive reaction to stock dividend and stock split announcements and the reaction was found to be larger for stock dividends than for stock splits. Adam and Stephen (2001) found that the stock market has a large and statistically significant negative reaction to revelations of potential fraud, but a smaller reaction to the filing of a lawsuit and no significant reaction to the outcome of litigations.

Despite individual impacts, Xavier (2011) argued that individual firm shocks do not average out in the aggregate if the distribution

of firm sizes is fat-tailed. He further showed that the idiosyncratic movements of the largest 100 firms in the U.S. contribute about one-third of the variation in output growth. That is, if a considerably large firm encounters some fact that is influential to its performance, the effect may also spread over the whole economy. Based on the granular (individual-specific) hypothesis, we propose:

H_3: The granular (individual-specific) disturbances stimulate heterogeneous behavior among stock returns and play a dominant role in driving the stock return generating process.

The current studies on this literature review considered a variety of factors that influence stock market returns. We can see that these researches focused on whether a factor would or would not impact the stock market and examined how significant the effect and whether the effect differed over different industries. The literature, however, has largely ignored the latent-side dynamics behind large stock return fluctuations. No detailed study on whether stock return fluctuations are associated with aggregate, sectoral or individual-specific shocks has been conducted. This study is valuable for its insights in understanding the stock market return generating process over time, and also for its important implications about efficient portfolio diversification. Motivated by the gap in the existing literature, this paper is based on an overall level, investigating to what degree could the aggregate, sector-specific and individual-specific factors interpret stock return fluctuations, and moreover, whether the degree of interpretation will differ over time.

METHODOLOGY

Following Kose et al. (2003, 2008), the dynamic latent factor model is constructed as

$$y_t^{i,j,k} = \beta_{aggregate}^{i,j,k} f_t^{aggregate} + \beta_{\text{sector}}^{i,j,k} f_t^{\text{sector}} + \varepsilon_t^{i,j,k} \quad (3.1)$$

Let $y_t^{i,j,k}$ denote the stock return for i^{th} observable in the sector j (j = 1,…,19) of firm k from year t. The aggregate factor, $f_t^{aggregate}$, is common across all K = 137 firms stock return. The sectoral factors, f_t^{sector}, (j = 1,…, 19), are common to the sector in each of J = 19 specific sectors. The $\beta_{aggregate}^{i,j,k}$ and $\beta_{\text{sector}}^{i,j,k}$ are called factor loads and compute the sensitivity of an individual granular stock return to the latent factors, such as the aggregate and sectoral components. Finally, $\varepsilon_t^{i,j,k}$ is the idiosyncratic granular-specific allocation component of the i stock return rate. Each granular - specific component follows an AR(p) process. Following Kose et al. (2008), we restrict them to be AR(3) for each factor and idiosyncratic term. Since the stock return rate is measured on the monthly level, this should capture most spillovers, either contemporaneous or lagged, across sectors.

Following Otrok and Whiteman (1998) and Kose et al. (2003, 2008), this paper employs Bayesian techniques with data augmentation to estimate the model. The Bayesian procedure has an advantage in dealing with large cross sections of data and a large number of factors in dynamic factor models. Based on successively drawing from a series of conditional distributions using a Markov chain Monte Carlo (MCMC), the Bayesian estimation entails simulating draws from the posterior distribution for the model parameters and factors. The posterior distribution properties for the model parameters and factors are based on 200,000 MCMC replications after 20,000 burn-in replications.

In the following step we employ variance decompositions to compute the relative contributions of the aggregate, sectoral-specific and granular-specific factors to stock return fluctuations. With orthogonal factors the variance in the stock return for the observable $y_t^{i,j,k}$ can be expressed as follows:

$$Var(y_t^{i,j,k}) = (\beta_{aggregate}^{i,j,k})^2 Var(f_f^{aggregate}) + (\beta_{\text{sector}}^{i,j,k})^2 Var(f_t^{\text{sector}}) + Var(\varepsilon_t^{i,j,k}) \quad (3.2)$$

In the final step the fraction of the volatility attributable to the aggregate factor can be measured as

$$(\beta_{aggregate}^{i,j,k})^2 Var(f_t^{aggregate}) / Var(y_t^{i,j,k}) \quad (3.3)$$

The proportions of the total variability in firm size i stock return attributable to the sectoral and granular component are defined similarly.

DATA AND EMPIRICAL RESULTS

Data and basic statistics

The unique monthly sectoral stock return dataset over the period 1992-2013 are drawn from the Taiwan Economic Journal (TEJ) Data Bank. The unique TEJ feature is its longitudinal source data that permits us to explore the time-series behavior of the stock return into aggregate, sector-specific and granular-specific shocks. The monthly data breakouts by the nineteen major sectors: Chemical, Cement, Semiconductor, Finance, Construction, Food, Plastic, Textile, Shipping and Transportation, Paper and Pulp, Trading and Consumers' Goods, Electronic Parts, Electrical and Cable, Electric Machinery, Other Electronic, Rubber, Steel and Iron, Tourism, and Other.

TABLE 1a
SUMMARY STATISTICS FOR STOCK RETURN IN TAIWAN, 1992-2013

Mean	Std. dev.	Mini.	Max.	Mean	Std. dev.	Mini.	Max.
Chemical				**Finance**			
-0.7	12.1	-42.2	43.9	-0.1	11.6	-28.8	52.2
0.2	13.1	-50.3	66.0	0.0	12.8	-30.8	54.9
0.2	8.6	-35.0	30.4	-0.3	11.9	-53.7	51.1
0.7	14.0	-48.1	59.8	**Construction**			
0.3	12.7	-47.6	45.2	0.1	14.1	-110.4	41.3
0.2	12.1	-42.8	54.4	-0.2	20.3	-69.0	132.3
0.0	12.4	-37.1	46.8	-1.4	17.5	-56.1	51.9
0.3	10.7	-31.2	61.6	0.1	11.6	-41.0	35.8
0.1	16.2	-49.2	90.9	0.0	12.8	-49.1	35.7
Cement				-0.7	17.0	-72.8	79.0
0.5	11.8	-48.4	55.1	0.0	16.0	-74.4	49.1
0.6	10.0	-34.6	31.0	0.2	14.0	-44.4	73.2
-0.1	10.6	-45.1	29.9	**Food**			
0.4	9.9	-27.0	45.2	0.3	14.2	-77.5	59.3
-0.4	11.0	-28.3	37.9	0.6	9.7	-38.1	35.9
-0.2	7.7	-23.4	34.9	-0.2	14.0	-51.7	95.1
Semiconductor				0.2	10.0	-31.8	31.4
-0.4	14.6	-60.0	47.9	1.0	8.8	-28.6	35.5
-1.2	16.9	-50.5	62.5	-0.2	11.3	-35.7	65.4
0.8	12.7	-41.9	54.9	-0.1	12.7	-36.5	43.1
1.3	14.2	-45.0	58.3	0.0	10.6	-33.2	37.7
0.3	18.3	-71.1	88.6	-0.4	11.3	-36.3	53.5
Other				0.3	15.3	-89.7	67.1
-0.6	14.5	-62.3	50.5	0.3	11.9	-35.9	37.8
-0.2	14.7	-49.7	55.9	0.2	14.2	-41.4	45.4
-0.6	21.4	-67.5	83.8	**Plastic**			
-0.5	17.5	-49.6	102.3	1.0	9.2	-25.3	45.3

1.2	10.8	-38.9	34.9	1.0	9.9	-31.2	38.2
0.5	10.0	-42.9	44.5	0.5	13.8	-42.5	48.5
-0.6	21.5	-85.9	89.1	0.0	16.0	-52.2	61.6
0.6	11.7	-44.8	58.9	0.4	12.4	-34.6	46.4
1.3	10.4	-39.8	49.6	0.6	14.5	-43.5	57.3
Other Electronic				-0.1	14.6	-38.7	50.6
0.4	13.4	-36.6	62.7	0.3	14.6	-45.0	57.8
2.0	12.4	-45.7	58.5	0.1	15.7	-43.4	53.0
-0.2	13.5	-48.8	60.9	0.3	14.1	-39.5	44.7
0.5	12.6	-46.9	49.8	0.1	15.2	-51.2	66.8
				1.1	10.1	-29.6	42.0

TABLE 1b
SUMMARY STATISTICS FOR STOCK RETURN IN TAIWAN, 1992-2013

Mean	Std. dev.	Mini.	Max.	Mean	Std. dev.	Mini.	Max.
Textile				**Electronic Parts**			
0.7	11.9	-37.5	38.3	1.6	11.2	-45.9	32.1
-0.1	15.0	-46.3	68.3	0.4	14.9	-50.0	50.6
-0.3	14.3	-64.9	49.1	0.3	14.3	-49.5	41.4
-0.9	15.9	-47.5	75.0	**Electrical and Cable**			
-0.6	17.1	-58.6	77.8	-0.1	13.9	-59.6	46.3
-0.2	16.9	-51.4	107.0	-0.2	12.5	-32.6	48.5
-0.2	12.2	-52.5	36.3	0.0	11.2	-41.4	40.3
-0.5	15.5	-64.7	59.0	-0.1	11.3	-42.6	53.2
0.0	14.2	-39.8	49.5	0.0	11.2	-31.2	93.3
-0.6	12.3	-38.8	43.5	0.2	10.4	-36.2	36.3
0.6	8.9	-20.1	33.0	**Electric Machinery**			
-0.4	13.0	-48.3	54.5	0.2	9.0	-23.4	34.4
0.3	12.2	-41.9	46.2	0.4	9.6	-31.9	45.0
-0.8	17.3	-51.0	94.6	-0.6	14.5	-83.0	51.2
-0.6	14.0	-38.3	47.2	0.6	9.9	-32.6	32.4
0.1	14.4	-43.8	55.7	**Rubber**			

-0.2	11.4	-29.7	40.8	0.2	13.6	-52.4	51.3
-0.2	13.7	-82.2	52.0	0.8	12.3	-45.8	44.1
0.2	14.1	-43.2	49.6	0.5	12.3	-32.2	64.8
Shipping and Transportation				1.2	11.0	-38.0	47.8
0.3	11.5	-45.1	45.1	1.0	12.6	-36.4	53.2
0.5	10.8	-31.8	38.0	0.6	10.6	-27.2	29.7
0.9	10.9	-49.8	40.1	**Steel and Iron**			
0.0	13.9	-40.8	70.6	0.8	8.2	-21.3	38.8
0.3	13.2	-37.5	67.0	0.3	10.2	-45.3	33.3
Paper and Pulp				-0.9	17.2	-65.1	87.6
-0.4	14.7	-47.4	60.6	-0.3	14.4	-73.8	42.9
-0.1	13.2	-37.2	67.6	-0.1	13.9	-37.9	62.3
0.2	10.0	-26.1	28.0	0.1	8.7	-24.9	31.5
-0.1	13.9	-44.1	51.7	-0.2	13.1	-43.5	64.6
-0.3	14.8	-41.8	81.8	0.3	12.8	-121.5	57.6
0.2	10.4	-31.2	41.1	**Tourism**			
0.1	11.2	-29.4	36.5	0.0	11.0	-30.2	43.0
Trading and Consumers' Goods				-0.2	13.5	-31.4	53.1
-0.2	12.6	-58.9	47.1	0.0	12.4	-33.5	56.9
0.5	11.9	-35.3	44.7	-0.3	14.8	-47.4	47.7
0.3	11.9	-39.4	39.6	0.2	11.9	-104.6	58.0
0.5	9.5	-29.3	60.1				
-0.1	16.5	-46.7	67.2				
0.7	10.4	-41.7	30.3				

Table 1 reports a summary of the statistics for the sectoral stock returns from 1992 to 2013. A key feature of the data is the high magnitude of stock return fluctuation. For example, the stock returns range from roughly 90.9 to -50.3 percent per month in the Chemical sector. Another prominent feature of the data is the stock return divergence within the sectors, with the exception of Shipping and Transportation, Electronic Parts and Rubber. For example, the stock return rate averaged 1.3 percent for the fourth Semiconductor firm, compared to -1.2 percent for the second firm. The different stock return rates across firms indicate that there is a substantial heterogeneity in the stock return change direction among firms within the same sector. In a given year many firms increase employment while other firms in the same sector experience stock return contraction. The typical pattern for Electronic Parts performance entails considerable homogeneity in the firm-level stock return change and the first firm exhibits the highest stock return.

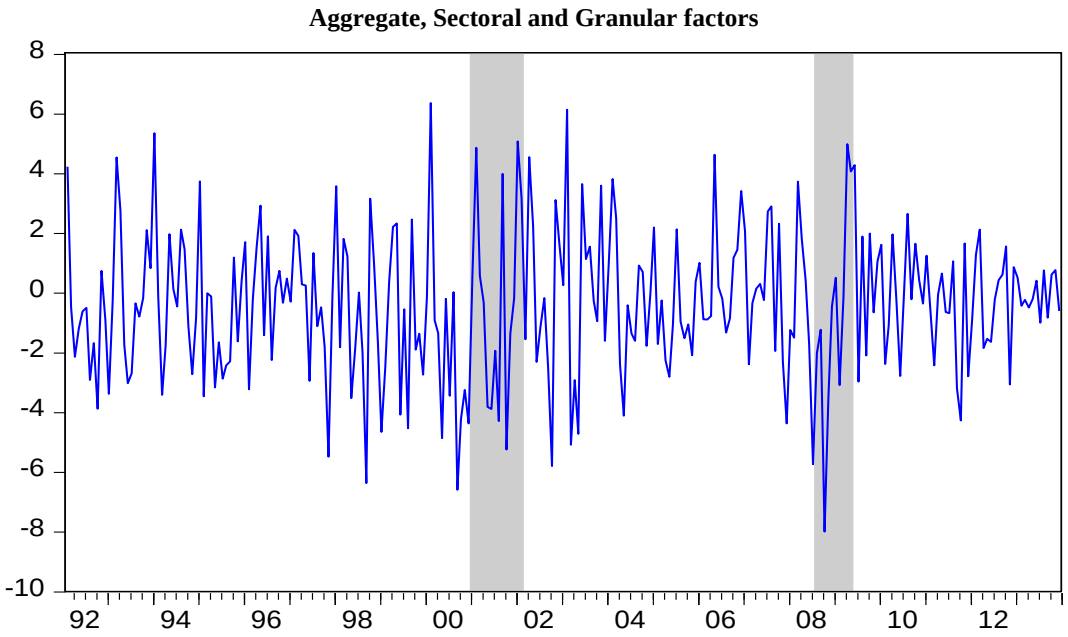

Figure 1. Aggregate component for stock return in Taiwan, 1992-2013. The blue lines depict the mean for the posterior distributions for the aggregate component. The shaded area represents recession.

Figure 1 displays the posterior mean for the aggregate factor, 0.05 and 0.95 posterior quantiles for the estimated factor. We explore how the aggregate factor matches up with the recession period (shaded area). The aggregate factor reflects the major economic recession over the 1992-2013 periods; encompassing the early 2000s recession and the beginning of the latest financial crisis.

TABLE 2a
LOADINGS ON THE AGGREGATE COMPONENT FOR STOCK RETURN IN TAIWAN, 1992-2013

Mean	Std. dev.	Mini.	Mean	Std. dev.	Mini.
Chemical			**Finance and Insurance**		
0.4084	0.0629	0.8272	3.4149	3.1238	3.7198
3.2202	2.8298	3.6268	3.7103	3.3891	4.0387
1.9362	1.6656	2.2145	2.9134	2.5657	3.2702
3.8850	3.5152	4.2760	**Building Material and Construction**		
3.5644	3.2204	3.9128	2.6534	2.1713	3.1315
3.3504	3.0144	3.6991	3.4479	2.7772	4.1058
3.9008	3.6159	4.2028	3.0150	2.4351	3.6123
2.7587	2.4351	3.1027	3.1611	2.8415	3.4865
4.6121	4.1969	5.0395	3.8691	3.5602	4.1922
Cement			3.7087	3.1996	4.2325
3.0666	2.7576	3.3872	3.5625	3.0537	4.0822

2.4235	2.1504	2.7058	4.1204	3.7522	4.5179
2.9657	2.6908	3.2530	**Food**		
2.4067	2.1078	2.7242	3.3138	2.8764	3.7602
3.0066	2.6805	3.3298	2.5068	2.2304	2.7874
1.8875	1.6542	2.1293	2.6206	2.1774	3.0798
Semiconductor			2.8235	2.5614	3.0939
4.4292	4.0582	4.8091	2.3225	2.0488	2.6103
2.0066	1.2801	2.7295	3.1564	2.8494	3.4801
2.4584	2.0806	2.8534	3.7143	3.3979	4.0466
3.0408	2.6251	3.4668	2.8601	2.5867	3.1434
2.6671	2.0471	3.2883	2.5142	2.1685	2.8705
Other			2.4805	1.9719	2.9979
2.1268	1.6070	2.6564	3.9687	3.7062	4.2555
2.5253	2.0042	3.0565	4.0343	3.6490	4.4310
2.7369	2.0115	3.4674	**Plastic**		
4.9910	4.5309	5.4622	2.1814	1.9108	2.4645
2.8114	2.4870	3.1460	2.4845	2.1728	2.8045
2.6089	2.3139	2.9072	3.6355	3.3137	3.9729
3.3365	2.6266	4.0718	3.9285	3.5296	4.3363
3.4908	3.1844	3.8187	3.0483	2.6701	3.4330
0.5767	0.0741	1.0565	3.1773	2.8222	3.5505
Other Electronic			3.6765	3.3344	4.0303
2.8783	2.4801	3.2851	3.2752	2.8819	3.6781
1.8909	1.4683	2.3189	4.2768	3.9116	4.6577
3.6215	3.2442	4.0112	3.8413	3.5034	4.1888
2.2432	1.8303	2.6650	4.5118	4.1458	4.8981
			2.2764	1.9577	2.6082

TABLE 2b
LOADINGS ON THE AGGREGATE COMPONENT FOR STOCK RETURN IN TAIWAN, 1992-2013

Mean	0.05	0.95	Mean	0.05	0.95
Textile			**Electronic Parts/Components**		
3.2975	2.9565	3.6516	1.9713	1.6031	2.3490
4.3604	4.0170	4.7222	2.8410	2.3852	3.3063
4.1329	3.7263	4.5529	3.0517	2.6216	3.4807
4.6496	4.2874	5.0238	**Electrical and Cable**		
4.8547	4.4259	5.2998	3.9396	3.5555	4.3417
4.6259	4.2039	5.0617	3.1903	2.8096	3.5796
3.1514	2.7825	3.5307	3.4479	3.1463	3.7626
3.9800	3.5372	4.4287	3.5559	3.2687	3.8545
3.9758	3.5740	4.3910	3.2603	2.9610	3.5752
3.5522	3.2442	3.8661	2.6466	2.3536	2.9468
2.7508	2.5112	3.0015	**Electric Machinery**		
3.0700	2.6620	3.4928	2.6467	2.4208	2.8866
3.6501	3.3574	3.9524	2.8924	2.6361	3.1560
3.9078	3.4108	4.4297	3.0563	2.5812	3.5400
3.8420	3.4783	4.2229	2.8512	2.5772	3.1398
3.9535	3.6061	4.3225	**Rubber**		
2.7036	2.3717	3.0491	4.0539	3.7040	4.4265
2.8168	2.3371	3.2944	3.6449	3.3354	3.9712
3.7526	3.3782	4.1389	3.3099	2.9378	3.6899
Shipping and Transportation			2.4375	2.1166	2.7785
2.7541	2.4008	3.1166	2.9686	2.6066	3.3424
2.8425	2.5391	3.1585	2.6810	2.3554	3.0168
2.7782	2.4613	3.1050	**Steel and Iron**		
3.8754	3.4823	4.2878	1.9512	1.6921	2.2197
3.7263	3.3748	4.1002	2.6912	2.4033	2.9924

Paper and Pulp			4.5239	4.0617	5.0046
4.8261	4.5121	5.1691	3.3174	2.8842	3.7637
3.4979	3.1034	3.9013	4.0535	3.7246	4.4053
3.0173	2.7723	3.2674	2.3514	2.1103	2.6019
4.1514	3.8167	4.5053	3.4955	3.1505	3.8534
3.9711	3.5661	4.4019	2.1913	1.7492	2.6382
2.9626	2.7027	3.2340	**Tourism**		
3.4982	3.2278	3.7814	3.1035	2.8276	3.3975
Trading and Consumers' Goods			3.6078	3.2583	3.9769
3.1265	2.7381	3.5273	3.1556	2.8156	3.5106
3.6140	3.3059	3.9316	4.0576	3.6764	4.4459
3.3299	3.0010	3.6695	2.0502	1.6377	2.4651
2.5106	2.2421	2.7952			
5.0608	4.6553	5.4850			
1.9954	1.6352	2.3624			

Table 2 shows all posterior load means on the aggregate factor are positive, which indicates that the aggregate factor is positively related to the Taiwanese firm stock return. Although the aggregate factor exhibits greater volatility coinciding with the economic events, there is a notable downward trend since the beginning of the latest financial crisis. As one would expect the Great Moderation was characterized by a falling volatility in the aggregate factor.

It is interesting that the Steel and Iron factor experienced one notable uptick pattern in the 2003-04. The factor loads on the Steel and Iron factor are all positive, so that increases in the sectoral factor signal increases in individual stock returns (Figure 2). Since the mid-1970s the "Ten Major Construction Projects" launched by the government and the steel industry started a rapid growth regime. The 1990s was a volatile decade for the steel industry because of cross-strait political instability and increasing Taiwanese investment in China. In the early 2000s the steel demand in China was on an upward trend together with the fast growth of other steel-consuming industries, such as the construction sector. The global steel output resulted in a substantial increase in the international steel trade with an increase in raw material prices. In 2004 the China government introduced a control policy to moderate its overheated economy.

CONCLUSION

There has been a large volume of works in the literature on the factors that explain the sources of fluctuations in stock returns. Studies disagree somewhat on the relative importance of aggregate shocks (e.g. monetary policy), sectoral-specific shocks and granular (individual-specific) disturbances. This study extends the literature by exploring the latent-side dynamics behind the large stock return generating process. This paper used a dynamic latent factor model that has a special merit in decomposing stock return fluctuations into aggregate, sector-specific and idiosyncratic firm-specific allocation factors. Xavier (2011) emphasized that idiosyncratic firm-level shocks play a role in aggregate movements.

TABLE 3
LOADINGS ON THE SECTORAL COMPONENT FOR STOCK RETURN IN TAIWAN, 1992-2013.

Mean	0.05	0.95	Mean	0.05	0.95
Chemical			**Finance**		
0.9941	0.1243	2.0749	3.6185	2.8879	4.3627
-0.3774	-1.5196	0.7417	5.9152	4.8854	6.9768
-1.3609	-2.6047	-0.2764	3.5584	2.7387	4.3840
3.4964	1.6264	5.0670	**Construction**		
0.1041	-0.9679	1.1166	0.7824	0.0743	1.7633
-0.9681	-1.9710	0.0765	-0.2366	-1.5577	1.1185
-1.0823	-2.0266	-0.1667	0.4795	-0.8226	1.7888
-0.9758	-2.2060	0.1400	-3.5243	-4.8177	-2.3676
3.8145	2.0175	5.4390	-1.9616	-2.9312	-1.0648
Cement			-1.9618	-3.2504	-0.6648
5.5001	4.7827	6.2190	-1.8004	-3.0927	-0.5057
5.1472	4.4579	5.8489	-3.3217	-4.5471	-2.1969
2.3313	1.6905	2.9669	**Food**		
1.4760	0.7615	2.1995	1.9601	1.0032	2.9144
1.6170	0.9034	2.3394	2.2515	1.5107	2.9713
1.8778	1.3473	2.3994	1.5952	0.5744	2.5943
Semiconductor			3.0276	2.3263	3.7472
0.8903	0.1920	1.6514	-0.3678	-1.0458	0.3112
-1.0989	-2.2349	0.0529	2.4600	1.7182	3.2010
-6.8814	-8.0678	-5.7679	2.6131	1.8497	3.3616
-6.2491	-7.2859	-5.2440	3.7903	2.9977	4.5885
-2.9338	-4.0877	-1.7984	2.3233	1.4925	3.1695
Other			2.8681	1.6792	4.0457
1.0705	0.1007	2.4086	-0.7987	-1.4462	-0.1681
0.1455	-1.3411	1.6703	0.8850	-0.0011	1.7661
-0.7074	-2.4434	1.1963	**Plastic**		
0.3032	-1.2247	1.7747	1.5443	1.0092	2.0711
-1.2579	-3.0275	1.0609	1.5072	0.9510	2.0733
-0.8765	-2.4127	0.9101	4.9484	4.4074	5.4930
0.2967	-1.3253	1.9011	4.9534	4.2498	5.6479
-1.0180	-2.5672	0.6664	1.4404	0.7447	2.1381
0.0052	-1.4572	1.5073	5.5002	4.8573	6.1308

Other Electronic			5.6178	5.0495	6.1862
4.8111	3.4879	6.1394	4.8409	4.1274	5.5318
4.2295	2.9767	5.4359	4.8128	4.1564	5.4501
1.8658	0.8805	2.8370	4.3135	3.7285	4.8963
3.6218	2.4964	4.7478	2.0299	1.3451	2.7072
			1.9899	1.3895	2.6008

Notes: 0.05 (0.95) delineate 0.05 (0.95) quantiles for the posterior distributions for sectoral component.

We disclosed these unknown disturbances and the current economy-wide shocks are important in stock return fluctuations. The aggregate factor explains roughly 45 percent the stock return volatility. We found that the idiosyncratic firm-specific factor on average accounts for another 45 percent of the stock return volatility across sectors for the period 1992-2013, which is consistent with the granular hypothesis proposed by Xavier (2011). This finding highlights the importance of idiosyncratic firm-specific disturbances in stock return process. Finally, we found that the sectoral factor played a more important role (more than 20 percent) in explaining stock return fluctuations in the Electronic Parts, Finance and Insurance and Semiconductor sectors. As a result these results can be employed to construct profitable investment strategies for selecting portfolios across rather than within sectors.

This study can be extended in several directions. First, it would be worthwhile to further explore the relationship between the aggregate factor and other macroeconomic aggregates (e.g. monetary policy), which may provide fruitful insights for the monetary policy mechanism on the latent side of the stock market. Second, the idiosyncratic granular shocks are a crucial, and possibly the major part of the stock return source. This study suggests that to better understand the origins of stock return fluctuations, one should not focus exclusively on aggregate shocks. Further study of the idiosyncratic granular factor this study has identified and its relationship to potential variables (e.g. dividend yields) merits consideration. Third, Zhou et al. (2012) studied the volatility spillovers between the Chinese and world stock markets. They found that the U.S. stock market had dominant volatility impacts on other stock markets during the subprime mortgage crisis. Moreover, the volatility interactions among the stock markets of China, Hong Kong and Taiwan were stronger than those among the Chinese, Western and other Asian markets. It would be interesting to further investigate the stock market dynamic linkage between China, the U.S. and Taiwan at the individual level. These possible extensions will further enhance our understanding of the stock market dynamics in Taiwan. We plan to pursue these research projects in the near future.

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