

# Exploring the Financial Ratios: The Case Study of the Famed Chemical Industry Firms in the US

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## Abstract

The objective of this paper is to explore the linkage between corporate financial conditions and the market valuation of the famed US chemical industry firms by the case study using financial ratio and market data. More concretely, we first conduct corporate financial ratio analyses including the Du Pont system analysis as to four well-known large chemical industry firms in the US. Our analyzing period is from the fiscal year of 1979 to 2012. After the financial ratio analyses for the above period, we further examine the relations between corporate financial conditions and the market valuation of the four US firms by using their stock price data after the end of the fiscal year of 2012. As a result, the corporate financial conditions of the four firms at the end of the fiscal year of 2012 appear to be adequately reflected in the subsequent stock prices in equity markets.

**Keywords:** Capital structure, Du Pont system, Financial-ratio analysis, Market valuation, US Chemical industry

## 1. Introduction

How are the corporate financial conditions evaluated and reflected in stock markets? To answer this question more specifically, case studies shall be one of the most effective tools. As for related studies, Holthausen and Larcker (1992) attempted to predict the stock returns using financial statement information. Smith and Pourciau (1988) compared the financial characteristics of December and non-December year-end firms. Maricica and Georgeta (2012) analyzed the business failure risk using financial ratios. We further review related literature in the later section; however, preceding specific case studies appear to be rare.

Based on the above situation, this paper aims to examine the linkage between corporate financial conditions and the market valuation of the specific large US firms by the case study using the financial ratio and market data. More specifically, this paper conducts corporate financial ratio analyses of four well-known large chemical firms in the US. The firms we investigate are 3M Company (3M), the Dow Chemical Company (Dow Chemical), E. I. du Pont de Nemours and Company (Du Pont), and Procter & Gamble Company (P&G). We also conduct the Du Pont system analysis in this study.

After analyzing the financial conditions of the above four firms, this paper finds that for the above US large chemical firms, corporate financial conditions appear to be adequately reflected in stock markets. This line of case study would be rare as we documented above, thus our present study shall add the various specific case results to the existing body of research in related fields. The rest of this paper is organized as follows. Section 2 reviews the recent related studies, Section 3 explains our data and variables, Sections 4 to 6 document the results of our analyses, and Section 7 summarizes our findings.

## 2. Literature Review

This section briefly reviews the related literature by focusing on the recent studies. First, Tsuji (2006) examined whether Economic Value Added (EVA) was a superior measure of corporate performance in Japan. Wang and Lee (2008) proposed a clustering method for identifying major financial ratios. Niemann et al. (2008) introduced a new approach for improving the predictability of corporate rating forecasting models by reducing the heterogeneity of financial ratios. Johnston et al. (2009) suggested that sell-side debt researches highly influenced on the firms' stock prices, financial ratios, and debt issues.

Further, using the samples of Chinese banks, Avkiran (2011) examined to what extent bank data envelopment analysis (DEA) super-efficiency estimates were related to key corporate financial ratios. Mate-Sanchez et al. (2012) researched the long-term average adjustment of corporate financial ratios. Maricica and Georgeta (2012) analyzed the business failure risk using financial ratios. Selahudin et al. (2014) studied the difference of earnings management, leverage, financial distress, and free cash flow of the firms in Malaysia and Thailand. Gazzola and Amelio (2014) investigated the differences of the corporate performance reporting selections between comprehensive income and net profit during the period of financial crises.

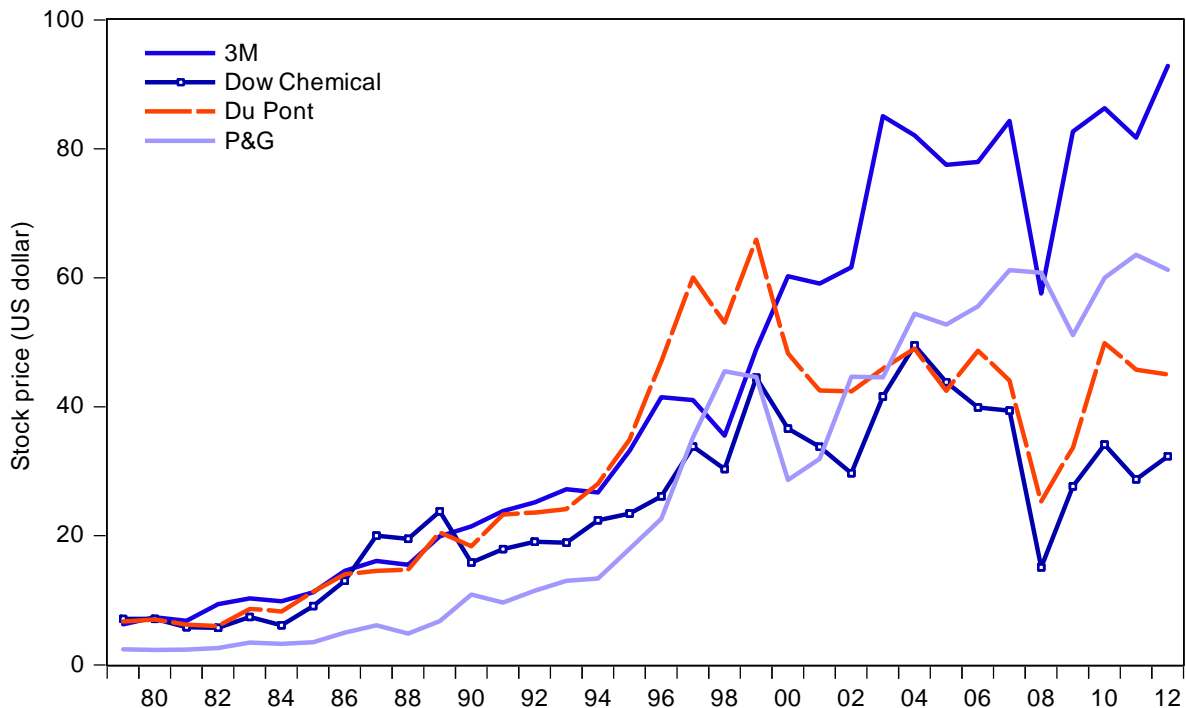


Figure 1. The Dynamics of the Stock Prices of Four Major US Chemical Industry Firms: Time-series Evolution for the Fiscal Year from 1979 to 2012

### 3. Data and Variables

This section describes the data investigated in this study. All US financial and stock price related data are from the Compustat data base of Standard & Poor’s Financial Services LLC. Further, our full sample period is from the fiscal year of 1979 to 2012. For our analyses, we calculate financial and valuation measures of four US companies, 3M, Dow Chemical, Du Pont, and P&G.

Other than 1) stock prices, we use and explore many financial ratios of the above four firms. Explaining our financial ratio variables in order, 2) ICR: Interest coverage ratio; 3) RD: R&D expenses to total asset ratio; 4) CFM: cash flow to sales ratio; 5) DR: total debt to total asset ratio; 6) ROE: income before extraordinary items to common equity; 7) ISR: income before extraordinary items to sales ratio; 8) TAT: total asset turnover ratio; 9) LEV: total asset to common equity ratio. Further, in order to check the market valuation, we also use 10) the stock price to book value ratio. As above, we thus use and analyze the above ten variables in this study.

### 4. Stock Prices and Several Financial Ratios

We first present the stock prices of the four famous US chemical firms in Figure 1. From this figure, P&G and 3M seem to record higher stock prices around the end of our sample period. Further, we also display several financial ratios of the four US firms in Figure 2. Panel A of Figure 2 shows that 3M exhibits the highest interest coverage ratio and P&G is the second. Next, Panel B of this figure exhibits that 3M demonstrates the highest R&D to total asset

ratio in general, and Du Pont also shows the higher R&D ratio after around the fiscal year of 1997. Further, Panel C of this figure suggests that 3M demonstrates the highest cash flow margin in general, and this ratio of P&G continuously increases and keeps higher level after around the year of 2000. Finally, Panel D of Figure 2 exhibits that 3M keeps the lowest debt ratio almost throughout our full sample period whilst the Dow Chemical shows the highest debt ratio in general.

We consider that the above overview of the stock prices and several financial ratios of 3M, Dow Chemical, Du Pont, and P&G supplies us useful information to grasp their financial characteristics and market values. From Table 1, we also understand that all of the interest coverage ratio, R&D to total asset ratio, and cash flow to sales ratio of 3M exhibit the highest historical average values in four firms. In addition, the historical average of the debt ratio of 3M favorably shows the lowest value in four firms. Hence as far as judged by the four financial ratios, we understand that 3M keeps the best financial condition in four firms for our analyzing period. Hence we can interpret that these results are consistent with the highest stock prices of 3M after around the fiscal year of 2000, which are recognized in Figure 1.

## 5. Analyzing with the Du Pont System

Next, we analyze the above four US chemical firms further by using the Du Pont system. Our analyzing system can be written as following equation (1).

$$\begin{aligned}
 ROE_{i,t} &= \frac{\text{Income before extraordinary items}_{i,t}}{\text{Common equity}_{i,t}} \\
 &= \frac{\text{Income before extraordinary items}_{i,t}}{\text{Sales}_{i,t}} \times \frac{\text{Sales}_{i,t}}{\text{Total asset}_{i,t}} \times \frac{\text{Total asset}_{i,t}}{\text{Common equity}_{i,t}}
 \end{aligned} \tag{1}$$

As above, by using the Du Pont system, we can decompose ROE into three important components, namely, (1) income before extraordinary items to sales ratio (profitability), (2) total asset turnover ratio (asset utilization efficiency), and (3) the ratio of total asset to common equity (the common shareholders' interest in the company) (financial leverage). As we understand from Panel A of Figure 3, 3M and Du Pont display higher values of ROE. Analyzing their ROEs by the Du Pont system, as shown in Panels B, C, and D of Figure 3, higher ROE of Du Pont is because of the higher financial leverage (Panel D); on the other hand, higher ROE of 3M is because of the higher profitability (Panel B) and higher asset utilization efficiency (Panel C). Thus our Du Pont system analyses clarify that 3M has the most favorable firm characteristics that produce higher ROE in the four firms.

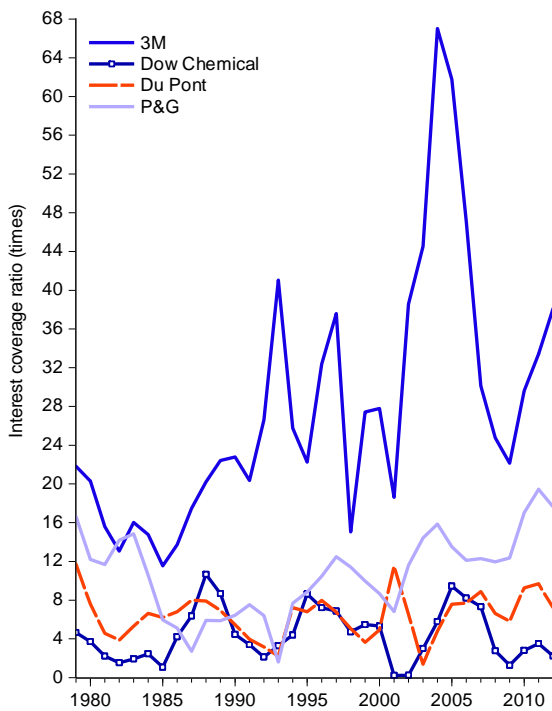
From Table 1, we also understand that the historical average of income before extraordinary items to sales ratio of 3M shows the highest value in four firms. We also recognize that from the historical average values, P&G also shows superior values for the factors in the Du Pont system. On the other hand, as seen in Panel C in Figure 3, we note that total asset turnover ratio of P&G continuously decreases. As above, we consider that our analyses using the Du Pont system effectively clarify the corporate financial conditions of the four firms.

Table 1. Descriptive Statistics of Analyzing Variables: For the period of the fiscal year from 1979 to 2012

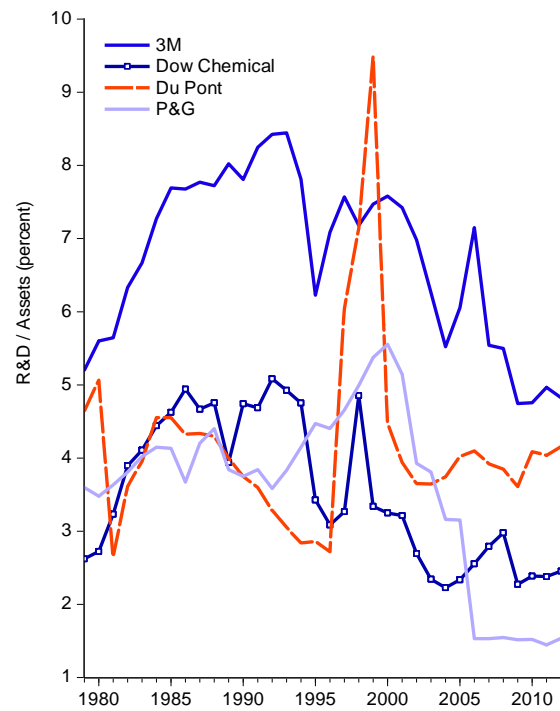
Panel A. Interest coverage ratio (ICR)				
	3M	Dow Chemical	Du Pont	P&G
Mean	27.7003	4.4213	6.4621	10.6527
Std. Dev.	13.1735	2.7233	2.3276	4.3331
Skewness	1.3044	0.5163	0.0920	-0.0594
Panel B. R&D to total asset ratio (RD)				
	3M	Dow Chemical	Du Pont	P&G
Mean	6.7394	3.5285	4.1748	3.5687
Std. Dev.	1.1570	0.9896	1.2814	1.1933
Skewness	-0.3424	0.2265	2.4640	-0.6493
Panel C. Cash flow margin (CFM)				
	3M	Dow Chemical	Du Pont	P&G
Mean	16.8974	11.9512	12.7357	12.1175
Std. Dev.	2.1289	3.7765	3.2261	4.0915
Skewness	0.5257	-0.0093	1.0237	-0.0477
Panel D. Debt ratio (DR)				
	3M	Dow Chemical	Du Pont	P&G
Mean	15.1877	28.3081	23.1197	24.5692
Std. Dev.	4.4465	4.4186	4.6629	7.4211
Skewness	0.4929	-0.0034	-0.1878	0.0158
Panel E. ROE				
	3M	Dow Chemical	Du Pont	P&G
Mean	24.3328	14.0740	18.7270	20.8363
Std. Dev.	6.2192	9.5888	10.2954	8.3030
Skewness	0.7234	-0.0355	0.5917	0.3184
Panel F. Income before extraordinary items to sales ratio (ISR)				
	3M	Dow Chemical	Du Pont	P&G
Mean	11.4980	5.5631	6.4347	8.4222
Std. Dev.	2.6005	3.8255	3.0996	3.5576
Skewness	0.5862	0.2220	0.9944	0.0229
Panel G. Total asset turnover ratio (TAT)				
	3M	Dow Chemical	Du Pont	P&G
Mean	1.0980	0.8707	0.9577	1.1331
Std. Dev.	0.1117	0.1278	0.2410	0.3406
Skewness	-0.6857	0.9623	0.7809	-0.4489
Panel H. Financial leverage (LEV)				
	3M	Dow Chemical	Du Pont	P&G
Mean	1.9488	3.0889	3.1849	2.4191
Std. Dev.	0.3046	0.6920	1.1289	0.5022
Skewness	0.2844	1.1106	0.7001	0.4935

*Notes:* In the table, Std. Dev. denotes the standard deviation and all descriptive statistics above are computed under our full sample period from the fiscal year of 1979 to 2012. Further, 3M means 3M Company, Dow Chemical means the Dow Chemical Company, Du Pont means E. I. du Pont de Nemours and Company, and P&G means the Procter & Gamble Company, respectively.

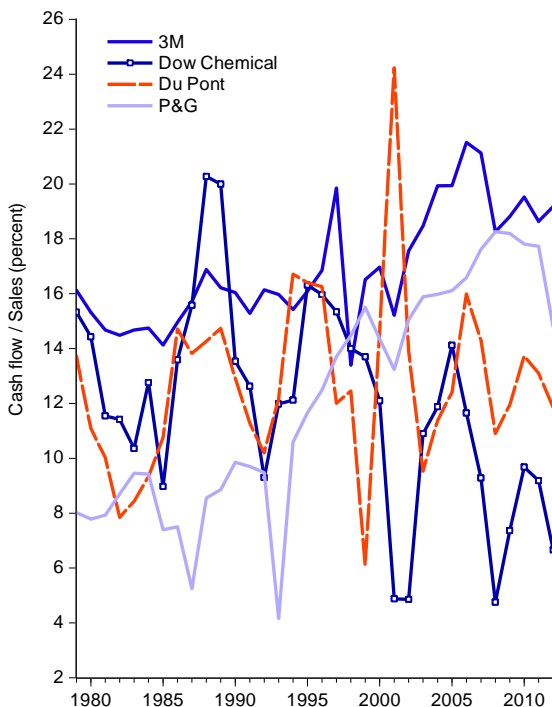
Panel A. Interest coverage ratio (ICR)



Panel B. R&D to total asset ratio (RD)



Panel C. Cash flow margin (CFM)



Panel D. Debt ratio (DR)

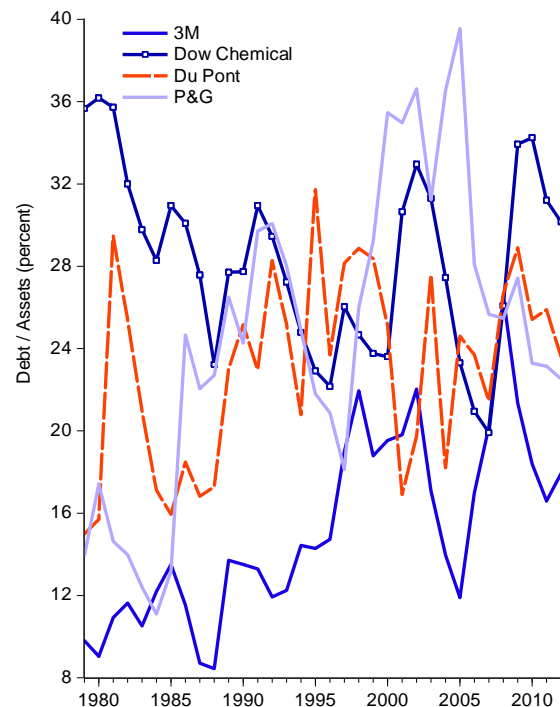
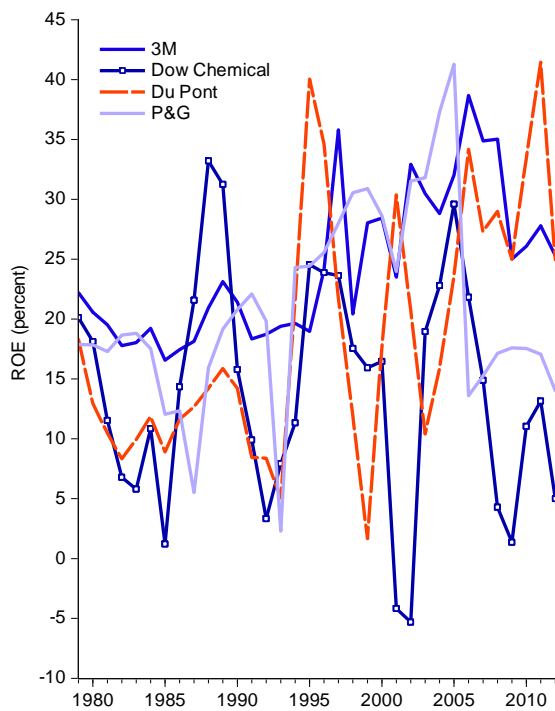
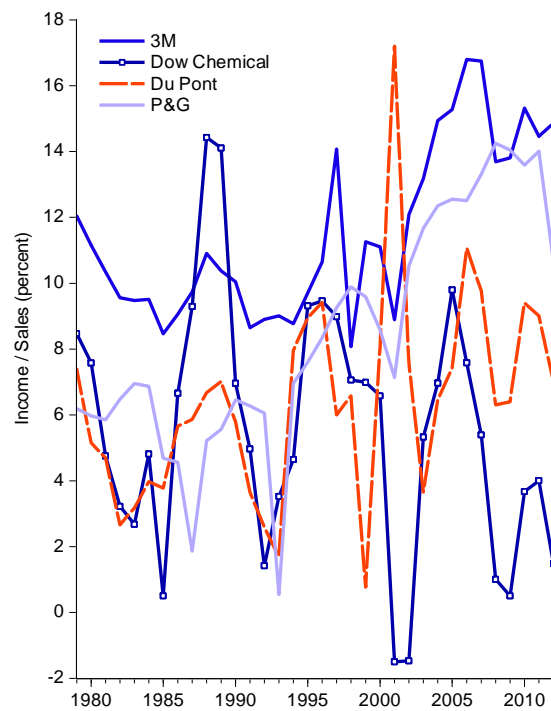


Figure 2. The Dynamics of the Financial Ratios of the US Major Chemical Industry Firms: Time-series Evolution for the Fiscal Year from 1979 to 2012

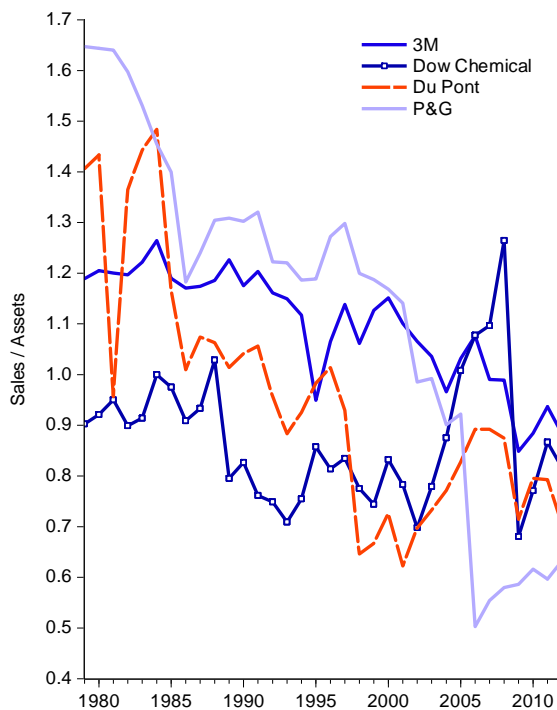
Panel A. ROE



Panel B. Income sales ratio (ISR)



Panel C. Total asset turnover (TAT)



Panel D. Financial leverage (LEV)

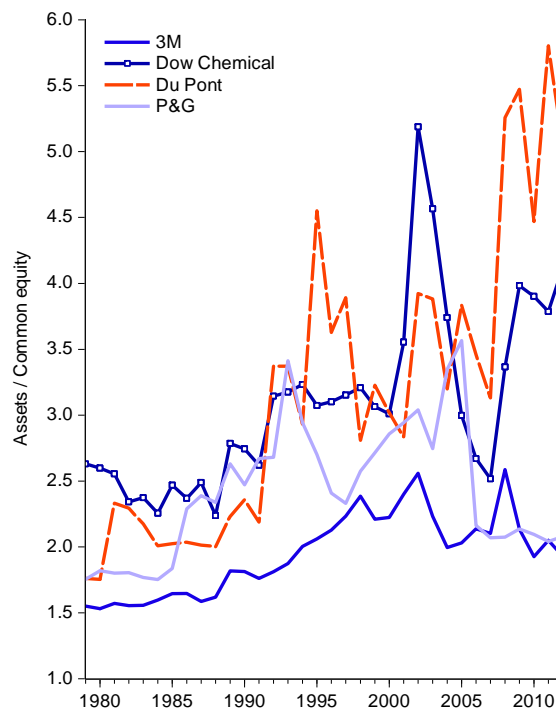


Figure 3. The Dynamics of the Financial Ratios in the Du Pont System of the US Major Chemical Industry Firms: Time-series Evolution for the Fiscal Year from 1979 to 2012

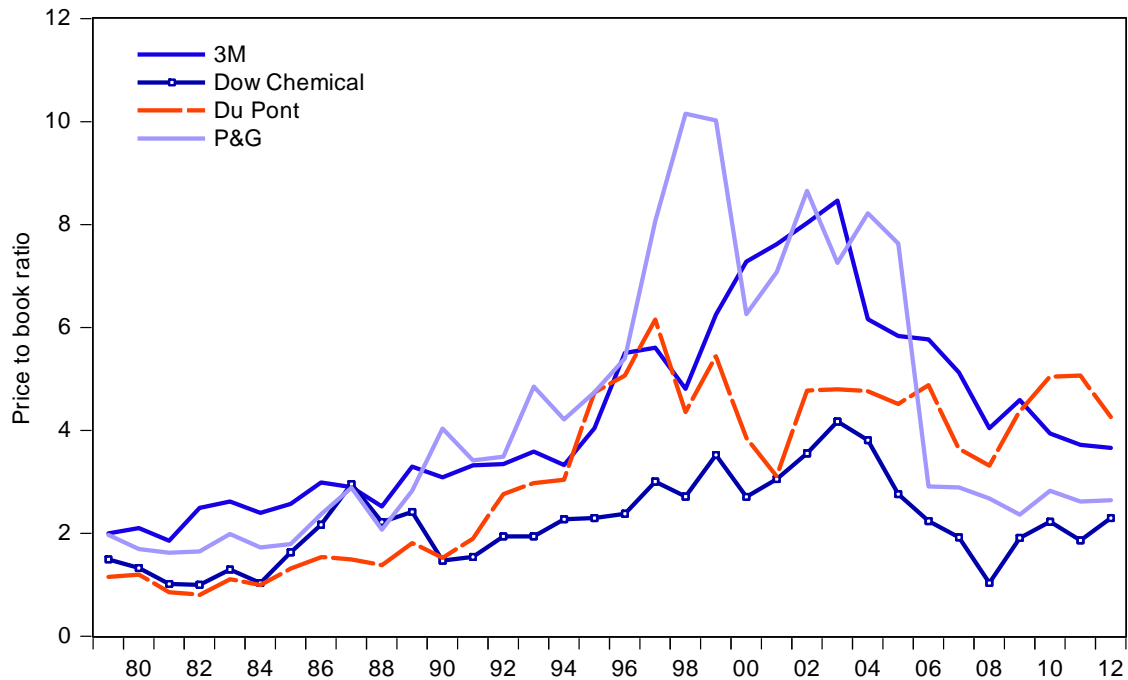


Figure 4. The Dynamics of the Market-to-book Ratios of the US Major Chemical Industry Firms: Time-series Evolution for the Fiscal Year from 1979 to 2012

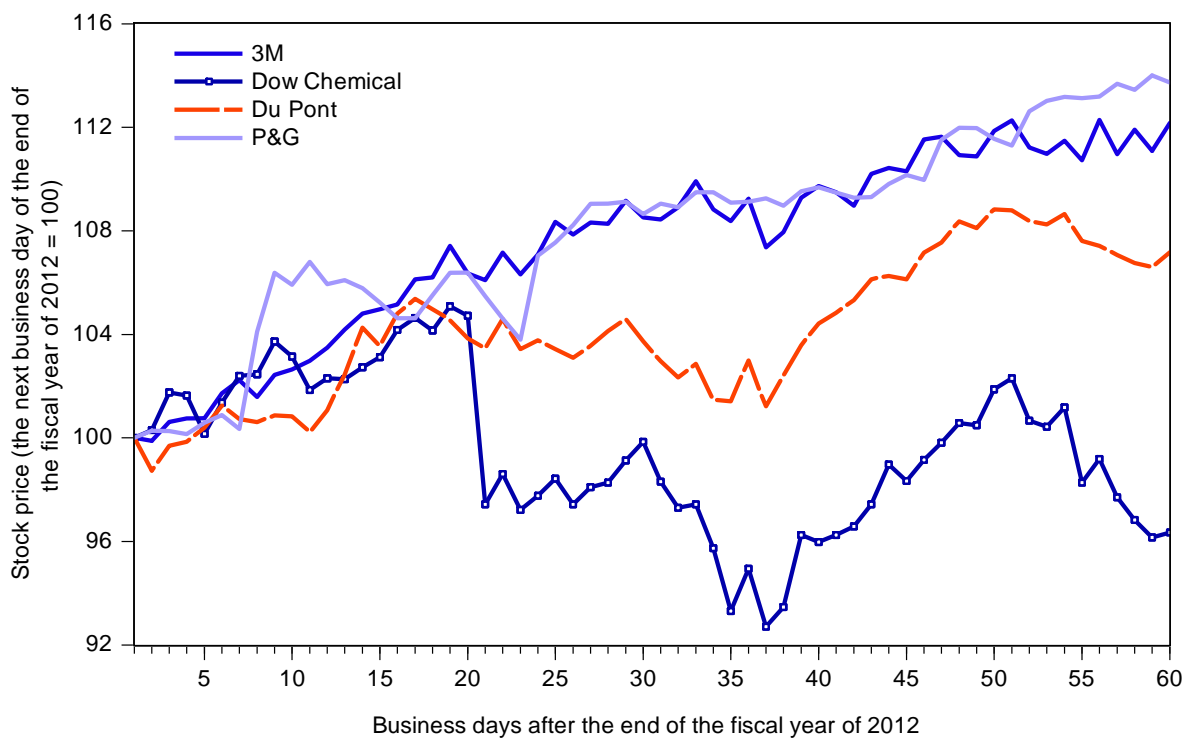


Figure 5. The Daily Dynamics of the Stock Prices of the US Major Chemical Industry Firms: Time-series Evolution after the Fiscal Year of 2012



## 6. Market Valuation

Finally, we analyze the market valuation of the four major US chemical firms by using the market-to-book ratios, whose dynamics are shown in Figure 4. This figure displays that Du Pont exhibits the highest market-to-book ratio around the end of our full sample period. On the other hand, the price-to-book ratio of 3M gradually decreases towards the end of our full sample period although the value of this ratio of 3M stands at the second highest in four firms at the end of the fiscal year of 2012. Similarly, the price-to-book ratio of P&G decreases towards the end of our full sample period and the Dow Chemical shows the lowest market-to-book ratio in four firms continuously after around the fiscal year of 1990.

In addition to the above, in order to further examine the market valuation of the four firms, we collect the daily stock price data from the yahoo finance and present the adjusted stock price data trends for roughly one-quarter after the end of the fiscal year of 2012 in Figure 5. In this figure, we adjust the stock prices so that their values equal to 100 on the next business day of the end of the fiscal year of 2012 (Only P&G has the fiscal year from July to June and other three firms' fiscal years are from January to December; we present the prices in the fiscal year basis.). Figure 5 shows that after their fiscal year ends, P&G and 3M present the higher performance in stock markets whilst the Dow Chemical underperforms behind other three firms. Du Pont is thirdly valued in four firms and Du Pont may be overvalued at the end of the fiscal year of 2012 based on the recent financial condition of this company. (Du Pont demonstrates the highest valuation in Figure 4.) We interpret that these trends of stock prices of four firms after the end of the fiscal year of 2012 are consistent with the historical and recent corporate financial conditions clarified by our financial ratio analyses.

## 7. Summary and Conclusions

This paper explored the corporate financial ratios of the four US well-known chemical firms. The interesting findings from our financial ratio analyses can be summarized as follows. (1) First, from the viewpoint of corporate profitability, 3M and P&G exhibit the higher profitability as seen in their income before extraordinary items to sales ratios and cash flow margins. (2) Second, as the dynamics of the total asset turnover ratios indicate, 3M keeps the highest asset utilization efficiency in general whilst the asset utilization efficiency of P&G continuously declined. (3) Third, judging from the trends of R&D expenses to total asset ratios, it is understood that 3M and Du Pont have higher growth potential. (4) Fourth, with regard to financial strength, we understand that 3M holds the highest corporate solvency and financial soundness. (5) Further, according to the price-to-book ratios, around the end of the fiscal year of 2012, the market valuation of Du Pont was highest and 3M also kept its higher market valuation.

(6) Finally, our additional examinations of the daily stock price dynamics suggested that, the above financial conditions for four firms at the end of the fiscal year of 2012 were adequately reflected in stock markets after the fiscal year of 2012. As our investigations demonstrated, as to large well-known firms, related information would diffuse rapidly in markets, thus market values would generally reflect the financial aspects of such firms adequately. On the other hand, as for small firms, related information is not so rich; hence market valuation of small

firms may not always efficiently reflect such firms' financial conditions. (The evidence of accounting anomalies exists. (e.g., Ball; 1992)) Based on these discussions, we consider that the case studies focusing on specific firms such as small firms would be interesting and effective. In particular, the clarifying the linkage between the state of small firms' financial ratios and market valuation is interesting research agenda and it is one of my future tasks.

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