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MODERATOR EFFECT OF RDI ON FIRM FINANCE PERFORMANCE: TAIWAN TEXTILE INDUSTRY

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ABSTRACT
Purpose- Is the textile industry only pursuing high labor intensity, low value added products and moving factories to reduce production costs? Just only high tech industries alone emphasize research and development investment(R&D) and pursue high value added products?
Methodolog - This study examined the impact of R&D investment on the finance performance of the Taiwanese textile industry, for the period 2006-2016. A panel data model was used to empirically analyses the impact of R&D intensity (RDI), firm size on finance performance.
Finding - RDI of the textile industry has a positive impact on financial performance and lag periods. In regard to the resource based view, the resources owned by an enterprise are positively correlated with performance. However, this study also finds that RDI as moderator effect for firm's size on finance performance.
Conclusion- The effect of R&D on finance performance is not only limited to the high tech industry. This indicates that RDI affect firms' sustainable management.

Keywords: R&D intensity、finance performance, knowledge absorptive capacity, firm Size, textile industry
JEL Codes: O30, M00, D83

1. INTRODUCTION

The textile industry has a long history as a leading industry from the Industrial Revolution onwaeds, and now has become a typical low tech industry (Von Tunzelmann & Acha, 2005). However, with the use of synthetic fibers in the early 1920s, and the smart textiles recently launched (Lu, 2012). Traditional industry regarded innovative activities and the ability to adapt to changing needs and environment as the basis for their competitiveness. External R&D absorption varies between industries, so firms should concentrate on the innovation and absorption of R&D needs, even in low tech industries (Naanaa & Sellaouti, 2017). In policy, government encourages high tech companies to do more R&D and often subsidizes a certain amount (Xing M, 2018).

Specifically, the textile industry has attached great importance to labor-intensive textiles and clothing since the 1980s. Nonetheless, Taiwan is a small open economy and depends on the import of raw materials. Due to the shift of manufacturing industry and soaring labor costs, to remain competitive, the manufacturers of many companies in this industry outsourced their production to other countries/regions with lower labor and production costs. Taiwanese firms needs focused on high tech man-made fibers and other knowledge intensive textiles which required greater R&D abilities and more advanced technology (Chang & Robin, 2012). Chiao (2013) R&D activities on business financial performance

clearly suggested that R&D exerts a certain impact on the yield ratio of manufacturers' daily business income and on their operation. Therefore, firms must stress RDI in order to improve future business value.

In the current literature it is found that Companies with the traditional industries pay less attention to R&D than high tech industries. This study will probe into the above issues, and conduct an empirical study on Taiwan's textile industry within the traditional industries. In order to streamline the study, it will eliminate other external factors and only focus on whether the manufacturers' business performance will be affected by RDI and certain operational factors on the part of the manufacturers. This empirical study is designed to explore the following issues: (1) The related impact of the lagged effects of R&D on the manufacturers' operation and financial performance. Whether the characteristics of lag effect of R&D exist as textile industries. (2) Exploration and empirical research into the resource-based view and R&D; R&D and knowledge absorptive capacity were examined respectively. This study collected information, regarded the relevant impact of RDI in the R&D activities of companies in China's Taiwan as the subjects, and provided the empirical results to the managers or R&D entities for reference.

2. LITERATURE REVIEW

This chapter will explore and propose research hypotheses of the impact of knowledge absorptive capacity and RDI in firms' R&D activities on business performance, as well as firm size and performance in the resource-based view.

2.1 Resource-Based View (RBV and R&D)

R&D investment is innovation activies. Poldahl (2012) firms' R&D activities and total factor productivity growth is fixed. R&D seems to not only directly lead to productivity growth, but indirectly to innovations which beat competitors and other companies. In respect of firm size, Lee et al., (2010) took Korean firms as examples and found that firm size in different industries impacted innovation performance. They believe that firm size is positively correlated with innovation performance. They also point out that larger firms are more capable of increasing investment in innovative talents and capital due to sufficient funds. On the contrary, small firms fear unknown risks and therefore will not invest a great amount of resources in innovation. Large firms attach greater importance to in-house R&D innovation activities, external R&D innovation and other innovation activities than small firms. Kiran, R. (2017) Investing in R&D firms is likely to add value to existing products, but its impact may be limited to a few medium sized and large businesses, as most small businesses lack the immense resources needed for their products.

Urata & Kawai (2002) examined various aspects of total factor productivity across different firm sizes in Japan, and indicate that larger firms had higher total factor productivity levels and growth. Barney et al.,(2001) firm can develop short-term business performance and long-term sustainable competitive advantage by virtue of their unique resources and capabilities.

Legros & Galia (2012) firm size have a positive impact on the decisions and intensity of R&D. De & Nagaraj (2014) small firms have the advantage of more flexible management and lower response time to market changes, larger firms have the advantages of economies of scale and political clout. Chen & Chang (2010) R&D performance of the US pharmaceutical industry that larger firms can make use of more resources than small firms do. The advantages of firm size in the pharmaceutical industry are significant. When pharmaceutical firms have more resources to carry out R&D activities, it enables better R&D performance and generates better profitability. However, some scholars indicate that smaller companies have an advantage over large companies in producing more new products per unit of R&D investment, but that this advantage was overshadowed by a decline in the quality of their innovative products (Lejarraga & Martinez, 2014). As can be concluded from the above opinions, the larger the firm size have more resources (R&D、sales and advertising budget), the better the resources can promote finance performance. Therefore, this study offers the following hypotheses:

H1: firm's resource are proportional to finance performance.

2.2 Exploration of R&D Activities

2.2.1 R&D and Knowledge Absorptive Capacity

Firm's R&D has started a new round of knowledge transfer process, bringing new knowledge and skills unique to the firm to further improve product quality and grade, production process or reduce production costs, and finally reflects the financial statements. And the study of knowledge as a key determinant of economic growth(Sokolov-Mladenović, Cvetanović, & Mladenović, 2016). Legros & Galia (2012) knowledge accumulation is one of the most important characteristics of innovation. The accumulation of knowledge arises from complex and dynamic interactions between a firm's own internal capability and external expertise. R&D remains important in the innovation process, but it must be integrated with knowledge from other sources, such as training and knowledge capitalization.

Cohen & Levinthal (1989, 1990) proposed two aspects of R&D: 1. A firm's ability to enhance the assimilation of knowledge, explore and absorb knowledge of the external environment through its own R&D is referred to as "Absorptive Capacity". 2. New knowledge developed from a firm's investment in R&D. A firm's R&D not only generates innovation and new knowledge, but also develops the firm's ability to identify opportunities. Kim (2015) argues that absorptive capacity may be the byproduct of R&D investment and participation in export markets. However, the author of this argument properly questioned that when a manufacturer focuses on R&D, in case of unchanged time required and other conditions, an enterprise's absorptive capacity should be enhanced. This should be more appealing to manufacturers in making investments. Ferragina & Mazzotta (2014) firms in the high tech-intensive industries are more likely to benefit from FDI. Becker & Hall (2013) government funding is significant only for low tech R&D, while foreign R&D and skilled labor matter in high tech sectors. Naanaa & Sellaouti (2017) R&D enhances a firm's knowledge absorptive capacity. The understanding of mechanisms by which technology is involved in determining business performance differs depending on the industry studied (depending on whether it is high or low technology), the level of human capital, and also the importance of trade and the foreign direct investment. RDI has a certain impact on business performance. Vithessonthi & Racela (2016) RDI as a means by which firms engage in both exploitative and explorative forms of knowledge acquisition.

2.2.2 RDI and Finance Performance

Lu (2012) textile firms that rely on acquiring new machinery、technology and are involved in internal R&D activities, are more likely to have more highly effective R&D, which translates into a positive profit margin. RDI does not contribute significantly to R&D effectiveness. However, to offset increasing production cost and sustain its diminishing low-cost comparative advantage, the textile industry's next step was to focus on R&D to keep the industry competitive in the global marketplace.

Bogliacino (2013) explored the determinants of industries' RDI, innovative turnover and profit growth, and highlighted the complexity of relationships, reciprocal influences and feedback loops for 38 manufacturing and service sectors in 8 European countries for two periods from 1994 to 2006. Greater R&D expenditures resulted in successful innovations. The ability to realize innovations led to high entrepreneurial profits, and higher business income encouraged the manufacturers to make a greater commitment to invest in technological improvement. Industries, innovation and performance showed a dynamic and interactive relationship. Li (2011) foreign technology alone did not facilitate innovation in Chinese high tech enterprises, unless in house R&D was also conducted. In contrast, domestic technological R&D absorptive capacity was found to have a favorable direct impact on innovation. As a result, it can be observed from his study that internal R&D expenditures are far more important that the introduction of foreign technology (Haberl, 2015). The global textile industry was confronted with rising raw material, labor and transportation costs, yet it still concentrated on a relatively low product value chain. Typically, the enterprise value chain needs to increase expertise and R&D to improve corporate profits. Generally, improving a value chain by R&D activities is one of the industry indicators.

They also propose an overall long-run effect of R&D investments on the knowledge production required by firms, such as the innovation process of pharmaceutical firms. R&D innovation activities affect a company's performance, and R&D during the time difference (lag effect) would be directly proportional to firm performance (Falk, 2012; Maliranta, 2005). Lin (2006) indicates that lagged effects would be produced for 4 years, resulting from R&D investment. Wang & Hagedoorn (2014) lag 1 year being significant in all distributed lag specifications. However, R&D has a lagged effect, but there is no consensus about lag periods.

Based on the above viewpoints,(1) R&D activities and intensity of R&D investment help to improve an enterprises' absorptive capacity, which in turn enhances the firm’s innovation and business performance.(2) Due to differences in industrial structure and in the requisite technical skills, the effectiveness varies. The high tech industry focuses more on R&D activities and investment than the traditional industries do. The textile industry manufacturers in Taiwan also began to develop higher value added textile products, which exerts a positive impact on the manufacturers' finance performance. Therefore, this study offers the following hypothesis:

H2: R&D intensity has a lagged effect and positive effect on finance performance

H3: R&D intensity as moderator effect for firm's size on finance performance

3. DATA AND METHODOLOGY

3.1.1 Data Sources

We drew data from the Taiwan Economic Journal (TEJ) and the Taiwan Stock Exchange Corporation’s Market Observation Post System. It sorted and analyzed published financials of companies from 2006 to 2016. To improve accuracy of assessment, we excluded firms that were acquired, delisted, presented no data, or had missing values during the period. We disregarded firms that had not existed or had not been publicly traded at least 6 years, 52 firms remained for study.

3.1.2 Methodology

This paper conducted an empirical study on panel data. All variable data were first subject to a panel unit root test to confirm whether the data were stationary. This study then examined whether the empirical data presented in this paper were stationary by means of the LLC test (Levin, Lin & James Chu, 2002) and the PP test (Maddala & Wu, 1999).

In this study, panel data was used for analysis. panel data, also known as "vertical and horizontal data", this analysis combined with cross-sectional data and time series data analysis method, for each study of the company for a period of continuous observation, the observed data is vertical and horizontal information. Hausman test can be performed first. If the test statistic rejects null hypothesis, Establish a fixed effect model; if you cannot reject the null hypothesis, the use of random effects model. According to the test results, we use the fixed effects model in panel data to analyze the effects of unobserved variables on the model by adding dummy variables to measure the differences among different companies. In the meantime, Dummy variables, in order to control the impact of different years.ε_t is the residual of time period t, it is used to test for the existence of autocorrelations in the residuals, and use Durbin-Watson statistics to test for the presence or absence of autocorrelation in errors.

3.1.3 Model Variables

Business performance is affected by fluctuations in the macro economy and by microfactors such as firm size, debt, competitors, market share, domestic tax rates, international trade tariffs, exchange rates, natural disasters, and many other factors. Therefore, it is impossible to consider all the factors. This article focuses on the internal impact of the company, and lists the following variables.

Dependent Variables

Finance performance: ROA (return on assets,ROA) = (earnings before interest, taxes, depreciation and amortization/average total assets) is often used to measure business performance, innovation performance and business profitability indicators. Vithessonthi & Racela (2016) ROA to measure firm performance.

Independent Variables

(1) RDI (R&D intensity ,RDI) is the result of dividing a company's R&D expenses by net revenues over a certain period. RDI)= R&D expenses/net operating income. Gentry & Shen (2013)RDI as the proportion of corporate R&D expenses to sales in each fiscal year, and used this variable to measure the intensity of a company's R&D expenses.

(2) SIZE (Total Asset, SIZE) measures company resources. (Ciftci & Cready, 2011)On the basis of regarding returns to scale as a concept, the profits to firms resulting from R&D investment and the changes in profits are affected by firm size. With regard to the resource-based view, the larger the firm (total assets) size, the more available resources.

Control Variables

(1) LEV (Debt Ratio, LEV) is an important indicator of a company's capital structure. LEV = (total debts/total debts). When the debt ratio is high, it indicates that the company needs to repay larger debts, which may reduce the company's earning power and performance (Vithessonthi & Racela, 2016).

(2) GPM (Gross Profit Margin, GPM) is one of the analysis indicators of operational capacity commonly used in financial analysis. GPM = (Gross Profit / Net Operating Revenue) *100%.

(3) TAGR (Total asset growth rate, TAGR) reflects the growing trend of a company and can be estimated as follows. TAGR = (Total assets of current time range − Total assets of previous time range)/total assets of previous time range.

Panel Data Model

We assume that the factors influencing innovation performance (ROA) are RDI, SIZE, LEV, GPM and TAGR. In model , subscripts *i* and *t* denote the company and the current year ,subscripts *i* and *t−k* represent the company and the lag year. $RDI_{i,t-k}$ is the RDI of the $(t–k)^{th}$ year. In model (3), subscripts SIZE*RD,if this interaction variable holds, it represents moderation's effect factor exists.

To test whether the firm's size and performance have a positive correlation, a research model is developed, equation(1)

$$\mathrm{ROA}_{i,t} = \beta_{1,t} SIZE_{i,t} + \beta_{2,t} LEV_{i,t} + \beta_{3,t} \mathrm{GPM}_{i,t} + \beta_{4,t} \mathrm{TAGR}_{i,t} + \alpha_i + \gamma_t D_t + \varepsilon_{i,t} \quad (1)$$

To test whether there is a positive correlation between the firm's R& D on business performance and with lag periods of R&D, equation (2)

$$\mathrm{ROA}_{i,t} = \beta_{1,t}\mathrm{RDI}_{i,t-k} + \beta_{2,t}LEV_{i,t} + \beta_{3,t}\mathrm{GPM}_{i,t} + \beta_{4,t}\mathrm{TAGR}_{i,t} + \alpha_i + \gamma_t D_t + \varepsilon_{i,t} \quad (2)$$

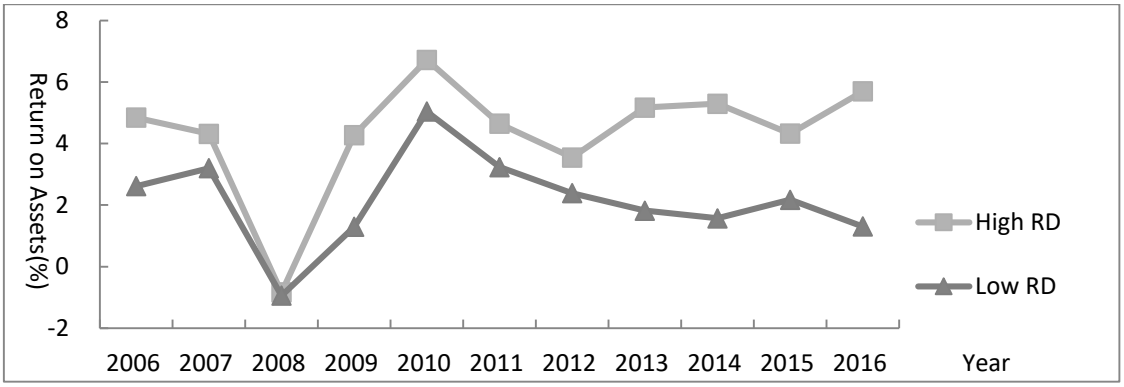
Finally, for testing RDI has a moderating effect on firm size and performance, as equation (3)

$$\mathrm{ROA}_{i,t} = \beta_{1,t}SIZE_{i,t} + \beta_{2,t}LEV_{i,t} + \beta_{3,t}\mathrm{GPM}_{i,t} + \beta_{4,t}\mathrm{TAGR}_{i,t} + \beta_{5,t}\mathrm{RDI}_{i,t-k} + \beta_{6,t}SIZE_{i,t} * \mathrm{RDI}_{i,t-k} + \alpha_i + \gamma_t D_t + \varepsilon_{i,t} \quad (3)$$

3.2 Empirical Analysis

Figure 1 We divide the average R&D expenditures of individual textile firms into two groups with high and low R&D expenses that measure innovation performance. For example, in the financial tsunami in 2008, firms with a high R&D expenditure group had higher innovation performance ROA than those with low R&D expenditure, and finance performance rebounded well after Economic recovery.

Figure 1: ROA of R&D Investment of Textile Companies in Taiwan, 2006–2016



Source: Taiwan's new economic (TEJ) database

Table1, Results for the LLC and ADF-Fisher tests of unit roots for each variable are presented herein. The p-values of all variables are below 0.1. just only In the ADF-Fisher Chi-square of the SIZE variable is 0.1846 ,p>0.1.indicating statistical stationarity.

Table 1: Unit-root Test

Method	ROA	SIZE	LEV	GPM	TAGR	RDI
LLC	-11.996***	-1.996**	-7.281***	-14.12***	-19.79***	-7.696***
PP	235.106***	116.779	139.195**	250.865***	338.429***	117.402***

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01*

Table2,As regards the deferred effect, $\mathrm{RDI}_{i,t-k}$, where k is the lag periods (in years), the value of k was estimated using the individual root-Fisher ADF test. k=3, ADF - Fisher Chi-square and Choi Z-stat Both are significant, k = 3 best choice ($\mathrm{RDI}_{i,t-3}$)

Table 2: Individual Root-Fisher ADF Test

	Lag period	RDI_{-1}(k=1)	RDI_{-2}(k=2)	RDI_{-3}(k=3)
AIC	ADF - Fisher Chi-square	117.40***	103.418**	145.148***
	ADF - Choi Z-stat	-1.13164	-0.6088	-1.79915**

*Note: * p < 0.1, ** p < 0.05, *** p < 0.01*

The Hausman test is performed prior to Panel Data model analysis as a basis for selecting random or fixed effects models. Test statistic was 45.017、37.039、40.335,p< 0.05，The above test statistic all fell into the reject domain, which denied the random effect model of null hypothesis. This indicates that this study is suitable for adopting the individual fixed effect model.

Table 3: Impact of RDI and Firm's Size on ROA

	ROA		
Variable	Model 1	Model 2	Model 3
SIZE	0.548*** (4.824)		0.5674*** (3.211)
LEV	-0.1527*** (-2.8284)	-0.1232* (-1.6757)	-0.1229 (-1.4482)
GPM	0.3316*** (10.649)	0.3211*** (7.8107)	0.3989*** (8.0594)
TAGR	0.1602*** (6.1124)	0.1793*** (5.3283)	0.0964*** (2.7464)
$RDI_{(-3)}$		0.1214** (2.0493)	0.1259** (2.0013)
SIZE*RDI			0.1547*** (3.0321)
Adj-R^2	0.7178	0.7184	0.7501
Sum squa redresid	145.6145	107.4199	81.8516
D-W	1.7259	1.7295	1.8101
F	27.4072***	20.2536***	30.2012***
Fixed Effect Model			

*Note：***p<0.001;**p<0.05,*p<0.1, The coefficient estimates are standardized and the brackets are the t statistics for the coefficient estimates.*

As can be seen from Table 3, Model 1 mainly considers the impact of a firm's resources on its finance performance.The result shows that Adj-R^2 is 0.7178;D-W is 1.7259 were between 1.5-2.5. Therefore, there was no autocorrelation in errors between the residuals of the model. Firm's resources (Size) is positively correlated with ROA (β=0.548, t =4.824 and p< 0.05); LEV is negatively correlated with ROA (β= -0.1527, t =-2.8284 and p< 0.1); GPM and ROA are positively correlated (β=0.3316, t =10.649, and p < 0.01), TAGR and ROA (β=0.1602, t = 6.1124 and p < 0.01). Hypothesis 1 gets support.

Model 2 mainly considers the impact of a company's RDI on its finance performance. The result shows that Adj-R^2 is 0.7184; D-W is 1.7295. The lagged RDI is positively correlated with ROA (β=0.1214, t =2.0493 and p< 0.05); LEV is negatively correlated with ROA (β= -0.1232, t =-1.6757 and p< 0.1); GPM and ROA are positively correlated (β=0.3211, t =7.8107, and p < 0.01), and TAGR and ROA (β= 0.1793, t = 5.3283 and p < 0.01). It can be observed from the above results that, the R&D expense investment (RDI) of Taiwan's textile companies exhibits a lagged effect and produces a positive impact on finance performance. Hypothesis 2 gets support.

Model 3, This model takes both RDI and firm's resources (Size) into consideration and observes their changes: The result shows that Adj-R^2 is 0.7501; D-W is 1.8101. The Size*RDI is positively correlated with ROA (β=0.1547, t =3.0321 and p< 0.01). Hypothesis 3 gets support.

4. FINDINGS AND DISCUSSIONS

In recent years, textile companies in the international market have been reduced by emerging countries with low labor costs and low need for technological capacity. Do Taiwan's textile companies only have to constantly relocate in pursuit of cutting production costs? Perhaps the textile firms are need considering whether investment in R&D expenses, manpower and time can help their finance performance. This study only probes into the firm's RDI according to the resource based view and to literature and theories related to finance performance. carried out empirical research into the impact of RDI and resource-based view on performance and arrived at the following theory empirical and conclusions:

(1) RDI has a lagged effect because R&D expenditures input enterprises led R&D activities generated new knowledge, skills and products are takes time to form and accumulate. RDI has positive impact on finance performance. This also shows that the impact of RDI on finance performance in addition to existing in high tech industries also exist in the traditional industries.

(2) The larger an firm's assets, the more it implies that there are more corporate resources available to invest in more resources than the smaller vendors such as marketing, labor and advertising budgets. It can be observed from the above results that, the firm's resources of Taiwan's textile companies exhibits and produces a positive impact on finance performance.

RDI plays moderating effect between the firm's size and finance performance. RDI in the firm's operating process have this interference effect. This also means that firms with larger or smaller assets should pay attention to their own RDI.

5. CONCLUSION

However, R&D activities are a viable choice regarding a firm's operation. Companies can pursue commodities of higher added value, improve product quality and production efficiency, and optimize their process. A feasible way is to invest in R&D, or they can still mass produce to lower the unit price of production costs, or relocate the production bases to areas with lower labor and production costs. Nonetheless, once the labor costs and production costs increase, will the companies repeat the above practice? This problem requires us to think carefully. In addition, the impact of R&D investment on innovation performance will have a positive impact on the size or the industry to which they belong, just have different degree. Jacobs et al. (2002) even small economies needed to invest in R&D. Truett (2014) in case of small textile industrial scale or no benefits brought by economies of scale in country/regional economies, maintaining a high-quality reputation might be a very useful strategy. These results indicate the great importance of R&D. To conclude, this study hopes that its findings will be useful to practitioners, researchers and policymakers, and will be of some help to relevant future research as a reference.

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