The Impact of Cross-Border M&A on Firm Productivity - Exploitation vs. Exploration

Research Article

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Abstract

This paper examines the causal relationship between cross-border M&A and firm's productivity using a rich micro dataset across the global market over the period 2002-2011. It extends the empirical evidence on the impact of cross-border M&A on acquirer's productivity and enriches the empirical evidence in the M&A literature on resource exploitation vs. exploration. This paper finds that the increase in a target's productivity only takes place in the integration between MNEs in the completed cross-border M&A. However, it reports that the completion of a cross-border M&A decreases the post-acquisition productivity level of acquirers compared with that of similar firms in takeover rumours. We furtherly conclude that there is a low firm productivity in the short term in both market-seeking and strategic asset-seeking expansions.

Keywords: Cross-Border M&A; Productivity; Exploitation; Exploration.

Introduction

Productivity gaps between foreign-owned firms and domestic firms have been widely observed and extensively investigated in the international industrial organisation (IO) literature, and ample empirical evidence on the effects of M&A on performance from the aspect of productivity has been documented [33, 34, 45, 70]. Cross-border M&A implying an ownership change from domestic to foreign owners offers an appropriate framework to isolate effects of foreign ownership [8]. However, existing empirical evidence on the causal link between international M&A and firm's productivity is inconclusive. While a number of studies have found positive effects of cross-border M&A on firm's productivity [55], for the US; for the UK; [4], for Indonesia; [12], other research has found that target firms do not gain any benefit from foreign ownership [11, 45], for the UK; [5, 35].

Internalisation theory stresses that FDI depends on a firm's ownership advantages such as technology, organisational assets, and brand names. Economists and policy makers incline to presume that large endowments of intangible assets make foreign-owned firms possess an advantage over domestic firms, because they can compensate for a lack of local information and experience [26] [27, 35, 38, 23, 65, 69]. The phenomenon of M&A therefore presents an opportunity to exploit the extent to which such ownership advantages are transferred into the acquired business, this improving firm performance. Nevertheless, domestic production activities of either acquirers or targets may be substituted by similar investments abroad [73]. Such substitution will affect the productivity of firms. Thus, this paper will examine the performance on the exploitation of intangible advantages for acquirers through the market-seeking M&A.

From another aspect, due to the complexity and diversity of new high-technology products and processes, firms cannot merely depend on their internal R&D to maintain competitiveness [67]. Some desired technological capabilities and knowledge are possessed by other firms which are even located in different industries and countries. Hence, it is increasingly important for firms to exploit external technological opportunities and knowledge sources so that they can complement the shortage of internal R&D efforts [76, 77, 43, 19, 60, 53, 63]. Besides, it is argued that obtaining the complementary assets and technology is one of objectives of cross-border M&A [62]. Therefore, M&A are increasingly regarded as a strategic instrument for obtaining the external intangible resource,e.g. technological knowledge [78]. With these external sources, incumbent firms could compensate for their technological productivity or expiring patents [22, 47]. From the home countries' view, cross-border M&A enables the transfer of

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade*. 2022;5(1):119-129.

knowledge from abroad which may reinforce domestic techno-logical capabilities. However, from the host countries' view, domestic firms in knowledge-intensive industries may be protected from foreign acquisitions by policy makers [73]. Thus, it is questioned for acquirers to effectively explore the desired intangible assets. This paper will assess the exploration of complementary resources from targets through the strategic asset-seekingM&A. This research extends the empirical evidence on the impact of cross-border M&A on acquirer's productivity and enriches the empirical evidence in the M&A literature on resource exploitation vs. exploration from a resource-based view. This research will adopt the approach of [53] to generate the TFP for the firm's productivity measure. It also exploits the potential channel function of M&A in shaping the post-acquisition productivity level. The labour productivity will be employed as the alternative firm's productivity measure for the robustness check.

In firm performance studies, previous researchers use matching approach to address the sample selection issue while we will use the rumoured but abandoned M&A as a control group which is a better way to address it. To our knowledge, it is the first time to be used in the M&A performance study. Actually, what we compared is the performance of between the real completed M&A and potentially completed M&A, rather than that of between the completed deals and the irrelevant firms in other events. Thus, we report the different results from the previously positive ones in some M&A research. Furthermore, existing empirical evidence on the effects of cross-border M&A is mostly limited to target firms, while little is known about the effects on the acquiring firms. This research will assess the impacts of M&A from aspects of both acquirers and targets.

This paper is organized as follows: section 2 reviews previous theoretical literature and empirical evidence. Section 3 provides a description of the data and empirical model. Results of the empirical analysis and discussion are presented in section 4. Section 5 concludes.

Theoretical Back Ground

MNE vs. Non-MNE

The performance gap identified by foreign M&A (rather than foreign ownership in general) has received much attention. It is necessary to assess the effect of pre- and post-foreign M&A on firm performance. According to [44], it is suggested by studies that the international M&A are found to be affected by the pre-acquisition performance of firms, such as productivity, return on assets/ shares, managerial performance, and growth potential, as well as industry-specific characteristics. With respect to the pre-M&A productivity of the domestic target, foreign acquirers could select two alternative types of targets which are unproductive firms and productive firms. Furthermore, [61] indicate that foreign targets are acquired by either the higher or the lower productive firms. Firms benefit from the synergy/restructuring effect by exploiting the firm-specific assets and networks of new parents or subsidiary firms, thus achieve additional efficiency gains [9]. This proposition also echoes (3) internalisation theory which states an inputs transfer following a takeover such as technology, organisational assets, and brand names would expect an increase in the volume and/or value of outputs. Therefore, the ownership advantage

possessed by MNEs will improve target's productive efficiency in takeovers. Hypothesis 1 is deduced as follows:

Hypothesis 1: There is a positive relationship between MNE and the target's post-M&A productivity level in the completed cross-border M&A.

Completed M&A vs. Uncompleted M&A

In above cases, there would be a selection bias when assessing the post-acquisition impact of foreign M&A, if one simply compares the time-profile of acquired and non-acquired firms. The selection bias occurred refers that the improvement of firm's productivity may be explained not only by the impact of cross-border M&A but also by the initial high productivity level of firm per se. In other words, if the multinational firm has a high productivity level prior to the takeovers, its high productivity may continue rather than be influenced by takeovers. We will use the rumoured but uncompleted M&A to control the selectivity bias.

When foreign firms acquire those targets with a low productivity, foreign acquirers intend to replace the poor management through overtaking inefficient managers who desire to maximise their own achievements rather than company profits. Then, surviving firms are expected to achieve ahigher post-acquisition performance [48]. In contrast, other disparate literature such as the corporate efficiency hypothesis suggests that cross-border deals are usually accompanied by a higher risk of failure [13, 46]. The reason for increased risk of failure in cross-border M&A predominantly results from the information asymmetries between acquirers and targets. The large cultural distance and institutional differences bring firms with the information asymmetries which leads to high transaction costs [25]. Furthermore, the geographical distance makes it difficult to monitor [24] and transmit tacit knowledge [14].

From other aspects, the asymmetry due to lack of political influence and knowledge networks will increase the difficulty in organisational integration and may mislead the takeover decisions [44]. Therefore, caused by these factors, including the resource shortage due to the difficulty of coordination over distance, a higher return might be expected by acquirers in cross-border M&A in order to compensate for the high costs and risk during these transactions. In general, because of information asymmetry, [39] find that the cross-border M&A are on average much larger than domestic deals. Moreover, foreign operations are suggested to experience higher costs compared with domestic firms from the transaction cost literature. These may bring a negative relationship between cross-border M&A and firm's productivity in spite of the good intention to improve firm performance. Thus, hypothesis 2 is generated as follows:

Hypothesis 2: The acquirer's post-M&A productivity level decreases after the cross-border M&A is completed, compared with that in the similar uncompleted takeover.

Resource Exploitation

Built into the IO literature, the operational efficiency theory asserts that highly productive firms will be inclined to change ownership leading to improved post-acquisition productivity [31]. Drawing on this theory, [16] argue that the foreign acquirer can

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade*. 2022;5(1):119-129.

131

achieve monopoly power through overtaking the domestic monopolist in order to reduce capacity and avoid a price war between the acquired target and itself.

Although it is suggested that some multinational firms show higher productivity than domestic-owned firms [36], it does not mean that foreign ownership per se leads to higher productivity. [45] argue that, to the extent that foreign investors acquire the best performing firms, the productivity advantage might not be associated with foreign ownership per se. [71] explains that foreign multinationals may also influence the market structure and the extent of competition in the host country. The industrial organization (IO) literature casts further complex lights on the impacts of M&A on firm's productivity in the longer-run. On the one hand, the concentration of market power leads to a decline in competition [15]. Less competition pressure provides firms with less incentive to improve their productivity, which potentially lowers the long-run productivity growth in that industry. On the other hand, the application of technological or organisational knowledge, economies of scale, or the remediation of managerial slack leads to long-run productivity gains. In the short-run, however, it is expected that the high short-run costs of reorganisation results in a negative impact of takeovers on firm's productivity. This impact of reorganisation is expected to be larger after cross-border deals because of higher adaptation costs. Similarly, long-run productivity changes after foreign M&A are potentially more pronounced due to the larger scope for knowledge spill-over and adverse competition [71].

Since the modern internalisation and transaction cost theory [17, 30] is presented, [18] further indicates that the premier among proprietary assets of multinational enterprises is the firm-specific knowledge embodied in new products, processes and proprietary technology. Caves implies that the industries with high R&D and advertising intensities are the places where multinationals usually gather. The investing multinationals are usually argued to provide the domestic firms with their advantageous intangible assets such as innovativeness, technological and managerial knowledge, brand name capital and organisational capabilities [29, 57, 51]. However, it is problematic to mobilise the technological knowledge and brand name recognition/reputation across markets. Especially, licensing brand name will share an intangible asset (reputation) at the risk of horizontal externalities. Similarly, some multinationals own competitive advantage such as superior organisational routines and practices which are uneasily mobilised between markets due to their intangibility [7]. Thus, it is assumed that the productivity improvement of acquired firms may not be reflected immediately after takeovers. This may suggest a low post-M&A productivity level for both acquirer and target firms. Accordingly, hypothesis 3 is developed as follows:

Hypothesis 3: The completion of cross-border M&A makes the acquirer's post-M&A productivity level lower in cases of market-seeking motives, compared with the similar takeover rumour.

Resource Exploration

In addition to the traditionally known arguments, other concepts also are developed from a resource-based view in recent research, for instance the complementarities in assets between the acquirer and target [62]. The resource-based approaches assume that firms own heterogeneous factors which comprise the intangible resources, and these strategic resources possess the feature of immobility. The strategic composition of idiosyncratic resources such as knowledge, competences and capabilities eventually determine the competitiveness of a firm [6, 64, 37]. A competitive advantage is generated from the immobile, non-substitutable and imperfectly imitable strategic resources [56, 3, 64, 75]. In fact, the differences in performance across firms from the same industry can be interpreted by these different resources [75]. Moreover,[6] implies that the competitive advantages would be strengthened through obtaining the underlying resource. Accordingly, these features of strategic resources allow M&A to be a premier strategy in outsourcing. M&A can maintain the whole batch of knowledge, competences and capabilities under integrated management [59]. Thus, the heterogeneous resource endowment and the superiority of certain resource bundles make a firm perform differently from other firms within the same industry, and they explain the intra-industrial M&A activity and their success. The heterogeneity of resource endowment between acquirers and targets can be reallocated and adjusted via takeovers, which should explain the difference in post-M&A productivity level.

The productivity of investing firms can be influenced by cross-border M&A via a variety of channels, for instance the innovation activities. First, acquisitions may directly relocate innovation activities in order to improve productivity. Second, acquisitions may indirectly change productivity through affecting other determinants of productivity such as a firm size, market share, competition, technological opportunities, external knowledge sources, market demand, and financial factors [20, 42]. As the competition in technology mainly occurs in the international market, the technological relatedness between acquirer and target is important in the cross-border M&A [32]. Furthermore, it is suggested that technology shocks drive the assets to be reallocated to more productive firms via M&A in recent theoretical and empirical contributions [49]. Acquiring the main competitors is an attractive way to eliminate competition in the product markets [50] or technology markets [40]. However, the elimination of the competition in technology markets due to takeovers may provide less incentive for firms to increase innovation activities which lead to a potential decrease in productivity after takeovers [15].

A recent attempt to link intangible assets to productivity improvement has been conducted by [66]. Their findings significantly prove that firms with a higher proportion of intangible assets are more likely to be highly productive. Acquirers can explore the production capabilities or intangible assets by acquiring target firms with these resources [49]. The dissemination of knowledge within the combined entity [68] or reallocation of technology to more efficient uses [49] will generate productivity gains after an acquisition. The synergetic effect stemming from M&A might increase the efficiency of innovation activities which might improve productivity of firms. However, intangible assets include a wide range of contents and are more difficult to measure than R&D expenditure or innovation capabilities of firms. The various elements of intangible assets are also found to contribute to productivity in different ways [66]. Additionally, the firms may not gain productivity improvement after takeovers if the intangible resources such as knowledge, technology, and managerial capability are not explored effectively [73]. For example, due to the intangibility of tacit knowledge, it is difficult to transmit such knowledge as managerial skills or manufacturing technique from target firms [14]. Accordingly, it is inconclusive in evaluating the

impacts of intangible assets on firm's productivity, especially when such M&A are driven by a strategic-asset seeking motive. Thus, hypothesis 4 is listed as follows:

Hypothesis 4: The completion of cross-border M&A makes the acquirer's post-M&A productivity level lower in cases of strategic asset seeking motives, compared with the similar takeover rumour.

Data and Methodology

Data

This research is based on firm-level dataglobally over the period from 2002 to 2011. It employs M&A data from the Bureau van Dijk's Zephyr database which has information on over 19,685 cross-border M&A all over the world between 2002 until 2011. This information is combined with the data from the Orbis database which provides detailed balance sheet data for all target and acquirer firms. The Orbis database also allows the construction of longitudinal panels as it collects firm-level information over a period of ten years. Also, many firms are observed for a shorter period of time, making the panel unbalanced. Regarding productivity analysis, Orbis offers the opportunity to measure TFP due to the availability of total fixed assets which is commonly used to proxy capital in the production function. The combination of both datasets allows us to investigate the effects of cross-border M&A on the short-run performance of target or acquirer firms respectively in different industries.

This research divides the sample collected into two subsamples based on the difference of intangible assets volume prior to cross-border M&A between acquirer and targets. The two subsamples comprise the deals that acquirers own more intangible assets than targets and the deals that acquirers own less intangible assets than targets. The purpose of this separation is to examine the effects of market seeking M&A and strategic-assetseeking M&A respectively. The deals with high intangible assets of acquirers are categorised to the market seeking M&A, while the deals with low intangible assets of acquirers are categorised to the strategic asset seeking M&A. Table 1lists the distribution of cross-border M&A status in the deals with product market driven expansion and complementary resource driven expansion. In table 1, there are 18,091 international deals in the former type expansions, which account for 91.9 per cent of all types of expansion. Furthermore, most cross-border M&A are rumoured and completed, which accounts for 90.38 per cent of all international deals.

Measuring Productivity

The main productivity measure is TFP, since changes in TFP directly reflect the efficiency gains following acquisitions due to the diffusion of technological or organisational knowledge and economies of scale. Given the advantage of the LP approach in controlling for the simultaneity between firm's choice of input levels and unobserved productivity shocks. Therefore, this research follows approach of [54] to construct TFP.

With adopting the LP approach, The Cobb-Douglas production function has been reformed as follows:

$$y_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \omega_{it} + \varepsilon_{it} \equiv \beta_l l_{it} + \varphi_t (k_{it}, m_{it}) + \varepsilon_{it} \quad (1)$$

where $\varphi_t \equiv \varphi_t (k_{it}, m_{it}) = \beta_0 + \beta_k k_{it} + \omega_{it} (k_{it}, m_{it})$ is an unknown function of capital and intermediate inputs. φt is a strictly increase in the productivity shock ωt, so that it can be inverted and one can write $\omega_{it} = \omega_t (k_{it}, m_{it})$ for some function ωt. Levinsohn and Petrin (2003) [54] approximate $\varphi_t (k_{it}, m_{it})$ by a third order polynomial in k and m, $\sum_{j=0}^{3}\sum_{s}^{3}\delta_{js}k_{it}^j m_{it}^s$ and obtain the estimate of β_l and φ_t via OLS. Follow the first stage of the estimation procedure above, the second stage defines the elasticity of capital β_l as the solution tomin $_{\beta_k^*}\Sigma_i\Sigma_t(y_{it} - \hat{\beta}_1 l_{it} - \beta_k^* k_{it} - \bar{\omega}_{it})^2$, where $\bar{\omega}_{it}$ is a nonparametric approximation E [ω_{it} | ω_{it-1}]. All of the estimators in the two stages make it vary to calculate the covariance matrix of the parameters, so the bootstrapping procedure is applied to estimate standard errors. Once obtaining consistent estimates, the log of productivity can be expressed as $\hat{\omega}_{it} = \hat{y}_{it} - \beta_0 - \hat{\beta}_1 l_{it} - \hat{\beta}_k k_{it}$.

The computation of TFP requires information on output, physical capital, labour, and the corresponding inputs' elasticity. The author measures output as firm's economic value added. Capital and labour are measured as total assets and the number of employees, respectively. The author also includes intermediate inputs, measured by the material cost, which is included as an instrument to control the unobservable technology shock in the estimation procedure of [54]. The quality of the results depends crucially on the construction of a detailed and unbiased productivity measure. Thus, this research also uses the labour productivity to check for the robustness of the main results.

TFP and Labour Productivity

By comparing TFP with labour productivity, [71] indicate that TFP reflects firm efficiency gains due to the diffusion of technological or organisational knowledge and economies of scale, with less focus on the transmission channels. Labour productivity, in contrast, is a broader measure that captures these TFP effects as well as changes in the firm's capital-labour ratio. The increase in labour productivity due to foreign ownership can result from an increase in the capital-labour ratio, i.e. capital deepening, instead

Table 1. The distributions of cross-border M&A status and pre-M&A acquirer feature.

Pre-M&A acquirer	Uncompleted M&A		Completed M&A		Total
High intangible asset	1,690	-9.34%	16,401	-90.66%	18,091
	-89.23%		-92.19%		-91.90%
Low intangible asset	204	-12.80%	1,390	-87.20%	1,594
	-10.77%		-7.81%		-8.10%
Total	1,894	-9.62%	17,791	-90.38%	19,685
Source: Author's calculations from Orbis and Zephyr data set.					

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade.* 2022;5(1):119-129.

133

of the theoretically suggested TFP effects, i.e. technological or organisational knowledge diffusion. Therefore, [71] concludes that TFP is the more appropriate measure to identify the causal impact of foreign acquisitions on firm performance.

Method and Variables

This research will examine the effects of cross-border M&A on acquirer firm's productivity. The baseline model in this research takes the following form:

$$TFP_{it+1} = \alpha_0 + \alpha_1 Completed\_MA_{it} + \alpha_2 X_{it-1} + \alpha_3 MAtype_{it} + v_t + v_j + \varepsilon_i \quad (2)$$

where TFP_{it+1} is the value in one year after the M&A deal completed or rumoured. Sometimes, the firm's financial information is incomplete during the year of M&A announcement or completion because an M&A event may occur in the middle of the firm's financial year. This ensures that the firm's financial information is complete for a whole financial year. Particularly, in terms of the rumoured but uncompleted deals, the TFP_{it+1} refers to the productivity level of potential acquirer whoever was involved in the uncompleted international M&A.

The $Completed\_MA_{it}$ is a binary variable, capturing the cross-border M&A's status, which takes value 1 if the M&A's status of testing firm is rumoured and completed, and takes value 0 if its M&A's status is rumoured but uncompleted. Testing if this dummy is statistically significant in affecting TFP level will show us evidence for the role of completion of M&A deals, controlling for other factors and firm unobserved heterogeneity. The main interest of this research is whether a firm's productivity is influenced after the completion of an M&A deal compared with the abandoned potential deal which is the deal only experiencing the takeover rumour. The vector X_{it-1} captures a set of control variables that have been found in the literature to be important in explaining firm's productivity level in general. According to [10], the pre-acquisition characteristics could affect performance in the future, so pre-performance is linked to explanations of possible productivity gains after an M&A activity. These variables include following firm characteristics observed in the pre-acquisition period: firm size, the intangible resource, and characteristic variables to capture financial leverage and liquidity. Firm size is measured by firm's total fixed assets. The financial leverage and liquidity are measured by the firm's gearing ratio and cash flow respectively.

It is suggested that some firm characteristics can also accumulate from the preceding period due to the effect of firm's productivity such as technological advantage or cash holdings, etc. Similarly, there is simultaneity between M&A activities and firm's productivity. Hence, there is potential endogeneity in the estimation model. However, the predetermined variable is usually employed to diminish the potential endogenous problem. Therefore, the firm's productivity level is led by one year for the dependent variable in the estimation model. Additionally, the baseline investigation uses pooled static models in which all explanatory variables, except for Completed_MA and MA type, are lagged by one year to diminish the potential endogeneity and correct heteroskedastic standard errors by clustering at the individual firm level.

Another control variable is MA type$_{it}$. It stands for the type of M&A which includes vertical, horizontal and conglomerate M&A.

Finally, the error term is made up of a time-specific component (v_t), a two-digit industry-specific component (v_j), and an idiosyncratic error term ε_i.

This research also looks at the subsample of deals with acquirers having more intangible assets than targets and deals with targets having more intangible assets than acquirers. This separation will answer the effect of M&A event on firms' productivity in the deals where an acquirer firm's advantage in intangible resources e.g. advanced technology can compensate for its disadvantage in information asymmetry and in the deals where a target firm's intangible resource is the main aim of M&A. This baseline model is equal to allow for intercept heterogeneity. The estimation corrects heteroskedastic standard errors first by clustering at the individual firm level in the baseline least squares estimation, and then by using labour productivity as a robustness check. The labour productivity is defined as total revenue per employee. The working assumption is that a good measure of TFP should exhibit a reasonable high correlation with labour productivity.

Conditional on effects of M&A completions on the productivity level, the research further search for potential channels through which completion of M&A may shape post-acquisition TFP. To this end, we modify equation 3 by allowing parameter heterogeneity in M&A completions:

$$TFP_{it+1} = \beta_0 + \beta_1 Completed\_MA_{it} + \beta_2 X_{it-1} + \beta_3 X_{it-1} * Completed\_MA_{it} + \beta_4 MAtype_{it} + v_t + v_j + \varepsilon_i \quad (3)$$

By interacting $Completed\_MA_{it}$ with firm characteristics, equation (3) examines the TFP effects due to completion of M&A indirectly through various firm characteristics differences.

The similar estimation will be also conducted for labour productivity.

In order to assess whether there is a difference in ownership advantage between MNEs and non-MNEs, this research will also estimate the impact of firm MNE status on target's post-M&A productivity level by modelling four groups of completed cross-border M&A deals. They are four types of deals with MNE acquirer, non-MNE acquirer, MNE target and non-MNE target respectively. The specifications are constructed as follows:

$$TFP_{it+1} = \beta_0 + \beta_1 T\_mne + \beta_2 X_{it-1} + \beta_3 MAtype_{it} + v_t + v_j + \varepsilon_i \quad (4)$$
$$TFP_{it+1} = \beta_0 + \beta_1 A\_mne + \beta_2 X_{it-1} + \beta_3 MAtype_{it} + v_t + v_j + \varepsilon_i \quad (5)$$

T_mne stands for the target's MNE status dummy, while A_mne stands for the acquirer's MNE status dummy. Value of 1 denotes MNE firm and value of 0 denotes non-MNE firm. Other variables keep the same. The four types of deals are constructed by dividing A_mne = 1 or 0 in the equation (4) and T_mne = 1 or 0 in the equation (5).

Results and Discussion

The Impact of MNE Status on Target's Productivity

The impact of MNE status on a target's post-acquisition productivity is reported in table 2. All these models include the pre-M&A target's characteristics such as cash flow, corporate financial

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade*. 2022;5(1):119-129.

134

leverage, intangible assets and firm size. Four models also include the target MNE status dummy and acquirer MNE status dummy respectively. The year and industry dummies are controlled in all the four models.

In model (1), when the acquirer is an MNE in the international M&A, target's MNE status shows a significant and positive sign. This means MNE target's TFP level will be improved when it is acquired by another MNE firm. The MNE status in model (2), (3) and (4) is not found significant. It is not found the significant evidence for the transfer of ownership advantage from MNEs to non-MNEs in the international takeovers.

The significant and negative coefficients of the target's gearing ratio in columns (1), (3) and (4) suggest that a high level of the target's leverage will reduce its TFP level when it is acquired by an MNE and no matter whether it is an MNE. This can be explained that a high debt burden forces the firm to reduce its spending on technological innovation, which is not beneficial to the TFP improvement. In terms of the target's cash flow, the significant and positive coefficients in columns (1), (2) and (4) imply that the

large cash holdings of targets improve their TFP levels no matter whether they are acquired by MNEs or when they are non-MNEs per se. This could be explained that the large cash holdings enable targets to increase expenditure on R&D, which results in the TFP improvement. In addition, the target's size measure reports a significant and positive sign for all columns in table 2. This suggests that large firms incline to have high TFP levels no matter whether they are MNEs. This echoes the results for MNE status.

Effects of Cross-border M&A on Acquirer's TFP

The sample information for the model of M&A's impact on acquirer's post-acquisition TFP is summarised in the table below. From this table, all variables show positive mean values in the sample of 2,436 cross-border M&A.

Table 4 reports the effects of cross-border M&A on acquirer's productivity measured by TFP over the examined period, 2002-2011. In order to examine possible TFP change channels through which a completion of an M&A may influence firm's productivity, this research interacts the M&A completions dummy

Table 2. The impact of MNE status on target's post-M&A TFP.

	(1)			(2)			(3)			(4)		
	MNE acquirer			Non-MNE acquirer			MNE target			Non-MNE target		
TTFP$_{t+1}$	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.
T_mne	4.03E-1	9.99E-2	***	2.77E-1	1.87E-1							
A_mne							1.52E-1	1.79E-1		1.14E-1	9.03E-2	
TGearingRatio$_{t-1}$	-1.09E-3	2.72E-4	***	-6.25E-4	4.85E-4		-2.68E-3	6.54E-4	***	-7.86E-4	2.55E-4	***
TCashFlow$_{t-1}$	5.37E-6	2.28E-6	**	1.22E-5	4.11E-6	***	-9.41E-7	4.98E-6		6.48E-6	2.17E-6	***
TIntangibleAsset$_{t-1}$	1.30E-6	3.87E-6		2.63E-6	6.92E-6		1.01E-6	7.56E-6		1.41E-6	3.84E-6	
TTotalAsset$_{t-1}$	5.88E-8	1.43E-8	***	7.13E-7	3.51E-7	**	9.26E-8	1.85E-8	***	1.58E-7	4.16E-8	***
MAtype												
Vertical_MA	9.41E-2	1.97E-1		4.53E-1	4.51E-1		-1.01E-1	4.46E-1		2.77E-1	1.98E-1	
Horizontal_MA	-4.47E-2	8.96E-2		-2.54E-2	1.59E-1		1.08E-1	1.81E-1		2.59E-2	8.69E-2	
Constant term	5.85E+0	9.93E-1	***	5.03E+0	1.49E+0	***	6.64E+0	1.46E+0	***	4.78E+0	1.37E+0	***
Adj R-squared	0.096			0.105			0.142			0.059		
No. of obs.	1167			391			307			1251		
Note: 1. All regressions include year dummy and NACE 2-digit industrial sector dummies.												
2. ***, **, * denotes significance at the 1, 5, and 10 percent level, respectively.												

Table 3. Descriptive statistics for the impact of M&A on acquirer's TFP.

Variable	Obs.	Mean	Std. Dev.	Min	Max
ATFP$_{t+1}$	2436	9.753	1.715	1.530	13.956
Completed_MA$_t$	2436	0.911	0.286	0	1
AGearingRatio$_{t-1}$	2436	85.868	113.209	0	989.3
ACashFlow$_{t-1}$	2436	423760.3	2135241	-5.43E+7	3.35E+7
AIntangibleAsset$_{t-1}$	2436	28479.58	19972.61	228	63487
ATotalAsset$_{t-1}$	2436	5321627	2.36E+7	122	7.96E+8
MAtype	2436	1.748	0.947	1	3
The descriptive statistics is analysed by using the full model with control variables.						

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade*. 2022;5(1):119-129.

with key firm characteristics. Thus, two sets of static model estimation results are discussed below, which are a baseline model and a model with interaction terms. By calculating the difference of intangible assets between target and acquirer firms, the samples are also split into two subsamples that capture the deal where an acquirer with high technology and managerial advantage acquires other targets and the deal that a target with complementary resource is acquired by other acquirers. The year and industry effects are controlled for both baseline model and interaction model.

Across model specifications, the key variable Complete_M&A shows significant and negative coefficients in column (1) and (2) of table 4. This suggests that the completion of cross-border M&A will reduce the acquirer's TFP level comparing with the abandoned takeover rumours. Furthermore, controlling for other factors, columns (3) and (4) confirm significant and negative relationship between their TFP level and the completion of cross-border M&A for the deals with high acquirer's intangible assets. This implies that acquirer cannot achieve the high TFP level after completing cross-border M&A in the short term. This can be explained that the high technology and managerial skills of acquirers fail to exert their advantage in diversifying the international investment risk in overseas markets due to being unfamiliar with local information.

In column (1) and (2) of table 4, the significant and positive signs of acquirer's cash flow demonstrate that the high liquidity of a firm can improve their productivity in international takeovers. This is consistent with the previous findings thatless financial restrictions facilitate innovation development and hence boost higher productivity. Columns (3), (4) and (6) suggest that cash flow shows positive impact on its TFP no matter that acquirer has high or low intangible assets. This can be explained that more cash holding could boost higher acquirer's productivity together with its intangible resources. Moreover, the financial advantage in liquidity can compensate for the disadvantage in lack of technological resource. Thus, acquirer can achieve TFP improvement from high liquidity.

In terms of acquirer's intangible assets in cross-border M&A, columns (1) and (2) of table 4show thattheacquirer's TFP improvement can benefit from its technology or managerial advantage and the completion of international M&A will reinforce this

effect. Column (3) also verifies this positive effect in the deals of product market-oriented expansion. However, from column (6), if an acquirer has no advantage in intangible resource, it will fail to reallocate target's complementary resource well and damage acquirer's productivity level itself. The completion of M&A will make that situation worse in the deals of complementary resource-oriented expansion. This can be explained by [1, 74] that the acquirer takes time to digest or establish intangible assets, especially when it involves aspects such as research and development, brand development, good-will and other expenses with a long-term effect. In general, the above findings are supported by the theoretical model of [61]. They suggest that the scope for productivity spill-over from the acquirer to the target firm is most pronounced if the acquirer operates in a technology-intensive industry, while productivity spill-over might even be negative if it operates in a marketing-intensive industry.

The total assets measure the size of a firm and provide significant positive signs for acquirers in cross-border M&A. This means that big multinational firms are more likely to havehigh productivity levels. From columns (3) and (4) in table 4, firm size is positively related to acquirer's TFP level in the deals with intangible advantage oriented expansions, and the completion of M&A will reinforce the positive effect of big multinational firm's high technological and managerial advantage on acquirer's TFP level. One reason might be that, those more efficient or productive multinational firms are able to overcome the entry barriers to enter foreign markets and to be competitive in the host markets [58]. By contrast, columns (5) and (6) show that large size of a firm will help increase the acquirer's TFP level in the expansions by seeking strategic assets, but the completion of M&A will impair this positive effect of large firm size in the takeovers where acquirers have a disadvantage in intangible assets. Therefore, although large multinational firms can penetrate into the host market to explore the strategic assets, their dependences on the strategic assets make the acquirers passive in their operations and the integration of intangible assets may be difficult, which leads to the decrease in acquirer's post-acquisition TFP level.

Effects of Cross-border M&A on Acquirer's Labour Productivity

The sample information for the model of M&A's impact on acquirer's post-acquisition labour productivity is summarised in the

Table 4. The impact of cross-border M&A on acquirer's TFP.

Model	All international deals						High intangible assets in acquirers						Low intangible assets in acquirers					
	(1)			(2)			(3)			(4)			(5)			(6)		
Dep: ATFP$_{t+1}$	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.
Completed_MA$_t$	-2.04E-1	1.17E-1	*	-4.99E-1	2.11E-1	**	-2.19E-1	1.26E-1	*	-4.67E-1	2.43E-1	**	-1.64E-1	3.74E-1		-4.90E-1	6.66E-1	
AGearingRatio$_{t-1}$	-2.18E-4	2.99E-4		-5.22E-5	1.14E-3		-1.86E-4	3.15E-4		4.68E-4	1.23E-3		-5.24E-5	1.06E-3		1.48E-3	4.42E-3	
AGearingRatio_MA$_{t-1}$				-1.75E-4	1.17E-3					-6.77E-4	1.26E-3					-1.64E-3	4.52E-3	
ACashFlow$_{t-1}$	1.09E-7	2.10E-8	***	1.16E-7	5.22E-8	**	1.08E-7	2.19E-8	***	2.37E-7	8.66E-8	***	1.42E-7	9.46E-8		2.02E-7	1.06E-7	*
ACashFlow_MA$_{t-1}$				-2.26E-9	5.61E-8					-1.30E-7	8.91E-8					5.44E-7	3.72E-7	
AIntangibleAsset$_{t-1}$	7.04E-6	1.63E-6	***	-2.10E-6	5.38E-6		8.31E-6	1.79E-6	***	9.29E-7	5.91E-6		-7.68E-6	1.55E-5		-8.74E-5	5.12E-5	*
AIntangibleAsset_MA$_{t-1}$				1.01E-5	5.63E-6	*				8.22E-6	6.19E-6					9.65E-5	5.44E-5	*
ATotalAsset$_{t-1}$	9.24E-9	1.87E-9	***	5.59E-9	5.97E-9		8.20E-9	1.92E-9	***	-8.13E-9	9.26E-9		3.08E-8	1.12E-8	***	4.20E-8	2.54E-8	*
ATotalAsset_MA$_{t-1}$				4.04E-9	6.21E-9					1.72E-8	9.43E-9	*				-6.98E-8	4.13E-8	*
M&A type																		
Vertical_MA	1.56E-2	1.80E-1		1.32E-2	1.80E-1		3.58E-2	1.87E-1		3.51E-2	1.87E-1		-9.92E-1	7.33E-1		-1.14E+0	7.43E-1	
Horizontal_MA	9.80E-2	7.13E-2		9.65E-2	7.14E-2		1.07E-1	7.62E-2		1.04E-1	7.62E-2		2.20E-1	2.34E-1		2.43E-1	2.33E-1	
Constant term	9.33E+0	9.62E-1	***	9.62E+0	9.79E-1	***	8.71E+0	1.16E+0	***	8.95E+0	1.17E+0	***	1.13E+1	2.15E+0	***	1.21E+1	2.23E+0	***
Adj. R-squaredd	0.157			0.157			0.149			0.149			0.215			0.226		
Number of obs.	2436			2436			2145			2145			291			291		
Note: 1. All regressions have controlled year dummy and NACE 2-digit industrial sector dummies.																		
2. ***, **, * denotes significance at the 1, 5, and 10 percent level, respectively.																		

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade*. 2022;5(1):119-129.

table below. From this table, all variables show positive mean value in the sample of 3,285 cross-border M&A.

The acquirer's labour productivity has been tested and reported in table 6. It considers the effect of cross-border M&A and uses the cross-border M&A completions dummy to interact with key firm characteristics. Similarly, two sets of static model estimation results and two subsamples estimations are discussed below. The year and industry effects are also controlled for both baseline model and interaction model.

Across the specifications in table 6, the variable Completed_MA shows significant and negative coefficients for acquirers in the cross-border M&A. This means that the completion of M&A makes acquirer's labour productivity low comparedwiththe abandoned takeover rumours. This finding supports the aforementioned negative relationship between cross-border M&A and acquirer's TFP level. Columns (3) and (4) show that acquirer cannot achieve the high labour productivity level after completing international M&A in the deals with market-seeking intention. This means that the acquirers with advantages in technology and managerial capabilities have not performed well after the completion of M&A. According to the learning curve, [74] also argues that firm needs to take a longer time to accumulate knowledge, experience and the capability to obtain productivity improvements. Although [52] conclude that there are substantial positive impacts of product innovation on productivity, [41] argues that the impact of innovation process is more ambiguous because, for instance, most innovations are process-related in the service sector.

From column (6) of table 6, the coefficient of interaction term between the acquirer's intangible assets and completion of international M&A is significant and negative. It means that the high intangible assets could not facilitate the acquirer to achieve high post-acquisition labour productivity with the channel of international M&A completions in the complementary resource-oriented expansion. This could result from the difficulty in acclimatisation of the target's complementary resource in the new parent firms in the short term after the takeovers.

In column (1) of table 6, the variable acquirer's total assetsgives a significant and positive sign in cross-border M&A, which suggests that the bigger the acquirer is, the higher its labour productivity level is in overseas takeovers. This finding confirms the effect of firm size on the acquirer's productivity in TFP measure. This can be easily explained that the large total asset means a high amount of firm's capital stock invested. This increases the ratio of capital over labour, which leads to high level of acquirer's labour productivity. Especially, the positive coefficients in columns (5) and (6) with respect to the total asset show that bigger multinational firms incline to achieve higher labour productivity levels in the complementary resources-oriented deals. It can be explained that the ability and skill of bigger acquirer firms are more mature than smaller firms in integrating the complementary resources acquired from the targets. They can allocate and apply the assets effectively to enlarge the total output volume, which improves their labour productivity levels after cross-border M&A.

Comparison in Goodness of Fit for Labour Productivity and TFP Models

The LR test is performed by estimating the log likelihoods of two models and comparing the fit of one model to the fit of the other. This research has used the LR test to compare differences among nested models. The diagnostics used by LR chi-squared and adjusted R-squared show whether the baseline models are

Table 5. Descriptive statistics for impact of M&A on acquirer's labour productivity.

Variable	Obs.	Mean	Std. Dev.	Min	Max
ALP_{t+1}	3285	3377.546	1743.169	1	6837
$Completed\_MA_t$	3285	0.907	0.290	0	1
$AGearingRatio_{t-1}$	3285	86.455	120.876	0	989.3
$ACashFlow_{t-1}$	3285	414127.8	2278171	-5.43E+7	4.64E+7
$AIntangibleAsset_{t-1}$	3285	28273.37	20093.1	228	63487
$ATotalAsset_{t-1}$	3285	4811573	2.21E+7	89	7.96E+8
$MAtype$	3285	1.725	0.941	1	3
The descriptive statistics is analysed by using the full model with control variables.					

Table 6. The impact of cross-border M&A on acquirer's labour productivity.

	All international deals						High intangible assets in acquirers						Low intangible assets in acquirers					
Model	(1)			(2)			(3)			(4)			(5)			(6)		
Dep: $ALabourPro_{t+1}$	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.	Coef.	Std. Err.	sig.
$Completed\_MA_t$	-2.26E+2	1.07E+2	**	-3.05E+2	1.92E+2		-2.05E+2	1.16E+2	*	-3.70E+2	2.23E+2	*	-2.60E+2	3.18E+2		7.36E+2	5.47E+2	
$AGearingRatio_{t-1}$	3.27E-1	2.58E-1		7.37E-1	8.84E-1		3.59E-1	2.68E-1		6.47E-1	9.39E-1		3.05E-1	1.04E+0		4.13E+0	3.25E+0	
$AGearingRatio\_MA_{t-1}$				-4.49E-1	9.23E-1					-3.15E-1	9.78E-1					-4.07E+0	3.44E+0	
$ACashFlow_{t-1}$	3.71E-6	1.98E-5		-4.07E-5	4.55E-5		6.99E-6	2.17E-5		-1.26E-5	9.83E-5		-1.10E-4	7.43E-5		-1.10E-4	7.98E-5	
$ACashFlow\_MA_{t-1}$				5.52E-5	4.96E-5					2.19E-5	1.01E-4					2.45E-4	2.62E-4	
$AIntangibleAsset_{t-1}$	-4.47E-4	1.51E-3		-5.00E-3	5.00E-3		-1.13E-3	1.64E-3		-7.11E-3	5.56E-3		-8.20E-3	1.44E-2		6.12E-2	3.97E-2	
$AIntangibleAsset\_MA_{t-1}$				5.02E-3	5.25E-3					6.55E-3	5.82E-3					-7.96E-2	4.29E-2	*
$ATotalAsset_{t-1}$	3.30E-6	1.96E-6	*	8.67E-6	6.40E-6		2.72E-6	2.02E-6		4.55E-6	1.14E-5		1.82E-5	1.03E-5	*	2.47E-5	1.38E-5	*
$ATotalAsset\_MA_{t-1}$				-5.97E-6	6.67E-6					-1.84E-6	1.16E-5					-2.90E-5	3.07E-5	
M&A type																		
Vertical_MA	-9.88E+1	1.69E+2		-1.02E+2	1.69E+2		-1.03E+2	1.79E+2		-1.04E+2	1.79E+2		-6.19E+1	6.03E+2		-3.32E+1	6.14E+2	
Horizontal_MA	5.91E+1	6.70E+1		6.05E+1	6.71E+1		8.31E+1	7.12E+1		8.41E+1	7.13E+1		-1.63E+2	2.26E+2		-1.69E+2	2.25E+2	
Constant term	3.82E+3	7.54E+2	***	3.86E+3	7.71E+2	***	4.02E+3	8.19E+2	***	4.17E+3	8.40E+2	***	1.19E+3	2.17E+3		5.39E+2	2.23E+3	
Adj R-squaredd	0.035			0.035			0.032			0.032			0.032			0.040		
Number of obs	3285			3285			2903			2903			382			382		
Note: 1. All regressions have controlled year dummy and NACE 2-digit industrial sector dummies.																		
2. ***, **, * denotes significance at the 1, 5, and 10 percent level, respectively.																		

nested in the interaction models. However, when considering which model can explain better the impact of cross-border M&A completion on firm's productivity between the models with using TFP and those with using labour productivity, LR chi-squared and adjusted R-squared are unable to show the comparison of model fit because these two models are not nested each other. This research uses the AIC (Akaike Information Criterion) and the BIC (Bayesian Information Criterion) to test model fit and compare the goodness-of-fit for the both above models. The AIC is a measure of the relative quality of statistical models for a given set of data [2]. Hence, AIC provides a means for model selection. The BIC is closely related to theAIC.In statistics, the BIC is a criterion for model selection among a finite set of models; the model with the lowest BIC is preferred [72]. When fitting models, it is possible to increase the likelihood by adding parameters, but doing so may result in over-fitting. Both BIC and AIC resolve this problem by introducing a penalty term for the number of parameters in the model; the penalty term is larger in BIC than in AIC [1]. Therefore, both BIC and AIC statistics should be considered more carefully in the selection of specification.

Table 7 reports measures of model fit for effects of cross-borderM&A on acquirer's labour productivity and TFP. The results from likelihood ratio test from above several sections have indicated the more appropriate model from comparisons of corresponding baseline and interaction models. This section compares labour productivity baseline models (1 and 3) with TFP baseline models (2 and 4) for targets within the whole sample of international M&A and the subsample of high acquirer's intangible assets respectively. This section continues to compare labour productivity interaction model (5) with TFP interaction model (6) for targets within the subsample of high acquirer's intangible assets. By using the same numbers of observations within the three samples, table 5.12 shows three positive values (309.436, 264.18 and 53.247) of BIC' difference between labour productivity and TFP models respectively. These results provide strong supports for the acquirer's TFP models for the three samples.

Generally, the TFP model shows a better fit for both targets and acquirers based on the diagnostic analysis for goodness of model fit. Furthermore, TFP models show more significant variables compared with labour productivity models. There is no clear evidence to argue that the impact of foreign M&A depends on the different measure of firm's productivity according to the results of regressions. Nevertheless, TFP, as the result of diffusion in

technological or organisational knowledge and economies of scale, can be the more direct measure to identify the causal impact of international acquisitions on firm's productivity performance.

Conclusion

This paper examines the causal relationship between cross-border M&A and firm's productivity using a rich micro dataset across the global market over the period 2002-2011. The effects of cross-border M&A and firm-level characteristics on firm's productivity are assessed from the aspects of target side and acquirer side respectively. This research also employs two kinds of firm's efficiency measure, i.e. TFP and labour productivity, to compare the influence of choosing different productivity measures. The rumoured but uncompleted M&A are used as a control group to compose the dummy of M&A completions together with rumoured and completed deals. By using an M&A deal-level variable, the comparison of the impact on firm's productivity between the completed M&A and rumoured but abandoned M&A contributes to the above debate and the literature on the performance of cross-border M&A.

The literature on firm's productivity after M&A wrestles with the unresolved debate, concerning whether M&A will improve firm performance. The effects of cross-border M&A are assessed for acquirer firms. From the view of acquirers, those firms who possess certain intangible advantages would like to attempt to expand their product markets via international takeovers. However, those firms who lack some intangible advantages would like to obtain the strategic assets from acquired firms via international takeovers. Based on these two points, cross-border M&A are motivated by market seeking or strategic assets seeking incentives. This paper separates cross-border M&A into two subsamples, which include deals with high acquirer's intangible assets relative to the target's assets and deals with low acquirer's intangible assets relative to the target's respectively. The analysis is conducted with the two subsamples to test the impact of cross-border M&A on firm's post-acquisition productivity. The first subsample is used to examine whether the intangible advantages successfully transfers from acquirer to target in the product market-driven expansion. The second subsample is used to examine whether acquirers effectively exploresthe target's intangible assets in the strategic assetsdriven expansion.

Furthermore, this paper investigates the impacts of cross-border

Table 7. Comparisons of fit for regresses of acquirer's post-M&A labour productivity and TFP.

Dependent variable	All international M&A			High intangible assets for acquirers			High intangible assets for acquirers		
	Labour productivity	TFP		Labour productivity	TFP		Labour productivity	TFP	
Model:	(1) Baseline	(2) Baseline	Difference	(3) Baseline	(4) Baseline	Difference	(5) Interaction	(6) Interaction	Difference
N:	2289	2289	0	2018	2018	0	271	271	0
Log-Lik Intercept Only:	-20295.678	-4471.153	-1.58E+4	-17876.329	-3927.599	-1.39E+4	-2418.049	-542.719	-1875.33
Log-Lik Full Model:	-20202.786	-4223.543	-1.60E+4	-17794.858	-3714.038	-1.41E+4	-2362.819	-460.866	-1901.953
D:	40405.573(2191)	8447.087(2191)	31958.486(0)	35589.716(1922)	7428.075(1922)	28161.641(0)	4725.637(190)	921.731(190)	3803.906(0)
LR:	185.783(94)	495.219(94)	-309.436(0)	162.942(92)	427.123(92)	-264.180(0)	110.460(77)	163.707(77)	-53.247(0)
Prob> LR:	0	0	0	0	0	0	0.007	0	0.007
R2:	0.078	0.195	-0.117	0.078	0.191	-0.113	0.335	0.453	-0.119
Adjusted R2:	0.038	0.16	-0.122	0.033	0.152	-0.119	0.069	0.235	-0.166
AIC:	17.738	3.776	13.962	17.731	3.776	13.955	18.036	3.999	14.037
AIC*n:	40601.573	8643.087	31958.486	35781.716	7620.075	28161.641	4887.637	1083.731	3803.906
BIC:	23456.281	-8502.205	31958.486	20963.561	-7198.08	28161.641	3661.235	-142.671	3803.906
BIC':	541.389	231.953	309.436	537.165	272.985	264.18	320.903	267.656	53.247
Source from the analysis by using the command of 'fitstat' in Stata package.									

Yupu Lin. The Impact of Cross-border M&A Deals on Firm-level Profitability. *Int J Financ Econ Trade*. 2022;5(1):119-129.

M&A on firm performance by using the determinants of cross-border M&A completions. Previous literature conducts such performance analysis by employing the characteristics of a likely target firm. However, the determinants of M&A completions can identify a firm in M&A, while the determinants of a likely target do not necessarily determine the completion of M&A. This is because other potential uncertain factors, e.g. the regulatory factor will affect M&A, but they do not influence whether a firm is chosen as a likely target. Therefore, the factors from previous research may be biased. The determinants of M&A completions should have different impacts on the firm performance compared with the characteristics of a likely target.

This paper tests the multinational status of firms on target's productivity to isolate firm's ownership advantages on its performance. The result shows that the increase in a target's productivity only takes place in the integration between MNEs in the completed cross-border M&A. Compared with small domestic firms, large MNEs have more advantages especially in finance to get access to the advanced technology or resource across the world. Such updated technology or intangible capability enables MNEs to achieve high productivity. However, this paper reports that the completion of a cross-border M&A decreases the post-acquisition productivity level of acquirers compared with the productivity of similar firms in takeover rumours. The information asymmetry across markets causes the difficulty in integration between targets and acquirers. This results in high transaction costs and accordingly low firm's productivity. This paper compares two kinds of firm efficiency measure, i.e. TFP and labour productivity. Its objective is to answer whether the performance of takeovers will depend on different productivity measures. The results about TFP measure reports are more significant coefficients than those about labour productivity measure. It is found that the increase in a firm's labour productivity is mainly caused by capital deepening rather than diffusion in technological or organisational knowledge and economies of scale. Therefore, TFP is regarded as more appropriate measure for a firm's productivity.

In particular, with the market seeking motive, this paper proves that the completion of international takeovers will reduce the productivity for acquirers in terms of TFP level and labour productivity level. The foreign acquirers tend to expand their markets abroad based on their firm-specific advantages or successful operational experience. However, some intangible assets such as advanced technology and brand name are not easy to transfer successfully. For example, the adaptation of technology in the host country will affect the knowledge transfer. Are there enough skilled workers in the job markets or are the standards of their skills enough to satisfy the requirement of using the new technology? Another example is the success of introducing a brand into the host country which depends on the reputation of such a brand or its investing firm. The perceptions of customers on the brand will gradually constitute the brand or firm reputation. Therefore, Cross-border M&A are attempted with a potentially good intention in market expansion, but the difficulty in transfer of intangible advantages will lead to a low firm's productivity when takeovers are completed.

Apart from seeking markets, certain strategic assets including intangible resources are also important for firms because they can be used to formulate the firm's competitive advantages. This is especially true when strategic assets from outsides of firms show resource complementarities with firm's own assets; most firms will attempt all channels to obtain such assets including takeovers. Hence, the strategic asset seeking becomes another motive to support takeovers. However, the evidence from this paper shows that the completion of international takeovers will reduce the target's labour productivity level in strategic assets seeking M&A. It is explained that M&A leads to the low competition in markets. This offers less incentive for firms to improve organisational innovation and internal efficiency, and accordingly leads to a low firm's labour productivity. Besides this, the ineffective reallocation of acquired complementary intangible resources decreases the target's productivity level after completing international M&A in the short term. The above results suggest that neither of these two motives behind cross-border M&A could make firm's productivity level improve in the short term.

As for the effects of a firm's characteristics, a firm's high leverage level has been found to have a negative effect on its post-M&A efficiency. High leverage level means that firms have to make large amounts of payment due to the high proportion of debt. The limited disposable capital can be used in innovation to improve firm's productivity. Nevertheless, the results of this paper show that firm's high liquidity, high level of intangible asset and large size will improve its post-M&A efficiency. These factors provide firms themselves with sufficient capital, advantages in technology or brand, and the possibility of access to available resources. They facilitate firms to improve their productivity in the short term. Furthermore, horizontal international M&A shows positive target's labour productivity. It is explained that the expansion into the same industry often leads to substitution of domestic production in the host country. This will reduce the workforce in target firms and bring capital deepening effect which increases firm's labour productivity.

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139

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140