Analysis of Outflow Direction for M&A Chinese Enterprises Overseas based on a Gravity Model

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Abstract — China's overseas Merger and Acquisition (M&A) have been experiencing a steady increase after the 2008 world financial crises, as the biggest emerging developing countries, the direction of capital outflow is affected by many factors which different from developed countries. In this paper, we analyzed the factors between home country and host countries respectively. Using the gravity model, we adopted Pooled regression and TOBIT regression to do empirical analysis, the results show that cultural distance, skills and other specific factors of overseas M&A play important roles. Meanwhile, bilateral trades, the government rectitude of the host countries and financial deepening level also have significant impact to the direction of capital outflow. However, the GDP and distance between host and home country are not significant.

Keywords - overseas M&A; gravity model; pooled regression; TOBIT regression

I. INTRODUCTION

The gravity model widely applied in economics is derived from physicist Newton's law of gravitation, i.e. the force between two point masses is proportional to the product of the two masses and inversely proportional to the square of the distance between them. Ravenstein was the first one to introduce the gravity model into economics and apply it in population analysis. As for the application of gravity model in international trade, it is necessary to mention Tinbergen [1]. He proposed a simplified form of gravity model by replacing the mass with GDP in the gravity model and the distance between two masses with the distance between two countries, and used this simple model to interpret the bilateral trade flow between two countries. In later studies, gravity model was further improved by a series of derivation conducted by many scholars. Linnemann studied gravity model with Walrasian equilibrium method and added a demand equation of a third country representing any other country outside the two trade countries[2]. Bergstrand added variables, like exchange rate and whether in the same economic organization, and, for the first time, systematically adopted a general equilibrium model to deduce the gravity model [3]. He pointed out that, the traditional gravity model has some deviation due to the lack of a price variable. So the added the price variable into the trade gravity model as an exogenous variable, changing the traditional idea that price is only a tool to balance supply and demand. Gravity model is also widely applied in measuring and calculating the potential of trade and investment, and explains some economic phenomena observed in the real world. Most of gravity equations finally will translate into the form of bi-logarithm gravity, such as the studies of Anderson and Wincoop [4].

Because of the wide application and good reputation in the studies of international direct investments, gravity model has been used in the field of overseas M&A. Julian di Giovanni directly replaced the direct investments with the capital the amount of the overseas M&A[5], Keith Head and John Ries derived and proved a gravity model which is suitable both for FDI and overseas M&A[6]. On that basis, Nicolas Coeurdacier (2009) made some improvement and derived a gravity model which is suitable for various industries[7]. The basic expression of this model is as follows:

\[ M & A_{i,j,t} = e^{\alpha_{i,t} + \alpha_{j,t} (GDP_{i,t} GDP_{j,t})^{\beta} \gamma_{i,j,t} \eta_{i,j,t}} \]  (1)

Where M&A_{i,j,t} is the investment (can be expressed by amount, number, share, etc.) between the investment country i and the host country j at the moment t, GDP_{i,t} and GDP_{j,t} represent the economic aggregate of country i and country j respectively, \( \lambda_{i,j,t} \) represents a series of substitutable variables which can effect the flow direction of overseas investment, e.g. investment cost (distance), trade barrier, etc. \( \alpha_{i,j,t} + \alpha_{j,i} + \alpha_{i,j} \) represent the fixed effect respectively from the investment country i, the host country j at the moment t, and \( \eta_{i,j,t} \) is the residual term. After taking the logarithm from the two sides of the above equation, it will become a general form of gravity model. This model is applied to the researches of the M&A flow direction between countries of EC, having making certain research achievement. Scholars like Hea-Jung, Hyun did some empirical studies on this basis, and further strengthened the theory and practical significance of the gravity model used as a important tool in the field of overseas M&A[8]. However, the research of most western scholars focus on the developed country, the international investment direction for the emerging countries is different from the developed country; there almost little research results about the flow direction for Chinese...
enterprises’ overseas M&A, in this paper, we try to solve the above gap.

We organize the rest of the article as follows: In the next section, we highlight the theory and derive hypotheses pertaining to the M&A flow direction between home and host country. Then, we describe our data, variable and analysis details. Next, we discuss the methodological details of how we validated our findings and conducted robustness checks and then present the results of our analysis. Finally, we discuss the significance of our findings with specific reference to implications for theory and practice.

II. LITERATURE REVIEW AND ASSUMPTION

Existing research on the inter-related domains of the international investment, provide valuable insights about the factors of M&A flow direction.

1) The total market scale of the two countries

As a kind of outward foreign direct investment, overseas M&A follow the basic principles of international trade. And at the same time, as one of the gravity model variables, GDP should be included in the model factors. According to the investment theory of Dunning (1981), a country's outward foreign direct investment increases gradually with the development of its economy. So the larger a country's GDP is, the greater its potential for investment will be. Investment potential of the investment country and the investment absorptive capacity of the host countries together constitute the factors that affect the flow direction of overseas M&A.

2) The distance between the main economic shipping centers of China and the host country

When Tinbergen (1962) for the first time applies the gravity model to the field of international trade[1], the distance between the countries was used to replace the centered distance between the material, where the shipping distance between the two countries increases the investment cost and this interpreting variable and GDP constitute the basic frame of the gravity model. For the manufacturing enterprises, too long distance means that the transportation cost of the related materials in outward foreign investment. The distance of the overseas M&A not only reflects the gap in cultural psychology but also increases the risk and cost of M&A, especially the cost of administration and control. Therefore, I suppose that the enterprises in China are more likely to take over the enterprises in nearer countries. Meanwhile, the distance here should not only mean the sea transportation distance while the more reasonable alternative should be the distance between the active areas of economy in the two countries. Out of the two considerations, I choose Shanghai as the coordinate point of China while the host country is represented by its capital.

3) The total volume of the bilateral trade between China and the host country

The relationship between trade and direct investment is always the important issue studied by scholars who generally think that trade and direct investment have the same direction of flow and thus they are complementary. The competitive theory of Kojima (1978) also indicated that direct investment can cause the complementarities in international trade[9]. But Baldwin (2001) argued that enterprises will engage in both the interindustry trade and interindustry investment, which is caused by product differences and trade costs[10].

4) The degree of deepening of finance

Caprio proved that financial development plays a significant role in economic growth, financial stability and financial globalization etc[11]. The financial markets with a certain size and mobility provide very good conditions for the development of overseas M&A. Good financial market provides more favorable financing environment for the enterprises that usually develop rely on the external finance. Shleifer pointed out that a higher degree of financial deepening represents a weaker financial repression, which provides more freedom for M&A[12]. The financial market values not only the general condition of the resources of financial market but also the efficiency and freedom of the financial market, especially the security market, so I chose the ratio of the security market scale to GDP (STC/GDP) to measure the financial deepening in the product form in view of the common effect on both China and the host country.

5) The actual exchange rate

Kazutaka Takechi demonstrated that changes in exchange rates have an important impact on FDI, believing that the depreciation of the currency of a country will attract FDI inflows[13]. Yet R.MacDermott believed that the inflow and exchange rate of FDI have a significant correlation, when the currency of the host country devaluates, the FDI inflows will increase[14]. The choice of acquisition time is usually influenced by exchange rates. When the currency of the host country appreciates relative to that of the investing country, the value of its enterprises corresponding virtually increase, that will, to some extent, hinder M&A activity. Meanwhile, as a barometer of expectations of a country's economic prospects, exchange rate to some extent reflects the good level of economic operation between two countries. When the currency of one country devaluates relative to that of the other, it means the country's economic outlook is bleak and the enterprise operation condition is poor, so the possibility of M&A increases. As the nominal exchange rate does not reflect the actual value of the two currencies, not taking into account the impact of inflation factors on the price index, so I chose the real exchange rate to measure the variables.

6) The differences of corruption degree

As an institutional factor that has been paid close attention to, it has been demonstrated by Wei and Mohsin Habib that corruption has negative effects on attracting direct investment, which has been wildly accepted[15,16]. Moreover, Mohsin Habib also mentioned that the differences of corruption degree between the two countries directly affect their FDI flows, and he found that with the larger gap of corruption degree, the flow of FDI will suffer a significant decline[16]. The level of corruption in the investment country also plays an important role in overseas M&A. Countries with a high degree of economical activeness and broad market prospects usually have the low level of corruption. Meanwhile, as the implementation of investment, enterprises with state-owned components are directly affected by the level of corruption in their home...
country. High level of corruption results in the poor operational efficiency and credit loss of state-owned enterprises and credit losses, which will adversely affect the occurrence of M&A. This paper will reflect the impact of corruption on M&A flow by the difference of the level of corruption in China and the host country. The impact of corruption on overseas M&A can be divided into two parts. On the one hand, the low level of corruption in the host country attracts cross-border M&A. On the other hand, the large gap of corruption degree between China and the host country of the low corruption level may hinder the M&A. But which one of the two impacts play a more important role remained further empirical research.

7) The technical level of labors

Mamoru Nagano pointed out that with the development of science and technology, the international competition become fierce, knowledge and technology based intangible assets plays an increasingly important role in enterprise development[17]. The impact from the differences in labor technical level on M&A flows can be considered from two aspects. On the one hand, the level of high-tech demands for higher wage costs, but, with higher production efficiency, the unit cost will fall, the possibility of M&A will increase. On the other hand, the development of knowledge-based economy has prompted many companies to reconsider the development strategy, trying to transfer to the field of higher development[18]. The impact from the differences in labor technical level on M&A flows can be considered from two aspects. On the one hand, the level of high-tech demands for higher wage costs, but, with higher production efficiency, the unit cost will fall, the possibility of M&A will increase. On the other hand, the development of knowledge-based economy has prompted many companies to reconsider the development strategy, trying to transfer to the field of higher development[18].

8) The gap of income tax rate

The tax rate has a direct impact on the company's operations motivation, as well as the M&A motivation. Maja Pervan studied the impact of different tax rates for different operations motivation, as well as the M&A motivation. Some firms can access to advanced experience, host country's intellectual capital and technology "spillover effect". In this paper, human capital (educational attainment) is used to characterize the technical level and the dummy variable is set to measure the relative skill levels.

9) Cultural gap

The cultural gaps are probably the influencing factors that have been discussed most frequently regarding overseas M&A. Some scholars found that cultural differences between the acquirer and the target company for acquisition have a negative impact on the acquirer's long-term abnormal returns after he studied the cross-border M&A in the UK. However, Florian Bauer pointed out that cultural differences in the long term will benefit both sides of M&A[20]. The cultural dimensions system of Hofstede is a good indicator which has been widely used and recognized of. Hofstede divided culture into the following dimensions: individualism (IDV), power distance (PDI), uncertainty avoidance (UAV) and masculine (MAS). After further researches, he added another dimension the long-term orientation (LTO) in 1991. Based on the Hofstede's four-dimensional model, Kogut, Singh, proposed the exponential formula used to calculate the cultural gap between the two countries. In this paper, the index calculated by this formula is used to measure the cultural gap between China and the host country.

10) Avoidance of double taxation agreements

Tax treaties have many benefits. First of all, it can avoid double taxation for the multinational firms; Secondly, it is able to use uniform criteria to define the relevant taxes so as to facilitate the determination of the international tax. What's more, tax treaty has promoted the bilateral exchange of tax information, and is very beneficial for both sides to improve their tax law system. From a microscopic point of view, the avoidance of double taxation agreements actually reduces the tax burden on companies, increases profit opportunities for companies and theoretically reduces the cost of operating business, should be conducive to the occurrence of cross-border M&A.

According to the above discussion, we have the following assumptions. The meaning of each explanatory variable and the expected impact are listed in the following table I:

**TABLE I INDEPENDENT VARIABLE AND ASSUMPTION**

<table>
<thead>
<tr>
<th>Variable</th>
<th>The meaning of variable</th>
<th>The expecting impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>the product term of China and the host country GDP, (100 million U.S. dollars)</td>
<td>+</td>
</tr>
<tr>
<td>DIS</td>
<td>The major economic distance between the shipping centers of China and the host country (km)</td>
<td>-</td>
</tr>
<tr>
<td>TRADE</td>
<td>the product term of the GDP accounted for the securities market scale of China and the host country</td>
<td>+</td>
</tr>
<tr>
<td>FD</td>
<td>RMB real exchange rate</td>
<td>+</td>
</tr>
<tr>
<td>E</td>
<td>Gap of corruption between the host country and China</td>
<td>+/−</td>
</tr>
<tr>
<td>CORR</td>
<td>The technical level of labor, dummy variables</td>
<td>+</td>
</tr>
<tr>
<td>SKILL</td>
<td>difference of the tax rates</td>
<td>+</td>
</tr>
<tr>
<td>CD</td>
<td>Cultural gap between China and the host country</td>
<td>-</td>
</tr>
<tr>
<td>TA</td>
<td>Avoidance of double taxation agreements, dummy variables</td>
<td>+</td>
</tr>
</tbody>
</table>
III. Method

A. Dependent Variable

The dependent variable M&A in this paper includes the numbers of China's all overseas M&As during 2002 to 2009. The samples have excluded the tax shelter islands like British Virgin Islands, the Cayman Islands, whose economic significance for overseas M&A is not consistent with the purpose of our analysis. The cross-section samples involve 39 countries and regions, which come from the Thomson OneBanker database. The time of events is selected by the Effective date, Thomson Group is an international authoritative information services providing professional information on businesses and professionals, whose M&A database covers almost all of the M&A transactions that can be recorded. So it can be said to be the best sources of M&A transactions data worldwide. During this period there were 599 M&A.

B. Independent Variables

Ten representative variables are selected as interpreting variables. Respective explanations are given as follows:

(1) $GDP_{it}$ - GDP. It come from the World Bank database (http://data.worldbank.org).

(2) $DIS_{it}$ - the central distance between the major economic sea shipping centers of China and the host country. It comes from the distance measurement device on the website of the host country. The unit is kilometer.

(3) $TRADE_{it}$ - the total bilateral trade between the host country and China, the sum including both imports and exports. It comes from the foreign economic columns of the National Bureau of Statistics database, the unit is million dollars.

(4) $FD_{it}$ - Financial deepening, measured by the following form:

$$FD_{it} = \frac{STC_{it} - STC_{jt}}{GDP_{it} - GDP_{jt}}$$

where the STC represent the total value of the security market, the data is also from the World Bank database, Taiwan's data is from the website (www.tse.com.tw).

(5) $E_{it}$ - actual exchange rate, which is a indirectly priced exchange rate based on standard of 2005, which means how much per RMB converts to the currency of the host country. So that when RMB depreciated relative to the host country currency, this indicator drops. The data is from the database of Economic Research Service of the agencies of the USA (www.ers.usda.gov), based on 2005 as the base converted price of the real exchange rate for the direct method (excluding the impact of the national CPI).

(6) $CORR_{ij}$ - the level of corruption, reflecting the gap of the corrupting level between the host country and China. There are lots of indicators to measure corruption, among which the more authoritative one is the Corruption Perceptions Index (CPI) published annually by Transparency International. CPI uses 10-point scale, where 10 are the highest score meaning the least corrupt and 0 stands for the most corrupt. This indicator is defined in this paper as the CPI values of the Host Country minus the CPI value of China, so the higher the index is, the more corrupt is to our country than the host country. Data is from www.transparency.org.

(7) Skills - technical level of labors where the labor capital (education background) is used to represent the technical level and dummy variables s is set to measure the relative skill levels. This data is measured using the adult (15 years of age and above) Literacy rate (the ratio of the total population) published by the World Bank database (http://data.worldbank.org/). The set value is 1 if the host country has a ratio greater than that of China, and otherwise the set value is 0.

(8) $Tax_{it}$ - Gap of the income tax rates, reflecting the difference in the income tax rates between the host country and Chinese enterprises. This indicator is defined as the tax rate of China minus tax the rate of the host country, where the greater the index is, the tax burden of the host country is lighter. Data is from the World Bank database (http://data.worldbank.org).

(9) $CD_{it}$ - cultural gap. The index formula to calculate the cultural gap between the two countries according to Hofstede’ four dimensional model is as follow:

$$CD_{it} = \frac{\sum_{k=1}^{4} ([I_{it} - I_{j}])^2}{V_{j}} / 4$$

where $I_{it}$ represents the $k$-th dimension of the cultural index of the $i$ country, $V_{j}$ represents the variance of the $k$-th cultural dimension, $I_{j}$ represents the host country, $CD_{it}$ represents the cultural gap between the host country $i$ and country $j$, the higher value means the greater cultural gap. The entire cultural dimension index is from http://www.geert-hofstede.com. Due to partial deletion, the corresponding replacement is necessary.

(10) $TA_{it}$ - Avoidance of double taxation agreements. If the agreements have put into effect, dummy variables is set to 1, otherwise is set to 0. The data is from the State Administration of Taxation website (http://www.chinatax.gov.cn).

C. Model

According to the frame of the gravity model, we follow Keith Head, John Ries, Nicolas Cœurduacier method, the basic form of the model is as follow[6,7]:

$$M & A_{ij} = \alpha + \beta_1 \ln(GDP_{ij}GDP_{jt}) + \beta_2 \ln(DIS_{ij}) + \beta_3 \ln(TRADE_{ij}) + \beta_4 \ln(FD_{it}) + \beta_5 \ln(E_{it}) + \beta_6 \ln(CORR_{ij}) + \beta_7 \ln(Skills_{it}) + \beta_8 \ln(Tax_{it}) + \epsilon_{it}$$

The model adopts non-dummy variables and explanatory variables to test our assumption, in order to eliminate the impact of hetroscedasticity, all the variable take logarithmic form.
We adopt the mixed regression model to test above assumption, check the robustness of our findings with the TOBIT regression model. Two kinds of regression analysis are illustrated respectively as below. The statistical software STATA version 11.0 is used to do our analysis.

### A. Mixed Regression Analysis

The explanatory variables selected in this paper such as the distance, the cultural gap don't change over time, so a fixed effects model regression will produce a singular matrix, which can not be reasonably effective regression analysis. For the purpose to inspect the influencing effects of all explanatory variables, we use the mixed regression models for analysis.

To adopt the mixed model for regression analysis, we must first determine whether the data is suitable for mixed regression with the Lagrangian Breusch and Pagan LM Test. The idea of Lagrangian Breusch and Pagan LM Test is as below: under the constraints, we can use the Lagrangian method to construct the objective function. If the constraint is effective, then the estimator obtained by the maximized Lagrangian function should be located near the estimate of the maximized unrestrained parameters. The test results show that it is suitable to take mixed regression. In the process of regression, in view of some variables with lower t value, we have adopted the backward method to gradually eliminate the insignificant variables. The standard is that the t statistic is not significant and the minimum, eliminating one by one until the remaining variables and t statistics become significant. The results of each regression analysis are showed in the table II.

### IV. RESULTS

Table 2 shows the findings of the mixed model by backward regressions method, Model 1 show that DIS is not significant and the minimum, so it is removed in model 2, Model 2 show that GDP is not significant and the minimum, so it is removed in model 3, Model 3 show that E is not significant and the minimum, so it is removed in model 4, After removing the variables like distance, GDP and exchange rate, the remaining seven explanatory variables are significant and the minimum, so it is removed in model 2, Model 3 show that E is not significant and the minimum, so it is removed in model 3, Model 4 show that E is not significant and the minimum, so it is removed in model 4.

(1) The effect of distance is insignificant. As important variables of the gravity model, distance is usually the main consideration for scholars to study the influence to FDI. However, due to the development of the international shipping industry, the influence of distance is weaken.

(2) GDP is not significant. As previous analysis, TRADE factor itself also includes the consideration of economic scale, which may appear collinearity together with GDP.

(3) The total trade volume of China and the host country are not significant in the initial model, which is likely to be caused by the correlation with GDPs. After removing the factors of distance and GDP, it becomes significant in the 5% level, and its coefficient is positive same as our assumption.

(4) The coefficient of the degree of financial deepening is positive and significant, also in line with previous expectations, which means the good financial market environment in both countries is a foundation for M&A to occur. Chinese enterprises should take into account not only the target market economic scale, but also the development of the financial environment as a whole when they choose target firms.

(5) Exchange rate is not significant, which may appear collinearity together with Trade.

(6) Corruption gap has a significant positive impact on cross-border M&A, indicating that the greater the gap is, cross-border M&A are more likely to occur. The gap of corruption is calculated by the Corruption Perceptions Index of the host country minus that of China, the greater gap shows the lower level of corruption in the host country, it means that political environment of the host country play a positive role.

(7) The cultural gap as expected has a significant impact. The negative coefficient shows that too large cultural gap

### Table II Results of Mixed Model by Backward Regressions Method

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>-10.201</td>
<td>-10.581</td>
<td>-5.740</td>
<td>-6.267</td>
</tr>
<tr>
<td>DIS</td>
<td>0.103</td>
<td>0.107</td>
<td>0.329</td>
<td>0.330</td>
</tr>
<tr>
<td>TRADE</td>
<td>0.266</td>
<td>0.269</td>
<td>0.329</td>
<td>0.330</td>
</tr>
<tr>
<td>CORR</td>
<td>-0.136</td>
<td>-0.133</td>
<td>-0.133</td>
<td>-0.133</td>
</tr>
<tr>
<td>SKILL</td>
<td>2.742</td>
<td>2.743</td>
<td>2.736</td>
<td>2.773</td>
</tr>
<tr>
<td>TAX</td>
<td>-0.079</td>
<td>-0.080</td>
<td>-0.080</td>
<td>-0.082</td>
</tr>
<tr>
<td>CD</td>
<td>-0.937</td>
<td>-0.937</td>
<td>-0.879</td>
<td>-0.793</td>
</tr>
<tr>
<td>TA</td>
<td>-1.804</td>
<td>-1.806</td>
<td>-1.825</td>
<td>-1.802</td>
</tr>
<tr>
<td>R²</td>
<td>0.3096</td>
<td>0.3096</td>
<td>0.3087</td>
<td>0.3045</td>
</tr>
<tr>
<td>Adjusting R²</td>
<td>0.2867</td>
<td>0.2890</td>
<td>0.2905</td>
<td>0.2885</td>
</tr>
</tbody>
</table>

* represent the significant in 1%, 5% and 10% confident level respectively.
will hinders the motivation of our cross-border M&A. The small cultural gap makes the probability of success in M&A increase, and also reduces the management costs of post-merger integration, which play a significant role in promoting the occurrence of M&A.

(8) The impact of the dummy variables, labor and technical level, is very significant, in line with our assumption and precious analysis. The motivation to acquire foreign Technology account for a large proportion in all M&A deals, some object enterprises with high technology are very attractiveness to the China's enterprises.

(9) In the two tax-related variables, the result of the income tax rate is contrary to expectations. It is probably will promote the occurrence of M&A. However, the result of taxation brought by the agreement are very important, which are very attractiveness to the China's enterprises.

M&A deals, some object enterprises with high technology account for a large proportion in all technical level, is very significant, in line with our cross-border M&A. Some countries that have great attractive to Chinese enterprises such as American and European countries, generally have higher taxes, which however does not become the barrier that hinder M&A happen.

According to the result, Prob>chi2=0.0000 , Log likelihood=-519.86, the regression is quite efficient as a whole. The regression results are roughly the same with the using of mixed regression, TOBIT regression model. We provide strong and robust empirical evidence for the outflow direction of Chinese enterprises cross-border M&A. The GDP and distance between home country and host countries. The results show that cultural distance, skills and other specific factors of overseas enterprises significantly affect the outflow of Chinese enterprises cross-border M&A.

It should be noted that the Pseudo R2 of TOBIT regression is only 0.122, far less than that of the mixed regression. However, because the TOBIT model includes the consideration of censored data, it simulates the problem more realistically.

V. CONCLUSION

We provide strong and robust empirical evidence for the outflow direction of Chinese enterprises’ overseas M&A by the using of mixed regression, TOBIT regression respectively. To the best of our knowledge this is the only study to report the results about the factors of outflow direction for Chinese enterprises’ overseas M&A between home country and host countries. The results show that cultural distance, skills and other specific factors of overseas M&A play important roles. Meanwhile, bilateral trades, the government rectitude of the host countries and financial deepening level also have significant impact to the direction of capital out flow. However, the GDP and distance between...
host and home country are not as obvious as that in the area of foreign directly investment.

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