
Focusing on the Chinese health industry: an empirical enquiry on the TCM listed firms. Is large and private beautiful?

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Abstract: TCM is a key part of the Chinese healthcare system and TCM industries might play a growing role in the domestic and international markets. This work focuses on TCM listed companies in China. In particular, we study the effect of ownership and size on corporate performance. Multivariate permutation tests on the effects of ownership and size on corporate performance show that among the TCM listed companies, private companies perform better than state-owned ones, while big companies perform better than small ones. Moreover, the study shows that in TCM industry ownership has stronger effects than size on corporate performance.

Keywords: traditional Chinese medicine; TCM; health; industry; China; state owned enterprises; company ownership; company size; company performance.

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1 Introduction¹

The ageing population, decades of the one-child policy and, in general, the increase in income associated to economic growth have been producing a continuous rise (and change) in Chinese people's demand for health.

Chinese Government authorities recognise the centrality of the health issue. According to the Twelfth Five-Year Plan for Health Sector Development: "The new stage of socioeconomic development brings about multiple health challenges, and the task of the health sector becomes more formidable. China, at a time of rapid industrialization and urbanization as well as accelerated aging, faces more complicated health issues. On the one hand, we face the ever-present severe communicable diseases, a growing threat from non-communicable diseases and mental illnesses, and the potential threat from emerging diseases and traditional deadly infectious diseases. On the other hand, changes in ecological environment and lifestyle, and issues such as food and drug safety, occupational health, drinking water safety, as well as environmental issues pose more threats to the health of people. The recurring natural disasters, accidents and social security incidents increased the demand for health assurance. The contradiction between supply and demand of medical and health services becomes more intense, and the ideology and model of service must be adjusted accordingly in a timely manner²."

International institutional observers share similar views. According to the World Bank: "The population is aging and there is a surge in non-communicable diseases such as cancer, diabetes and heart disease. The number of people over 65 years old in China is now at 140 million and is expected to increase to 230 million by 2030. Infectious diseases have been replaced by non-communicable diseases as the greatest health threat to Chinese people, accounting for more than 80 percent of the 10.3 million deaths every year. Those diseases are exacerbated by high-risk behaviors such as smoking, sedentary lifestyles and alcohol consumption, as well as environmental factors such as air pollution. At the same time, with higher economic growth and personal incomes, people are demanding more and better health care" (World Bank, 2016).

No one doubts that the capacity of answering the growing expectations in healthcare is one of the biggest challenges for China and it is a central issue for the sustainability of the whole process of economic and social change (World Bank 2016; Huang, 2013; Daemrich, 2013; Di Tommaso et al., 2013). In the same perspective, the capacity of growth of the national health industry should be considered a priority for China³.

In this framework, the traditional Chinese medicine (TCM) industry in China has to be regarded as a strategic sector (Di Tommaso and Huang, 2010). Its development and its capacity of answering to the variety of needs of the contemporary Chinese population have to be considered a priority. It is important to understand and to study the strengths and weaknesses of this industry, given that it is still playing a central role in responding to the Chinese people's demand for health. Chinese Government authorities recognise the importance of TCM, as the Twelfth Five-Year Plan for Health Sector Development clearly argues: we will further improve the TCM service system and strengthen the development of county level TCM hospitals. We will push forward practice and research for preventing major diseases with TCM. We will actively develop TCM treatment and preventive care, and recognise a central role to the advantages and functioning of TCM in basic public health services. We will improve the TCM service capacity at primary health facilities and promote appropriate TCM technology, encourage retail pharmacies to provide TCM diagnosis services. We will improve the protection, research, development and rational use of TCM resources, and accelerate the development of the TCM industry. We will train a team of high-quality TCM doctors and foster a team of TCM masters. We will primarily establish a TCM inheritance and innovation system by strengthening our work in this area. We will reinforce the inheritance and development of national medicines and promote integration between western medicine and TCM. We will actively push forward the development of TCM related legislation, information and standards. We will actively develop TCM culture and encourage TCM to go global. We will study and generate health insurance plans and essential medicine policies that encourage TCM services, and improve the mechanism that assures the development of TCM" (The Twelfth Five-Year Plan for National Economic and Social Development of the People's Republic of China).

The most important market for the TCM industries is, of course, China. In mainland China the diffusion of TCM is evident and it has not lost its traditional central position in healthcare practices. According to World Health Organization (2013)⁴, in China there are 440,700 health-care institutions providing TCM services. They have 520,600 patient beds, including all levels of TCM hospitals and general hospitals, clinics and health ambulatories in urban and rural areas. The great majority of general hospitals (90%) include at least one TCM department and they provide TCM health services for both outpatients and inpatients. In China, government and private insurances fully cover TM therapies and services: doctors and patients are free to follow TCM or western medicine for health-care services. Looking at the domestic market for drugs, in 2012 the sales revenue of China's pharmaceutical industry amounted to 1,515.61 billion yuan⁵, among which the sales revenue of TCM was 506.71 billion yuan.

In this scenario, it is also true that the Chinese TCM industry seems to have important opportunities to grow also abroad, given that the use of T&CM (Traditional and Complementary Medicine⁶) is experiencing a clear boom also outside China. Not only large Chinese communities of expatriates and immigrants living abroad (in particular in the US, Europe and Australia) demand for TCM but also foreign patients and doctors

have been showing a growing interest in the so-called alternative healthcare practices. According to WHO: "...over 100 million Europeans are currently T&CM users, with one fifth regularly using T&CM and the same number preferring health care which includes T&CM. There are many more T&CM users in Africa, Asia, Australia and North America" (WHO, 2013).

In this framework, it is important to study the status of the TCM Chinese industry that has been definitively under-explored in the existing economic literature. How this industry is today organised is a relevant field for economic analysis. In China there are nowadays 48 main large-size companies specialised in TCM. They are the listed companies operating in the TCM sector, 13 of them are state owned enterprises (SOEs) while the rest have private ownership and management. Furthermore, official statistical sources records a community of 2.252 enterprises involved in the manufacturing of a variety of TCM products: they are all not-listed companies and the majority of them can be classified as SMEs⁷.

This paper focuses on the listed TCM companies and, in particular, we study how ownership (state-owned vs. private) and size (large vs. small) might affect TCM company performances. It is well known: economics, management and business theories have very often emphasised how large companies are supposed to perform better than small-size firms. Analogously, a large literature has traditionally highlighted the inefficiencies of state-owned enterprises suggesting that, by definition, private property would guarantee better performances to companies. However, it also clear that these general statements need further specifications and empirical confirmations based on specific industry, territorial and institutional contexts. It has been showed that in some circumstances small and medium size companies might perform better than large enterprises. Similarly, it has also been demonstrated that company performances are not associated to ownership (private vs. public) but to the degree of competition characterising one specific industry.

In this scenario we decided to investigate the specific case of the Chinese TCM industry. We discuss if, in this specific case, ownership and firm size have a significant effect on the performance of enterprises. And, if this will be proved to be the case, we will try to measure which of the two effects is greater. Section 2 provides some statistical data on TCM industry and describes the research goals in details. Section 3 reviews the relevant theory and proposes our hypotheses. Section 4 introduces the methodology used in this research and Section 5 shows the results of the analysis to testify the hypotheses. Section 6 presents the final remarks.

2 Research objectives

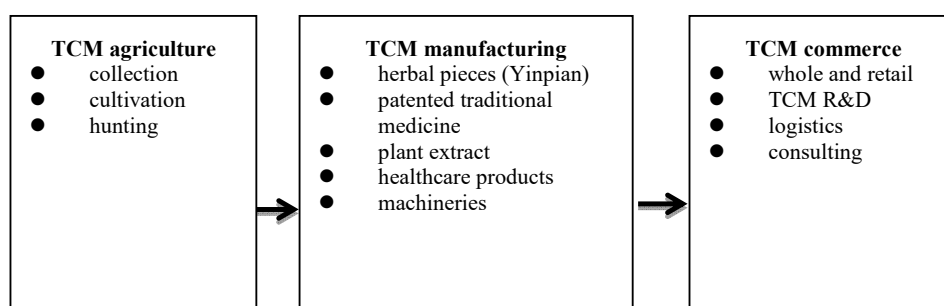
TCM refers to the drugs applied for preventing, diagnosing or treating disease, or adjusting physical functions under the guidance of TCM theory, and it is mainly represented by botanical drugs, as well as by some animal and mineral medicines (Zhao, 2015).

TCM industry refers to the production, processing, services, research and other economic activities related to TCM principles (Feng and Chang, 2010). According to different manufacturing techniques, TCM products mainly include TCM raw materials, prescription TCM products, Chinese herbal pieces, etc. Based on the industrial classification of China's national economy, it is possible to divide the TCM industry into

three categories: TCM agriculture, TCM manufacturing industry and TCM commerce (Figure 1):

- 1 TCM agriculture mainly refers to the collection, cultivation, hunting of traditional Chinese medicinal materials.
- 2 TCM manufacturing industry includes the processing of Chinese herbal pieces (Yinpian), the production of TCM prescription medicines and the production of TCM healthcare products. It also includes related industries, such as pharmaceutical machineries, auxiliary materials, packaging materials, vegetable drug processing, etc.
- 3 TCM commerce refers to the storage, transportation, sale and other services closely related to the TVM industry, including exports of TCM (Feng, 2009).

Figure 1 A taxonomy of TCM industry activities



Source: Elaboration of the authors

Table 1 Sales of TCM and WM products from 2003 to 2012 (billion yuan)

Year	WM sales	Yearly growth (%)	TCM sales	Yearly growth (%)	Total sales	Yearly growth (%)
2003	179.73		77.37		257.1	
2004	206.94	15.14	89.12	15.18	296.06	15.15
2005	262.55	26.87	110.34	23.81	372.89	25.95
2006	289.39	10.22	135.51	22.81	424.9	13.95
2007	365.92	26.45	162.38	19.83	528.3	24.34
2008	479.03	30.91	198.85	22.46	677.88	28.31
2009	566.25	18.21	239.87	20.63	806.12	18.92
2010	688.41	21.57	310.81	29.58	999.22	23.95
2011	855.87	24.33	408.93	31.57	1,264.8	26.58
2012	1,008.90	17.88	506.71	23.91	1,515.61	19.83

Source: Chinese Pharmaceutical Yearbook, various years.

In 2012, the cultivation of TCM raw materials across the country covered an area of 1.552 million hectares, accounting for 1% of the total crop planting area. There were 17 professional markets of traditional Chinese medicinal materials, covering 1.436 million m², and sales amounted to 79.79 billion yuan (NBS, 2014). In 2012, the total sale revenue of TCM products was 506.71 billion Yuan, accounting for 1/3 of the sales

revenue of medicine products throughout the country. In recent years, the yearly growth rate of TCM sales has always been higher than western medicine and almost above 20% (Table 1).

The export of TCM products in 2012 reached about 2.5 billion USD, mainly plant extract and traditional Chinese medicinal materials. The export of Chinese patented medicine and TCM for health care was instead relatively low, with decreasing growth rates in the last few years (Table 2).

Table 2 Export of TCM products (100 million dollars)

<i>Year</i>	<i>Total</i>	<i>Health products</i>	<i>Plant extract</i>	<i>Prescription TCM</i>	<i>TCM Yinpian and raw materials</i>
2006	10.91	0.69	4.77	1.35	4.10
2007	11.80	0.70	4.80	1.50	4.80
2008	13.09	0.87	5.30	1.71	5.21
2009	14.62	0.89	6.55	1.63	5.54
2010	19.44	1.61	8.15	1.93	7.76
2011	23.32	2.06	11.29	2.30	7.67
2012	24.99	2.13	11.64	2.65	8.58

Source: Chinese Pharmaceutical Yearbook, various years.

In 2008 there were more than 2,000 enterprises engaged in the TCM industry, with 422 of them (more than 20%) registering a loss. This has been partly due to the impact of the financial crisis on the pharmaceutical industry and partly to the new GMP certification, which sets higher requirements on enterprises, forcing some of them to exit the market (Table 3). However, the number and percentage of unprofitable enterprises gradually declined in recent years (Table 3).

Table 3 Number of TCM firms from 2007 to 2012

<i>Year</i>	<i>Total n. of companies</i>	<i>Number of losing companies</i>	<i>%</i>
2008	2,150	422	19.63
2009	2,256	373	16.53
2010	2,369	319	13.47
2011	2034	165	8.11
2012	2238	178	7.95

Source: Chinese Pharmaceutical Yearbook, various years.

The analysis presented in the subsequent part of the article concentrates on the impact of ownership and scale of listed TCM companies on the corporate performance.

The first aim of the study is to understand what kind of ownership (private or public) and what scale (small or large) have an impact on corporate performance. Secondly, we want to understand which of the two has the stronger effect.

The significance of our exercise is twofold:

- a For firms, it aims to help them in their strategic choice of the internal governance structure and in their decision to expand or to reduce their scale. The nature of ownership right directly determines if the enterprise can construct a proper governance structure.

- b For the government, it is necessary to know what type of enterprise would be more effective to promote while shaping the policy aims and tools. Consequently, to clarify the impact of ownership and scale on corporate performance is crucial for both business strategy and government decisions.

3 Theory and hypothesis

3.1 Ownership and enterprise performances

There is a wide and established international literature on which kind of ownership allows for the best company performances, if state-owned or private enterprises (Millward, 1982; Boardman and Vining, 1989; Vining and Boardman, 1992; Anderson et al., 1997; Wolf, 2009; Cornett et al., 2010; Bogart and Chaudhary, 2015; Färe et al., 1985). In Western countries academic and policy maker circuits, with few exceptions, the general statement is that private ownership has to be recommended because of its superior performances. This argument has been quite powerful and in the last decades it has inspired privatisation programs and reforms in Europe, North America and in many other emerging and developing countries (World Bank, 1990, 1996; Parker and Kirkpatrick, 2005; Roland, 2008).

In this context of international consensus, what is interesting here to note is that also China has gradually accepted this perspective. Many empirical analyses carried out by Chinese scholars have intended to prove that private enterprises are more efficient than state-owned enterprises (SOEs). For instance, Yao (1988) and Liu (2004) compared the technical efficiency of various types of enterprises and found out that the technical efficiency of private enterprises was the highest, followed by foreign-funded enterprises and collective enterprises, with SOEs being the less efficient. Song and Chang (2009) used data on different industries in 2006 and 2007, including state-owned firms, state-owned holding industrial enterprises and private industrial enterprises, and found out that the efficiency of private enterprises was the highest with DEA method analysis. Liu and Shi (2010) used provincial panel data of 29 regions from 1985 to 2004 and discovered that SOEs suffered from efficiency losses and soft budget constraints, which instead boosted the development of private enterprises, and prevented the entire economy from growing. Interesting in this area of study are the results of Li and Hazel (2010): they used a difference-in-difference model to analyse data from 1996 to 2006, discovering that before 2003, the performance of state-owned enterprises was much lower than other enterprises, but there were no evident distinctions in performance after 2003.

In this general scenario it is also true that sector-based studies might arrive to different results and that, with few exceptions (Hao, 2011; Jing 2011), there is a lack of studies on the specific case of the Chinese TCM industry. In the light of these considerations we suggest our first hypothesis:

H1 Private TCM companies have better performance than state-owned TCM companies.

3.2 Company size and performance

Also in the case of the relationship between company size and performance, the international literature has produced a huge number of works. Even if some authors have

suggested that in some circumstances small can also be beautiful, large size has always been recommended for companies wishing to promote their efficiency, competitiveness and innovation capacity (Viner 1932; Stigler, 1946; Bain, 1956; Hanoch, 1975; Panzar and Willing, 1977; Silvestre, 1987).

In the last decades the debate in China has confirmed this perspective focusing on the Chinese contemporary economic reality. The Chinese government in its catching-up policies has always promoted large size enterprises to achieve efficiency and technological upgrading (Di Tommaso et.al, 2013; Rubini and Barbieri, 2013). The Chinese academic literature too has worked on this topic and, in general, results confirm what the international literature developed while studying the experience of western economies. Several empirical studies on China's industry (Zhang and Sun, 2010; Wang and Chen, 2013) show how enterprise scale has a positive effect on productivity. Besides lower costs, stronger profitability and higher market competitiveness, large-scale enterprises can accumulate more capital for production, technology innovation and staff training, all impacting on productivity (Zhang and Sun, 2010; Wang and Chen, 2013).

However, very few scholars have analysed the scale-versus-performance issue in the Chinese TCM industry. Despite this lack of literature, it seems reasonable to expect that company scale has an impact on profitability also in the case of contemporary Chinese TCM industry. Generally speaking, larger enterprises are expected to better exploit scale economies, and enjoy higher advantages in resource acquisition, market power and channel expansion, etc. These considerations lead to our second hypothesis.

H2 Large TCM companies have better performances than small TCM companies.

3.3 Comparison between the role of ownership and scale on performance

Given the two dimensions we discussed so far (size and ownership), it is also interesting to study if – in the specific case of the Chinese TCM industry – company ownership has a higher (or lower) influence on performance than company size. As we noted above, the specialised international and Chinese economic literature is not particularly rich in this field. Nevertheless, it is reasonable to argue that the existing literature shows a greater emphasis on the market-oriented reform and the positive effect that private ownership might play in improving TCM company performances (WHO, 2013; NBS, 2014; Hao, 2011; Jing, 2011). For this reason we believe that it would be relevant to test also the following hypothesis:

H3 Corporate ownership has a higher influence on performance than corporate size.

4 Methodology

This study focuses on all the 48 listed TCM companies in China in 2014. All data have been extracted from the 2014 annual reports of these companies. The appendix presents the basic information of these companies.

As mentioned above, the goal of the empirical study presented in this research consists of testing some hypotheses concerning the effect of ownership and size on the economic performance of TCM listed companies. Ownership and size are dichotomous variables that classify TCM companies as private-owned vs. state-owned and big vs. small. Studying the effect of one variable, we compare groups of companies,

defined according to a given dichotomous variable (factor), net of the confounding effect of another dichotomous variable (covariate) (VanderWeele and Shpitser, 2013), to test whether the factor has a significant effect on performance. In order to test the ownership effect, ownership takes the role of factor and size takes the role of confounder. For testing the size effect, the opposite classification holds. Instead, the test on the joint effect of both mentioned variables assumes that the two variables jointly contribute to the definition of one factor, by identifying four groups of companies:

- 1 private-owned and big
- 2 private-owned and small
- 3 state-owned and big
- 4 state-owned and small.

It is worth noting that, since the hypotheses under test are directional, we are not only investigating the significance of the effects. In other words, we look for empirical evidence in favour of the hypothesis that the performance of private-owned companies is greater than the performance of state-owned companies, and in favour of the hypothesis that big companies present a better performance than small ones. Furthermore, we test a specific order of the four groups of companies defined above, according to the economic performance.

An element of complexity of the problem is given by the multivariate nature of the variable that represents the economic performance (PERF). As a matter of fact, we take into account two different variables of economic performance:

- ROE: return on equity
- EPS: earning per share.

Hence, since each of the two variables represents a partial aspect of the performance, every mentioned testing problem can be broken down into three sub-problems corresponding to the partial aspects under investigation. For example, in the problem regarding the effect of ownership, under the null hypothesis of equal performance of private-owned (PO) and state-owned (SO) companies, the null hypothesis H_0 states the joint equality of ROS, EPS and ROE between the two groups. In other words, the null hypothesis is true when the equality of the performance of private-owned and state-owned companies is jointly true for ROS, EPS and ROE. Formally:

$$H_0 : [PERF_{PO} = PERF_{SO}] \equiv [(EPS_{PO} = EPS_{SO}) \text{ and } (ROE_{PO} = ROE_{SO})].$$

Under the alternative hypothesis, the equality is not true for at least one of the two variables of performance, that is at least one of the three variables of performance takes greater values in the group of private-owned companies. Formally:

$$H_1 : [PERF_{PO} > PERF_{SO}] \equiv [(EPS_{PO} > EPS_{SO}) \text{ or } (ROE_{PO} > ROE_{SO})].$$

When investigating the effect of size, similar hypotheses can be defined, that is:

$$\begin{aligned} H_0 : [PERF_{BIG} = PERF_{SMALL}] \\ \equiv [(EPS_{BIG} = EPS_{SMALL}) \text{ and } (ROE_{BIG} = ROE_{SMALL})] \end{aligned}$$

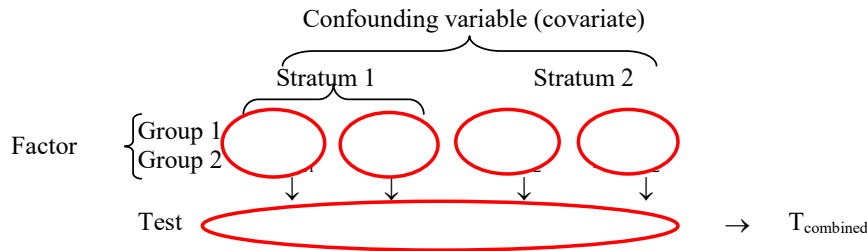
and

$$H_1 : [PERF_{BIG} > PERF_{SMALL}] \\ \equiv [(EPS_{BIG} > EPS_{SMALL}) \text{ or } (ROE_{BIG} > ROE_{SMALL})].$$

To take into account the confounding effect of one factor, when testing the positive effect of the other one, stratification can be applied (Arboretti and Bonnini, 2009). Hence, companies are classified into two groups (strata), according to the confounding variable, the testing problem is performed within each stratum and a suitable combination of the within-stratum tests is applied. This implies that the overall testing problem is broken down into four partial tests: two response variable times two strata (Figure 2).

Such a complex problem can be solved by means of a nonparametric methodology. Specifically, we can apply a combined permutation test that consists in a multiple permutation test with combination of the partial p-values through a suitable combining function (Bonnini et al., 2014). The application of one-sided two-sample permutation (partial) tests on means implies that neither normality nor other distributional assumptions, with the only exception of exchangeability under H_0 , are required. The application of a suitable combining function allows to transform the multivariate test statistic into a univariate test statistic. We used the Fisher combining function because there is no expectation about the possible number of true alternative hypotheses. The null distribution of this statistic implicitly takes into account the dependence structure of the partial statistics (through a suitable permutation strategy). Thus, there is no need of assuming a specific multivariate distribution function (like in the likelihood ratio test) for computing the overall p-value. This distribution-free testing procedure is very flexible, robust, powerful and can be applied in wide range of different situations.

Figure 2 Breakdown of the multivariate multistrata test on performance for the comparison of two groups of companies (see online version for colours)



Source: Elaboration of the authors.

For the test on the ordering of the four groups, by denoting with 1, 2, 3 and 4 the compared groups of companies we have:

$$H_0 : [(EPS_1 = EPS_2 = EPS_3 = EPS_4) \text{ and } (ROE_1 = ROE_2 = ROE_3 = ROE_4)]$$

and

$$H_1 : [(EPS_1 \geq EPS_2 \geq EPS_3 \geq EPS_4) \text{ and } (ROE_1 \geq ROE_2 \geq ROE_3 \geq ROE_4)]$$

with the strict inequality ($>$) true under the alternative hypothesis in at least one case (one pair of groups and one variable).

Even for this problem we can find a methodological solution within the family of combined permutation tests, by considering the trivariate permutation test on stochastic ordering, with method and properties similar to those of the two-sample test described above.

5 Results

In Table 4 some basic statistics are shown. We note that the sample sizes of the four groups of TCM companies, defined by jointly considering ownership and size, are very small: from a minimum of six to a maximum of 24. This is one reason more for choosing nonparametric methods for our testing problems. With such small sample sizes, the real underlying distribution of data cannot be tested with reliable procedures and asymptotic distributional properties, such as those related to the central limit theorem, do not hold.

Table 4 Means of the performance indicators in different types of the listed TCM companies

	<i>Number</i>	<i>EPS</i>	<i>ROE</i>
State-owned	13	0.758	6.13
Private-owned	35	0.706	15.67
Small	31	0.596	11.73
Big	17	0.947	15.56
Private_big	11	0.8427	16.10
Private_small	24	0.6433	15.48
State_big	6	0.9717	10.75
State_small	7	0.5743	2.171

Source: Elaboration of the authors.

The result of the test on the effect of ownership on performance is reported in Table 5. For estimating the multivariate permutation p-values of the test, 1,000 conditional Monte Carlo iterations were considered (Bonnini et al., 2014). According to the significance level $\alpha = 0.10$ and the overall p-value, $0.092 < \alpha$, we have a significant positive effect of private ownership respect to public ownership. To attribute the overall significance of the test to one or more partial tests, a closed testing method was applied for controlling the multiplicity and adjusting the partial p-values, thus avoiding an increase of the type first error probability (Arboretti et al., 2012). According to the adjusted p-values (compared with α), we have significance only in the case of the partial test T_4 , that is private-owned TCM listed companies present a greater performance than state-owned TCM listed companies but this is true only in the case of small companies and if we consider ROE as performance variable. We have no empirical evidence of better performance in terms of EPS and for big companies.

Table 5 Test on the effect of ownership on performance of listed TCM companies

<i>Size (covariate)</i>				
<i>Big</i>		<i>Small</i>		
T ₁	T ₂	T ₃	T ₄	T _{combined}
EPS	ROE	EPS	ROE	
0.572	0.335	0.572	0.092	Overall p-value 0.092

Source: Elaboration of the authors.

Note: $H_1: [PERF_{PO} > PERF_{SO}]$, $\alpha = 0.10$.

The result of the test on the effect of size to performance is reported in Table 6. Again we considered 1,000 conditional Monte Carlo iterations and $\alpha = 0.10$. The combined p-value of $0.058 < \alpha$ implies that there is a significant positive effect of size on performance. Even in this analysis, to attribute the overall significance to one or more partial tests, a closed testing method was applied. According to the adjusted p-values, we have significance only in the case of the partial test T_1 , that is big TCM listed companies present a greater performance than state-owned TCM listed companies but this is true only in the case of private companies and if we consider EPS as performance variable. We have not empirical evidence of better performance in terms of ROE and for state-owned companies.

Table 6 Test on the effect of size on performance of listed TCM companies

<i>Ownership (covariate)</i>				
<i>Private-owned</i>		<i>State-owned</i>		
T ₁	T ₂	T ₃	T ₄	T _{combined}
EPS	ROE	EPS	ROE	
0.085	0.133	0.341	0.258	Overall p-value 0.058

Source: Elaboration of the authors.

Note: $H_1: [PERF_{BIG} > PERF_{SMALL}]$, $\alpha = 0.10$.

Table 7 Stochastic ordering test result

<i>P/B > P/S > S/B > S/S</i>		
T_1	T_2	$T_{combined}$
EPS	ROE	overall p-value
0.380	0.058	0.058

Source: Elaboration of the authors.

Note: $H_1: [PERF_{P/B} > PERF_{P/S} > PERF_{S/B} > PERF_{S/S}]$, $\alpha = 0.10$.

The result of the stochastic ordering test on the comparison of the effect of size and ownership is reported in Table 7. Again we considered 1,000 conditional Monte Carlo iterations and $\alpha = 0.10$. The combined p-value of $0.058 < \alpha$ implies that there is a significant order that performance of the four groups is the same as we proposed. In this analysis, to attribute the overall significance to one or more partial tests, a closed testing

method was applied. According to the adjusted p-values, we have significance only in the case of the partial test T_2 , which means this is true only if we consider ROE as performance variable. We have no empirical evidence of this order in terms of EPS.

6 Discussion of the results and final remarks

Based on all 48 TCM listed companies in China, we have studied the effect of ownership and size on corporate performance. First, we used a NPC software to test the effect of ownership and size on corporate performance. Then, we checked if ownership or size has bigger influence on performance in TCM industry. The results are discussed in the following sentences:

- 1 Private TCM companies show better performance than state-owned TCM companies. It might be argued that corporate governance mechanisms in private TCM listed company make the difference. In private companies, shareholders and managers are both guided by profit-seeking attitudes and their actions are able to encourage efficiency and innovation. On the contrary, in state owned enterprises managers might also be influenced by other goals defined in accordance with (local and national) policy makers in the framework of broader political scenarios. Moreover, this special relationship between managers and government officials might encourage rent-seeking and clientelism causing negative effects on company performance.
- 2 Big TCM companies show better performances than small TCM companies. It might be asserted that economies of scale are important in the contemporary Chinese TCM industry. TCM large enterprises have economic advantages that can be reasonably explained according to many reasons: access to inputs, human resources management and recruiting, production and processing, R&D, learning by doing and knowledge management, sale channels and distribution, reputation and relationship with government.
- 3 Corporate ownership has more influence on performance than corporate size. With reference to ownership and size, we classified the companies into four categories: private big companies, private small companies, state-owned big companies and state-owned small companies. We used ordering test to identify the performance order of the four types of companies. Among them, private large companies show the best performance. From the results of the ordering test, this study confirmed that the role of ownership in China's TCM industry is greater than size. To understand this result it might be argued that private enterprises, thanks to their better governance and management mechanisms, are able to better exploit economies of scale.
- 4 The policy implications of this empirical investigation can be explored and discussed. The final results of our analysis might suggest that from an industrial policy perspective private large enterprise should be encouraged. Large and private should be considered beautiful. This could be the case but it is better to add further specifications. Company behaviours, management and performance are strongly influenced by the level of competition characterising one specific market. Private companies working in a monopoly setting, if protected from (domestic and foreign)

new entries, have normally low incentives to perform efficiently. Vice versa, on the other extreme, state-owned enterprises operating in competitive markets might be highly efficient and innovative. For this reason it is better to be prudent in elaborating too-basic policy implications. Large and private can be beautiful but competition clearly matters. The crucial issue is connected to the evolution of this fast-growing sector. How is the Chinese TCM domestic industry going to change in the future? How will strategic company conducts change the domestic TCM market structure? What about the potential entry of foreign competitors? Given the present market structure and in the current competitive setting, our enquiry on the Chinese TCM listed companies shows that large private enterprises perform better. However, the structure of this fast-growing industry can be destined to change. Company efficiency is not just a matter of size and ownership. It is also connected to the rate of competition associated to one specific market in one specific period. Mergers, acquisitions, trusts, entries and exits might rapidly change the Chinese TCM industry structure. This kind of events has an impact on companies' performance going definitively beyond the issues of ownership. In this sector characterised by a relative low number of companies, will China need antitrust policies in the future? Moreover, so far the Chinese TCM Industry has tended to remain rather immune from foreign competition both in the domestic and in the international markets. Chinese consumers (in mainland China and living abroad) have a clear preference for Made-in-China TCM goods and this allows Chinese companies implicit advantages and protection. Furthermore, Made-in-China TCM is legally protected by quite strict import regulations that make export to China (from countries such as Japan or Korea) particularly difficult. For how long is this scenario going to be confirmed? This protected position, in the medium and long run, might lead to problems for the Chinese TCM industry. An isolated and protected industry has scarce incentives toward innovation, technological upgrading and efficiency. And a weak, inefficient a scarcely innovative TCM national industry may rapidly loose domestic market shares in case of an aggressive entries in the Chinese market of TCM and Western medicine (WM) foreign competitors. Despite the lower performance at present, will China need to follow national-champion strategy investing again in the role of state-owned enterprises?

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Notes

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- 2 People's Republic of China, Twelfth Five-Year Plan for Health Sector Development 2011–2015.
- 3 For a discussion on the meaning of health Industry (Di Tommaso and Schweitzer, 2005).
- 4 The WHO reports Chinese official sources: Government of China, National Bureau of Statistics of China. China Statistical Yearbook 2011: Chinese Medicine (1987–2010). The State Administration of Traditional Chinese Medicine, China. (<http://www.satcm.gov.cn/1987-2010/start.htm>).
- 5 1 dollar = 6.90678 yuan (March 2017).

- 6 WHO uses the following definition: “The terms “complementary medicine” or “alternative medicine” refer to a broad set of health care practices that are not part of that country’s own tradition or conventional medicine and are not fully integrated into the dominant health-care system. They are used interchangeably with traditional medicine in some countries (WHO, 2013). (<http://www.who.int/medicines/areas/traditional/definitions/en/>).
- 7 Chinese Pharmaceutical Yearbook, 2013; National Science and technology department and the Ministry of health, the national science agency sent word [2007] No. 77 “Chinese medicine innovation development plan (2006–2020)”, 2007.

Appendix

Table A1 The listed TCM companies in 2014 in China

<i>Name</i>	<i>Listed year</i>	<i>Region</i>	<i>Ownership</i>
云南白药	1993	Yunnan	State-owned
白云山	2001	Guangdong	State-owned
康美药业	2001	Guangdong	Private
天士力	2002	Tianjin	Private
同仁堂	1997	Beijing	State-owned
中新药业	2001	Tianjin	State-owned
太极集团	1997	Chongqing	State-owned
昆药集团	2000	Yunnan	Private
东阿阿胶	1996	Shandong	State-owned
康恩贝	2004	Zhejiang	Private
中恒集团	2000	Guangxi	Private
益佰制药	2004	Guizhou	Private
济川药业	2001	Hubei	Private
以岭药业	2011	Hebei	Private
红日药业	2009	Tianjin	Private
江中药业	1996	Jiangxi	State-owned
葵花药业	2014	Heilongjiang	Private
康缘药业	2002	Jiangsu	Private
信邦制药	2010	Guizhou	Private
仁和药业	1996	Jiangxi	Private
吉林敖东	1996	Jilin	Private
千金药业	2004	Hunan	State-owned
健民集团	2004	Hubei	Private
贵州百灵	2010	Guizhou	Private
香雪制药	2010	Guangdong	Private

Table A1 The listed TCM companies in 2014 in China (continued)

<i>Name</i>	<i>Listed year</i>	<i>Region</i>	<i>Ownership</i>
上海凯宝	2010	Shanghai	Private
桂林三金	2009	Guangxi	Private
片仔癀	2003	Fujian	State-owned
九芝堂	2000	Hunan	Private
众生药业	2009	Guangdong	Private
太龙药业	1999	Henan	State-owned
太安堂	2010	Guangdong	Private
奇正藏药	2009	Xizang	Private
羚锐制药	2000	Henan	Private
益盛药业	2011	Jilin	Private
紫鑫药业	2007	Jilin	Private
汉森制药	2010	Hunan	Private
恒康医疗	2008	Gansu	Private
福瑞股份	2010	Neimenggu	Private
精华制药	2010	Jiangsu	State-owned
嘉应制药	2007	Guangdong	Private
佐力药业	2011	Zhejiang	Private
辅仁药业	1996	Shanghai	Private
佛慈制药	2011	Gansu	State-owned
台城制药	2014	Guangdong	Private
沃华医药	2007	Shandong	Private
紫光古汉	1996	Hunan	State-owned
龙津药业	2015	Yunnan	Private