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## Article

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# How does subsidy change a firm's market power? The case of China's rice processing industry

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## ABSTRACT

The effect of subsidy on firms' market power is controversial and unclear. In this article, we investigate such effect through an unbalanced panel data at firm level. Empirical results indicate that subsidy weakens the market power of firms subsidized. We then verify our hypothesis for this result that striving for subsidy through building or keeping relationship with governments will lead to higher administration and selling expense, and therefore lower market power, given that the rice processing industry is relatively competitive due to its low entry barrier and high homogenous product. Compared with non-state-owned enterprises, state-owned enterprises are found to be weaker in market power, to be higher in administration expense and to be lower in selling expense, which are well consistent with China's reality. Finally, robustness test consolidates our conclusions.

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Subsidy; market power;  
SOEs; non-SOEs

## 1. Introduction

Social stability and economic growth are generally the two main goals for transition economies. To achieve these objectives, governments from countries in transition usually provide various assistance to intervene economic activities. A widely used one is subsidy (Frye & Shleifer, 1997), which is regarded to be necessary, especially on protecting infant industries or vulnerable groups. In China, for example, the government spends an enormous sum of money to subsidize enterprises each year, with aims to prompt employment, innovation and development, especially for some industries with disadvantage or strategic significance, such as agriculture, food and high-tech sectors (Dang & Motohashi, 2015; Jaumandreu, 2005; Yi, Sun, & Zhou, 2015). The subsidy for China's grain processing mainly targets at promoting the level of industrialization and scale development of the enterprises, which are regarded as essential cornerstone for rural employment and food security (Wu & Xu, 2017). The National Office of Comprehensive Development of Agriculture (NOCDA), a specialized agency established under the Ministry of Finance (MOF) of China, undertakes the work of authorizing subsidy policies related to agribusiness. For instance, the *Guidance on Subsidizing Programs of*

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*Comprehensive Development and Industrialized Operation of Agriculture in 2009* (No. 2008–208 Document of NOCDA) explicitly stipulates the detailed plan of subsidy on agribusiness, including the principles, subsidizing range and targets, application requirements and other items. It also regulates the spending orientations of the subsidy fund on production workshop, equipment, infrastructure of water and electricity, road, quality inspection, environmental protection, etc.<sup>1</sup>

The effect of subsidies in China and other countries is discussed and confirmed by the literature. For instance, subsidy is demonstrated to be affirmative in increasing innovation output for Chinese manufacturers (Chen & Zhu, 2008), or in facilitating innovation performance only if the subsidy income is used to promote human capital (An, Zhou, & Pi, 2009). Moreover, Broekel (2015) found that subsidies for R&D cooperation contributed to stimulate the regional innovation efficiency in Germany. Pechrová (2015) manifested a positive and statistically significant impact of subsidies on the technical efficiency for Czech farms.

Despite Shepherd (1972) declared that political elements including all kinds of subsidies are factors of importance on determining market power, whether subsidy strengthens firms' market power is still controversial. On the one side, a positive relationship between subsidy and market power may originate from the following aspects. First, subsidy tends to induce rent-seeking and unfair competition, resulting in the change of firms' market power. Specifically, subsidy is regarded as a recognized signal by the government, or a symbol of good relationship with the government in a political-led society. By virtue of either or both the enterprises subsidized are relatively easier to obtain financing and bank loan (Feldman & Kelley, 2006; Kleer, 2010), and some other invisible advantages. Second, the positive effect from subsidy on innovation may also bring a positive relationship between subsidy and market power, given innovation is proved as an important source of monopoly (Aghion & Howitt, 1992; Klette & Griliches, 2000; Liu & Huang, 2016; Zhang & Jia, 2011).

On the other side, enterprises subsidized by the government are supposed to face higher cost and therefore lower market power. First, it is common that many enterprises in China strive to acquire more subsidy through building and managing relationship with government. It spends a lot of resources which would be used to improve enterprises' performance. This process increases their production and management cost (Zhao, Wang, Yang, & Cao, 2015). Yu, Hui, and Pan (2010) proved this point that fiscal subsidy on China's private enterprises connected to local governments will generate a negative effect on their performance. From another perspective, Liang, Li, and Lv (2012) found that subsidy policy in under-developed regions tends to attract firms with low efficiency to enter the local markets. Furthermore, to obtain more subsidy, managers always make some unpractical decisions, e.g., financial fraud, excess employment or production. Second, subsidy would reduce the incentive of enterprises subsidized on raising efficiency as they can enjoy a steady and sometimes large benefits easily. In terms of viability, Lin (2012) pointed out that huge subsidy has to be paid to enterprises when the government forces to develop the sectors violating factor endowment advantage, while those enterprises being short of viability would be hard to achieve international competitiveness when they lose subsidy. Similarly, Huang, Song, and Zhu (2015) also

<sup>1</sup>Please see the official website of the MOF of China for detailed information. [http://nfb.mof.gov.cn/zhengwuxinxi/zhengcefabu/xiangmuguanlilei/200812/t20081202\\_94003.html](http://nfb.mof.gov.cn/zhengwuxinxi/zhengcefabu/xiangmuguanlilei/200812/t20081202_94003.html).

found that in a market with high degree of competition, ongoing subsidies would reduce the sensitivity of enterprises to competition pressure and cause the risk of so-called production only for obtaining subsidies as well as overcapacity. In consequence, whether subsidy ultimately strengthens or weakens market power depends on the offset between these two considerations.

Additionally, debate on the heterogeneity of market power between China's SOEs (state-owned enterprises) and non-SOEs (non-state-owned enterprises) has drawn a lot of attention. China's SOEs have been criticized intensively for their low-cost efficiency and privileges on bank loans, investment, financing and so on (Ariff and Can, 2008; Fu & Heffernan, 2007; Wei & Wang, 2000; Zhao, Zhong, & Jiang, 2001; Zheng, Liu, & Bigsten, 2003). In addition, SOEs are more likely to be subsidized since the government has the so-called paternalism on SOEs (An et al., 2009; Wu & Shen, 2013). Therefore, the effect from subsidy on market power may include a part of indirect effect from ownership, and we will take it as a control variable to isolate this effect. In addition, it is helpful for us to test whether there is a significant difference in market power between SOEs and non-SOEs.

To the best of our knowledge, previous studies have paid relatively little attention on examining the relationship between subsidy and market power, especially for China. This article sheds light on testing this relationship using rice processing industry as a case study. First, rice is one of the most important and heavily consumed food in China. The planting area of rice accounts for 18.16% of the total sown area of farm crops, producing nearly a third of China's grain in 2015.<sup>2</sup> Second, the rice processing industry plays an important role in China's food industry which links farmers and consumers directly. Third, the rice processing industry is heavily subsidized in China given its low profit, high labor-intensive character, and the important role on food security. The subsidies obtained by rice processing enterprises may include various items, e.g., Agricultural Industrialization subsidy, employment subsidy and Interest subsidy. Since we have no detailed information about the variety and amount of subsidies for our sample, the subsidy discussed in this article is a comprehensive variable. No matter what kind of subsidy a firm obtains, it does mean that firm acquires benefit or attention from the government. In this article, we estimate the market power for each individual rice processing enterprise with a stochastic frontier model and then investigate the effect of subsidy on market power empirically.

The rest content of the article is arranged as follows. [Section 2](#) introduces the methodology and data. [Section 3](#) describes the empirical results. [Section 4](#) explains the robustness check, and [Section 5](#) makes the conclusion.

## 2. Methodology and data

We construct our methodology framework starting at assuming that firms pursue maximum profit, and government subsidy is increasing with output,<sup>3</sup> then firms' profit can be represented as follows:

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<sup>2</sup>Data source: China Statistical Yearbook 2016.

<sup>3</sup>This assumption is consistent with the reality of China's agribusinesses, since the main indicator according to which the government decides whether or how much to provide subsidy to a firm is its production size. Scaled firms are more possible to be subsidized since a large amount of production means big contribution to food security and employment, which are the most important policy targets in China.

$$\pi_{it} = (p_{it} + s_{it})Q_{it} - C_{it}^1(Q_{it}) - C_{it}^2(S_{it}), \quad (1)$$

where  $p_{it}$  and  $s_{it}$  are firm  $i$ 's price and unit subsidy, respectively,  $Q_{it}$  is output,  $C_{it}^1$  and  $C_{it}^2$  represent costs of production and subsidy, respectively,  $S_{it} = s_{it} \cdot Q_{it}$  is total subsidy. The FOC of firm  $i$  is given as:

$$\frac{\partial \pi_{it}}{\partial Q_{it}} = \frac{dp}{dQ_{it}} Q_{it} + (p_{it} + s_{it}) - MC_{it}^1 - \frac{dC_{it}^2(S_{it})}{dS_{it}} s_{it} = 0, \quad (2)$$

Then, we have the expression of Lerner Index imbedding with subsidy:

$$L_{it} = \frac{p_{it} - MC_{it}^1}{p_{it}} = \frac{1}{\varepsilon_{it}} - \frac{s_{it}}{p_{it}} (1 - MC_{it}^2), \quad (3)$$

where  $\varepsilon_{it} = -\frac{dp_{it}}{dQ_{it}} \frac{Q_{it}}{p_{it}}$  represents firm  $i$ 's demand elasticity. The marginal cost of subsidy  $MC_{it}^2 = \frac{dC_{it}^2(S_{it})}{dS_{it}}$  is expected to be positive as is well known that obtaining subsidy always induces additional cost for firms subsidized in China, e.g., rent and expenditure for building relationship with the officials of the subsidy-related authorities. Market power has nothing to do with subsidy if  $MC_{it}^2 = 1$ , which means the increasing subsidy can only compensate the corresponding cost. In that case, firms have no incentive to acquire subsidy from the government. If  $0 < MC_{it}^2 < 1$ , it implies that the cost of an additional unit of subsidy is less than the increased revenue from the subsidy, and market power will be less than the case without subsidy. The higher the subsidy level (larger  $s_{it}$ ), the weaker the market power. In other words, firms in this situation do not need to struggle for strong market power to achieve maximum profit. While if  $MC_{it}^2 > 1$ , i.e., adding one unit of subsidy requires paying more than one unit of cost; then, enterprises will increase market power. Under this condition, the higher the subsidy level, the more the company needs to increase prices or reduce marginal costs to enhance market power and therefore to maintain profit maximization. In general, firms' market power increases with the marginal cost of subsidy  $MC_{it}^2$ , every rational firm would not operate under the condition of  $MC_{it}^2 > 1$ .

The stochastic frontier cost function (SFCF) proposed by Schmidt and Lovell (1979) and improved by Berger and Hannan (1998) has been widely employed to estimate the market power for each individual enterprise (Guevara, Maudos, & Pérez, 2005; Maudos & Guevara, 2007; Solís & Maudos, 2008; etc.). Considering the special condition of China's rice processing industry, we construct the SFCF as follows:

$$\ln C_{it} = \sum \gamma_h \ln \omega_{hit} + \gamma_q \ln Q_{it} + \frac{1}{2} \sum \sum \gamma_{hj} \ln \omega_{hit} \ln \omega_{jit} + \frac{1}{2} \gamma_{qq} (\ln Q_{it})^2 \\ + \sum \gamma_{hq} \ln \omega_{hit} \ln Q_{it} + \rho_t T + \rho_q T \ln Q_{it} + \sum \rho_h T \ln \omega_{hit} + \ln u_{it} + \ln v_{it}, \quad (4)$$

where  $C_{it} = C_{it}^1 + C_{it}^2$  and  $Q_{it}$  represent total cost and output, respectively.  $\omega_{it}$  and  $T$  are input prices (including raw material, labor and capital) and time tendency representing technical progress, respectively.  $u_{it}$  represents the cost inefficiency and is assumed to be independently half-normally distributed, i.e.,  $N^+(0, \sigma_u^2)$ , and  $v_{it}$  is a white noise with independent identical distribution, i.e.,  $v_{it} \sim \text{i.i.d. } N(0, \sigma_v^2)$ . Taking derivative on both sides of Equation (4) with respect to  $Q_{it}$ , we can get the expression for marginal cost:

$$MC_{it} = (\gamma_q + \gamma_{qq} \ln Q_{it} + \sum \gamma_{hq} \ln \omega_{hit} + \rho_q T) C_{it} Q_{it}, \quad (5)$$

and the Lerner Index can be calculated through the following equation:

$$L_{it} = 1 - (\gamma_q + \gamma_{qq} \ln Q_{it} + \sum \gamma_{hq} \ln \omega_{hit} + \rho_q T) C_{it} P_{it} Q_{it}, \quad (6)$$

To estimate the effect of subsidy on market power, our model is as below:

$$\begin{aligned} \ln L_{it} = & \alpha + \beta_1 \ln SUB_{it} + \beta_2 D_{it} + \beta_3 \ln EDU_{it} + \beta_4 \ln ADV_{it} + \beta_5 \ln RD_{it} + \beta_6 \ln TAX_{it} \\ & + \beta_7 \ln XKTA_{it} + \mu_i + \varepsilon_t, \end{aligned} \quad (7)$$

where  $L_{it}$  and  $SUB_{it}$  are the Lerner Index and subsidy for firm  $i$ , respectively.  $D_{it}$  is set as an ownership dummy variable, where  $D_{it} = 1$  if the firm is SOE, and otherwise  $D_{it} = 0$ .  $EDU_{it}$ ,  $ADV_{it}$ ,  $RD_{it}$ ,  $TAX_{it}$  and  $XKTA_{it}$  are control variables representing employee training expenditure, advertising expense, R&D expenditure, tax, and the ratio of capital to total asset, respectively.

We apply an unbalanced panel data at the firm level from 1999 to 2011. The data of all the variables except prices of rice and paddy are taken from *China's Industrial Enterprise Database*, which is also called *Annual Survey of Industrial Firms (ASIF)* in some other literature. This is the best and widely used micro dataset at the firm level in China. It covers all the state-owned industrial enterprises and non-state-owned ones with prime operating revenue above five million CNY. The database contains almost all the important financial variables but has no direct information on output and material prices. In consequence, we have to calculate the output of rice for each firm through dividing the output value by the rice prices at the province level. We obtained the price of rice and paddy from *Statistical Yearbook of China* and matched them to the firm-level database according to the location code for each firm. In that case, it has an underlying implication that firms in the same province face an identical output and material price, which is not very precise but acceptable as a second best choice. Table 1 illustrates the number of observations, mean, standard deviation, minimum and maximum for the main variables such as rice production, rice price and capital price. For example, the average rice price is 2.695 CNY per kg, with minimum 1.388 CNY per kg and maximum 5.05 CNY per kg.

**Table 1.** The summary statistics for main variables (1999–2011).

Variables	Obs	Mean	Std. Dev.	Min	Max
Rice production	3033	13,000,000	24,300,000	66,229	518,000,000
Rice price	3033	2.695	0.676	1.388	5.050
Capital price	3033	0.062	0.005	0.055	0.071
Wage	3033	18,063	6806	6195	37,441
Paddy price	3033	1.625	0.414	0.842	3.040
Subsidy	2727	37,977	399,434	−136,000	12,100,000
Advertisement	2035	13,479	125,573	0	3,769,000
R&D	1752	73,224	1,356,947	0	50,100,000
Tax	3033	912,358	4,496,134	1,000	174,000,000
Capital/total asset	2870	0.435	0.243	0.005	4.531

### 3. Empirical results

Table 2 shows the estimation results of SFCF. Most of the coefficients are statistically significant at the 1% or 5% level. The estimate of  $\gamma$  is 0.917 and significant at the 1% level, indicating that applying the stochastic frontier model is sensible. We calculate the marginal cost for each enterprise through substituting the relevant coefficients estimated into Equation (5) and then compute the Lerner Index through Equation (6).

Figure 1 illustrates the median value of estimated Lerner Index annually from 1999 to 2011. It shows that market power of China's rice processing enterprises is relatively weak (i.e., less than 0.06). One possible explanation could be that China's rice processing industry has very low entry barrier and the product is relatively homogenous. Thus, it is quite competitive rather than monopolistic. In addition, an Inverted-U shape variation is easy to be found from 2001 to 2007, following with an increasing trend after 2007.

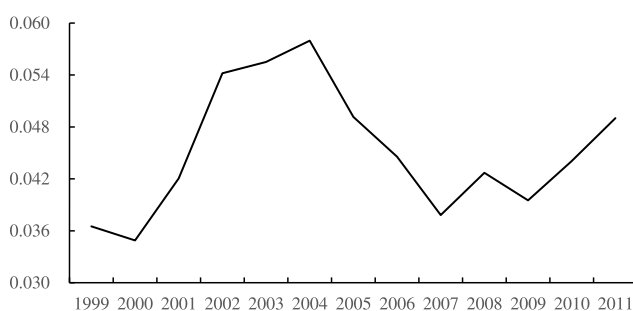
Table 3 presents the effect of subsidy on market power. It includes five regressions in which column (1) does not control any fixed effect and other variables which may affect market power, column (2) adds four control variables. Year and province fixed effects are gradually introduced into columns (3) and (4), while column (5) controls the year by province fixed effects to capture the fixed effects varying with year and province simultaneously. Robust standard errors are reported in parentheses. Empirical results show that subsidy has a negative and statistically significant effect on Lerner Index, suggesting that subsidy on rice processing enterprises tends to weaken their market power. After controlling the year and (by) province fixed effects, the coefficients of subsidy turn to be

**Table 2.** The estimation results of SFCF.

$\ln C_{it}$	Coefficient	Std. Dev.
$\gamma_k$	9.283**	4.609
$\gamma_l$	0.499	0.999
$\gamma_m$	-98.300***	16.00
$\gamma_q$	17.53***	2.868
$\gamma_{kk}$	3.712***	1.203
$\gamma_{lk}$	-0.240	0.362
$\gamma_{mk}$	-1.340***	0.440
$\gamma_{ml}$	1.001***	0.179
$\gamma_{ll}$	-0.213***	0.067
$\gamma_{mm}$	-1.868***	0.131
$\gamma_{qq}$	0.023***	0.001
$\gamma_{kq}$	0.151***	0.027
$\gamma_{lq}$	0.055***	0.012
$\gamma_{mq}$	0.043***	0.010
$\rho_t$	0.145***	0.023
$\rho_q$	-0.008***	0.001
$\rho_k$	—	—
$\rho_l$	—	—
$\rho_m$	0.046***	0.008
CONS	-274.00***	46.00
$\sigma^2$	0.504***	0.033
$\gamma$	0.971***	0.002
$\sigma_u^2$	0.490***	0.033
$\sigma_v^2$	0.015***	0.000

\*\*\* and \*\* represent significance at the 1% and 5% level, respectively. The coefficients of the cross terms of T and labor, as well as T and raw material, are omitted due to the collinearity. Robust standard errors are reported in the parentheses.





**Figure 1.** The median value of Lerner index in each year.

**Table 3.** The estimation results for the effects of subsidy on market power.

Variables	(1) Without controlling any effect	(2) Controlling related variables	(3) Controlling year fixed effect	(4) Controlling year & province fixed effects	(5) Controlling province by year fixed effects
Subsidy	−0.021** (0.009)	−0.022** (0.009)	−0.022*** (0.008)	−0.017** (0.008)	−0.019** (0.008)
SOEs	−0.204** (0.087)	−0.219** (0.087)	−0.150** (0.066)	−0.317*** (0.065)	−0.345*** (0.069)
Training expenditure		−0.023*** (0.007)	−0.029*** (0.006)	−0.025*** (0.006)	−0.025*** (0.006)
Advertising expense		0.016** (0.007)	0.003 (0.007)	0.001 (0.006)	0.001 (0.007)
R&D expenditure		−0.002 (0.012)	0.016 (0.011)	0.016 (0.011)	0.144 (0.011)
Tax		−0.020* (0.012)	0.038*** (0.010)	0.030*** (0.011)	0.031*** (0.011)
Capital/total asset	0.081** (0.032)	0.076** (0.032)	0.062** (0.028)	0.041 (0.027)	0.039 (0.028)
Constant	−3.171*** (0.041)	−2.915*** (0.148)	−3.856*** (0.196)	−3.710*** (0.197)	−3.809*** (0.349)
Year FE	NO	NO	YES	YES	NO
Province FE	NO	NO	NO	YES	NO
Year*Province FE	NO	NO	NO	NO	YES
R <sup>2</sup>	0.009	0.021	0.052	0.139	0.205
Observations	2870	2870	2870	2870	2870

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% level, respectively. All the variables are taken the natural logarithm. Robust standard errors are reported in the parentheses. In column (5), we add the cross term of year and province to capture the fixed effects varying with year and province simultaneously.

slightly smaller (from −0.021 to −0.019) but still significant, validating the negative relationship between subsidy and market power. This is probably due to the increased marginal cost induced by acquiring subsidy from the government. Given the rice price in a competitive market with low entry barrier and high level of homogeneity, the increase of marginal cost for firm *i* would weaken its market power. We will further discuss and test this intuition at the end of this section. What is more, the results also demonstrate that SOEs have lower market power. The main reason is that SOEs are generally found to have

higher marginal cost and thus lower price margins as well as lower market powers, given a competitive market and relatively stable product price. We use the model in column (5) as the benchmark of our empirical analysis.

Another concern is about the endogeneity problem due to the possible bidirectional causality and omitted variable bias (Coloma, 1999). Specifically, firms with stronger market power might be easier to be subsidized by the government (Chen & Yu, 2019), and the omitted unobservable factors might be correlated with subsidy. In those cases, the estimated coefficient of  $\beta_1$  in Equation (7) is inconsistent by OLS. The Chi-square statistic and the corresponding  $p$ -value of the Hausman test are 17.29 and 0.027, respectively, significantly rejecting the null hypothesis of exogeneity. Therefore, we apply the 2SLS (two-stage least square), LIML (Limited Information Maximum Likelihood Method) and GMM (Generalized Method of Moments) methods to estimate the coefficient via adequate instrumental variables. Following Koetter, Kolari, and Spierdijk (2012) and Ariss (2010), we develop an instrumental variable through calculating the annual average of subsidy over all the firms except firm  $i$  in every province as the instrumental variable for firm  $i$ . In addition, the 1 year lagged subsidy is also treated as an instrumental variable. These two instrumental variables are closely related to firm  $i$ 's subsidy but not related to its market power and error term. The estimation results with instrumental variables are summarized in Table 4. As shown in column (1), the coefficients of subsidy and SOEs are negative and significant at the 5% and 1% level, respectively, very close to the results through OLS methods in Table 3. The LM and F Statistics reject the null hypotheses of under identification and weak instrumental variable, respectively, suggesting that the 2SLS estimation results are reliable and robust. Furthermore, we estimate the model through the LIML and GMM methods which are deemed to be more robust under the conditions of weak identification and heterogeneity, respectively. As shown in columns (2)

**Table 4.** Estimation results with instrumental variables.

Variables	(1)	(2)	(3)
	2SLS	LIML	GMM
Subsidy	-0.028** (0.011)	-0.028** (0.011)	-0.025** (0.011)
SOEs	-0.221** (0.087)	-0.221** (0.087)	-0.229*** (0.085)
Training expenditure	-0.033*** (0.007)	-0.033*** (0.007)	-0.030*** (0.008)
Advertising expense	0.010 (0.008)	0.010 (0.008)	0.008 (0.008)
R&D expenditure	0.011 (0.013)	0.011 (0.013)	0.012 (0.014)
Tax	0.038*** (0.014)	0.038*** (0.014)	0.037*** (0.140)
Capital/total asset	-0.016 (0.035)	-0.016 (0.035)	-0.019 (0.035)
Constant	-3.260*** (0.183)	-3.260*** (0.184)	-3.320*** (0.368)
Year*Province FE	YES	YES	YES
Kleibergen-Paap rk LM Statistic	77.823		
Cragg-Donald Wald F statistic	776.199		
Kleibergen-Paap rk Wald F statistic	38.384		
$R^2$	0.197	0.197	0.167
Observations	1697	1697	1697

\*\*\* and \*\* represent significance at the 1% and 5% level, respectively. All the variables are taken the natural logarithm. Robust standard errors are reported in the parentheses.

and (3), the estimation results with LIML and GMM are almost the same as those with 2SLS, indicating the robustness of our findings. So, the estimation results with instrumental variables would be more reliable if the endogeneity problem indeed exist, though there are very close to those estimated by the OLS approach.

A further question is why subsidy has a negative relationship with market power. Since the rice processing industry is competitive and the price is relatively stable, the change of Lerner Index mostly depends on the variation of marginal cost, i.e., a higher marginal cost will lead to a lower Lerner Index. Therefore, we hypothesize that the negative effect of subsidy on market power may be caused by the increased cost, especially the rent-seeking cost.

In order to verify this hypothesis, we have checked China's accounting criterion and find that enterprises' expenditure on building or keeping relationship with governments like banquet meals, presents fee, or even bribery is charged as business entertainment under the term of administration expense or selling expense, which has been cut since 2012 when the new government come into power.<sup>4</sup> Therefore, we estimate the effect of subsidy on administrative and selling expenses through OLS method, as shown in Table 5. The results indicate that subsidy increases the administration and selling expenses significantly, even after controlling year and province fixed effect as well as other variables such as ownership. It suggests that these enterprises subsidized may have to pay a price for the government subsidy. There is no free lunch for them. In other words, it increases their cost inevitably, and much worse, makes some enterprises falling into the "laze" habit relying on the subsidy but neglecting the management and R&D. There are so many enterprises going to their end through this way.

**Table 5.** The effects of subsidy and ownership on administration and selling expense.

Variables	Administration expense			Selling expense		
	(1)	(2)	(3)	(4)	(5)	(6)
Subsidy	0.036*** (0.008)	0.057*** (0.007)	0.052*** (0.007)	0.016** (0.007)	0.033*** (0.007)	0.033*** (0.007)
SOEs	0.192* (0.103)	0.264*** (0.086)	0.235** (0.092)	-0.624*** (0.119)	-0.393** (0.074)	-0.412*** (0.075)
Training expenditure	0.025*** (0.006)	0.058*** (0.006)	0.052*** (0.006)	0.014*** (0.005)	0.028*** (0.005)	0.027*** (0.005)
Advertising expense	-0.003 (0.008)	0.023*** (0.008)	0.023*** (0.008)	-0.003 (0.006)	0.015 (0.006)	0.018*** (0.006)
R&D expenditure	0.019* (0.011)	0.007 (0.013)	0.013 (0.013)	0.018 (0.014)	0.021 (0.012)	0.023** (0.011)
Tax	0.256*** (0.017)	0.250*** (0.014)	0.261*** (0.014)	0.269*** (0.014)	0.252*** (0.010)	0.252** (0.011)
Capital/total asset	-0.187*** (0.036)	-0.152*** (0.031)	-0.146*** (0.032)	-0.198*** (0.027)	-0.159** (0.023)	-0.179** (0.023)
Constant	9.225*** (0.206)	9.109*** (0.234)	8.906*** (0.236)	13.244*** (0.173)	12.612*** (0.199)	12.608*** (0.194)
Year fixed effect	NO	YES	YES	NO	YES	YES
Province fixed effect	NO	NO	YES	NO	NO	YES
R <sup>2</sup>	0.199	0.230	0.267	0.340	0.396	0.420
Observations	2833	2833	2833	2870	2870	2870

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% level, respectively. Robust standard errors are reported in the parentheses.

<sup>4</sup>Please see the details of enterprises' accounting criterion from the Ministry of Finance of the People's Republic of China, in which both the terms of administration and selling expense include an important sub-term "business entertainment": [http://kjs.mof.gov.cn/zhengwuxinxi/zhengcefabu/200805/t20080522\\_33653.html](http://kjs.mof.gov.cn/zhengwuxinxi/zhengcefabu/200805/t20080522_33653.html).

In addition, we also find that compared to non-SOEs, SOEs have higher administration expense but lower selling expense. The reason for the former is obvious and has been demonstrated intensively (see the beginning of this article for a brief literature review). While the latter is possibly due to SOEs' natural connection to the government, which gives them ascendancy in some market segments and saves lots of expense on advertisement and marketing channels (e.g., lower selling expense) since they are endorsed by the strong government.

The reasons why training and R&D expenditures result in more selling and administration expenses may be that, assigning employees to attend training outside or inviting experts to train their employees inside would probably induce some other kinds of cost, such as the expenditure on material, transportation, accommodation for both the invited experts and employees trained. In addition, training and R&D are important measures for firms to improve their performance on production and marketing, which would also produce more selling and administration expenses.

#### 4. Robustness check

In this section, we check the robustness of our findings with different model specifications. We separate the sample by enterprise size, which are below and above the median of firms' total asset. Additionally, we use the profit ratio as explained variable which is calculated as the ratio of profit subtracted by subsidy over total asset, given that it is positively correlated with market power since either lowering marginal cost or raising price is conducive to increase enterprises' profit.

Columns (1) and (2) of Table 6 show the regression results with subsample whose total asset is less than the median level. Columns (3) and (4) present the regression results with subsample whose total asset is larger than the median level. Columns (5) and (6) are regressions with net

**Table 6.** Robust test for the model.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Less total asset		More total asset		Net profit ratio as explained variable	
Subsidy	-0.032* (0.018)	-0.028 (0.022)	-0.037** (0.016)	-0.035** (0.014)	-0.047*** (0.014)	-0.043*** (0.012)
SOEs	-0.796*** (0.185)	-0.910*** (0.141)	-0.675*** (0.240)	-0.865*** (0.164)	-0.891*** (0.167)	-0.960*** (0.121)
Training expenditure	-0.009 (0.008)	-0.003 (0.008)	-0.023** (0.011)	-0.005 (0.010)	-0.020*** (0.007)	-0.013* (0.007)
Advertising expense	-0.013 (0.012)	-0.023* (0.013)	0.007 (0.012)	0.016 (0.011)	-0.012 (0.009)	-0.019** (0.009)
R&D expenditure	0.017 (0.015)	0.023 (0.016)	0.008 (0.018)	-0.014 (0.014)	0.017 (0.013)	0.009 (0.012)
Tax	0.571*** (0.030)	0.528*** (0.027)	0.514*** (0.038)	0.531*** (0.032)	0.497*** (0.026)	0.458*** (0.020)
Capital/total asset	0.254*** (0.073)	0.222*** (0.062)	0.156** (0.079)	0.137** (0.060)	0.305*** (0.062)	0.283*** (0.046)
Constant	-8.118*** (0.368)	-7.885*** (0.400)	-8.526*** (0.487)	-8.428*** (0.440)	-7.582*** (0.309)	-7.025*** (0.305)
Year fixed effect	NO	YES	NO	YES	NO	YES
Province fixed effect	NO	YES	NO	YES	NO	YES
R <sup>2</sup>	0.501	0.567	0.458	0.516	0.408	0.456
Observations	1140	1140	759	759	1900	1900

\*\*\*, \*\* and \* represent significance at the 1%, 5% and 10% level, respectively. All the variables are taken natural logarithm. Robust standard errors are reported in the parentheses. Models (1) and (2) are regressed on the subsample with total asset less than the median level, while models (3) and (4) are regressed on total asset above the median level; models (5) and (6) are regressed with the net profit ratio as explained variable.

profit ratio as explained variable. Almost all the coefficients of subsidy and SOEs are negative and statistically significant, indicating that our empirical results are robust.

## 5. Conclusions

Subsidy is regarded as a double-edged sword for its positive incentive on innovation and negative incentive on efficiency. Studies concerning the effects of subsidy have been emerged richly in the last two decades, especially on the cases of developing countries. We, in this article, investigate the effect of subsidy on market power through an unbalanced panel data at the firm level. Empirical results indicate that subsidy does not increase enterprises' market power, on the contrary, it weakens the market power of those subsidized, and robust tests also support this result. One possible explanation is that most of enterprises striving for more subsidy from the government tend to spend much resource on rent-seeking to build or keep the relationship with the officials being in power. It increases their cost inevitably, and much worse, makes some enterprises falling into the "laze" habit relying on the subsidy but neglecting the management and R&D. What is more, SOEs are found to be weaker in market power than non-SOEs, implying that SOEs may have higher marginal cost and lower markup due to well-known reasons, since all the enterprises are competing in a common industry. In other words, our empirical results verify the low efficiency of China's SOEs further from a new perspective.

Even so, some deficiency exists in this article due to the limitation of data. First, there is only one industry discussed and whether the conclusion could be ubiquitous in China's industries is unknown. Second, we only consider the situation of seller market power in the downstream stage, neglecting the case of buyer market power in the upstream stage. These are the two main aspects we will try to work in the future research.

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