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The Impact of Government Subsidies on Business Performance of Public Utility Companies

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Abstract: Public utility enterprises are main providers of public utility products (quasi-public goods) in theory and practice. Special nature of products makes government subsidies important for the survival and development of public enterprises while focus on which is less, especially at the micro enterprise level. The purpose of paper is to quantify the impact of government subsidies on business performance of public utility enterprises which is important for evaluating and optimizing government financial subsidy policies and improving efficiency of public utility enterprises. Based on financial data of public utility enterprises in Guotai'an database from 2017-2019, the paper uses quartile statistical description method and weighted least squares regression method. The conclusions are as follows. There is a significant positive impact of government subsidies on the business performance of public utility enterprises which is larger and more significant for small & micro enterprises and private companies. So, differences in ownership nature and enterprise size need to be considered for government subsidies.

Keywords: government subsidies; public utility enterprises; business performance

JEL Classification: H71; H24; H41

1. Introduction

Public utility products (i.e., quasi-public goods) which has significant externalities and spillovers are the basic components to meet the needs of residents for a good life. Public utility products are usually provided by public utility enterprises in China. Therefore, government subsidies are important for the survival and development of public utility enterprises.

Scholars have discussed the performance of government subsidies from different perspectives (Luo et al, 2020; Zhong, 2020; Zheng et al, 2020; Yu et al, 2020), and the results and extent of impact varied. Research has focused on high-tech, new energy automobile, biomedical enterprises, food processing and other industries in China (Dong & Zhong, 2020; Rong & Zhong, 2020; Yu et al, 2020; Cao & Yi, 2018; Yang & Fan, 2015; Wu, 2019). But focus on government subsidy on public utility enterprises are less, especially at micro enterprise level.

Therefore, this paper uses an empirical analysis paradigm to quantify effects of government subsidies on business performance of public utility enterprises, which is important for adjusting and optimizing government subsidy policy and improving overall efficiency of public utility industry.

Most studies have confirmed government subsidies improve firm performance. Rong and Zhong (2020) confirmed that government subsidies significantly improved firm performance, using a sample of 450 high-tech firms in the China GEM from 2016-2018. Zheng et al (2020) confirmed that government subsidies have a significant positive effect on firm performance at back end of industry chain using Chinese tombarthite industry as an example. Wu (2019) confirmed that government subsidies can significantly increase firm profits using a sample of Chinese listed firms from 2007-2009. Dvouletý and Blažková (2019) confirmed that government subsidies in agriculture improve firm performance using Czech as a sample. Lu et al. (2016) selected listed manufacturing firms from 2012-2014 and found that government subsidies are significantly and positively related to firm performance. The main reason for positive impact may be that government subsidy funds, as a current benefit inflow to the firm, can cover the capital gap of firm and promote its capital turnover.

However, government subsidies may also reduce firm performance. Wang et al. (2017) found that government subsidies promote innovation performance but no effect on business performance which used a sample of listed companies in the new energy vehicle industry from 2010-2015. Cao and Yi (2018) analyzed sample of listed biopharmaceutical manufacturing companies from 2012-2015 and found that government subsidies had a negative impact on firm performance. Wang et al. (2015) analyzed negative effects of government subsidies that made IPO companies' surplus persistence worse and long-term performance lower. The main reason for negative impact is that government subsidies make firms dependent on the government and less motivated to operate.

It is also found that the impact of government subsidies on firm performance is uncertain. Yang and Fan (2015) selected listed renewable energy category companies from 2009-2012 and found that government subsidies have positive impact on financial performance but have negative impact on financial performance of state-controlled enterprises. Liu and Hu (2015) selected listed new energy companies from 2012-2014 and found government subsidies had significantly positive impact on current performance but had negative impact on long-term performance.

Although studies on government subsidies affecting business performance are mature, there is no consensus on the direction of the relationship. Furthermore, there are fewer studies discussing impact of government subsidies with public utility companies as the research target. The scientific issue is quantitative impact of government subsidies on business performance of public utility firms. On one hand, it can enrich the theory of policy support for public utility enterprises and provide a basis for financial performance evaluation. On the other hand, it can optimize government financial subsidy policies and improve efficiency of government subsidies of enterprises in practice.

Government subsidies are funds or other non-monetary assets given by government departments to support and encourage survival or development of certain types of industries or enterprises. Therefore, government subsidies can provide cash inflow in the current period which can improve the enterprise's capital turnover and enhance the profitability and profit level. So, the first hypothesis is proposed here.

Hypothesis 1: Government subsidies have positive effect on the current business performance of public utility enterprises.

Large enterprises have a wide range of financing channels and better financing ability. Therefore, government subsidies have a lower contribution to the current capital turnover of large enterprises than that of small enterprises. So, the second hypothesis is proposed here.

Hypothesis 2: Government subsidies have a greater contribution to the business performance of small enterprises.

State-owned enterprises have an advantage in obtaining policy support and government subsidies which determines ability to obtain more external funds. However, state-owned enterprises generally have lower productivity and capital efficiency than private firms. So, the third hypothesis is proposed here.

Hypothesis 3: Government subsidies have a greater contribution to the business performance of private enterprises.

2. Methodology

The following econometric model is set up using mixed cross-sectional data of Chinese listed firms from 2017-2019.

$$ROS_{it}=c+ b\ Govsub_{it}+acontrol_{it}+\varepsilon_{it} \quad (1)$$

In equation (1), i denotes the firm and t denotes the year. ROS_{it} represents the business performance of the i firm in t year. $Govsub_{it}$ denotes government subsidy income received by the i firm in t year which is the key explanatory variable. b reflects the impact of government subsidy on the firm's operating performance. If the estimated result of coefficient b is positive, it means that government subsidies have positive effect on the business performance of the enterprise in the year. And if the estimated result of b is negative, it indicates negative effect. $control_{it}$ is matrix of control variables. ε_{it} is the random error term.

The explanatory variable-business performance. There are several choices of measures for business performance, such as profitability of sales, return on net assets, and earnings per share. Referring to previous studies and characteristics of the sample, the profit margin on sales (expressed as *POS*) is selected for the following reasons: profit is the core indicator for survival and development of enterprises and the basis for other profitabilities, and *POS* can reflect profitability of enterprise sales. Moreover, *POS* is easy to calculate. In addition to avoid potential endogenous problems of profitability indicators, the return on assets (expressed as *ROA*) is used as a robust test to verify the stability of findings. Specifically, *POS*=total profit/operating revenue, *ROA*=total profit/average total assets.

Explanatory variables-government subsidies. Considering the influence of enterprise size on intensity of government subsidies, in order to ensure the stability of results, two measures are adopted: one is the ratio of government subsidies relative to the total number of employees (per capita government subsidy income) expressed as *AGovsu*b. In order to reduce the fluctuation of the value and the influence of price, the natural logarithm is taken here. The second is the ratio of government subsidy income relative to operating income which is expressed as *PGovsub*.

Seven control variables are included which are solvency, operating capacity, profitability, development capacity, fixed assets ratio, enterprise size, and years of operation. The solvency is measured by gearing ratio expressed as *gr* = total liabilities/total assets. Asset turnover ratio is to measure a company's operating capacity which is expressed as *rat* = operating income/average total assets. Net sales margin is used to measure profitability which is expressed as *nsm* = net profit/revenue. The growth rate of operating income is used to measure the ability of the enterprise to grow which is expressed as *ror* = operating income growth / operating income. The number of employees expressed as *noe* and operating income expressed as *or* are used to measure size of the enterprise that the natural logarithm is taken to eliminate the influence of heteroskedasticity and variability. In addition, fixed assets ratio expressed as *rfa* = fixed assets/total assets, and years of operation expressed as *yo* = (sample year –year of establishment + 1) which are also used as control variables.

The micro data of public utility companies from 2017-2019 used in paper are obtained from the Guotai'an database. The specific data processing process is as follows: if there is any missing data of the sample, it is excluded; if the year of enterprise establishment is larger than the sample year, it is excluded; if the number of enterprise employees is less than or equal to zero, it is excluded. Finally, the sample frame is comprised by 322 samples in 2019, 282 samples in 2018 and 244 samples in 2017. The statistical software is Stata11.

After variable selection and data processing, the specific econometric model is shown in equation (2) below.

$$POS_{it} = c + bGovsub_{it} + a_1 gr_{it} + a_2 rat_{it} + a_3 nsm_{it} + a_4 ror_{it} + a_5 noe_{it} + a_6 or_{it} + a_7 rfa_{it} + a_8 yo_{it} + e_{it} \quad (2)$$

For the specific regression process, the weighted least squares regression method was used to avoid possible heteroskedasticity. To test the robustness and reliability of conclusions, supplementary regressions were performed by replacing the metrics of independent variable and categorization regression. In addition, in the descriptive statistics stage, the minimum, maximum, mean, median, and quantile values of government subsidies are used.

3. Results

3.1. Statistical Description

1. Government subsidies received by all public utility companies

All samples received government subsidies and statistical characteristics are shown in Table 1. The average value of subsidy income received by public utility enterprises from 2017 to 2019 was ¥41.6 million, ¥51.5 million, and ¥38.8 million. It seems that there is a fluctuating trend. At the same time, the minimum value of government subsidies received by enterprises was 0, while the maximum value was ¥1 billion in 2019. Difference is huge and extreme which is similar in 2018 and 2017. There are significant differences in government subsidy revenues of public utility enterprises. That is, the data distribution is suitable for the research task. Just for this reason, all samples are classified below and scale of government subsidies for different category are described in detail.

Table 1. Government subsidies received by all utility enterprises in 2017-2019 (Unit: 10 million yuan)

Year	sample size	mean	standard deviation	25% quantile	median	75% quantile	min	max
2019	322	3.88	8.18	0.65	1.62	3.74	0.00	100.00
2018	282	5.15	26.40	0.50	1.39	3.61	0.01	426.00
2017	244	4.16	14.50	0.41	1.13	2.75	0.00	174.00

Government subsidy income per capita of public utility enterprises is used to measure intensity of government subsidies. Interesting results are shown in Table 2. Mean of government subsidy income per capita is ¥29,800, ¥27,600, and ¥23,100 from 2017 to 2019 with a small decrease trend year by year. The median value is ¥0.77 million, ¥0.87 million, and ¥0.97 million with a steady increase year by year. The minimum value of government subsidy income per capita is close to ¥0 while the maximum value is ¥1.7 million in 2019. The same characteristics exist in 2018 and 2017. The difference between median and mean mainly due to the maximum value every year. Sample distribution has some differences and shows skewed characteristics. Intensity of government subsidies of public utility enterprises is relatively stable from 2017 to 2019 overall with skewed characteristics.

Table 2. Government subsidy income per capita of all samples in 2017-2019 (Unit: 10 thousand yuan)

Year	sample size	mean	standard deviation	25% quantile	median	75% quantile	min	max
2019	322	2.31	9.67	0.34	0.97	2.22	0.00	169.91
2018	282	2.76	15.99	0.3	0.87	2.17	0.01	266.24
2017	244	2.98	20.64	0.26	0.77	2.06	0.00	321.70

2. Government subsidies received by enterprises of different sizes

According to the above, government subsidies received by public utility enterprises may be related to the size of enterprises. Therefore, relative division method was used here according to number of employees in enterprise. Each quartile of employees is shown in Table 3. Then using three quartiles of Table 3 as standard, sample was divided into four categories: large enterprises, medium enterprises, small enterprises, and micro enterprises.

Table 3. Size of employees in public utility enterprises, 2017-2019 (Unit: persons)

Year	25% quantile	median	75% quantile
2019	764	1640	3558
2018	801	1562.5	3439
2017	724.5	1385	3119.5

Table 4 shows descriptive statistics results of four categories. The average value of government subsidies received by large enterprises during 2017-2019 is larger than that of other enterprises. Average value decreases gradually as the size of enterprises decreases. Same trend is shown with median data. For example, average value of large enterprises is 10 times higher than that of micro enterprises. The larger size of enterprise, the easier it is to obtain government subsidies. I.e., government subsidies tend to favor large enterprises.

Table 4. Government subsidies of different size of employees (Unit: 10 million yuan)

Year	type of enterprise	sample size	mean	standard deviation	25% quantile	median	75% quantile	min	max
2019	large	80	8.80	14.30	2.18	3.82	9.22	0.28	100.00
	medium	81	3.50	4.48	0.74	1.99	4.17	0.00	26.70
	small	80	2.06	2.97	0.30	1.13	2.79	0.01	18.60
	micro	81	1.21	1.37	0.26	0.81	1.60	0.01	7.38
2018	large	70	13.70	51.90	1.17	3.12	8.68	0.05	426.00
	medium	71	3.67	5.87	0.67	1.49	4.41	0.02	34.50
	small	70	2.02	2.45	0.31	1.03	2.64	0.03	14.90
	micro	71	1.26	2.05	0.23	0.66	1.45	0.01	15.00
2017	large	61	11.40	27.00	1.14	2.36	9.46	0.06	174.00
	medium	61	2.76	5.95	0.46	1.16	2.32	0.02	42.80
	small	61	1.72	1.98	0.28	1.09	2.44	0.02	11.00
	micro	61	1.19	1.78	0.24	0.57	1.02	0.00	10.10

3. Government subsidies received by enterprises of different ownership

Government subsidies obtained by public utility enterprises may be related to the nature of enterprise ownership. So here samples are classified according to nature of enterprise ownership: state-owned enterprises, private enterprises, and foreign enterprises. Statistical results of subsidies obtained by three categorical samples are shown in Table 5. Because sample size of foreign enterprises is too small, they are not analyzed. the average value of government subsidies obtained by state-owned enterprises from 2017 to 2019 is greater than that of private enterprises, even 10 times in 2018 and 2017. It can be seen that state-owned enterprises are more likely to receive government subsidies than private enterprises, i.e., government subsidies are more inclined to state-owned enterprises.

Table 5. Government subsidies of utility enterprises of different ownership (Unit: 10 million yuan)

Year	type of enterprise	sample size	mean	standard deviation	25% quantile	median	75% quantile	min	max
2019	state-owned	97	7.01	13.50	2.18	3.82	9.22	0.28	100.00
	private	222	2.56	3.52	0.60	1.42	3.24	0.00	26.60
	foreign	3	-	-	-	-	-	-	-
2018	state-owned	97	11.00	44.40	0.85	2.33	6.39	0.03	426.00
	private	183	2.13	2.87	0.38	1.04	2.66	0.01	17.20
	foreign	2	-	-	-	-	-	-	-
2017	state-owned	86	9.26	23.40	0.66	1.93	8.02	0.02	174.00
	private	156	1.56	1.88	0.37	0.93	2.07	0.00	10.10
	foreign	2	-	-	-	-	-	-	-

3.2. Basic Regression Results and Robust Test

White test showed that the general regressions with both subsidy income per capita and subsidy income as share of operating income as explanatory variables had heteroskedasticity. So weighted least squares was chosen as basic regression method. The results are shown in Table 6 Column reg1-2. Regardless of subsidy income per capita or share of subsidy income to operating income as the explanatory variables, government subsidies significantly increased sales margin, i.e., government subsidies improved the operating performance of public utility companies, which is consistent with Hypothesis 1.

To test the robustness of the results, the return on assets indicator was used as a proxy variable for business performance. The results are shown in Table 6 reg3-4. Government subsidies still improve business performance more significantly. Therefore, government subsidies have a significant positive impact on business performance of public utility companies, which is consistent with Hypothesis 1.

3.3 Extended regression analysis

The effect of government subsidies on business performance of utility enterprises may be sensitive to enterprise size. Therefore, a categorical regression using enterprise employee size as a criterion to classify enterprise types to test Hypothesis 2 is implemented which results are shown in Table 6 reg5-7. Coefficients of government subsidies for small and micro enterprises are larger and significant than those for medium and large enterprises, which is consistent with Hypothesis 2. Compared with small and micro enterprises, medium and large enterprises have more extensive financing channels and higher operating income. Therefore, inflow of government subsidies has less favorable impact on medium and large enterprises.

Table 6. All regression results

	reg1	**reg2**	**reg3**	**reg4**	**reg5 for micro &small**	**reg6 for medium**	**reg7 for large**	**reg8 for state-owned**	**reg9 for private**
dependent var	ROS	ROS	ROA	ROA	ROS	ROS	ROS	ROS	ROS
Agovsub	*0.20** *(1.73)*		*0.42** *(1.91)*		*0.32** *(1.81)*	*0.13* *(0.76)*	*0.03* *(0.70)*	*0.20* *(1.32)*	*0.54** *(1.68)*
Pgovsub		*0.04** *(1.69)*		*0.39**** *(2.20)*					
gr	-0.01 (-0.74)	-0.01 (-0.71)	-0.01 (-0.35)	-0.01 (-0.30)	-0.02 (-0.95)	0.01 (0.65)	0.02 (1.40)	0.04 (0.43)	-0.03 (-1.58)
rat	-0.01** (-2.43)	-0.01** (-2.37)	-0.02*** (-3.45)	-0.02*** (-3.43)	-0.03*** (-3.72)	-0.00 (-0.71)	-0.00 (-0.29)	-0.01* (-1.75)	-0.01 (-1.58)
nsm	1.02*** (210.55)	1.02*** (208.15)	0.33*** (26.63)	0.34*** (26.91)	1.02*** (161.99)	1.12*** (49.96)	1.13*** (45.89)	1.17*** (59.80)	1.01*** (203.94)
ror	0.00 (0.79)	0.00 (0.73)	0.01*** (2.80)	0.00*** (2.77)	-0.00 (-0.32)	0.01 (0.97)	0.00 (0.49)	0.00 (0.80)	0.00 (0.39)
rfa	0.04*** (3.98)	0.04*** (3.83)	0.05** (2.25)	0.06** (2.34)	0.05*** (2.81)	0.05*** (4.16)	0.01 (1.13)	0.03** (2.50)	0.03** (2.10)
noe	-0.00** (-2.30)	-0.00* (-1.91)	-0.01* (-1.97)	-0.01** (-2.40)	-0.01* (-1.91)	-0.00 (-0.58)	0.00 (0.16)	-0.01 (-1.42)	-0.00 (-1.54)
or	0.00 (0.14)	-0.00 (-0.26)	-0.01* (-1.92)	-0.01** (-2.47)	0.01** (2.35)	-0.00 (-0.66)	-0.00 (-0.36)	-0.00 (-1.15)	0.00 (0.95)
yo	0.00 (1.12)	0.00 (1.01)	0.00 (0.47)	0.00 (0.23)	0.00 (0.40)	-0.00 (-0.03)	0.00* (1.71)	0.00 (0.62)	0.00 (0.27)
constant	0.05 (1.45)	0.06* (1.69)	0.13 (1.61)	0.19** (2.24)	-0.08 (-0.40)	0.10 (1.17)	0.00 (0.09)	0.11** (2.01)	0.01 (0.15)
Sample size	848	848	848	848	424	214	210	255	586
Ajusted R^2	0.99	0.99	0.73	0.73	0.98	0.97	0.97	0.92	0.94

Note: t-statistics in parentheses, * indicates significant at 10% level of significance, ** indicates significant at 5% level of significance, *** indicates significant at 1% level of significance.

The impact of government subsidies on operating performance of public utility enterprises may be sensitive to ownership of enterprises. Therefore, a categorical regression

using ownership as a criterion to classify enterprise types to test Hypothesis 3 is implemented which results are shown in Table 6 reg8-9. The coefficient of government subsidies on business performance of state-owned utilities is positive but insignificant; the coefficient of government subsidies on private utilities is positive, larger in absolute value and significant. This is consistent with Hypothesis 3. This result may be explained by fact that state-owned enterprises are relatively dependent on government subsidies. While private enterprises pursue profit and operational efficiency, use but do not rely on government subsidies. Therefore, they can use government subsidies efficiently and effectively to increase operational performance.

4. Discussion

Firstly, there is significant positive effect of government subsidies on the operating performance of public utility enterprises which is consistent with the results of previous studies (Dong & Zhong, 2020; Rong & Zhong, 2020; Wu, 2019). The specific path is that government subsidies increase current cash inflows of the enterprise. Then cash inflows improve its capital turnover capacity and enhance its profitability and profit level. This path is tested ever by Lu et al. (2016).

Secondly, the positive impact of government subsidies on the business performance is greater and more significant for small and micro enterprises. Compared with small and micro enterprises, large and medium-sized enterprises have more extensive financing channels and higher operating income. Because of law of diminishing marginal utility, government subsidies have less favorable effects on large and medium-sized enterprises. This conclusion is relatively innovative.

Thirdly, the positive impact of government subsidies on the operating performance is larger and more significant for private companies. State-owned enterprises do not have profit as their only goal and lack cost constraints. Lack of incentives makes them less efficient in using funds and more dependent on government subsidies. While private enterprises pursue profits and operational efficiency, therefore they can use subsidies efficiently to promote the growth of operating performance. This conclusion is also relatively innovative.

Therefore, government subsidies for public utility enterprises are necessary. Differences in ownership nature and enterprise size need to be considered to improve the efficiency of government subsidies. On one hand, government subsidy policy should be implemented for public utility enterprises. Production and operation of public utility enterprises is a process of realizing government functions and meeting the growing needs of Chinese residents for a better life. On the other hand, government subsidies for private and micro and small public utilities should be increased. And differences in efficiency of enterprises of different sizes and ownership systems should be taken into considered.

In further research, mechanism and role of government subsidies affecting business performance of public utility firms are needed to reason and test deeply. After these works, measures to improve government and enterprises efficiency can be proposed specifically.

There are two limitations in this study as follows. On one hand, for the specific research subject-public utility companies, only accounting performance is accounted for and the social

benefits of their positive externalities are not considered. This approach may underestimate the positive impact of government subsidies. On the other hand, the panel data used here is a short panel of three years, and the results reflect more short-term effects. The long-term trend between government subsidies and business performance is not fully reflected.

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