The Importance of Tax Policies on Innovation - A Reassessment Using Chinese National Statistics Data

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This study evaluates the effects of Chinese research and development (R&D) tax credit policies enforced around 2008 on corporate profit and patent activity. Compared with governmental direct tax subsidies, R&D tax credit more positively relates to corporate patent activity and profit. This paper separately examines samples of Chinese state-owned enterprises (SOE), privately-owned enterprises (POE), and foreign invested enterprises (FIE), and find that stimulating effect is the strongest for POEs. This study not only increases our understanding of China's R&D policy, but also adds to the R&D tax credit literature and a stream of R&D effectiveness literature.

INTRODUCTION

Chinese economy advanced dramatically at an average rate of above 9% from 1979 through 2017 (world bank). Adopted technologies played an big part in early economic development. But to sustain economic growth, China gradually picked up indigenous research and development (R&D) investment intensity. R&D expenditure as a proportion of the country's GDP (i.e. R&D intensity) has risen from 0.563% in 1996 to 2.1% in 2017. Numeric R&D expenditure of China second only to that of the United States. If the growth momentum is maintained and innovation efficiency is improved, China could be transformed from the world's low-tech manufacturing powerhouse to a relatively high technological center (Sigurdson et al. 2005). This change would have important implications for the rest of the world.

Lack of access to finance is considered to be one of the biggest constraint on Chinese innovation especially for privately-owned enterprises (POE) due to discriminate lending practices that favor state-owned enterprises (SOE). In an effort to sustain R&D growth, China government explored several venues to promote indigenous corporate innovation capabilities: funding basic scientific research in universities and research institutions; establishing high tech areas with preferential treatments; direct funding of specific corporate innovation activities; and indirect funding of private sector R&D activities through R&D tax credits. The latter two are the focus of this paper.

Many prior studies find governmental subsidies to positively affect private sector's R&D expenditure in developed countries (Hall, 1993; Bloom, Griffith, & Van Reenen, 2002; Wilson, 2009; Guceri & Liu, 2015; Rao, 2016; Agrawal, Rosell, & Simcoe, 2014; Mulkay & Mairesse, 2013;). But prior research on China's R&D tax credit provides mixed views of the effectiveness of those subsidies (Zhao, Fan & Zhou 2014; Chen 2015; Jiang & Wang 2015; Howell 2016; Jia & Ma 2017), probably due to the limited length of the time period for studies that are conducted right after the policy implementation, and that those survey studies and empirical studies draw data from different cities or provinces.

This paper attempts to draw a more complete picture by using China National Bureau of Statistics' national data on governmental R&D tax subsidies and enterprises' expenditure to examine the effect of China's R&D tax credit policies enforced around 2008. Previous studies that use change in R&D user cost as measure of R&D tax change assumed that implementation of R&D policy was immediately 100%, which was shown to be untrue (Zhao, Fan & Zhou 2014; Chen 2015). By using statistical data on the amount of R&D tax credit, I avoid making assumptions on implementation efficiency of R&D policy.

I first find the R&D tax credit to significantly stimulate R&D expenditure for the sample period. Then I ask whether we see increase in innovation activities and productivities associated with R&D tax credits and governmental direct subsidies for R&D. My results are consistent with R&D tax credit stimulate patent activities, especially for privately owned enterprises (POE), and also for SOEs, but not for FIEs. R&D tax credit is also positively associated with new product sale for POEs. Government direct subsidies for R&D show lower effect. My study not only increases our understanding of the institutional detail of China's R&D policy, but also adds to a stream of literature that examine the effectiveness of governmental R&D subsidies.

The contribution of this paper is several folds. It examines the effectiveness of R&D tax credit in inducing private sector's R&D effectiveness in China's unique setting; it avoids using the cost of R&D as the dependent variable, as that does not take slow implementation of tax credit policy into consideration. Ownership structure is an important aspect of China capital market studies, my study also compared the SOE, POE and FIE's response to governmental R&D policies. In addition, this paper avoids treating R&D tax credit as an isolated policy by examining R&D tax credit together with other governmental R&D subsidies.

The rest of the paper is organized as follows. Section 2 describes the China institutional background. Section 3 reviews the relevant literature and develop research hypotheses. In Section 4, I generate model for empirical testing, and describe data. Regression results are reported in Section 5. Section 6 concludes with a discussion of the results and contributions to literature. Section 6 also talks about limitations of this paper and suggests future research.

BACKGROUND: CHINA'S R&D POLICY

Direct R&D Subsidies

Orchestrated by Ministry of Science and Technology (MOST), Chinese governments at different levels directly grant subsidies to specific science research projects. In a lot of cases these projects are aligned with the themes heavily promoted by the central government, such as wind and solar power in 2000s and electric vehicles. In many cases, these government-funded research projects are jointly conducted by enterprises, universities or research institutions, and the participatory enterprises will be able to use the research results for their for-profit businesses. Empirical research finds that these subsidies are preferentially given to state-owned enterprises (SOE), enterprises with prior grants, and enterprises in developed provinces (Zhao, Xu, & Zhang 2018). In addition, governmental R&D subsidies serve as a positive signal in the sense that recipients are more likely to receive other preferential treatment such as special loans (Wu 2016).

R&D Tax Credit Before 2008

Private sector's R&D research plays a very important role in a country's overall innovation process. firms in the private sector cited the lack of funding as the main constraint to carrying out R&D (Hu et al. 2005). To overcome such hurdle, R&D tax incentives have become a major tool for promoting business R&D. As of 2017, 30 of the 35 OECD countries, 21 of 28 EU countries and a number of non-OECD economies provide tax relief on R&D expenditures.

China's R&D tax credit policy was first initiated in 1996. The initial policy (industrial number 41) only allowed tax credit for profit making state owned and collective owned companies. It provides 150% super-deduction of R&D expenditures of firm/year that incurs more than 10% increase in R&D.

In 2002, profitable large private corporation are added to the list of companies that may claim R&D tax credit. In 2006 Bulletin of the State Council 2006 No.9 made tax credit deferral possible. It removed the requirement for the corporation to have 10% annual increase in R&D in tax year.

by 2006, it seems that China's R&D tax credit would save corporations a good amount of tax money. But claiming this credit was very difficult, if not nearly impossible, as the infrastructure and detailed instructions required for implementation were not in place.

R&D Tax Credit Policy of 2008

In October 2008, State administration of tax (SAT) updated "People's Republic of China Annual Corporate Income Tax Return Form". This tax update made detailed definition of 8 categories of qualified R&D expenditures, and stipulated procedures of claiming the tax credit. It went into effect retroactively on January 1 2008. Coupled with "corporate income tax law" which was passed on March 16th of 2007 in the fifth meeting of tenth national people's congress, this new tax rule made R&D tax credits significantly more accessible to private corporations. The new rule also made it clear that the tax credit

R&D Tax Credit Policy After 2008

2008 marks a big change for China's R&D tax credit. Nevertheless, studies still found that corporations started slowly with claiming their R&D tax credits (Jiang 2015). For the reasons of not applying for R&D tax credit, corporations cited unawareness, missing instructions, tedious paperwork and/or limited tax credit benefits.

In order to make corporations more aware of the R&D tax credit policy, China's Ministry of Finance (CMF) and SAT jointly issued circular, Caishui [2013] No. 70 in September 2013 to provide more detailed guideline about what qualifies for R&D tax credit.

In November 2015 CMF, SAT and the Ministry of Science and Technology (MST) issued joint circular, Caishui [2015] No.119 (Circular 119) and expanded scope of qualifying industries plus research and development expenditures. It allowed Back-claim application for up to three years and simplified administrative approval procedures. For example, prior project verification and record-filling are no longer required. Circular 19 also provided negative list of industries and types of activities for the first time. In short, Circular No. 70 and 119 aimed to facilitate R&D tax credit implementation procedure and to expand scope of qualifying projects. Outsourced R&D (except for oversea contractors) are capped at 80% of the actual outsourcing cost.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

There are long standing debates on whether government R&D subsidy would stimulate firms to be more effective in R&D or not (Lach, 2002). On one hand, R&D subsidies and other governmental support reduces the cost of R&D, so the firm may expand the scale of R&D activities, ultimately leading to an increased level of total R&D investment. Researchers call this effect the induction or spillover effect (David et al., 2000; Hyytinen and Toivanen, 2005; Klette and Møen, 1998). on the other hand, government subsidies may crowd out firms' private capital investment in R&D. When government funds are available, enterprises might allocate its private capital to less risky activities such as production (Busom, 2000; Görg and Strobl, 2007; Wallsten, 2000). Empirical studies have confirmed the existence of both effects.

Early research on China's R&D tax subsidies shows crowd out effect. The criticism is the allocation of subsidies are often based on whether the enterprise is state-owned or has political connections, instead of how good the projects are (Zhao, Xu & Zhang 2018). Prior studies on China's R&D tax credit also provide conflicting views on the effectiveness of the policy (Zhao, Fan & Zhou 2014; Chen 2015; Jiang & Wang 2015;) In addition, China faces similar issues as other developing countries. To name a few: intellectual property theft, a low talent pool, poor institutional protection, insufficient market demand (Howell, 2015). A more recent study finds that China R&D tax credit has positive impact on firm total factor of productivity (TFP) (Jia & Ma 2017). But they use cost of R&D as the independent variable, which basically assume that R&D tax credit policy implementation would be homogeneous after 2008. In the special setting, can China's infrastructure afford the mechanisms the R&D tax credit needed to influence the private sector's R&D activities? My first hypothesis is stated in alternative form:

H1: *Governmental R&D tax credit stimulate enterprises' innovation activities and productivities*

Next, I ask how does R&D tax credit compare to governmental direct R&D subsidies? R&D investment is risky, so it is possible that when government provide funding without the perquisite that enterprises also invest in R&D, enterprises would divert their own funding to other ordinary expense categories. As mentioned above, governmental direct R&D funding crowd out enterprises' R&D spending in 1990s, but the test has not been done in more recent years. R&D tax credit to a certain degree avoids this problem, as it is designed to lower the cost of R&D, but the enterprises still need to pay. In this setting, enterprises have incentive to engage in R&D projects that they believe to have potentially highest return. So my second hypothesis is stated in alternative form.

H2: *The stimulating effect of R&D tax credit is higher than that of direct R&D subsidies.*

Ownership structure makes a big difference in R&D subsidy distributions and R&D expenditures. SOE, FIE and POE are treated differentially when it comes to R&D subsidies. SOE are top on the list, FIE also receive special treatment. Prior to 2008, POE arguably receive the least subsidies from the government. Because the profit and loss of SOE largely belong to the government, and many SOEs are too big to fail, they might be less sensitive to R&D stimulating policies. Hypothesis 3 is stated in alternative form.

H3: *R&D tax credit and direct R&D subsidies exhibit higher stimulating effects of R&D expenditure for POE than for SOE.*

METHODS

Aggregated national R&D tax credit data from Chinese National Bureau of Statistics are used to study the effect of tax credit policy on enterprise's profit and innovation. Part of the reason for previous conflicting result about the effect of tax credit may stem from the lack of actual data on the amount of R&D tax credit granted to corporations (so that one has to make assumptions about tax credit policy implementation efficiency), or that they are conducted on different data or sample period. Tax is private information, so collecting this information from all Chinese enterprises may prove to be extremely difficult. The aggregated national data afford me the ability to do statistical analysis on the important question of whether China's R&D tax credit indeed improve innovation.

Sample

Aggregated cross-sectional data on amount of R&D tax credit, government's direct funding for R&D, and aggregated enterprises' R&D expenditure and accounting data are obtained from China national bureau of statistics.

Sample period is 2009-2015. A seemingly ideal setting is to study the effect of 2008 reform of Chinese R&D tax credit, which would call for data continuity before and after 2008. As R&D tax credit data are reported together with other tax credit prior to year 2009, it would be extremely difficult to carry out such study. Nevertheless, the national data from 2009 to 2015 still enables me to conduct the research: as I mentioned earlier in section 2, implementation of the R&D tax credit policy was a gradual process.

I also run my tests on provincial data and got similar results. Using provincial data would increase my sample size significantly (6 years by 30 provinces = 180 data points). But on provincial level, the national bureau of statistics does not separate the sample based on ownership. So if I want to separately test for each ownership sample, I need to use the national level data, which limit my sample size.

Variables

I consult previous literature and economic theory when I did my variable selection. For proxy for innovation activities I use number of patent petition. And I use granted patent as a sensitivity control. I use new product sale to capture R&D's effect on profitability, while some use the sale as a measure of R&D

efficiency (innovation) as well (Cooper et.al. 2019). The main test variable is the aggregated amount of R&D tax credit granted to all enterprises. Another test variable is governmental direct funding for R&D research. The R&D tax credit is also called indirect R&D subsidy. The total amounts of indirect and direct R&D subsidies are comparable, so it makes sense to examine the effect of both type of R&D subsidies.

I control for size as larger corporations are likely to incur more R&D expenditures. Because outcome of R&D is highly sporadic, larger corporations who can afford more R&D projects are likely to have higher incentive to invest in R&D.

Next corporate's operating income is to interpret variables and try to observe how the sales revenue of building materials company would affect corporation's R&D expenditure decisions.

Capital intensity is the fixed asset divided by number of personnel. Usually firms with higher capital intensity tends to spend more with on R&D.

Export activities are included as control variable for innovation testing models, as previous research find that export activities might positively relates to corporation's R&D expenditure.

Model

To avoid issues that is associated with sample variance distribution, I use logarithm transformed variables in the following regression model. Because of the size of the sample, I am not able to include year dummy in my model to test year specific effect, and I am not able to include all control variables in one regression. These are limitation of small sample studies.

Model 1 confirms the relationship between R&D tax credit and enterprises' R&D expenditure:

$$ln\mathrm{RD}_{\mathrm{t}} = \beta_0 + \beta_1 ln\mathrm{RDSubsidies}_{\mathrm{t}} + \beta_2 ln\mathrm{Size}_{\mathrm{t-1}} + \beta_3 ln\mathrm{Profit}_{\mathrm{t-1}} + \beta_4 ln\mathrm{KL}_{\mathrm{t-1}} + \varepsilon_{\mathrm{t}} \quad (1)$$

Where RD = aggregate enterprise R&D expenditure
RDSubsidies = RDTC or GDFRD
RDTC = R&D tax credit amount
GDFRD = governmental direct funding
Size = number of total employees of corporations
Profit = income of corporations
KL = capital intensity of corporations
t = year

Next Model 2 examine whether innovations are affected by previous periods' R&D tax credits.

$$ln\mathrm{PP}_{\mathrm{t}} = \beta_0 + \beta_1 ln\mathrm{3yrRDSubsidies} + \beta_2 ln\mathrm{Profit}_{\mathrm{t-1}} + \beta_3 ln\mathrm{Export}_{\mathrm{t-1}} + \varepsilon_{\mathrm{t}} \quad (2)$$

Where PP = patent petition
3yrRDSubsidies = $RDTC_t + RDTC_{t-1} + RDTC_{t-2}$ or $GDFRD_t + GDFRD_{t-1} + GDFRD_{t-2}$
Export = amount of exported product sales of corporations

Model 3 examine whether new product sale is affected by previous periods' R&D tax credits.

$$ln\mathrm{NS}_{\mathrm{t}} = \beta_0 + \beta_1 ln\mathrm{3yrRDSubsidies} + \beta_2 ln\mathrm{Profit}_{\mathrm{t-1}} + \beta_3 ln\mathrm{Export}_{\mathrm{t-1}} + \varepsilon_{\mathrm{t}} \quad (3)$$

Where NS = Sale of new products, which capture the innovation results of R&D.

RESULTS

I first run model 1 on all POE, SOE and FIE samples for confirmation. (dummy variables of ownership are included in the regression) For the period of 2009-2015, I find that the amount of R&D tax credit is significantly positively correlated (coefficient 1.76, t value 2.42) with the entire sample's total R&D expenditure (Table 3, column 1). Governmental direct R&D subsidies are not significantly positively correlated with R&D expenditure in the same year, but they are not negatively correlated with R&D expenditure either (Table 3, column 2). It is possible that due to small sample/lack of power of my model, I fail to detect the association between R&D expenditure and direct R&D subsidies. The conclusion is that R&D stimulating effect of governmental indirect subsidies (via the form of R&D tax credit) is stronger than that of governmental direct subsidies.

To test my hypotheses, I first run model 2 and model 3 on total sample. Sale of new product is significantly associated with both R&D tax credit (RDTC) and government direct funding (GDFRD) for the entire sample (Table 4, column 3 and 4), but patent petition are not significantly associated with RDTC and GDFRD (Table 4, column 1 and 2).

Some may point out that my sample size is small. I also run the tests on provincial data and got similar results. Using provincial data increases my sample size significantly (6 years by 30 provinces = 180 data points). But on provincial level, the national bureau of statistics does not separate the sample based on ownership. So I would not be able to conduct the following tests:

Next I run model 2 and 3 for POE sample (Table 5), SOE sample (Table 6), and FIE sample (Table 7). Table 5 column 1 and Table 6 column 1 show that RDTC may promote patent petition activities for POE and SOE samples. This effect is not seen for FIE sample (Table 7 column 1). Table 5 column 3 and 4 show that new product sale is significantly increased with more RDTC and GDFRD for POE samples, but I failed to detect the same effect for SOE and FIE firms (Table 6 and 7). Again, it is possible that I cannot detect the significant association due to low power of the test. The results are consistent with R&D tax credit encouraging patent petition for POE and SOE, and promoting new product sale for POE. Overall I find stronger effect of R&D tax credit than governmental direct R&D subsidies.

CONCLUSION AND DISCUSSION

I use aggregated R&D tax credit data to study the overall effect of China's 2008 R&D tax credit on corporate R&D spending and innovation activities. The result shows that even though the implementation of the R&D tax credit has been a gradual process, this policy achieved, to a degree, what it has intended to do: stimulate R&D expenditure.

China's private sector's R&D expenditure is still lagging behind that of OECD countries. My study shows that when China start to add indirect R&D subsidies (R&D tax credit), the overall stimulating effect for enterprises' R&D expenditure is better than just using direct R&D subsidies. The R&D tax credit enforced around 2008 made China's R&D policy more complete.

This paper also separately examines the state owned and privately owned and foreign invested enterprises. SOE receive preferential treatment when it comes to various governmental subsidies. Nevertheless, the R&D stimulating effect of R&D tax credit is higher among POE and FIE samples. Policy makers may want to consider how to more effectively stimulate innovation activities for SOEs.

A potential concern is that the validity of this paper relies on the authenticity of the data. The statistical data from national bureau of statistics could contain error due to collection process or due to governmental interference. There is no good way to address the governmental interference. Potentially doing the study over a longer sample period in the future could mitigate the errors due to collection process.

Increased R&D expenditure is just part of what the R&D subsidies mean to achieve. Along this line, researcher may examine the effect of other type of R&D subsidies promulgated by China government, such as the New/High tech tax subsidies.

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APPENDIX

TABLE 1
SUMMARY STATISTICS OF SOE, POE, FIE SAMPLES (2011-2015)

Statistics	lnCRD	lnRDTC	lnGDFRD	lnSize	lnProfit	lnKL	lnExport	lnPP	lnNS
Max	18.08	14.97	15.32	18.17	20.13	5.31	19.21	13.10	20.91
Mean	17.04	13.91	14.13	17.19	19.12	4.52	17.95	12.08	19.90
Min	16.01	12.92	13.10	16.05	17.73	3.78	16.36	11.41	18.72
N	15	15	15	15	15	15	15	15	15
P1	16.01	12.92	13.10	16.05	17.73	3.78	16.36	11.41	18.72
P25	16.70	13.38	13.19	16.75	18.82	4.18	17.20	11.67	19.65
P50	16.92	13.84	14.11	17.06	18.92	4.41	17.86	11.88	19.80
P75	17.36	14.38	14.96	17.49	19.40	4.93	18.76	12.44	20.29
P99	18.08	14.97	15.32	18.17	20.13	5.31	19.21	13.10	20.91
StdDev	0.57	0.63	0.88	0.59	0.60	0.45	0.93	0.55	0.61

TABLE 2
PEARSON(UPPER)/SPEARMAN(LOWER) CORRELATION TABLE OF SOE, POE, FIE SAMPLES (2011-2015)

	lnCRD	lnRDTC	lnGDFRD	lnSize	lnProfit	lnKL	lnExport	lnPP	lnNS
lnCRD	1	0.98	0.83	0.82	0.89	0.22	0.70	0.85	0.95
lnRDTC	0.98	1	0.88	0.69	0.79	0.40	0.65	0.76	0.93
lnGDFRD	0.88	0.83	1	0.49	0.64	0.57	0.26	0.64	0.68
lnSize	0.51	0.45	0.45	1	0.97	-0.36	0.68	0.92	0.78
lnProfit	0.65	0.59	0.66	0.90	1	-0.20	0.63	0.91	0.81
lnKL	0.48	0.53	0.47	-0.44	-0.25	1	-0.11	-0.13	0.17
lnExport	0.67	0.71	0.36	0.58	0.48	0.08	1	0.53	0.87
lnPP	0.68	0.59	0.70	0.88	0.89	-0.13	0.47	1	0.74
lnNS	0.83	0.87	0.54	0.54	0.52	0.29	0.94	0.51	1

TABLE 3

Independent Variable	Coefficient	t Value	Coefficient	t Value
Constant	6.26	0.63	-6.03	-1.75
$lnRDTC_t$	**1.76****	**2.42**		
$lnGDFRD_t$			**0.05**	**0.08**
$lnSize_{t-1}$	1.52	1.68	0.41	1.09
$lnProfit_{t-1}$	-0.11	-0.18	0.60	1.13
$lnKL_{t-1}$	-0.60	-0.53	0.82	2.34
Adj R^2	0.92		0.86	
N	21		21	

$$ln\text{RD}_{t} = \beta_0 + \beta_1 ln\text{RDSubsidies}_{t} +_{t} + \beta_2 ln\text{Size}_{t-1} + \beta_3 ln\text{Profit}_{t-1} + \beta_4 ln\text{KL}_{t-1} + \varepsilon_{t}$$

Sample: all ownership enterprises 2009-2015

Dependent variable: log transformed enterprise R&D expenditure

TABLE 4

Dependent	lnPP				lnNS			
Independent Variable	Coefficient	tValue	Coefficient	tValue	Coefficient	t Value	Coefficient	t Value
Constant	-3.76	-2.09	-3.72	-2.04	12.17	6.86	10.19	8.31
ln3yrRDTC	**0.04**	**1.29**			**0.00**	**5.40*****		
ln3yrGDFRD			**0.02**	**0.28**			**0.00**	**6.79*****
$lnProfit_{t-1}$	0.84	5.43	0.84	5.33	0.08	0.85	0.11	1.46
$lnExport_{t-1}$	-0.05	-0.58	-0.04	-0.45	0.32	6.79	0.40	10.50
Adj R^2	0.92		0.89		0.94		0.96	
N	15		15		15		15	

$$ln\text{PP}_{t} = \beta_0 + \beta_1 ln\text{3yrRDSubsidies} + \beta_2 ln\text{Profit}_{t-1} + \beta_3 ln\text{Export}_{t-1} + \varepsilon_{t}$$

$$ln\text{NS}_{t} = \beta_0 + \beta_1 ln\text{3yrRDSubsidies} + \beta_2 ln\text{Profit}_{t-1} + \beta_3 ln\text{Export}_{t-1} + \varepsilon_{t}$$

Sample: All ownership enterprises aggregated 2011-2015

TABLE 5

Dependent	lnPP				lnNS			
Independent Variable	Coefficient	tValue	Coefficient	tValue	Coefficient	tValue	Coefficient	tValue
Constant	2.88	1.78	0.75	1.62	24.82	3.73	16.00	5.12
ln3yrRDTC	**0.70**	**2.31***			**0.00**	**3.44****		
ln3yrGDFRD			**0.60**	**1.12**			**0.00**	**4.61****
$lnProfit_{t-1}$	0.06	0.83	0.09	3.10	0.12	1.20	-0.16	-2.34
$lnExport_{t-1}$	-0.12	-0.35	0.20	3.51	-0.55	-1.12	0.32	1.59
Adj R^2	0.62		0.56		0.97		0.98	
N	5		5		5		5	

$$ln\text{PP}_t = \beta_0 + \beta_1 ln\,\text{3yrRDSubsidies} + \beta_2 ln\,\text{Profit}_{t-1} + \beta_3 ln\,\text{Export}_{t-1} + \varepsilon_t$$

$$ln\text{NS}_t = \beta_0 + \beta_1 ln\,\text{3yrRDSubsidies} + \beta_2 ln\,\text{Profit}_{t-1} + \beta_3 ln\,\text{Export}_{t-1} + \varepsilon_t$$

Sample: Aggregated privately owned enterprises 2011-2015

TABLE 6

Dependent	lnPP				lnNS			
Independent Variable	Coefficient	tValue	Coefficient	tValue	Coefficient	tValue	Coefficient	tValue
Constant	-4.32	-0.65	-9.87	-12.63	19.98	2.72	18.20	1.76
ln3yrRDTC	**0.95**	**1.97***			**0.00**	**1.20**		
ln3yrGDFRD			**1.42**	**2.46****			**0.00**	**0.43**
lnProfit t-1	-0.20	-0.44	0.21	3.96	0.18	0.37	0.19	0.23
lnExport t-1	0.32	0.74	0.27	4.26	-0.24	-0.56	-0.14	-0.16
Adj R^2	0.56		0.66		0.11		0.82	
N	5		5		5		5	

$$ln\text{PP}_t = \beta_0 + \beta_1 ln\,\text{3yrRDSubsidies} + \beta_2 ln\,\text{Profit}_{t-1} + \beta_3 ln\,\text{Export}_{t-1} + \varepsilon_t$$

$$ln\text{NS}_t = \beta_0 + \beta_1 ln\,\text{3yrRDSubsidies} + \beta_2 ln\,\text{Profit}_{t-1} + \beta_3 ln\,\text{Export}_{t-1} + \varepsilon_t$$

Sample: Aggregated state owned enterprises 2011-2015

TABLE 7

Dependent	lnPP				lnNS			
Independent Variable	Coefficient	tValue	Coefficient	tValue	Coefficient	tValue	Coefficient	tValue
Constant	3.32	0.43	0.63	-2.29	20.38	2.29	24.43	1.39
ln3yrRDTC	**-0.05**	**-0.08**			**0.00**	**1.12**		
ln3yrGDFRD			**0.83**	**1.41**			**0.00**	**0.72**
lnProfit $_{t-1}$	-0.34	-0.32	0.63	1.53	-0.41	-0.49	0.10	0.07
lnExport $_{t-1}$	0.83	0.68	0.20	2.82	0.36	0.42	-0.42	-0.19
Adj R^2	0.31		0.58		0.66		0.49	
N	5		5		5		5	

$$ln\text{PP}_t = \beta_0 + \beta_1 ln\,\text{3yrRDSubsidies} + \beta_2 ln\,\text{Profit}_{t-1} + \beta_3 ln\,\text{Export}_{t-1} + \varepsilon_t$$

$$ln\text{NS}_t = \beta_0 + \beta_1 ln\,\text{3yrRDSubsidies} + \beta_2 ln\,\text{Profit}_{t-1} + \beta_3 ln\,\text{Export}_{t-1} + \varepsilon_t$$

Sample: Aggregated foreign invested enterprises 2011-2015