研发补贴与融资约束：信号效应的检验

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200433

摘　要： 研发补贴一直被政府视为缓解企业融资约束的重要手段，已有文献对于研发补贴的研究主要强调其资源效应，却忽略了研发补贴对于缓解企业融资约束的信号效应。文章选取2008–2015年沪深A股上市公司的数据，探讨了研发补贴、信息不对称与企业融资约束之间的关系。结果表明，融资约束问题仍然普遍存在于中国企业之中，而研发补贴可以有效缓解企业融资约束。进一步的研究发现，"信号效应"是研发补贴缓解企业融资约束的一个重要的隐藏机制，它通过降低企业与外部投资者之间的信息不对称问题增加更多的外源融资。最后，文章通过研发补贴的"信号效应"的异质性分析，发现研发补贴对于中小规模的、处于成长阶段的、低市场化程度地区和动荡的行业环境中的企业影响更大。

关键词： 研发补贴；融资约束；信号效应；企业创新

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一、引　言

"　　　　　　　　" Freeman　1982

Hyytinen　Toivanen

2005　Czarnitzki　2006

"　　　" Lemon's

Premium　Akerlof　1978

Feldman　Kelley　2006

"　　　""

"""　　　　　　　　"

"　　　"　　　　　　　　　Binz　Czarnitzki　2008

2015

Feldman　Kelley　2006　Lerner　1999　Meuleman　De Maeseneire　2012

Lerner 1999   "   "

"   "

2012

Almeida   (2004)   —   "

"

"   "

"   "

Feldman   Kelley 2006   Meuleman   De Maeseneire

2012

A

二、文献回顾

Akerlof   "   "   Akerlof 1978

1974

A. Michael Spence   Spence 1974

"   "

"   "

Boot   2006 Sufi 2009   Bharath   2007

Dahiya   2003 Dennis   Mullineaux 2000 Gatti   2008

Lerner 1999

Lerner 1999   SBIR small business innovation

research   1982   SMEs small and medium enterprises

SBIR

Lerner 1999

" "

Feldman Kelley 2006 Meuleman De Maeseneire 2012

Lerner "

" Takalo Tanayama 2010 Holmstrom Tirole 1997

" " " "

Cumming

" " Cumming 2007 Howell 2017

"

" 2014 2017 R&D

" "

" " "

"

Connelly 2011

Chen 2018 Peng 2004 Sheng 2011

Colombo 2011

" "

" "

三、研究设计

（一）样本说明

R&D

Feldman Kelley
2006   Cumming 2007   Meuleman De Maeseneire 2012

50%

20%   2020

(Boeing 2016)

A

CSMAR

2008–2015   *ST ST   PT

2707

（二）变量设定

1.   Asy

"   "

Amihud 2002   ILL

$$ILL_{it} = \frac{1}{D_{it}} \sum_{k=1}^{D_{it}} \sqrt{\frac{|r_{it}(k)|}{V_{it}(k)}} \tag{1}$$

$r_{it}(k)$ i   t   k V_{it} k D_{it}

2.   RDsub   2017   2018 Chen   2018
"   "

1   "   ""   ""   ""   ""   ""   ""
""   ""   ""   "   2
"   ""   ""   ""   ""   ""   ""   ""   "
"   ""   ""   ""   ""   ""   "   3
"863""973""   ""   "

3.   2012
2018   1

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① 央广网：融资成本高出欧美50% 六大举措发力降低企业融资成本，http://www.sohu.com/a/112360971_119556。

表 1 变量的选取与定义

变量名称	变量缩写	变量定义
信息不对称	Asy	$ILL_{it} = \dfrac{1}{D_{it}} \sum\limits_{k=1}^{D_{it}} \sqrt{\dfrac{|r_{it}(k)|}{V_{it}(k)}}$
研发补贴	RDsub	（研发补贴/总资产）×100
非研发补贴	NRDsub	（（政府补贴−研发补贴)/总资产）×100
研发强度	R&D	（研发支出/总资产）×100
固定资产占比	Fasset	固定资产净额/总资产
财务杠杆	Lev	总负债/总资产
企业年龄	Age	公司自成立年份起的年数
股权集中度	Top1	第一大股东持股比例
市场势力	Market	企业营业收入与营业成本之比
风险投资	CV_dum	前10大股东中是否包含风险投资机构，是记为1，否记为0
分析师关注度	Coerage	证券分析师针对目标企业发布研报的数量
现金持有量变动	Cash	现金及现金等价物增加额/期初总资产
营业现金流	CF	经营活动现金流量净额/期初总资产
托宾Q值	TobinQ	市值/（资产总计−无形资产净额−商誉净额）
企业规模	Size	企业总资产的自然对数

注：企业数据来源于国泰安数据库（CSMAR）并经作者整理计算。

四、实证结果与分析

（一）描述性统计与Pearson相关性分析

2

0.0572   = −0.0541

2.60‰

3.30‰

Tobin Q

Tobin Q

0.4

（二）研发补贴与信息不对称

$$Asy_{it} = \beta_0 + \beta_1 RDsub_{it} + \sum{}^{\beta_k} Z_{it} + \delta_t + \varepsilon_{it} \tag{2}$$

Asy   RDsub   Z

κ   k

i t

3   Model1

Model 2   Model 1

=−0.001 07 p<0.05

Model 3   Model 2

=−0.000 896 p<0.01

表 2 主要变量的描述性统计与Pearson相关性检验

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Asy	1														
2.RDsub	−0.054 1	1													
3.NRDsub	−0.017 9	0.004 6	1												
4.R&D	0.077 2	0.341 8	0.09	1											
5.Tobin	0.175 8	0.171 7	0.042 6	0.253 6	1										
6.Fasset	−0.065 4	−0.092 8	0.099 9	−0.195 6	−0.119 6	1									
7.Lev	−0.053 7	−0.178 8	0.015	−0.242 7	−0.192 9	0.139 9	1								
8.Age	−0.058 4	−0.096 9	−0.019	−0.136 9	0.015 1	0.015 8	0.258 4	1							
9.Top1	−0.054 2	−0.086 9	0.007 3	−0.073	−0.100 1	0.049 1	0.026 7	−0.159 9	1						
10.Market	0.011 1	0.154 2	−0.003 7	0.243 1	0.202 4	−0.189 6	−0.369	−0.070 4	−0.016 9	1					
11.VC_dum	−0.041 4	0.084 1	−0.014	0.097 9	0.048 2	−0.080 2	−0.115 7	−0.092	−0.040 7	0.074 6	1				
12.Coerage	−0.105 4	0.021 7	−0.023 6	0.097 1	0.003 8	−0.030 2	−0.108 2	−0.181 1	0.106 5	0.203 8	0.089	1			
13.Cash	0.103 5	0.014 5	0.002 5	−0.022 1	0.099 8	−0.170 9	−0.153 7	−0.096	0.001 8	0.152 3	0.079 6	0.139 5	1		
14.CF	0.004 1	−0.009 2	0.02	0.082 4	0.043 3	0.193 5	−0.131 1	0.016 4	0.061 2	0.229 5	−0.032 3	0.186	0.111 7	1	
15.Size	−0.174 7	−0.2	−0.048 8	−0.229 2	−0.407 9	0.156 1	0.514 1	0.204 9	0.240 5	−0.206	−0.072 1	0.298 4	−0.073 1	0.077 3	1
Mean	0.057 2	0.260 1	0.330 2	1.960 7	2.434	0.232 5	0.445 2	13.921 9	36.166 4	0.358 6	0.213 6	7.579 8	0.240 353	0.040 5438	21.804 82
S.D	0.017 7	0.479 2	0.568 7	1.767	3.598 3	0.173 2	0.228 5	5.431 8	15.560 3	0.301 1	0.409 8	9.194 2	0.138 6258	0.127 8537	1.324 874

Fisman   Svensson 2007

3-digit

industry

Wallsten 2000

表 3 研发补贴与信息不对称的回归结果

	Model 1	Model 2	Model 3	Model 4
	Asy	Asy	Asy	Asy
RDsub		−0.001 07**	−0.000 896***	−0.000 217*
		（−2.39）	（−2.74）	（−1.79）
NRDsub	−0.001 65***	−0.001 78***	−0.000 422	−0.007 67
	（−4.45）	（−4.76）	（−1.54）	（−1.28）
R&D	−0.001 61***	−0.001 57***	−0.000 150	0.017 6*
	（−8.77）	（−8.51）	（−1.09）	（1.79）
Fasset	0.001 03	0.001 05	−0.006 94***	−0.009 22
	（0.44）	（0.44）	（−3.96）	（−1.42）
Lev	0.007 22***	0.007 12***	0.004 19***	−0.010 5
	（3.98）	（3.92）	（3.15）	（−1.04）
Age	0.000 145*	0.000 146*	−0.001 59***	−0.000 671
	（1.66）	（1.66）	（−14.77）	（−1.54）
Top1	−0.000 159***	−0.000 159***	−0.000 0450*	−0.000 506*
	（−4.58）	（−4.57）	（−1.77）	（−1.90）
Market	−0.000 783	−0.000 787	−0.000 695	0.014 6
	（−0.48）	（−0.49）	（−0.59）	（1.34）
VC_dum	−0.000 984**	−0.000 976**	−0.000 0126	0.007 40*
	（−2.06）	（−2.04）	（−0.04）	（1.70）
Coverage	−0.000 179***	−0.000 178***	0.000 0536**	−0.000 659**
	（−5.87）	（−5.85）	（2.38）	（−2.42）
Year			YES	YES
_cons	0.054 0***	0.054 3***	0.097 3***	0.106***
	（25.09）	（25.19）	（45.80）	（3.46）
R^2	0.145 6	0.146 2	0.542 4	45.651 4
F-value	153.05***	139.73***	625.61***	138.22***
CDW F-Val				18.35
Hansen P-Val				0.001 7
N	11262	11262	11262	10037

注：*、**和***分别表示10%、5%和1%的显著性水平，下同。

              model 4   =−0.000 217
p<0.1

                                                                                    Cragg-
Donald Wald F   Hansen-J   Wald F   "
      " Hansen-J   "   "   Wald F
                         5%   18.35%
                   Hansen-J   p   1%

"   "

（三）研发补贴缓解融资约束的机制

1.

Myers　Majluf　1984

—

Fazzari　1988　　　　　　　—　　　　　　　investment-cash flow sensitivity

—

—　　　　　　ICFS

—　　　　　　　　　　　　　　　Vogt　1994

Jensen　1986　Stulz　1990　　　　　　—

Tobin Q

Gilchrist　Himmelberg　1995　Erickson　　Whited　2000

Cummin　2006　　　　　　　　　　Kaplan　Zingales　1997　Moyen　2004

—

Almeida　　（2004）　　　　　　　　　　　　　　　　　　　　—

cash-cash flow sensitivity　　　　　　　　　　Quader　Abdullah (2016)

1981　　2010　　7　　　　　5086

2.

Almeida　　（2004）　　　　　　2012

$$\Delta Cash_{it}=\beta_1 CF_{it}+\kappa_0 RDsub_{it}\cdot CF_{it}+\mu_0 RDsub_{it}+\beta_2 Q_{it}+\beta_3 Size_{it}+Y_r+\varepsilon_{it} \tag{3}$$

$$\Delta Cash_{it}=\beta_1 CF_{it}+\kappa RDsub_{it}\times CF_{it}+\mu RDsub_{it}+\lambda Asy_{it}\times CF_{it}+\nu Asy_{it}+\beta_2 Q_{it}+\beta_3 Size_{it}+Y_r+\varepsilon_{it} \tag{4}$$

Cash　　　　　　　　　　　　CF　　　　　　　　　　RDsub

Asy　　　　　　　　　Q　　　　　Size

4　1　　　　　　　　　　　　　　　　　　　　　　　　（ =0.311　p<0.01)

—　　　　　　　　　　　　　　　　RDsub×CF

$_0$　　　　　　 =−0.125　p<0.01

Lerner　1999　Chen　　2018　　　　　　　　　　4　2

Asy×CF　　　　　　　　　　　　　1%

（ =3.002 p<0.01）   —

表 4 研发补贴缓解融资约束的机制检验

	(5) Cash	(6) Cash	(7) Cash	(8) Cash
L·Cash			−0.077 6***	−0.078 0***
			（−6.23）	（−6.26）
L·2.Cash			−0.027 4***	−0.026 6***
			（−3.95）	（−3.83）
CF	0.311***	0.129**	0.378***	0.236**
	（15.94）	（2.37）	（12.34）	（2.20）
R&Dsubsidy	−0.002 76	−0.002 41	0.000 0191	0.000 0183
	（−0.77）	（−0.68）	（0.99）	（0.94）
R&Dsubsidy·CF	−0.125***	−0.115***	−0.136**	−0.134**
	（−9.25）	（−8.49）	（−2.09）	（−2.15）
Asy		0.638***		0.133
		（5.58）		（0.99）
Asy·CF		3.002***		2.734***
		（3.48）		（3.24）
TobinQ	0.001 57**	0.001 28*	0.004 03***	0.002 95***
	（2.27）	（1.86）	（4.90）	（3.36）
Size	0.034 5***	0.033 0***	0.060 8***	0.058 5***
	（9.60）	（9.25）	（14.85）	（13.97）
Year	Yes	Yes		
_cons	−0.726***	−0.750***	−1.363***	−1.318***
	（−9.39）	（−9.79）	（−15.17）	（−14.40）
R^2	0.098 6	0.100 4		
F-val	114.86***	100.23***		
Wald chi2			570.93***	593.43***
AR（1）			0.832 5	0.830 8
Sargan P-val			0.000 0	0.000 1
N	15265	15231	10626	10626

2012

—

—

3 RDsub×CF   3

Asy×CF   1 RDsub   ₁   4

—   0.115   × ₁

0.0051   H₀   ₁ = 0   10%

95.7%[=0.115/（0.115 + 0.0051）]

4.3%

Arellano Bond 1991

GMM

Sargan

8   —   =0.236 p<0.05

=2.734 p<0.01   2

（四）异质性分析

1.   50%   60%

GDP 70%   80%

SMEs

Ennew   Binks 1995 Berger   Udell 1998

5   RDsub×CF

（   =−0.119 p<0.01）   —

=3.739 p<0.01

"   "

表 5　政府研发补贴与信息不对称的异质性分析

	企业规模		企业生命周期			制度环境		行业环境	
	大规模企业	中小型企业	成长期	成熟期	衰退期	市场化程度低	市场化程度高	稳定型	动荡型
	Model9	Model10	Model11	Model12	Model13	Model14	Model15	Model16	Model17
CF	0.347***	0.097 2	0.220**	0.709***	1.541***	0.342***	−0.013 6	0.102*	0.363***
	(4.42)	(1.52)	(2.31)	(10.14)	(8.35)	(4.20)	(−0.18)	(1.73)	(3.41)
R&Dsub	0.006 42	−0.003 37	0.001 40	0.004 99	0.010 0	0.005 89	−0.012 4**	0.007 82	−0.012 8**
	(0.70)	(−0.85)	(0.23)	(1.02)	(0.91)	(1.18)	(−2.33)	(1.51)	(−2.51)
R&Dsub·CF	0.013 8	−0.119***	−0.394***	−0.139***	0.077 9***	−0.128***	0.008 95	0.004 57	−0.143***
	(0.16)	(−7.93)	(−3.12)	(−3.89)	(3.29)	(−8.02)	(0.30)	(0.15)	(−10.40)
Asy	0.514***	0.661***	0.452***	0.088 7	0.023 4	0.779***	0.731***	0.536***	0.986***
	(2.70)	(5.08)	(2.68)	(0.52)	(0.06)	(4.85)	(4.20)	(3.96)	(5.08)
Asy·CF	−1.427	3.739***	4.350***	−1.511	−11.45	5.009***	−0.244	0.028 3	2.783***
	(−1.07)	(3.72)	(2.94)	(−1.32)	(−3.70)	(4.14)	(−0.19)	(0.02)	(2.97)
TobinQ	0.005 61	0.001 37*	−0.004 02**	−0.001 26	−0.002 12**	0.002 45**	0.001 02	0.003 57***	0.001 47
	(1.59)	(1.78)	(−2.35)	(−1.31)	(−2.17)	(2.25)	(0.97)	(2.75)	(1.62)
Size	0.026 8***	0.033 1***	0.025 7***	0.007 15*	0.007 59	0.034 1***	0.040 2***	0.027 5***	0.046 0***
	(3.79)	(7.00)	(3.93)	(1.85)	(0.65)	(7.24)	(6.77)	(6.66)	(7.25)
Year	YES	YES	YES	YES	YES	YES	YES	YES	YES
_cons	−0.659***	−0.742***	−0.513***	−0.245***	−0.213	−0.792***	−0.899***	−0.644***	−1.032***
	(−3.93)	(−7.44)	(−3.65)	(−2.94)	(−0.86)	(−7.77)	(−7.08)	(−7.14)	(−7.68)
R^2	0.101 4	0.109 6	0.192 1	0.191 7	0.396 9	0.088 5	0.120 1	0.091 1	0.128 9
F-val	14.75***	91.34***	87.11***	53.02***	29.29***	38.21***	62.86***	49.02***	60.30***
N	2 369	12 862	7 905	5 359	1 965	7 012	8 219	8 263	6 968

① 数据源自网易财经，https://www.sohu.com/a/342258142_120044875。

2. Kaplan Stromberg 2001

Williamson 1975 Berger Udell 1998 Dickinson 2011

R&Dsub×CF

5

$_1$=−0.394 p<0.01 $_2$=−0.139 p<0.01 $_3$=−0.0779 p<0.01

Asy×CF " " =4.350 p<0.01

" "

3.

(Fan 2007)

2009 2012

Firth

2009 5

R&Dsub×CF =−0.128 p<0.01

Asy×CF =5.009 p<0.01

4.

2011

Bernanke 1983 Finkelstein Boyd 1998 Sun

Govind 2017 5

5

=−0.143 p<0.01 Asy×CF

=2.783 p<0.01 " "

" "

"

"

五、结　论

Hall   Lerner   2010   2008–2015   A

R&D

"   "

R&D   R&D

"   "

"   "

"   "

R&D   Hall 2005   R&D

R&D   "   "

VC   PE

"   "

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R&D Subsidies and Financing Constraints: Based on the Signaling Theory

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Summary：R&D subsidies have been well established as an important way to alleviate corporate financing constraints. The existing literature on R&D subsidies mainly focuses on its resource effects：As the role of cash resources supported by government agencies with free of charge，R&D subsidies can share the cost and risk of new product innovation，and as unabsorbed organizational slack，it can ensure firm innovation to continue. However，the initial investment of R&D activities is vast，which cannot be covered by government subsidies solely. Therefore，external financing (including debt financing and equity financing) has become an important way to fill the funding gap of R&D investment. Then，with the exception of resource effects brought by direct subsidies，do government R&D subsidies have other effects? We argue that R&D subsidies can also be regarded as an informational signal to release firms' technological capabilities to the external capital market. R&D subsidies are the screening results based on comparisons between intra-industry and inter-industry and technical ability evaluations of firms themselves. In the process of applying for R&D subsidies，the low-quality firms need to pay higher costs compared with the high-quality ones，thus there is a separation equilibrium between high-quality and low-quality firms. Also，fearing of the disclosure of R&D information by external investors，firms are willing to disclose their R&D information to government agencies，so that government agencies have more information advantages in judging firm quality. To sum up，R&D subsidies are the "certification" made by the government for firm technical capability and market potential. We

agreement. At the same time，the extent to which the rights of bondholders are protected depends on the constraint mechanism and incentive mechanism faced by the trustee. The legal system of corporate bonds in our country should let the trustee of corporate bonds play a more active role， and we can try from the following several aspects：First，the set up of a trustee shall conform to the specific trigger condition，and for those bondholders are mainly institutional investors or only a small scale of issue bonds，there is no need to establish a trustee. Second，it is necessary to clearly define the connotation of the duty of diligence assumed by the trustee in the legislation，and clearly stipulate the civil liability assumed by the trustee in violation of the duty of diligence. On this basis，the trustee is restricted by expanding the power of bondholders to select and settle the trustee，and the trustee is encouraged by optimizing the compensation structure. Third，we should pay attention to the connection between the trustee system and the bondholder meeting system， further facilitate bond investors to exercise relevant rights at the bondholder meeting，and promote the trustee to supervise bond issuers more effectively. Fourth，the completeness of the fiduciary management agreement directly determines the performance of the trustee rights and obligations，so the legislation should improve the relevant provisions of the fiduciary management agreement as far as possible to determine the basis for the trustee to supervise the bond issuing company.

Key words corporate bonds; corporate trustee of debentures; bondholder

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believe that it can alleviate the information asymmetry between firms and external investors，as well as the constraints on R&D financing.

Using the data of A/share listed companies in Shanghai and Shenzhen from 2008 to 2015，we investigate the relationship between R&D subsidies，information asymmetry and corporate financing constraints. The results show that R&D subsidies can effectively alleviate information asymmetry problems，and the results are robust after ruling out the endogenous problems. Furthermore，based on cash/cash flow sensitivity proposed by Almeida，et al.（2004），this paper finds that financing constraints are prevalent in Chinese firms，and R&D subsidies can alleviate corporate financing constraints. Additionally，the "signal effect" is found as an important mechanism of R&D subsidies alleviating corporate financing constraints，because it can increase more external financing by reducing information asymmetry between firms and external investors. Finally，the heterogeneity analysis of the "signal effect" shows that the effect is greater for SEMS in the early lifestyle，low/marketization regions and turbulent environment.

Key words R&D subsidies; financing constraints; signal effect; firm innovation