Appendix A: Innovation distribution in regions with different population density

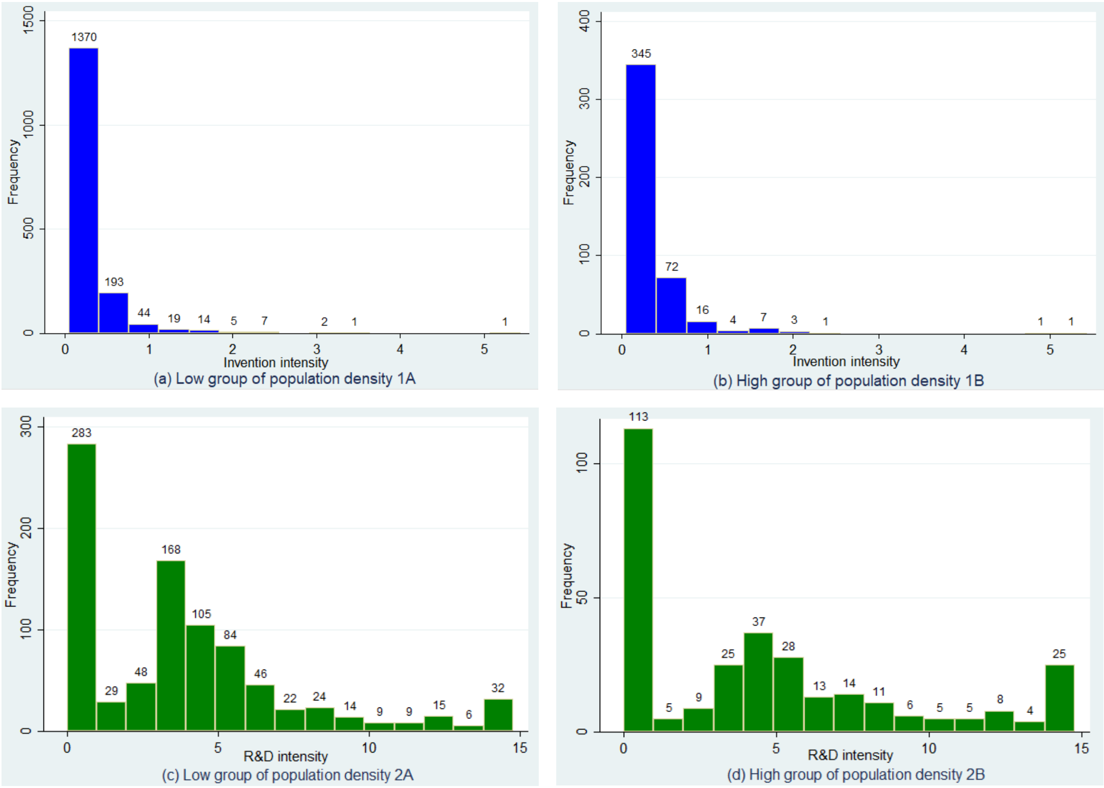

Figure A1. The comparisons of invention intensity and R&D intensity in subsamples of low- and high- population density

Note: Figure A1-(a) and (b) refers to the frequency of invention intensity of the treatment group in subsamples of low- and high- population density respectively. Figure A1-(c) and (d) refers to the frequency of R&D intensity of the treatment group subsamples of low- and high- population density respectively. The low population density refers to the interval $(-\infty, 1100]$, and the high population density refers to the interval $(1100, +\infty)$.

Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

Table A1. Kolmogorov-Smirnov test on innovation distribution in regions with different population density

Smaller group	*D*	*p-value*
0:	0.0458	0.062
1:	-0.076	0.927
Combined K-S:	0.0458	0.123

Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

Appendix B: Parallel trend test

We verify the parallel trend assumption to ensure the validity of the treatment group and the DID method in our sample. Taking government subsidy intensity as the dependent variable, we examine the coefficients of the interaction items of the treatment effect dummy (*Treat*) and the year dummies (*Year2012* to *Year2017*). The results are reported in Table B1. From column (1), we see that the coefficients of the interaction term of *Treat* and the policy year dummies (*Year2015* and *Year2016*) are positive, with the interaction term of *Treat* and *Year2016* significantly so. The coefficients of the other interaction items are all negative and insignificant. These results are robust to change in sample period, as reported in column (2), indicating that the treatment group and the control group have parallel trends before the policy shock and that the treatment group experiences a significant increase in government subsidies in 2016. Therefore, our construction of the treatment group satisfies the parallel trend assumption of the DID method.

Table B1. Test of parallel trend

	GS	
	2007-2017	*2009-2017*
	Reg-1	*Reg-2*
Treat	0.0010***	0.0009***
	(3.20)	(2.61)
*Treat*Year17*	-0.0007	-0.0006
	(-1.01)	(-0.92)
*Treat*Year16*	0.0013**	0.0013**
	(2.02)	(2.12)
*Treat*Year15*	0.0002	0.0003
	(0.31)	(0.42)
*Treat*Year14*	-0.0004	-0.0003
	(-0.59)	(-0.46)
*Treat*Year13*	-0.0002	-0.0001
	(-0.35)	(-0.19)
*Treat*Year12*	-0.0007	-0.0006
	(-1.14)	(-0.92)
Controls	Yes	Yes
Year	Yes	Yes
Industry	Yes	Yes
City	Yes	Yes
Constant	0.0177***	0.0195***
	(7.69)	(9.00)
Obs	20617	19289
R^2	0.124	0.131

Note: This table reports the results of parallel trend test. The dependent variable is *GS*, the government subsidies received by a firm scaled by its total assets. The coefficients of the interaction items are of interest. Controls include the control variables *Size*, *SOE*, *Leverage*, *RDS*, *Sales* and *CF*. Definitions of variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. *** and ** indicate significance at 1% and 5% and 10% respectively.

Sources: China Stock Market and Accounting Research (CSMAR) database.

Appendix C: Impact of population agglomeration on the relation between government subsidies and R&D intensity

The theoretical part of this paper predicts that government subsidies should negatively impact R&D expenditure in regions with low population densities due to the dominance of the crowding effect of subsidies in this case. Considering the large magnitude of R&D intensity, we use the logarithm of 1 plus R&D intensity *ln*(1+*RDS*) as the dependent variable to examine the effect of government subsidies on firms' R&D expenditure.

Table C1 shows the results. The coefficients of the triple interaction item *GS*Post*Treat* indicate a significantly negative relation between government subsidies and firms' R&D intensity in the sample of firms located in cities with population densities below 1100 people per square kilometer. In the sample of firms located in cities with population densities above 1100 people per square kilometer, the relation between government subsidies and firms' R&D intensity is positive but insignificant. The results of Table C1 also demonstrate the crucial role population agglomeration plays in the effect of subsidies on R&D expenditure.

Table C1. The impact of population density：A view from R&D expenditures

	ln (RDS+1)			
	Density>1100		*Density<=1100*	
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*
GS	13.5783***	12.8316***	8.0700***	8.0187***
	(5.22)	(5.56)	(6.30)	(6.58)
Post	0.3614***	0.3476***	0.4341***	0.3940***
	(13.36)	(13.20)	(32.76)	(30.61)
Treat	0.0987**	-0.0038	0.1421***	0.0122
	(2.10)	(-0.08)	(5.72)	(0.49)
*GS*Post*Treat*	5.3394	4.5289	-15.1660***	-12.8228***
	(0.75)	(0.71)	(-3.85)	(-3.41)
*GS*Post*	-2.8718	-2.2344	4.8125***	4.9862***
	(-0.69)	(-0.56)	(2.61)	(2.89)
*GS*Treat*	9.0581**	9.1878**	6.3916**	5.3441**
	(1.99)	(2.40)	(2.57)	(2.25)
*Post*Treat*	-0.0504	-0.0699	0.0585	0.0498
	(-0.67)	(-1.00)	(1.55)	(1.37)
Size		0.0220*		-0.0026
		(1.95)		(-0.45)
SOE		-0.1751***		-0.2142***
		(-6.69)		(-16.83)
Leverage		-0.9012***		-0.8385***
		(-13.72)		(-26.57)
Sales		-0.1492***		-0.2424***
		(-6.08)		(-16.90)
CF		-0.1215		-0.0642
		(-1.07)		(-0.94)
Industry	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes
Constant	-0.1736***	-0.1305	0.1577	1.0918***
	(-6.80)	(-0.56)	(1.63)	(6.72)
Obs	4114	4114	16503	16503
R^2	0.552	0.605	0.474	0.530

Note: This table reports the moderating effect of population density in the relationship between the surging government subsidies and R&D expenditures in small-cap enterprises. The dependent variable is the logarithm of (1+*RDS*); this transformation is due to the large magnitude of *RDS*. The coefficient of the triple interaction item is of interest. Definitions of variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. ***, ** and * indicates significance at 1%, 5% and 10% respectively.

Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

Appendix D: Robustness tests

Besides, we conduct several robustness tests: (1) using the sample of Chinese industrial enterprises, (2) alternatively taking the firms with a subsidy surge after encountering the policy shock in 2015 as treated firm, (3) using the subsample of private enterprises, (4) replacing the measure of population agglomeration with employment density, (5) standardizing government subsidies with firm's operation revenue instead of total assets, and (6) using the bottom 10% of firms by size as the treatment samples, results from these tests are all consistent with the threshold argument of population agglomeration on the relation between government subsidies and firm innovation, as reported in Table 5 and Table 6. Detailed results are reported here successively.

D.1 The sample of Chinese industrial enterprises

In this paper, we use the mass entrepreneurship and innovation policy in 2015 as a natural experiment based on the resulting boost in government subsidies to small-cap enterprises. Figure 2 shows that the treatment group and control group before 2014 almost satisfies the parallel trend assumption, thus we use the DID method in our empirical tests to address the potential endogeneity issue. Data availability around the policy is a main reason why we choose the Chinese listed firms as our sample.

However, to further mitigate the endogeneity concern related to sample representativeness, we check the robustness of our main results by using the data from Chinese Industrial Enterprises Database[1]. This database covers most of unlisted manufacturing firms tracked by National Bureau of Statistics (NBS) of China annually, including all state-owned firms and non-state firms with sales above 5 million RMB[2] of Chinese industrial firms from 31 provinces/province-equivalent

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[1] Here we thank the editor and anonymous referee for this suggestion. It should be noted that this database is also named "China Annual Survey of Industrial Firms" or "China Annual Survey of Manufacturing Firms" in some research.

[2] About 600,000-800,000 US dollars during the sample period.

municipal cities of Mainland China. The dataset contains detailed information on such fundamental characteristics as firm code, location, industry classification and key financial and output variables. It starts from 1998 and is now updated to 2013, but key variable related to our research, the subsidies, ends in 2007.[3] Moreover, most studies using this dataset also end the sample period in 2007, for example, Guariglia et al. (2011), Song et al. (2011), Brandt et al. (2012), and Ma et al. (2014). Accordingly, we follow the mainstream literature and conduct this robustness test over the period 1998-2007. The database contains more than 165,000 firms in 1998, by the end of 2007, the sample size exceeds 336,000 in total.

It is noteworthy to mention that using a big setting such as the aforementioned Chinese industrial firms can employ a more random allocation of subsidies in sample, which might mitigate the endogeneity concerns. However, since the period restriction, when using this setting, the "mass entrepreneurship and innovation" policy and the related difference-in-difference method are not available for us, which might exacerbate the endogeneity worries. Overall, we just present the regression results based on Chinese Industrial Enterprises Database for reference only.

In detail, we reinvestigate the moderating effect of population agglomeration on the relation between subsides and firm innovation by comparing the effect the of subsides on firm innovation in areas with different population density directly. The results of the effect of government subsidies on firm innovation and the impact of population agglomeration are as follows:

Table D1. The effect of government subsidies on innovation and the threshold value of population density

	Innovation: output value of new products						
	Whole Sample	*Density >600*	*Density >700*	*Density >800*	*Density >900*	*Density >1000*	*Density <=800*
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*	*Reg-5*	*Reg-6*	*Reg-7*
GS	-0.0350*	-0.0496	-0.0354	0.1515***	0.0818*	0.1385*	-0.0801***
	(-1.66)	(-1.45)	(-0.88)	(3.29)	(1.70)	(1.76)	(-3.38)
Size	0.0110***	0.0099***	0.0096***	0.0115***	0.0082***	0.0063***	0.0108***

3 Output value of new products, which measures firm innovation, is missing in 2004 and not available after 2010.

	(59.23)	(36.73)	(30.77)	(31.31)	(20.39)	(11.09)	(50.27)
SOE	0.0010	-0.0014	-0.0036*	0.0067***	0.0213***	0.0210***	-0.0002
	(1.05)	(-0.84)	(-1.88)	(2.74)	(7.39)	(5.23)	(-0.17)
Leverage	-0.0044***	-0.0046***	-0.0066***	-0.0023*	-0.0005	-0.0002	-0.0052***
	(-6.81)	(-4.65)	(-5.69)	(-1.71)	(-0.37)	(-0.10)	(-7.08)
RDS	6.4421***	6.6629***	6.7853***	3.8782***	3.3019***	3.6588***	7.5495***
	(78.84)	(61.96)	(57.68)	(29.57)	(23.62)	(18.61)	(74.80)
Sales	0.0007***	0.0010***	0.0013***	0.0019***	0.0014***	0.0008**	0.0004***
	(9.51)	(8.70)	(9.19)	(10.97)	(6.85)	(2.17)	(4.86)
CF	0.0071***	0.0068***	0.0066***	0.0093***	0.0068***	0.0088***	0.0067***
	(6.86)	(4.20)	(3.53)	(4.54)	(3.26)	(2.75)	(5.58)
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.1250***	-0.0692***	-0.0476	-0.0958***	-0.0777***	-0.0957***	-0.1215***
	(-25.31)	(-5.87)	(-0.01)	(-12.35)	(-8.74)	(-7.37)	(-23.83)
Obs	605932	309584	232359	164293	114531	62406	441639
R^2	0.125	0.140	0.153	0.091	0.055	0.055	0.144

Note: This table reports the effect of government subsidies on innovation and the threshold value of population density. *Innovation* is measured as output value of new products of Chinese industrial enterprises, definitions of other variables are all the same as those of Chinese listed firms, reported in Table 2 in the manuscript. T-statistics calculated by robust standard errors are displayed in parentheses. *** and * indicates significance at 1% and 10% respectively.

Sources: Chinese Industrial Enterprises Database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

From the results of this table, we know that the positive effect of government subsidies on the output value of new products is also only significant in high densely populated regions. Though the effect of government subsidies on the output value of new products is negative in the whole sample of Chinese industrial enterprises during the year 1998-2007 and the threshold of population density in this sample is 800 people/km^2, this result is almost consistent with the results reported in Table 4, Table 5 and Table 6, which indicate the threshold argument of population in the relationship between government subsidies and firm innovation. Since the patent data is not available in the database, we couldn’t do robustness checks using alternative measures of patents.

The threshold of population density decreases to 800 people/km^2 when we examine the sample of unlisted manufacturing firms in contrast to that of listed firms.

The reason of the difference lies in the sample periods of these two samples are completely different. The sample period of unlisted firms is 1998-2007 (due to lack of subsidies data after 2007), while the sample period of listed firms is 2007-2017 (due to lack of R&D data before 2007). As time goes by, firm's innovation level increases and then the threshold of population density rises, resulting in the threshold different from 1100 people/km^2 in listed firms during 2007-2017. These results imply us that the threshold of population density also survives in less developed regions, although the threshold value may be lower than that in developed regions.

D.2 Firms with a subsidy surge after the policy shock in 2015 as treated firms

We also alternatively take the firms with a subsidy surge after encountering the policy shock in 2015 as treated firm (*Treat1*=1), and other firms as control firms. Since the policy is aiming at small-sized firms, we define the firms with a sharp rise of subsidies as treated firms in accordance with the following conditions. 1) The size of firm is located below 40 percentiles of our sample; 2) Firm's government subsidies (scaled by total assets) in 2015 exceed the average government subsidies (scaled by total assets) in 2014 by more than one standard deviation; 3) We eliminate the outlier firms whose government subsidies in 2015 exceeds the average government subsidies (scaled by total assets) in 2014 by more than three standard deviations. For robustness, we also rule out those firms losing government subsidies in 2016 or 2017, and shrink the sample period to 2013-2017. The results related to our main threshold argument is reported in Table D2, and is almost consistent with Table 5 in the manuscript. It is noteworthy to address that if we maintain the 2007-2017 period, the results would not change.

Table D2. The impact of population density: Testing the threshold value by conducting an alternative design of DID method over the period 2013-2017

	Invention			
	Density>800	*Density>900*	*Density>1000*	*Density>1100*
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*
GS	18.7306***	17.2036***	20.1595***	24.6583***

	(4.66)	(3.80)	(3.42)	(3.59)
Post	-0.0731**	-0.0736*	-0.0770*	-0.0420
	(-2.32)	(-1.87)	(-1.68)	(-0.89)
Treat1	0.4040	0.5451	0.9256**	0.9342**
	(1.60)	(1.47)	(2.38)	(2.42)
*GS*Post*Treat1*	1.5443	20.9162	44.9472*	54.5603**
	(0.08)	(0.86)	(1.91)	(2.12)
*GS*Post*	-6.1434	-6.6623	-7.7144	-12.8847
	(-1.14)	(-1.06)	(-0.97)	(-1.46)
*GS*Treat1*	-19.6686*	-21.7676	-45.5318***	-50.7049***
	(-1.71)	(-1.32)	(-2.98)	(-3.39)
*Post*Treat1*	0.3937	-0.4646	-0.8957**	-1.0080**
	(0.86)	(-1.11)	(-2.05)	(-2.17)
Size	0.2057***	0.2168***	0.2296***	0.2037***
	(11.04)	(8.81)	(8.39)	(7.19)
SOE	0.0794**	0.0755	0.0283	-0.0038
	(1.99)	(1.48)	(0.51)	(-0.07)
Leverage	-0.0255	0.1062	0.1038	0.0852
	(-0.31)	(1.13)	(0.97)	(0.64)
RDS	0.0057*	0.0087*	0.0081	0.0062
	(1.72)	(1.76)	(1.47)	(0.96)
Sales	0.0611***	0.0587***	0.0530**	0.0182
	(2.95)	(2.80)	(2.47)	(0.95)
CF	0.9016***	1.0158***	1.0349***	0.6876***
	(4.82)	(4.49)	(4.15)	(3.27)
Industry	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes
Constant	-4.7675***	-5.6552***	-5.2269***	-4.5523***
	(-11.59)	(-9.10)	(-8.95)	(-7.20)
Obs	3319	2167	1829	1447
R^2	0.236	0.255	0.257	0.250

Note: This table reports the impact of population density under different threshold values in the relationship between the surging government subsidies and innovation outputs (invention patent applications) in small enterprises. Here we take the firms with a subsidies surge after encountering the policy shock in 2015 as treated firm (*Treat1*=1), and other firms as control firms (*Treat1*=0). The dependent variables are *Invention*, the number of invention patent applications scaled by total assets. The coefficients of the triple interaction item are of interest. Definitions of other variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. ***, ** and * indicates significance at 1%, 5% and 10% respectively.

Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

D.3 Subsample of private enterprises

Compared with state-owned enterprises, it is less clear whether private enterprises are inspired by the mass entrepreneurship and innovation policy. To avoid the interference of SOEs in our sample and to clarify the policy effects for private enterprises, we omit SOE observations and examine the impact of population density for private enterprises. The results are reported in Table D3, which shows that both the magnitude and significance of the coefficients of *GS*Post*Treat* are consistent with the results shown in Table 6. Therefore, the impacts of population agglomeration on the subsidy-innovation relationship are not weakened by state ownership.

Table D3. The impact of population density in private enterprises

	Density>1100			*Density<=1100*		
	Invention	*Utility*	*Tpatent*	*Invention*	*Utility*	*Tpatent*
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*	*Reg-5*	*Reg-6*
GS	25.3239***	17.9319***	56.0806***	10.6050***	6.2531***	20.2935***
	(6.41)	(5.50)	(6.42)	(6.93)	(4.01)	(5.35)
Post	-0.0186	-0.0097	-0.0494	-0.0802***	-0.1010***	-0.2481***
	(-0.56)	(-0.29)	(-0.63)	(-4.57)	(-4.87)	(-5.35)
Treat	0.1220***	0.1731***	0.3394***	0.1592***	0.1745***	0.4417***
	(2.74)	(3.70)	(3.24)	(7.62)	(7.26)	(8.20)
*GS*Post*Treat*	18.2627***	12.3753*	41.3081***	4.8559	4.8051	4.5958
	(2.68)	(1.73)	(2.63)	(1.45)	(1.43)	(0.57)
*GS*Post*	-19.5662***	-12.4603**	-38.5744***	-4.5003*	-5.1717**	-3.3958
	(-3.51)	(-2.23)	(-3.04)	(-1.74)	(-2.02)	(-0.50)
*GS*Treat*	-22.2106***	-13.9128***	-46.3044***	-10.4589***	-6.8150***	-22.1456***
	(-5.08)	(-3.82)	(-4.95)	(-5.90)	(-3.75)	(-5.21)
*Post*Treat*	-0.0615	-0.0851	-0.2303*	0.0670**	0.0495	0.1399**
	(-1.19)	(-1.52)	(-1.90)	(2.40)	(1.48)	(1.99)
Size	0.1925***	0.2096***	0.5142***	0.2397***	0.2527***	0.6148***
	(7.98)	(7.13)	(8.10)	(17.63)	(16.84)	(18.07)
Leverage	-0.0288	-0.0447	-0.1749	-0.1149***	-0.0943**	-0.3927***
	(-0.40)	(-0.74)	(-1.14)	(-3.70)	(-2.54)	(-4.83)
RDS	0.0133***	0.0057**	0.0274***	0.0102***	0.0032***	0.0142***
	(3.19)	(2.33)	(3.37)	(5.18)	(2.76)	(4.29)
Sales	0.0212	0.0245	0.0839**	0.0897***	0.1168***	0.3046***
	(1.47)	(1.61)	(2.34)	(5.94)	(7.44)	(8.09)
CF	0.3010***	0.1913*	0.7248**	0.3092***	0.5057***	1.1129***
	(2.65)	(1.68)	(2.50)	(3.91)	(5.49)	(5.39)
Industry	Yes	Yes	Yes	Yes	Yes	Yes

City	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.0740***	-4.4295***	-10.9414***	-5.3454***	-5.7458***	-13.7797***
	(-7.89)	(-7.02)	(-8.01)	(-17.56)	(-17.19)	(-18.12)
Obs	3315	3315	3315	12799	12799	12799
R^2	0.275	0.319	0.315	0.246	0.286	0.267

Note: This table reports the impact of population density in the relationship between the surging government subsidies and innovation outputs in small private enterprises. The dependent variables are *Invention*, *Utility and Tpatent*. The coefficients of the triple interaction item are of interest. Definitions of variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. ***, ** and * indicates significance at 1%, 5% and 10% respectively.

Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

D.4 Alternative measure of population agglomeration

To guarantee the robustness of our empirical results and to show that the results are not driven by our choice of the measure for population agglomeration, we use another variable, employment density (*EDensity*), in place of the variable *Density* and as the criterion for grouping.[4] The results are reported in Table D4. Once again, the results are consistent with our baseline findings. The coefficients of *GS*Post*Treat* are all positive and significant for firms located in cities with employment density above 1100 employees per square kilometer, indicating the positive impact of employment density, which gauges population agglomeration in another way, on both high-quality and low-quality innovation outputs.

Table D4. The impact of employment density

	EDensity>1100			*EDensity<=1100*		
	Invention	*Utility*	*Tpatent*	*Invention*	*Utility*	*Tpatent*
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*	*Reg-5*	*Reg-6*
GS	21.2151***	16.3113***	46.3406***	9.8486***	5.6032***	18.5646***
	(7.84)	(6.59)	(7.63)	(8.09)	(4.78)	(6.58)
Post	-0.0811***	-0.0742**	-0.2086***	-0.0543***	-0.0937***	-0.2021***
	(-2.97)	(-2.48)	(-3.13)	(-3.23)	(-4.83)	(-4.72)
Treat	0.1197***	0.1230***	0.2500***	0.1393***	0.1596***	0.3839***
	(3.64)	(3.43)	(3.16)	(8.63)	(8.23)	(9.20)
*GS*Post*Treat*	12.8651**	10.5237*	24.8142*	2.0863	0.2251	-1.3024

[4] Since the employee information of some cities in 2017 is not available, the sample period in this test is 2007-2016.

	(2.09)	(1.66)	(1.68)	(0.68)	(0.07)	(-0.17)
*GS*Post*	-9.3749**	-7.3562*	-16.4624	-2.6251	-0.1053	1.5437
	(-1.98)	(-1.67)	(-1.45)	(-1.07)	(-0.04)	(0.25)
*GS*Treat*	-19.7398***	-13.6102***	-39.6850***	-10.5664***	-7.1819***	-21.9123***
	(-6.07)	(-4.55)	(-5.60)	(-7.32)	(-4.84)	(-6.53)
*Post*Treat*	-0.0667	-0.0749	-0.1200	0.0150	0.0268	0.0643
	(-1.32)	(-1.29)	(-0.98)	(0.55)	(0.72)	(0.82)
Size	0.1850***	0.1864***	0.4440***	0.2002***	0.2145***	0.5187***
	(11.23)	(9.56)	(10.55)	(22.23)	(20.46)	(22.49)
SOE	-0.0381	-0.0620**	-0.1050*	0.0039	-0.0188	-0.0207
	(-1.46)	(-2.31)	(-1.72)	(0.29)	(-1.25)	(-0.62)
Leverage	-0.0920	-0.0493	-0.2145	-0.1415***	-0.1613***	-0.4682***
	(-1.59)	(-0.82)	(-1.59)	(-5.20)	(-5.26)	(-6.75)
RDS	0.0131***	0.0070***	0.0245***	0.0120***	0.0027**	0.0158***
	(3.51)	(2.79)	(3.51)	(5.13)	(2.01)	(4.05)
Sales	0.0373***	0.0317***	0.1026***	0.0566***	0.0753***	0.2299***
	(3.49)	(3.03)	(4.00)	(5.09)	(5.95)	(7.81)
CF	0.2513***	0.2434**	0.7031***	0.2194***	0.2454***	0.7240***
	(2.74)	(2.45)	(3.06)	(3.65)	(3.44)	(4.52)
Industry	Yes	Yes	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.2390***	-4.3526***	-10.2204***	-4.4657***	-4.6976***	-11.4474***
	(-11.54)	(-10.06)	(-10.95)	(-22.10)	(-20.33)	(-22.60)
Obs	3792	3792	3792	13142	13142	13142
R^2	0.2977	0.3305	0.3278	0.2785	0.3084	0.2942

Note: This table reports the impact of an alternative measure of population agglomeration, employment density (denoted as *EDensity*), in the relationship between the surging government subsidies and innovation outputs. The dependent variables are *Invention*, *Utility and Tpatent*. The coefficients of the triple interaction item are of interest. Definitions of variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. ***, ** and * indicates significance at 1%, 5% and 10% respectively.

Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

D.5 Alternative measure of government subsidies

In our main tests, we use *GS* to gauge the intensity of government subsidies. *GS* is computed as the amount of a firm's government subsidies divided by the firm's total assets. In this subsection, we use *GSS* (measured as government subsidies / operation revenue) in place of *GS* to check the robustness of our results. The results are shown in Table D5. The coefficients of *GSS*Post*Treat*, *GSS*, and *Treat* are all consistent with the baseline results in Table 6. With this measurement of subsidies, population density plays a crucial role in the positive impact of government subsidies on both high-quality innovation outputs (*Invention*) and low-quality innovation outputs (*Utility*), but is more pronounced for the former.

Table D5. The impact of population density: an alternative measure of government subsidies

	Density>1100			*Density<=1100*		
	Invention	*Utility*	*Tpatent*	*Invention*	*Utility*	*Tpatent*
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*	*Reg-5*	*Reg-6*
GSS	6.8749***	3.7609***	13.6416***	1.2549***	0.7865*	1.8808**
	(5.59)	(4.95)	(5.36)	(2.90)	(1.78)	(1.98)
Post	-0.0825***	-0.0604**	-0.1900***	-0.0750***	-0.1060***	-0.2196***
	(-2.80)	(-2.04)	(-2.70)	(-4.72)	(-5.82)	(-5.53)
Treat	0.0967**	0.1499***	0.2964***	0.1400***	0.1681***	0.3987***
	(2.43)	(3.82)	(3.18)	(7.81)	(8.08)	(8.72)
*GSS*Post*Treat*	7.5126***	4.0659**	14.2056***	1.5700	1.2340	2.4212
	(3.13)	(2.05)	(2.75)	(1.50)	(1.13)	(1.05)
*GSS*Post*	-6.1257***	-3.7740***	-11.8866***	-1.4113*	-0.8622	-1.4938
	(-3.62)	(-3.13)	(-3.29)	(-1.83)	(-1.04)	(-0.84)
*GSS*Treat*	-7.6324***	-3.5385***	-14.4843***	-2.0266***	-1.5969***	-3.9569***
	(-4.59)	(-3.14)	(-4.31)	(-3.63)	(-2.88)	(-3.26)
*Post*Treat*	-0.0406	-0.0581	-0.1441	0.0527**	0.0481	0.0947
	(-0.79)	(-1.05)	(-1.19)	(2.11)	(1.62)	(1.51)
Size	0.2055***	0.2199***	0.5471***	0.2433***	0.2587***	0.6196***
	(10.06)	(8.95)	(10.00)	(21.65)	(20.88)	(22.20)
SOE	-0.0396	-0.0843**	-0.1539*	0.0306*	-0.0078	0.0305
	(-1.16)	(-2.57)	(-1.91)	(1.90)	(-0.44)	(0.77)
Leverage	-0.0790	-0.1452**	-0.3494**	-0.1257***	-0.1364***	-0.4291***
	(-1.12)	(-2.19)	(-2.18)	(-4.36)	(-4.02)	(-5.81)
RDS	0.0156***	0.0062**	0.0311***	0.0126***	0.0034***	0.0172***
	(3.56)	(2.40)	(3.56)	(5.73)	(2.73)	(4.74)
Sales	0.0441***	0.0369***	0.1258***	0.0909***	0.1121***	0.3191***
	(3.42)	(2.91)	(3.96)	(6.47)	(7.37)	(8.71)
CF	0.3429***	0.2097*	0.7879***	0.3269***	0.4417***	1.0840***
	(2.97)	(1.90)	(2.73)	(4.82)	(5.53)	(6.07)
Industry	Yes	Yes	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.2620***	-4.5307***	-11.3813***	-5.8486***	-6.2963***	-15.0144***
	(-9.88)	(-8.77)	(-9.87)	(-21.52)	(-21.14)	(-22.27)

Obs	4114	4114	4114	16502	16502	16502
R^2	0.252	0.299	0.288	0.262	0.288	0.277

Note: This table reports the impact of population density in the relationship between alternative proxies of surging government subsidies (*GSS*, the ratio of government subsidies to operation revenue) and innovation outputs in small size enterprises. The dependent variables are *Invention*, *Utility and Tpatent*. The coefficients of the triple interaction item are of interest. Definitions of variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. ***, ** and * indicates significance at 1%, 5% and 10% respectively.
Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

D.6 The bottom 10% of firms by size as the treatment group

In our main tests, we use the bottom quintile of firms by size as the treatment sample. To rule out the concern that the results would change when altering the quantile of firm's size used in specifying the treatment group, in this subsection we use the bottom 10% of firms by size as the treatment sample and redo the regressions. The results are shown in Table D6. The coefficients of *GS*Post*Treat2*, *GS*, and *Treat2* are all consistent with those in Table 6; the impact of population density is more pronounced for high-quality innovation outputs (*Invention*) than for low-quality innovation outputs (*Utility*).

Table D6. The impact of population density using the smallest 10% enterprises as treatment samples

	Density>1100			*Density<=1100*		
	Invention	*Utility*	*Tpatent*	*Invention*	*Utility*	*Tpatent*
	Reg-1	*Reg-2*	*Reg-3*	*Reg-4*	*Reg-5*	*Reg-6*
GS	22.8859***	14.5000***	49.1187***	8.1877***	4.7292***	15.6656***
	(7.33)	(6.15)	(7.31)	(6.69)	(3.86)	(5.47)
Post	-0.0628**	-0.0544*	-0.1592**	-0.0713***	-0.1095***	-0.2377***
	(-2.26)	(-1.96)	(-2.41)	(-4.58)	(-6.17)	(-6.08)
Treat2	0.0931**	0.1364***	0.3110***	0.2162***	0.2197***	0.5770***
	(2.33)	(2.95)	(3.13)	(10.30)	(9.21)	(10.67)
*GS*Post*Treat2*	17.2893**	13.0117*	38.1888**	-0.7618	-1.9643	-7.9067
	(2.47)	(1.85)	(2.40)	(-0.24)	(-0.60)	(-1.06)
*GS*Post*	-15.8882***	-9.0999**	-29.4751***	-0.8713	0.9066	5.8362
	(-3.32)	(-2.22)	(-2.79)	(-0.38)	(0.39)	(1.03)
*GS*Treat2*	-21.3681***	-9.7087***	-40.4597***	-9.2335***	-6.6760***	-20.4564***
	(-5.69)	(-2.87)	(-4.91)	(-5.56)	(-3.77)	(-5.11)

*Post*Treat2*	0.0474	-0.0433	-0.0281	0.0416	0.0497	0.1203
	(0.72)	(-0.59)	(-0.18)	(1.40)	(1.41)	(1.54)
Size	0.2073***	0.2151***	0.5502***	0.2393***	0.2499***	0.6056***
	(10.91)	(9.46)	(10.88)	(23.08)	(21.86)	(23.49)
SOE	-0.0377	-0.0826**	-0.1494*	0.0294*	-0.0082	0.0290
	(-1.11)	(-2.53)	(-1.86)	(1.83)	(-0.46)	(0.73)
Leverage	-0.1083	-0.1689**	-0.4208***	-0.1480***	-0.1583***	-0.4874***
	(-1.55)	(-2.57)	(-2.66)	(-5.13)	(-4.64)	(-6.58)
RDS	0.0142***	0.0054**	0.0278***	0.0114***	0.0026**	0.0144***
	(3.12)	(2.20)	(3.17)	(5.57)	(2.21)	(4.30)
Sales	0.0269**	0.0270**	0.0899***	0.0830***	0.1065***	0.3016***
	(2.25)	(2.21)	(3.06)	(6.08)	(7.10)	(8.43)
CF	0.2729**	0.1584	0.6189**	0.2714***	0.3949***	0.9454***
	(2.45)	(1.48)	(2.26)	(3.95)	(4.87)	(5.22)
Industry	Yes	Yes	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.3182***	-4.4395***	-11.4924***	-5.7043***	-6.0335***	-14.5281***
	(-10.77)	(-9.30)	(-10.79)	(-22.96)	(-22.14)	(-23.57)
Obs	4114	4114	4114	16503	16503	16503
R^2	0.262	0.303	0.298	0.265	0.288	0.280

Note: This table reports the impact of population density in the relationship between the surging government subsidies and innovation outputs in the smallest 10% enterprises, an alternative division for the treatment group, denoted as *Treat2*. The dependent variables are *Invention, Utility and Tpatent*. The coefficients of the triple interaction item are of interest. Definitions of variables are listed in Table 2. T-statistics calculated by robust standard errors are displayed in parentheses. ***, ** and * indicates significance at 1%, 5% and 10% respectively.
Sources: China Stock Market and Accounting Research (CSMAR) database, China City Statistical Yearbooks and the statistical yearbooks of provinces and prefecture-level cities.

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