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Picking winners in strategic emerging industries using government subsidies in China: the role of market power

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This study explores the effects of government subsidies on company labour productivity in strategic emerging industries under conditions of market power in downstream and upstream markets. A sample of 1392 listed companies from emerging industries in China from 2006 to 2019 is used. Labour productivity will be lower in companies with high seller power. The positive effect of subsidies on labour productivity will be enhanced when firms possess higher seller power, whereas the positive effect of subsidies on labour productivity will be weakened when firms possess higher buyer power. Heterogeneity analysis shows that the role of market power is more evident for domestic enterprises compared to foreign investment companies. The mechanisms of picking winners based on government subsidies should take the effects brought by various degrees of market power into account.

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Introduction

The Chinese government's industrial strategy since 2008 has increasingly placed a premium on innovative companies in emerging sectors that can reach the global innovation frontier to foster the country's fast technological transformation and heightened global competitiveness (The Economist, 2020; Jing, 2021; Mao et al. 2021). With a traditional focus on facilitating the growth of companies in vital industries by promoting or restricting new entry (e.g., van Beers and Sadowski, 2003), industrial policy has just recently become concerned with the global competitiveness of innovative firms in strategic emerging industries (Boeing, 2016; Prud'homme et al. 2018; Li et al. 2022). With ample governmental subsidies available to facilitate innovation and competitiveness of companies, policy tools aimed at just picking winners, such as innovative firms in each sector (e.g., Lazzarini, 2015; Perez-Aleman and Alves, 2017; Wan et al. 2023) might not generate the desired results as the market power of these firms in upstream and downstream markets might have some countervailing effects (Chen and Naughton, 2016; Dai et al. 2018; Park et al. 2020; Kao et al. 2023).

Because numerous studies have focused on the question of whether public R&D spending is complementary to or crowds out private R&D investment (e.g., Almus and Czarnitzki, 2003; Arqué-Castells and Mohnen, 2015; Czarnitzki et al. 2011; Cin et al. 2017; Wang et al. 2022), the evidence derived from these studies has been far from conclusive in the context of developed countries (e.g., Zúñiga-Vicente et al. 2014). In a developing country or newly industrialised economy context, studies on the effects of governmental subsidies on labour productivity have been scarce (Hall and Maffioli, 2008; Cerulli, 2010; Cin et al. 2017). However, in cases in which governmental subsidies generated additionality effects for firms, these effects are not necessarily related to crowding out of other private firms (Czarnitzki and Fier, 2002; Rehman et al. 2020). To investigate the role of governmental subsidies on firm performance in China, we derived an empirical model from a Cobb-Douglas function which comprises market power as a moderating variable. We investigated the productivity effects of governmental R&D subsidies in companies in emerging industries in China. Similar to earlier studies on market power (e.g., Bellamy et al. 2014; Christensen and Bower, 1996; Peters, 2000; Chen, 2019; Wang et al. 2022), the focus was on the extent to which market power moderates the effects of government subsidies on labour productivity.

The contributions of the paper are threefold. Firstly, with a focus on the impact of government subsidies on firm performance under conditions of market power in emerging industries, the paper provides better insights into the objectives of industrial R&D policy. The results allow policymakers to define specific rationales and justifications for innovation policy beyond the classical market failure paradigm (Fu et al. 2016). Secondly, greater attention has been paid to the extent to which industrial R&D policies generate sufficient incentives for innovative companies to improve their firm performance by examining the effects of market power. In case governmental subsidies facilitate supplier and buyer market power with negative effects on the innovative performance of companies, governmental agencies have to provide further pro-competitive incentives to stimulate company growth (Fu and Mu, 2014). Thirdly, while investigating this relationship in the context of emerging industries in an emerging country, the study is aimed at complementing existing research on this issue in developed countries. By moving from a policy environment where national champions were shielded from global competition, the challenge for these companies in an industrialized country is that policy should aim at increasingly exposing these firms to a competitive environment while reducing the effects of market power. In this way, our paper will provide a better understanding of how governmental institutions and various forms of market structure interact with each other and influence the economic activities of firms.

The remainder of this paper is organized as follows. Section 2 presents the literature review and background. Section 3 derives the econometric model and estimation method. The results are provided in Section 4, whilst Section 5 shows the robustness check. We conduct a heterogeneity analysis among different types of companies in Section 6. Section 7 concludes the paper by summarizing our main findings and deriving theoretical implications and policy recommendations.

Literature review and background

As traditional labour cost advantages in China have gradually eroded, government efforts to improve productivity have focused on a mix of subsidies, tax breaks, and preferential (often subsidized) ways of financing (Chen, 2019). The Chinese government has developed the "Made in China 2025" program aimed at moving the manufacturing sector from low-value-added into high-value-added market segments to achieve these ambitious objectives. The program is aimed at facilitating Chinese firms with large market power to enter the high-value-added segments. However, even if the effects of government subsidies have spurred firms' innovation input in Chinese companies, the effects of these subsidies under conditions of various forms of market power have rarely been examined. Less is known about the role of governmental subsidies if firms possess limited market power, such as small and medium enterprises or new ventures.

Innovative firms and labour productivity. Because winning firms can outperform competitors based on their innovativeness compared to non-innovative firms (Geroski and Machin, 1992; Rubera and Kirca, 2012), government R&D investment can facilitate this innovativeness in different ways: A government agency intends to award the subsidy in a way that it provides an additional incentive to develop innovations and increases the total amount of private R&D (input additionality), as well as generates more innovation and leads to higher productivity (output additionality) because this investment can affect input and output stages of a firm's business R&D (Czarnitzki and Delanote, 2017). These effects of R&D subsidies have been included within the structural model literature by using the framework developed by Crépon, Duguet, and Mairesse (CDM) (Crépon, et al, 1998). The CDM framework is based on a knowledge production function which defines innovation at three stages: (i) the stage at which managers have to decide whether or not a firm engages in innovation activities, (ii) the stage at which a decision has to be made about the amount to invest in R&D (as measured by R&D intensity), and (iii) the stage at which innovation output and/or labour productivity can be measured (Crépon et al. 1998; Lööf et al. 2017). The study has demonstrated that innovative firms can outperform competitors in terms of productivity due to their adoption of new technologies and the accumulation of human capital (Crépon et al. 1998; Lööf et al. 2017).

Furthermore, the study has shown that innovative firms in competitive industries achieve greater productivity advantages, compared with firms that operate in more concentrated industries (Castellacci, 2011; Shi et al. 2020). Rather surprisingly, it seems that firms in industries with higher levels of market concentration can secure smaller productivity gains (Castellacci, 2011). Consequently, the recent discussion has increasingly focused on the role of market power as a confounding factor in the relationship between innovation and productivity (Ugur and Vivarelli, 2021).

Governmental subsidies and private R&D investment. To explain the rationales for governmental subsidies in facilitating

processes of innovation at the firm level, the market failure approach has been used to argue based on two major assumptions: Firstly, due to knowledge spillovers, companies would invest less in R&D because they will be unable to appropriate the expected private returns on innovation. As a result, the incentives for R&D investment would be below socially optimal levels (Arrow, 1962). Secondly, due to information asymmetry between inventors and their potential financiers (Arrow, 1962), private investors were unable to value their innovations over the long term correctly (Hall and Lerner, 2010). For companies in emerging economies trying to catch up with leading firms at the global technological frontier, governmental R&D subsidy can have a greater impact as companies are exposed to low risks stemming from technical and informational uncertainties (e.g., Boeing, 2016). However, the evidence on the effects of governmental programs on private R&D has rather been inconclusive.

With an increase in attention on the effects of subsidies on firms' innovation input (David et al. 2000; Dimos and Pugh, 2016; Marino et al. 2016), the debate has increasingly focused on the specific market and industry conditions under which government subsidies are provided (Dimos and Pugh, 2016; Song et al. 2022; Zhu et al. 2022). Within the ongoing economic transition from strictly centralized to more open markets, China represents an interesting case for industrialized economies as government intervention has explicitly been aimed at facilitating the growth of innovative firms (e.g., Howell, 2017; Shi et al. 2020, 2022). Even if the impact of government subsidies on labour productivity has differed across firms and industries, initial studies have indicated that there has been a positive, inverted U-shaped association between government subsidies and firms' investment in innovation in high-tech industries (Huang and Sattar, 2021).

Within the debate on additionality versus crowding out effects of government subsidies (David et al. 2000; Dimos and Pugh, 2016), the attention has shifted towards addressing the accumulation of indigenous innovative capabilities and picking 'winning firms' (Howell, 2017) to catch up with leading multinational companies in strategic emerging industries. As these strategic emerging industries have been addressed by a variety of governmental initiatives, some scepticism has recently been raised concerning the extent to which public funding may force out private R&D and fail to incentivize companies to deliver innovations due to information asymmetry and adverse selection (Huang and Sattar, 2021; Boeing et al. 2022).

Market power and innovation. Within the extensive literature on buyer power, the incentives of companies to increase dynamic efficiency have just recently been investigated (e.g., Inderst and Wey, 2007). Buyer power stifles the incentives of companies to innovate (Chen et al. 2016; Chen, 2019). However, the longer-term implications of government subsidies on the investment incentives of private companies are currently far from clear. For governmental subsidies, Zúñiga-Vicente et al. (2014) propose that further attention should be paid to areas such as the constraints facing the firm. We extend this line of research by exploring the role of market power in the relationship between government subsidies and firm performance. As market power is an important constraint of firm performance, the extent to which market power is linked to upstream suppliers or downstream buyers remains an important question for research. The R&D of firms is influenced by various levels of market power (e.g., Bellamy et al. 2014; Christensen and Bower, 1996; Peters, 2000; Sun et al. 2021; Wang et al. 2022). These studies have been undertaken in markets with limited governmental intervention. However, in some strategic emerging industries such as telecommunications equipment provision in China, governmental interventions have been vital in facilitating innovation and

increasing productivity of domestic firms (Fan, 2006; Yu et al. 2020). However, little is known about the effects of market power when a firm's R&D activities are affected by government subsidies. Based on firm-level data of Chinese companies, we investigate these effects and the way in which market power (on the buyer and on the seller side) moderates these effects. Our results offer new insights for policymakers and managers in picking winners in strategic industries in industrialised countries such as China.

Model specification and estimation method

Model specification. Similar to previous studies (e.g., Cin et al. 2017), we assume that a firm faces a typical Cobb–Douglas production function. Within the production function noted by $Q = AK^{\beta_1}L^{\beta_2}$, the total factor productivity (A) is assumed to depend on private R&D investment ($R\&D$) and firm age (Age): $A = C\,(R\&D)^{\gamma_1}\,(Age)^{\beta_3}$, where C is a constant term.

Dividing both sides of this function by labour (L) and taking logarithms, we obtain the following labour productivity model:

$$\ln\left(Q/L\right)_{i,t} = \beta_0 + \gamma_1 \ln\left(R\&D/L\right)_{i,t} + \beta_1 \ln\left(K/L\right)_{i,t} \\ + \partial \ln L_{i,t} + \beta_3 \ln\left(Age\right)_{i,t} \tag{1}$$

Considering the role of market power, government subsidy, as well as time and industry effects, the estimated model can be rewritten in a way that reflects the underlying panel data framework:

$$\ln\left(Q/L\right)_{i,t} = \beta_0 + \gamma_1 \ln\left(R\&D/L\right)_{i,t} + \gamma_2 D_{i,t} + \theta_1 (BP)_{i,t} \\ + \theta_2 (SP)_{i,t} + \theta_3 (BP)_{i,t} \times Subsidy_{i,t} + \theta_4 (SP)_{i,t} \\ \times Subsidy_{i,t} + \beta_1 \ln\left(K/L\right)_{i,t} + \partial \ln L_{i,t} \\ + \beta_3 \ln\left(Age\right)_{i,t} + \sum_k \delta_k Industry_k + \sum_j \tau_j Year_j \\ + \sum_n \phi_n Nature_n + \sum_m \psi_m \Pr ovince_m + \varepsilon_{i,t} \tag{2}$$

A random effects estimator is used because that it makes fixed effects estimates inefficient and unreliable for variables that change only slowly over time, the between part of the variance is substantially larger than the within component (Plümper and Troeger, 2007). The endogeneity of the explanatory variable, $\ln\left(R\&D/L\right)$, is an major econometric issue. In particular, a 2SLS estimation method is used to address the possible problem of endogeneity in Equation (2) referring to Castellacci (2011) and Shi et al. (2020). It was instrumented using one-year lag of innovation input ($L.R\&D/L$). This procedure allows the definition of the dependent variable ($\ln\left(Q/L\right)$) in a way that the procedure cannot determine the research investment in previous years ($L.R\&D/L$). Nevertheless, $L.R\&D/L$ is considered related to the current $R\&D/L$. Hausman test is used to confirm whether $\ln\left(R\&D/L\right)$ is endogenous variable. Weak instrument test is also performed.

Variables. For the analysis, we use the following variables, all of which are available during the sample period and have standardised definitions. The variable explained in the model is the innovation performance of a company (Q/L), which is based on the current year's operating income (Q) and the number of employees (L) (e.g., Castellacci, 2011). The ratio between Q and L was defined as follows to eliminate the influence of the company's size: $\log\left(1 + Q/L\right)$.

The explanatory variables comprise R&D intensity ($R\&D/L$), government subsidy ($Subsidy/L$), and different types of (buyer and/or supplier) market power (BP and SP). The variable $R\&D$ is measured by R&D investment of a firm at the current year. Since

subsidies have a lagged effect on R&D investment and R&D has been cumulative, we use accumulated R&D investment delayed by one year. Buyer power (*BP*) is calculated by the proportion of total purchases of the top five suppliers (S5). Consistent with Peters (2000), the variable BP was normalised to allow the data to be mapped according to [0,1], $BP = \frac{S5_{max} - S5}{S5_{max} - S5_{min}}$. The value of BP is higher when a firm has a higher buyer power. Seller power (*SP*) is calculated by the proportion of total sales of the top five customers (C5). Similar to the calculation of the variable *BP*, seller power is calculated as $SP = \frac{C5_{max} - C5}{C5_{max} - C5_{min}}$. The value of SP is high when a firm has a high seller power.

The control variables which are mainly considered are capital input (*K/L*), labour input (*L*), nature of firms, the classification of strategic industries, age, year, and the geographical distribution of cities. The capital input *K* is calculated as 10% of total assets to include depreciation (Verspagen, 1995).

Data and statistical description. We examine the joint effects of government subsidies and various types of (supplier and buyer) market power on firm performance in strategic emerging industries using data from Chinese publicly listed firms. We collected the data sample from 2006 to 2019. We did not use data after 2020 as the data quality has been influenced by the effects of lockdown measures caused by COVID-19. We adopted the following procedures for data collection. First, data samples are selected from listed companies affiliated with manufacturing industries by considering the fact that listed manufacturing companies are more likely to be favoured by government innovation subsidies. Secondly, consistent with the document 'Classification of Strategic Emerging Industries (2018)' issued by the National Statistics Bureau of China, we were able to manually place each firm into one of the following categories in the strategic emerging sectors: *digital creative, next-generation information technology, new materials, renewable energy, electric cars, biotech, energy conservation and environmental protection*, as well as *high-end equipment manufacturing*. Thirdly, we deleted observations where the value of employment is missing. After excluding the data of non-strategic emerging enterprises, 10835 firm-level observations of 1392 companies were selected. The distribution of firms across sectors was as follows: new materials (26.77%), next-generation information technology (18.95%), high-end equipment manufacturing firms (18.65%), biotech (16.18%), and energy conservation and environmental protection firms (10.91%). A small percentage of companies were from renewable energy (4.63%), electric cars (2.32%), and the digital creative sector (1.60%).

Table 1 presents the descriptive statistics. The mean per employee enterprise R&D investment during the sample period is 1.280 with a standard deviation of 0.765. The labour productivity is 4.340 with a standard deviation of 0.788. Almost all companies surveyed received R&D subsidies from the government. This is a high level of subsidy, reflecting the 'picking winners' strategy of Chinese government in strategic emerging industries.

Table 2 presents the correlation among the main variables. The correlation between explanatory variables and control variables was less than 0.7, and the VIF is not more than 2, indicating that the multi-collinearity problem between variables is not an issue.

Regression results
We perform Hausman test to check if R&D input (*R&D/L*) is endogenous varibale. The test shows that the Chi2 in model 1 to model 3 are equal to 56.10, 71.59, and 106.79 respectively, and all the p-value are less than 0.05, which confirm the existence of endogeneity. Partial R-squared value are 0.796, 0.796, and 0.797 respectively and minimum eigenvalue statistic are 15469.3, 15278.8, and 15239 respectively, which confirms that the weak instrument hypothesis is rejected.

The results from the estimations are presented in Table 3. In all three models, the regression coefficients for R&D input (*R&D/L*) are statistically significant at the 5% level, indicating that a firm's level of R&D plays a crucial role in its productivity. Model 1 shows that labour productivity is positively related to the age of the firm (*Age*), government subsidy (*Subsidy*), and the company size (*L*) has a positive effect on labour productivity.

In Models 2 and 3, we analyse the effects of government subsidies and supplier market power on a firm's labour productivity. The coefficient for supplier power (*SP*) is negative in both models, which is significant at the 5% level in Model 3. This indicates that firms with large selling power have lower labour productivity. After adding the interaction terms for buyer power (BP* *Subsidy*) and supplier power (SP* *Subsidy*) in Model 3, the coefficients for firm age (*Age*) and government subsidy (*Subsidy*) still become significant. The variable BP* *Subsidy* is negative (−0.048), but the variable for buyer power (*BP*) is positive and statistically significant at the 5% level. This means that the effects of subsidies on labour productivity will weaken when firms have high buyer power.

The interaction variable coefficient for supplier power and subsidy (SP* *Subsidy*) is 0.025 and is significant at the 5% level. This indicates that the effect of a government subsidy on labour productivity varies with the level of supplier power. If a corporation has a larger seller power, the positive effect of a government subsidy on labour productivity will be greater.

Robustness analysis
In Section 4, we used Baltagi's EC2SLS random-effects estimation to analyse the panel data. To perform the robustness anlysis, we use the two-stage least-squares first-differenced estimator and the estimation result is shown in Table 4. Little difference exists between Tables 3 and 4 in terms of the significance level and signs of the estimation coefficient, which is indicating the robustness of the results.

Heterogeneity analysis
To analyse the efficacy of the Chinese government picking winners through subsidies, we divide the sample into two groups based on company ownership: foreign investment companies and domestic enterprises. The results are shown in Table 5. It demonstrates that the role of buyer and seller power is greatly significant for domestic enterprises compared to foreign investment companies. It indicates that market power has a greater impact on domestic companies' decisions to use government subsidies to raise labour productivity. The heterogeneity study confirms China's government's policy should focus on the role of seller and buyer power when picking winners amongst indigenous companies using subsidies. The effect on foreign investment firms is not revealed. The results can be partly supported by Shi et al. (2020) that the high productivity of foreign invetment companies in China is not easily influenced by market competition.

Table 1 Statistical description of main variables.

Variable	Observations	Mean	Standard deviation	Min	Max
Q/L	10835	4.340	0.788	0.000	9.22
K/L	10835	2.769	0.663	0.409	7.762
L	10835	7.542	1.114	2.890	12.342
R&D/L	10835	1.280	0.765	0.000	6.665
D	10835	1.001	3.998	0.000	256.508
SP	10835	0.678	0.224	−0.000	1.000
BP	10835	0.673	0.219	−0.000	1.000
Age	10835	2.790	0.347	0.693	4.127

Table 2 Correlation matrix for variables.

Variables	Q/L	K/L	L	R&D/L	D	SP	BP	Age
Q/L	1							
K/L	0.657*	1						
L	−0.033*	−0.304*	1					
R&D/L	0.396*	0.467*	−0.199*	1				
Subsidy	0.137*	0.235*	−0.139*	0.163*	1			
SP	0.049*	−0.041*	0.164*	−0.006	−0.026*	1		
BP	−0.104*	−0.149*	0.272*	−0.030*	−0.036*	0.349*	1	
Age	0.162*	0.139*	0.154*	0.147*	−0.010	0.027*	0.009	1

Notes: A star (*) is added to correlations significant at 1% level after the Bonferroni adjustment.

Table 3 Regression results.

Variables	Model 1	Model 2	Model 3
R&D /L	0.153*** (0.017)	0.155*** (0.017)	0.157*** (0.017)
K/L	0.673*** (0.014)	0.673*** (0.014)	0.674*** (0.014)
L	0.016** (0.009)	0.020*** (0.009)	0.021*** (0.009)
Age	0.081*** (0.037)	0.083*** (0.037)	0.082*** (0.037)
Subsidy	0.003*** (0.001)	0.003*** (0.001)	0.012*** (0.004)
SP		−0.027 (0.033)	−0.060** (0.033)
BP		−0.008 (0.027)	0.039* (0.029)
SP* Subsidy			0.025*** (0.005)
BP* Subsidy			−0.048*** (0.010)
_cons	1.784*** (0.193)	1.760*** (0.190)	1.745*** (0.191)
N	9055	9055	9055
R-sq	0.505	0.505	0.506
Wald Chi2	8224.24***	8244.98***	8303.63***

Note: All regressions include a constant, industry dummies, and time dummies; standard error in brackets; *p < 0.2, **p < 0.1, ***p < 0.05.

Table 4 Robustness check.

Variables	Model 1	Model 2	Model 3
ΔR&D /L	−0.005 (0.059)	−0.008 (0.059)	−0.028 (0.061)
ΔK/L	0.591*** (0.025)	0.591*** (0.025)	0.594*** (0.026)
ΔL	−0.249*** (0.019)	−0.246*** (0.019)	−0.246*** (0.019)
ΔAge	0.128 (0.227)	0.144 (0.227)	0.137 (0.227)
ΔSubsidy	0.002** (0.001)	0.002** (0.001)	0.003 (0.003)
ΔSP		−0.171*** (0.038)	−0.206*** (0.039)
ΔBP		0.014 (0.027)	0.041* (0.029)
ΔSP* Subsidy			0.025*** (0.006)
ΔBP* Subsidy			−0.026*** (0.009)
_cons	0.048*** (0.017)	0.048*** (0.017)	0.051*** (0.017)
N	7451	7451	7451
R-sq	0.234	0.230	0.225
Wald Chi2	3021.90***	3046.16***	3053.08***

Note: All regressions include a constant, industry dummies, and time dummies; standard error in brackets; *p < 0.2, **p < 0.1, ***p < 0.05.

Summary and conclusion

China has evolved from a low-tech manufacturing economy to an innovation-driven economy as a result of extensive R&D investment by firms and subsidies provided by government. However, there are still several hurdles innovative activities, particularly for strategic emerging industries facing higher risks and greater technological constraints compared to firms in developed countries. Governmental subsidies can help towards decreasing the risk of innovation activities for private firms, although their usefulness in encouraging innovation is not adequately acknowledged. Based on the dataset of listed companies in strategic emerging industries in China, this paper has examined the impact of government subsidy and market power on firm performance in greater detail.

Consistent with the structural model literature (Crépon et al. 1998), the study has shown that the innovativeness of firms is positively related to their labour productivity. In focusing on the effects of market power and governmental subsidies on labour productivity, the contributions of this paper have been twofold: (1) In aligning with numerous studies analysing buyer market power (e.g., Bellamy et al. 2014; Christensen and Bower, 1996; Peters, 2000), the study demonstrated that seller market power can have a negative effect on labour productivity for companies in strategic emerging industries. (2) The paper demonstrated that governmental subsidies can provide additional positive effects on labour productivity (Czarnitzki and Delanote, 2017), but these effects are moderated by the level of supplier market power. The

Table 5 Heterogeneity analysis: Foreign investment firms vs domestic firms.

	Foreign investment firms	Domestic firms
RD/L	0.012 (0.095)	0.164*** (0.018)
K/L	0.797*** (0.072)	0.677*** (0.014)
L	0.063* (0.047)	0.033*** (0.008)
Age	−0.161 (0.156)	0.113*** (0.036)
Subsidy	0.092 (0.089)	0.014*** (0.004)
SP	−0.090 (0.181)	−0.051* (0.034)
BP	−0.157 (0.172)	0.049** (0.029)
SP* Subsidy	−0.077 (0.071)	0.027*** (0.005)
BP* Subsidy	0.010 (0.108)	−0.055*** (0.010)
_cons	2.021*** (0.719)	1.593*** (0.165)
N	358	8699
R-sq	0.6495	0.500
Wald chi2	481.86***	7915.91***

Note: All regressions include a constant, industry dummies, and time dummies; standard error in brackets; *$p < 0.2$, **$p < 0.1$, ***$p < 0.05$.

positive effect of a governmental subsidy on labour productivity will be enhanced when firms possess high seller power; the positive effect of subsidies on labour productivity will be low when firms possess high buyer power.

For policymakers, it will become important to investigate the extent to which subsidies inadvertently facilitate supplier and buyer market power, as this may have negative consequences for the innovative performance of companies. As extensively discussed by Fu et al. (2016) and Fu and Mu (2014), increasingly pro-competitive incentives are required to promote company growth. By examining the business environment facing these firms in terms of buyer power and seller power, the study offers a nuanced understanding of the role of subsidies under this type of specific market conditions. Under these conditions, the paper emphasizes that it becomes increasingly important to expose these innovative firms gradually to a competitive environment whilst simultaneously reducing the negative impact of market power.

Because the State Council of China issued the 'Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries' in October 2010, the government has extensively granted governmental subsidies to companies in these industries. The objectives for industrial policy defined in this document serve as guidelines to facilitate the growth of companies in strategic industries in China. However, the media has regularly exposed problems surrounding companies which are generating hardly any additionality effects based on existing government subsidies. These companies may forego additionality benefits by reducing private R&D, forego firm-level efficiency gains and actually decrease labour productivity.

In the case that government subsidies to companies in strategic emerging industries actually crowd out R&D investment, the selection criteria for these subsidies should be reviewed. This comprises the method by which these subsidies are awarded and the way in which information about the target firms should be disclosed. Furthermore, because seller power positively moderates the effect of government subsidy on labour productivity, and buyer power negatively moderates the effect of government subsidy on labour productivity. Further governmental efforts are needed to supervise the way in which subsidies are spent to large firms with significant buyer power.

Although it is easier for the government to grant subsidies to successful firms, small start-ups face higher risks and uncertainties in their R&D investment decisions and face greater difficulties in becoming embedded in existing innovation ecosystems. Consequently, SMEs required more financial assistance from the government. This was also a research constraint for our analysis as the listed companies do not include these types of small businesses. Further research has to show whether the productivity of SMEs with market power will benefit in a similar fashion from government subsidies compared to their larger counterparts. In addition, Chinese government invest intensively in strategic emerging industries especially owing to recent trade disputes between China and the United States. Future research on the efficiency of subsidies and effect of market power can be investigated in details when new high-quality data becomes available.

Data availability

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Acknowledgements

Author contributions

JS made substantial contributions to conception and design, data acquisition and analysis, and interpretation of results, editing, revision. He also took the lead in writing the manuscript; BMS participated in the design of the study, developed the theory, provided critical feedback, and helped shape the research. XZ performed the statistical analysis and was involved in drafting the first manuscript. SD conceived the study, participated in its design and coordination, and helped to draft the manuscript and editing. JX participated in the discussion of this study, and revised the manuscript critically for important intellectual content. QS and SL participated in data collection, data analysis, editing, and discussion.

Competing interests

The authors declare no competing interests.

Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

Informed consent

This article does not contain any studies with human participants performed by any of the authors.

Additional information

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