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R&D investment and political connections - complements or substitutes? evidence from Russia

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ABSTRACT

Technological progress is an important factor in economic development, yet it can create problems for governments, if the costs are felt by their supporters while the benefits go to potential challengers. As a result, politicians face a trade-off between stifling economic growth and facing the threat of technological displacement of their supporters. This paper proposes a model of government support for innovation that preserves technological advantage of companies connected to the incumbent. Provided the government values the future higher than the companies, it can stimulate the development of new technologies by both connected and unconnected companies via co-funding the costs of innovation. In addition, it can condition the provision of additional benefits received by the connected companies on the success of their research and development (R&D) project, stimulating extra effort on their part. This model implies three observable implications: governments will distribute cost-reducing grants to both connected and unconnected companies; connected companies will show a larger effect of R&D grant support on economic performance; and during the assessment period of R&D projects, government contracts will preferentially support connected companies. Analyzing evidence from a cost-reducing R&D support program in Russia, a trajectory-balancing approach produces results consistent with each of these implications.

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1. Introduction

Innovation is key to long run economic development (Aghion & Howitt, 1990; Aghion et al., 1998; Romer, 1990), but often causes painful shifts in economic structure, displacing workers and reducing the value of capital and specialized labour tied to old technologies.[1] It can create 'superstar firms' (Autor et al., 2020) with abnormal returns, while rendering others obsolete (Bloom et al., 2013). Banerjee and Duflo (2019) compare these effects to those of international trade: increasing technological development benefits society on

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the whole, but can have negative effects on the groups and industries left behind. While the political economy of trade has been studied, the political economy of technological development to date focussed on international settings (Ruttan, 2006; Taylor, 2016). This paper, by contrast, focuses on domestic setting. For political leaders these highly uneven returns to new technologies can also threaten to shift the balance of power in the economy, reducing the wealth of key supporters while generating a wealthy and powerful group that may challenge the regime. Politicians may thus appear to have incentives to stifle the development of new technologies, just as they sometimes do to impose trade barriers (Acemoglu & Robinson, 2006; Mokyr, 1992a, 1992b).

As a result, politicians face a trade-off between limiting economic growth – a costly action since most political leaders depend on positive economic growth for popular support and legitimacy – and facing a threat of technological displacement of their supporters. Yet, instead of suppressing innovation, governments have historically played a large role in fostering it via different policy tools: intellectual property rights regulations (Acemoglu & Akcigit, 2012; Hu & Jaffe, 2007; Lerner, 2009; Moser, 2005, 2013; Moser & Nicholas, 2013; Moser et al., 2013), tax credits (Akcigit et al., 2022; Dechezlepretre et al., 2020; Guceri & Liu, 2017) and direct grants and programs (Azoulay et al., 2019; Bronzini & Iachini, 2014; Ganguli, 2017; Lach et al., 2017).[2]

How can this apparent contradiction be reconciled? This paper proposes an explanation: the government's incentive is not to block technological change altogether, but rather to channel it so as to firms and industries allied to the regime can retain or even improve upon their position in the economy. In the proposed formal model, though government support for innovation flows to companies whether they are politically connected to the incumbent or not, the technological advantage of the allied companies is maintained. Since social impact of technologies is greater than corporate one due to positive spillovers, this can stimulate the development of new technologies by both connected and unconnected companies via co-funding the costs of innovation. The success of R&D project depends on the effort of companies. The incumbent is able to condition additional progress-contingent benefits to connected companies, stimulating and offsetting the cost of that effort.

There are several observable implication of this model. First, it predicts that governments will provide co-investment in corporate R&D projects to both connected and unconnected companies. Second, such R&D grants should have higher impact on technology generation of connected companies. Third, connected grant recipients should outperform unconnected recipients on economic performance. Forth, connected companies that engage in government-sponsored R&D project are expected to receive higher levels of other types of government funding, if successful, but only after the assessment of the progress of their R&D project. At the same time, unconnected companies should expect no changes in other types of government funding after receiving government R&D grant.

In order to test these observable implications, I investigate a program of R&D support implemented by the Russian government since 2010 (the Decree 218 Program). This program provides government grants to Russian companies that purchase the creation of new technologies from Russian universities. Under the terms of the grant, the company has to co-invest an amount equal to or greater than the size of the government grant, which the university cannot spend for other purposes.

I find, first, that grants go to both connected and unconnected companies, consistent with the first prediction. Consistent with the second prediction, connected companies appear to benefit more than unconnected ones from winning these grants and generate greater number of patents. Specifically, while winning a grant had only insignificant effects on outcomes for unconnected companies, connected companies generated more patents and showed greater profits and returns on assets. Third, in keeping with the final prediction, connected companies that won grants showed a higher volume of government contracts two years later during the R&D assessment period, while unconnected companies showed no difference.

This paper contributes to several strands of literature. First, it is related to the literature on the value of political connections. Many studies show that they are value-enhancing (see, for example, Acemoglu et al., 2016; Akey, 2015; Ang et al., 2013; Faccio, 2006; Faccio & Parsley, 2009; Fisman, 2001; Ovtchinnikov & Pantaleoni, 2012; Voth & Ferguson, 2008). Political connections can help companies in different ways. They allow companies to gain better access to external funding (Claessens et al., 2008; Cull et al., 2015; Khwaja & Mian, 2008) and government help in times of crises (Duchin & Sosyura, 2012; Faccio, 2006). Connected companies are more likely to obtain government support in the form of contracts or subsidies (Goldman et al., 2008; Johnson & Mitton, 2003; Tahoun, 2014). Such companies can enjoy better protection from government expropriation (Batta et al., 2014) or law enforcement (Correia, 2014; Wu et al., 2016). Political connections can bend government policy to favor certain firms (Agrawal & Knoeber, 2001; Claessens et al., 2008). Fifth, political connections can provide a firm with relevant information that allows it to optimize its strategy (Cohen & Malloy, 2014; Ovtchinnikov et al., 2019).[3] This paper suggests that connected companies benefit from government R&D investment more then unconnected ones. It underscores that the incumbent may be incentivized to provide partial access to government support to unconnected companies, while providing performance-based bonus to connected. This is in contrast to the common wisdom that incumbent either channel all benefits to connected firms or provide equal benefits to all companies, providing a more nuanced view of the role of political connections.

Next, this paper contributes to the literature on the effect of government R&D policy on technological development (see, for example, Akcigit et al., 2022; Dechezlepretre et al., 2020; Guceri & Liu, 2017). In particular, Bronzini and Iachini (2014), Azoulay et al. (2019), Ganguli (2017) and Lach et al. (2017) look at the effect of government grants on company R&D effort and resulting innovation.

Finally, it speaks to emerging literature on the role of political connection in firm innovation. The role of political connections seems to depend on the context of the country in which the company operates. For example, Akcigit et al. (2023) find that in Italy, politically connected companies make less R&D investment and produce fewer patents than unconnected ones. By contrast, Su et al. (2019) find that in China, politically connected companies generate more innovation compared to unconnected ones, with government subsidies being the mediator in this relationship. Ovtchinnikov et al. (2019) find that US companies engaging in political activism (campaign contributions) obtain additional information, thus reducing political risks. Consequently, they invest in R&D more and produce more patents. This paper presents an alternative explanation. Rather then focussing on firm's access to information, I suggest that it's the government's willingness to act on the information about the success of the R&D project implemented by the connected companies that drives the latter to invest extra effort into innovation compared to unconnected ones.

This paper is organized as follows: Section 2 provides a model of choice of government R&D policy. Section 3 provides the building block for the empirical tests: Subsection 3.1 provides information about the state of government R&D policy and Decree 218 in particular. The sample is presented in Section 3.3. Section 3.5 provides a brief overview of the methods. Finally, I test empirical implications of the model in Sections 4–6. Section 4 illustrates that political connections alone don't determine the receipt of the grant. Section 5 investigates the role of winning a grant on firms' performance. Section 6 presents evidence of a potential mechanism of additional funding provided to connected companies for their R&D effort. Section 7 provides the discussion and Section 8 concludes.

2. Model: incentivizing innovation through politically conditional grants

This paper proposes a model the strategic use of innovation subsidies by an incumbent government that faces a trade-off between promoting economic growth and maintaining political control. Firms differ in their political connection to the incumbent, and the government designs a grant program that offers cost-sharing subsidies and performance-contingent bonuses. In this paper, I do not consider tax incentives, direct government R&D creation or investment in scientific infrastructure, focussing exclusively on grant programs. Government support is funded by the positive externalities of innovation.

Consider a model with a politician and a continuum of firms $i \in [0, 1]$. A share $\theta \in (0, 1)$ are *connected* to the incumbent; the remaining $1 - \theta$ are *unconnected*. Connected firms support the incumbent and are visible to him: the politician learns about their success at no cost.

Each firm decides whether to undertake a risky R&D project. A project costs I and succeeds with probability equal to effort e_i. Effort is privately costly, and successful projects generate a total social return of V, of which the firm privately appropriates γV, while $(1 - \gamma)V$ is a spillover that accrues to the government and society more broadly. Because returns are risky and non-collateralizable, firms cannot effectively borrow to fund these investments. Let us focus on marginal firms that will invest only if the government provides a grant of size g, awarded with probability π. A well-designed innovation policy should precisely target this set, rather than reward firms that would conduct R&D regardless of subsidies (Bloom et al., 2019). In addition to grants, the government can award performance-contingent bonus B_C to connected and to unconnected (B_U) companies.

The politician cares about both economic growth and political stability. Economic growth is captured by the aggregate value of successful innovations $G = \pi[\theta e_C + (1 - \theta) e_U]$. Political stability is achieved when loyal (connected) firms disproportionately benefit from that growth $D = \theta e_C - (1 - \theta) e_U$, ensuring that economic power does not shift away from the incumbent. Let $\alpha \in [0, 1]$ index the politician's preference for economic growth; $(1 - \alpha)$ captures the weight on ensuring that growth is concentrated among connected firms.

The government balances the trade-off between economic growth and preserving economic power by choosing the rules of grant and bonus allocation. We focus on four different Regimes of R&D funding:

Table 1. Notation and definitions.

Symbol	Definition
$i \in [0, 1]$	Index for firms (continuum of mass 1)
$\theta \in (0, 1)$	Fraction of firms that are *connected*
$1 - \theta$	Fraction of firms that are *unconnected*
I	Fixed cost of undertaking an R&D project
g	Grant size (assumed $g = I$)
$\pi \in (0, 1]$	Probability that any given firm receives a grant
$e_i \in [0, 1]$	Effort level of firm i (success probability)
e_C	Effort of a connected firm, if granted
e_U	Effort of an unconnected firm, if granted
$c>0$	Cost parameter: effort cost is $\frac{c}{2} e_i^2$
$V>0$	Social return from a successful innovation
$\gamma \in (0, 1)$	Share of V appropriated privately by the firm
$(1 - \gamma)V$	Spillover to the public from a success
$B_C \geq 0$	Success-contingent bonus per unit of effort for connected firms
$B_U \geq 0$	Success-contingent bonus per unit of effort for unconnected firms
$\alpha \in [0, 1]$	Weight the politician places on economic growth (vs. political dominance)
G	Expected aggregate growth $= \pi[\theta e_C + (1 - \theta) e_U]$
D	'Connected-dominance' $= \theta e_C - (1 - \theta) e_U$
U_G	Government's expected utility

We focus on four benchmark policy regimes (which differ in who is eligible for grants and bonuses):

- **Regime 1: Fully Inclusive (Grants and Bonuses to All): $(B_C, B_U) = (B, B)$** All firms receive R&D grants with probability π, and both connected and unconnected firms are eligible for performance-contingent bonuses B upon success.
- **Regime 2: Partially Inclusive (Grants to All, Bonuses to Connected): $(B_C, B_U) = (B, 0)$** All firms receive R&D grants, but only connected firms are eligible for success-contingent bonuses.
- **Regime 3: Exclusive with Bonus (Grants and Bonuses to Connected Only): $(B_C, B_U) = (B, 0)$** Only connected firms receive R&D grants, and only they are eligible for bonuses.
- **Regime 4: Exclusive without Bonus (Grants Only to Connected): $(B_C, B_U) = (0, 0)$** Only connected firms receive R&D grants. No firm receives any bonus.

Table 1 summarizes notation and definitions.

2.1. Government utility function

The government maximizes the following utility function, taking into account the economic effect of the grant program, its political effect, and its cost:

$$U_G = \underbrace{\alpha V \pi[\theta e_C + (1 - \theta) e_U]}_{\text{expected growth benefit}} + \underbrace{(1 - \alpha) [\theta e_C - (1 - \theta) e_U]}_{\text{economic power preservation}} - \underbrace{\pi\left[g + \theta B_C e_C + (1 - \theta) B_U e_U\right]}_{\text{expected fiscal cost}}.$$

Here, expected fiscal cost is comprised from grants and bonuses and equals $\pi g + \pi [\theta B_C e_C + (1 - \theta) B_U e_U]$.

Government support for R&D is financed through the social spillovers from innovation. Spillover revenue per firm from each successful innovation is $\pi(1 - \gamma) V [\theta e_C + (1 - \theta) e_U]$.

The budget constraint requires that the expected public cost — grants plus bonuses — does not exceed the expected value of spillovers:

$$\pi\big(g + \theta B\, e_C\big) \le \pi\,(1-\gamma)\,V\,[\theta\, e_C + (1-\theta)\, e_U].$$

The **timing** of the model is as follows:

(1) The government publicly announces the grant g and the bonus schedules (B_C, B_U), thereby defining the regime.
(2) Each firm $i \in \{C, U\}$ observes g and its own bonus B_i, then chooses effort e_i (cost $\frac{c}{2}e_i^2$).
(3) The government disburses grants and bonuses. Outcomes (success vs. failure) are realized given the chosen efforts.

2.2. Firm behaviour

Each firm $i \in [0, 1]$ decides whether to undertake a risky R&D project and how much effort $e_i \in [0, 1]$ to exert. Projects cost I and succeed with probability e_i. Upon success, the firm privately appropriates γV, while $(1-\gamma)V$ accrues as social spillover. Exerting effort e_i costs $\frac{c}{2}e_i^2$.

Because venture capital is underdeveloped, firms cannot borrow to finance the fixed cost I. As such, only those who receive a grant of size g can invest. We focus on *marginal* firms (i.e. those indifferent at g), so to simplify, assume $g = I$. In other words, the grant fully covers the fixed cost, and a grant-receiving firm's post-grant payoff is

$$\max_{e_i \in [0,1]} \; e_i(\gamma V + B_i) - \frac{c}{2}e_i^2.$$

Hence the interior solution (as long as $\gamma V + B_i \le c$) is

$$e_i^* = \frac{\gamma V + B_i}{c}, \quad e_i^* = 1 \quad \text{if} \; \frac{\gamma V + B_i}{c} > 1.$$

Because each firm receives a grant with probability π, its ex ante expected effort is

$$\mathbb{E}[\, e_i\,] = \pi\,\frac{\gamma V + B_i}{c}.$$

Under different regimes, connected firms have $B_C = B$ (or 0) and unconnected firms have $B_U = B$ (or 0) as dictated by the regime.

2.3. Regime comparison under **budget slack**

When the value of innovation V is sufficiently large, none of the regimes' budget constraints bind. In this 'budget slack' case, each regime can choose its interior bonus B to maximize utility. Each regime's utility $U_r(B)$ under optimal firm effort levels already and bonuses are presented below. Derivations of the optimal $B_r^*(\alpha)$ appear in Appendix A.

When V is large enough that none of the budget constraints binds, each regime can choose its unconstrained interior bonus $B_r^*(\alpha)$. In Appendix A we derive those interior bonuses. Here we simply plug effort into each utility:

Regime 1 (Fully Inclusive). Connected and unconnected firms both choose

$$e_C = e_U = \frac{\gamma V + B}{c}.$$

Let

$$A_1 := \alpha V + (1 - \alpha)(2\theta - 1).$$

Then (with $\pi = 1$ for expositional simplicity)

$$U_1(B) = \frac{1}{c}(\gamma V + B)(A_1 - B) - g,$$

subject to the slack constraint

$$g + B\,\frac{\gamma V + B}{c} \le (1 - \gamma)\,V\,\frac{\gamma V + B}{c}.$$

Regime 2 (Grants to All, Bonuses to Connected). Connected firms choose

$$e_C = \frac{\gamma V + B}{c}, \quad e_U = \frac{\gamma V}{c}.$$

Let

$$A_2 := \alpha V + (1 - \alpha).$$

Then

$$U_2(B) = \frac{1}{c}\big[A_2\big(\theta(\gamma V + B) + (1 - \theta)\,\gamma V\big) - \theta B\,(\gamma V + B)\big] - g,$$

subject to

$$g + \theta\,\frac{B\,(\gamma V + B)}{c} \le (1 - \gamma)\,V\left[\theta\,\frac{\gamma V + B}{c} + (1 - \theta)\,\frac{\gamma V}{c}\right].$$

Regime 3 (Exclusive with Bonus). Only connected firms receive grants and bonus B. Thus

$$e_C = \frac{\gamma V + B}{c}, \quad e_U = 0,$$

and let

$$A_3 := \alpha V + (1 - \alpha).$$

Then

$$U_3(B) = \frac{\theta}{c}[A_3(\gamma V + B) - B(\gamma V + B)] - \theta g,$$

subject to

$$g + \frac{B\,(\gamma V + B)}{c} \le (1 - \gamma)\,V\,\frac{\gamma V + B}{c}.$$

2.4. Interior bonuses and cutoffs (summary)

Appendix A shows that when none of the budget constraints bind, the first-order conditions yield:

$$
\begin{aligned}
B_1^*(\alpha) &= \frac{\alpha V + (1-\alpha)(2\theta - 1) - \gamma V}{2}, \\
B_2^*(\alpha) &= \frac{(\alpha - \gamma)\, V + (1-\alpha)}{2}, \\
B_3^*(\alpha) &= \frac{(\alpha - \gamma)\, V + (1-\alpha)}{2}.
\end{aligned}
$$

When these formulas are negative, we set $B_r^* = 0$. Substituting back gives closed-form expressions $U_r\big(B_r^*(\alpha)\big)$. In particular, one finds three cutoff values:

$$
\alpha_{2,3}^* = \frac{cg + \gamma V}{\gamma V (1+V)}, \qquad \alpha_{1,2}^* = \frac{3 + \gamma V}{3 + V}.
$$

(Appendix A also checks that Regime 4 is strictly dominated by Regime 2 when slack holds.)

Hence, under *budget slack*, the ranking is:

$$
\alpha < \alpha_{2,3}^* \Longrightarrow \text{Regime 3}, \qquad \alpha \in (\alpha_{2,3}^*,\ \alpha_{1,2}^*) \Longrightarrow \text{Regime 2}, \qquad \alpha > \alpha_{1,2}^* \Longrightarrow \text{Regime 1}.
$$

In particular, for any α in the middle interval $\big(\alpha_{2,3}^*,\ \alpha_{1,2}^*\big)$, *Regime 2* (grants to all, bonuses only to connected) is strictly optimal when V is large enough that none of the budget constraints binds.

Figure 1. Regime regions on $\alpha \in [0, 1]$ under budget slack.

When innovation value V is low, the budget constraint may bind, forcing each regime to use a capped bonus $\bar{B}_r$. In that case, it must set the bonus equal to the regime-specific feasible $\bar{B}_r$, the government's fiscal space is limited, and it cannot afford broad, incentive-compatible inclusion. In this case, it may resort to more exclusive regimes and limit bonus use to high-loyalty cases. Numerical example for the constrained case, as well as corresponding regime rankings is presented in Appendix A.

Why Regime 3 wins at low α: Political dominance (weight $(1-\alpha)$) outweighs growth, so the government excludes unconnected firms entirely and funnels everything (grant + bonus) to connected firms. Regime 2 dominates at intermediate α: A positive weight on growth requires including unconnected firms, but still rewarding connected firms with a bonus. This maximizes growth relative to Regime 3 while preserving some political advantage over Regime 1. Regime 1 dominates at high α: When growth is nearly all that matters, fully inclusive regime dominates. Because Regime 4 both excludes unconnected firms (hurting growth) and does not offer a bonus to connected firms (leading to lower

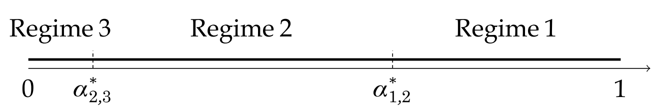

Figure 1. Regime selection by α under budget slack. From left to right: Regime 3 when $\alpha < \alpha_{2,3}^*$; Regime 2 when $\alpha_{2,3}^* < \alpha < \alpha_{1,2}^*$; Regime 1 when $\alpha > \alpha_{1,2}^*$.

effort), it is never the best response when the government can set an interior bonus in Regime 2 to satisfy its budget slack.

2.5. Empirical implications

The model suggests that Regime 2 — where all firms receive grants, but only connected firms are eligible for performance-contingent bonuses — is optimal under a broad range of political preferences $\alpha \in (0, 1)$, both when the government faces budget slack and when it is constrained by limited public spillover revenue. This regime allows the incumbent to balance two objectives: stimulating economic growth through broad-based grant access, and consolidating political power by tying additional support to performance among connected firms. It provides a rationale for a partially-inclusive allocation strategy in which unconnected firms are not excluded from funding, but connected firms are better positioned to capture follow-on rewards. So, the model suggests that one expects that connection status alone would not be able to predict the receipt of the grant.

Next, under this partially-inclusive regime (all firms receive the baseline grant, but only connected firms earn a success-contingent bonus), connected companies have greater incentives to invest effort into resulting R&D projects. Recall that interior-solution effort levels:

$$B_2^*(\alpha) = (\alpha - \gamma)\,V + \frac{1}{2}\,(1 - \alpha) \Longrightarrow e_C^* = \frac{\gamma V + B_2^*(\alpha)}{c}, \quad e_U^* = \frac{\gamma V}{c}$$

where

- $B_2^*(\alpha)$ is the equilibrium bonus awarded to connected firms,
- e_C^* and e_U^* are equilibrium R&D effort of connected vs. unconnected firms,
- V is the project's gross payoff, γ the government's co-funding share, α the weight the government places on future productivity, and c the cost parameter.

Key Comparative Statics:

$$e_C^* - e_U^* = \frac{B_2^*(\alpha)}{c} > 0 \quad \text{whenever} \quad (\alpha - \gamma)\,V + \frac{1}{2}\,(1 - \alpha) > 0, \tag{1}$$

$$\Pr(\text{success}_C) - \Pr(\text{success}_U) = e_C^* - e_U^* = \frac{B_2^*(\alpha)}{c}. \tag{2}$$

Even though both connected and unconnected firms receive the same upfront grant, connected firms exert strictly higher effort and thus enjoy strictly greater success probability-so long as the government's bonus is positive (i.e. $(\alpha - \gamma)V + \frac{1}{2}(1 - \alpha) > 0$).

Since companies appropriate part of the value of innovation, they are expected to benefit more than unconnected companies as a result of the grant beyond the number of generated technologies.

Finally, under this partially-inclusive regimes we should expect to see some additional government funding flowing to connected companies that generate more patents as a result of the grant, and not such reward for unconnected companies.

Overall, this setting challenges the conventional view that in regimes with politically driven resource allocation, favoritism alone explains all patterns of support. Instead, when incumbents care about both economic growth and political loyalty, a mixed strategy – inclusive grants paired with selective, performance-based rewards – can be both economically and politically rational.

In what follows, I demonstrate that between 2008–2016 at least one government R&D program in Russia followed this partially-inclusive regime: grants were awarded broadly, yet only politically connected firms obtained follow-on contracts after the two-year evaluation period. Although explicit 'bonuses' for regime allies are uncommon, government contracts often function as political rewards (Goldman et al., 2008; Johnson & Mitton, 2003; Tahoun, 2014). We therefore interpret these contracts as the empirical counterpart to the model's conditional bonus *B*. Consistent with this mechanism, connected firms that generated new patents were significantly more likely to secure post-evaluation contracts, translating into superior performance in both technology and product markets relative to unconnected winners.

3. Background and data: Russia's decree 218 program

In what follows I first provide relevant background on the Russian R&D policy landscape, then details of Decree 218, followed by details of the data collection for the empirical test case.

3.1. Russian R&D policy

Before the collapse of the USSR, the Soviet/Eastern European scientific community accounted for close to one-third of the world's scientists and engineers as well as R&D expenditures (Graham & Dezhina, 2008; Sagasti et al., 1994). In 1991, it was pauperized overnight.

With severe economic crisis hitting Russia, no money was available to continue R&D funding, leading to shortages of lab supplies and months of unpaid wages (Ganguli, 2017). Many scientists chose to to continue their careers in the United States, Israel, or Europe. By 1993, the Russian government estimated that there was a 35.2 percent decrease in the researchers working in higher education institutions (Graham & Dezhina, 2008).[4] In the early 2000s, with the economy recovering, observers still saw Russia's science and technology as its 'major untapped resource' (Sher, 2000). Despite the USSR's scientific legacy, Russia's innovative performance remains astonishingly low, coining the term 'Russian innovation paradox' (Gianella & Tompson, 2007). The explanations for such poor performance include the deterioration of human capital (Gaddy & Ickes, 2013), weak intellectual property rights protection (Aleksashenko, 2012), and territorial imbalances in access to world technologies through multinational corporations (Crescenzi & Jaax, 2017). Among many determinants of unsatisfactory innovative performance, scholars underscore two: weak demand for R&D in the economy and low government funding for R&D (Alexeev et al., 2013). In 2010, the Russian government decided to tackle both of them with Decree 218, aimed at generating demand for Russian R&D from private companies and relaxing their budget constraints on innovation investments.

3.2. Decree 218

In 2010, the Russian government issued Decree 218 called 'Measures of state support for development of cooperation between Russian universities, research organizations and companies which implement complex projects for high-tech production.' Its mechanism is similar to that of matching grants – one of the broadly used tools of R&D policy. The main feature of this tool is that manufacturing companies that implement projects can be the direct recipients of public funding that has been earmarked for universities. The company that implements the project pays for up to half of the R&D costs using the funds that it received from the government. It then conducts the project jointly with its university partner (218, 2020). The program was deemed as one of the most successful based on interviews with company managers (Simachev et al., 2014), interviews with universities (Uskov et al., 2018), and the assessment of progress based on the 2010–2013 waves (Dezhina & Simachev, 2013). In short, Decree 218 grants do seem to result in creation of new technologies that are purchased and implemented by winning companies.

Over 2010–2018, the winners of nine rounds were announced and 45.1 billion rubles (around 750 million USD) was allocated to them. The typical grant equaled 210 million rubles in 2010 (around 7 million USD). By the terms of the contract, companies had to co-invest funds matching at least 100% of the government subsidy in R&D. Winners that failed to implement the R&D project in accordance with the grant obligations are obliged to return the funds received from the government, sometimes with a fine. They could deduct the cost of R&D expenses they had already paid in case of force majeure during the R&D phase. Over the observed 2010–2016 time period, 1946 companies have applied for the grant, and 202 have received it.

3.3. Data

The sample consists of companies that applied for a Decree 218 government grant over the 2010–2016 time period. The list of names and addresses of such companies is available on the Decree 218 website, together with the lists of winners of each wave of the grant. Furthermore, using the Kontur-Focus service that searches company details from official registries, I establish registration numbers for each company. Twenty percent of Decree 218 companies return multiple candidates in the Kontur-Focus database. For these, I employ record linkage based on name and address, and later check the industry of the candidate company to verify correct record linkage. Using the company registration number, I collect data about their date of registration, owner, industry, gross profits, returns on assets (ROA), returns on equity (ROE), sales, revenues, and fixed assets over the 2008–2016 time period from the SPARK database. Of 1946 companies that applied for a grant, I was able to recover economic data for 1237 companies. The oldest company in the sample was created in 1957, the youngest in 2016. Government procurement data for each company and year is collected through the ClearSpending database,[5] collected by the Civil Society Committee. The composition of Decree 218 applicants by application status and industry is presented in Table 2. On average, the company that applied for Decree 218 grant at least once had a 17% chance of obtaining it. The majority of applications and winners were concentrated in manufacturing, technology and retail sectors. Yet the chances of winning a grant for companies operating in these industries were smaller then for companies in administration, real estate or agriculture. Data from Russian patent covers 2008–2016, and comes from RUSPTO — Russian patent office.

Summary statistics for the main variables of interest are presented in Table 3. There is significant variation in economic outcomes of companies in the sample. Note that many

Table 2. Summary statistics: application decisions by industry.

Industry	Loser	Winner	Share of winners
Administration	5	2	0.40
Agriculture	17	4	0.24
Arts & recreation	24	4	0.17
Construction	43	6	0.14
Education	3	0	0
Electricity & gas	8	1	0.12
Finance	1	0	0
Food service	2	0	0
Health	0	0	NA
ICT	42	10	0.24
Manufacturing	463	77	0.17
Mining	37	5	0.14
Other	4	0	0
Public Administration	15	1	0.07
Real Estate	23	8	0.35
Technology	204	39	0.19
Retail	122	20	0.16
Transportation	17	2	0.12
Water and Utilities	5	1	0.20
Total	1035	180	0.17

Table 3. Summary statistics (raw data).

Statistic	*N*	Min	Max	Mean	St. Dev.
log(Gross Profit)	6696	6.908	25.725	16.607	2.812
log(Fixed Assets)	5096	−6.908	23.712	13.607	3.706
ROA	8118	−46.500	151.033	0.152	2.574
ROE	8015	−232.500	832.000	0.337	10.953

companies in the collected sample have some economic outcomes missing in some years. In cases where I control for pretreatment economic outcomes, I employ a multiple imputation procedure (van Buuren et al., 2015) to fill the gaps in the raw data, together with identifiers of missingness (a dummy variable that is set to 1 if the observation is imputed, 0 otherwise) for each variable. This approach helps me to alleviate the failure of 'missing at random' assumption. I do not impute outcome variables of interest, so for the approaches that require the balanced panel (Section 3.5), I remove the companies that have at least one missing observation.

Reassuringly, in the last year before the onset of the Decree 218 program, companies that won a grant in any wave of the program were similar to applicants that never won a grant on many characteristics (Table 4). Notably, however, winners had higher level of fixed assets.

Table 4. Winners and losers look similar in 2009.

	Losers	Winners	*p*-value
ROA	0.035	0.044	0.69
ROE	0.095	0.2	0.66
Gross Profit	$245*10^6$	$97*10^6$	0.56
Authorized Capital	$3.89*10^9$	$11*10^6$	0.63
Fixed Assets	$47*10^6$	$311*10^6$	0.04

3.4. Measuring political connections

Corporate political connections can take many forms and, consequently, require different approaches to measurement. The seminal paper of Fisman (2001) relies on opinions of consultants to detect if a company enjoys political connection to Suharto. Other studies proxy political connections with corporate political activism via contributing to campaigns (Akey, 2015; Claessens et al., 2008; Jayachandran, 2006; Voth & Ferguson, 2008), lobbying efforts (Sobel & Leeson, 2006), employing former or current politicians (Akcigit et al., 2018; Canayaz et al., 2015; Faccio, 2010; Nee & Opper, 2010), having a member of management appointed by government (Cull et al., 2015), or coming from the same town/village/home district (Faccio & Parsley, 2009). Some papers rely on a combination of different measures (Acemoglu et al., 2016; Eggers & Hainmueller, 2014).

The approach presented in this paper is closest to Lamberova and Sonin (2018a), where the authors measured social ties as co-occurrence of members of predefined populations in general web pages through the news section of the most popular Russian search engine, Yandex. The populations of interest are owners of companies applying for Decree 218 government grants and members of the dacha cooperative 'Ozero' that is comprised of Vladimir Putin's inner circle. I append the list of 'Ozero' members with others – university friends, former colleagues, and relatives – whose biographies and connections to Vladimir Putin were featured in Novaya Gazeta, a newspaper famous for its journalistic investigations. The benefit of this approach is in the omission of joint mentions, in which any of the firm owners cited Vladimir Putin, a sitting president of Russia, or refer to him in his official capacity. Connections of Vladimir Putin and 'Ozero' members were featured in Forbes Russia, Bloomberg, Novaya Gazeta,[6] etc. All inner circle members formed their relationships with Vladimir Putin before his accession to power. The resulting list is conservative and not exhaustive. However, omission of inner circle members would bias my results downward, since the failure to detect connections to missing inner circle members means that some of the 'unconnected' businessmen might in fact be connected to the inner circle member I don't observe. Many sources have noted that Vladimir Putin manages a lot of his business connections through the members of his inner circle (Dawisha, 2015; Morrison, 2019). Thus, it is straightforward to assess the political connection of a company/individual based on the connection to one of such people.

Instead of investigating the whole network of interactions, I focus on direct connections, as they were found to be the most important in previous research (Lamberova & Sonin, 2018a). I use both a binary measure of connection (1 if a company owner is connected to at least one of 24 people in the 'inner circle' list, 0 otherwise) and the number of 'Ozero' members the company owner is connected to.

3.5. Trajectory balancing

In what follows, I employ two main methods: factorial difference-in-difference (Xu et al., 2024) and kernel-based trajectory balancing. Factorial difference-in-differences speakes to heterogeneity of effect of winning a grant by group (connected and unconnected) in a two-way fixed effects specification. The main specification of interest, however, is trajectory balancing, introduced in Hazlett and Xu (2018). It tolerates time-varying confounders in order achieve the causal interpretation of the effects of government R&D grants on corporate performance. This method is an approach to the more general Synthetic Control Method (Abadie et al., 2010; Abadie & Gardeazabal, 2003; Cavallo et al., 2013). The intuition behind the synthetic control is as follows: assume that there exists a set of omitted time-varying confounders and that some time-fixed linear combination of these confounders affects the outcomes of both the treated and control units. These confounders enter control units to different degrees. Then, weighting the control units to make their averaged pretreatment trend match that of the treated units replicates the combination of confounders that must be influencing the treated unit as well. So, with these weights on the control units, the time-varying confounders are differenced out. The Synthetic Control Approach approach relies on the Linearity in Prior Outcomes assumption. Hazlett and Xu (2018) relax this assumption and balance on the high-order 'trajectory' of pretreatment outcomes rather than their period-wise average. It ensures that overall distributions of trajectories are similar between the treatment group and the reweighted control group.

The weights put on control units are chosen such that

$$\frac{1}{N_{tr}}\sum_{G_i=1}\phi(Y_{i,pre}) = \sum_{G_i=0}\phi(Y_{i,pre}), \tag{3}$$

and $\sum_{G_i=0} w_i = 1$, $w_i > 0$ for all i in the control group. The choice of ϕ is achieved through a similarity measure: a Gaussian kernel $k(Y_i, Y_j) = exp(-\|Y_i - Y_j\|^2/h)$. Then, under assumptions of conditional ignorabilty, linearity of pretreatment outcomes in $\phi(Y_{i,pre})$, and feasibility of weights (the existence of non-negative weights that achieve kernel balancing), the ATT_t is calculated as follows:

$$\widehat{ATT}_t^k = \frac{1}{N_{tr}}\sum_{G_i=1} Y_{it} - \sum_{G_i=0} w_i Y_{it}. \tag{4}$$

Since there are substantial number of pre-treatment outcomes to be balanced, achieving the balance on both level and dynamics proved to be different. Hazlett and Xu (2018) solve this problem by allowing an intercept shift for each unit. Before reweighting, the average outcome from period T1 to period T0 is subtracted from the original outcome for each unit, making the outcome of each treated or control unit mean zero in the pre-treatment period. Thus, we focus on the imbalance in dynamics but not levels. This assumption imposes the parallel trends assumption similar to the one that exists for difference-in-difference model. Figure C1 presents the trends of the logarithm of gross profits by connection status and group. Note that companies that won R&D grant at least once did it in different periods. However, we can see that the trends in profits were parallel before the start of the program, i.e. before any company had a chance to win a grant.

4. Test of implication 1: political connections and grant allocation

Though there is evidence that politically connected companies in Russia do typically receive preferential treatment.[7] By contrast, this model predicts that for the type of program analyzed here, the government will not be preferential in awarding grants to more connected companies. Does this prediction hold up?

As shown in Table 5, in the last year before the R&D grant program was implemented (2009), politically connected companies differed were, on average, more profitable and had greater authorized capital and fixed assets.

Table 5. Politically connected companies were different in 2009.

	Unconnected	Connected	*p*-value
ROA	0.035	0.036	0.948
ROE	0.200	−0.588	0.006
Log(Gross Profit)	16.018	16.812	0.001
Authorized capital	14.251	15.279	0.002
Fixed Assets	12.469	13.659	0.002

Table 6. Connections and grant awards.

	Unconnected	Connected
Loser	849	204
Winner	153	31

Yet, the simple tabulation of award and connection statuses of companies in Table 6 suggests that, if anything, connected companies are slightly less likely to win the grant: 15.1% of connected applicants win the grant, and 18% of unconnected win a grant.[8]

5. Test of implication 2: effects of government R&D grants of corporate performance

In this section, I test the second observable implication of the theoretical model, namely that politically connected companies benefit more from implementing R&D projects. I focus on the following outcomes: gross profit, fixed assets, sales, and revenues. Fixed assets are especially important, since purchase of new equipment or patents (behaviour that is expected of winners of a 218 grant) should be reflected here. I also look at two indicators of corporate performance – Returns on Assets (ROA) and Returns on Equity (ROE).[9]

In order to investigate if receiving a government R&D grant results in better economic performance, I first consider a fixed effects model. The most common approach to the estimation of a fixed effects model with varying treatment timing takes the following form[10]:

$$Y_{it} = \alpha_t + w_i + \beta D_{it} + \theta X_i + \epsilon_{it} \tag{5}$$

where where Y_{it} is the outcome of interest, α_t is a time-fixed effect, w_i is a 'group' fixed effect, D_{it} is a treatment indicator that is equal to one if company i is holds a grant at time t and zero otherwise, X_i is a vector of observed characteristics, and ϵ_{it} is an error term.

Differentiating between effects of receiving a grant for connected and unconnected companies would require modifying Equation (5) in the following way:

$$Y_{it} = \alpha_t + w_i + c_i + \beta D_{it} + \gamma D_{it} {*} c_i + \theta X_i + \epsilon_{it} \tag{6}$$

where c_i is a 'connected' fixed effect. Vector X_i is comprised of firm-level variables, namely, amount of authorized capital in 2009, year of registration, and 2009 economic outcomes: Log(Gross Profit), Fixed Assets, ROA, and ROE. Controlling for pretreatment economic outcomes should attenuate the endogeneity problem that arises from the fact that winning companies are more likely to be systematically different from losing companies.

Table 7 suggests that companies that win a government 218 grant at any time during 2010–2016 period, in general, have higher profits and fixed assets. Connected companies

Table 7. Political connections, government R&D grant and economic performance.

	Dependent variable:			
	log(Gross Profit) (1)	ROE (2)	ROA (3)	log(Fixed Assets) (4)
Ever Won	0.189***	−0.161	0.090	−0.238**
	(0.069)	(0.351)	(0.080)	(0.106)
Connected	0.151**	−0.476	−0.069	−0.093
	(0.064)	(0.327)	(0.075)	(0.098)
Grant Received	−0.024	−0.545	−0.110	0.314**
	(0.117)	(0.564)	(0.129)	(0.158)
Grant Received*Connected	0.718***	0.750	0.085	0.725**
	(0.236)	(1.163)	(0.267)	(0.312)
Constant	12.803	−62.067	−11.995	−25.719**
	(8.227)	(42.667)	(9.744)	(12.466)
Industry FE	+	+	+	+
Econ Controls	+	+	+	+
Observations	6556	7867	7967	5019
R^2	0.510	0.007	0.046	0.459
Adjusted R^2	0.508	0.003	0.042	0.456
Residual Std. Error	1.963	11.037	2.543	2.685
F Statistic	226.690	1.800	12.660	141.187
Robustness value	0.037	0.0073	0.0036	0.032

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

tend to have higher profits. Companies that have already won the grant (in the current or previous period) have higher fixed assets. Connected companies that have already won the R&D grant have much higher profits and fixed assets than unconnected winners.

While I control for pretreatment outcomes, this specification is still very vulnerable to omitted variable bias. Table 7 reports the robustness value for each specification, following the approach of Cinelli and Hazlett (2020) to sensitivity analysis. The robustness value shows how much of the residual variance the omitted variable would have to explain to reduce the absolute value of the effect by 100%. For example, in specification 1 of Table 7, the robustness value equals 0.037, meaning that unobserved confounders (orthogonal to the covariates) that explain more than 3.7% of the residual variance of both the treatment and the outcome are enough to reduce the absolute value of the effect size by 100%.

Benchmarking the effect of the interaction coefficient of Won and Connected on the logarithm of Gross Profit against the logarithm of Gross Profit in 2008 for this specification suggests that the omitted variable would have to be at least twice as influential in order to reduce the effect to zero (Figure 2).

Table 8 presents the results of trajectory balancing inference for the effect of winning a 218 R&D grant for connected and unconnected companies and the corresponding difference in means. Standard errors are presented in parenthesis, and N is the number of observations used in estimation. As in the baseline model, connected companies benefit more from winning a grant in terms of profits relative to unconnected companies. In addition, they generate higher return on assets. Though the magnitude of the effect of winning a grant on fixed assets is much higher for the connected companies, it is statistically insignificant.

Figure 3 presents the results of winning a 218 R&D grant for connected companies. The figures for fixed assets, ROA, and ROE are presented in Appendix C. Connected recipients of the Decree 218 saw sustained growth of thier gross profits relative to connected companies that were not awarded R&D grant.

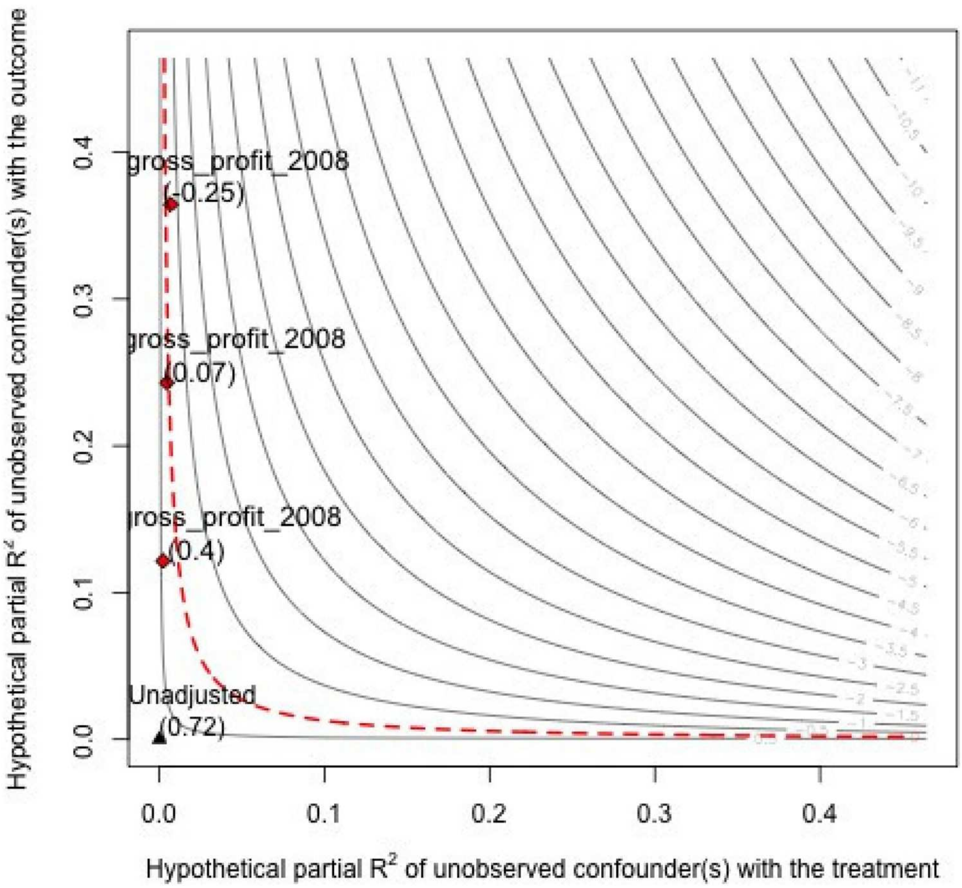

Figure 2. Benchmarking coefficient of interest against Log(Gross Profit 2008).

Note that due to the varying time of treatment, there are several treatment groups, depending on the year the R&D grant was received. Figure C2 presents the balance on outcomes and the weights put on control units for connected companies that had their last pre-treatment period in 2014. After demeaning, the balance on pre-treatment measured of the outcome variable, log(Gross Profit), has improved for all pre-treatment periods and for the date of company registration. The later was included to account for the differences in corporate performance that are due to company age (and stage of its lifecycle). Note that many companies were effectively excluded from the comparison (the weights on 24 control units is 0) since their pre-treatment gross profits were not comparable to those of treated units.

Figure 4 presents the results for unconnected firms. It is important to note that the pre-treatment trajectories of average logarithm of gross profit overlap for treated and

Table 8. Heterogenous treatment effects with trajectory balancing.

	Log(Gross Profit)	Fixed Assets	ROA	ROE
Connected	0.53 (0.16); $N = 522$	0.69 (0.66); $N = 567$	0.17 (0.06); $N = 1071$	−0.07 (0.09); $N = 1035$
Unconnected	−0.74 (0.27); $N = 1908$	0.15 (0.48); $N = 2016$	0.01 (0.02); $N = 3897$	−0.3 (0.2); $N = 3825$
Difference	1.27 (0.31)	0.54 (0.82)	0.16 (0.06)	0.23 (0.21)

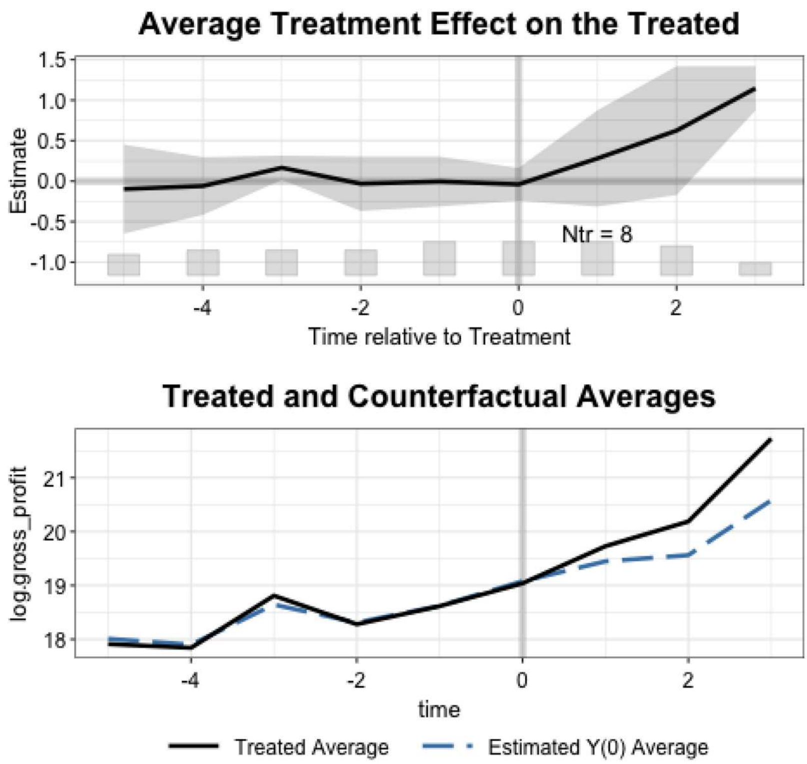

Figure 3. Log(Gross Profit) under trajectory balancing (connected firms).

counterfactual units. There are 33 treated units in the sample of unconnected companies. If anything, there is a (statistically insignificant) reduction in gross profits of companies in the first two years after receiving the R&D grant. The effect of winning it never becomes significantly greater than zero for the subgroup of politically unconnected applicants for the Decree 218 grant.

As before, the balance of the pre-treatment gross profits of treated and counterfactual observations is achieved trough re-weighting of control units. The resulting balance of pre-treatment de-meaned gross profits for companies that were first treated in 2015 is presented on Figure C4.

One can also examine the balance of treated and counterfactual units for treatment groups that received the grant in different years (see Figure C4). Note that the later the grant was received, the longer the trajectory that has to be balanced. For example, companies that received the grant in 2011 have to be similar in their trajectories of gross profits to control companies over three years — 2008, 2009 and 2010. However, companies that were first treated in 2015 have to be similar to counterfactual in the trajectory of their gross profit over 2008–2014 time period.

Winning a grant has a lasting and positive impact on gross profits and returns on assets of connected companies, but not for unconnected ones. Similar heterogeneity of the effect of the grant is observed for the return on assets (see Figures C4 and C3 of the Appendix). While the magnitude of the estimated ATT effect of the R&D grant on the fixed assets on connected companies was much greater than for the unconnected

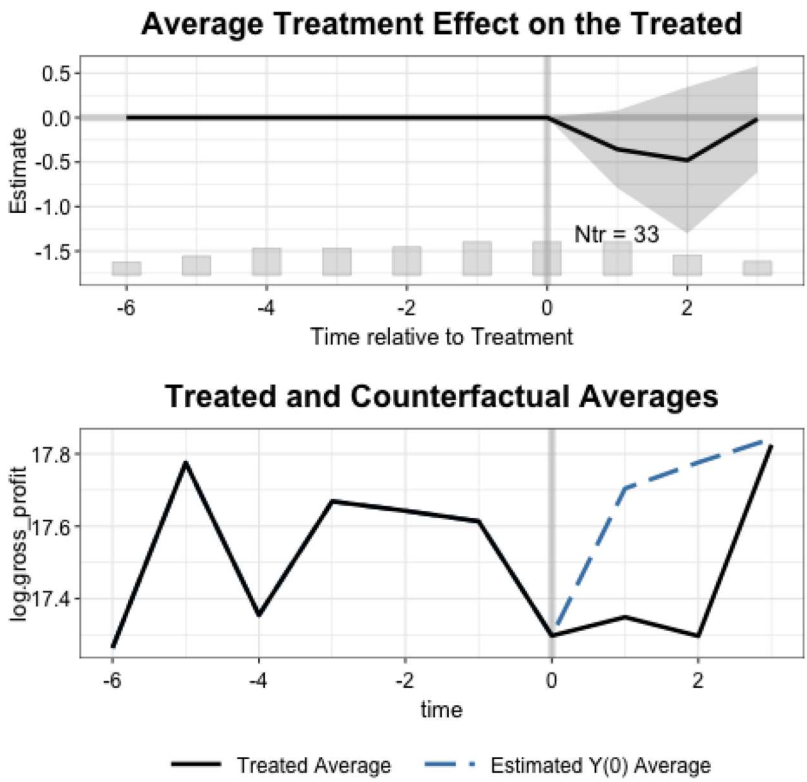

Figure 4. Log(Gross Profit) of unconnected companies under trajectory balancing.

companies, the difference is not statistically significant (see Figures C1 and C2, respectively). The model presented in Section 2 suggests that connected companies are, indeed, expected to be more successful in implementing their R&D project and suggests a mechanism: providing more benefits to connected companies, conditional on the success of their R&D project. In absence of the data on the direct outcomes of the R&D project, such as information about patents filed or the volume of innovative goods produced, it is hard to test this mechanism directly. Section 6 provides indirect evidence by examining whether there is a change in allocation of government contracts to the winners of the Decree 218 grant after the initial assessment of progress on the R&D project.

6. Test of implication 3: government contracts as incentive

Table 9 explores the effect of 218 Grant on patent generation. The key coefficient of interest — interaction term '218 Grant × Connected' is positive (22.72 in column (2); 56.84 in column (3)) but does not reach conventional significance, suggesting that connections largely offset the apparent drag of the grant on patent counts and allow connected firms to convert public R&D dollars into genuine innovative output. Columns (2) and (3) reveal that mere receipt of the 218 grant did not translate into higher patent output for the average firm. The 'Connected' indicator is positive and highly significant (119.08 in column (2), 77.14 in column (3), both $p < 0.01$), reflecting a large baseline advantage in patenting for politically connected firms.

Table 9. Patent generation, connections and 218 grant.

	Dependent variable:		
	Patents		
	(1)	(2)	(3)
218 Grant	−3.921	−104.440***	−118.875***
	(2.731)	(19.239)	(20.216)
Connected	−3.778**	119.076***	77.139***
	(1.817)	(12.768)	(13.340)
Patents in 2009	1.065***		
	(0.001)		
218 Grant × connected	7.174	22.718	56.842
	(4.893)	(34.508)	(36.579)
Constant	−308.973	925.833	2212.794
	(219.975)	(1551.387)	(1498.713)
Industry and Time FE	+	+	+
Econ Controls	+	+	−
Observations	13,404	13,404	13,404
R^2	0.989	0.448	0.365
Adjusted R^2	0.989	0.430	0.344
Residual Std. Error	60.983 (df = 12,973)	430.097 (df = 12,974)	461.228 (df = 12,990)
F Statistic	2689.659*** (df = 430; 12,973)	24.565*** (df = 429; 12,974)	18.052*** (df = 413; 12,990)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Conventional wisdom suggests that winning a government R&D grant should do little to increase the likelihood of obtaining government contracts, at least during the R&D phase (the first two years after receiving a grant). Figure C5 suggests that there is, indeed, no difference in the amount of government contracts received by firms that have won an R&D grant at any point compared to firms that applied for the grant at least once but lost.

By contrast, the theoretical model above predicts that grant winners should receive additional government contracts during the assessment phase but only (or preferentially) if they are politically connected, a tool used by incumbents to incentivize connected companies to supply more effort.

To test this, I start with the difference-in-difference type model, described in Equation (6), where the outcome variable is logged volume of government contracts received by the company i in year t. Table 10 suggests that connected companies do, in general, receive more funds in the form of government contracts. In addition, they receive even more funds after winning a government R&D grant.

The robustness value reported in Table 10 suggests that unobserved confounders (orthogonal to the covariates) that explain more than 2.11% of the residual variance of both the treatment and the outcome are enough to reduce the absolute value of the effect size by 100%. Benchmarking the result against the logarithm of gross profit in 2008 suggests that the unobserved confounders should be more than three times more influential than it (Figure 5).

Next, I employ trajectory balancing to examine the link between the timing of the R&D phase of the grant and government contracts received by the company. The specification of trajectory balancing is the same as in Section 3.5. First, I examine the effect of winning a grant on the volume of government contracts for unconnected companies. Consistent with the predictions of the model, winning a government 218 R&D grant is not related to the volume of government contracts awarded to the company for unconnected firms (Figure 6).

Table 10. Government contracts and R&D grant.

	Dependent variable: log(contracts)
Ever Won	−0.089
	(0.204)
Grant Received	−0.171
	(0.349)
Connected	0.497***
	(0.189)
Grant Received*Connected	1.628**
	(0.723)
Constant	76.146***
	(23.364)
Industry FE	+
Econ Controls	+
Observations	11,169
R^2	0.121
Adjusted R^2	0.119
Residual Std. Error	7.576 (df = 11,138)
F Statistic	51.284*** (df = 30; 11,138)
Robustness value	0.02

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

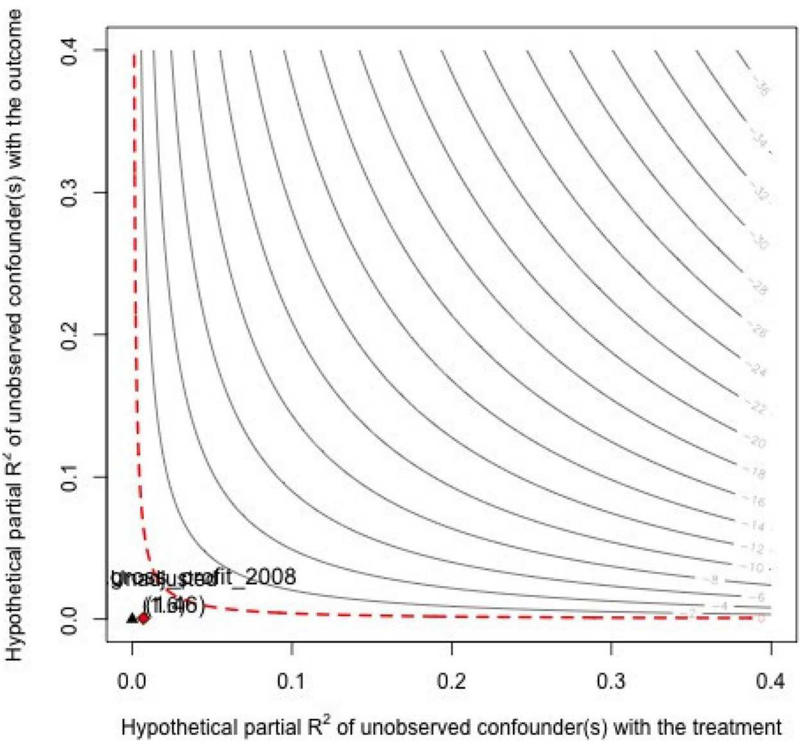

Figure 5. Benchmarking the effect of unobserved confounder against pre-program gross profits.

For the connected companies, however, the timing of increased government contracts received by the company coincides with assessment of progress of R&D project carried out under Decree 218 grant (Figure 7).

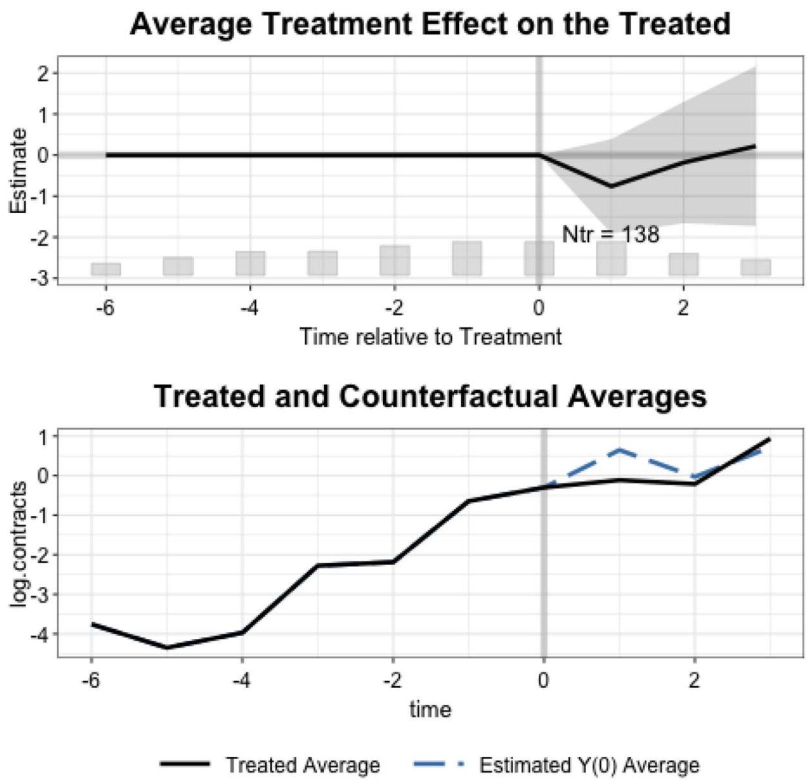

Figure 6. The effect of winning a 218 grant on the volume of received government contracts for unconnected firms.

Finally, Table 11 explores the reward mechanism that appears as a 'bonus' term in the model. Here, the sample is restricted to connected firms that won a 218 grant and defines the treatment dummy as the product of the two-year assessment-period indicator and an indicator for having generated any new patents in that window. Across all three specifications, the 'Treatment' coefficient is large and highly significant (4.09, 3.65, and 3.92; $p<0.01$), implying that connected grant winners who actually patent receive roughly a 40–45 percent higher volume of government contracts (in log points) during the assessment window. In contrast, the 'Assessment' main effect is negative (−2.32 to −1.71; $p<0.01$), indicating that non-patenting firms experience a drop in contracts over the same period, and the 'Patents generated' main effect is also negative (−0.56 to −1.07; $p<0.01$). The positive interaction more than offsets both negative baselines, pinpointing patent output-not just grant receipt — as the crucial mechanism driving follow-on contract awards for connected firms. These results remain robust to inclusion of the lagged contract control, a full battery of economic covariates, and moderate unobserved confounding.

Figure 8 shows the benchmarking plot for specification 1 of Table 11. Omitted variable at least as strong as the benchmark — logarithm of gross profit in 2009 — is not sufficient to bring the point estimate to zero.

The empirical implications implied by the model in Section 2 all appear to hold.

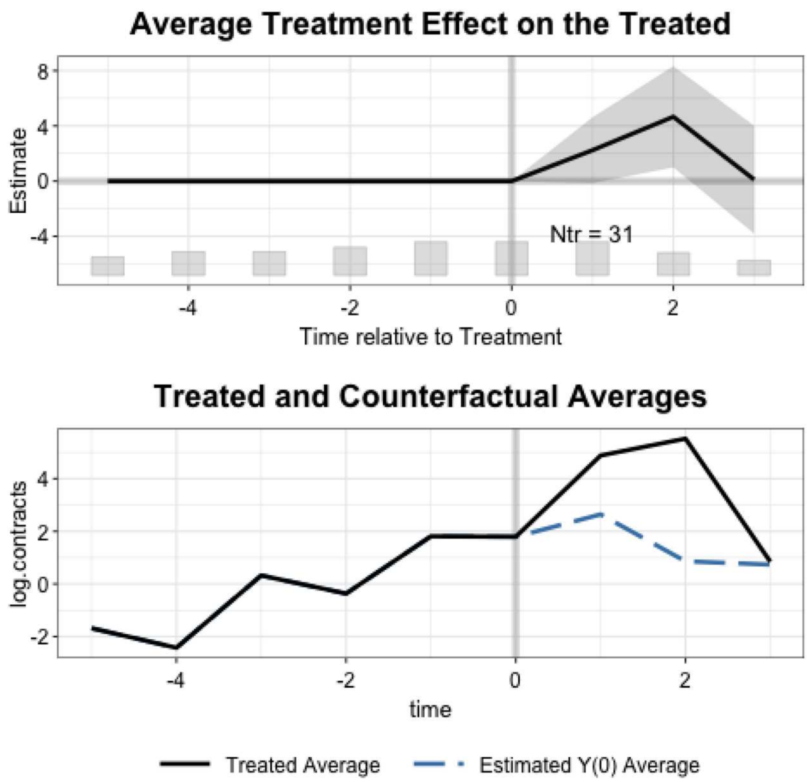

Figure 7. The effect of winning a 218 grant on the volume of received government contracts for connected firms.

Table 11. Among grant winners, connected companies that produce more grants receive more contracts after assessment.

	Dependent variable:		
	log.contracts		
	(1)	(2)	(3)
Treatment	4.087***	3.650***	3.920***
	(0.779)	(0.810)	(0.809)
Assessment	−2.321***	−2.013***	−1.708**
	(0.660)	(0.687)	(0.689)
Patents generated	−0.560***	−1.071***	−0.996***
	(0.209)	(0.217)	(0.213)
log(Contracts in 2009)	0.639***		
	(0.024)		
Constant	94.201***	240.796***	278.846***
	(34.181)	(35.095)	(31.772)
Industry FE	+	+	+
Econ Controls	+	+	+
Observations	8786	8786	8786
R^2	0.293	0.234	0.218
Adjusted R^2	0.256	0.195	0.179
Residual Std. Error	7.402 ($df = 8355$)	7.702 ($df = 8356$)	7.777 ($df = 8372$)
F Statistic	8.046*** ($df = 430; 8355$)	5.954*** ($df = 429; 8356$)	5.640*** ($df = 413; 8372$)
Robustness value	0.06		

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

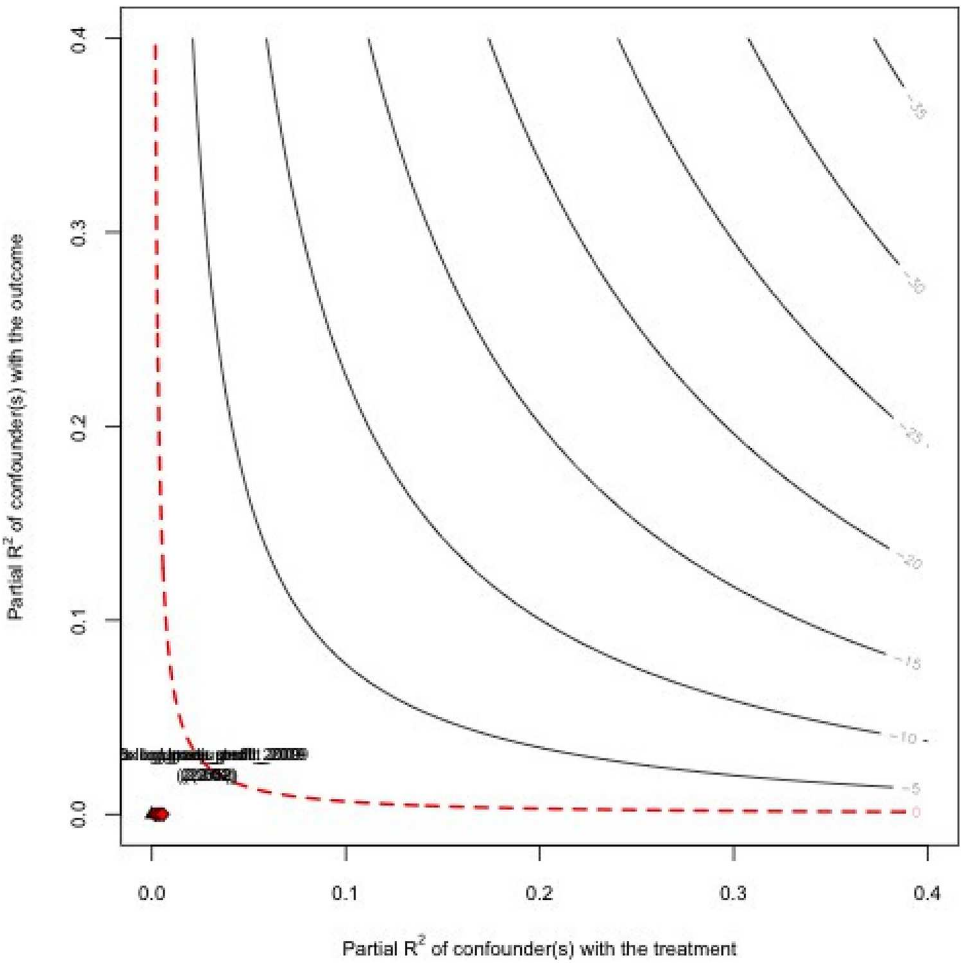

Figure 8. Being connected and producing more patents: Benchmarking the effect of unobserved confounder against pre-program gross profits.

7. Discussion

This paper presents a model of regimes of government support for innovation, applied differentially to connected and unconnected companies that could promote technological development of the society and alleviate the threat of technological displacement of companies that belong to the loyal supporters of the incumbent.

At the same time, the proposed view helps to reconcile theoretical notion of government incentives to stifle innovation and the observation that many governments devote substantial funds and efforts to its promotion.

Furthermore, this view does not contradict empirical evidence that political connections improve corporate innovation, yet suggests a different mechanism that could explain their findings (Ovtchinnikov et al., 2019; Su et al., 2019). In particular, Ovtchinnikov et al. (2019) suggests that politically connected companies gain access to information that could help them limit the political risks of R&D investment. I hypothesize that it is

Table 12. Summary of key model predictions and empirical findings.

Prediction	Model implication	Empirical finding
A. Grant Allocation	Grants are offered uniformly to all firms, regardless of political connections.	No significant difference in award rates: connected firms win 18.0% vs. 15.1% for unconnected (Table 6).
B. Technology Production	Connected winners generate more technologies through preferential access to performance-based bonuses.	Positive coefficients on the Grant × Connected interaction of 22.7 and 56.8 patents (Cols. 2–3, Table 9), matching the predicted direction and magnitude but not statistically significant (p>0.1).
C. Performance Gains	All grant winners increase R&D effort, but connected firms obtain larger net returns due to the performance-contingent bonus.	Connected winners exhibit larger post-grant gains in profits (5.2 pp, p<0.01), fixed assets (8.7 pp, p<0.05), and ROA (2.1 pp, p<0.05) compared to unconnected (Table 7).
D. Contract Bonus	Only connected winners with confirmed success receive the conditional bonus, yielding a surge in government contracts.	Connected winners who generated patents in the two-year window see 4 log-points higher contracts (p<0.01), while unconnected winners show no increase (Table 11).

willingness of the incumbent to act of the information about the success of R&D projects implemented by connected companies that incentivizes them to pour additional investment in R&D.

Such view is very intuitive, if one considers that government has repeated interactions with connected companies, but one-shot interaction with unconnected ones. Then conditioning future grant allocations on the success of the current project for the former provides additional incentives to them, but not to the unconnected companies. Thus, it is the information available to the incumbent that helps to explain the difference in the impact of government R&D grant on the economic outcomes of politically connected and unconnected companies (Table 12).

The empirical analysis employed in this paper is consistent with the model. Yet, it suffers from several important limitations: first, grant allocation is non-random. Moreover, it is allocated based on the merits on the projects, not corporate characteristics. Theses factors complicate the evaluation of the effect of the grant. However, trajectory balancing mitigates these concerns to which balancing on the trajectory of pre-treatment outcomes achieves conditional ignorability on unobserved omitted variables. In addition, both the model and the empirics focus on differential impact of grant on connected and unconnected companies, rather than the effects themselves. Another possible concern is that it is the government contracts, available to connected companies that drive better corporate performance than that of unconnected companies, and not more successful technology generation. Thus, under this view, the difference in performance is achieved regardless of R&D projects. While I cannot rule out this explanation, it is worth noting the timing of increased government contracts — they are granted in the period of evaluation of the progress of the R&D project. Furthermore, the growth in government contracts awarded to connected companies is a one-time development, and should not be able to explain the consistent growth of return on assets and profit enjoyed by connected recipients of 218 grant after the grant was awarded. The ATT of winning the Decree 218 grant on government contracts over the whole time period is statistically indistinguishable from zero (ATT = 1.824, 1.21). Next, even in the available data many companies have information on their economic outcomes missing for one or more years. Where possible, I employ multiple imputation and indicator variable for missingness to alleviate the problem. Yet, this approach is not possible for the trajectory balancing approach, leaving it vulnerable to selection bias. The broad consistency of the trajectory balancing and baseline specifications helps to mitigate this problem.

8. Conclusion

Technological progress is an important factor in economic development, yet it can be a destabilizing force, upending the existing balance of power in the economy. Such changes can be unwelcome to the government that would like to preserve the existing status quo. However, blocking technological development is costly as it harms economic growth. In this paper, I show that the incumbent can support technological development of all companies in the economy, while assuring technological advantage of loyal companies.

Unlike pork-barrel forms of favoritism that are often illustrated in the literature, government support of innovation in the form of co-sponsoring corporate R&D project requires some efforts on the part of receiving company so that it actually obtains technological advantage. In order to assure technological advantage of companies that belong to loyal individuals, government can provide additional benefits to such companies conditional on success of realization of their R&D project. For example, it can channel greater volume of government contracts to such firms.

In this paper, I have demonstrated that politically connected companies are more likely to obtain government R&D grants. Furthermore, they benefit more from the grant, generating more patents, higher profits and return on assets, compared to unconnected companies. I further find evidence that connected companies that carried out the R&D project under Decree 218 grant obtain greater volume of government contracts during the assessment of progress of the R&D project, but only if they generated more patents before or at the assessment period.

Notes

1. Berman et al. (1998), Caselli (1999), Galor and Savitskiy (2017), Salomons and Autor (2018), Acemoglu and Restrepo (2018) and Acemoglu and Restrepo (2019).
2. The normative grounds for this stem from observation that the value of the new technology is not fully appropriable by its creator (Arrow, 1962). In fact, the effect of government R&D funding seems to be very large: Dyevre (2023) find public R&D spillovers to be two to three times as impactful as private R&D spillovers for firm productivity. Similarly, Fieldhouse and Mertens (2023) find that an increase in nondefense R&D appropriations leads to increases in various measures of innovative activity and higher business-sector productivity in the long run.
3. There is evidence of political connection being value-destroying (Aggarwal et al., 2012; Coates, 2012). They can keep a company afloat even if it lacks efficiency (Okazaki & Sawada, 2017).
4. Little foreign help was targeted at R&D (Sher, 2000), yet the funding that was available through George Soros' program, which provided grants to over 28,000 Soviet scientists shortly after the end of the USSR, more than doubled publications on the margin, significantly induced scientists to remain in the science sector, and had long-lasting impacts (Ganguli, 2017).
5. ClearSpending (2020).
6. Sokolova (2011), Reznik et al. (2015) and Gazeta (2015).

7. see Treisman (2011, 2013, 2016), Yakovlev and Zhuravskaya (2004) and Lamberova and Sonin (2018b) for some examples.
8. One may expect to find a regression, estimating the conditional correlation of connections status on the probability to win a grant, that accounts for industry fixed effects. In fact, such a regression would show that connected companies are more likely to win within an industry. However, making conclusions from such analysis could be misleading. Trifonov (2021) shows that political connections are unevenly distributed by industry. Hence, regression with industry fixed effects has a problem controlling for confounder: the way connections are defined (based on co-occurrences in year 2004 on Yandex News), choice of the industry can be a result of the owner of the company being politically connected. For example, aviation, oil & gas, and banking were the most politically connected sectors of the Russian economy. These industries tend to have a heavy technology oriented dimension (engineering for aviation, catalysis and petrochemistry for oil and gas, platform development for banking). Hence, including industry fixed effects would effectively control for the collider, introducing bias. Restricting the sample to the older companies reduces the number of observations dramatically and generates non-representative sample. The model requires only that both connected and unconnected companies receive grants with the sample probability in the economy in general — which is confirmed by Table 6.
9. ROA indicates how effectively an organization is taking earnings advantage of its base of assets. ROE indicates how effectively the firm takes advantage of its shareholder equity (Total Assets − Liabilities). That is, if we see high ROE and low ROA, we can conclude that company is taking on a lot of debt.
10. See Wooldridge (2005), Chernozhukov et al. (2013), Borusyak and Jaravel (2017), Goodman-Bacon (2018) and Athey and Imbens (2018).

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