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"Acquire and leave": Effects of startups acquisitions by digital ecosystems

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Abstract. Digital ecosystems penetrate many areas of modern life, they integrate many services and are growing partially through acquiring start-ups. These can lead to a rise of their market power, which in turn has caused the increased attention of antitrust regulators in recent years . The new changes into the Russian antitrust law contain the requirement for scrutiny for mergers above 7 billion of rubbles. This additional criterion is designed to include the acquisitions of startups by digital ecosystems that currently do not need to be announced to the Russian antitrust service. As for economic literature, there is no consensus on the way mergers with startups affect markets, in particular, venture capital market. The purpose of this work is to assess the effects of mergers of digital ecosystems with Russian startups in different niches of the venture investment in these niches. Methodologically, our study is based on economic theory and particularly on industrial organisation, antitrust economics; we also use econometrics while estimating causal inferences. We perform econometric analysis of panel data and matching to evaluate the effect of mergers of digital ecosystems with startups. In our quantitative analysis we use data collected from the website Rusbase, which gathers information on deals with Russian startups building primarily on open sources. In our study, we conclude that niches where digital ecosystems more actively purchase or invest in startups tend to be lower investments, smaller total and average purchase prices, which may indicate some washing out of investments in such niches. However, the effect we see may be present due to the changing popularity of niches and/or bringing forward of investor decisions, and not to the kill zone that is claimed to be one of the downsides of such mergers, since we observe a short-term increase in the number of investment decisions in a niche during the period when a startup is acquired by the digital ecosystem.

Keywords: digital ecosystems; antitrust law; acquisitions; venture capital; platforms; impact assessment; panel matching.

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«А ты купи и отойди»: эффекты от сделок экономической концентрации цифровых экосистем со стартапами

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Аннотация. Цифровые экосистемы объединяют комплекс сервисов и разрастаются в том числе за счет поглощения стартапов. Это потенциально может приводить к росту их рыночной власти, а следовательно, вызывает беспокойство антимонопольных регуляторов. Новые поправки в антимонопольное законодательство содержат дополнительный критерий стоимости сделки, который призван обеспечить необходимость согласования с антимонопольным органом. При этом в литературе отсутствует консенсус относительно того, как именно поглощение стартапов цифровыми экосистемами влияет на разные рынки, в частности рынок венчурных инвестиций. Статья посвящена оценке эффектов от сделок экономической концентрации цифровых экосистем с российскими стартапами для разных ниш рынка венчурного финансирования. Методологическую основу исследования составили теория организации отраслевых рынков и положения антимонопольного регулирования. Применялись эконометрический анализ панельных данных и метод мэтчинга. Информационную базу составили данные о сделках с российскими стартапами, представленные на сайте Rusbase. Сделан вывод о том, что рыночные ниши, в которых цифровые экосистемы сравнительно активнее совершают сделки (покупки и вложения), характеризуются более низкими объемами инвестиций, меньшим суммарным и средним размером покупок, что может свидетельствовать о некотором «вымывании» инвестиций. Вместе с тем это может быть связано с изменением популярности ниш и переносом решений инвесторов, а не с возникающей «зоной отчуждения» (kill zone) вокруг таких поглощений, поскольку в этот период наблюдается краткосрочный рост сделок в рыночной нише.

Ключевые слова: цифровые экосистемы; антимонопольное регулирование; сделки экономической концентрации; венчурное финансирование; платформы; эффекты от сделок; панельный мэтчинг.

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INTRODUCTION

Due to their rapid growth digital ecosystems (DESs) come under increasing scrutiny of the country's regulators, such as the Federal Antitrust Service of the Russian Federation (the FAS Russia), the Central Bank of Russia, and the Ministry of Economic Development of the Russian Federation. There are mounting concerns about large DESs' economic deals due to the fact that such deals usually involve startups that develop new digital technologies.

The study discusses and evaluates the possible effects that deals[1] of digital ecosystems with startups may have on venture capital markets. We have chosen venture capital market as it may experience potential positive and negative consequences, such as an increase or decline in investment volumes in different niches, which, in turn, can affect the long-term development of the industry. For instance, one of the concerns regarding startups acquisitions by ecosystems is the formation of the so-called 'kill zone' implying a drop in investments following a merger, which may be a result of a decline of competitive pressure in the relevant niches. At the same time, although it is impossible to adequately determine the potential mechanism of the relationship between deals with startups and ecosystems and investments in other startup companies, the very fact that such a connection raises the question of the need for appropriate antitrust regulation.

The *purpose* of the study is to evaluate the effects of deals between digital ecosystems and startups in the venture capital market.

To attain the stated purpose, we accomplished the following *objectives*:

- systematized empirical estimates of the effects of deals with startups and formulated hypotheses;
- gathered and processed data on deals with Russian startups;
- evaluated the effects of deals between DESs and startups;
- identified potential ways the obtained results can be used to improve antitrust regulation.

LITERATURE REVIEW

During the last decade the world has witnessed a boom in digital platforms that connect two or more functionally heterogeneous groups of users that have a direct contact with each other [Shastitko, Markova, 2019]. When a digital platform creates and develops digital ecosystem this platform can become even more popular among users as digital ecosystems (DESs) provide end consumers with a whole range of services. Digital ecosystems can be conceptualized as "a set of business entities closely related to a key company through a digital platform or digital infrastructure and interacting with it and with each other using a hybrid governance mechanism" [Shastitko, Kurdin, Filippova, 2023]. A company expands DESs by developing its own services, as well as by adding new services through M&A. Typically, such deals involve startups, i.e., young companies that use innovative ideas to create and bring new products to the market, and withal operate in conditions of high uncertainty [Gerasimenko et al., 2021], and in order to develop and monetize its business they require investors [Islam, Fremeth, Marcus, 2018].

Deals in venture capital markets differ from mergers and acquisitions in their traditional sense: one of the central goals of startups is to attract investors. In turn, the investors in this market are searching for new businesses they can invest in [Lemley, McCreary, 2021].

When acquiring a startup, a large DES may gain additional benefits because of increased indirect network externalities, especially when the startup is a potential competitor or collects data complementary to those that the DES has [Motta, Peitz, 2021]. Such deals are called conglomerate mergers and can be beneficial to end consumers, since when a platform or DES has access to user data from different sources, it can make more accurate predictions of consumer actions and thus enhance product quality by providing consumers with personalized offers. At the same time, users may be 'locked in' the platform or DES due to rising switching costs, that can be partially explained by the fact that it is difficult for end users to search for additional information and they may refuse to search for other alternatives [Vásquez Duque, 2022]. What is more, more accurate prediction of users' behavior may be used by platforms and DESs when setting prices: using personalized prices (3rd degree price discrimination) the DES may increase its surplus by means of a fall in consumer welfare [Pavlova, Markova, 2023].

In addition, merger regulation is aimed at dealing with the consequences of the mergers and acquisitions for markets where these deals happen, and thus antitrust agencies are not always able to provide a holistic picture of ongoing mergers, which together can deteriorate the competition landscape in the long term [Jin, Leccese, Wagman, 2022]. For example, in the Bayer-Monsanto merger the FAS Russia has assessed its influence on individual markets, as well as other markets that were not affected by the merger. FAS Russia concluded that the merger could lead to the emergence of platforms in the areas of precision agriculture and accelerated breeding technologies [Dudrina, Sluzhevskaiia, 2020]. This, in turn, could serve as the basis "for creating and enhancing market power in the Bayer-Monsanto merger"[2].

At the same time, startups play an important role in stimulating economic growth, linking scientific and technological progress with economic growth: startups can commercialize by creating new technologies and which

[1] In this study we explore venture capital deals (when companies invest in startups without buying its stocks), acquisitions (when companies buy startups) and all deals (we also call them "deals" – the sum of venture capital deals and acquisitions).

[2] Tsyganov A. The Bayer-Monsanto deal is not about carrots, but about breeding technologies and platform solutions. The FAS Russia. https://fas.gov.ru/publications/14847. (in Russ.)

in turn contributes to economic advancement [Zemtsov, Kotsemir, 2019]. Deals with startups can result in the efficiency defense manifested in cost reduction due to economies of scale [Golovanova, 2014], in optimization of production chains, the synergy effect that arise due to the elimination of overlapping functions in the company, and increased investment opportunities of the new company (for example, through the combination of patents). Among the positive effects for startups acquisitions is an increase in investments to other similar startups, which is observed in the short term, usually within a year [Prado, Bauer, 2022]: GAFAM[1] acquisitions are associated with an increase in investments in the same niche by 30.7 % and 32.4% % for the European and American markets, respectively. The positive effect revealed persists for a few months only and may be caused by redistribution of investments from other niches.

However, startup acquisitions by DESs could potentially have negative unilateral and coordinated effects: such deals may result in the rise of market power of the acquirer, which, on the one hand, can lead to an increase in prices (unilateral effects) and make it difficult for new participants to enter the markets, and, on the other hand, make it easier for companies collude (coordinated effects).

The potentially negative impact of acquisitions on competition may be caused by a number of reasons [Jin, Leccese, Wagman, 2022]: 1) DESs can perform strategic acquisitions to reduce competitive pressure [Cunningham, Ederer, Ma, 2021]; 2) by acquiring a startup the DES may create a kill zone in the niche which means the deterrence of investment in this niche induced by the pessimism of the DES's potential competitors regarding their success in the corresponding markets [Kamepalli, Rajan, Zingales, 2020]; 3) vertical acquisitions can limit interoperability of services [Argentesi et al., 2021]; 4) post-acquisition changes in management practices may adversely affect consumer welfare [Eliason et al., 2020]. Let's take a closer look at the mechanisms for potential negative consequences of deals between digital ecosystems and startups.

DESs can conduct deals with startups to get rid of potential competitors. In the pharmaceutical industry, such phenomena are called 'killer acquisitions': acquiring innovative company by a large pharmaceutical company reduces the likelihood of developing similar drugs [Cunningham, Ederer, Ma, 2021]. As for GAFAM[2] deals, between 50 % and 70 % of acquired services are fully integrated into the ecosystem, while the likelihood of discontinuation of a startup's brand name rises following the acquisition and is negatively related to the startup's age [Gautier, Lamesch, 2021]. This fact may indicate that such acquisitions are made to purchase technology or integrate personnel (they are also called acqui-hire acquisition). However, the largest digital companies rarely acquire targets within the acquirer's core business: from 2009 to March 2020, only 8 % of GAFA[3] M&As were overlapping with their "core" business [Latham, Tecu, Bagaria, 2020].

On the other hand, startup acquisition by a large player may indicate the interest of the latter in developing business in the relevant niche, which makes investments in competing startups unattractive due to the need for larger investments to overcome the competitive pressure from the large player. In this case, one can assume a kill zone that follow a startup acquisition, where there is a drop in investment in the niche where the acquisition occurred. Moreover, the negative consequences of such acquisitions can persist for 4 years following the deal [Kamepalli, Rajan, Zingales, 2020]. If being acquired by a larger player is the ultimate goal of startup founders, the explanation of the kill zone in the startup space proceeds as follows: creating a new startup and spur investment to the niches become less attractive when a similar startup has just been acquired, since the likelihood of receiving money at early stages of funding is low [Song, Pan, 2021].

Startup acquisitions by digital ecosystems can have negative long-term effects if such deals are in fact vertical. In particular, M&A that involve data-intensive startups may deteriorate competitive landscape in related markets by providing acquirer with competitive advantages [Jin, Leccese, Wagman, 2022]: other things being equal, using two aggregated datasets can provide more insights and create additional economic value compared to using two separate datasets [Martens, 2020; Parker, Petropoulos, Van Alstyne, 2021]. In addition, after the merger between Meta (Facebook)[4] and Instagram[5], the latter's interoperability with other services was deteriorated [Argentesi et al., 2021].

Thus, different authors find both positive [Prado, Bauer, 2022] and negative [Kamepalli, Rajan, Zingales, 2020; Jin, Leccese, Wagman, 2022] effects of deals with startups. The lack of consensus about this issue requires additional research, which is especially important in light of increased antitrust scrutiny of deals of DESs in Russia.

STARTUPS AND DESs IN RUSSIA

According to the core business, digital ecosystems in Russia can be categorized into three groups by industry:

- banks (Sber, Tinkoff, VTB);
- telecom operators (MTS, Megafon);
- other digital companies (VK (Mail), Yandex).

These companies and groups of companies are classified as DESs as they can be characterized by the following features:

[1] GAFAM refers to top-5 most dominant American technology companies – Google, Amazon, Facebook*, Apple, and Microsoft (GAFAM). *Facebook is a product owned by Meta, which is recognized as an extremist organization in Russia and banned.

[2] Google, Amazon, Facebook*, Apple, and Microsoft (GAFAM). *Facebook is a product owned by Meta, which is recognized as an extremist organization in Russia and banned.

[3] Google, Amazon, Facebook*, and Apple (GAFA). *Facebook is a product owned by Meta, which is recognized as an extremist organization in Russia and banned.

[4] Meta is recognized as an extremist organization in Russia and banned.

[5] Instagram is a product owned by Meta, which is recognized as an extremist organization in Russia and banned.

1) the presence of a digital platform;

2) connecting complementors to a variety of ecosystem services (which helps us eliminate such large marketplaces as Wildberries and Ozon that do not currently connect complementors);

3) creating connection with end users (for example, through a loyalty system, which is not available in the classified advertisement website Avito);

4) interaction with users based on a hybrid governance mechanism (firms in such an interaction remain autonomous [Ramenskaya, 2020]; "a two-sided dependence of agents without full integration" arises between complementors and the platform [Shastitko, Kurdin, Filippova, 2023], which does not exist when we take one of the largest Russian food retailers X5 Group considered in some studies as a DES).

In the present study, we analyze deals consummated by the largest Russian DESs, which, according to Skolkovo experts[1], include VK, Sber, Yandex, and MTS (VSYM). The VSYM companies meet the criteria for digital ecosystems specified above and compete in different niches: digital content production, finance, telecommunication services, e-commerce, healthcare services, development and involvement of human potential (this includes microtasking and Ed Tech platforms), technology, logistics and transport, and delivery. The list of services provided can be expanded through both the development of their own services and deals with startups (Fig. 1).

In contrast to other countries, the advancement of high-tech solutions to markets in Russia is hampered despite the substantial share of R&D employees, significant scientific and technological developments of the USSR era, and numerous business opportunities [Auzan, Komissarov, Bakhtigaraeva, 2019]. This phenomenon is called 'the Russian innovation paradox' [Gokhberg, Kuznetsova, 2012].

Startups in Russia are heterogeneous by region: about 25 % of them are founded in Moscow, another 15 % are in Saint Petersburg and Moscow region. Between 2000 and 2020, startups developed steadily both by region and industry: startups in Russia predominantly emerged in knowledge-intensive niches (Ed Tech, telemedicine, fintech, etc.) and in high-tech industries (robotics, unmanned vehicles, medical devices, etc.) [Zemtsov, Chepurenko, Mikhaylov, 2021].

Another specific feature of Russian startups is the lower capitalization and size of startups compared to developed countries, which can be due to the smaller size of the venture capital market and Russia's lesser involvement in global venture markets [Zemtsov, 2022].

Deals with startups have recently faced an increased antitrust scrutiny as they need to notify their deals to the FAS Russia [Tarkhova, Alifirov, Gorokhova, 2020], which is reflected in amendments to the country's antitrust regulation (so-called the fifth antitrust package)[3]. In particular, on September 1, 2023, amendments to Article 28 of the Federal Law of July 26, 2006 No. 135-FZ "On the Protection of Competition" came into force, which introduced an additional (to the amount of revenue and assets of all parties of a deal[4]) threshold for the deal price: if it exceeds 7 billion rubles, the parties should notify the FAS Russia. As a result of this amendment, the burden on the antimonopoly authority will increase. For example, in the period of 2010–2020, the new criterion could have increased the number of scrutinized mergers by 4–5 additional cases annually (Fig. 2).

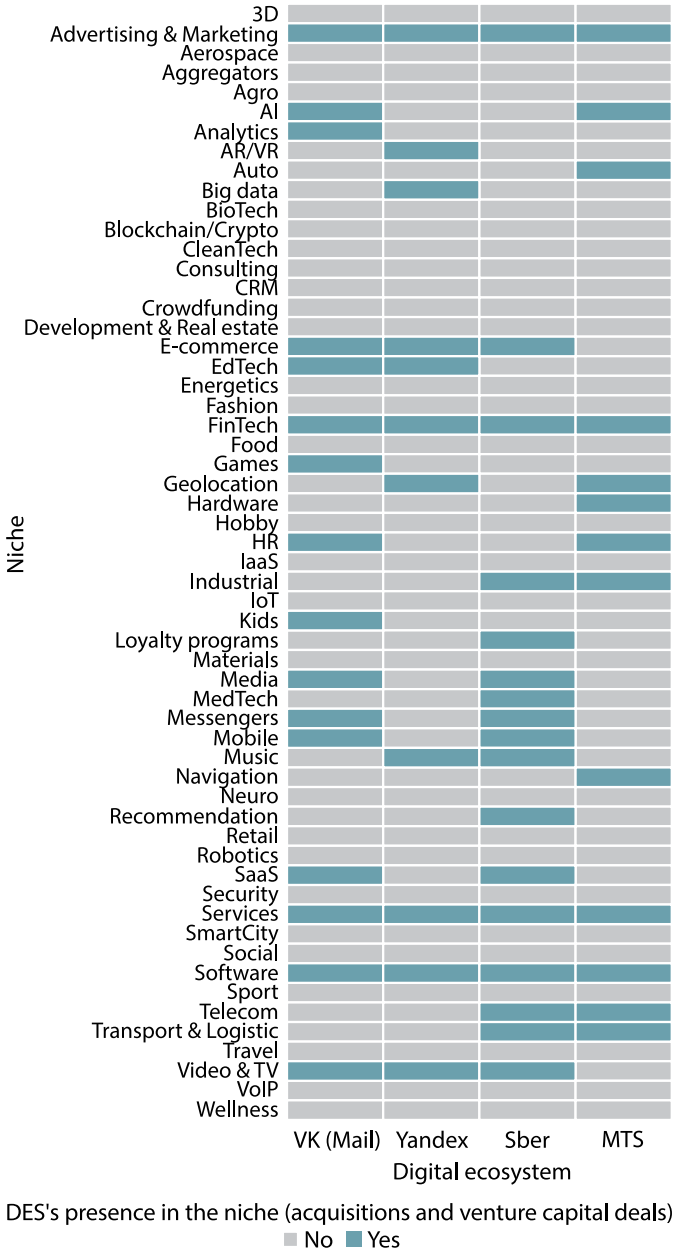


Fig. 1. Acquisitions and venture capital deals between the largest DESs and startups in Russia[2]

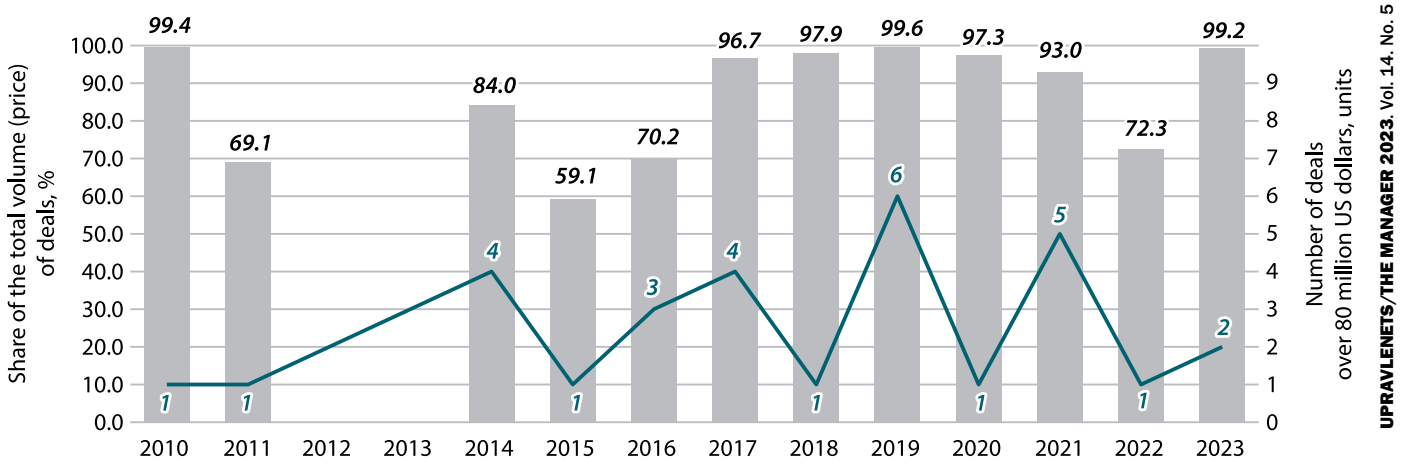
Рис. 1. Сделки экономической концентрации российских стартапов с крупнейшими российскими ЦЭС

[1] Experts named companies with signs of ecosystems. RBC News. https://www.rbc.ru/technology_and_media/01/02/2022/61f3d76f9a794775ff544309. (in Russ.)

[2] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

[3] On amendments to the Federal Law "On the Protection of Competition": Federal Law of July 10, 2023 No. 301-FZ.

[4] Article 28 of the Federal Law No. 135-FZ.



Note: at the time of writing, 7 billion rubles is approximately equivalent to 80 million US dollars.

Fig. 2. Number and price of deals that could have been under antitrust scrutiny according to the new M&A notification threshold[1]

Рис. 2. Количество и сумма сделок, которые потенциально могли попасть под антимонопольное регулирование

DATA AND EMPIRICAL STRATEGY

Data. To test our hypothesis about the negative effects of deals between DESs and startups in Russia on the venture capital market, we will use data collected from the Rusbase portal[1]. The Rusbase portal collects data from open sources and provide detailed information on deals with Russian startups covered in the media. This may potentially influence our conclusions on overall effect of deals with DESs on the venture capital market while some deals may not be covered in the news. Nevertheless, the number of deals with Russian startups covered by Rusbase is comparable to that by the Dsight, which is a part of Crunchbase, which is one of the most reliable sources of information about startups[2] (Fig. 3).

In our study, we use data on 10,293 deals with Russian startups consummated between January, 2010 and April, 2023. The final sample included 9,039 deals with available data on the month of the deal and the startup's niche for the period under review. We also use data on the deal price and the size of the niche; in this case, the data sample included 4,400 and 5,830 observations, respectively.

To analyze the effects of deal across the niches, we turn to data in which multiple-niches deals are included in each niche as individual observations. The final sample contains data on the companies' acquisitions and venture capital deals in different niches (Fig. 4). Table 1 provides descriptive statistic of all variables for each of the types of deals – acquisitions and venture capital deals – broken down to treated and untreated (no deals) niches.

We concentrate on deals involving digital ecosystems, since it is the type of deals that especially concerns an-

[1] Deals. Rusbase. https://rb.ru/deals/. (in Russ.)

[2] Crunchbase is an authoritative source of global data about early-stage startups, but currently banned from accessing from Russia.

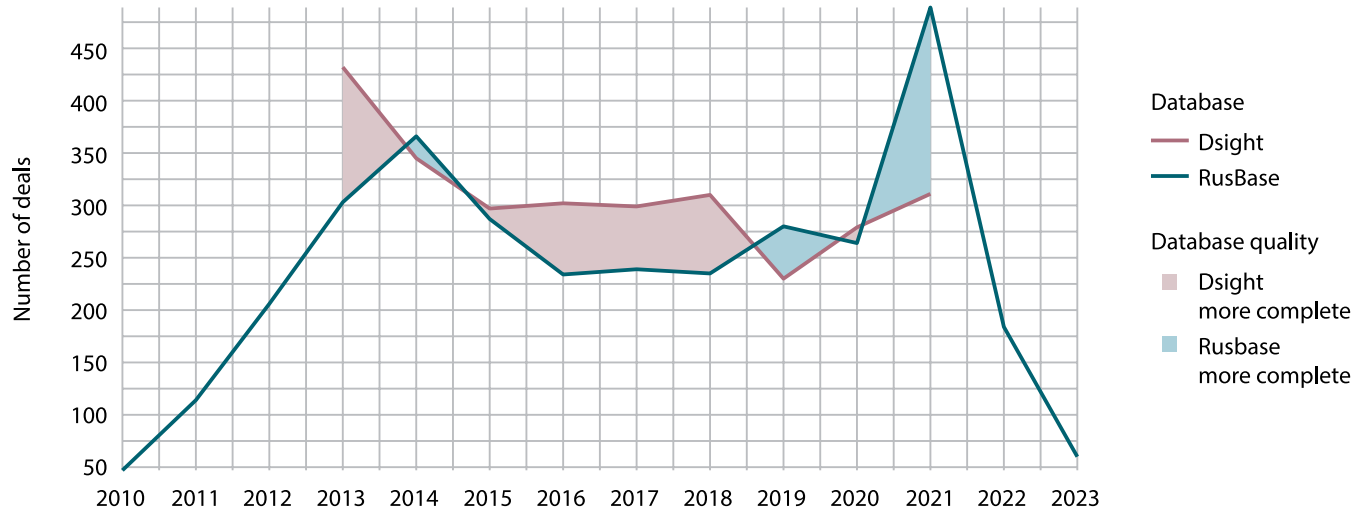


Fig. 3. Number of deals (acquisitions and venture capital deals) with Russian startups, 2010–2023[2]

Рис. 3. Количество сделок российских стартапов, 2010–2023

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

[2] Source: compiled by the authors based on Dsight report "Venture Russia: Results" (for the corresponding years). Rusbase. https://rb.ru/deals. (in Russ.)

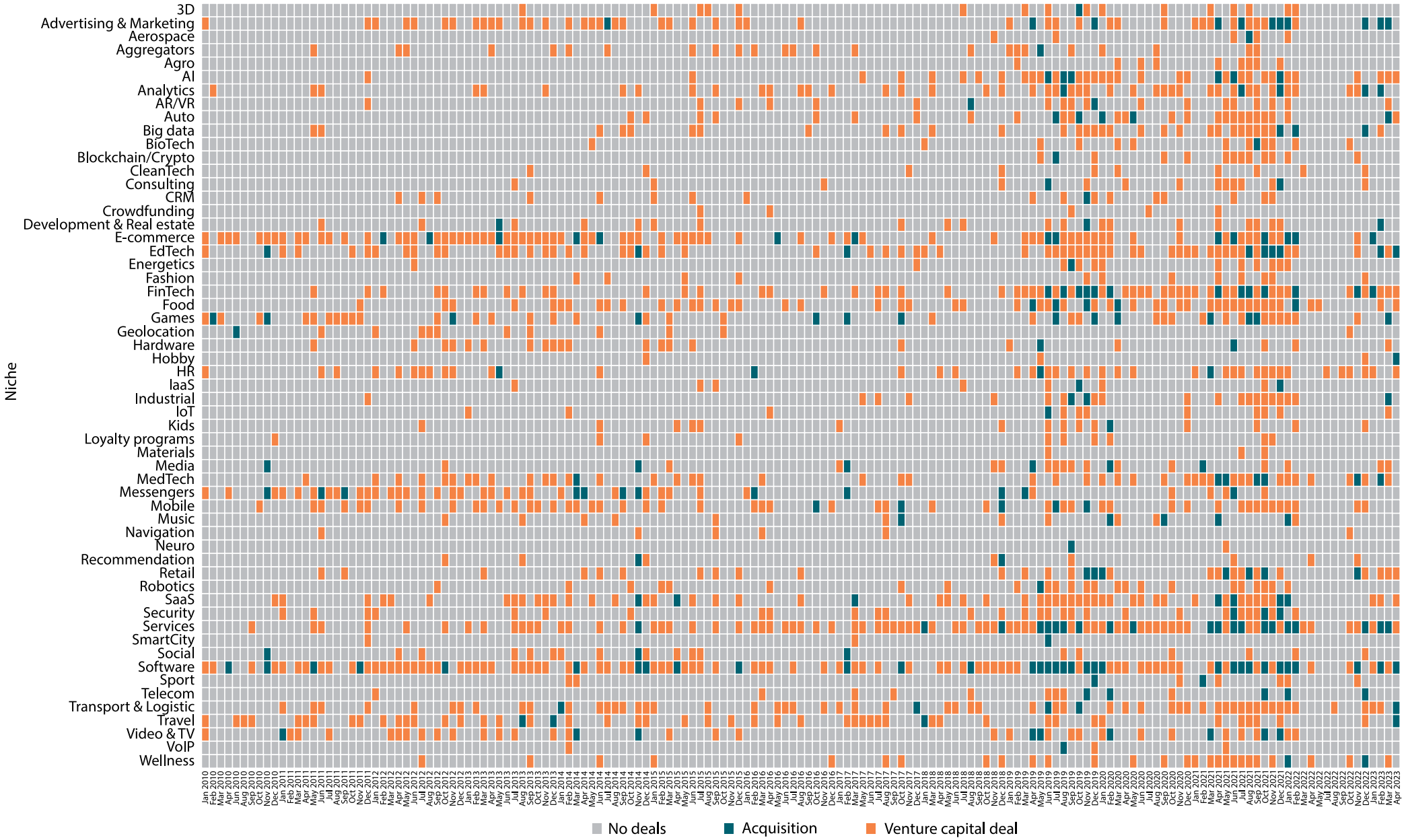


Fig. 4. Distribution of deals by months and niches[1]

Рис. 4. Распределение сделок во времени по нишам

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

Table 1 – Descriptive statistics of the variables aggregated by month and niche
Таблица 1 – Описательная статистика используемых переменных, агрегированных на уровень месяца и ниши

Variables	Number of observations	Mean	Standard deviation	Min	Max
Number of deals (acquisitions and venture capital deals) in a niche, units	8,835	0.653	2.701	0	86
Number of acquisitions in a niche, units	8,835	0.033	0.201	0	4
Number of venture capital deals in a niche, units	8,835	0.621	2.623	0	84
Proxy for the number of startups in a niche, units	8,835	14.343	57.009	0	807
Acquisition volume in a niche (total), US dollars	8,835	15 743 072.0	214 152 270.0	0	12 357 000 000
Acquisition volume in a niche (average), US dollars	8,835	4 310 764.0	72 203 762.0	0	3 500 000 000
Volume of venture capital deals in a niche (total), US dollars	8,835	1 338 180.0	32 565 659.0	0	1 325 300 000
Volume of venture capital deals in a niche (average), US dollars	8,835	1 323 480.0	32 478 201.0	0	1 325 300 000
Cumulative volume of venture capital deals in a niche, US dollars	8,835	628 310 747.0	1 905 776 359.0	0	24 451 650 120
Cumulative volume of acquisitions in a niche, US dollars	8,835	112 016 777.0	351 651 993.0	0	1 684 280 000
Cumulative number of venture capital deals in a niche, units	8,835	30.120	65.517	0	776
Cumulative number of acquisitions in a niche, units	8,835	1.498	3.590	0	45

Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

titrust authorities in terms of potential negative effects [Shastitko, Kurdin, Filippova, 2023].

This study examines the deals of the largest Russian digital ecosystems (VSYM):

- the ecosystem of VK (Mail): the deals involving VK, VKontakte, Mail;
- the ecosystem of Sber: the deals involving Sberbank, SBT Venture (Sberbank Venture Capital);
- the ecosystem of Yandex: the deals with Yandex, Yandex.Market, Yandex.Taxi, Yandex.Drive;
- the ecosystem of MTS: the deals with MTS, MTS AI, and MTS StartUp Hub.

Although Mail Group and Sber are also members of O2O Holding, we do not consider separate effects for the latter. Fig. 5 shows the distribution of the deals in different niches under study over time (for distribution of deals by DESs see Fig. 10 in Appendix).

Empirical strategy. Based on the existing studies, we build following hypotheses:

- deals with the DESs lead to short-term investment growth (number and volume of acquisitions and venture capital deals) in the same niche where these deals occurred;
- a kill zone appears in the niche where DESs consummates deals.

The empirical strategy of our research consists of two parts. Firstly, we build ***two-way fixed effects model*** to assess whether there is a relationship between the number of deals with the DESs and the parameters of the venture capital market in the context of Russian startups' niches, i.e., the number of deals (investments and acquisitions), the total volume and average price of acquisitions and venture capital deals. Secondly, we employ ***panel matching*** to identify causal effect of deals with DESs.

Two-way fixed effects model. The basic specification for two-way fixed effects model (TWFE) (see Appendix, Table 1A for results) is as follows:

$$\log(Y_{it} + 1) = \beta_1 \text{ cum\_treatment}_{it} + \beta_2 \text{ capacityit} + \beta_3 \text{ cum\_buys}_{it} + \beta_4 \text{ cum\_investments}_{it} + \beta 5 \text{ cum\_sum}_{it} + \beta_6 \text{ cum\_price}_{it} + \alpha_i + \tau_t + \varepsilon_{it},$$

where

- Y_{it} is a dependent variable, which can be one of the following variables:
  - deals_{it} is the number of deals (acquisitions and venture capital deals) in niche *i* in month *t*, units;
  - buys_{it} is the number of acquisitions in niche *i* in month *t*, units;
  - investments_{it} is the number of venture capital deals in niche *i* in month *t*, units;
  - sum_sum_{it} is the total volume of acquisitions in niche *i* in month *t*, US dollars;
  - avg_sum_{it} is the average price of acquisition in niche *i* in month *t*, US dollars;

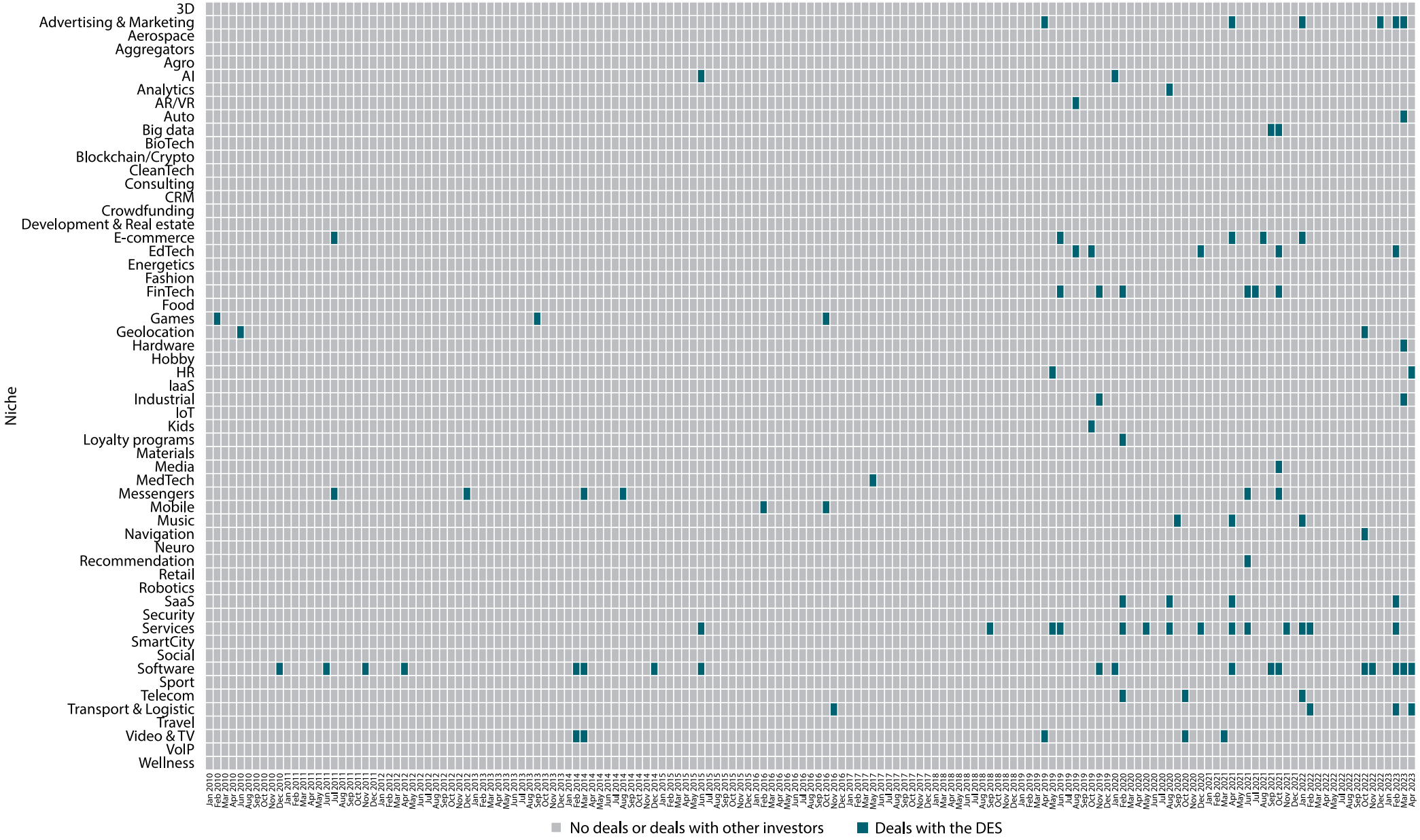


Fig. 5. Distribution of the deals with DESs, 2010–2023[1]

Рис. 5. Распределение сделок с участием ЦЭС, 2010–2023

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

– sum_price$_{it}$ is the total volume of venture capital deals in niche *i* in month *t*, US dollars;

– avg_price$_{it}$ is the average volume of venture capital deals in niche *i* in month *t*, US dollars.

• cum_treatment$_{it}$ is the cumulative number of all deals (sum of acquisitions and venture capital deals) with the DESs in niche *i* by month *t*;

• capacity$_{it}$ is niche size proxy, the number of startups in niche i by month *t*;

• cum_buys$_{it}$ is the cumulative number of acquisitions in niche *i* by month *t*;

• cum_investments$_{it}$ is cumulative number of venture capital deals in niche *i* by month *t*;

• cum_sum$_{it}$ is the cumulative volume of investments in niche *i* by month *t*;

• cum_price$_{it}$ is the cumulative volume of acquisitions in niche *i* by month *t*;

• α_i, τ_t niche and month fixed effects;

• ε_{it} is standard errors clustered according to [Abadie et al., 2017].

We use log transformation of the dependent variable in all the specifications because, firstly, our dependent variables always are non-negative (as our dependent variable can equal zero, we add 1 to each observation before performing log transformation), and secondly, the distribution of the original dependent variables is close to the log-normal distribution.

Next, we assume that there is dynamic influence of deals with DESs on venture capital market activity, and there can have a passive and/or delayed effect of such deals on the dependent variables, thus, we add lagged cumulative number of deals with the DESs to the explanatory variables. However, as we can see from Table 2A (see Appendix), the results do not confirm our assumption of such dynamic relationship, and in subsequent steps we excluded the lags from our specification.

Then, we test the non-linear relationship of the variables in our model: we add the squares of the cumulative number of the deals with the DESs and of the niche size proxy, as well as the logarithms for the cumulative number and volume of acquisitions and venture capital deals (Table 2). After that, for the final specification, we test again whether the effect of lagged values of the cumulative number of the deals with the DESs (Appendix, Table 3A) is significant, and reject the assumption of possible dynamic relationship once more. Thus, the results of estimation of our final model specification are presented in Table 2.

Table 2 – Correlation between the total number of deals, the total volume of deals and the average deal price and the cumulative number of deals with the DESs using the assumption about a non-linear relationship between regressors

Таблица 2 – Взаимосвязь общего количества сделок, общей суммы сделок и средней цены сделки и накопленного количества сделок ЦЭС с использованием предпосылки о нелинейной связи между регрессорами

Variables	Number of deals, units			Volume of deals, US dollars			
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21
Dependent variable	acquisitions and venture capital deals	acquisitions	venture capital deals	acquisitions, total	acquisitions, average price	venture capital deals, total	venture capital deals, average price
Cumulative number of deals with the DESs (acquisitions and venture capital deals) in a niche, units	–0.0967*** (0.0218)	–0.0039 (0.0069)	–0.0853*** (0.0195)	–1.571*** (0.3068)	–1.513*** (0.2976)	–0.0879* (0.0438)	–0.0876. (0.0438)
Square of the cumulative number of deals with the DESs (acquisitions and venture capital deals) in a niche, units	0.0063. (0.0037)	0.0001 (0.0005)	0.0055 (0.0036)	0.1232** (0.0408)	0.1191** (0.0390)	0.0077 (0.0051)	0.0077 (0.0051)
Proxy for the number of startups in a niche, units	0.0136*** (0.0016)	0.0012*** (0.0002)	0.0129*** (0.0015)	0.1029*** (0.0147)	0.0972*** (0.0139)	0.0048** (0.0014)	0.0048** (0.0014)
Square of proxy for the number of startups in a niche, units	–1.57e-5*** (3.75e-6)	–9.18e-7* (4e-7)	–1.48e-5*** (3.54e-6)	–0.0001*** (3.33e-5)	–0.0001*** (3.15e-5)	–7.68e-6** (2.75e-6)	–7.68e-6** (2.75e-6)
Log of the cumulative number of acquisitions in a niche, units	–0.0867** (0.0291)	0.0486*** (0.0079)	–0.1213*** (0.0260)	–1.840*** (0.3161)	–1.767*** (0.3029)	–0.0316 (0.0675)	–0.0321 (0.0675)
Log of the cumulative number of venture capital deals in a niche, units	0.0803*** (0.0200)	–0.0162*** (0.0033)	0.0934*** (0.0195)	0.7605** (0.2302)	0.6941** (0.2173)	–0.0477 (0.0301)	–0.0475 (0.0301)
Log of the cumulative volume of venture capital deals in a niche, US dollars	0.0035. (0.0021)	0.0019*** (0.0004)	0.0019 (0.0020)	0.0755** (0.0265)	0.0771** (0.0254)	0.0115** (0.0037)	0.0115** (0.0037)

Table 2 (concluded)
Окончание таблицы 2

Variables	Number of deals, units			Volume of deals, US dollars			
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21
Log of the cumulative volume of acquisitions in a niche, US dollars	–0.0014 (0.0024)	–0.0006 (0.0005)	–0.0016 (0.0022)	0.0520. (0.0262)	0.0511* (0.0251)	0.0340*** (0.0057)	0.0340*** (0.0057)
Fixed effects	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Clustered standard errors	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Number of observations	8,835	8,835	8,835	8,835	8,835	8,835	8,835
R2	0.67179	0.23473	0.64102	0.34565	0.33960	0.07066	0.07073
Within R2	0.49228	0.11801	0.45643	0.22017	0.21698	0.01830	0.01831

Note. Significance level of variables: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; in all models, logarithms are calculated for variables increased by 1.
Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

Panel matching. Further, we estimate the causal relationship between the deal with DESs and the number of deals (acquisitions and venture capital deals), the total volume and the average price of acquisitions and venture capital deals. The main difficulty in estimating the treatment effect using our data is choosing the way we define our treatment variable, i.e., a variable that equals 1 in those months and niches, where all deal with the DES occurred (in Fig. 5, the dark gray cells indicate where the treatment variable takes on the value 1, i.e., the all with the DES occurred).

The way we specify the treatment variable implies it does not satisfy the exogeneity assumption: investors' decisions about consummating a deal are not random, rather, they have some economic reasons for preferring one project to the other. Otherwise, to test the hypotheses on causal inference we could just compare means of venture capital market activity or perform simple linear regression analysis; however, as we assume endogeneity, there are some features of the data generating process we should keep in mind when with choosing an appropriate method of estimation.

One of the ways to tackle the problem of endogeneity is the difference-in-differences estimating [Abadie, 2005], but in our case, we have repeated treatment which complicates our assessment. First, different niches enter the treatment group at different times (Fig. 6). Latham and Brugués [2021] also address this issue of venture capital market. This problem is typically solved using the staggered adoption difference-in-differences method [Sun, Abraham, 2021], which makes it possible to make estimations when our units (niches) move to a treatment group at different times (Fig. 6, right), and the treatment assignment matrix has a 'staggered' form (as opposed to the block treatment assignment for the classical difference-in-differences method (Fig. 6, left).

Second, niches change their treatment status dynamically not just at different times, but also repeatedly: there can be deals in neighboring periods (see Fig. 5). That means that we have repeated treatments. This prevents us from routinely dividing the sample into control and treatment groups, and into periods before and after deals with the DES, as these groups are constantly chang-

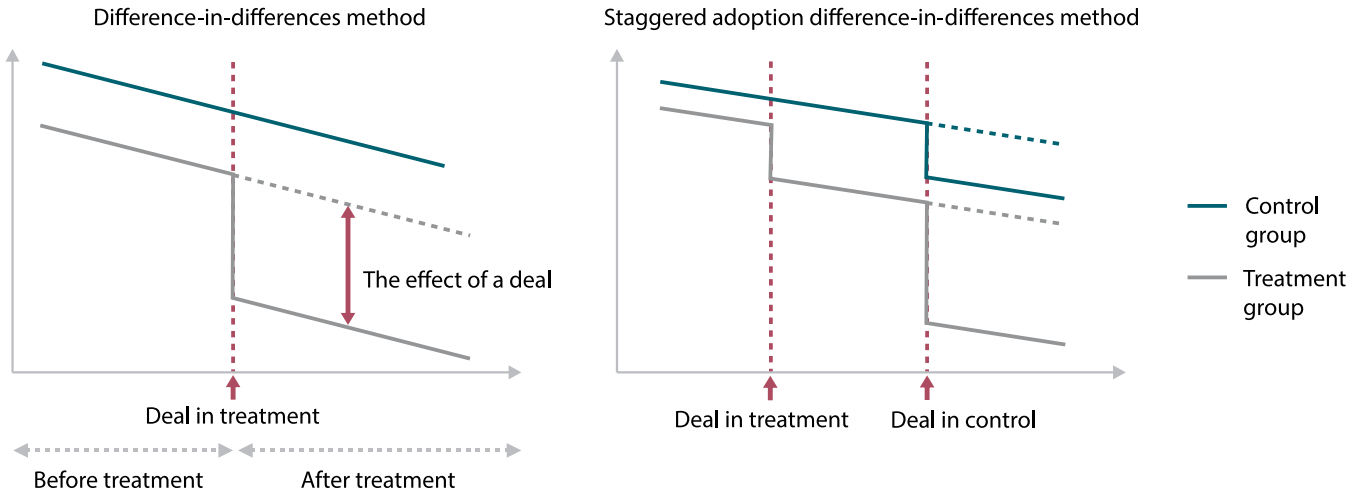


Fig. 6. Treatment options

Рис. 6. Возможные варианты воздействия

ing their status. Taking into account the aforementioned problems we switch to estimating the effect of deals with DESs on the number of deals (volumes and average price of deals) before and after mergers using dynamic difference-in-differences model, also known as panel matching [Imai, Kim, Wang, 2021]. To perform panel matching model, we use three-month treatment history, niche and date, total number of deals and the number of deals with the DESs, and total funding over the past year; the model was used for deriving dynamic estimates of the DES deals' effects within the year following the deal.

ESTIMATING THE EFFECTS OF DEALS WITH THE DESs

Our results of estimating the effects of deals with the DESs for venture capital market only partially confirm the results obtained in [Prado, Bauer, 2022].

The results for the *two-way fixed effects model* are given in Table 2 and Appendix (Tables 1A–3A, Other model specifications). The niches in which the DESs are comparatively more active in consummating deals (acquisitions and venture capital deals) can be characterized by lower volumes of venture capital deals, which indicates the 'washing out' of investments from these niches. However, the same effect is not observed for startup acquisitions. This does not allow us to unambiguously confirm the second hypothesis, since deals between the DESs and startups most likely do not result in creation of kill zones, since changes in number of deals may be caused by the fact that investors change timing of their decisions to earlier periods.

As for the price of acquisitions, there is also a non-linear relationship[1] with the cumulative number of all deals with the DESs: other things being equal, in the niches with a larger number of deals with the DESs we can observe smaller volumes of acquisitions and their average prices.

One more result that we found is that the greater the cumulative number of acquisitions in a niche, the fewer the number of deals in it, and vice versa, the greater the number of venture capital investment deals – the fewer the number of deals in the niche in question. We can view this effect as a result of multidirectional relationship for acquisitions and venture capital deals:

- cumulative number of venture capital deals in a niche is negatively related to acquisitions and positively correlated with the volume of venture capital deals: the niches that are attractive for investors remain attractive for them, whereas ceteris paribus, they turn out to be less attractive for those companies that look for startups to buy;
- cumulative number of acquisitions in a niche, in turn, is negatively related to the volume of venture capital deals in this niche and positively correlated with acquisitions: this supports our thesis that there are some specific patterns of investment (consummation of venture capital deals) in different niches.

At the same time, for the total and average volumes of acquisitions, there is a negative relationship with the cumulative number of acquisitions and a positive relationship with the cumulative number of venture capital deals. This may indicate that companies interested in acquisitions are attracted in promising or just popular niches. Wherein these niches should be not overloaded by other companies – otherwise the probability of investing in such niches fall.

The size of the niche, namely, the number of startups involved in deals within the niche also influences the number of deals with Russian startups in the niches (including acquisitions and venture capital deals). This relationship is non-linear and has an inverse U-shape.

Turning to the relationship between the number of deals (and specifically acquisitions and venture capital deals) and niche size proxy, we can note that initially, with a small niche size, the relationship is positive, i.e., the greater the number of startups in the niche, the more deals of both types are made. What is more, the elasticity of the number of venture capital deals by niche size is even greater than that of acquisitions, but this quadratic relationship has maximum when the niche size is around 433 for all deals and 653 and 435 for acquisitions and venture capital deals (Fig. 7). This could potentially be attributed to the niches' life cycles: when we look at a "young" niche there are few startups and, therefore, a small number of deals; as the niche gets more mature, less and less deal are consummated, and large and old niches attract just a small number of investors.

There is also an inverse U-shaped relationship between the niche size and the total and average volumes of acquisitions and venture capital deals (Table 2, models 18–21).

When we look at niches with large volumes of deals (both acquisitions and venture capital deals) and average size of deals we can notice that in periods before the one we consider, ceteris paribus, they were more attractive for investors. In addition, there is a positive relationship between the total and average volume of venture capital deals in a niche and the cumulative volume of acquisitions: this may indicate that the niches differ in their attractiveness to potential investors.

Results of panel matching. If the DESs consummate a deal, then, ceteris paribus, there are more deals in this niche in this month than in the niches where there were no deals with DESs. This may be due to the growing attention of investors to the niche in the same period. However, 4, 7 and 8 months after the acquisition, there is a decrease in the number of deals in the niche in question. For acquisitions taken separately, the effect in the same month is also positive and significant. For the total number of venture capital deals, a negative effect is recorded after 4, 7, 8, and 12 months following the deal with the DESs (Fig. 8).

[1] In this section we discuss the correlations found, therefore, we use the term 'relationship'; in the section with the results of panel matching (see below) we discuss the causal relationships.

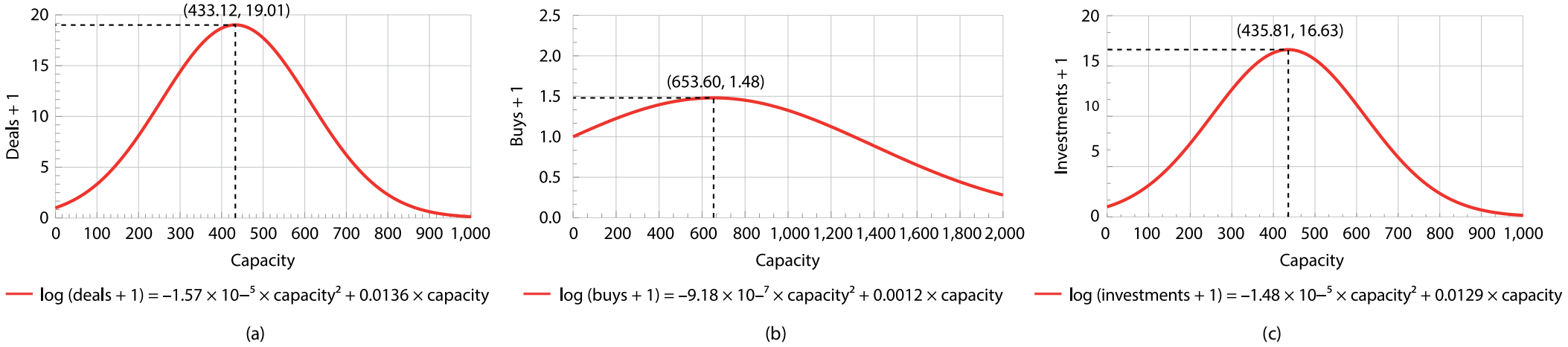


Fig. 7. Type of functional relationship between (a) the number of deals (acquisitions and venture capital deals), (b) the number of acquisitions, (c) venture capital deals, and niche size proxy

Рис. 7. Вид функциональной связи: a) количества сделок: b) количества покупок; c) количества инвестиций и прокси размера ниши

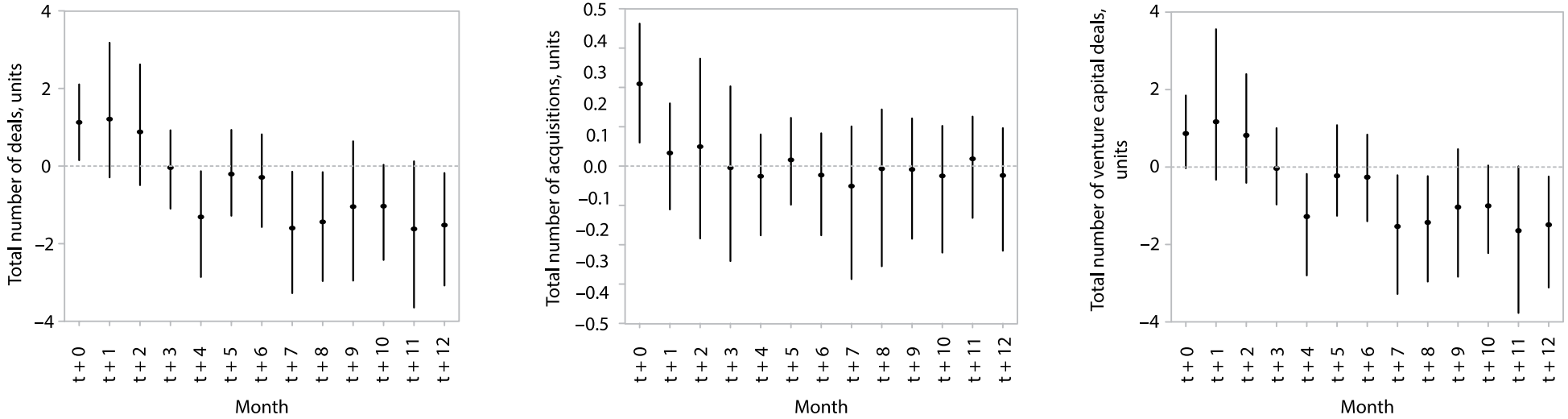


Fig. 8. Effects of deals with the DESs on the total number of deals, including acquisitions and venture capital deals (results of the dynamic difference-in-differences)[1]

Рис. 8. Эффекты сделок ЦЭС на общее количество сделок, покупок и инвестиций (вложений), полученные методом динамической разности разностей

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

There is no effect of deals with the DESs on the total volume and average value of venture capital deals. However, we can observe a positive effect of deals with the DESs on the total volume of acquisitions in the same month on other acquisitions and within two months after that, as well as after 5 and 8 months following the deal. The positive effect on the average value of deals is also significant in the month when acquisition occurs and in the 1st, 5th, 8th, and 10th months after the deal (Fig. 9).

Summarizing the above conclusions, we assume that deals with the DESs may attract investors' attention to the niches in the current quarter. This effect is likely the result of changing timing of investors' decisions as they reschedule deals to earlier periods, since we see an increase in the number of deals with the DESs in a niche simultaneously with a decrease in the number of all deals (not only those with digital ecosystems). This observation supports our first hypothesis.

We also conduct placebo tests to check the robustness of our results. To that end, using the initial disaggregated data on deals with Russian startups we randomly generate new dates in the same time interval – from January 2010 to April 2023 (in-time placebo test). Next, we process new data in the same way as the initial data (removing gaps, aggregating by niche and month, etc.) and estimate all the aforementioned models using new data. We expect that control variables such as niche size proxies will be still significant in placebo test, since we do not change the initial data on deals characteristics, their value, niches (all of the data except for data of the deal). At the same time but we expect that the effect of deals with the DESs on venture capital market will become insignificant. At the end of the day we get insignificant effect of the DES deals' on the variables of interest in the panel matching, as well as the estimates of the coefficients for the cumulative number of DES deals and their squares obtained through the two-way fixed effects model are also insignificant when we use placebo dataset. These indicates that our results are robust (see Fig. 11, 21, Table 4A in the Appendix).

DISCUSSION

The results we get are important especially when we turn to antitrust merger control of deals between digital ecosystems and startups. On the one hand, the threshold value of 7 billion rubles for price of deals that should be notified to the FAS Russia[2] is intended to tackle the problem of startup acquisitions that may negatively influence competition[3]. On the other hand, such amendments in antitrust law will increase burden of Russian antitrust regulator.

For example, Yandex and Kinopoisk that consummated merger in 2014 that worth of 80 million US dollars, did not have to notify this deal to the FAS of Russia since the book value of Kinopoisk's assets, according to Spark Interfax, in 2013 and 2014, when the companies were considering the deal, amounted to 147.1 and 117.2 million rubles, respectively. New amendments suggest that parties in such a deal should notify it.

At the same time, the results we obtain in this study question the need for additional regulation of M&A deals

[2] Bill No. 160280-8 On amendments to the Federal Law "On the Protection of Competition" (in terms of improving antitrust regulation of 'digital' markets). https://sozd.duma.gov.ru/bill/160280-8. (in Russ.)

[3] Startup acquisitions will come to the attention of the Federal Antimonopoly Service of Russia. https://cljournal.ru/news/19912/. (in Russ.)

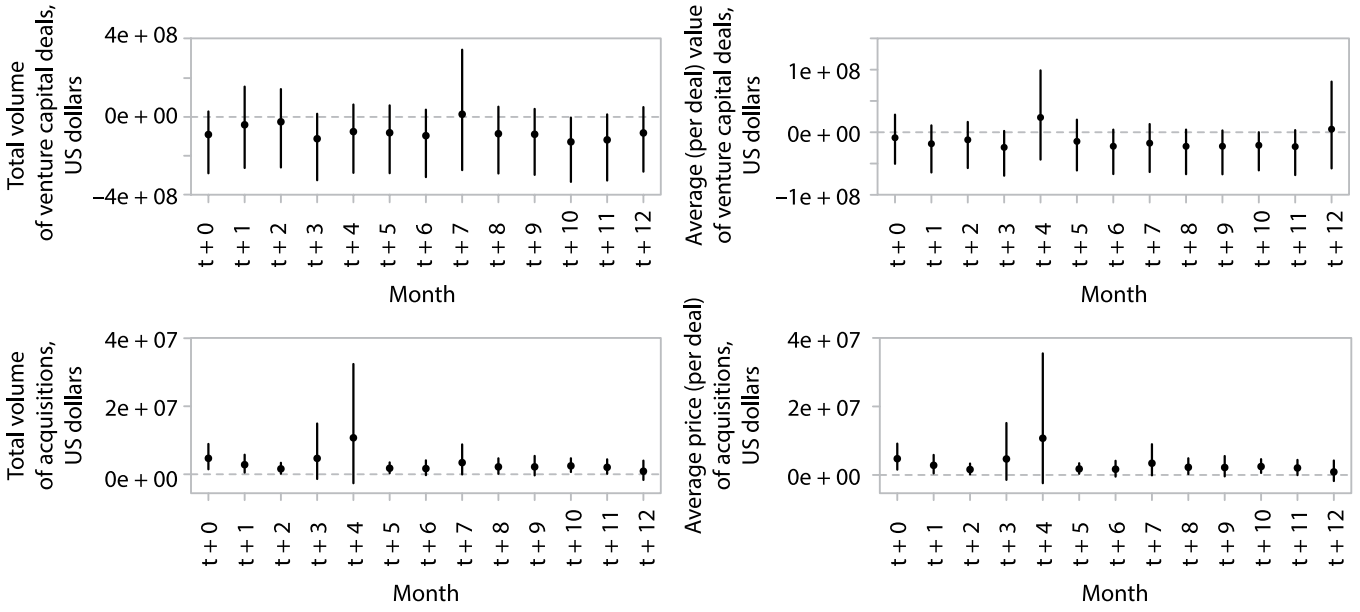


Fig. 9. Effects of deals on the volume and average value of acquisitions and venture capital deals (result of the dynamic difference-in-differences)[1]

Рис. 9. Эффекты сделок ЦЭС на объем и среднюю величину покупок и инвестиций (вложений), полученные методом динамической разности разностей

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

with startups: the pro-competitive effect of the additional regulation in the venture capital market is doubtful.

Moreover, there is a risk that companies will strategically decrease the volume of their deals to avoid notification and possible rejection of the FAS Russia. Such an occasion happened recently when Yandex tried to purchase the Vezet Group [Pavlova, Markova, 2023]: when the deal was blocked by the FAS Russia in July 2019 the DES (Yandex) purchased a part of the Vezet Group business (call centers and freight transportation business). At that, the new deal did not require notification by the FAS Russia.

Another drawback of such regulation is the distortion of incentives for companies and startups: the use of the deal-value threshold may create a kind of 'selection effect'. If companies assume nonzero probability that deal notification will be rejected by the FAS Russia, the bargaining power of the investor will increase, which may result in decreasing of the acquisition price of startups [Fumagalli, Motta, Tarantino, 2022]. There are two types of consequences here. On the one hand, lower prices for the startups being purchased can provide the potential competitors of DESs with more incentives to develop their own products. On the other hand, a decline in startup prices in the venture capital market may cause the 'washing out' of high-type startups as part of adverse selection [Wang, 2021] and distort innovators' incentives, who create startups in order to sell them to large companies [Bryan, Hovenkamp, 2020].

Moreover, even if there is a kill zone around startups acquisitions by ecosystems, it may be heterogeneous: while some companies reduce R&D spending when there are greater threats from the startup space, companies with strong network externalities, on the contrary, invest relatively more in R&D when they face greater new entry threats [Pan, Huang, Gopal, 2019].

All this ignite debates about the potential of using competition policy measures, rather than antitrust regulation, which are aimed at promoting competition, ensuring interoperability of services, and encouraging data portability between different ecosystems. In addition, compulsory licensing can also be a separate instrument that can be viewed as behavioral remedies for dominant platforms that create DES around them [Bryan, Hovenkamp, 2020].

CONCLUSION

Mixed evidence of the effect of deals between digital ecosystem and startups on the venture capital market makes it difficult to answer the question whether amendments in antitrust regulation concerning merger control is required. This study attempts to assess the effect of deals that digital ecosystems consummate with Russian startups on the venture capital market.

Although we have found that there are lower volumes of venture capital deals in the niches where DES perform deals, the acquisition price is non-linearly related to the cumulative number of deals with the DESs: with a large number of deals in a niche, it attracts more investors. This may be due to the fact that after a series of acquisitions, a sufficient number of competitors may have entered the niche, and therefore this companies may be immune to be abused by DESs there.

The other interesting result we found is the relationship between venture capital deals, acquisitions and their cumulative volumes: the niches attractive for investors retain their attractiveness, but, other things being equal, they turn out to be less attractive for those companies looking for acquisitions. These indicates that there are different investment patterns in different niches. In addition, investors are interested in popular niches that had not been squeezed out by others, which is evidenced by the fact that the total and average volumes of acquisitions are negatively related to the cumulative number of acquisitions, and positively related to the cumulative number of venture capital deals.

The niche size appears to be a significant factor across all the specifications examined. This shows that niche size is a significant predictor of deals in niches, but the observed relationship is apparently non-linear and follows an inverse U-shape. This could potentially be due to the life cycles of niches.

The results of panel matching indicate that if the DESs consummate deals, then, ceteris paribus, there are more deals in this niche in this month than in niches where there were no deals with DESs. This may indicate that deals between DESs and startups attract attention of other investors to the niche.

According to the findings, deals between the DESs and startups most likely do not lead to a kill zone in niches, and a change in the number of deals may be due to company decisions being transferred to earlier periods.

Although the issue of the negative reaction of venture capital markets to startup acquisitions by digital ecosystems (as the 'washing out' of them from the respective niches) is partially clarified in the given research, for a more detailed discussion of the need to regulate M&A deals with digital ecosystems, one needs additional studies of their possible effects in other markets as well. ■

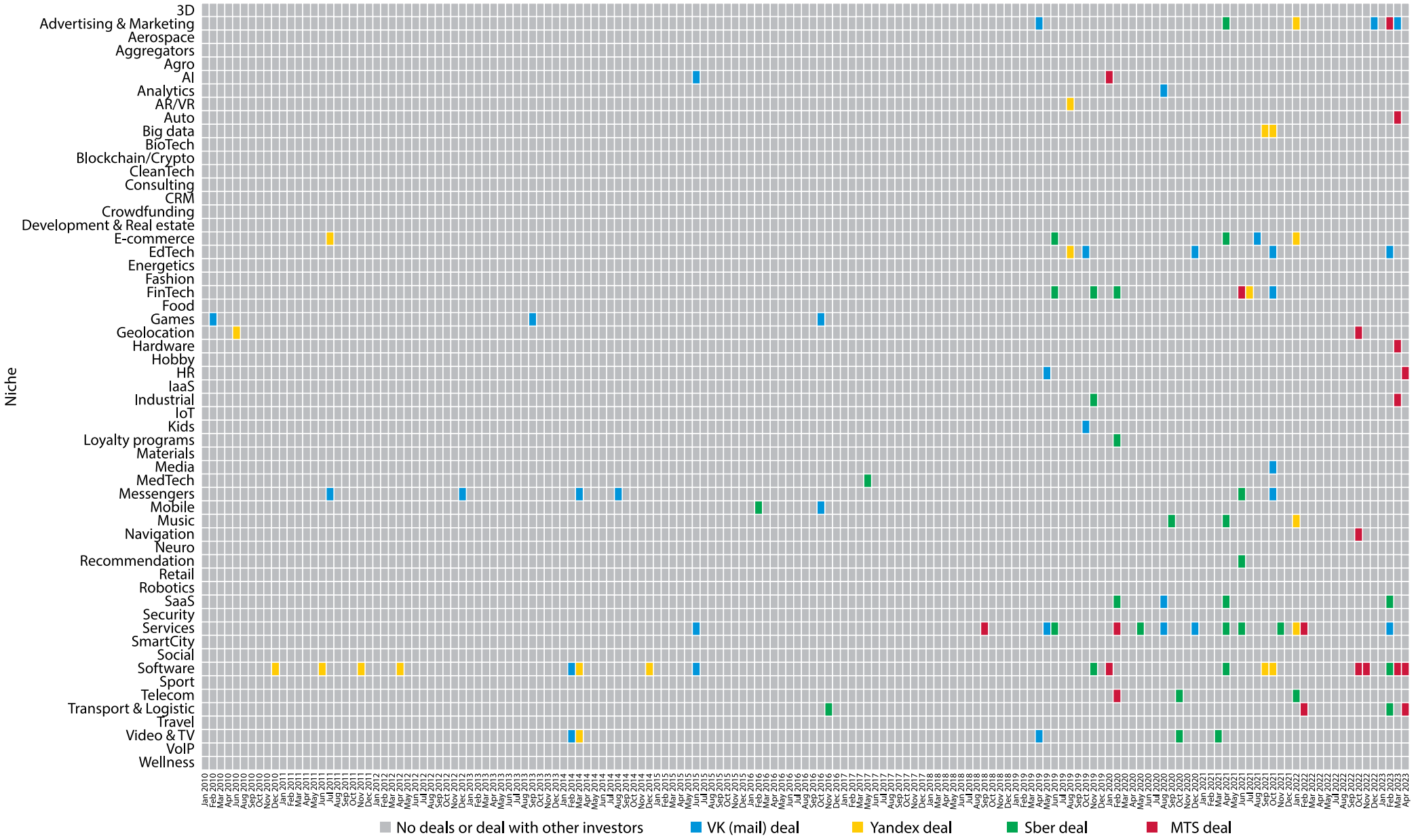


Fig. 10. Distribution of the deals under study[1]

Рис. 10. Распределение изучаемых сделок

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

Table 1A – Relationship between the total number of deals, the total volume of deals and the average deal price and the cumulative number of deals with the DESs in the niche

Таблица 1А – Взаимосвязь общего количества сделок, общей суммы сделок и средней цены сделки и накопленного количества сделок ЦЭС в нише

Variables	Number of deals, units			Deal volume, US dollars			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Dependent variable	acquisitions and venture capital deals	acquisitions	venture capital deals	acquisitions, total	acquisitions, average price	venture capital deals, total	venture capital deals, average price
Cumulative number of deals with the DESs (acquisitions and investments) in a niche, units	–0.0285* (0.0109)	0.0042 (0.0047)	–0.0304* (0.0118)	–0.4675* (0.2024)	–0.4460* (0.1961)	0.0325 (0.0484)	0.0326 (0.0484)
Proxy for the number of start-ups in a niche, units	0.0073*** (0.0014)	0.0009*** (0.0001)	0.0069*** (0.0013)	0.0449** (0.0132)	0.0423** (0.0125)	0.0018* (0.0008)	0.0018* (0.0008)
Cumulative number of acquisitions in a niche, units	–0.0364** (0.0114)	0.0112*** (0.0026)	–0.0432*** (0.0120)	–0.5315*** (0.0826)	–0.4985*** (0.0794)	–0.0359 (0.0265)	–0.0360 (0.0265)
Cumulative number of venture capital deals in a niche, units	–0.0016. (0.0009)	–0.0008*** (0.0002)	–0.0010 (0.0008)	–0.0058 (0.0106)	–0.0061 (0.0101)	–0.0002 (0.0014)	–0.0002 (0.0014)
Cumulative volume of venture capital deals in a niche, US dollars	1.71e–11 (1.23e-11)	2.42e-12 (2.32e-12)	1.49e-11 (1.22e-11)	1.07e-10 (8.03e-11)	9.82e-11 (7.64e-11)	–1.23e-11 (10e-12)	–1.24e-11 (9.99e-12)
Cumulative volume of acquisitions in a niche, US dollars	9.25e-11. (5.41e-11)	–3.02e-11 (2.02e-11)	1.11e-10* (4.96e-11)	1.45e-9** (4.55e-10)	1.38e-9** (4.35e-10)	4.58e-10 (2.99e-10)	4.58e-10 (2.99e-10)
Fixed effects	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Clustered standard errors	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Number of observations	8,835	8,835	8,835	8,835	8,835	8,835	8,835
R2	0.56964	0.22588	0.54459	0.25641	0.25098	0.05838	0.05846
Within R2	0.33426	0.10780	0.31042	0.11381	0.11191	0.00533	0.00534

Note. Significance level of variables: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; in all models, logarithms are calculated for variables increased by 1.
Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

Table 2A – Relationship between the total number of deals, the total volume of deals and the average deal price and the cumulative number of deals with the DESs in the niche and their lagged values

Таблица 2А – Взаимосвязь общего количества сделок, общей суммы сделок и средней цены сделки и накопленного количества сделок ЦЭС в нише и их лагированных значений

Variables	Number of deals, units			Deal volume, US dollars			
	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Dependent variable	acquisitions and venture capital deals	acquisitions	venture capital deals	acquisitions, total	acquisitions, average price	venture capital deals, total	venture capital deals, average price
Cumulative number of deals with the DESs (acquisitions and venture capital deals) in a niche, units	–0.0409* (0.0171)	0.0022 (0.0057)	–0.0411* (0.0176)	–0.5547* (0.2163)	–0.5278* (0.2115)	0.0347 (0.0492)	0.0348 (0.0492)
first lag	–0.0064 (0.0061)	0.0005 (0.0014)	–0.0072 (0.0057)	–0.0620 (0.0618)	–0.0612 (0.0595)	0.0141 (0.0096)	0.0141 (0.0096)
second lag	–0.0009 (0.0099)	–0.0004 (0.0020)	–8.17e-5 (0.0092)	0.0174 (0.0655)	0.0172 (0.0611)	–0.0238 (0.0230)	–0.0238 (0.0230)
third lag	–0.0230** (0.0069)	–0.0055* (0.0025)	–0.0184** (0.0062)	–0.1068 (0.1036)	–0.0888 (0.0987)	–0.0120 (0.0143)	–0.0120 (0.0143)

Table 2A (concluded)
Окончание таблицы 2А

Variables	Number of deals, units			Deal volume, US dollars			
	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
fourth lag	–0.0119 (0.0073)	–0.0007 (0.0014)	–0.0124 (0.0080)	–0.1531 (0.1126)	–0.1472 (0.1098)	0.0106 (0.0106)	0.0107 (0.0106)
fifth lag	0.0042 (0.0063)	–0.0012 (0.0025)	0.0030 (0.0064)	0.0392 (0.0767)	0.0338 (0.0733)	0.0370 (0.0221)	0.0370 (0.0221)
sixth lag	0.0071 (0.0091)	–0.0031* (0.0015)	0.0089 (0.0095)	0.1313 (0.0884)	0.1179 (0.0814)	–0.0043 (0.0118)	–0.0041 (0.0117)
Proxy for the number of startups in a niche, units	0.0071*** (0.0014)	0.0009*** (0.0001)	0.0067*** (0.0013)	0.0427** (0.0128)	0.0404** (0.0121)	0.0018* (0.0009)	0.0018* (0.0009)
Cumulative number of acquisitions in a niche, units	–0.0293. (0.0154)	0.0111*** (0.0030)	–0.0351* (0.0157)	–0.4794*** (0.0717)	–0.4503*** (0.0713)	–0.0440 (0.0318)	–0.0441 (0.0318)
Cumulative number of venture capital deals in a niche, units	–0.0017. (0.0009)	–0.0008** (0.0002)	–0.0012 (0.0008)	–0.0067 (0.0107)	–0.0069 (0.0103)	0.0001 (0.0017)	0.0001 (0.0017)
Cumulative volume of venture capital deals in a niche, US dollars	2.64e-11. (1.32e-11)	4.09e-12 (2.64e-12)	2.33e-11. (1.32e-11)	1.7e-10* (8.43e-11)	1.57e-10. (8.14e-11)	–1.4e-11 (1.4e-11)	–1.41e-11 (1.39e-11)
Cumulative volume of acquisitions in a niche, US dollars	7.55e-11 (5.76e-11)	–2.62e-11 (1.91e-11)	8.62e-11 (5.3e-11)	1.3e-9** (3.96e-10)	1.23e-9** (3.82e-10)	5.15e-10. (3.06e-10)	5.15e-10. (3.06e-10)
Fixed effects	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Clustered standard errors	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Number of observations	7,905	7,905	7,905	7,905	7,905	7,905	7,905
R2	0.57876	0.22893	0.55543	0.26401	0.25842	0.06617	0.06626
Within R2	0.33851	0.10786	0.31501	0.11345	0.11157	0.00647	0.00648

Note. Significance level of variables: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; in all models, logarithms are calculated for variables increased by 1.
Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

Table 3A – Relationship between the total number of deals, the total volume of deals and the average deal price and the cumulative number of deals with the DESs in the niche and their lagged values using the assumption about a non-linear relationship between the regressors
Таблица 3А – Взаимосвязь общего количества сделок, общей суммы сделок и средней цены сделки и накопленного количества сделок ЦЭС в нише и их лагированных значений с использованием предпосылки о нелинейной связи между регрессорами

Variables	Number of deals, units.			Deal volume, US dollars			
	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28
Dependent variable	acquisitions and venture capital deals	acquisitions	venture capital deals	acquisitions, total	acquisitions, average price	venture capital deals, total	venture capital deals, average price
Cumulative number of deals with the DESs (acquisitions and venture capital deals) in a niche, units	–0.0556* (0.0249)	–0.0059 (0.0041)	–0.0484* (0.0240)	–0.6021*** (0.1613)	–0.5779*** (0.1556)	–-0.0210 (0.0237)	–0.0208 (0.0237)
first lag	–0.0033 (0.0067)	–0.0004 (0.0015)	–0.0036 (0.0063)	–0.0084 (0.0702)	–0.0098 (0.0689)	0.0095 (0.0133)	0.0094 (0.0133)
second lag	0.0042 (0.0058)	0.0012 (0.0018)	0.0039 (0.0052)	0.0293 (0.0442)	0.0286 (0.0427)	–0.0102 (0.0113)	–0.0102 (0.0113)
third lag	0.0189 (0.0130)	0.0009 (0.0018)	0.0196 (0.0133)	0.1158 (0.0772)	0.1162 (0.0726)	–0.0148 (0.0182)	–0.0149 (0.0182)

Table 3A (concluded)
Окончание таблицы 3А

Variables	Number of deals, units.			Deal volume, US dollars			
	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28
fourth lag	–0.0008 (0.0102)	–0.0028 (0.0018)	0.0002 (0.0104)	0.0249 (0.1272)	0.0228 (0.1239)	0.0109 (0.0149)	0.0109 (0.0149)
fifth lag	0.0162* (0.0062)	0.0002 (0.0015)	0.0143* (0.0059)	0.1208 (0.0764)	0.1114 (0.0734)	0.0248 (0.0204)	0.0248 (0.0204)
sixth lag	–0.0011 (0.0097)	–0.0046* (0.0018)	0.0015 (0.0093)	0.0986 (0.0759)	0.0882 (0.0731)	–0.0144 (0.0130)	–0.0143 (0.0129)
Proxy for the number of startups in a niche, units	0.0130*** (0.0014)	0.0012*** (0.0001)	0.0124*** (0.0013)	0.0908*** (0.0133)	0.0856*** (0.0126)	0.0043** (0.0013)	0.0043** (0.0013)
Squared proxy for the number of startups in a niche, units	–1.39e-5*** (2.57e-6)	–8.61e-7** (2.5e-7)	–1.33e-5*** (2.39e-6)	–0.0001*** (2.17e-5)	–0.0001*** (2.06e-5)	–5.68e-6** (1.82e-6)	–5.68e-6** (1.82e-6)
Log of the cumulative number of acquisitions in a niche, units	–0.0902* (0.0356)	0.0490*** (0.0089)	–0.1210*** (0.0337)	–2.050*** (0.4083)	–1.964*** (0.3929)	–0.0695 (0.0830)	–0.0702 (0.0830)
Log of the cumulative number of venture capital deals in a niche, units	0.0874*** (0.0217)	-0.0170*** (0.0039)	0.0994*** (0.0210)	0.8916*** (0.2496)	0.8176** (0.2356)	-0.0486 (0.0307)	-0.0484 (0.0307)
Log of the cumulative volume of venture capital deals in a niche, US dollars	0.0035. (0.0019)	0.0017*** (0.0004)	0.0021 (0.0019)	0.0767** (0.0249)	0.0785** (0.0238)	0.0112** (0.0034)	0.0112** (0.0034)
Log of the cumulative volume of acquisitions in a niche, US dollars	–0.0012 (0.0023)	–0.0005 (0.0005)	–0.0015 (0.0022)	0.0476. (0.0251)	0.0470. (0.0243)	0.0345*** (0.0063)	0.0345*** (0.0063)
Fixed effects	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Clustered standard errors	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Number of observations	7,905	7,905	7,905	7,905	7,905	7,905	7,905
R2	0.67685	0.23835	0.64925	0.34119	0.33486	0.07711	0.07720
Within R2	0.49255	0.11875	0.45957	0.20643	0.20314	0.01810	0.01812

Note. Significance level of variables: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.
Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

Table 4A – Placebo relationship between the total number of deals, the total volume of deals and the average deal price and the cumulative number of deals with the DESs using the assumption about a non-linear relationship between the regressors
Таблица 4А – Плацебо взаимосвязь общего количества сделок, общей суммы сделок и средней цены сделки и накопленного количества сделок ЦЭС с использованием предпосылки о нелинейной связи между регрессорами

Variables	Number of deals units			Deal volume, US dollars			
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21
Dependent variable	acquisitions and venture capital deals	acquisitions	venture capital deals	acquisitions, total	acquisitions, average price	venture capital deals, total	venture capital deals, average price
Cumulative number of deals with the DESs (acquisitions and venture capital deals) in a niche, units	0.0053 (0.0052)	0.0015 (0.0023)	0.0051 (0.0050)	0.0486 (0.0982)	0.0393 (0.0971)	0.0105 (0.0347)	0.0105 (0.0347)
Squared cumulative number deals with the DESs (acquisitions and venture capital deals) in a niche, units	–0.0002 (0.0003)	–0.0004. (0.0002)	–5.89e-5 (0.0003)	–0.0130* (0.0050)	–0.0114* (0.0048)	–0.0010 (0.0017)	–0.0010 (0.0017)

Table 4A (concluded)
Окончание таблицы 4А

Variables	Number of deals units			Deal volume, US dollars			
	Model 15	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21
Proxy for the number of startups in a niche, units	0.0080*** (0.0007)	0.0005*** (0.0001)	0.0077*** (0.0006)	0.1038*** (0.0120)	0.1011*** (0.0120)	0.0011* (0.0005)	0.0011* (0.0005)
Squared proxy for the number of startups in a niche, units	–7.44e-6*** (1.4e-6)	–3.98e-7* (1.81e-7)	–7.01e-6*** (1.3e-6)	–0.0001*** (2.33e-5)	–0.0001*** (2.32e-5)	–2.68e-6*** (6.82e-7)	–2.68e-6*** (6.82e-7)
Log of the cumulative number of acquisitions in a niche, units	0.0086 (0.0106)	0.0409*** (0.0044)	–0.0204. (0.0109)	–0.5101* (0.2357)	–0.4864* (0.2335)	–0.0334 (0.0508)	–0.0334 (0.0508)
Log of the cumulative number of venture capital deals in a niche, units	0.1017*** (0.0198)	–0.0138** (0.0046)	0.1130*** (0.0201)	1.423*** (0.2530)	1.395*** (0.2506)	–0.1103* (0.0514)	–0.1103* (0.0514)
Log of the cumulative volume of venture capital deals in a niche, US dollars	0.0040*** (0.0008)	0.0005 (0.0005)	0.0036*** (0.0008)	0.1522*** (0.0415)	0.1522*** (0.0413)	0.0032 (0.0028)	0.0032 (0.0028)
Log of the cumulative volume of acquisitions in a niche, US dollars	–0.0010 (0.0009)	0.0002 (0.0003)	–0.0015. (0.0008)	–0.0069 (0.0225)	–0.0079 (0.0220)	0.0277*** (0.0050)	0.0277*** (0.0050)
Fixed effects	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Clustered standard errors	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month	Niche and month
Number of observations	9,120	9,120	9,120	9,120	9,120	9,120	9,120
R2	0.75106	0.11291	0.73371	0.40951	0.40163	0.04184	0.04184
Within R2	0.49077	0.03395	0.46198	0.24246	0.23869	0.01240	0.01240

Note. Significance level of variables: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.
Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

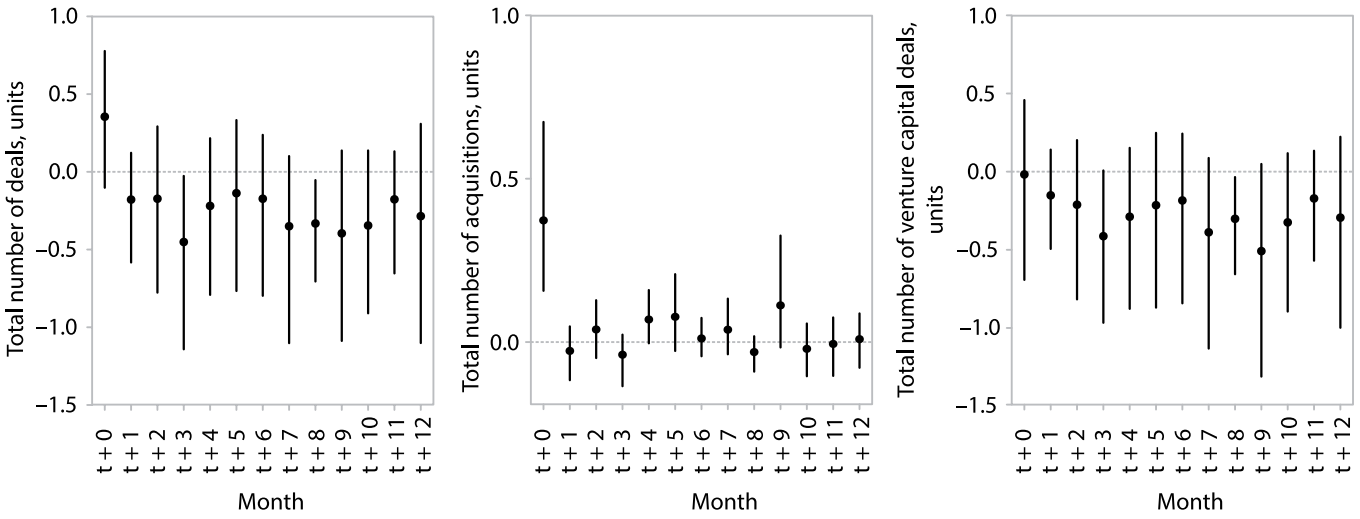


Fig. 11. Placebo effects of deals with the DESs on the total number of deals, acquisitions and venture capital deals (units) obtained by the dynamic difference-in-differences method[1]

Рис. 11. Плацебо эффекты сделок ЦЭС на общее количество сделок, покупок и инвестиций (вложений), шт., полученные методом динамической разности разностей

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

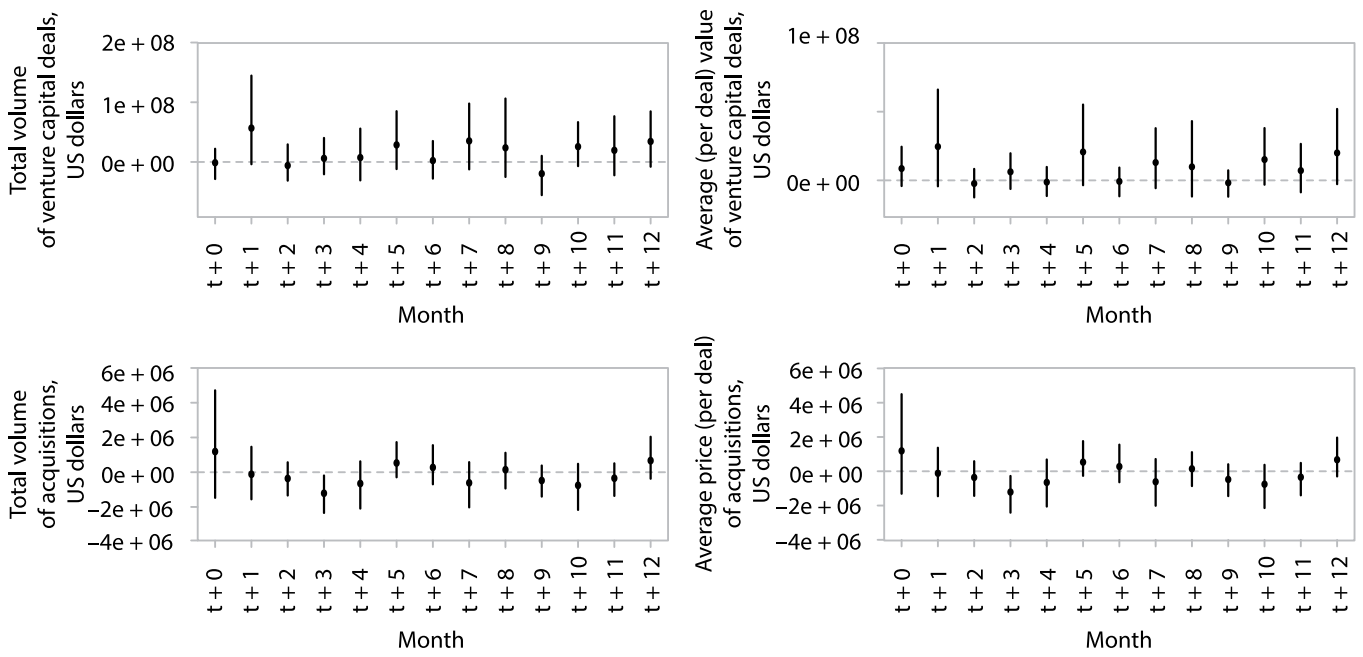


Fig. 12. Placebo effects of deals with the DESs on the volume and average value of acquisitions and venture capital deals obtained by the dynamic difference-in-differences method[1]

Рис. 12. Плацебо эффекты сделок ЦЭС на объем и среднюю величину покупок и инвестиций (вложений), полученные методом динамической разности разностей

[1] Source: compiled by the authors based on Rusbase data. https://rb.ru/deals. (in Russ.)

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