Business group affiliation and financial performance in the agricultural sector of transition economies: The case of Russian agroholdings*

*Alisher Tleubayev, Ihtiyor Bobojonov, Taras Gagalyuk, Thomas Glauben***

Abstract

The Russian agri-food sector illustrated remarkable progress over the last decade. Still, the Russian government is striving to boost production even further and has set a number of goals for the industry for the coming years. Agroholdings are believed to be the main engine not only behind the success of the industry in recent years, but they are also expected to play a key role in moving the sector towards the set targets.

In spite of their increasing role, the literature on agroholdings is still in its infancy and it fails to provide a clear answer on whether they represent a more efficient form of agri-food production. To fill this gap in the literature, we utilise a manually collected panel data set of 203 corporate Russian agri-food enterprises for the years between 2012 and 2017 and provide new empirical evidence on the effects of agroholding affiliation on firms' financial performance, measured in terms of returns on assets and sales.

The results of the random effects model indicate a significant positive impact of agroholding affiliation on financial performance. Further analysis reveals that this positive effect might be attributed to agroholding affiliates' better access to capital, efficient management and stimulating executive compensation systems. The paper provides empirical recommendations for policy makers and corporate executives involved in the Russian agri-food industry.

Keywords: agroholdings, resource dependence theory, financial performance, Russia, agriculture

JEL Codes: M14, Q12, Q13

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1 Introduction

Russia's agricultural sector has shown remarkable progress over the last decade. While the country's gross agricultural output has more than doubled, from RUB 2.46 billion in 2010 to RUB 5.11 billion in 2017 (RosStat, 2018), its agricultural exports jumped by around 130 %, from USD 9 billion in 2010 to USD 21 billion in 2017 (Uzun et al. 2019). In 2017, Russia produced a record amount of around 86 million tons of wheat, of which 33 million tons were exported, making Russia the largest wheat exporter in the world (FAOSTAT, 2017b, 2017a). Substantial progress can also be seen in the production of poultry and pork. Between 2008 and 2017, the production of poultry increased by more than 150 %, whereas the production of pork nearly doubled (Wegren et al. 2019). While Russia is regarded as one of the largest agri-food importers in the world, remarkable growth in its domestic agricultural production over the last decade resulted in a significant decrease in the imports of agri-food products. Agri-food imports dropped by about 67 %, from around USD 43 billion in 2013 (all-time high since the fall of the communist regime) to nearly USD 29 billion in 2017, thereby narrowing the negative trade balance for agri-food products (Uzun et al. 2019). This profound decline in the imports of agri-food products was mainly caused by an import embargo on a range of agri-food products that was introduced by Russia in August of 2014 against a number of western countries (Smutka et al. 2016; Bobojonov et al. 2018). Today, Russia is the largest exporter of wheat and beet pulp and among the top three exporters of sunflower oil, peas, oil cakes, oil meal, flaxseed and barley worldwide (USDA 2018a; Uzun et al. 2019). With the aim of becoming net exporters of agri-food products by 2022[1], Russian policy makers are striving to further increase both the volume and variety of exported agri-food products (Kremlin, 2018). In 2018, the Russian president decreed growing the country's agri-food exports to USD 45 billion by 2024 and moving Russia into the top ten agri-food exporting countries[2] (Dyatlovskaya, 2018b). To achieve these ambitious goals, the Russian government has been pouring an extraordinary amount of financial resources into its agri-food sector, with the total amount of money being allocated to the sector reaching nearly RUB 1.8 trillion between 2012 and 2019 (Wegren et al. 2019).

Large scale agri-food enterprises in general and agroholdings in particular are believed to be the driving force behind such profound progress in Russia's agriculture sector and are considered to be the main engine for reaching the ambitious government goals set for the agri-food industry (Liefert and Liefert

1 As of 2017, Russia has been a net importer of agri-food products, with a negative trade balance of around USD 8 billion.

2 Russia was ranked as the 23rd largest agri-food exporter in 2017 in USD value of exported agri-food products (Knoema, 2017).

2015; Wegren and Elvestad 2018). According to Epshtein et al. (2013), "Agroholdings are business groups, i.e. collections of legally independent firms that operate in horizontally and/or vertically related stages of the food chain and/or in totally unrelated industries and which are bound together by equity ties". In Russia, agroholdings represent a severe concentration of agricultural land, resources and production, having strong economic power, with less than a quarter of farms accounting for 93 % of all profits (Wegren, 2018). Furthermore, the top five agroholdings operate nearly 3.7 million hectares of agricultural land (BEFL agency, 2019) and the top 18 agroholdings produce almost half of the country's total animal feed (Kulistikova, 2017). The same can be observed for the meat industry, with around 60 % of all pork and about 55 % of all poultry production accounting for the top 20 and top ten agroholdings, respectively (Dyatlovskaya, 2018a; USDA, 2018b). Since the government relies heavily on agroholdings to reach its production and export targets, they were the primary recipients of financial support from the state. For example, in 2015, only 248 large scale agri-food enterprises (1.2 % out of the total number), which included agroholdings, received more than 40 % of all subsidies (Uzun et al. 2019). Apart from major amounts of government support, agroholdings also received significant financial investments from domestic and foreign investors. More than USD 3 billion in foreign investments and around RUB 1 trillion in domestic investments was made in Russian agriculture between 2012 and 2016, with most of these resources being directed towards agroholdings (Wegren, 2018).

In spite of the substantial growth and increasing importance of agroholdings for the country's agri-food industry, the current literature on agroholdings is still relatively immature and has several gaps to be filled. Firstly, the vast majority of prior research investigates the effects of agroholdings on production performance, such as efficiency and productivity (e.g. Hahlbrock and Hockmann 2011), with studies on the financial performance of agroholdings being non-existent. The exception is a paper by Epshtein et al. (2013), where in addition to productivity and efficiency analysis, they also compared the average profitability ratios of agroholding affiliates compared to stand-alone firms. However, the analysis of the financial performance in this study was rather limited to a descriptive examination and did not involve comprehensive econometric estimations. It is worth mentioning that corporate farms in Russia account for almost a quarter of all bankruptcy cases (Yastrebova, 2005). It is therefore vital to understand how agroholding affiliation can affect not only production, but also the financial performance of corporate agri-food enterprises in Russia. Secondly, even within the available literature, there is no consensus among scholars about whether agroholding affiliation improves or hinders firm performance. While some scholars have revealed a productivity and efficiency premium for agroholding members over independent firms (Hahlbrock and Hockmann 2011; Epshtein et al. 2013), other researchers have observed rather contradicting re-

sults (Hockmann et al. 2009; Uzun et al. 2012). The current literature therefore fails to shed light on the potential political economy implications of the Russian government's increasing reliance on agroholdings in recent years. Based on a panel dataset of Russian corporate agri-food enterprises, this study therefore aims to fill this gap in the literature and attempts to understand the impacts of agroholding affiliation on firms' financial performance. Moreover, this paper tries to identify the characteristics of agroholding affiliates that make them more or less financially efficient compared to independent firms.

The remainder of this article is organised as follows: In section 2, we provide a theoretical framework and an overview of the literature on agroholdings and their performance. In section 3, we then describe the methodology and data employed in the study. This is followed by section 4, where we describe and discuss the results of our empirical analysis. Finally, we present our concluding remarks in section 5.

2 Theoretical framework and review of the literature

Agroholdings are certain types of business groups that have emerged in a number of post-communist countries, including Russia, at the end of the 1990s and have been growing considerably since then (Visser et al. 2014; Rada et al. 2017). In this study, we attempt to investigate agroholdings through the prism of Resource Dependence Theory (RDT hereafter), introduced by Pfeffer and Salancik (1978). It is one of the most widely used theories among scholars to explain the emergence and evolution of business groups (Hillman et al. 2009). According to RDT, enterprises can be regarded as non-autonomous, open systems, which are constrained by their external environment and are interdependent with other companies. Uncertainties regarding both the external environment and the actions of other organisations with which the companies are interdependent leads to an ambiguity concerning the survival and future success of the company (Pfeffer 1987; Hillman et al. 2009), which leads to the formation of various new organisational forms and structures (Dentoni et al. 2020). As suggested by Pfeffer and Salancik (1978), companies can undertake various actions to manage environmental dependencies and minimise uncertainties, which may give companies economic and strategic advantages over competitors and substantially reduce their transaction costs. Such actions include, but are not limited to, mergers, vertical integrations, joint ventures and business groups. In this study, we propose that RDT can be a good framework for explaining the emergence and further growth of agroholdings in Russia. Agroholdings are vertically integrated groups that control the whole process of the value chain, including the production of inputs, the production and processing of the end agri-food products, and the distribution of these products to the market (Davydova & Franks, 2015; Matyukha, 2017). This enables them to minimise the dependence

and related uncertainties from other interdependent organisations such as input suppliers, processors, distributors, etc. (Hockmann et al. 2011; Rada et al. 2017). Such uncertainties are even higher in transition economies with characteristics of under-developed factor markets and severe institutional turbulence (Gagalyuk & Valentinov, 2019). Indeed, Matyukha et al. (2015) suggest that, to a great extent, the existence and evolution of agroholdings in Russia is the result of deficiencies in market infrastructure and institutional settings in the country. A study by Gagalyuk & Valentinov (2019) argue that the rise of agroholdings might have very little to do with their superior efficiency, and may rather be better explained by the resilience that agroholdings create for their member enterprises against external institutional turbulences. In transitional economies with turbulent institutional settings, agri-food companies might face serious existential risks associated with existing legal system weaknesses and imperfections of production factor markets. This entails potential threat of their access to key external resources that are vital for the functioning of their companies, such as capital, land and labour. Joining larger business groups, such as agroholdings, allows agri-food enterprises to face these major challenges and, to a certain extent, secure their access to those vital resources. This view supports our hypothesis that the phenomenon of agroholdings might be well explained by RDT. Summing up, agroholdings create a sort of enclave, where they are protected against external turbulences and uncertainties, especially with regards to access to vital external resources. This helps them survive, grow and maybe even outperform other forms of agri-food production in transition economies with imperfect market conditions, institutions and highly unpredictable business settings.

While RDT provides a good theoretical justification for the emergence of agroholdings, it can also serve as a framework for explaining the potential advantages of agroholdings over other forms of agri-food production. One of the main arguments of RDT is that organisations are highly dependent on the external environment and resources, such as raw materials, labour, capital, etc. (Hillman et al. 2009). An agroholding form of agri-food production might be a good way to advance the linkage between a company and its external environment, thereby improving access to vital external resources. Indeed, prior research observes that agroholdings have better access to outside capital and modern technologies and employ innovative and advanced techniques (Hahlbrock and Hockmann 2011; Visser et al. 2014). They also have sufficient resources to attract a qualified workforce and maintain adequate quality and standards control by implementing the best international standards and practices (FAO, 2009). Moreover, agroholdings are believed to have strong political and business connections and therefore have better access to substantial government subsidies (Matyukha et al. 2015). In addition, the vast majority of agroholdings seem to operate in the regions of South and Central Black Earth, which are the most favourable regions of

Russia from the point of view of agro-climatic conditions (FAO, 2009; Grouiez, 2018). Furthermore, in addition to external resources, agroholdings as business groups have internal markets for resources that other organisational forms do not have. For instance, agroholding affiliates have access to intra-group labour, capital and trade markets and can also benefit from the within-group transfer of technology (Wan 2005; Belenzon et al. 2013). By looking at the agroholdings through the prism of RDT, we therefore propose that agroholding affiliation might improve firm performance. Nevertheless, existing empirical evidence reveals both positive and negative effects of agroholding affiliation on firm performance (Hahlbrock and Hockmann 2011; Visser et al. 2014; Matyukha et al. 2015).

On the one side, some researchers observe performance premiums of agroholding affiliates over stand-alone firms. Rylko et al. (2008) suggest that Russian agroholdings have higher labour and land productivity compared to other types of agri-food producers. Hahlbrock and Hockmann (2011) investigated the productivity and efficiency effects of agroholding affiliation for a sample of Russian agri-food enterprises operating in the Belgorod region. They observe that, on average, agroholding members have higher scale efficiency compared to independent farms. Moreover, holding affiliates illustrated a higher adoption of modern technology, allowing them to significantly improve their total factor productivity during the analysed time period, compared to only minor improvements achieved by stand-alone firms. Another study by Hockmann et al. (2011) suggests that the existence of internal trade markets in agroholdings lowers the price uncertainties of their affiliates, which substantially decreases their external transaction costs. This, together with a more intense risk management system implemented by agroholdings, substantially decreases the production variation in holding members compared to non-affiliated firms. Similar research by Epshtein et al. (2013) reveals that, due to the higher adoption of modern production technologies, tougher corporate control and attracted outside financing among agroholdings, their affiliates illustrate significantly higher levels of efficiency as opposed to independent companies in Russia's Belgorod region. Davydova and Franks (2015) suggest that, resulting from their vertical and/or horizontal integration, agroholdings benefit highly from the economies of scope, which might give a considerable economic advantage to agroholdings over other forms of agri-food production organisation.

On the other hand, some scholars reveal a negative effect of agroholding affiliation or do not observe any significant impacts of agroholding membership on enterprise performance. Hockmann et al. (2005) investigated the efficiency levels of more than 100 large-scale agri-food companies, including agroholdings, in the Belgorod region of Russia. In spite of the restructuring and higher adoption of modern technology, agroholdings demonstrate significantly lower levels of efficiency compared to other forms of agri-food enterprises. Similar

results were discovered by Hockmann et al. (2009) in the case of the Oreol and Belgorod regions. A study by Uzun et al. (2012) looked at the inefficiencies of Russian grain producing agroholdings. According to their findings, despite more investment and technologies in agroholdings and their significantly higher use of fertilisers (260 % higher compared to other agri-food companies), grain yields of agroholdings were only 13 % higher compared to non-agroholding companies. A later study by Matyukha et al. (2015) did not reveal any evidence on the economic advantages of agroholding affiliates compared to stand-alone farms in the Belgorod region of Russia. A similar study by Gataulina et al. (2014) and Guriev and Rachinsky (2004) neither observed a marked difference in the average productivity levels between Russian agroholdings and independent farms.

3 Methodology and Data

3.1 Model

Our baseline regression model is expressed as follows:

$$\boldsymbol{Firm\ Performance} = \alpha_0 + \alpha_1 \boldsymbol{Agroholding\ Membership} + \alpha_2 \boldsymbol{Control\ Variables} + \varepsilon \quad (1)$$

The econometrics literature suggests three main models when dealing with a longitudinal data analysis: pooled OLS, fixed effects and random effects models. The results of the F-test and Breusch and Pagan Lagrangian multiplier test (Appendices 2 and 3) correspondingly suggest the significance of fixed and random effects in our model. Furthermore, the results of the Hausman test imply that the random effects model is preferable over the fixed effects model (Appendix 4). The test fails to reject the null hypothesis that the random effects model is consistent and more efficient than the fixed effects model at the 5 % significance level. Hence, in this study we employ a random effects model to conduct our regression analyses[3]. Moreover, the nature of the data used in this study points to the appropriateness of the chosen model for the following reasons. Firstly, using a random effects model is recommended if the data represents a sub-sample of the population (Greene, 2012). Secondly, a random effects model is preferred if the independent variables have a low variation over time (Wooldridge, 2002).

Cross-sectional dependence in the error terms is the main issue that panel data models may encounter, especially if the number of time periods (T) in the panel is less than the number of cross-sectional observations (N) (De Hoyos & Sarafidis, 2006). To tackle this issue, in addition to the random effects regression, we also run our baseline model using the Driscoll-Kray (DK) robust

3 Nevertheless, we also estimate both pooled OLS and fixed effects models, the results of which are illustrated in Appendix 2.

standard errors, as suggested by Hoechle (2007). The results of the model with DK standard errors are robust to the cross-sectional dependence, as well as to heteroscedasticity and autocorrelation (Hoechle, 2007).

Another issue that may potentially arise when studying the effect of agroholding membership on firm performance is the presence of endogeneity. Based on the existing literature (Carter et al. 2003; Campbell and Mínguez-Vera 2008; Marinova et al. 2016), we employ a 2SLS (two-stage least squares) method to account for potential endogeneity in our model. An instrumental variable is required to run a 2SLS model, which should be correlated with the explanatory variable of interest, but should not correlate with the error term. Following studies by Caramanis and Lennox (2008) and García-Meca and Sánchez-Ballesta (2011), we treat the first lag of the explanatory variable as an instrumental variable.

Firm performance, agroholding membership and control variables used in this study are described in Table 1 and explained in detail in the following sub-section.

3.2 Variables

3.2.1 Firm performance

Market value based measures (e.g. Tobin's Q) and accounting based measures (e.g. returns on assets) are the main indicators of firm performance used in the financial literature (Terjesen et al. 2016; Yi and Ifft 2019). Market based variables are not available for the companies within our sample. Therefore, in this study, we focus on two accounting based measures: Return on Assets (ROA) and Return on Sales (ROS), as has been suggested by previous studies (Andrieș et al. 2020; Liu et al. 2014; Tleubayev et al. 2020).

3.2.2 Agroholding membership

While there is no official definition for an agroholding, there is a consensus among scholars that an agroholding is a type of business group that consists of a number of agri-food companies whose controlling package of shares are possessed by the holding enterprise (Visser et al. 2012; Hermans et al. 2017). Our interpretation of agroholding membership relies on this explanation and we define agroholding members as enterprises whose controlling package of shares (more than 50 %) belong to a holding company. The dummy variable for agroholding membership *(agrh_mem)* therefore takes the value of 1 if the holding company owns more than 50 % of its shares and 0 otherwise.

Table 1: Variables and descriptions

Variables	Description
Panel A: Dependent variables	
ROA	Net Income / Total Assets
ROS	Net Income / Sales
Panel B: Explanatory variables	
agrh_mem	Dummy variable, which is equal to 1 if more than 50 % of the firm is owned by a holding company and 0 otherwise
Panel C: Control variables	
Board characteristics	
bsize	The total number of directors in the boardroom
bod_ind	Percentage of independent directors in the boardroom
bod_div	Percentage of female directors in the boardroom
exec_comp	Dummy variable, which is equal to 1 if a firm implements performance based executive compensation and 0 otherwise
Firm characteristics	
fage	The number of years since the firm was first registered by the state
fsize	Natural logarithm of the firm's total assets
leverage	Total debt / Total assets
opex	Operating expenses / Sales

Source: Compiled by authors

3.2.3 Control variables

There are also many different factors besides agroholding affiliation that could potentially impact firm performance. To control for such factors, we include a number of board- and firm-related control variables in our regression model.

At the board level, we control for the size of the board *(bsize)*, independence of the board *(bod_ind),* diversity of the board *(bod_div)* and executive compensation *(exec_comp)*. A positive link between independence of the board (e.g. Black and Kim 2012), diversity of the board (e.g. Terjesen et al. 2016), executive compensation (e.g. Ozkan 2011) and firm performance can be observed in previous research. The size of the board, on the other hand, might be oppressive for an enterprise, require additional coordination costs and therefore may hamper the overall firm performance (e.g.Yermack 1996).

At the firm level, we follow the existing studies and control for the size of the firm *(fsize)* (e.g. Skała & Weill 2018), age of the firm *(fage)* (e.g. Reddy et al. 2008), leverage *(leverage)* (e.g. García-Meca and Sánchez-Ballesta 2011) and operating expense ratio *(opex)* (e.g. Wang 2010).

3.3 Data

This study employs a firm-level panel data set of 203 corporate agri-food enterprises from 27 administrative regions in Russia for the years from 2012 to 2017. These companies are involved in the production and/or processing of the agri-food products and represent a sub-sample of Russian agri-food production. The sample was selected using the convenience sampling technique, which implies that the research sample be selected based on its ease of availability and accessibility (Etikan et al. 2016; Henry 1990). Due to the unavailability of publicly accessible, longitudinal data[4] for most of Russia's corporate agri-food enterprises, our sample, therefore, includes those 203 companies for which panel data for the variables of interest were publicly available.

If one considers that larger companies usually tend to better disclose information about their corporate governance and financial indicators, our sample selection method might have resulted in the sample consisting of relatively larger firms. Furthermore, one of our main research questions is on the effects of agroholding affiliation on financial performance and agroholding enterprises are generally large in size (Davydova & Franks 2015; Hermans et al. 2017). Indeed, according to the Ruslana database[5], there are around 3,600 joint stock, corporate agri-food enterprises in Russia. As of 2017, the average size of these firms was around RUB 771 million and RUB 813 million in terms of annual sales and total assets, respectively. Thus, our sample is representative of a rather larger-sized sub-sample of the population with average annual sales and total assets in 2017 being around RUB 2.3 billion and RUB 2.9 billion, respectively. Nevertheless, in terms of financial performance, our sample illustrates more or less similar results compared to the general population. While the population of Russian agri-food enterprises illustrated an ROA of 5 % and ROS of 5.3 % as of 2017, the ROA and ROS of the firms in our sample were about 4.6 % and 4.9 % during the same year, respectively.

Quarterly and annual reports and financial statements of the enterprises are the main sources of the data used in this study. These documents are publicly available from the database of the "Interfax – Corporate Information Disclosure Center (CIDC)[6]" agency, which is one of the five agencies authorized to disclose information on the securities market of Russia. Using the above-mentioned reports and statements, we manually collected a number of variables, including the ownership structure of the enterprises, the size and characteristics of the corpo-

4 Given the generally small number of empirical studies, as well as the prevalence of cross-sectional analyses among those scarce studies on the relationship between agroholding affiliation and financial performance, we wanted to use panel data to get more in-depth insights and verify existing theories on the topic.

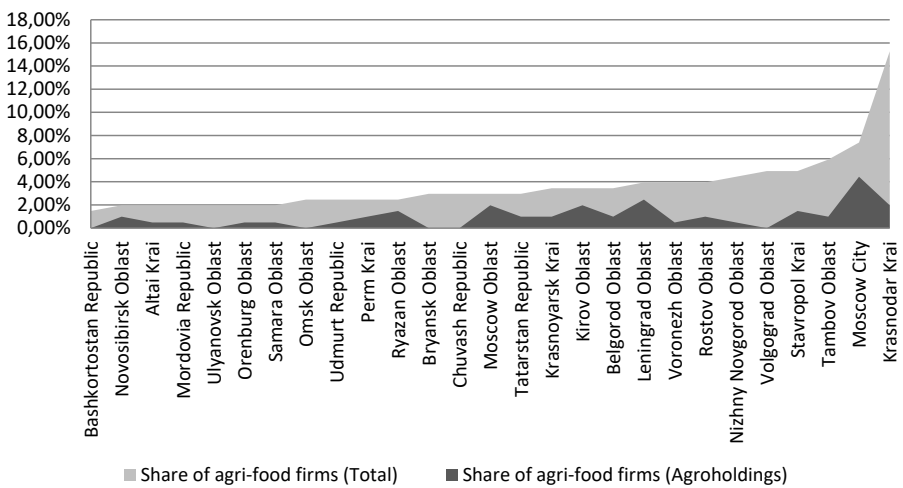
5 More information available here: https://ruslana.bvdep.com/.

6 More information available here: https://www.e-disclosure.ru/.

rate boardrooms and firms' financial indicators, among others. Noteworthy, the main subject of our analysis is not an agroholding as a whole, but an agroholding-affiliated enterprise. We aim to investigate whether agroholding affiliation has a positive effect on firm performance and, if so, what the possible firm-level explanations and implications for that are. Therefore, the main sources of our data are the stand-alone reports and financial statements of individual agroholding-affiliated firms.

Krasnodar Krai, Moscow City, Tambov Oblast and Stavropol Krai have the highest number of agri-food enterprises among our sample, collectively accounting for around one-third of the total firms used in the study (Figure 1). In five regions, such as Kirov Oblast, Ryazan Oblast, Moscow city, Moscow Oblast and Leningrad Oblast, the share of agroholdings exceeds those of the stand-alone enterprises (Figure 1).

Figure 1: The share of agri-food firms represented by each region in the sample



Source: Compiled by the authors.

Table 2 illustrates the descriptive statistics of the key variables used in the study. On average, nearly 28 % of the companies in the sample belong to agroholdings.

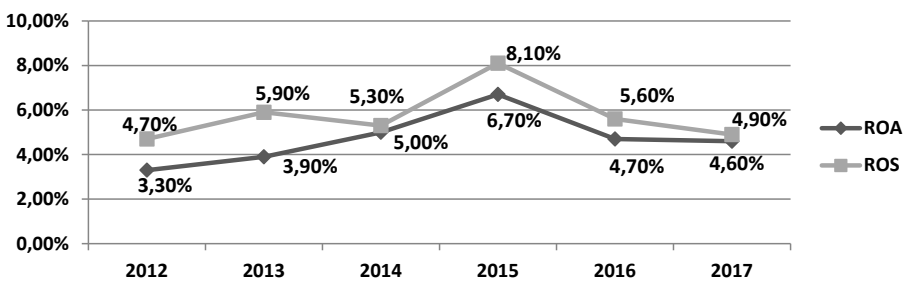
Table 2: Descriptive statistics of key variables

Variables	Obs	Mean	Std	Min	Max
ROA	1218	4.7 %	0.10	-0.85	0.84
ROS	1218	5.7 %	0.27	-2.26	2.93
agrh_mem	1218	27.7 %	0.45	0	1
bsize	1218	6	1.68	3	15
bod_ind	1218	50.8 %	0.38	0	1.8
bod _div	1218	29.27 %	0.22	0	1
exec_comp	1218	35.8 %	0.47	0	1
fage	1218	16	6.16	0	25
fsize	1218	12.92	1.57	7.25	18.87
leverage	1218	47.4 %	0.31	0.006	1.83
opex	1218	0.85	0.27	0.043	5.17

Source: Compiled by the authors.

While an average boardroom in the sample consists of six directors, around 51 % and 29 % of them are independent directors and female directors, respectively. Nearly 36 % of the firms employ performance-based compensation programs for their executive management. Moreover, the firms are 16 years old on average, have total assets worth about RUB 2.3 billion (USD 35.7 million) and have a ratio of total debts to total assets at around 47 %. The average ratio of operating expenses is about 0.85. Finally, the values of the Return on Assets (ROA) and Return on Sales (ROS) are around 4.7 % and 5.7 % on average, respectively. Both of these performance measures increased significantly from 2012 to 2015, with the levels of ROA doubling and the levels of ROS growing by nearly 73 %. Nevertheless, both the ROA and ROS have been decreasing since 2015, with the levels returning back to about 4.9 % and 4.6 %, respectively, by 2017 (Figure 2).

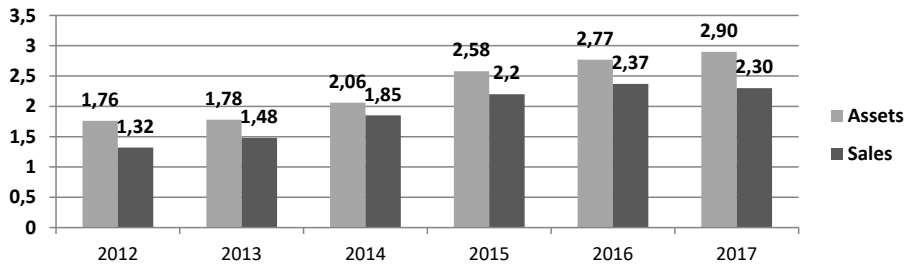
Figure 2: Dynamics of ROA and ROS from 2012 to 2017



Source: Compiled by the authors.

If we look at the company size dynamics year over year, we can observe a significant growth in size from 2012 to 2017 in terms of both total assets and annual sales (Figure 3). While firms' total assets, on average, increased by almost 65 % from 2012 to 2017, the average sales of the companies have risen by approximately 74 % during the same period.

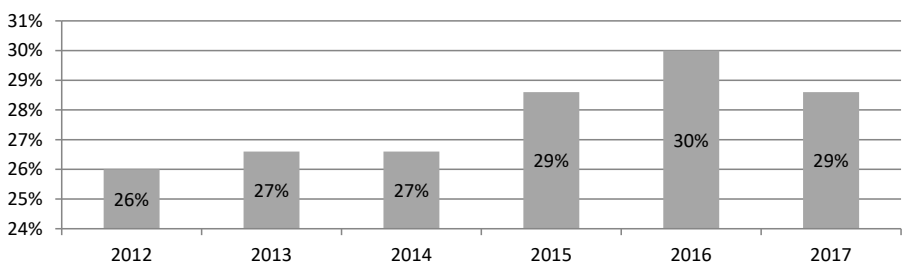
Figure 3: Dynamics of Total Assets and Annual Sales from 2012 to 2017



Source: Compiled by the authors.

Furthermore, we can observe a positive dynamic in the number of firms that are affiliated to agroholdings. Figure 4 illustrates that the share of companies that belong to agroholdings have increased from 26 % in 2012 to 29 % in 2017.

Figure 4: The share of agroholding members from 2012 to 2017



Source: Compiled by the authors.

Finally, Appendix 1 illustrates the correlation coefficients among all independent variables. High correlation among the variables, usually a level of 0.7 or above as suggested by Liu et al. (2014), points out that the data has an issue of multicollinearity. However, since the highest correlation observed among the independent variables was only 0.36, we conclude that multicollinearity is not an issue in our sample.

4 Results and discussion

In order to answer our main research question of whether agroholding membership has an effect on financial performance, we first proceed with the comparison of the averages of performance variables for holding affiliates versus independent firms.

Table 3: Z-test for the statistical difference of the means of performance variables (agroholding affiliates VS independent firms)

Performance measures	Whole sample (N=1218)	Agroholding members (N=338)	Independent firms (N=880)	Difference	Z-score
Return on Assets (ROA)	4,69 %	5,63 %	4,34 %	1,29 %	**2,24****
Return on Sales (ROS)	5,75 %	9,58 %	4,29 %	5,29 %	**3,46*****

*** p<0.01, ** p<0.05, * p<0.1

Source: Compiled by the authors.

Table 3 presents the results of this analysis. In the case of both measures (ROA and ROS), agroholding members, on average, perform better than the entire sample and illustrate significantly higher levels of performance compared to independent firms. While agroholding members, on average, have a 1.3 % higher ratio of ROA compared to non-member companies, the difference in the ratios of ROS is even higher, around 5.3 %.

As the next step, we run the Random Effects (RE) regression analysis with ROA and ROS as dependent variables and a dummy for agroholding membership *(agrh_mem)* as the main explanatory variable. The results of this analysis are illustrated in the first and second columns of Table 4. We observe a significantly positive impact of agroholding membership *(agrh_mem)* on financial performance (in terms of both ROA and ROS). As was the case with our previous analysis, agroholding affiliation has a stronger effect on ROS compared to ROA. Returns on assets and returns on sales that agroholding affiliates generate are by 2.3 % and 3.8 % higher compared to stand-alone enterprises. The results of the regressions with DK robust standard errors (columns 3 and 4) and 2SLS models (columns 5 and 6) present similar results, therefore suggesting that the findings are robust to a potential cross-sectional dependence and endogeneity (Table 4). Furthermore, we also test for the presence of a reciprocal causation between each of the performance variables (ROA and ROS) and *leverage*. While companies' leverage ratios may influence their financial performance on the one hand, on the other hand, leverage itself might depend on firm profitability. Hence, to account for the potential presence of reciprocal causation between performance variables and leverage, we also estimate our model using the system of simultaneous equations (Maddala, 1983) (Table 5).

Table 4: Agroholding affiliation (*agrh_mem)* and firm performance (ROA, ROS) (standard errors in parentheses)

	Random Effects (RE)		DK robust standard errors		2SLS	
Variables	**(1) ROA**	**(2) ROS**	**(3) ROA**	**(4) ROS**	**(5) ROA**	**(6) ROS**
agrh_mem	0.0230***	0.0379*	0.0230*	0.0379***	0.0303**	0.0869**
	(0.0083)	(0.0206)	(0.0094)	(0.0312)	(0.0154)	(0.0382)
fage	-0.0016	-0.0050	-0.0016	-0.0050	-0.0016	-0.0052
	(0.0006)	(0.0014)	(0.0006)	(0.0018)	(0.0006)	(0.0015)
fsize	0.0047*	0.0251***	0.0047	0.0251***	0.0040	0.0201***
	(0.0026)	(0.0063)	(0.0040)	(0.0069)	(0.0029)	(0.0071)
leverage	-0.1267***	-0.1911***	-0.1267***	-0.1911***	-0.1264***	-0.1895***
	(0.0122)	(0.0298)	(0.0159)	(0.0367)	(0.0122)	(0.0299)
opex	-0.1166***	-0.3203***	-0.1166**	-0.3203**	-0.1164***	-0.3189***
	(0.0109)	(0.0291)	(0.0354)	(0.0889)	(0.0109)	(0.0292)
bsize	-0.0016	0.0042	-0.0016	0.0042	-0.0014	0.0061
	(0.0022)	(0.0053)	(0.0027)	(0.0053)	(0.0022)	(0.0054)
bod_ind	0.0247***	0.0745***	0.0247*	0.0745**	0.0250***	0.0758***
	(0.0095)	(0.0234)	(0.0107)	(0.0294)	(0.0095)	(0.0235)
bod_div	0.0564***	0.1260***	0.0564**	0.1260***	0.0571***	0.1317***
	(0.0150)	(0.0376)	(0.0177)	(0.0382)	(0.0151)	(0.0379)
exec_comp	0.0027	-0.0017	0.0027	-0.0017	0.0025	-0.0033
	(0.0049)	(0.0137)	(0.0062)	(0.0139)	(0.0049)	(0.0138)
_cons	0.1448	0.0660	0.1448	0.0660	0.1504	0.1054
	(0.0392)	(0.0957)	(0.0956)	(0.1169)	(0.0405)	(0.0994)
R-squared	**0.255**	**0.223**	**0.255**	**0.223**	**0.253**	**0.218**
N	**1218**	**1218**	**1218**	**1218**	**1218**	**1218**

*** p<0.01, ** p<0.05, * p<0.1
Source: Compiled by the authors.

Indeed, the results of the analysis suggest a significant two-sided relationship (Table 5). On the one side, one can observe a significant negative effect of *leverage* on both ROA and ROS. On the other side, ROA and ROS themselves have a significant negative impact on *leverage*. Nevertheless, the relationship between agroholding affiliation *(agrhmem)* and both performance variables (ROA and ROS) remain positive and statistically significant, underpinning the robustness of our results.

Table 5: Agroholding affiliation (*agrh_mem*) and firm performance (ROA, ROS) System of simultaneous equations (standard errors in parentheses)

Variables	(1) ROA	(2) ROS
ROA <-		
leverage	-0.2643***	-0.4094***
	(0.0727)	(0.1176)
agrhmem	0.0185**	0.0424**
	(0.0098)	(0.0204)
age	-0.0057***	-0.0111***
	(0.0010)	(0.0018)
lnassets	-0.0121***	-0.0023
	(0.0043)	(0.0079)
oper	-0.1645***	-0.4110***
	(0.0195)	(0.0373)
boardsize	0.0054**	0.0129**
	(0.0027)	(0.0054)
outdir_per	0.0720***	0.1567***
	(0.0145)	(0.0276)
femdirtot_per	0.0464**	0.1096***
	(0.0182)	(0.0379)
perf_bonus	0.0057	0.0021
	(0.0083)	(0.0172)
_cons	0.2196***	0.2160**
	(0.0483)	(0.0981)
leverage <-		
ROA / ROS	-0.6966***	-0.7371***
	(0.1107)	(0.1206)
_cons	0.6009***	0.5166***
	(0.0185)	(0.0115)
N	**1218**	**1218**

*** p<0.01, ** p<0.05, * p<0.1
Source: Compiled by the authors.

Having revealed that agroholding affiliation significantly improves financial performance, we proceed further and try to explore which characteristics of agroholding affiliates make them more financially efficient compared to unaffiliated companies. For this reason, we re-run our baseline regression model by including the interaction terms between the agroholding affiliation variable *(agrh_mem)* on the one side and all firm and board specific variables on the other side. Table 6 presents the results of this regression.

To begin with, the ratio of total debts to total assets *(leverage)* has a significant negative impact on both ROA and ROS (Table 6). According to RDT, organisa-

tions are highly dependent on the external environment and resources, such as access to loans. An agroholding form of agri-food production might be a good way to facilitate access to both external and within-group loans, which might give agroholding affiliates economic advantages over stand-alone enterprises. With respect to external finances, Lopez-Valeiras et al. (2016) suggest that additional monitoring by debt providers might improve the corporate governance and thus the overall performance of the company. Furthermore, as suggested by Koç et al. (2019), an increase in agricultural credits may have a significant positive impact on agricultural value-added and thereby on overall farm performance. However, the true impact of leverage depends on the actual cost of debt. If it is too high, the positive impact of leverage might be outweighed, and it may in fact worsen firm performance (González, 2013). In Russia, the cost of debt is relatively high and access to debt capital is more difficult compared to other developed economies (Iakovleva et al. 2013). This might be one of the main reasons for an overall negative impact of leverage on financial performance observed in this study. Nevertheless, an interaction term between agroholding affiliation *(agrh_mem)* and leverage *(leverage)*, *agrh_memXleverage,* has a significantly positive effect on both ROA and ROS. This implies that the negative effect of *leverage* on financial performance is significantly lower if a company belongs to an agroholding. While a 1 % increase in *leverage* decreases the ROA and ROS of non-affiliated firms by 0.14 % and 0.22 %, respectively, the same level of increase in the leverage of agroholding members leads to about a 0.07 % decrease in both ROA and ROS. Better access to capital might be one of the possible reasons for such differing effects of leverage on the performances of affiliated and unaffiliated firms. The economies of size of agroholdings and their affiliation to a holding company serve as a valuable collateral base, which not only eases access to external financing, but it also provides an opportunity to secure better financing conditions (i.e. lower interest rates on bank loans) (Rada et al. 2017; Gagalyuk 2017). Thus, it might well be the case that, overall, banks prefer agroholdings to stand-alone enterprises. Moreover, in addition to external financing, agroholding members have access to internal capital markets (Matyukha 2017), which might be even more important in the case of Russia, which has a relatively poor system of financial intermediation (Connolly 2011). The cost of internal capital is also believed to be substantially lower compared to the cost of external debt, such as a bank loan (Dewaelheyns & Van Hulle 2008). Summing up, we follow the findings of previous studies (Hahlbrock and Hockmann 2011; Visser et al. 2014), and, in line with RDT, suppose that agroholding affiliates have better access to capital. As opposed to independent firms, agroholding members face lower costs of debt in general, thanks to their position of securing better conditions for external debt and due to their access to relatively cheaper within-group loans. These factors substantially reduce the negative impact of leverage on the financial performance of agroholding mem-

bers and to some extent explain their financial premium over independent firms. Looking at the issue through the RDT perspective, the results suggest that the unique structure of agroholdings allows them to secure better access to perhaps one of the most vital resources – capital, which in turn makes them financially more better off compared to non-affiliated companies. Having better access to financing and facing a relatively lower cost of debt, agroholding affiliates are also in a better position to access modern technologies and implement advanced and innovative farming and food production techniques. As the prior literature suggests (Epshtein et al. 2013; Hahlbrock & Hockmann 2011; Visser et al. 2014), in general, agroholdings have better access to advanced and innovative technologies, which might explain their production and financial efficiency over stand-alone agri-food companies to a certain extent.

Table 6: Agroholding affiliation and firm performance
Extended model with the interaction terms of explanatory variables
(Standard errors in parentheses)

	Random Effects (RE)		DK Robust Standard Errors	
Variables	**(1) ROA**	**(2) ROS**	**(3) ROA**	**(4) ROS**
agrh_mem	0.1539**	0.2376	0.1539**	0.2376**
	(0.0780)	(0.1921)	(0.0878)	(0.2122)
fage	-0.0020	-0.0053	-0.0020	-0.0053
	(0.0007)	(0.0017)	(0.0008)	(0.0019)
fsize	0.0082**	0.0313***	0.0082*	0.0313***
	(0.0032)	(0.0076)	(0.0038)	(0.0085)
leverage	-0.1416***	-0.2176***	-0.1416***	-0.2176***
	(0.0136)	(0.0333)	(0.0167)	(0.0363)
opex	-0.2038***	-0.5491***	-0.2038***	-0.5491***
	(0.0215)	(0.0577)	(0.0344)	(0.1016)
bsize	-0.0008	0.0049	-0.0008	0.0049
	(0.0024)	(0.0056)	(0.0026)	(0.0058)
bod_ind	0.0283**	0.0805***	0.0283*	0.0805**
	(0.0113)	(0.0280)	(0.0116)	(0.0285)
bod_div	0.0866**	0.3099***	0.0866*	0.3099**
	(0.0372)	(0.0988)	(0.0416)	(0.0994)
exec_comp	0.0037	0.0010	0.0037	0.0010
	(0.0048)	(0.0136)	(0.0064)	(0.0150)
agrh_memXfage	0.0005	-0.0004	0.0005	-0.0004
	(0.0013)	(0.0032)	(0.0016)	(0.0036)
agrh_memXfsize	-0.0097*	-0.00211*	-0.0097*	-0.0211***
	(0.0055)	(0.0013)	(0.0058)	(0.0040)
agrh_memXleverage	0.0698***	0.1465***	0.0698***	0.1465**
	(0.0209)	(0.0555)	(0.0267)	(0.0620)
agrh_memXopex	0.1792***	0.4891***	0.1792***	0.4891***
	(0.0371)	(0.1016)	(0.0381)	(0.1084)
agrh_memXbsize	-0.0070	-0.0018	-0.0070*	-0.0018
	(0.0065)	(0.0163)	(0.0070)	(0.0171)

	Random Effects (RE)		DK Robust Standard Errors	
Variables	**(1) ROA**	**(2) ROS**	**(3) ROA**	**(4) ROS**
agrh_memXbod_ind	-0.0177 (0.0195)	-0.0238 (0.0492)	-0.0177* (0.0202)	-0.0238 (0.0511)
agrh_memXbod_div	-0.0313 (0.0291)	0.0510 (0.0754)	-0.0313 (0.0293)	0.0510 (0.0757)
agrh_memXexec_comp	0.0286** (0.0136)	0.0571* (0.0338)	0.0286* (0.0157)	0.0571** (0.0401)
R-squared	**0.271**	**0.230**	**0.271**	**0.230**
N	**1218**	**1218**	**1218**	**1218**

*** p<0.01, ** p<0.05, * p<0.1
Source: Compiled by the authors.

Secondly, an operating expense ratio *(opex)* has a strong negative effect on financial performance (Table 6). In line with the financial literature (example Ahrendsen & Katchova 2012; Gunsel 2005), we interpret an operating expense ratio as a measure of management efficiency. An operating ratio illustrates to what extent the management of the companies is efficient at maintaining low costs while at the same time maintaining certain revenue levels. The lower the levels of *opex*, the more efficient the executive management is. Correspondingly, higher values of *opex* indicate managerial inefficiency. Labour, particularly high-quality labour, is also one of the key resources that companies highly depend on for their successful functioning, according to the RDT. In the case of corporate enterprises, where there is a separation of ownership and control, the role of management is of particular importance. It is crucial that corporate firms have access to high quality managers who can represent the best interests of the shareholders and strive to maximise company values. The results of the analysis illustrate that managerial inefficiency has a significant negative impact on financial performance, with a 1 % increase in the *opex* leading to a 0.20 % and 0.55 % decrease in the levels of ROA and ROS, respectively. However, a strong positive link between *agrh_memXopex* (an interaction term between *agrh_mem* and *opex*) and financial performance, suggest that the magnitude of this negative effect is substantially lower, around 0.02 % and 0.06 % for ROA and ROS, respectively, if a company is affiliated with an agroholding. We therefore presume that, in general, the management of agroholding affiliates are more efficient than independent firms or, at least, the inefficiency of agroholding affiliates' managers is reduced by managerial expertise provided by agroholdings' mother companies (Ostapchuk et al. 2021). This finding supports previous research that suggests that agroholdings have superior management (Visser et al. 2014), adopt modern management practices (Hockmann et al. 2009) and put greater emphasis on managerial training (Rada et al. 2017). From the perspective of RDT, the agroholding form of agri-food production seems to provide better access to high quality labour, measured in terms of managerial efficiency. Hence, the results of

this study allow us to presume that agroholding members have enough resources to attract qualified management personnel and/or train efficient managers by themselves, which makes them financially better off compared to stand-alone enterprises. Moreover, a positive effect of *agrh_memXopex*, as opposed to a negative effect of *opex* for the whole sample on financial performance, implies that agroholding members use better production technologies, such as more expensive and high-quality inputs, which are transformed into better performance results.

Furthermore, based on the data on hand, we can observe that a substantially higher share of agroholding affiliates, around 45 %, employ performance-based executive compensation programs, as opposed to about 32 % of stand-alone firms. Knowing that their efforts actually count and that their income depends directly on the company performance, managers would be more likely to work harder and more efficiently for the good of the company. This may also minimise the potential agency conflict between the owners and managers of the firm, since the latter would better value their position and try not to risk their top positions in the company. It is therefore less likely that such managers would engage in the expropriation of company assets for their own benefit, putting personal interests above the interests of the company and its shareholders (Florackis 2008; Sajid et al. 2012). While the analysis does not reveal a significant impact of performance based executive compensation *(exec_comp)* on financial performance, there seems to be a strong positive relationship between *agrh_memXexec_comp* (an interaction term between *agrh_mem* and *exec_comp*) and both ROA and ROS. Among agroholding affiliates, the ROA and ROS of the firms with performance-based executive compensation are around 3 % and 5.7 % higher on average than the firms who don't employ such compensation programs. Again, from the perspective of RDT, agroholding affiliates seem to have better access to external resources, including capital and managerial expertise, which allows them to adopt stimulating compensation schemes. To sum up, the above results indicate that agroholding affiliates have more efficient management, better production technologies and stimulating executive compensation systems compared to independent firms, which to a certain degree explains the financial advantages of the former over the latter. Again, if we look at the results through the lens of RDT, the financial efficiency of agroholding affiliates might, to some extent, be attributed to their better access to external resources. With better access to resources, agroholdings possess enough means to adopt better production technologies, recruit and train efficient managers and implement and maintain best international standards and practices, including modern management techniques and stimulating compensation programs, among others.

It is also worth mentioning that, as opposed to the positive effect of the size of the whole sample on performance, the impact of the size of agroholding members (*agrh_memXfsize*) on performance is rather negative (Table 6). This

implies a still suboptimal size of agroholding members, under-utilising their economies of scale, suggesting that the motivation for being large holdings may be broader than just the economies of size. Being large, for instance, may help when it comes to protection under the conditions of insecure property rights. This is in line with the arguments of Gagalyuk & Valentinov (2019), who claim that agroholdings are more resilient and that they provide member firms with a safe haven in the turbulent transition environment.

In addition to firm-level characteristics, factors of institutional environments, such as political connectedness of agroholdings and public policies, might also affect their economic performances. Prior research suggests that agroholdings have strong political connections (Hermans et al. 2017) and that they are highly supported by the government at both the regional and federal levels (Hockmann et al. 2009; Matyukha et al. 2015), with a significant portion of government investments and subsidies directed towards agroholdings (Wegren 2018). For instance, in 2016, almost 91 % of all subsidised credits (RUB 33.6 billion) allocated for the advancement of the beef cattle sector were received by Bryans Meat Packers, a member company of the Miratorg agroholding (Uzun et al. 2019). Recent empirical evidence by Tleubayev et al. (2020) suggests that the extent of state ownership within Russian agri-food enterprises has a positive impact on financial performance, provided, however, that the level of state ownership concentration is below the certain threshold value. Hence, at least to some extent, agroholdings' political connections and strong state support might create favourable conditions for their advantageous economic positions.

Furthermore, in 2014, the Russian economy was highly affected by several macroeconomic events, such as an introduction of a food import ban on a number of agri-food items from the list of western countries, a drop in world oil prices and a significant devaluation of national currency (Ruble). In this respect, it is interesting to identify how these events affected the performances of agri-food enterprises in the country and whether agroholding firms reacted differently to these shocks vis-à-vis their non-agroholding counterparts. To capture these effects, we re-ran our baseline regression model and introduced a dummy variable for the years after 2014. Appendix 6 illustrates the results of this model. In the case of both ROA and ROS, the events of 2014 *(d_2014)* seem to have positively influenced the performances of agri-food firms in general (Appendix 6: Columns 1 and 2). However, a statistically insignificant effect of the interaction term between *d_2014* and agroholding affiliation *(agrh_memXd_2014)* suggests that the events of 2014 did not affect the performances of agroholding affiliates in particular (Appendix 6: Columns 3 and 4).

Although this article adds a number of contributions to the literature, it surely has several limitations, which need to be addressed by future research. Firstly, the selection of the sample in this study was data-driven, meaning that the

sample covers only those firms for which the required data was available. This has made the sample be composed of mainly larger-sized firms compared to the average size of the companies in the population. Hence, the results of this study should be interpreted with caution and might not be generalisable to a general population. Upcoming works should therefore concentrate on a broader sample that represents the whole population, including relatively smaller firms. Secondly, the paper suggests that agroholding affiliates have higher financial performance compared to independent firms, which, everything else being equal, might be attributed to a number of features of agroholdings that are stated above in the article. Nevertheless, there is a need for further qualitative studies, which could shed more light on what exactly agroholding affiliates do differently and how exactly they could achieve those features as opposed to stand-alone firms. Furthermore, prior studies suggest that factors of institutional settings, such as political connections or regional power configurations, may have an impact on the performance and development of agroholdings (Matyukha et al. 2015). Although it is very difficult to trace and find evidence on the formal connections of most of the agroholdings to certain politicians, future studies should try to incorporate this factor into their analyses.

5 Conclusion

Agroholdings have played a crucial role in the remarkable progress achieved by the Russian agri-food industry during the last decade and are expected to be the driving force for reaching the ambitious future goals set for the industry by the government. Nevertheless, the existing literature on agroholdings is still relatively scarce and it fails to provide clear evidence on whether agroholdings are more successful in terms of economic efficiency as opposed to non-agroholding enterprises and, hence, the potential political economy implications of the government's reliance on agroholdings remains unknown. This study employs firm-level data on Russian corporate agri-food enterprises and provides new empirical evidence on the effects of agroholding affiliation on firm performance.

In addition to an empirical contribution, this paper is also one of the pioneering attempts to provide a theoretical justification for the emergence of agroholdings through the prism of Resource Dependence Theory. Based on the arguments of Resource Dependence Theory, this study proposes that agroholding affiliation allows agri-food firms to have better access to vital external resources, including access to capital, high-qualified personnel and best management practices, which in turn improves their financial performance. Indeed, the results of the random effects model indicate a significant positive impact of agroholding affiliation on firm financial performance, in terms of both ROA and ROS. A further extension of the model, with the interaction terms of the explanatory variables suggests that the positive impact of agroholding affiliation may be attributed to

the following factors. Firstly, agroholding members are in a better position to secure favourable financing terms for outside capital and also have access to internal capital markets, which usually offer lower borrowing costs compared to external financing. This makes the overall cost of borrowing lower for the affiliated firms. Moreover, agroholding affiliates seem to put a greater emphasis on company management. They offer better performance evaluation programs to their executive management and have more efficient management compared to stand-alone enterprises.

The findings of this study might be of interest for both policy makers and managers or executives in Russia. For the policy makers, this paper provides additional evidence that agroholdings are perhaps better equipped than other forms at keeping up with existing institutional conditions and that they may indeed be the driving force behind the further growth of the agri-food sector towards the stated goals. Nevertheless, this does not mean that the government support should be directed exclusively towards agroholdings. Instead, agroholdings' financial advantages, at the background of mixed evidence of their productivity premiums, should urge policy makers to address such misbalances by providing an equal access to resources for "other forms" of agri-food producers. These areas include better access to capital, labour and production technologies, as well as improving the qualifications of the managers.

From the practical side, the results of this paper suggest that the top management and the boards of directors of corporate agri-food enterprises should pay more attention to improving managerial quality. A special focus should perhaps be given to management efficiency, since it may substantially improve firm financial performance. Implementing modern management practices and adopting continuous management training programs might be one of the ways for doing so. In this regard, there is a need for deeper qualitative studies which could provide more details on the management practices of agroholdings and help to understand how they maintain higher management efficiency. In addition, the boards of directors may also consider improving executive compensation systems within their companies. Offering stimulating compensation programs in which top executives' incomes depend directly on the company performance might minimise potential agency conflict and significantly improve the financial performance of firms.

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Appendices

Appendix 1: Correlation matrix of independent variables

		1	2	3	4	5	6	7	8	9
1	*agrh_mem*	1.000								
2	*fage*	0.031	1.000							
3	*fsize*	0.363	-0.074	1.000						
4	*leverage*	0.086	0.199	0.204	1.000					
5	*opex*	-0.079	-0.095	-0.143	0.089	1.000				
6	*bsize*	-0.132	-0.016	0.056	-0.095	0.023	1.000			
7	*bod_ind*	-0.096	-0.139	-0.145	-0.229	0.006	0.113	1.000		
8	*bod_div*	-0.116	0.042	-0.110	-0.015	0.048	0.041	0.053	1.000	
9	*exec_comp*	0.132	-0.089	0.153	-0.109	-0.116	-0.065	-0.035	-0.026	1.000

Source: Compiled by the authors.

Appendix 2: Agroholding affiliation (*agrh_mem*) and firm performance (ROA, ROS) Pooled OLS and FE models (standard errors in parentheses)

	Pooled OLS		Fixed Effects (FE)	
Variables	**(1) ROA**	**(2) ROS**	**(1) ROA**	**(2) ROS**
agrhmem	0.0133**	0.0343**	0.0613***	0.0612*
	(0.0062)	(0.0167)	(0.0151)	(0.0435)
age	-0.0018***	-0.0049***	-0.0028*	-0.0123*
	(0.0004)	(0.0011)	(0.0016)	(0.0046)
lnassets	0.0048***	0.0243***	0.0183*	0.1002***
	(0.0018)	(0.0049)	(0.0109)	(0.0315)
leverage	-0.1146***	-0.1827***	-0.2014***	-0.2999***
	(0.0089)	(0.0239)	(0.0256)	(0.0737)
oper	-0.1019***	-0.3132***	-0.1322***	-0.3276***
	(0.0098)	(0.0264)	(0.0132)	(0.0380)
boardsize	-0.0010	0.0029	-0.0088	0.0213
	(0.0015)	(0.0041)	(0.0053)	(0.0154)
outdir_per	0.0224***	0.0791***	0.0430**	0.0521
	(0.0071)	(0.0190)	(0.0172)	(0.0494)
femdirtot_per	0.0487***	0.1131***	0.0641***	0.1836***
	(0.0116)	(0.0311)	(0.0242)	(0.0696)
perf_bonus	0.0056	0.0019	0.0002	-0.0067
	(0.0052)	(0.0141)	(0.005)	(0.0143)
_cons	0.1288***	0.0742	0.0573	-0.8446**
	(0.0288)	(0.0772)	(0.1318)	(0.3789)
R-squared	**0.257**	**0.223**	**0.227**	**0.167**
N	**1218**	**1218**	**1218**	**1218**
			$F(202, 1006)^1 = 3.32$	$F(202, 1006)^1 = 2.08$
			Prob > F = 0.0000	Prob > F = 0.0000

*** p<0.01, ** p<0.05, * p<0.1

[1] F-test for fixed effects (Ho: fixed effects are insignificant; H-alternative: significant fixed effect)

Source: Compiled by the authors.

Appendix 3: Breusch and Pagan Lagrangian multiplier test for Random Effects(Ho: Random Effects are insignificant; H-alternative: significant random effect)

	Var	sd = sqrt (Var)		Var	sd = sqrt (Var)
ROA	0.0106	0.1029	**ROS**	0.0726	0.2695
e	0.0059	0.0769	**e**	0.0488	0.2211
u	0.0019	0.0437	**u**	0.0081	0.0898
	Test: Var (u) = 0			Test: Var (u) = 0	
	chibar 2 (01) = 158.99			chibar 2 (01) = 51.75	
	Prob > chibar 2 = 0.0000			Prob > chibar 2 = 0.0000	

Source: compiled by the authors.

Appendix 4: Hausman test
(Ho: RE is consistent and more efficient than FE; H-alternative: FE is consistent)

	ROA	ROS
chi2 (9)	16.48	13.12
Prob>chi2	0.0575	0.1572

Source: Compiled by the authors.

Appendix 5: Agroholding affiliation and firm performance
Extended model with the interaction terms of explanatory variables; fixed effects model with clustered errors at the firm level (standard errors in parentheses)

Variables	(1) ROA	(2) ROS
agrh_mem	0.4298**	0.5107
	(0.1688)	(0.4807)
fage	-0.0026	-0.0132*
	(0.0016)	(0.0046)
fsize	0.0218*	0.1066***
	(0.0113)	(0.0322)
leverage	-0.2411***	-0.3752***
	(0.0265)	(0.0757)
opex	-0.2523***	-0.8117***
	(0.0248)	(0.0706)
bsize	-0.0071	0.0278*
	(0.0055)	(0.0156)
bod_ind	0.0518***	0.1028*
	(0.0194)	(0.0554)
bod_div	0.1543***	0.6971***
	(0.0471)	(0.1339)
exec_comp	0.0024	0.0012
	(0.0048)	(0.0138)
agrh_memXfage	-0.0007	0.0017
	(0.0021)	(0.0058)
agrh_memXfsize	-0.0315**	-0.0511
	(0.0135)	(0.0387)
agrh_memXleverage	0.1178***	0.2301***
	(0.0256)	(0.0729)
agrh_memXopex	0.2386***	0.9480***
	(0.0407)	(0.1161)
agrh_memXbsize	-0.0051	-0.0065
	(0.0103)	(0.0294)
agrh_memXbod_ind	-0.0275	-0.1245
	(0.0304)	(0.0867)
agrh_memXbod_div	-0.0017	0.0596
	(0.0387)	(0.1104)

Variables	(1) ROA	(2) ROS
agrh_memXexec_comp	0.0775*** (0.0232)	0.2575*** (0.0662)
_cons	0.1235 (0.1372)	-0.4956 (0.3908)
R-squared	**0.250**	**0.188**
N	**1218**	**1218**

*** p<0.01, ** p<0.05, * p<0.1
Source: Compiled by the authors.

Appendix 6: Agroholding affiliation and firm performance
Extended model with a dummy variable for the effects of the events of 2014, RE models (standard errors in parentheses)

Variables	(1) ROA	(2) ROS	(3) ROA	(4) ROS
agrh_mem	0.0236*** (0.0083)	0.0380* (0.0206)	0.0213** (0.0099)	0.0320* (0.0256)
fage	-0.0021*** (0.0006)	-0.0051*** (0.0015)	-0.0021*** (0.0006)	-0.0051*** (0.0015)
fsize	0.0037 (0.0026)	0.0249*** (0.0063)	0.0038 (0.0026)	0.0249*** (0.0063)
leverage	-0.1233*** (0.0122)	-0.1903*** (0.0301)	-0.1232*** (0.0122)	-0.1903*** (0.0301)
opex	-0.1157*** (0.0109)	-0.3203*** (0.0291)	-0.1157*** (0.0109)	-0.3202*** (0.0292)
bsize	-0.0014 (0.0022)	0.0042 (0.0053)	-0.0014 (0.0022)	0.0042 (0.0053)
bod_ind	0.0240** (0.0095)	0.0743*** (0.0234)	0.0240** (0.0095)	0.0745*** (0.0234)
bod_div	0.0563*** (0.0150)	0.1260*** (0.0376)	0.0567*** (0.0150)	0.1268*** (0.0377)
exec_comp	0.0021 (0.0049)	-0.0018 (0.0137)	0.0022 (0.0049)	-0.0017 (0.0137)
d_2014	0.0095* (0.0050)	0.0027* (0.0013)	0.0083 (0.0057)	-0.0049 (0.0016)
agrh_memXd_2014			0.0042 (0.0102)	0.0115 (0.0288)
_cons	0.1569 (0.0397)	0.0682 (0.0964)	0.1567 (0.0396)	0.0682 (0.0964)
R-squared	**0.257**	**0.223**	**0.258**	**0.223**
N	**1218**	**1218**	**1218**	**1218**

*** p<0.01, ** p<0.05, * p<0.1
Source: Compiled by the authors.