

Global bank lending during political conflicts: Evidence from the agricultural industry

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Abstract

Concerns are growing about the pressure faced by agricultural industry triggered by Western sanctions imposed on Russia in the aftermath of the annexation of Crimea in 2014 and the subsequent Russo-Ukrainian war. We provide novel evidence on the role of globally active banks' lending behavior to mitigate the adverse effects during this conflict. Using syndicated loan data, we show that global banks provide more credit to the agricultural sector after Russian annexation of Crimea. Relative to lending to other industries, the number and the volume of loans increase by 20.9% and 50.4%, respectively. Moreover, loan contract terms for the agricultural industry become more favorable, reflected in more unsecured loans, and lower loan rates. Global banks also shift their agricultural lending towards publicly listed borrowers that are less opaque.

Keywords: economic sanctions, syndicated loans, agriculture

JEL Codes: G21, G28

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1. Introduction

We investigate bank lending in the context of growing concerns about the pressure faced by agricultural industry manifested by the conflict between Russia and Ukraine. The war, which started in 2022, has caused surge of food price due to increased energy price and less agricultural exports from Ukraine, one of the top exporters of grain and vegetable oil worldwide. Although this issue has been a key focus in the public debate, concerns about food security date back to 2014 when Russia annexed Crimea and got involved in the conflict in eastern Ukraine. In reaction to Russia's annexation of Crimea in 2014, the EU and other western countries imposed a series of sanctions against Russia, such as asset freezes, travel bans, and trade restrictions. In response to EU sanctions against Russia in 2014, Russia imposed a ban on imports of certain agricultural products from the EU, including fruit, vegetables, dairy, and meat. The ban was initially introduced for a year, but was later extended, leading to a significant negative impact on the EU agricultural sector, particularly in countries heavily reliant on exports to Russia. The export ban lead to negative impact on the financial performance of agricultural companies in Europe, raising possible issues regarding cash flow and payment abilities. This inspired us to explore how banks react to the shock on agricultural sector through lending.

While the EU is a top agricultural producer worldwide, the investment trends vary between its member states. In 2018, the EU produced a total of EUR 181.7 billion worth of agricultural products, making it the world's largest agricultural producer. However, investments in this sector are declining overall. Specifically, in 2018, the agricultural sector in the EU 24 invested EUR 54.1 billion in fixed assets, which is 4% lower than the investment level in 2011. Nonetheless, there are significant differences in investment growth rates between member states, with ten of them experiencing positive annual growth rates in agriculture investments between 2011 and 2017 (European Commission (2020)). Our study demonstrates the supportive role of banks in agricultural development, including mitigating cash flow issues and supporting

investment activities, especially during abnormal situations such as market shocks/political conflicts.

Prior work has focused on how sanctions affect economic growth (Hufbauer et al. (1997); Evenett (2002); Neuenkirch and Neumeier (2014); Besedes et al. (2018)), international capital flows and bank responses to sanctions and geopolitical tensions (Mian and Khwaja (2006); Houston et al. (2011); Besedes et al. (2016); Li and Ngo (2018)), and banks' behavior regarding sanctioned countries (Efung et al. (2018); Mamonov et al. (2021)). However, little is known about how bank lending changes for the agricultural sector, a basic but critically important industry that lays at the start of the global food chain against quickly growing concerns about global food supply. Our paper aims to fill the gap in the literature.

In this paper, we compare credit supply to the agricultural sector in European countries with other capital intensive sectors before and after Russia's annexation of Crimea in 2014. Specifically, we test whether the shock arising from sanctions on agricultural products imposed by Russia affect the total number and total volume of loans to the agricultural industry relative to other industries, the sources of these variations (home banks or foreign banks), and loan characteristics.

Banks and other financial intermediations can react to the shock in two ways. On one hand, they may support the sanctioned sector by providing more loans to deal with the recession. Economic sanctions result in costs for both imposing countries (Hufbauer et al. (2000); Besedes et al. (2018)) and sanctioned countries and hamper economic growth (Evenett (2002); Neuenkirch and Neumeier (2015)). Despite its ongoing evolution, agriculture remains a capital-intensive industry (Moss et al. (1997)). The financing gap for the agricultural sector exists among most of the European countries varying from EUR 19.8 to EUR 46.6 billion, and restricted access to long-term loans is identified as the main cause of the gap. (European Commission (2020)). Therefore,

borrowers in this sector may be more dependent on external capital during the shock and demand more loans. Banks may also lend more to the agricultural sector because of growing concerns about food security. The UN Food Price Index has been soaring since March 2022 and remains near its peak. Moreover, the Russo-Ukrainian war has significantly pushed up the cost of living in Europe. It is therefore plausible to expect that banks' growing awareness for food security may motivate them to expand lending to the agricultural sector following the initial shock in 2014.

On the other hand, banks may reduce lending to the agricultural sector because of the uncertainty arising from the sanctions. During a financial crisis, banks tend to adjust portfolios and reallocate lending towards safer and more transparent assets (Lang and Nakamura (1995); De Haas and Van Horen (2012)). Russia's counter sanctions against the EU's agricultural sector resulted in nearly an 8 times larger decline in trade flow than EU's sanctions on Russia (Belin and Hanousek (2021)). Sanctioned firms experience severe declines in revenue, asset value, and employment (Ahn and Ludema (2019)). Russia is one of the top five agricultural trading partners of the European Union. With bleak business prospects arising from Russia's sanctions on EU's agricultural products and lack of capital, the probability of default for agricultural loans may increase. Therefore, it is equally plausible to expect banks to curtail lending to the agricultural industry.

We start our analysis by empirically showing that performance of agricultural borrowers was hurt during the sample period (2011-2017), reflected by deteriorating revenue, EBITDA, EBIT, return on asset, and return on capital. These results support the view that the unexpected market disturbance negatively affected the profitability of agricultural borrowers. This may imply that bank loans are needed to alleviate the loss in cash flow and refinance loans for operating and investment activities.

We use syndicated loan data from LPC Dealscan and adopt differences-in-differences

estimation to analyze banks' lending behavior in the agricultural sector (treatment) and other capital intensive sectors (control group) before and after the 2014 sanctions. Our sample period spans from 2011 to 2017 which includes 3 years before and after the shock. Following De Haas and Van Horen (2012), we examine each lender's credit supply to every sector through 2011 to 2017. Variations of other unobserved heterogeneities across different sectors are accounted for by industry-fixed effects. Bank-fixed effects control for time-invariant bank characteristics in their lending activities. Unobserved time-variant factors are controlled for by year-fixed effects. We incorporated GDP per-capita as a control variable to account for the level of economic development, and also included inflation and gross savings rate as additional control variables.

The results suggest that banks respond positively to the sanctions, i.e., they increase the number of loans by 20.9%, and loan volume increases by 50.4% to the agricultural sector relative to other capital-intensive sectors after the sanctions. Banks support the agricultural sector by alleviating firms' financial constraints and helping them find other markets to sell products.. Further evidence for a reallocation of lending towards the agricultural sector arises from our results that split the sample by the median of agricultural importance, a variable measuring the share of the agricultural sector in the economy. Here, we find that it is countries whose agricultural sector accounts for a small portion in the economy that requires more agricultural lending after the shock. In other words, these countries are more developed and agriculture accounts for a smaller proportion of economic output.

We additionally investigate whether the increased credit supply comes from domestic or foreign lenders. Giannetti and Laeven (2012) show that lenders rebalance their loan portfolios in favor of domestic borrowers when facing financial crises. In line with this finding, in the presence of the pressure faced by agricultural sector and uncertainty about the agricultural industry, foreign banks may reduce lending whereas domestic

banks may increase lending. However, foreign lenders may also rebalance portfolios to alleviate capital shortages of domestic borrowers. It is possible that international banks provide more loans than home banks to prevent the transmission of economic shocks from sanctioned markets to banking sector in the country of origin (Morgan et al. (2004)). Our results are consistent with the latter hypothesis: foreign banks provide more agricultural lending. Both the number and volume of loans from foreign banks increased 21.1% and 72.8%, respectively.

Next, we focus on the composition of loan syndicates by studying separately the roles of arrangers and participants. Typically, arrangers are responsible for screening the loan, negotiating loan contracts, and monitoring the loan, while participants purchase loan shares from arrangers and rely on their due diligence in monitoring the loan. (De Hass and Van Horen (2010)). With the information advantages and industry uncertainty caused by the sanction, arrangers may attract and choose more participants to distribute the loan shares, which may trigger a moral hazard problem. Our evidence shows that - compared to other sectors - agricultural lending comes from foreign arrangers, indicating no moral hazard problem arising from arrangers' information advantages and economic sanctions.

Loan features are investigated as well. We choose the number of public firms, the number of unsecured loans, and the risk premium to identify whether agricultural loans exhibit higher or lower risk heterogeneous loan features relative to loans in other sectors. Public firms are less opaque since disclosure requirements are more stringent and they can generate positive information externalities to the industry. As a result, banks need less effort to screen and monitor the loan, meaning lending to public firms carries relatively lower risk. Another proxy for borrower's risk level is the requirement to pledge collateral (Berger et al. (2011); Cerqueiro et al. (2016)). We examine the number of unsecured loans in the agricultural sector to shed light on the question of whether banks consider borrowers from the agricultural sector as riskier borrowers. We also

examine the risk premium, defined as the interest rate the bank charges over the risk-free rate to capture whether banks charge a higher risk premium against agricultural loans as a compensation of higher loan risk as a result of sanctions. These tests suggest that agricultural lending tends to include more public firms, fewer unsecured loans, and lower risk premiums relative to the control group, therefore not necessarily burdens banks with higher risks.

The last part of our analysis focuses on the differential effects arising from the Russian sanctions against EU on targeted categories: meat, dairy products, and fruits and vegetables. Although the magnitude and significance vary across the product categories, overall, the results show that firms operating in products that are directly affected by sanction tend to be supported with higher number and volume of loans after the negative shock.

To ensure the robustness of our findings, we perform multiple tests using various sample periods and control groups. In the first set of robustness test, we expand the sample period to 2010 and 2019. In the second set of tests, all sectors are included in the analysis for the period from 2011 to 2017. Our results remain unaffected . In addition, we also exclude confounding effect caused by agricultural subsidies by controlling for subsidies.

The sanction from Russia on EU provides a valid setting to study the bank lending to agricultural sector during political conflicts. We propose several channels of why lenders direct more credit to agricultural sector. First, after sanctions are imposed, the sector was severely hit, for example, market shares shrank and business opportunities weakened companies' abilities to pay their bills. Thus, credit was used to refinance loans to overcome potential financial distress. Second, due to market disturbance, small firms tended to be acquired by large firms. The loans were needed for M&A transactions. Third, as mentioned in an informal meeting of the Heads of State or

Government Versailles Declaration 2022, “We will improve our food security by reducing our dependencies on key imported agricultural products and inputs, in particular by increasing the EU production of plant based proteins.” In other words, loans could be used to explore alternative products and markets to improve the resilience of agricultural firms.

This research contributes to two strands of literatures. First, our paper relates to prior work on the effect of sanctions. Previous studies suggest economic sanctions hinder the development of both the imposing and the target economies. Evenett (2002) investigates the effect of eight economic sanctions on South Africa, finding that the sanctions exert significantly negative effects for South Africa’s export. Hufbauer et al. (1997) point out that U.S. sanctions lead to export reductions to 26 target countries and contractions in employment in the export sector in the U.S. These results imply that sanctions impose domestic cost in the sanctioning country, although other scholars argue that the domestic costs of sanctions are limited because firms doing business with sanctioned countries tend to be large enough to contain the negative effects and can simultaneously expand their business with non-sanctioned countries (Besedes et al. (2018)). In addition, economic sanctions impede the target countries GDP growth, reduce the employment, and damage firms’ value (Neuenkirch and Neumeier (2014); Ahn and Ludema (2019)). Restrictive measures taken by the EU and Russia lead to huge loss of trade for related states and non-embargoed products (Moret et al. (2016); Crozet and Hinz (2016)). Our study provides a complementary perspective to prior research by demonstrating that despite facing sanctions, the agricultural sector continued to receive support from the banking sector. Additionally, while earlier studies have primarily focused on the negative economic consequences of sanctions on target businesses, our research highlights that banks increased their lending to the agricultural sector after the imposition of sanctions.

Second, our paper complements the literature about bank capital flows during crises,

economic sanctions, and geopolitical tensions. Mian and Khwaja (2006) use loan level data in Pakistan to investigate bank liquidity shocks after Pakistan's test of nuclear weapons in 1998. The results show that for the same firm borrowing from two different banks, its loan amount from the bank decrease by 0.6% if bank liquidity suffers a further 1% reduction. Houston et al. (2011) estimate how differences in regulations influence international bank capital flows. They find banks transfer capital from more regulated markets to less regulated markets. This 'race to the bottom' restricts regulators' ability to limit bank risk-taking. Besedes et al. (2016) study the effect of financial sanctions on cross-border capital flows by examining sanctions imposed by Germany from 2005 to 2014. They show that financial activities and capital flows between Germany and target countries were reduced significantly when sanctions are in place. Li and Ngo (2018) examine whether political relations between countries determine the cross-border capital (bank) flows. By tracking footsteps of the Dalai Lama between 2000 through 2013, they show that bank capital flows from China to the host country decline by 12% to 17 % after the Dalai Lama visits this country and meets with the prime minister. They also state that poor political relations are negatively correlated to bank flows for a broader panel of countries. In contrast to capital outflows documented in prior work, we find that banks (foreign arrangers) provide credit to sanction sectors abroad.

Two studies that are closely related to our research are the works by De Hass and Van Horen (2013) and Giannetti and Laeven (2012). The former shows that international banks curtail lending during financial crises, highlighting heterogeneities in terms of geographical location, lending experience, and presence of subsidiaries and co-lender networks. The latter points out that lenders adjust loan portfolios towards more domestic lending, known as the home bias. Our study provides novel evidence indicating that foreign banks provide more loans to a sanctioned sector (agriculture) as concerns of rising food security grow to prevent the further spreading of the crisis (flight to safety).

The rest of the paper proceeds as follows. Section 2 describes the background information of sanctions imposed by the EU and Russia. Section 3 presents our data and empirical strategy. Section 4 presents our results. Section 5 displays robustness tests. Section 6 concludes.

2. Evolution of sanctions, countersanctions, and political reactions

In early 2014, Russia invaded and annexed Crimea. In response to Russia's annexation of Crimea, the EU, along with other Western countries (U.S. and its allies), imposed various sanctions in July 2014.

There are two categories of restrictive measures against Russia. The first category are sanctions against individuals and entities that are associated with the annexation of Crimea. The sanctions include asset freezes and travel bans imposed on Russian officials, and embargoes of products from related entities. Another category imposes restrictions on specific economic sectors, mainly on finance, energy, transport, defense, and raw materials. For example, Russian banks' newly issued bonds, equity, and other financial instruments with a maturity exceeding 90 days cannot be bought or sold by EU nations and companies. Related financial services are prohibited as well. For the energy sector, the EU restricted exports to Russia of goods and technologies in the oil refining industry. The above sanctions have been renewed every 6 months and are expected to be continued in the future.

In reaction to the economic sanctions imposed on Russia, Russia itself enacted a one-year import ban for agricultural products originating from the EU and other Western countries in August 2014. The targeted categories were meat, dairy products, and fruits and vegetables. Following this import ban, the overall EU agri-food export to Russia decreased by 42.2% (EU Monitoring Agri-trade Policy (2015)). For specific categories, dairy products, meat, fruits and vegetables exported to Russia decreased by 97.6%, 86.3% and 86.4 respectively. The embargo has been renewed multiple times and remains in

place until to now (see more information in the appendix 1).

The EU took immediate measures against Russia's food embargo following Regulation (EU) No 1306/2013 and No 1308/2013. To tackle the market imbalance caused by Russia's countersanctions, the EU adopted actions to stabilize the affected sector. Specifically, the EU started promotion policies, market withdrawal with subsidies and free distribution of fruits and vegetables, and storage support for dairy products by private operators. In addition, the EU commission also tapped into the reserve for crises in agricultural sector, intending to provide additional support for the agricultural sector in case of major crises affecting agricultural production or distribution. According to Regulation (EU) No 1306/2013, the total amount of the reserve is 2,800 million Euros from 2014 to 2020, with equal annual instalments of 400 million Euros, paid by the Commission to member states.¹

With the full-scale Russo-Ukrainian war that started on 24 February 2022, food prices soared by 13% immediately after the war began and has stayed near its peak ever since. The war is also pushing up energy prices, further disrupting trade, fuelling hunger, and worsening a cost-of-living crisis.

..... *“Copa-Cogeca, the EU farmers’ union, and FoodDrink Europe and PFP, two of the big food producer associations, said their members had already begun to close operations and reduce their output, as they asked for the food chain to be exempt from any European plans to ration energy. ‘The latest increases in energy prices, especially natural gas and electricity, threaten the continuity of agri-food production cycles and therefore the ability to continue delivering essential agricultural commodities, food products and feed materials,’ they said in a*

¹ Note that Russian counter sanctions encompass a wide range. Russia imposed its sanctions at the 4-digit level of the Harmonised System for goods classification, whereas the EU imposed their sanction at the 8-digit level (Belin and Hanousek (2021)).

statement ahead of an emergency meeting of EU energy ministers in Brussels.....
(Financial Times, September 7 2022)²

In addition to the direct impact of loss of export of agricultural produce, various sanctions between Russia and Europe, which resulted in a spike in food prices, triggered a profound discussion in the European Parliament regarding how to build better long-term resilience and autonomy in food supply within Europe (The EU leaders' 10-11 March Versailles declaration). In line with the discussion, providing financing to the agricultural industry firms under the sanction would have two main points of significance: 1) provide immediate rescue for the negatively shocked sector to overcome the short-term austerity, 2) provide support for the agricultural sector in the region to build long-term viability.

Banks as financial intermediation, play an pivotal role in mitigating firms' financial distress and supporting firms' investment activities through lending. In the context of export ban, agricultural companies in Europe suffered negative impact on performance and lost market share. Therefore, it is possible that bank loans were needed to alleviate immediate cash flow issues. On the other hand, agricultural companies were able to ameliorate losses in export sales to Russia by diversifying the exports to other markets. The United States, China, and other Asian markets including Hong Kong and the Republic of Korea were the primary alternative destinations (European Commission (2015)). Hence, banks provide more credit to meet agricultural borrowers' financial needs to explore alternative markets.

3. Data and empirical strategy

3.1 Data

The main source of our data is the Loan Pricing Corporation DealScan database,

² To tackle these issues, global initiatives are under way, e.g., the World Bank is helping farmers, supporting sustainable agriculture and agri-food value chains through agriculture finance (World Bank, August 31 2022).

which contains information on syndicated loans. It provides details about loan breakdown, borrower, lender, and loan contract terms (e.g., date, spread, and volume). Using syndicated loan data allows investigating how large international lenders react to economic sanctions.

We define as agricultural loans whose borrower's major industry group is agriculture. We collect syndicated loan data for the period 2011-2017. Our syndicated loan data contain nearly 11825 loans across all European countries, covering 15 major industry groups, of which 301 are classified as agricultural loans. Russia and Ukraine are excluded from the sample.

Due to missing information in the database, a fraction of our loan sample does not have information of the loan breakdown on volume. For such loans, we follow De Hass and Van Horen (2013) and split the loan amount equally among all syndicate members. Figure 1 shows the total number and total volume of loans in the agricultural sector through 2011 to 2017.

[Figure 1]

We obtain data for the control variables such as GDP per-capita, inflation, gross savings rate, proportion, relevance of the agricultural sector for a country, and the risk-free rate from World Bank Development Indicators and the European Central Bank's Statistical Data Warehouse. The financial data used for estimating the performance of public and private agricultural borrowers is extracted from S&P Capital IQ.

The data of subsidies is retrieved from FarmSubsidy.org, a database aims to collect comprehensive information regarding the beneficiaries and amounts of farm subsidies in all EU member countries and present this data in a manner that is beneficial to citizens of Europe. We aggregate the subsidy data at the country and year level and introduce subsidies as a control variable to control the impact of agricultural subsidies

on bank loans for agriculture.

Analogous to De Hass and Van Horen (2013), we reaggregate the data at the bank-industry level. Specifically, for each lender, we calculate the number and the volume this lender provides to each major industry group from 2011 to 2017. By doing this, we can quantify a bank's lending to diverse sectors corresponding to economic sanctions. We take the log of the total number and total volume as dependent variables. We proceed analogously for the other dependent variables.

We determine whether a bank is domestic or foreign by comparing the lender's country of origin with the borrower's country. If the lender's parent operating country matches the borrower's country, we consider it a domestic lender otherwise a foreign lender. We identify home and foreign banks by matching a lender's parent country and a borrower's country. If the lender's parent country is the same as the borrower's country, it is treated as a home bank. Arrangers and participants are identified based on the 'primary role' information provided by Dealscan. Our sample period contains 3 pre- and post-shock years before and after the shock. We use expanded sample period (2010 to 2019) for robustness tests and the results are consistent. Table 1 presents summary statistics.

[Table 1]

3.2 Empirical strategy

We use difference-in-differences estimation to examine the causal effect of economic sanctions on agricultural lending. The treatment group is the agricultural sector, and the control group is the aggregation of all other capital-intensive sectors, for instance, manufacturing, automotive, and construction sectors. It is plausible to compare the agricultural sector with other capital-intensive sectors as the agricultural sector is a typical capital-intensive sector (Moss et al. (1997)). The model is as follows

$$Dependent Variable_{it} = \beta Treat_{it} * Sanction + Control + \alpha_i + \gamma_\tau + \delta_j + \varepsilon_{it}$$

where our dependent variable is the log of the total number or the total volume a lender provides to an industry in a given year, respectively. *Treat* equals 1 if the major industry group is agriculture (0 otherwise). *Sanction* takes on the value of 1 if the year is 2014 onwards and 0 otherwise. *Treat*Sanction* is our key interaction term. It takes on the value of 1 to identify agricultural lending after the shock (0 otherwise). *Control* represents the log of GDP per-capita, inflation, and gross savings rate.

We include industry-fixed effects δ_j to control for time-invariant loan demand and other unobservable industry level differences. We also include bank-fixed effects α_i to control for time-invariant bank characteristics that might affect lending. The year fixed effects γ_t control for unobservable time-variant factors in the corporate lending market. Standard errors are heteroscedasticity robust and clustered at the bank-industry level.

Figure 2 shows the trend of the total number and total volume of loans for treatment and control group before and after the sanctions. The pre-shock movement of treatment and control groups generally follows similar patterns. After the sanctions in 2014, both the total number and total volume of agricultural loans significantly increased. Figure 2 also illustrates parallel trends prior to the shock. To verify econometrically whether our setting satisfies the parallel trends assumption, we regress the log of the total number and total volume of loans on treatment-time dummies and plot the coefficients in Figure 3. The pre-shock coefficients of both dependent variables remain insignificant, indicating the exogeneity of the treatment.

[Figure 2]

[Figure 3]

4. Empirical results

We first explore the performance of agricultural companies in our sample by regressing performance measurement variables on the sanction dummy variable. Compared to non-sanctioned firms, sanctioned firms suffer significant decline in

revenue, value of assets, and employees (Ahn and Ludema, 2019). Hence, we propose and empirically test a mechanism that firms in agricultural sector were negatively impacted by Russian food embargo so they need loans to cover the loss in cash flow, compensate the payment ability, and for future investment.

We collect financial data of our agricultural borrowers and collect variables, including total revenue, EBITDA, EBIT, return on asset, return on equity, and return on capital, to measure their performance. Income related variables (total revenue, EBITDA, EBIT) are scaled by total assets. All variables are calculated as the log value plus one. We regress those variables on the sanction dummy to verify whether the performance of companies in agricultural sector deteriorated after 2014. Country and firm fixed effects are controlled for removing the confounding effects that arise from time invariant unobservable heterogeneities across countries and firms, respectively.

As illustrated in Table 2, the performance of agricultural borrowers was weakened after 2014, signified by statistically significant and negative coefficients of almost all performance measurement variables. To illustrate, total revenue declined significantly, demonstrating that after the sanction, total revenue of agricultural companies decreased 6.3%, or \$11 million relative to the mean. Analogously, other variables such as EBITDA, EBIT, ROA, and ROC also declined significantly. The empirical results show that sanction indeed caused negative effect on agricultural borrowers' financial performance. The loan purpose in the dataset also suggested that most of the loans are used for refinancing previous loan facilities indicating that there were issues existing about agricultural companies' loan financing and short term cash flow.

[Table 2]

4.1 Baseline results

Table 3 shows the effect of sanctions on the Total Number and Total Volume of loans to the agricultural industry. Total Number is defined as the total number of loans a bank

lends to an industry in a year. Total Volume is defined as the total tranche size of loans a bank lends to an industry in a year. Control variables or fixed effects are not included in Columns 1 and 2. We include bank-, year-, and industry-fixed effects in Columns 3 to 6. GDP per-capita of lenders' countries, inflation and gross savings rate enter in Columns 5 and 6.

[Table 3]

The results are consistent through all columns and indicate a positive and significant relationship between sanctions and credit supply. Based on Columns 5 and 6, compared with other sectors, the number of loans to the agricultural sector increased by 20.9% and the volume of loans to agricultural sector increased by 50.4% after the sanctions in 2014. In other words, lendings to agricultural sector increased by 210 million US dollars after the sanction relative to the mean, or 72.48 million US dollars relative to the median.

4.2 Importance of agriculture in different countries

The importance of the agricultural sector for the economy varies across different countries in Europe. For example, in the UK, the agricultural sector accounts on average for 0.9% of the economy between 2002 and 2014. In contrast, for Greece this figure rises to 5%. Therefore, we expect the sanctions to have heterogeneous effects on agricultural sectors as well as credit supply across different economies.

Table 4 presents our analysis of the effect on lending conditional on the importance of agriculture. The importance of agriculture is defined as the proportion of the agricultural industry relative to a country's GDP. The sample is split based on whether a country's agricultural importance is high, i.e., it is above the median of all European countries, or, alternatively if a country's agricultural sector is below the median (low importance).

Lending increased in both categories of countries, with a greater statistically

significant increase of loan volume in countries where the agriculture accounts for a small proportion in the economy. The results illustrate that the effect of sanctions on agricultural lending comes from both types of countries but the effect is stronger for countries where agriculture is less important in the economy. To examine whether the coefficients are statistically different between the two groups, a Chow-test is conducted based on the triple interaction among Treat, Sanction, and Low importance. The F statistics and P-values state that the coefficients of number of loans are different between the two groups while the coefficients of volume of loans are not.

[Table 4]

Table 4 highlights that although the total number of loans increased in both groups, the increase in volume of loans for the agricultural industry mainly comes from countries where the economic portion of agricultural sector is below the median. The volume of the credit supply to agriculture in these countries increased by 39.6% after the sanctions.

4.3 Structure of syndicates

4.3.1 Home banks and foreign banks

Economic sanctions hinder the development of target economies and related sectors, causing lower growth of GDP, reductions in export, declines in business activities, and shrinking in jobs (Hufbauer et al (1997); Evenett (2002); Neuenkirch and Neumeier (2014); Besedes et al. (2018)). These changes are likely to result in demand for credit to avoid a recession in the sector. Therefore, it is reasonable to expect credit supply to increase in the agricultural sector following Russia's counter sanction on agricultural products against Europe.

However, whether financing is provided by home or foreign banks is not clear. On one hand, home banks may adjust their loan portfolios in favour of domestic borrowers to prioritize mitigating the economic shock in the domestic market (Giannetti and

Laeven (2012)). On the other hand, international lenders also have incentives to rebalance their portfolios to alleviate capital shortages, thus triggering adverse outcomes in host markets.

[Table 5]

Table 5 highlights that the number of loans and the volume of loans from foreign banks increased by 21.1% and 72.8%, respectively, in the agricultural sector after the sanctions, consistent with foreign banks supporting the sector.

4.3.2 Arrangers and participants

In syndicated loans, arrangers take the senior role and are responsible for negotiation, monitoring, and syndication allocation. Hence, arrangers are less exposed to problems arising from information asymmetries than participants. Arrangers choose participants as syndicate members based on the information asymmetry between borrowers and participant lenders and the relationship between arranger lenders and participant lenders (Sufi (2007)). In other words, a bank is more likely to be chosen as a participant if it has less information asymmetry (stronger relationship) with borrower (arranger).

Table 6 examines the various effects on home and foreign arrangers, and home and foreign participants. In the agricultural industry, the volume of home participant loans significantly decreased by 20.4% after the sanctions are imposed. In contrast, both the number and volume of foreign arranger loans increased, by 17.4% and 69.0%, respectively. As the loans from foreign arrangers comprise changes in agricultural lending, there are no increased moral hazard problem between arrangers and participants due to the sanctions.

[Table 6 Panel A]

[Table 6 Panel B]

4.4 Loan characteristics

Table 7 Panel A tests whether the sanctions affect loan characteristics. Column 1 shows that the number of unsecured loans in the agricultural sector decreased by 14.3% compared to other sectors. Riskier borrowers are more likely to be required to pledge collateral (Berger et al. (2011); Cerqueiro et al. (2016)). However, Column 1 indicates that borrowers in the agricultural sectors are less likely to be required to do so than borrowers in other sectors under the sanctions.

Column 2 shows that there is a 7.5% increase in loans to public firms in the agricultural sector when sanctions are in place. Public firms are required to disclose more information than private firms. With more public firms, the agricultural sector has improved information environment than other sectors after the sanction.

Column 3 presents the change of the risk premium of loans in the agricultural sector compared with other sectors. The risk premium is defined as the interest rate of the loan minus the risk-free rate. The negative and significant coefficient suggests that banks charge 25.9% less risk premium for borrowers in the agricultural sector. In other words, on average, lenders charge 42.6 less basis points for borrowers from agricultural sector relative to the mean, or 43.1 relative to the median after the sanction.

[Table 7 Panel A]

To verify whether banks offer favourable loan terms to agricultural borrowers after the sanction we further test the effect on the number of unsecured loans by splitting the sample based on different percentile of risk premium. As shown in Table 7 Panel B, the number of unsecured loans come from loans whose risk premium are below the median.

[Table 7 Panel B]

Table 7 illustrates that loans in agricultural sector are less risky, have better information environment, and attract lower collateral requirements.

4.5 Heterogenous effects on sanctioned categories

We now embark upon a granular analysis to dig deeper into which sub-sectors in agriculture are most affected. The data is reaggregated at the bank-industry-country level. Among all agri-food products, dairy products, meat, and fruits and vegetables were mainly targeted and the most severely hurt sub sectors.

The results in Table 8 indicate that within the agricultural sector, borrowers in the categories of meat and fruits and vegetables receive more lending via the syndicated loan market, with increases of 45.6% and 47.6% in the number of loans after the sanctions, respectively. The volume of loans to meat sector increased by 74.1% after the sanctions. Taken all categories together, the volume of loans increased by 31.5% after the sanctions.

[Table 8]

5. Robustness tests

5.1 Alternative sample periods and control groups

We conduct our first robustness tests using different combinations of sample periods and alternative control groups.

For Table 9 and Table 11, we replicate our regressions of the baseline effect and home/foreign bank effect, except for the fact that the control group now includes not only capital-intensive sector borrowers, but all sectors except for the financial sector. For Table 10 and Table 12, we rerun the regressions of the baseline effect and home/foreign bank effect with the sample period from 2010 to 2019. All results remain consistent with the main results, and our inferences are unaffected.

[Table 9]

[Table 10]

[Table 11]

[Table 12]

5.2 Confounding effect of subsidy

In addition, we also incorporate farm subsidy payments as another control variable to account for the effect of subsidies on bank lending. The European Commission promptly implemented measures to assist the agricultural sector in navigating its market disturbance after the sanctions were imposed.. Apart from the emergency aid, for instance, promotion policies, market withdrawal, and storage support, according to Regulation (EU) No 1306/2013 and No 1308/2013, the EU can grant farm subsidies to recipients of member states. Therefore, we incorporate subsidy payments as a control variable to control for the confounding effect of subsidies on bank lending to borrowers in the agricultural sector. The subsidy data is aggregated on the country-year level. We take the natural log of the value of the subsidy payments and fill the missing data with the natural log of a value that is extremely close to zero (0.00001). Country, industry, bank, and year fixed effects are included to control for time-invariant and time-varying unobservable factors, respectively. The results in Table 13 underscore that our results remain unaffected after accounting for subsidy payments.

[Table 13]

6. Conclusion

We investigate how banks' syndicated lending activities adjust in response to the EU and Russia's bilateral economic sanctions back in 2014. Using difference-in-differences estimation and controlling for bank-, industry-, and year-fixed effects, we show that banks lend more to the agricultural sector. Both the number of loans and volume of loans increased after the sanctions are imposed. However, the effect is heterogeneous among countries with different importance of the agricultural sector. Borrowers in countries with low agricultural importance before the shock tend to obtain more credit after the shock. Banks tend to alleviate the situation caused by the sanction. A possible mechanism is that the agricultural companies' performance suffered adverse effects following the sanctions, necessitating the need for loans to mitigate the impact on

capital and cash flow.

Further, we show that it is foreign banks that increase lending to the agricultural sector and foreign arrangers are the main source of changes in agricultural lending. This indicates bank's awareness of food security and incentive to prevent the spread of the outcome of economic sanctions. Compared to other sectors, agricultural loans are less risky, have lower risk premium, and contain more public listed borrowers.

Our paper has implications for the ongoing debate about food security and the development of agricultural sector in the context of potential political tension. Banks can play an important supportive role by providing credit to the agricultural sector, which can help to alleviate the situation in the sector caused by international conflicts.

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Figures and tables

Figure 1

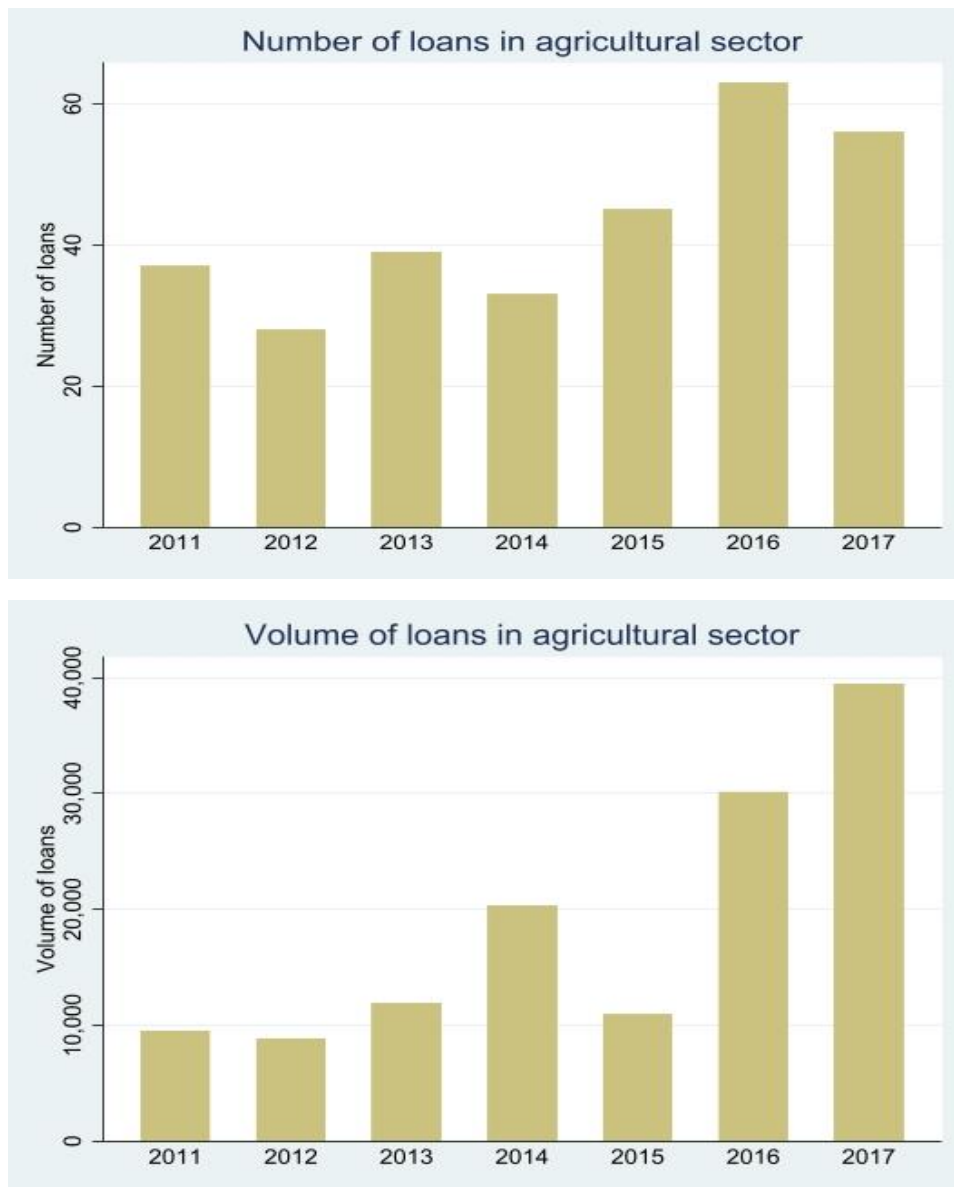


Figure 1 displays the total number and total volume of agricultural lending in Europe from 2010 to 2019. Source: DealScan, aggregated on industry-year level.

Figure 2

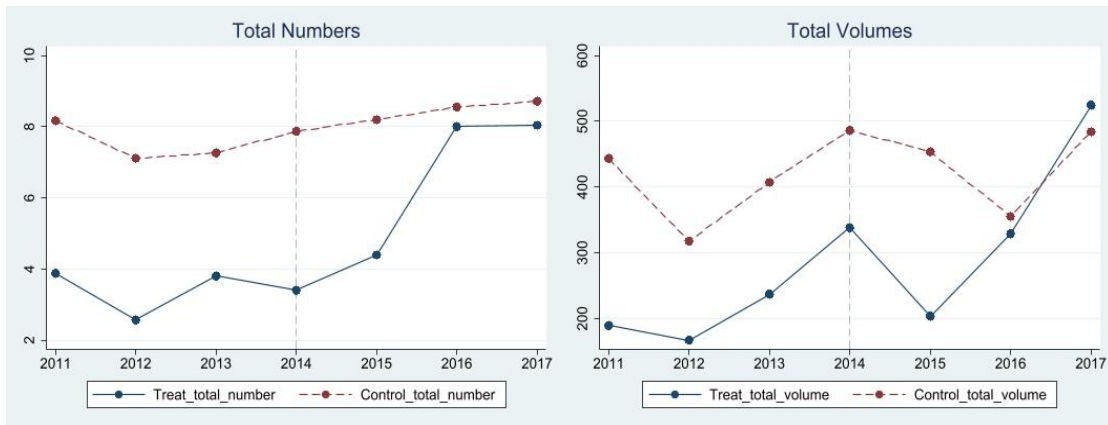


Figure 2 presents the pre and post trend of total number and total volume of loans a bank lends to a sector for agriculture (treatment) and other sectors (control groups)

Figure 3

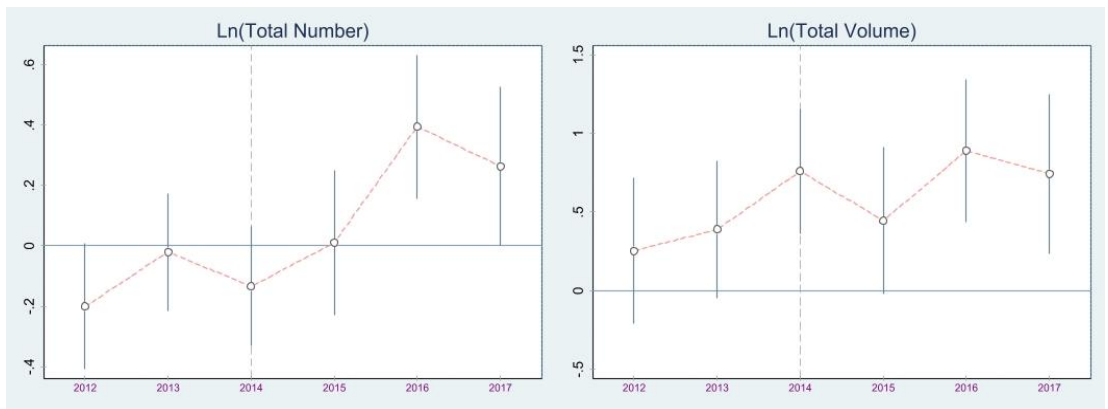


Figure 3 presents the plot of coefficients of the empirical tests of dynamic effect. The pre shock coefficients are insignificantly not equal to 0, indicating the existence of parallel trends between treatment and control group.

Table 1 Summary Statistics

Variable	N	Mean	p50	SD	Min	Max
Total number of loans	8958	7.860	4	11.75	1	149
Ln(Total number of loans)	8958	1.710	1.610	0.890	0.690	5.010
Total volume of loans	8958	416.5	143.8	707.3	0	9313
Ln(Total volume of loans)	8958	4.960	4.980	1.580	0	9.140
Treat	8958	0.0400	0	0.200	0	1
Sanction	8958	0.580	1	0.490	0	1
Ln(GDP Per-capita)	8958	10.54	10.69	0.630	6.430	11.73
Importance of Agriculture						
Total number of loans	19434	3.620	2	5.060	1	119
Ln(Total number of loans)	19434	1.280	1.100	0.620	0.690	4.790
Total volume of loans	19434	192	99.04	314.0	0	8142
Ln(Total volume of loans)	19434	4.580	4.610	1.190	0	9
Home/Foreign						
Ln(Number of Foreign Loans)	8958	1.160	1.100	1.010	0	4.620
Ln(Number of Home Loans)	8958	0.850	0.690	0.970	0	4.790
Ln(Volume of Foreign Loans)	8958	3.650	4.360	2.610	0	9.140
Ln(Volume of Home Loans)	8958	2.450	2.390	2.500	0	8.640
Arrangers/Participants						
Ln(Number of Home Arranger Loans)	8958	0.730	0	0.940	0	4.650
Ln(Volume of Home Arranger Loans)	8958	2.150	0	2.520	0	8.640
Ln(Number of Home Participant Loans)	8958	0.220	0	0.510	0	3.760
Ln(Volume of Home Participant Loans)	8958	0.620	0	1.410	0	7.820
Ln(Number of Foreign Arranger Loans)	8958	1.020	0.690	1.020	0	4.490
Ln(Volume of Foreign Arranger Loans)	8958	3.230	4.020	2.760	0	9.130
Ln(Number of Foreign Participant Loans)	8958	0.250	0	0.500	0	2.890
Ln(Volume of Foreign Participant Loans)	8958	0.970	0	1.830	0	8.220
Loan characteristics						
Ln(Number of unsecured Loans)	8966	1.270	1.100	0.940	0	4.790
Ln(Risk premium)	4626	5.060	5.270	0.910	-1.650	6.820
Ln(Share of loans to public firms)	8958	0.210	0.0500	0.260	0	0.690

Table 2 Performance of agricultural borrowers before and after the sanction

	(1) Ln(Total Revenue)	(2) Ln(EBITDA)	(3) Ln(EBIT)	(4) Ln(Return on asset)	(5) Ln(Return on equity)	(6) Ln(Return on capital)
Sanction	-0.0628*** (-2.77)	-0.0213* (-1.93)	-0.0252* (-1.85)	-0.0259** (-2.14)	-0.0294 (-0.50)	-0.0411* (-1.93)
Log of GDP per-capita	0.128 (1.25)	-0.0142 (-0.24)	-0.0797 (-1.16)	-0.0833 (-1.34)	-0.392 (-1.55)	0.0775 (0.71)
Inflation	-0.0161 (-0.71)	0.00301 (0.28)	0.00336 (0.28)	-0.00269 (-0.34)	-0.0470 (-0.93)	-0.0311 (-1.20)
Gross savings rate	0.00238 (0.02)	0.0390 (0.70)	0.0724 (1.17)	0.0944* (1.71)	0.288 (0.95)	-0.0410 (-0.46)
r2	0.944	0.686	0.614	0.603	0.376	0.799
N	277	260	284	277	265	271
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 2 investigates the performance of agricultural borrowers before and after the sanction. Firm and country fixed effects are controlled. Standard errors are clustered at the firm level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3 Baseline effect

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Total Number)	Ln(Total Volume)	Ln(Total Number)	Ln(Total Volume)	Ln(Total Number)	Ln(Total Volume)
Treat*Sanction	0.250*** (4.19)	0.563*** (4.18)	0.212*** (3.21)	0.508*** (3.56)	0.209*** (3.17)	0.504*** (3.54)
Log of GDP percapita					-0.116 (-1.11)	0.0385 (0.22)
Inflation					-0.00353 (-0.22)	0.0242 (0.83)
Gross savings rate					0.305*** (3.36)	0.557*** (3.56)
r2	0.0068	0.0094	0.604	0.647	0.605	0.647
N	8958	8958	8958	8958	8958	8958
Bank FE	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	Yes	Yes

Table 3 reports the baseline effect of the shock on lending where the dependent variables are log of total number and total volume a bank lends to an industry for each year from 2011 to 2017. No control variable and fixed effects are included in columns (1) and (2). Bank, year, and industry fixed effects are added from columns (3) to (6). Columns (5) and (6) also incorporate control variable. The results are consistent through all 6 columns. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses.

*, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively

Table 4: Importance of Agriculture

	(1)	(2)	(3)	(4)
	Ln(Total Number)	Ln(Total Number)	Ln(Total Volume)	Ln(Total Volume)
Treat*Sanction	0.382*** (3.87)	0.109** (2.30)	0.680** (2.49)	0.396*** (3.96)
Log of GDP percapita	-0.0911 (-0.48)	-0.150** (-2.34)	0.158 (0.40)	-0.122 (-1.00)
Inflation	-0.000972 (-0.04)	0.00441 (0.36)	0.0956** (1.96)	0.00714 (0.32)
Gross savings rate	0.272 (1.49)	0.0475 (0.73)	0.565 (1.56)	0.203* (1.69)
Importance of Agriculture	High	Low	High	Low
r2	0.429	0.198	0.402	0.309
N	3051	16382	3051	16382
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
	Number of	Volume of		
	loans	loans		
Chow test F-statistics	7.89	1.00		
Chow test P-value	0.0050	0.3178		

Table 4 reports the results where the sample is split based on the importance of agriculture of each country. High and low importance are countries whose economic portion of agriculture are above and below the median before 2014. Data is aggregated at bank-country-industry level. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 5 Home banks and foreign banks

	(1)	(2)	(3)	(4)
	Ln(Number of Foreign Loans)	Ln(Number of Home Loans)	Ln(Volume of Foreign Loans)	Ln(Volume of Home Loans)
Treat*Sanction	0.211*** (2.74)	0.0774 (0.95)	0.728*** (3.32)	0.0345 (0.14)
Log of GDP percapita	0.0881 (0.87)	-0.370*** (-4.81)	-0.0384 (-0.18)	-0.0853 (-0.41)
Inflation	0.00537 (0.34)	-0.0291** (-1.99)	-0.0311 (-0.79)	0.000373 (0.01)
Gross savings rate	0.0222 (0.23)	0.527*** (5.62)	0.190 (0.76)	1.230*** (4.72)
r2	0.647	0.628	0.694	0.644
N	8958	8958	8958	8958
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 5 reports the results of home and foreign bank effect. A bank is defined as a home bank if its parent country is the same as the borrower's country. The results indicate that foreign banks provide more loans to agricultural sector after the sanction. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 6 Panel A. Home arrangers and foreign arrangers.

	(1)	(2)	(3)	(4)
	Ln(Number of Home Arranger Loans)	Ln(Number of Foreign Arranger Loans)	Ln(Volume of Home Arranger Loans)	Ln(Volume of Foreign Arranger Loans)
Treat*Sanction	0.0988 (1.27)	0.174** (2.26)	0.180 (0.77)	0.690*** (3.02)
Log of GDP percapita	-0.311*** (-4.08)	0.185 (1.61)	-0.0388 (-0.18)	0.689** (2.17)
Inflation	-0.0479*** (-3.18)	0.00492 (0.29)	-0.0652 (-1.50)	-0.0292 (-0.64)
Gross savings rate	0.402*** (4.57)	0.0443 (0.39)	0.994*** (3.94)	0.121 (0.36)
r2	0.590	0.627	0.600	0.643
N	8958	8958	8958	8958
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 6 Panel B Home participants and foreign participants

	(1)	(2)	(3)	(4)
	Ln(Number of Home Participant Loans)	Ln(Number of Foreign Participant Loans)	Ln(Volume of Home Participant Loans)	Ln(Volume of Foreign Participant Loans)
Treat*Sanction	-0.00102 (-0.03)	0.0649* (1.95)	-0.204** (-2.15)	0.180 (1.52)
Log of GDP percapita	-0.174*** (-3.74)	-0.0205 (-0.23)	-0.273* (-1.87)	-0.503 (-1.42)
Inflation	0.0234** (2.00)	0.000969 (0.07)	0.0794** (2.29)	-0.0136 (-0.26)
Gross savings rate	0.336*** (6.09)	0.000192 (0.00)	0.788*** (4.92)	0.298 (0.87)
r2	0.322	0.229	0.292	0.232
N	8958	8958	8958	8958
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 6 shows the analysis of the effect of the sanction on loans from home/foreign arrangers/participants. It is shown that foreign arrangers are the main source of the changes in agricultural lending after the sanction. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7 Panel A Loan characteristics

	(1)	(2)	(3)
	Ln(Number of Unsecured Loans)	Ln(Risk Premium)	Ln(Share of loans to public firms)
Treat*Sanction	0.143** (2.03)	-0.259** (-2.02)	0.0745*** (3.83)
Log of GDP percapita	-0.378*** (-3.50)	0.639** (2.57)	0.00857 (0.20)
Inflation	-0.0227 (-1.27)	0.0161 (0.45)	0.0160** (2.31)
Gross savings rate	0.388*** (3.74)	-1.767*** (-7.85)	0.0139 (0.35)
r2	0.569	0.333	0.300
N	8966	4528	8958
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Table 7 panel A reports the effect of sanction on loan features including number of unsecured loans, loans to public firms, and loan risk premium. The results provide evidence that agricultural loans displayed lower risk compared to loans in other sectors after the shock. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7 Panel B Number of Unsecured loans (sample split based on percentile of risk premium)

	(>75 th)	(25 th -75 th)	(<25 th)	(>50 th)	(<50 th)	(all)
	Ln(Number of unsecured Loans)	Ln(Number of unsecured Loans)	Ln(Number of unsecured Loans)	Ln(Number of unsecured Loans)	Ln(Number of unsecured Loans)	Ln(Number of unsecured Loans)
Treat*Sanction	-0.481 (-1.54)	0.500** (2.47)	-0.461 (-1.13)	-0.207 (-0.96)	0.584*** (2.80)	0.321** (2.17)
Log of GDP percapita	0.259 (0.70)	-0.399 (-1.57)	-0.432 (-1.20)	-0.0904 (-0.35)	-0.274 (-1.17)	-0.335** (-2.24)
Inflation	0.170** (2.26)	0.0567 (1.19)	-0.0320 (-0.58)	0.0936* (1.91)	0.0409 (0.92)	0.0394 (1.36)
Gross savings rate	0.611** (2.03)	0.415 (1.28)	0.601** (2.02)	0.503** (2.14)	0.750*** (3.27)	0.683*** (4.52)
r2	0.669	0.634	0.609	0.655	0.604	0.611
N	1070	2244	1066	2220	2228	4528
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7 panel B investigates the effect of sanction on the number of unsecured loans on different subsamples divided by various percentile of risk premium. Results indicate that the number of unsecured loans come from the subsample where the risk of premium is below the median. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8
Effect on different categories

	Dairy Ln(Total Number)	Dairy Ln(Total Volume)	Meat Ln(Total Number)	Meat Ln(Total Volume)	Fruit & Veg Ln(Total Number)	Fruit & Veg Ln(Total Volume)	All Product Ln(Total Number)	All Product Ln(Total Volume)
Sanction*Treat	-0.0728 (-0.56)	0.185 (1.09)	0.456*** (3.57)	0.741*** (2.78)	0.476*** (4.08)	0.488 (1.39)	0.176* (1.79)	0.315* (1.87)
Log_GDP_Percapita_ Lender	0.0435 (0.10)	-0.357 (-0.51)	-0.202 (-0.52)	-1.244* (-1.73)	0.195 (0.55)	0.0360 (0.04)	0.00203 (0.01)	-0.0712 (-0.11)
Inflation	-0.169 (-1.22)	-0.136 (-0.71)	-0.0925 (-1.07)	-0.256* (-1.66)	0.0145 (0.17)	0.288 (1.46)	-0.0305 (-0.44)	0.218 (1.47)
Gross savings rate	0.182 (0.70)	-0.169 (-0.44)	0.231 (0.95)	0.0000957 (0.00)	-0.0325 (-0.12)	-0.896 (-1.56)	0.0996 (0.34)	-0.802 (-1.56)
r2	0.621	0.589	0.688	0.695	0.672	0.753	0.651	0.754
N	271	271	295	295	328	328	464	464
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sic FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 8 reports the effect of sanction on different targeted categories, including dairy product, meat, fruit and vegetable. Bank, year, sic, and country fixed effects are controlled. Standard errors are clustered at the bank-sic-country level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Robustness test

Table 9 Baseline with control group that includes all sectors

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Total Number)	Ln(Total Volume)	Ln(Total Number)	Ln(Total Volume)	Ln(Total Number)	Ln(Total Volume)
Treat*Sanction	0.234*** (3.92)	0.559*** (4.18)	0.174*** (2.71)	0.464*** (3.34)	0.173*** (2.69)	0.464*** (3.34)
Log of GDP percapita					-0.227*** (-3.05)	0.146 (1.16)
Inflation					-0.00566 (-0.47)	0.0144 (0.67)
Gross savings rate					0.304*** (4.70)	0.316*** (2.80)
r2	0.0035	0.0048	0.585	0.639	0.585	0.639
N	16799	16799	16799	16799	16799	16799
Bank FE	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	Yes	Yes

Table 9 reports the robustness of baseline analysis where the control group includes all sectors. No control variable and fixed effects are included in columns (1) and (2). Bank, year, and industry fixed effects are added from columns (3) to (6). Columns (5) and (6) also incorporate control variable. The results are consistent through all 6 columns. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 10 Baseline, Sample period: 2010-2019

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(Total Number)	Ln(Total Volume)	Ln(Total Number)	Ln(Total Volume)	Ln(Total Number)	Ln(Total Volume)
Treat*Sanction	0.226*** (4.12)	0.468*** (3.96)	0.109* (1.81)	0.342*** (2.79)	0.107* (1.80)	0.343*** (2.81)
Log of GDP percapita					-0.0216 (-0.25)	0.246* (1.73)
Inflation					-0.000615 (-0.04)	0.0421* (1.75)
Gross savings rate					0.156** (2.08)	0.126 (0.97)
r2	0.0048	0.0053	0.596	0.654	0.597	0.655
N	12915	12915	12915	12915	12915	12915
Bank FE	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes	Yes	Yes

Table 10 reports the robustness of baseline analysis with sample period from 2010 to 2019. No control variable and fixed effects are included in columns (1) and (2). Bank, year, and industry fixed effects are added from columns (3) to (6). Columns (5) and (6) also incorporate control variable. The results are consistent through all 6 columns. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 11 Home and foreign banks with control group that includes all sectors.

	(1)	(2)	(3)	(4)
	Ln(Number of Foreign Loans)	Ln(Number of Home Loans)	Ln(Volume of Foreign Loans)	Ln(Volume of Home Loans)
Treat*Sanction	0.188** (2.51)	0.0668 (0.85)	0.710*** (3.31)	0.0288 (0.12)
Log of GDP percapita	-0.0416 (-0.56)	-0.332*** (-6.14)	0.0576 (0.36)	0.0618 (0.41)
Inflation	0.0117 (1.02)	-0.0409*** (-3.73)	-0.00495 (-0.18)	-0.0356 (-1.18)
Gross savings rate	0.0854 (1.20)	0.398*** (6.62)	0.147 (0.82)	0.790*** (4.40)
r2	0.630	0.623	0.681	0.626
N	16799	16799	16799	16799
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 11 reports the robustness of home/foreign bank where the control group includes all sectors. Standard errors are clustered at the bank-industry level and the *t* statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 12 Home and foreign banks. Sample period: 2010-2019

	(1)	(2)	(3)	(4)
	Ln(Number of Foreign Loans)	Ln(Number of Home Loans)	Ln(Volume of Foreign Loans)	Ln(Volume of Home Loans)
Treat*Sanction	0.132** (2.00)	-0.0135 (-0.19)	0.491*** (2.77)	-0.109 (-0.56)
Log of GDP percapita	0.219*** (2.61)	-0.393*** (-6.61)	0.427** (2.42)	-0.425*** (-2.73)
Inflation	0.0178 (1.23)	-0.0360*** (-3.12)	0.0275 (0.78)	-0.0370 (-1.15)
Gross savings rate	0.00185 (0.02)	0.310*** (4.34)	-0.0519 (-0.25)	0.665*** (3.34)
r2	0.644	0.620	0.694	0.636
N	12915	12915	12915	12915
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table 12 reports the robustness of home/foreign bank where the sample period is from 2010 to 2019. Standard errors are clustered at the bank-industry level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 13 Confounding effect of subsidy

	(1)	(2)
	Ln(Total Number)	Ln(Total Volume)
Treat*Sanction	0.149*** (3.43)	0.433*** (4.60)
Log of GDP percapita	-0.155*** (-2.61)	-0.0528 (-0.46)
Inflation	0.00900 (0.83)	0.0278 (1.37)
Gross savings rate	0.0816 (1.33)	0.231** (2.04)
Subsidy	0.00205*** (4.78)	0.00190** (2.46)
r2	0.196	0.328
N	19434	19434
Bank FE	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Country FE	Yes	Yes

Table 13 shows whether subsidy would be an confounding factor to influence the effect on agricultural lending. Country, industry, bank, and year fixed effects are included. Standard errors are clustered at firms level and the t statistics are reported in the parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Appendix

1. Examples of bilateral sanctions.

The EU has adopted a series of restrictive measures against Russia over the Ukraine crisis since 2014. Sanction measures are devised to erode Russia's economic foundation, depriving it of critical technologies and markets and dramatically limiting its ability to wage war. Measures include individual restrictive measures, economic sanctions, restrictions on media (from 2022), and diplomatic measures. Examples of EU's sanction against Russia:

Individual restrictive measures: Restrictive measures against Russian officials, including asset freeze and travel ban.

Economic Sanctions: Limit Russia's access to EU capital market; Impose embargo on trade of arms and related material with Russia; Prohibit exports of dual use goods and technology for military use in Russia or to Russian military end-users; exports of certain energy-related equipment and technology to Russia are subject to prior authorisation by EU Member States.

Restrictions on media: The broadcasting activities of 5 Russian state-owned outlets has been suspended.

Diplomatic measures: Regular EU-Russia summits were cancelled; G8 summit has been substituted with G7 summit.

On 6 August 2014, the Russian Federation decreed a ban on agricultural products from the EU, Norway, and other Western countries in response to economic sanctions against Russia over Ukraine crisis. The responsive sanction covered specific products over multiple sectors including fruit and vegetables, dairy products, fishing, and meat. Russia's counter sanction caused severe reduction of EU's agri-food export to Russia from 2014 to 2017.

2. The timeline of the bilateral sanctions (main events).



3. Examples of borrowers:

Name	Country	Year	Volume	SIC	Purpose
RAMAFRUT SL	Spain	2013	12.41M	179: Fruits and tree nuts, nec	Refinancing
SalMar ASA	Norway	2014	242.42M	273: Animal aquaculture	Extend and restructure the company's existing credit facilities.
Agrifirm Holding BV	Netherlands	2015	225.66M	211: Beef cattle feedlots	Refinancing
Scandi Standard publ AB	Sweden	2016	157.21M	251: Broiler/fryer/roaster chickens	Facility will be used to refinance Co's improved terms.
DMK Deutsches Milchkontor GmbH	Germany	2017	106.86M	241: Dairy farms	Capital expenditure