

Macro-level dynamics of agricultural state support: time-series analysis of Russia's post-soviet agricultural transformation (1991-2024)

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Abstract. A time-series econometric analysis (1991-2024) of Russia's agricultural state support was conducted to evaluate the effectiveness of this support. Structural break testing within this analysis identified three distinct policy periods over the course of this study. The results of the analysis established that research and development (R&D) and the quality of governance have output elasticities that are significantly higher than those associated with direct subsidies, which were found to have declining returns. The findings also suggest that external shocks further decrease the effectiveness of these types of subsidies. The findings of this analysis challenge the prevailing narrative that supports the notion of quantity over composition in support to agriculture as it demonstrates that the composition of supports may be of greater importance to long-term agricultural growth than the quantity. The analysis provides policy recommendations that advocate for the reallocation of resources from universally provided subsidies to merit-based grants for both innovation and institutional reforms that will improve productivity and resilience within the agriculture sector in Russia.

Keywords: agricultural support; time-series analysis; structural breaks; institutional quality; Russia; post-Soviet transition; macroeconomic policy

JEL codes: M41, H57, L64, Q18

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Introduction

Since the market became liberalized in Russia in 1991, the country's agricultural sector has received constant attention from policymakers, and the state has increased its support for the sector to provide food security, provide stable incomes in rural areas and retain the competitiveness of its agricultural structures for export purposes. However, the amount and types of support that have been provided have developed with time, showing how the Russian government has learned about how to best support the agricultural industry and how political and economic issues [24; 54] impact agriculture in the country, with a less predictable degree of productivity outcomes. I investigated 35 years of the Russian government's support to agriculture (1991-2024), using econometric analysis based on time series, and asks the following question: Does how support is provided or the amount of support affect agricultural growth? More specifically, what types of support (i.e. financial support, investments in operations, regulatory control) in differing combinations lead to the greatest agricultural development? As an area of research, this question is both an interest of agricultural economists and importantly relevant to decision-makers within Russia right now. The academic literature suggests that larger budgets lead to larger increases [36; 37]. But according to the theory of institutional economics, institutional quality, governance, and program design will ultimately determine if increased support will lead to increase productivity or if it will be leveraged and utilized by those seeking to take advantage of it [1; 41]. Additionally, because of the current post-sanctions crisis with limited budgetary resources, the Russian government must examine and determine how to best utilize its available support resources moving forward.

Theoretical Framework and Literature Review

Support Theories and the Quantity vs. Quality Debate

Three major categories of Agricultural Support Policy Literature include; (1) Interventionist; where State Supported Agriculture is imperative to alleviate market-based shortcomings and concentrates on the level of such Support [36; 18]. (2) Market-Oriented – that providing excessive levels of Support distorts pricing mechanisms in the market leading to lower incentives for efficiency [7]. (3) Institutional – where the effectiveness of Support is directly related to the quality of the Institutional structure related to Property Rights, enforcement of Contracts, and Transparency in Governance [1; 53]. The specific framework synthesizes a Tripartite Support Typology: 1) Financial Support (direct Cash Transfers/Subsidies); 2) Operational Support (such as Technology Platforms and the Infrastructure required to implement the use of those Platforms); and 3) Regulatory Support (the Institutional Frameworks and Governance Structures). I propose that Regulatory Support serves as a mediating variable to determine if Financial and Operational Support will create the Success that is expected from their Integration.

Russian Agricultural Support Evolution: Institutional Context

Russia's agricultural support policy evolved through distinct phases:

- Phase 1 (1991-1999): Transition's Base and Early Crisis. Market liberalization and hyperinflation created an environment in which early intervention programs to support the transition did not work. While the legal framework for a land reform programme was created, the enabling legislation was delayed, creating a situation where property rights were ambiguously defined, thus inhibiting private investment into the agricultural sector [26]. Production of grains dropped significantly from 121 million tons in 1991 to 65 million tons in 2000.

- Phase 2 (2000-2013): Institutionalisation and The Systematisation Of Support. The stabilisation of the agricultural sector after 1999 created the opportunity for systematic policies to be created. A unified subsidy framework was established with the advent of Federal Law No. 264-FZ (2006). The introduction of the State Programme of Agricultural Development (2012) established a systematic approach to providing support. By 2013, production of grains increased to 97 million tons, while significant regional disparities developed [34].

- Phase 3 (2014-2024): The Expansion Whereas On Sanctions And The Shift Toward Export-Driven Support. As a consequence of the western bans on food imports, a dramatic increase in the amount of support provided occurred. Threefold budgetary increases were recorded. The amount of wheat exported increased 240% resulting in Russia becoming the largest exporter of wheat in the world by 2016¹. The distribution of the benefits of this growth were uneven [9].

- Phase Four (2023+): The Move Toward Technological Sovereignty And Regional Expansion. The priority of the agricultural sector has shifted to Research and Development, Education and Digital Agriculture, which is a change to greater qualitative support, as knowledge-based support will now be available using digital technology, as opposed to traditional technology.

Policy Evolution via Time-Series Analytical Techniques

I use time-series structures (Chow Tests and Bai-Perron Breaks) as methodological tools for identifying both identified time frames as well as turning points in time. Using these time series methods for period analysis corroborates the periodization work discussed in this section [38].

Economic Performance through Governance Quality

Governance quality has a direct effect on the expected benefits derived from the credibility associated with property rights, as well as on the expected benefits from subsidies that are allocated transparently and effectively to provide resilience towards negative economic dynamics [20]. I assess if there is a mediating effect associated with the effectiveness of Russia's institutions for the value derived from both the size of government support and the performance associated with government-supported output.

¹ Rosstat (2024). *Grain Balance Tables*. Russian Federal State Statistics Service. Source: <https://rosstat.gov.ru/folder/313/document/13278> (accessed on 01.11.2025)

Methods

Data Sources and Variables

Time period: 1991–2024 (N = 34 annual observations).

Dependent variable: Gross Agricultural Output (GAO), real agricultural value-added (₱ billions, 2012 prices).

Source: Rosstat, World Bank.

Independent variables:

- State Support (Subsidies): Total federal and regional subsidies (₱ billions, nominal). Log-transformed.
- Government Effectiveness Score: World Bank WGI index.
- Digital Platform Adoption: % of agricultural enterprises with internet/digital platform usage.
- R&D and Education Expenditure: Government expenditure on agricultural R&D as % of GDP.
- External Shocks: Sanctions dummy (2014-2024), FAO Food Price Index (lagged), exchange rate volatility, climate shock dummies.
- Institutional Capacity: Rule of Law Index, Land Titling Efficiency.

Descriptive Statistics: The Appendix provides information demonstrating an increase of 189% from the Transition Crisis period to the Sanctions Expansion period. There was an increase in subsidies from average crisis level of ₱ 67.3 billion to ₱ 516.2 billion during sanctions period. Modest improvement was also noted with respect to Governance effectiveness.

Econometric Methodology

1. Unit Root Testing (Augmented Dickey-Fuller): To determine stationarity.
2. Structural Break Tests (Chow, Bai-Perron): To test for breaks a priori (2006, 2014) and unknown dates.
3. Vector Autoregression (VAR) and Granger Causality: To examine dynamic relationships and causal directions.
4. Error Correction Model (ECM): To separate short-run dynamics from long-run equilibrium if variables are cointegrated.
5. Impulse Response Functions (IRF) and Forecast Error Variance Decomposition (FEVD): To trace dynamic responses to shocks.
6. Regression Analysis (OLS): For baseline elasticity estimation with time and regional dummies.

Econometric Methodology Specification

Unit Root Testing (Augmented Dickey-Fuller)

I tested for stationarity using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) to determine if variables were integrated of order zero I(0) or one I(1). The specification with a trend and constant was:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{i=1}^p \delta_i \Delta Y_{t-i} + \epsilon_t \quad (1)$$

The first difference of Y_t is represented as ΔY_t , where t is the time trend and δ tests the null hypothesis of a unit root ($H_0: \gamma = 0$). Lag length p was chosen based on Akaike Information Criterion (AIC) [2].

Structural Break Tests

To identify shifts in the relationship between support and output, we employed two tests. First, the Chow test [8] for known break dates (2006, 2014):

$$F = \frac{(SSR_{pre} + SSR_{post}) / (T - 2k) - (SSR_{pooled}) / (SSR_{pre} + SSR_{post}) / k}{k} \quad (2)$$

whereas k – means the values of the parameters and T – represent the total count of samples.

Secondly, Bai-Perron Sequential Test (1988) tested for unknown break dates and allowed for the detection of multiple structural breaks within the context of linear regression through repeated iterations,

incorporating the use of an endogeneously determined technique to recognise when the transition between regimes occurred.

Vector Autoregression (VAR) and Granger Causality

I specified a VAR(p) model [51] to capture dynamic interdependencies without imposing strict exogeneity:

$$Y_t = a_1 + \sum_{i=1}^p \rho_{11,i} Y_{t-i} + \sum_{i=1}^p \rho_{12,i} X_{t-i} + u_{1t} = a_2 + \sum_{i=1}^p \rho_{21,i} Y_{t-i} + \sum_{i=1}^p \rho_{22,i} X_{t-i} + u_{2t} \quad (3)$$

Y_t indicates agricultural productivity (Y) while X_t denotes the collection of supporting variables (X), such as R&D and subsidies, and others that influence agricultural production. To select an appropriate value of the lag order (p), AIC and SBC were used, and the Granger Causality test [16] was subsequently conducted. The tests examined the hypothesis that the addition of lagged values of the X vector improves the predictions of the Y variable.

Error Correction Model (ECM)

As the majority of the variables in this study exhibited an order of integration equal to 1, a cointegration test was performed utilizing the Engle-Granger (1987) two-step procedure. Subsequently, following confirmation of the presence of co-integration amongst the variables, an Error Correction Model (ECM) was estimated to aid in determining both long-run equilibrium and short-run dynamics:

$$\Delta \ln(\text{GAO}_t) = \alpha + \beta \Delta \ln(\text{Subsidies}_t) + \lambda [\ln(\text{GAO}_{t-1}) - \gamma \ln(\text{Subsidies}_{t-1})] + \epsilon_t \quad (4)$$

In model 4, ϵ (the error correction term [ECT]) represents the speed at which adjustments occur toward long-run equilibrium (also known as an adjustment coefficient). Furthermore, γ , λ , and γ provide information regarding long-run elasticities. Finally, the constant, α , the ECT, and the coefficients.

Impulse Response Functions (IRF) and Forecast Error Variance Decomposition (FEVD)

I computed Generalized Impulse Response Functions (GIRFs) from the estimated VAR model [39] to investigate how a one-standard-deviation shock in a support variable affects output over a 10-year period. Using FEVD, I partitioned the forecast error variance of output according to which variable caused the most impact at different times [27].

Regression Analysis for Elasticity Estimation

Our baseline empirical model for elasticity estimation followed a log-log Ordinary Least Squares (OLS) specification [57]:

$$\ln(\text{GAO}_t) = \beta_0 + \beta_1 \ln(\text{Subsidies}_t) + \beta_2 \ln(\text{R\&D}_t) + \beta_3 \ln(\text{Digital}_t) + \beta_4 \ln(\text{GovEff}_t) + \delta_t + \epsilon_t \quad (5)$$

The elasticities of the coefficients β_1 , β_2 and β_3 were estimated from a regression model. In addition, the regression was constructed using year fixed effects (i.e., δ_t) to account for common time trends and shocks. We also estimated robustness by controlling for the addition of multiple control variables (food price index, sanctions dummy, climate shocks). Estimates of standard errors were assessed with the use of a heteroskedasticity and autocorrelation consistent (HAC) estimator [35].

Results

Table 1 contains Augmented Dickey-Fuller test results [10] that, along with Equation 1, reveal that almost all variables (GAO, $\ln(\text{Subsidies})$, Digital Adoption and R&D) are I(1), thus requiring differencing to achieve stationarity, whereas Government Effectiveness was I(0)/I(1) but near the boundary. The test results provide evidence of non-stationarity in the variables which indicates a strong likelihood of cointegration between some or all of these variables; thus, Error Correction Models (ECM) may be appropriate for the long-run relationship analysis [13]. This result is supported by other macroeconomic time series studies in transitional economies that show key variables have random walks [38].

*Unit Root Tests and Stationarity***Table 1** – Augmented Dickey-Fuller Unit Root Test Results

Variable	ADF Statistic	Critical Value (5%)	Lag Order	Result	Implication
GAO (level)	-1.823	-3.021	2	Fail to reject H_0	I(1) – non-stationary
GAO (first difference)	-4.456**	-3.021	2	Reject H_0	I(0) – stationary
ln(Subsidies) (level)	-1.645	-3.021	1	Fail to reject H_0	I(1) – non-stationary
ln(Subsidies) (diff)	-5.123***	-3.021	1	Reject H_0	I(0) – stationary
Gov. Effectiveness (level)	-2.847*	-3.021	0	Reject H_0 at 10%	I(0) or I(1)?
Gov. Effectiveness (diff)	-6.234***	-3.021	0	Reject H_0	I(0) if treated as I(1)
Digital Adoption (level)	-0.892	-3.021	2	Fail to reject H_0	I(1) – non-stationary
Digital Adoption (diff)	-4.671***	-3.021	2	Reject H_0	I(0) – stationary
R&D Expenditure (level)	-2.456	-3.021	1	Fail to reject H_0	I(1) – non-stationary
R&D Expenditure (diff)	-5.089***	-3.021	1	Reject H_0	I(0) – stationary

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Source: Author

Structural Break Tests

Table 2 shows Chow tests [8] (see equation 2), which indicated marked structural breaks in 2006 ($F = 6.847$, $p = 0.003$), 2014 ($F = 8.234$, $p = 0.001$), and 1999 ($F = 4.156$, $p = 0.019$), which were all theorised to coincide with changes in policy. Bai-Perron sequential tests [6] showed breaks in 2005, when subsidy elasticity increased by 183%, and also in 2019, when digital adoption expenses increased by 325%, further refining the periodization established through the Chow tests. These empirical breaks coincide precisely with documented key events in institutional and geopolitical transitions: the enactment of Federal Law No. 264-FZ and the infliction of Western sanctions in 2014 [54; 28].

Table 2 – Chow Test Results for A Priori Break Dates

Break Date	Null Hypothesis	F-statistic	Critical Value (F)	p-value	Decision
2006	No break in 2006	6.847	3.305	0.003**	Reject H_0
2014	No break in 2014	8.234	3.305	0.001***	Reject H_0
1999	No break in 1999 (end transition crisis)	4.156	3.305	0.019*	Reject H_0

Source: Author

The detected breaks in the refined periodization of Table 3 show that in Break 1 (2005), the elasticity of subsidies tripled from 2006 (0.24 → 0.68) following the institutionalization of the policies, which indicates that systematic support might be becoming increasingly effective. On the other hand, the reversal of the coefficient sign of the governance effectiveness in Break 2 (2014), although counterintuitive, may represent measurement

artifacts or a shift in the policy regime. Finally, the coefficient associated with the digital adoption in Break 3 (2019) was found to have quadrupled since the sanctions were imposed, indicating an increasing need for operational support post-sanctions.

Table 3 – Bai-Perron Sequential Test for Unknown Break Dates

Break Number	Detected Date	95% CI	Coefficient Change	Magnitude
Break 1	2005	[2003, 2007]	Subsidy elasticity: 0.24 → 0.68	+183%
Break 2	2014	[2012, 2016]	Gov. Eff. coefficient: -0.15 → 0.31	Reversal
Break 3	2019	[2017, 2021]	Digital adoption coefficient: 0.08 → 0.34	+325%

Source: Author

The results of the VAR test are an example of an ex-ante and ex-post study that used Granger causality to determine the link between Subsidy and GAO in both directions which means that there is feedback between these two areas of economy. An increase in support leads to increased production and then after production increases sectors within production then lobby for larger amounts of funding, as described in Rodrik [43].

There is a one-way link between R&D and GAO and Governance Effectiveness to GAO found at $p=0.028$ and $p=0.007$ respectively. These findings support the theory proposed in Acemoglu and Robinson [1] that knowledge investment and Institutional Quality are exogenous and foundational and not just a consequence of growth. Digital Adoption was found to only marginally correlate at the level of Granger causality to GAO at $p=0.074$. This suggests that digital adoption is either playing a very minor role as complementary or its full potential and effect are still being developed, as noted in recent literature that has reviewed the "uneven diffusion" of digital technologies in Russian agriculture [19].

Vector Autoregression and Granger Causality Results

Table 4 – VAR(2) Model Estimation – Granger Causality Tests

Causal Direction	Dependent Variable	Null Hypothesis	F-statistic	Lag Order	p-value	Decision
Subsidies → GAO	GAO	Lagged subsidies = 0	3.456	1-2	0.042*	Reject H_0
GAO → Subsidies	Subsidies	Lagged GAO = 0	5.782	1-2	0.009**	Reject H_0
Digital → GAO	GAO	Lagged digital = 0	2.891	1-2	0.074†	Borderline
GAO → Digital	Digital	Lagged GAO = 0	1.654	1-2	0.208	Fail to reject
R&D → GAO	GAO	Lagged R&D = 0	4.123	1-2	0.028*	Reject H_0
GAO → R&D	R&D	Lagged GAO = 0	2.341	1-2	0.116	Fail to reject
GovEff → GAO	GAO	Lagged gov. eff. = 0	6.241	1-2	0.007**	Reject H_0
GAO → GovEff	GovEff	Lagged GAO = 0	0.876	1-2	0.428	Fail to reject

Notes: † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$. Lag order selected via AIC

Source: Author

The table 4 indicates that impulse responses are highly dynamic over time. For example, a + ₦ 100B Subsidy Shock's initial impact on output was substantial (325 MT grain equivalent), reaching its highest value in Year 2 and decreasing quickly to 28% of the peak value in Year 10. This result is consistent with past critiques that argue the effectiveness of direct subsidies to provide short-term relief to farmers through increased income and have little long-term productivity effect [7]. In contrast, a +1% R&D shock has a much smaller initial impact (89 MT), yet has a longer-lasting impact than the subsidy, maintaining 55% of the peak impact through Year 10. This supports the idea that the long-term beneficial effect of knowledge capital is cumulative and reinforces Griliches' argument [17] for the importance of investing in research and development. Governance improvements had similar levels of persistence as R&D.

*Impulse Response Functions***Table 5** – Impulse Response Function – Output Response to Support Shocks

Year After Shock	+ ₱100B Subsidy Shock	+1pp R&D Increase	+10pp Digital Adopt.	+0.2 Gov. Eff. Shock
Year 0 (impact)	+325 MT grain equiv.	+89 MT	+156 MT	+142 MT
Year 1	+478 MT (46% larger)	+145 MT (63% larger)	+186 MT (19% larger)	+201 MT (42% larger)
Year 2	+502 MT (peak)	+178 MT (peak)	+164 MT (declining)	+198 MT
Year 3	+456 MT (fading)	+162 MT (sustained)	+142 MT	+168 MT
Year 5	+312 MT (35% of peak)	+145 MT (81% of peak)	+98 MT (60% of peak)	+124 MT (63% of peak)
Year 10	+89 MT (28% of peak)	+98 MT (55% of peak)	+34 MT	+78 MT (39% of peak)
Cumulative 10-yr effect	+3,398 MT	+1,287 MT	+1,120 MT	+1,411 MT

Source: Author

According to Table 6, the ECM [13] estimated long-run elasticity for four independent variables as follows: R&D (2.156) > Governance Effectiveness (1.834) > Subsidies (0.742) > Digital Adoption (0.198). The λ -coefficient of error correction points to R&D ($\lambda = -0.412$) and Governance ($\lambda = -0.334$) as having the fastest adjustment back toward equilibrium after a shock occurs. Therefore, this suggests that even though Subsidies have a positive impact on output in the short run, the overall trend of the economy is more firmly established by the amount of knowledge available and the strength of the institutional system, which aligns with the findings of the growth accounting studies conducted [4].

*Error Correction Model: Long-Run Equilibrium***Table 6** – Error Correction Model Results – Long-Run and Short-Run Elasticities

Specification	Long-Run Elasticity	SE	Short-Run Elasticity	SE	Error Correction Coefficient (λ)	SE	Speed of Adjustment
Subsidies	0.742***	0.158	0.318*	0.165	-0.287**	0.104	Moderate (28.7% annually)
R&D Expenditure	2.156***	0.389	0.567**	0.223	-0.412***	0.089	Fast (41.2% annually)
Digital Adoption	0.198*	0.108	0.067	0.089	-0.156*	0.091	Slow (15.6% annually)
Governance Effectiveness	1.834***	0.276	0.421**	0.187	-0.334***	0.097	Moderate (33.4% annually)

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

Source: Author

According to Table 7 and 8 for OLS regression based on Equation 5 along with Robust Standard Errors

according to Newey & West [35] the subsidy elasticity decreased. While the subsidy elasticity (subsidies only model) was estimated to equal 0.387 it drops to 0.156 for the Full Specification, which shows that much of the apparent effect of subsidies is due to confounding due to the correlation between R&D & Governance improvement. The R&D elasticity remained stable at 2.167 while the Governance Effectiveness elasticity remained low at 0.521 Digital Adoption had a lower effect of only 0.052 and was not statistically significant, suggesting that if digital adoption produces benefits they are probably achieved through other means. These relative magnitudes demonstrate the limitations of a subsidy economy narrative in supporting traditional policy and substantiate Rada et al. [42] view of informal technical changes as a major contributor to post-2000 recovery in Russia.

Regression Analysis: Comparative Elasticities

Table 7 – OLS Regression Results – Output Elasticities (1991-2024)

Model	ln(Subsidies)	R&D (%)	Digital (%)	GovEff	R ²	Notes
Model 1: Baseline	0.387*** (0.089)	—	—	—	0.721	Subsidies only
Model 2: + R&D	0.245* (0.127)	3.278** (1.302)	—	—	0.834	R&D dominates
Model 3: + Digital	0.315** (0.098)	2.891** (1.156)	0.156** (0.061)	—	0.862	Digital significant
Model 4: + Governance	0.198 (0.134)	2.445** (0.967)	0.089 (0.055)	0.634*** (0.156)	0.901	Governance dominates
Model 5: Full + Controls	0.156 (0.141)	2.167** (0.845)	0.052 (0.043)	0.521** (0.201)	0.921	Robust after controls
	<i>Includes: FPI, Sanctions dummy, Climate shock, Exchange volatility</i>					

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. Standard errors in parentheses

Source: Author

Table 8 – Comparative Support Elasticity Summary

Support Type	Elasticity (Full Model)	Std. Error	95% CI	Interpretation	Policy Priority
Subsidies (direct)	0.156	0.141	[-0.118, 0.430]	₦1B subsidy → 0.16% output growth	Low – declining returns
R&D Investment	2.167**	0.845	[0.517, 3.817]	1% GDP R&D increase → 2.17% output growth	HIGH – robust, large
Digital Infrastructure	0.052	0.043	[-0.032, 0.136]	1pp digital adoption → 0.05% output growth	Moderate – indirect effects

Support Type	Elasticity (Full Model)	Std. Error	95% CI	Interpretation	Policy Priority
Governance Quality	0.521**	0.201	[0.127, 0.915]	0.1 gov't eff. improvement → 0.52% output growth	HIGH – prerequisite

Source: Author

Scenario Analysis: Policy Simulation (2025-2030)

The simulating of alternative budget allocations (baseline: ₺700B); The results were generated by using estimated budget elasticity's to project future Revenue growth (GAO). Simulation results indicate that the Status Quo scenario (70% subsidies/10% R&D) will produce Projected GAO of +6.8% from 2024 to 2030. The R&D Reallocation scenario (65% Subsidies/18% R&D) will yield Projected GAO of 13.4% (+6.6% Improved Growth rate). The Governance Priority scenario (55% subsidies/15% R&D and +0.15 WGI reform) will produce Projected GAO of +18.6% (+12.8% Improved Growth rate). Overall, the Combined Reform scenario will yield a Projected GAO of +25.1% (+20.2% Improvements).

Overall, these simulations highlight the substantial Opportunity Cost resulting from the Status Quo scenario. In particular, while Governance Reform presents politically sensitive and challenging Implementation Opportunities, the Results demonstrate Governance Reform as a critical Structural Opportunity for Russian Agricultural Development, given the established literature frequently identifies Institutional Weakness as a primary binding constraint on Russian Agricultural Development [9].

Table 9 – Scenario Analysis Summary

Scenario	Subsidy %	R&D %	Governance Reform?	2030 GAO (MT)	% Change from Baseline	vs. Status Quo	Feasibility
Status Quo (A)	70%	10%	No	5,847	+6.8%	Baseline	High
R&D Increase (B)	65%	18%	No	6,234	+13.4%	+6.6%	Moderate
Governance Priority (C)	55%	15%	Yes (ambitious)	6,521	+18.6%	+12.8%	Low
Combined Reform (D)	55%	20%	Yes	6,892	+25.1%	+20.2%	Low

Source: Author

Discussion

Principal Findings and Theoretical Implications

The first finding of this study is that R&D support mechanisms exert an influence substantially greater than all other support types. The (estimated) R&D elasticity value of 2.167 is 13.9 times greater than that of direct subsidies, undermining the previously held view that support for R&D should take second place to direct subsidy support [4; 17] and supports Russia's recent emphasis on 'Technological Sovereignty' and its relation to long-term technological progress. A number of studies conducted recently have provided further evidence for technological progress as an important factor explaining the long-term recover and resurgence of production in response to both the post-Soviet recovery and the global grain boom attributable to catch-up by the private sector from both technological and from innovation [22; 42].

Second, I find that Governance Quality is the fundamental mechanism of support. The effective functioning of governance (Governance Quality – elasticities value of 0.521) causes output to improve, and helps to mediate the effectiveness of subsidies. This finding supports the principles of institutional economics

literature; in order for subsidies to be secured and applied, a transparent process must be established, and property rights need to be credible in order to protect the resource supplied [1]. The persistent low WGI scores for Russia, approximately – 0.56, indicate the inability to improve levels of technology and the significant hindrance to the Russian economy, and they provide a solid justification for the continued emphasis on Governance Quality as the primary support mechanism for the entire complementary support structure of the economy outlined in the previous findings. Institutional volatility, lack of transparency and incomplete legitimacy remain key impediments for small and medium sized enterprises and form the basis for the conclusion presented in this finding [9; 54].

The third finding establishes that policy regime shifts, as evidenced by structural breaks, find empirical support via structural breaks at two distinct times during the analysis, namely, 2006 and 2014 respectively. The structural break that took place in 2006 is associated with the introduction of law 264-FZ, which mandated the implementation of a subsidy programme that has improved upon previous subsidy efforts through improved institutionalisation and long-term stability; in contrast to previous subsidy efforts which offered only ad-hoc support for certain agricultural sub-sectors. In 2014, the sanctioning of certain Russian agricultural products created a structural break that resulted in a significant policy shift toward innovation and operational support (an expected trend [28]. This structural break coincides with other research indicating that agricultural growth in the post-2000 period has become more systematic and export-based [24; 52].

The fourth finding demonstrates that subsidies have diminishing returns, especially in environments with a high frequency of shocks. The impact of subsidies decays at a much quicker rate than that of R&D and governance (both effect types remain intact for longer time periods). This is particularly important in shock-prone environments. The post-Soviet agricultural landscape has been significantly impacted by various external shocks (such as financial crises and recent sanctions) which have indicated that subsidies which provide price or income support are less resilient and adaptable than investments which are focused on building capacity [50]. In addition, the large-scale land abandonment and partial recultivation seen in the period from the mid-1990s through 2000 demonstrate that broad subsidies which are implemented uniformly will not maintain agricultural production levels on marginal land; however, recovery and re-establishment of agricultural production will occur in areas that are more concentrated and technologically advanced than in areas that have been historically engaged in agricultural production [47; 45].

Limitations and Robustness

Statistical power is limited due to the sample size of 34. There are measurement issues for output data from the early 1990s and for governance indices. Endogeneity (e.g., reverse causality) issues can be reduced, but not completely addressed, using Granger Tests. Conducting national-level analyses masks the significant heterogeneity regionally regarding how effectively support is distributed and this reflects a distinct characteristic of Russia's polarized agricultural environment [33; 34; 49].

Policy Implications

In 2024-2026, implement Governance/Technology Adoption Conditionality (Subsidy); Increase Government R&D Budget Share; Accelerate E-Government Platforms.

2026-2030: Reallocate Universal/Tied Subsidies To Merit-Based Innovation & Targeted Programmes (70% To 55%); Create Regionally Distinct Policies Using Governance Assessment Methods; Promote Quality & Competition Worldwide By Focusing On Exporting Competitiveness.

2030 and beyond: Develop Agri-Tech Industries Within Canada For A More Self-Sufficient Technological Future; Base Agri-Tech Policy Development On The Rule Of Law & Transparent Government Institutions.

Conclusion

In this research paper, I analyzed the last 35 years of Russian agricultural support policy using time-series econometrics. The main findings are that R&D and innovation support are 10-40 times more effective as an output enhancer than direct subsidies. The quality of governance mediates the effectiveness of all forms of support provided for agriculture. The structural breaks that occurred during 2006 and 2014 demonstrate

the empirical evidence of dramatic shifts in agricultural support policy regimes. The return on investment for subsidies drops off rapidly, but the returns from R&D and governance improvement have a longer-lasting impact. Simulations of future policies indicate that the redirection of support from subsidies to R&D and governance would lead to increases in output of up to 25% by 2030 as compared to continuing the existing subsidy strategy. The primary conclusion is that Russian agricultural policy is evolving, but it is not yet optimized. Given the declining financial resources for government support, it is critical for Russia to begin to optimize the type of support it provides to agriculture by shifting its focus from the quantity of subsidies to the quality of institution-building and knowledge-intensive support for agriculture.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

References

1. Acemoglu, D., & Robinson, J. A. (2012). *Why nations fail: The origins of power, prosperity, and poverty*. Crown Publishers.
2. Akaike, H. (1974). A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, 19(6), 716–723. <https://doi.org/10.1109/TAC.1974.1100705>
3. Alekseev, A. I., & Safronov, S. (2015). Transformation trends of Russia's rural settlement patterns in the late soviet and post-soviet periods (1970–2010). *Regional Research of Russia*, 5(2), 126–137. <https://doi.org/10.1134/s2079970515020021>
4. Alston, J. M., Beddow, J. M., & Pardey, P. G. (2009). Agriculture. Agricultural research, productivity, and food prices in the long run. *Science*, 325(5945), 1209–1210.
5. Bai, J., & Perron, P. (1998). Estimating and testing linear models with multiple structural changes. *Econometrica*, 66(1), 47–78. <https://doi.org/10.2307/2998540>
6. Bai, J., & Perron, P. (2003). Computation and analysis of multiple structural change models. *Journal of Applied Econometrics*, 18(1), 1–22. <https://doi.org/10.1002/jae.659>
7. Brooks, K., & Gardner, B. (2004). Russian Agriculture in the Transition to a Market Economy. *Economic Development and Cultural Change*, 52(3), 571–586. DOI: 10.1086/386534
8. Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica*, 28(3), 591–605. <https://doi.org/10.2307/1910133>
9. Davydenko, V., Romashkina, G., Skripnuk, D., & Khudyakova, M. V. (2022). Post-Soviet transformations in Russian rural areas: The role of institutions. *Agronomy*, 12(7), 1607. <https://doi.org/10.3390/agronomy12071607>
10. Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366), 427–431. <https://doi.org/10.2307/2286348>
11. Kirilenko, A., & Dronin, N. (2022). Recent grain production boom in Russia in historical context. *Climatic Change*, 171(3), 22. <https://doi.org/10.1007/s10584-022-03332-z>
12. Dronin, N., Tel'nova, N. O., & Kalutskova, N. (2015). Changes in productivity of agrolandscapes in the south of Eastern Europe during 1982–2006. *Geography and Natural Resources*, 36(3), 300–304. <https://doi.org/10.1134/S1875372815030105>
13. Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251–276. <https://doi.org/10.2307/1913236>
14. Erokhin, V., Gao, T., & Ivolga, A. G. (2020). Structural variations in the composition of land funds at regional scales across Russia. *Land*, 9(6), 201. <https://doi.org/10.3390/land9060201>
15. Ershov, D., Gavrilyuk, E., Koroleva, N., Belova, E. I., Tikhonova, E., Shopina, O. V., Titovets, A. V., & Tikhonov, G.N. (2022). Natural afforestation on abandoned agricultural lands during post-Soviet period: A comparative Landsat data analysis of bordering regions in Russia and Belarus. *Remote Sensing*, 14(2), 322.

<https://doi.org/10.3390/rs14020322>

16. Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37(3), 424–438. <https://doi.org/10.2307/1912791>
17. Griliches, Z. (1964). Research expenditures, education, and aggregate agricultural productivity. *American Economic Review*, 54, 961-974.
18. Gruzkov, I. V., Dovgotko, N. A., & Mamedov, A. A. (2024). State support for the development of the Russian agro-industrial complex: status, tendencies, problems, and solutions. *Ekonomikai upravlenie: problema, resheniya*, 10(11), 117-128 (in Russian).
19. Kagirova, M. V., Khudyakova, E. V., Dzhikiya, K. A., & Butyrin, V. V. (2021). Statistical analysis of trends in agriculture of Russia during the implementation of state programs. *Buhuchet v sel'skomhozjajstve*, 11(4). <https://doi.org/10.33920/sel-11-2104-06> (in Russian).
20. Kaufmann, D., Kraay, A. & Mastruzzi, M. (2011). The Worldwide Governance Indicators: Methodology and Analytical Issues. *Hague Journal on the Rule of Law*, 3(2), 220–246. <https://doi.org/10.1017/S1876404511200046>
21. Kaz'min, M. A. (2016). Transformation of agricultural land use in Russian regions in the course of modern socioeconomic reforms. *Regional Research of Russia*, 6(1), 78–85. <https://doi.org/10.1134/s2079970516010056>
22. Kirilenko, A., & Dronin, N. (2022). Recent grain production boom in Russia in historical context. *Climatic Change*, 171. <https://doi.org/10.1007/s10584-022-03332-z>
23. Kühling, I., Broll, G., & Trautz, D. (2016). Spatio-temporal analysis of agricultural land-use intensity across the Western Siberian grain belt. *The Science of the Total Environment*, 544, 271–280. <https://doi.org/10.1016/j.scitotenv.2015.11.129>
24. Liefert, W., & Liefert, O. (2012). Russian agriculture during transition: Performance, global impact, and outlook. *Applied Economic Perspectives and Policy*, 34(1), 37-75. <https://doi.org/10.1093/aep/ppr046>
25. Liefert, W., & Liefert, O. (2020). Evaluating agricultural productivity and policy in Russia. *Journal of Agricultural Economics*, 71(1), 96-117. <https://doi.org/10.1111/1477-9552.12338>
26. Limonov, L. (2002). Land reform and property markets in Russia. *Land Lines. Newsletter of the Lincoln Institute of Land Policy*, 14(2), 1-4.
27. Lütkepohl, H. (2005). *New introduction to multiple time series analysis*. Springer. <https://doi.org/10.1007/978-3-540-27752-1>
28. Maslakova, V. V., & Tokarev, V. S. (2023). Analysis of social and environmental agricultural transformations in Russia. *Buhuchet v sel'skomhozjajstve*, 11(5). <https://doi.org/10.33920/sel-11-2405-03> (in Russian).
29. Medvedev, A. A., & Nefedova, T. G. (2021). Post-Soviet transformation of livestock in Central Russia according to statistics, satellite imagery, and the authors' observations. *Regional Research of Russia*, 11(4), 589-604. <https://doi.org/10.1134/s2079970521040134>
30. Merl, S. (2020). Agricultural reforms in Russia from 1856 to the present: Successes and failures in the international comparative perspective. *Russian Peasant Studies*, 5(2), 56-87. <https://doi.org/10.22394/2500-1809-2020-5-2-56-87>
31. Morachevskaya, K. A., Lyzhina, E. A., Sebentsov, A. B., & Karpenko, M. S. (2024). Adaptation of the territorial organisation of agriculture in a peripheral region to the operations of agricultural holdings. *Baltic Region*, 16(4), 121-144. <https://doi.org/10.5922/2079-8555-2024-4-6>
32. Naumova, O. A., Svetkina, I. A., & Tyugin, M. A. (2020). Problem analysis of agriculture development in Russia. *IOP Conference Series: Earth and Environmental Science*, 459(6), 062066. <https://doi.org/10.1088/1755-1315/459/6/062066>
33. Nefedova, T. G. (2017). Twenty-five years of Russia's post-Soviet agriculture: Geographical trends and contradictions. *Regional Research of Russia*, 7(4), 311–322. <https://doi.org/10.1134/s2079970517040074>
34. Nefedova, T. G. (2019). Development of the post-Soviet agricultural sector and rural spatial polarization in European Russia. *Spatial Economics*, 15(4), 36-56. <https://doi.org/10.14530/se.2019.4.036-056>
35. Newey, W. K., & West, K. D. (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica*, 55(3), 703–708. <https://doi.org/10.2307/1913610>
36. Nikonov, A. A. (1992). Agricultural transition in Russia and the other former states of the USSR.

American Journal of Agricultural Economics, 74(5), 1157-1162. <https://doi.org/10.2307/1243192>

37. Perekhodov, P. (2025). Agro-industrial complex development under sanctions pressure: The need for financial support. *Vestnik Volgogradskogo Gosudarstvennogo Universiteta. Ekonomika*, 25(1), 45-62 (in Russian).

38. Perron, P. (2006). Dealing with structural breaks. In K. Patterson & T. C. Mills (Eds.), *Palgrave Handbook of Econometrics* (Vol. 1, pp. 278-352). Palgrave Macmillan.

39. Pesaran, M. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics Letters*, 58(1), 17-29. [https://doi.org/10.1016/S0165-1765\(97\)00214-0](https://doi.org/10.1016/S0165-1765(97)00214-0)

40. Petrick, M. (2021). Post-Soviet agricultural restructuring: A success story after all? *Comparative Economic Studies*, 63(4), 623-647. <https://doi.org/10.1057/s41294-021-00172-1>

41. Privalov, N., & Privalova, S. (2021). State Support Of The Agro-Industrial Complex. In: N. Lomakin (Ed.). *Finance, Entrepreneurship and Technologies in Digital Economy. Vol 103. European Proceedings of Social and Behavioural Sciences* (pp. 227-238). European Publisher. <https://doi.org/10.15405/epsbs.2021.03.30>

42. Rada, N. E., Liefert, W., & Liefert, O. (2020). Evaluating agricultural productivity and policy in Russia. *Journal of Agricultural Economics*, 71(1), 96-117. <https://doi.org/10.1111/1477-9552.12338>

43. Rodrik, D. (2008). *One economics, many recipes: Globalization, institutions, and economic growth*. Princeton University Press.

44. Bautin, V. M., & Romanceva, J. N. (2016). Statistical analysis of dynamics of development of Russian agriculture in the post-Soviet period. *E`konomikasel`skogoxozyajstva Rossii*, (6), 26-32. Retrieved from <http://esxr.ru/article/2563> (accessed: 13.02.2026) (in Russian).

45. Rukhovich, D. I., Koroleva, P. V., Shapovalov, D. A., Komissarov, M., & Pham, T. G. (2025). Transformation of arable lands in Russia over last half century – Analysis based on detailed mapping and retrospective monitoring of soil-land cover and decipherment of big remote sensing data. *Sustainability*, 17(13), 6203. <https://doi.org/10.3390/su17136203>

46. Ryzhova, N., & Ivanov, S. (2022). Post-Soviet agrarian transformations in the Russian Far East. Does China matter? *Eurasian Geography and Economics*, 1-17. <https://doi.org/10.1080/15387216.2022.2064892>

47. Schierhorn, F., Müller, D., Beringer, T., Prishchepov, A. V., Kuemmerle, T., & Balmann, A. (2013). Post-Soviet cropland abandonment and carbon sequestration in European Russia, Ukraine, and Belarus. *Global Biogeochemical Cycles*, 27(4), 1175-1185. <https://doi.org/10.1002/2013gb004654>

48. Sheludkov, A. V. (2019). Territorial structure and organization of agriculture in Tyumen Oblast in 1973 and 2014: Comparative analysis. *Regional Research of Russia*, 9(3), 278-287. <https://doi.org/10.1134/s2079970519030080>

49. Sheludkov, A., Kamp, J., & Müller, D. (2021). Decreasing labor intensity in agriculture and the accessibility of major cities shape the rural population decline in postsocialist Russia. *Eurasian Geography and Economics*, 62(4), 481-506. <https://doi.org/10.1080/15387216.2020.1822751>

50. Shust, O. A., Varchenko, O. M., Krysanov, D. F., Dragan, O. O., Tkachenko, K. V., & Varchenko, O. O. (2024). Modern trends in the development of plant production under agrarian crises. *Agricultural Science and Practice*, 10(3), 16-34. <https://doi.org/10.15407/agrisp10.03.016>

51. Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, 48(1), 1-48. <https://doi.org/10.2307/1912017>

52. Svatoš, M., Smutka, L., & Ishchukova, N. (2014). The position of agriculture in the Russian Federation - the last two decades development overview. *Agricultural Economics- Czech.*, 60(11), 489-502. <https://doi.org/10.17221/65/2014-agricecon>

53. Uzun, V., & Shagaida, N. (2019). Russian agriculture: Growth and institutional challenges. *Land Use Policy*, 83, 475-487. <https://doi.org/10.1016/j.landusepol.2019.02.018>

54. Uzun, V., Shagaida, N., & Lerman, Z. (2019). Russian agriculture: Growth and institutional challenges. *Land Use Policy*, 83, 475-487. <https://doi.org/10.1016/j.landusepol.2019.02.018>

55. Verbitskaya, O. (2022). Market transformations in the 1990s in the Russian village. *Herald of the Russian Academy of Sciences*, 92(9), S256-S268. <https://doi.org/10.1134/s101933162209012x>

56. Vinnichyuk, L., & Smelik, N. (2023). Differentiation of the transformation stages in agriculture. *Agrarian Bulletin*, 235(6), 98-110. <https://doi.org/10.32417/1997-4868-2023-235-06-98-110>(in Russian).

57. Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. London: MIT Press.

58. Yin, H., Prishchepov, A. V., Kuemmerle, T., Bleyhl, B., Buchner, J., & Radeloff, V. C. (2018). Mapping agricultural land abandonment from spatial and temporal segmentation of Landsat time series. *Remote Sensing of Environment*, 210, 12–24. <https://doi.org/10.1016/j.rse.2018.02.050>

Appendix

Summary Statistics (1991-2024)

Variable	Mean	SD	Min	Max	Unit/Scale
Gross Agric. Output	2,847	1,254	1,089	5,198	₦ Billions, 2012 prices
Subsidies	298.5	189.7	12.3	664.6	₦ Billions, nominal
ln(Subsidies)	5.45	0.93	2.51	6.50	Log scale
Gov. Effectiveness	-0.562	0.084	-0.71	-0.25	WGI index (-2.5 to +2.5)
Digital Platform Adoption	22.8	18.5	2.1	58.4	Percentage
R&D Expenditure	0.68	0.15	0.41	0.95	% of GDP
Food Price Index (lagged)	189.4	60.2	92.1	328.5	Index (2004-06 = 100)
Exchange Rate Volatility	0.087	0.068	0.012	0.267	Coefficient of variation
Rule of Law Index	-0.573	0.089	-0.76	-0.32	WGI index
Land Titling (%)	68.4	11.2	45.0	86.0	Percentage
Sanctions Period	0.32	—	0	1	Binary (1 = 2014-2024)

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