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The Impact of the EU GDPR Implementation on China's Digital Service Trade Exports

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Abstract. In the digital economy era, economic activities increasingly rely on data. With deepening globalization, cross-border data flows have become a vital element of international trade. However, the growing emphasis on digital security has led to rising restrictions on such flows, affecting trade dynamics. Using the European Union's General Data Protection Regulation (GDPR) as a policy case, this study utilizes OECD panel data from 2005 to 2021 to analyze the regulation's impact on China's digital service trade exports and the underlying mechanisms. Empirical findings suggest that the GDPR exerts a statistically significant positive influence on China's digital service exports. Robustness is validated through parallel trend tests, placebo tests, and country-sample variation. A dynamic effects model further reveals that the long-term benefits of GDPR implementation on export efficiency exceed the short-term effects. Heterogeneity analysis indicates that the regulation's impact varies with the development level of destination countries. Moderating effect analysis shows that institutional variables—such as rule of law, regulatory quality, government effectiveness, and corruption control—and final consumption expenditure enhance the regulation's export-promoting effect. In contrast, stronger trade competitiveness in destination countries weakens this positive influence. These findings offer empirical insights into the complex relationship between data regulation and digital trade, providing references for optimizing China's digital service trade policy framework.

Keywords: Digital service trade exports, General Data Protection Regulation, Cross-border data flow

1. Introduction

The acceleration of global digitalization has positioned digital service trade as a pivotal driver in the transformation of international trade structures. Characterized by high replicability, instantaneity, and low marginal costs, digital services rely on the Internet and data infrastructure for cross-border delivery. In 2023, global digital service exports totaled USD 4.25 trillion, accounting for 54.2% of total global service trade. As a leading digital economy, China has maintained stable growth in its digital service trade, with total import and export volume reaching USD 366.6 billion in 2023. Exports increased by 11.1% year-on-year, comprising 4.9% of the global share, thereby indicating sustained growth momentum.

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Despite its advantages, the development of digital service trade remains highly dependent on the unimpeded flow of data, which introduces challenges such as data privacy and sovereignty. The European Union's implementation of the General Data Protection Regulation (GDPR) in 2018 introduced stringent standards for data collection, processing, and transmission. As one of the most comprehensive data protection frameworks globally, the GDPR exerts significant extraterritorial influence. For Chinese digital service providers, this regulation raises compliance requirements while simultaneously offering potential competitive advantages through improved data governance and enhanced consumer trust.

2. Literature review

Since the implementation of the General Data Protection Regulation (GDPR) , its impact on the economy, market structure, innovation capacity, and the broader global political-economic landscape has been the subject of extensive academic inquiry. The prevailing consensus in the literature is that, although the GDPR imposes limitations on corporate data collection and usage, it simultaneously alters the dynamics of market competition. Empirical studies have shown that following the introduction of the GDPR, internet technology firms heavily reliant on personal data experienced a decline in market share [1]. Small and medium-sized enterprises (SMEs) also faced heightened operational pressure due to increased compliance costs. Certain industries [2], particularly e-commerce and finance, recorded noticeable reductions in online revenues and cross-border merger and acquisition activities as a result of GDPR-related obligations [3]. In the financial sector specifically, elevated compliance costs and heightened risks of regulatory penalties adversely affected overall operational efficiency [4].

Concurrently, the GDPR has exhibited significant extraterritorial influence, a phenomenon commonly referred to as the "Brussels Effect." This effect has compelled non-EU countries to modify their data protection regimes in response to global compliance pressures. For instance, China implemented its Personal Information Protection Law in 2021, aligning more closely with international standards [5]. While the GDPR strengthens data security, its rigorous market entry requirements have partially constrained export efficiency. Empirical evidence suggests that following the enforcement of the GDPR, China's digital service export efficiency to the European Union declined by approximately 8% to 12%, with the negative effects being more pronounced in developed countries [6]. Overall, although the regulation has encouraged firms to enhance their internal data governance mechanisms, it has also introduced greater institutional uncertainty and operational friction in cross-border business, positioning the GDPR as a pivotal regulatory factor influencing global digital service trade.

In recent years, digital service trade has garnered increasing academic attention. Existing studies emphasize that the growth of digital service trade is primarily driven by the development of the digital economy, improvements in digital infrastructure, and digital transformation at the firm level [7]. Moreover, external environmental factors—such as national trade policies, digital service trade barriers, and digital trade provisions in free trade agreements (FTAs) —exert significant influence on digital trade performance. Research findings indicate that restrictive measures targeting digital services tend to hinder export growth, whereas the inclusion of digital trade rules in FTAs can reduce transaction costs and enhance export performance. Additionally, the centrality of a country within the global digital service trade network is positively associated with domestic value-added in exports [8]. This implies that countries occupying more prominent positions in digital trade networks tend to exhibit greater export competitiveness.

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3. Theoretical framework and research hypotheses

Although the GDPR establishes a global benchmark for data protection, its trade-related implications differ across countries. This study adopts the theoretical perspective of institutional and market heterogeneity to examine how the institutional quality and market characteristics of importing countries influence the regulation's effect on China's digital service exports.

(1) Institutional Environment as a Moderator

The GDPR increases the regulatory threshold for market access. In countries with well-developed institutional frameworks—characterized by high levels of regulatory quality, rule of law, and governance—policy enforcement tends to be more consistent and transparent. This institutional strength reduces compliance-related uncertainties and fosters a predictable business environment, thereby enhancing the regulation's export-promoting potential. Conversely, in countries with weak institutional environments, heightened friction and unpredictability may reduce the positive impact of GDPR.

Hypothesis 1: GDPR positively affects China's digital service exports, and this effect is stronger in countries with higher institutional quality.

(2) Market Environment as a Moderator

From a demand-side perspective, the GDPR improves consumer trust in digital services. In economies characterized by high levels of final consumption expenditure and stronger public awareness of data privacy, firms adhering to GDPR standards are more likely to benefit from trust-driven demand.

Hypothesis 2: The export-enhancing effect of GDPR is stronger in countries with higher final consumption expenditure.

On the supply side, the regulation may intensify domestic competition. In markets where competitive domestic firms dominate, foreign firms may encounter elevated barriers to entry, thereby reducing the net positive trade effect.

In summary, this study constructs a multi-dimensional moderation framework and applies a difference-in-differences (DID) approach to empirically assess the effects of GDPR across varying institutional and market conditions. The analysis contributes to a more nuanced understanding of how global data regulations influence international digital trade and offers insights for enhancing China's digital governance and participation in global rulemaking.

4. Variable definition and data sources

4.1. Econometric model specification

4.1.1. Baseline DID regression model

This paper aims to explore the impact of GDPR implementation on China's digital service trade exports, employing a difference-in-differences (DID) approach to analyze the policy effects. Following the approach of Ma Shuzhong (2023) , countries outside the EU are set as the control group, and EU member states as the treatment group. By comparing China's digital service trade exports to the EU and non-EU countries before and after GDPR implementation, the empirical effect of GDPR is tested. The specific model is set as follows:

$$EXTE_{it} = \alpha + \beta_1 EU_i + \beta_2 Post_t + \beta_3 (EU_i \times Post_t) + \beta_4 Z_{it} + \gamma_i + \eta_t + \epsilon_{it} \quad (1)$$

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4.1.2. Baseline model

Where t denotes the year and iii denotes the country (or region) .The dependent variable is explained by the interaction term between the grouping variable and the policy variable. Both the grouping variable and the policy variable are dummy variables: the grouping variable equals 1 if country is a member of the European Union and 0 otherwise; the policy variable equals 1 if the year t≥2018t (the year GDPR came into effect) and 0 otherwise.A series of country-level control variables are included, such as the importing country's GDP per capital, the geographical distance between import and export countries, the importing country's market size, differences in internet development levels between countries, the average exchange rates, and the share of information and communication technology products in total goods trade.Country fixed effects γ_i and year fixed effects are incorporated to control for unobserved factors that are invariant over time within countries and ,η_t invariant across countries within years, respectively. The error term is denoted as ϵ_{it} . Ordinary Least Squares (OLS) regression is employed for the baseline estimation. β_3 measures the impact of GDPR implementation. Additionally, to address potential serial correlation and heteroscedasticity, all regressions cluster standard errors at the country level.

4.2. Moderation effect model

To enhance explanatory power, this study further introduces interaction terms with moderating variables to examine the heterogeneous moderating effects of institutional and market environments. To comprehensively reveal the external dependency of the policy effect, the moderating factors are categorized into two groups:

The institutional capacity dimension, which includes rule of law, regulatory quality, government effectiveness, and corruption control, reflecting the predictability and implementation foundation of the policy;

The market environment dimension, which includes final consumption expenditure and the trade competitive advantage index, characterizing market demand and competitive structure.

These two sets of variables respectively capture the conditional differences in whether the policy can be effectively enforced ("policy implementation") and whether it can be effectively responded to by the market ("market responsiveness") . The specific model is specified as follows:

$$EXTE_{it} = \alpha + \beta_1 EU_i + \beta_2 Post_t + \beta_3 (EU_i \times Post_t) + \beta_4 M_{it} + \beta_5 (EU_i \times Post_t \times M_{it}) + Z_{it} + \gamma_i + \eta_t + \epsilon_{it} \quad (2)$$

Where M_{it} represents the moderating variables, including regulatory quality, rule of law, government effectiveness, corruption control, trade competitive advantage index, and final consumption expenditure. The triple interaction term $EU_i \times Post_t \times M_{it}$is used to identify the moderating effects of the institutional environment and market conditions of the destination country on the export impact of the GDPR policy. The meanings of all other variables remain consistent with those in the baseline model.

4.3. Variable definitions

4.3.1. Core variables

The dependent variable is China's digital services exports to various countries, sourced from the OECD-WTO BaTIS database. Following the classifications of UNCTAD, OECD, and US-BEA, and

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methods from Zhou (2022) and Chen (2022) , we aggregate six sectors—telecommunications, finance, insurance, intellectual property, other business services, and cultural/entertainment—to construct total digital services exports. The key explanatory variable is the interaction term "EU × Post-GDPR," where EU countries are coded as 1, others as 0; years from 2018 onward are coded as 1 due to GDPR implementation in May 2018.

4.3.2. Control variables

Controls cover economic, geographic, and digital development factors. Economic variables include the importing country's per capita GDP and exchange rate, reflecting market size and price competitiveness. Geographic distance is measured by the distance between capitals, representing trade costs. Digital development is captured by internet penetration (broadband) and the ICT share in goods trade. All continuous variables are log-transformed (log(x+1)) to reduce skewness and heteroscedasticity.

4.3.3. Moderating variables

To identify the moderating effects of institutional and market environments on policy impact, five moderating variables are introduced: (1) regulatory quality, measuring the government's ability to formulate and implement policies; (2) rule of law, evaluating the fairness and enforcement of the legal system; (3) government effectiveness, reflecting the quality of policy formulation and public service delivery; (4) corruption control, assessing government integrity and transparency; and (5) trade competitive advantage index (TC) , measured by the GL index to capture the export competitiveness of the destination country.

$$TC = \frac{export_{it}^{s} - import_{it}^{s}}{export_{it}^{s} + import_{it}^{s}} \tag{3}$$

$export_{it}^{s}$ and $import_{it}^{s}$ represent China's export to and import from the importing country j in service subsector s, respectively. Here,s denotes service subsectors such as telecommunications, finance, intellectual property, and so forth.

(6) Final Consumption Expenditure of the Importing Country (Consumption) :This refers to the total expenditure incurred by resident units within a specific period to satisfy their material, cultural, and spiritual needs, both within the domestic economic territory and abroad. It includes household consumption expenditures for their own living, as well as the net expenditures by the government on providing public services to society, including the supply of goods and services to residents at subsidized or no cost. This variable is used to examine the stability and sustainability of economic growth.

5. Empirical analysis

5.1. Baseline regression

This study first investigates changes in China's digital services exports to the EU before and after GDPR implementation. Table 3 reports the regression results.

In Column (1) , only the core explanatory variable is included; the coefficient is 0.193 and significant at the 1% level. Columns (2) and (3) add control variables and year fixed effects, yielding

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coefficients of 0.184 and 0.171, respectively. These results suggest that GDPR increased China's exports to the EU by an average of 17.3% compared to non-EU countries.

Column (4) adds year and country fixed effects, with the coefficient still at 0.193. Column (5) includes all controls, and the coefficient of the interaction term is 0.173, also significant at the 1% level.

Overall, the baseline results show that GDPR significantly boosts China's digital services exports to the EU, and this effect remains robust across different model specifications.

Table 1: Baseline regression results

	(1)	(2)	(3)	(4)	(5)
EU × Post	0.193***	0.184***	0.171***	0.193***	0.173***
	(0.0625)	(0.0561)	(0.0554)	(0.0185)	(0.0191)
EU	0.218***	0.0139	0.0353		
	(0.0233)	(0.0256)	(0.0247)		
Post	0.112***	0.116***			
	(0.0265)	(0.0196)			
Control Variables	No	Yes	Yes	No	Yes
Year Fixed Effects	No	No	Yes	Yes	Yes
Individual Fixed Effects	No	No	No	Yes	Yes
Observations	3332	2220	2220	3332	2219
R-sq	0.046	0.385	0.405	0.944	0.915

Note: Standard errors clustered at the country level are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. This convention applies to all subsequent tables.

6. Robustness checks and dynamic effects analysis

6.1. Robustness checks

(1) Placebo Group Test

Placebo Group Test: Setting non-EU European countries as a placebo group yields an insignificant interaction term (0.0157) , suggesting regional shocks do not bias the results.

(2) Permutation (Placebo) Test

A placebo test with 500 random permutations of treatment assignment shows that the actual estimate significantly deviates from the simulated distribution centered around zero, confirming statistical significance.

(3) Sample Adjustments

The robustness of the results is confirmed through several sensitivity analyses. First, including the UK in the treatment group yields a consistent and significant coefficient of 0.173. Second, excluding tax havens, such as the Cayman Islands and the British Virgin Islands, does not alter the results, indicating that the findings are not driven by these jurisdictions. Third, dropping the years 2015–2017 to eliminate potential anticipation effects still results in a significant coefficient of 0.192. Finally, excluding the years 2020–2021 to control for the impacts of the COVID-19 pandemic also yields a significant coefficient of 0.146. These analyses collectively demonstrate the robustness of the findings across different sample compositions and time periods.

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Table 2: Robustness checks

	non-EU countries in Europe were the experimental group	The United Kingdom was added as the experimental group	Eliminate tax havens	Eliminate the expected effect	Remove the samples from 2020 and 2021
	(1)	(1)	(2)	(3)	(4)
$EU \times Post$		0.173*** (0.0191)	0.172*** (0.0191)	0.192*** (0.0208)	0.146*** (0.0242)
$nonEU \times Post$	0.0157 (0.0254)				
control variable	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
National fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	2219	2219	2202	1811	1978

6.2. Dynamic effects analysis

(1) Parallel Trend Test

A dynamic DID model shows insignificant pre-treatment coefficients, validating the parallel trend assumption. Post-treatment effects grow over time, indicating a cumulative impact.

(2) Short-term and Long-term Effects

The long-term effect (2020–2021) exceeds the short-term (2018–2019) , suggesting that GDPR's export-promoting impact strengthens as Chinese firms improve compliance capacity.

(3) Heterogeneity Analysis

To explore differential impacts, heterogeneity analysis was conducted across country development levels, digital infrastructure, and service categories. Results indicate that GDPR mainly boosts exports to high-income countries, where stricter compliance standards and trust sensitivity favor Chinese firms post-compliance.

Using US BEA classification, digital services were grouped into six categories. GDPR's effect is strongest in data-intensive sectors like information and financial services, where cross-border data flows are vital. Compliance thus yields greater export gains in these areas. Full results available upon request.

7. Effect analysis

To further analyze the marginal mechanisms of GDPR's impact, this study examines moderation effects from two dimensions: institutional environment and market environment.

7.1. Moderating role of institutional environment

Four institutional indicators—regulatory quality, rule of law, government effectiveness, and control of corruption—were interacted with the EU_Post variable in regressions. Results show that all four interaction coefficients are positive and significant, indicating:

Higher regulatory quality helps ensure market order and fair competition, boosting Chinese firms' confidence.Better rule of law provides stable and clear legal support.Higher government effectiveness reduces administrative barriers and transaction costs.Stronger corruption control

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fosters a fair and transparent business environment.These findings suggest that a sound institutional environment significantly strengthens GDPR's positive effect on China's digital service exports, supporting Hypothesis 1.

7.2. Moderating role of market environment

From market characteristics, two indicators—trade competitiveness index and final consumption expenditure—were analyzed.

(1) Trade Competitiveness Index

The coefficient on the interaction term is negative and significant, indicating that in countries with stronger trade competitiveness, GDPR's promoting effect is weaker.

(2) Final Consumption Expenditure

The interaction coefficient is positive and significant, suggesting that in countries with higher consumption expenditure, GDPR significantly increases China's digital service exports.

In summary, Hypothesis 2 is supported: the more intense the market competition, the weaker GDPR's marginal promotion effect; the stronger the consumption demand, the greater GDPR's positive impact. This reflects the greater value of data compliance in high-demand markets.

Table 3 : The regulatory effects of the institutional environment and the market environment

variable	EXTE(institutional environment)				EXTE(marketing environment)	
	Supervision quality	the level of legal institutions	governmental efficiency	Corruption management level	Trade Competitive Advantage Index	Final consumption expenditure
	(1)	(2)	(3)	(4)	(1)	(2)
EU_Post	0.0217 (0.597)	0.0744*** (2.582)	0.0794*** (2.937)	0.0595*** (2.594)	0.260*** (15.10)	0.103*** (6.356)
M_EU_Post	0.131*** (4.656)	0.0931*** (4.168)	0.0897*** (4.004)	0.111*** (6.459)	-0.853*** (-9.026)	0.0136*** (7.783)
intercept term	0.481*** (9.323)	0.447*** (8.692)	0.413*** (8.110)	0.410*** (8.053)	0.407*** (8.221)	0.482*** (9.388)
control variable	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
National fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2167	2167	2187	2167	2,202	2,049
R-squared	0.917	0.916	0.916	0.917	0.919	0.927
Adjusted R2	0.910	0.909	0.909	0.910	0.912	0.921

Analysis Results of the moderating effect of the system and market environment perspectives.

8. Conclusion and policy recommendations

(1) Conclusion

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Using China's digital services trade data from 2005 to 2021, this study employs a Difference-in-Differences (DID) approach to assess the impact of the GDPR. Results show that GDPR significantly increased China's digital services exports to the EU by an average of 17.3%, with effects growing from 15.4% in the short term to 23.1% in the long term.

Sectoral analysis indicates significant positive impacts across multiple industries, especially in intellectual property. The effect is stronger in countries with sound institutional environments (e.g., higher regulatory quality and rule of law) and higher consumption, but weaker in countries with strong trade competitiveness. These findings highlight the importance of both institutional and market factors in shaping policy outcomes.

(2) Policy Recommendations

At the national level, China should enhance its institutional framework and data governance, actively engage in global digital rulemaking, and align with EU standards on cross-border data flows. Legislative efforts should be accelerated to establish clear, efficient data transfer mechanisms and support enterprise compliance. Investments in digital infrastructure and talent development are also key to strengthening competitiveness and diversifying export markets.

At the enterprise level, firms should build robust compliance systems, backed by professional teams and technologies like AI and blockchain. Strategies should be tailored to different markets, with localized operations and enhanced risk management. Transparent data practices and ethical governance will help strengthen trust and global brand reputation.

A joint effort by government and enterprises is essential to promote the high-quality growth of China's digital economy and ensure continued success in the global digital services market.

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