Academic Journal of Management and Social Sciences
ISSN: 2958-4396 | Vol. 18, No. 1, 2026

The Impact of Cross-Border Data Regulation on the Resilience of China's Industrial and Supply Chains

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Abstract: Digital transformation has created huge economic benefits for cross-border data flow around the world, but it has also caused real problems such as violating privacy and leaking business secrets. For China, how to manage data well and maintain the stability of the industrial supply chain is a difficult policy problem in the negotiation of international rules. This article analyzes two opposite effects of cross-border data regulation. On the one hand, strict regulatory review and uncertain policy results will increase the compliance burden of enterprises. This will lead to the interruption of information exchange in the supply chain, which will weaken the ability of the supply chain to recover from the shock. On the other hand, if the regulatory framework is stable and predictable, mutual trust can be established between enterprises, which will help improve the adaptability of the supply chain. Whether regulatory rules are beneficial to the supply chain or harmful to the supply chain depends on two practical conditions: first, whether domestic rules are in line with international norms, and second, the degree of dependence of the industry on data resources. Combined with the experience of the three-stage reform of China's data outbound management and the actual cases of logistics and digital trade industries, this article believes that policymakers should no longer be entangled in the simple debate of "should be relaxed or tight" the rules, but should focus on establishing institutional interoperability. Specifically, a practical balance between data supervision and supply chain resilience can be found by unifying negative lists, promoting mutual recognition of regulators, and introducing business continuity assessment tools.

Keywords: Cross-border Data Regulation; Resilience of Industrial and Supply Chains; Compliance Costs; Institutional Openness.

1. Introduction and Literature Review

At present, geopolitical conflicts and competition with digital trade rules are intensifying, and the restructuring of the global industrial chain supply chain is accelerating, which makes the economic policy of "seeking progress in stability" particularly critical. In 2023, General Secretary Xi Jinping stressed at the meeting of the Political Bureau of the CPC Central Committee that it is necessary to promote the effective improvement of quality and reasonable growth of quantity of the economy. Meanwhile, since 2015, the value generated by global cross-border data flows has exceeded that of cross-border goods flows, making data a new factor in the circulation of the world economy. In 2023, the CPC Central Committee and the State Council specifically proposed in the Plan for the Reform of Party and State Institutions the establishment of the National Data Bureau to organize and implement the national big data strategy. The deep integration of cross-border data with industrial chains has improved the precision of supply–demand matching between upstream and downstream firms and facilitated the smooth functioning of the world economy. As Zouari et al. [9] point out, the degree of supply chain digitalization and the application of digital tools are key to enhancing supply chain visibility, predictability, and collaboration. However, issues such as data leakage, privacy infringement, and intellectual property violations have subjected the cross-border flow of data to multiple layers of regulation by governments and relevant institutions. In 2020, on the grounds that data such as genetic, geographic, and meteorological information could threaten national security, the U.S. House Foreign Affairs Committee approved a measure prohibiting federal employees from using TikTok, an application owned by the Chinese technology company ByteDance, on government devices. In 2023, French regulators found that Apple's placement of targeted advertisements in the App Store violated France's Data Protection Act and ultimately imposed a fine of up to EUR 8 million on the company.

Such cross-border data regulatory strategies inevitably increase the compliance costs of firms' multinational operations and international expansion, thereby exerting shocks on the development of global industrial and supply chains. Using multinational firm-level data, Ferracane et al.[3] find that more restrictive data policies have a significantly negative impact on the performance of downstream firms that rely on electronic data. Consistent with this finding, estimates based on market regulation data from the Information Technology and Innovation Foundation (ITIF) suggest that a one-unit increase in a country's data regulatory restrictiveness index would reduce its total trade output by 7 percent. Compared with Europe and the United States, where digital technologies are more advanced, second-tier economies represented by China are more likely to adopt stringent cross-border data regulatory strategies to guard against potential industrial security risks. According to the assessment of the European Centre for International Political Economy (ECIPE, 2018), China ranked first among 65 economies in terms of the intensity of data restrictions. In 2019, Salesforce's Data Beyond Borders report ranked 20 countries according to the degree of regulation in the field of cross-border data, and China was classified as belonging to the more restrictive category. Against the backdrop of the urgent need to improve the intensity of China's cross-border data regulation, this paper seeks to provide targeted policy recommendations for China's differentiated policymaking and sector-specific opening in the field of cross-border data by exploring the

impact of cross-border data flow regulation on economic development.

At present, research on cross-border data regulation in the field of economic development remains insufficient. Existing studies show that differences in digital trade rules reflect structural divergences between developed and developing countries in their approaches to data regulation: economies with leading digital technologies tend to maintain a relatively liberal environment for data flows, whereas catch-up economies rely more heavily on restrictive measures to guard against industrial security risks. At the same time, the structural gap between China's data regulatory system and high-standard global rules has become a source of institutional friction in cross-border supply chain collaboration[7-8]. In terms of quantitative research, Ferracane et al. [3], drawing on ECIPE's data restrictiveness sub-index, confirm at the multinational firm level that data restrictions not only raise information acquisition and compliance costs, but also hinder improvements in total factor productivity among downstream manufacturing firms. In addition, some scholars have conducted empirical tests using data such as the OECD's Digital Service Trade Restriction Index (DSTRI), and the results also show that restrictive measures will hinder the development of digital service trade.

These studies lay the foundation for our understanding of the economic impact of cross-border data regulation. In recent years, many literatures have discussed in detail how cross-border data restrictions change digital trade and enterprise productivity. However, there are still relatively few studies that directly explore the relationship between "cross-border data supervision and industrial chain supply chain resilience", which is precisely the core of China's current policy concern. In order to fill this gap, this article focuses on analyzing how data regulation rules affect the operation of the supply chain. This not only helps us understand digital economy governance more comprehensively, but also provides some theoretical references for China's next step to optimize cross-border data supervision rules.

2. Concept Definition and Institutional Background

2.1. Defining the Resilience of Industrial and Supply Chains

When defining the resilience of the industrial chain, this article mainly looks at how the supply chain usually operates. We divide resilience into three parts: first, when encountering institutional shocks, upstream and downstream enterprises can still maintain the ability of information exchange and continuous cooperation; second, the ability to recover business quickly after the supply chain is broken; third, the ability of long-term adjustment, that is, enterprises can readjust cooperation channels to adapt to the new regulatory environment. Power. From the perspective of macro goals, this is consistent with the direction of our country to build an "autonomous, controllable, safe and reliable" industrial chain. However, what is more important in this article is whether the information in the normal operation of the supply chain is consistent and whether the cooperation between enterprises is good. Because of the actual impact of cross-border data supervision, to tall it bluntly, it leads to the lack of information flow and changes the relationship of trust between partners.

2.2. The Three-Stage Evolution of China's Cross-Border Data Regulation

From the perspective of historical institutional evolution, China's cross-border data regulation has undergone roughly three stages. Prior to 2015 was a stage of "passive defense", during which relevant provisions were scattered across departmental rules in only a few sectors such as finance and healthcare, without a unified legal foundation at the level of higher-order law. The period from 2015 to 2020 was a stage of "legislation preceding implementation". During this period, the Cybersecurity Law initially established data localization and outbound data transfer approval requirements at the national legal level, yet the supporting assessment measures remained for a long time in draft form for public comment, and their actual binding force was therefore relatively limited. Since 2021, China has entered a stage of "institutionalization", in which the Data Security Law, the Personal Information Protection Law, and the Measures for Security Assessment of Outbound Data Transfers have jointly formed a multi-layered regulatory framework. The Provisions on Promoting and Regulating Cross-Border Data Flows, issued in 2024, further introduced the negative list approach.

From the perspective of resilience, these three stages carry different institutional implications. In the first stage, supply chains were almost unconstrained by data-related rules. In the second stage, the rules were ambiguous but the actual constraints were weak, and the erosion of resilience was therefore not pronounced. In the third stage, the rules became clearer and compliance costs became substantive, thereby activating both the cost effect and the trust effect on resilience. In other words, the impact of regulation on resilience varies not with the mere presence or absence of regulation, but with the degree of regulatory institutionalization and the clarity of the rules.

2.3. International Comparison of Regulatory Models and Institutional Characteristics

Global economies follow distinct approaches to managing cross-border data. The United States favors free data flows supported by ex-post accountability rules. The European Union applies adequacy decisions to maintain strict privacy safeguards for cross-border data. China's governance framework enables data cross-border movement under preconditions, with ex-ante security assessment as a core procedure. These model discrepancies produce institutional conflicts for collaborative cross-border supply-chain activities.

After China's data supervision entered the standardization stage, several institutional characteristics directly affected the operation of the supply chain. The most prominent problem is that pre-approval dominates. At present, the safety assessment and standard contracts are "one thing and one discussion". Enterprises must complete the provincial and national levels of examination, and sometimes it takes more than a month to go through the process. This is very different from the "principles plus exceptions" model advocated by CPTPP and DEPA, which brings a lot of friction to transnational cooperation. In addition, the unclear boundaries of important data also cause headaches for enterprises. Many industries have not yet issued clear important data catalogs, and there are no quantitative identification standards. It is difficult for enterprises to figure out how to comply. At the same time, the fragmentation of the pilot free trade zones in

various places has exacerbated this uncertainty. The data exit negative list standards formulated by different free trade zones are not uniform, which makes cross-regional supply chain enterprises often face the dilemma of rule fights.

3. Mechanism Analysis

3.1. The Compliance-Cost Channel: Information Discontinuities and the Erosion of Recoverability

Cross-border data supervision has put pressure on enterprises in all aspects: in order to meet compliance requirements, enterprises have to spend money to build systems; in order to cope with regulatory review, enterprises have to spend a lot of time. These pressures directly interfere with the normal communication and information sharing between upstream and downstream enterprises. Specifically, in order to meet compliance standards, enterprises may need to spend money to build local data centers, readjust internal security processes, or desensitize data, which will directly increase the operating costs of enterprises[4]. In addition to the cost, the review process itself is also very time-consuming. If the project involves important data leaving the country, not only the review cycle is particularly long, but it is also impossible to say whether it will be approved in the end. This will make the enterprises that have invested a lot of energy in the early stage suffer losses in vain.

For the supply chain, the impact of these burdens is far more than just making enterprises spend more money. Once the supply chain is interrupted, the delay in review and the ambiguity of the rules will directly cut off the exchange of information between enterprises on the chain. If upstream and downstream enterprises cannot synchronize orders, inventory and logistics in time, it will be difficult for the entire supply chain to recover quickly.

The electronic waybill service in international logistics is a typical example. The electronic waybill contains not only personal information, but also business records and logistics data. It is difficult to simply take them apart and hand them over to the regulatory authorities of different countries. Goods have to pass through many nodes in transnational transportation, and every time the data is handed over, it may step on the red line of compliance. If compliance procedures slow down the cross-border sharing of waybill data, logistics companies will not be able to provide customers with consistent full-process tracking, and additional costs will be incurred when dealing with abnormal situations. This case shows that the compliance burden will directly drag down the recovery of the supply chain. After all, if you want to recover quickly after interruption, you need to quickly distribute information and make decisions on the spon hand, and the compliance delay is stuck at this time.

The reality also confirms the above logic. Since the strict implementation of cross-border data rules, some enterprises have simply reduced overseas customers in order to avoid the heavy burden of compliance. Although cutting off part of the supply chain can reduce overseas risks, it also makes enterprises lose the risk resistance brought about by the diversification of global markets. Relying on technological innovation, enterprises may be able to withstand some upstream technological shocks, but it is difficult to make up for the losses caused by the loss of downstream overseas customers. Therefore, the damage of compliance burden to the resilience of the supply chain is real. It is difficult for enterprises to solve this problem by themselves, which further highlights the need to establish an institutional compatibility mechanism.

3.2. The Security-Trust Channel: Institutional Credibility and the Depth of Collaboration

Of course, the cost of supervision is not all. The risk of data security has been reduced, and partners in the supply chain have more confidence to trust each other and share information. [6]. In fact, good data governance is intended to encourage "legitimate and controllable" cross-border data flow. The "legitimate" here means that the data itself is safe; and "controllable" means that it is safe to use after the data flows out.From the perspective of resilience, when firms are confident that the boundaries of security responsibility after outbound data transfer are clearly defined, their willingness to share operational data with overseas partners is enhanced. Supply chain collaboration can then evolve from a transactional relationship toward deeper information coordination, which is precisely the source of adaptability.

However, this channel is subject to a strict condition: the predictability of rules. If catalogues of important data remain unclear for a long time, if negative lists differ across regions, and if enforcement standards vary from place to place, firms cannot determine what qualifies as compliance, and trust lacks an institutional foundation [7]. Clear, stable regulatory rules give rise to the security-trust effect, which cannot emerge merely from the existence of regulatory frameworks alone. This also explains why, in the early stage of regulatory institutionalization, the cost effect often appears before the trust effect.

3.3. Moderating Conditions and Dynamic Characteristics of the Net Effect: Institutional Compatibility

Since the two channels of compliance cost and security trust are opposite, which one has a greater impact in the end? This article believes that it depends on "system compatibility"[8]. Simply put, institutional compatibility refers to whether a country's regulatory rules can be compatible with international high-standard rules and the rules of major trading partners. If the compatibility is too low, even if the enterprise has complied with the company in China, it still has to face the problem of repeated review and rule fighting when going abroad for supply chain cooperation. This mismatch in the rules will make the negative impact of compliance costs even greater. [1].

Interestingly, transnational data found that if trading partners in the supply chain are very loose in data management, the negative impact of our strict domestic control will be greater. The reason is that the rules on both sides don't match. Our country is used to "strict examination in advance", while the other party may be "after the fact" or simply let it go. This forces enterprises to switch back and forth between two completely different regulatory logics, which is very troublesome. International experience also proves this. Even if everyone has signed and made promises in various international agreements, these superficial commitments often cannot control the actual data flow and data localization requirements. Therefore, if you really want to achieve institutional compatibility, you can't just look at how many agreements have been signed, but also whether the rule structure of both sides is really compatible.

From the above analysis, we can see a dynamic process of

change. At the beginning of the establishment of supervision, the pressure on compliance costs usually prevails, and the resilience of the supply chain will deteriorate in the short term. However, as the rules become more and more transparent, coupled with the gradual mutual recognition among countries, the benefits of security and trust will slowly emerge, and the resilience of the supply chain will also rise. This trend of "first down and then up" looks a bit similar to the "inverted U-shaped" threshold effect mentioned in some infrastructure studies. However, the root cause of the two is completely different. The inversion of the infrastructure is due to the fact that the hardware conditions cannot keep up, and the law found in this article is because the system needs to be learned, and trust also needs time to accumulate slowly.

4. Industrial Stylized Facts and Institutional Differences

4.1. International Logistics: The Coexistence of Compliance Discontinuities and Trust Erosion

The international logistics industry provides an ideal setting for observing the interaction between the two channels. The business logic of “one global waybill throughout the entire journey” requires waybill data to circulate freely on a unified global platform, whereas data localization requires such data to be interrupted at jurisdictional borders; the two therefore stand in a clear zero-sum relationship. At the same time, compliance discontinuities along agency chains erode the trust relationships that have been built up over time among agents. When regulatory requirements penetrate every cross-border agency node, firms are often forced to choose between preserving compliance and maintaining chain continuity, and this in turn weakens the redundancy and adaptability of supply chain networks. This industry case clearly shows that the compliance-cost channel and the trust channel do not operate independently; rather, they reinforce one another. Compliance discontinuities undermine trust, while the absence of trust, in turn, raises the costs of compliance coordination.

4.2. Negative Lists in Pilot Free Trade Zones: A Partial Experiment in Institutional Compatibility

In recent years, pilot schemes involving negative lists for outbound data transfers in specific areas such as pilot free trade zones have provided important material for observing localized variation in institutional compatibility. When data outside the negative list are exempted from ex ante security assessment, the essence of the arrangement is to reduce regulatory uncertainty through institutional innovation. From a mechanistic perspective, the scope of coverage of the negative list directly shapes firms’ compliance expectations: in sectors where coverage is broader and standards are clearer, the predictability of compliance costs is higher, and the security-trust channel is more likely to be activated; otherwise, the net effect of regulation on resilience is more likely to be negative. The analytical value of this institutional reasoning lies in the fact that it offers a falsifiable proposition for subsequent empirical testing: in sectors where negative lists provide broad coverage and rules are clear, the net effect of regulation on supply chain resilience will tend to be more positive.

4.3. The Structural Implications of Regional and Sectoral Differences

In terms of sectoral distribution, digitally intensive industries and manufacturing sectors deeply embedded in global value chains, such as new energy vehicles and electronic equipment, are the sectors most directly affected by data regulation. Existing macro-level empirical evidence indicates that restrictions on cross-border data flows have a significant negative impact on the output and exports of data-intensive sectors such as telecommunications, business services, and finance, whereas the impact on less data-intensive sectors is relatively limited. From a regional perspective, coastal areas with high data intensity and clusters of digital trade firms are more deeply exposed to the compliance-cost channel, but they also possess stronger technological and institutional capacities to absorb the security-trust effect. Therefore, the impact of regulation on the resilience of the supply chain is not uniform. It will show obvious differences due to the different degrees of dependence of each industry on data and the compatibility of the system. If these differences are not taken into account when formulating policies, the consequences may be terrible. Whether it is a complete tightening or a comprehensive relaxation without distinction, it may seriously affect some key industries or have blind spots that cannot be regulated.

5. The Inverted U-Shaped Mechanism of the Impact of Cross-Border Data Regulation on Industrial and Supply Chain Resilience

In the current digital economy era, digital trade is the main force to drive global economic growth, and the free cross-border flow of data is the prerequisite for digital trade to continue to grow. If cross-border data is too hard to control, data will not be able to play its role in supporting economic activities. Based on this background, this section focuses on analyzing how cross-border data supervision affects the performance of the industrial chain supply chain from the perspectives of "trade cost" and "cross-border investment".

5.1. The Trade-Cost Channel

Cross-border data supervision will actually increase the trade costs of enterprises in several aspects. In order to meet compliance requirements, enterprises have to put in a lot of resources, such as training employees, spending money on legal consultants, and introducing various technical means to make the cross-border transmission and processing of data comply with those complicated data protection regulations. [5], In addition, the inconsistent regulatory rules of different countries have also added a lot of bottlenecks to the daily operation of enterprises. In order to reduce compliance risks, enterprises may have to build local data centers in several countries, which not only makes hardware investment more, but also makes maintenance more complicated. Too strict control will also drag down trade efficiency. Although digitalization can alleviate the information asymmetry in international trade, strict data restrictions will slow down the speed of data transmission, lengthen the time of information exchange, and ultimately affect the operation efficiency of the cross-border supply chain. The changing policy environment also makes the burden on enterprises heavier. Enterprises have to spend energy and money to keep an eye on policy

changes. If they don't pay attention, they may get lawsuits or be fined. In the Digital Trade Restriction Index released by ECIPE, there is a "data supervision" indicator that can explain the problem: it requires the cross-border transmission of commercial data to undergo strict security review and risk assessment. The high threshold directly reduces the availability of information, making it difficult for data-dependent digital services to store, calculate and transmit. As a result, the cost of enterprises searching for information has become higher and communication has become more difficult, which ultimately limits the scale and scope of cross-border business activities.

As soon as the cost of trade rises, economic development will be dragged down by many aspects. As the cost of logistics, tariffs and approval becomes higher, the import and export costs of enterprises will increase, and the price advantage of products in overseas markets will be lost. It is difficult for enterprises to do business overseas, which will reduce the profit margin and make everyone unwilling to innovate. In addition, too high trade costs will lead to the inability to use resources on the blade. If the cost of cross-border business is ridiculously high, enterprises and countries will reduce international trade and turn to find domestic substitutes. In this way, resources cannot flow to the most efficient places, resulting in waste.

For example, the "local data processing and storage requirements" mentioned in ECIPE's DTRI index are a typical example of pushing up costs. This regulation forces enterprises to either build data centers in China or outsource their business to local service providers, which directly increases the fixed trade costs. In addition, if the data must be stored for a long time, the storage cost of the enterprise will rise; and if it is stipulated that certain data must be destroyed after use, the enterprise may have to spend time to re-collect it because it cannot find previous customer records. In addition, the original intention of the regulations on protecting the rights and privacy management of data subjects must be good, but if it is not implemented well, it will add chaos to the enterprise. For example, the process of collecting data is particularly cumbersome, or the regulatory authorities require direct data retrieval at any time, which can easily annoy foreign trading partners. Finally, if the enterprise's data violation is punished, the uncertainty of the policy will be greater; and the enterprise also has to spend money to consult legal consultants, which pushes the overall compliance cost higher. Existing scholarship confirms that reduced trade costs foster export upgrading [2]. It follows that mounting trade costs exert adverse influences on economic outcomes. Taken together, trade-cost effects create an inverted-U relationship between cross-border data regulation and industrial-supply-chain resilience.

5.2. The Cross-Border Investment Channel

In addition, cross-border data rules have also added a block to the transnational investment of enterprises. Multinational companies originally relied on data freedom across borders to optimize business, do market research, serve customers and coordinate various departments. However, some countries are very strict, requiring that data must exist and be processed locally, which disrupts the global operation rhythm of enterprises and naturally reduces efficiency. Moreover, the regulatory standards of different countries are different. Multinational companies must put a lot of resources into compliance, the business becomes more complex, and the cost also rises. Especially when encountering sensitive data such as personal information and business secrets, the compliance requirements are particularly strict. Enterprises spend more money on data protection, and at the same time, the hands and feet of data for analysis and innovation are also bound, which makes enterprises not flexible enough in the market.

In addition, if the control is too strict, the legal risks faced by enterprises will also be higher. Once you violate the law, you may not only be fined and slied, but also tarnish your reputation in the local market. It will be difficult to expand abroad in the future. Together with these concerns, multinational companies will become very conservative when investing money abroad. If everyone dares not invest or drags on, the liquidity of global capital will naturally become worse.

Falling cross-border investment brings multi-faceted harms to economic development. Foreign capital inflows constitute a vital source of external financing particularly for emerging-market and developing economies, funding infrastructure construction, industrial expansion and technological innovation. If foreign capital can't come in, the lack of money will limit the development of the supply chain. For example, infrastructure projects such as transportation, energy and communication will have to be postponed once there is a shortage of money, which not only affects production efficiency but also drags down the overall economy. In addition, multinational companies can provide a lot of jobs by building local factories. When there is less foreign investment, there are fewer new jobs, the unemployment rate is easy to rise, and ordinary people dare not spend money.

In addition to capital and employment, cross-border investment can also bring advanced technology and management experience to help local enterprises improve their innovation ability. Once foreign investment is reduced, the dissemination of this technology and experience will be interrupted, and it will be more difficult for domestic industries to upgrade. In addition, international investment can promote the opening up of trade and the optimal allocation of resources. If transnational capital retreats, it is likely to fuel protectionism and slow down the pace of global economic integration. The close economic ties established by investment were originally the basis for political cooperation between countries; now that investment ties are weak, geopolitical friction and uncertainty may become greater. Therefore, shrinking cross-border investment produces tangible damage for capital stock, employment and technology progress, with spillover risks for worldwide economic stability. These investment-related mechanisms also produce an inverted-U linkage between cross-border data regulation and industrial-supply-chain resilience.

6. Extension Analysis: The Impact of Cross-Border Data Regulation on Economic Growth

6.1. Model Construction

Given data availability, this paper selects 52 countries (Based on the World Bank classification, the 52 sample countries include 33 developed countries (the United States, the United Kingdom, France, Germany, Canada, Italy, Switzerland, Sweden, Japan, South Korea, Norway, Ireland, Austria, Estonia, Australia, Poland, Belgium, Iceland, Denmark, Finland, the Netherlands, Czech Republic,

Lithuania, Luxembourg, Latvia, Portugal, Slovakia, Slovenia, Greece, Hungary, New Zealand, Spain, and Israel) and 19 developing countries (Argentina, Brazil, Russia, the Philippines, Colombia, Costa Rica, Kazakhstan, India, Indonesia, Zimbabwe, Malaysia, Mexico, Peru, South Africa, Thailand, Turkey, Vietnam, China, and Chile).) as the research sample. Based on panel data from 2014 to 2022, the model examining the impact of cross-border data regulation on economic development is specified as follows:

$$lnGDP_{it} = \alpha_0 + \alpha_1 CDR_{it} + \alpha_2 X_{it} + \delta_i + \gamma_t + \varepsilon_{it} \quad (1)$$

Where $i$represents the country, and t represents the year. $lnGDP_{it}$denotes the natural logarithm of the gross domestic product; CDR_{it} represents the degree of cross-border data regulation;X_{it}represents a set of control variables, including internet penetration, intellectual property protection, service trade openness, Information and Communication Technology (ICT) development, Foreign Direct Investment (FDI), and innovation level.$\delta_i$and $\gamma_t$represent country fixed effects and year fixed effects, respectively, and ε_{it} is the error term.

6.2. Variable Selection

6.2.1. Dependent Variable

Economic development ($lnGDP_{it}$): This paper measures economic development by taking the logarithm of gross domestic product (GDP). GDP is commonly used to represent the size of an economy over a given period. This variable reflects the overall extent of economic expansion in a country. By observing changes in GDP, it is possible to assess a country's economic health, trade output, employment conditions, and other dimensions of economic activity.

6.2.2. Core Explanatory Variable

With respect to the measurement of the cross-border data regulation index, early studies mainly relied on weighted back-calculations based on the data restrictiveness index released by the European Centre for International Political Economy (ECIPE). However, single-year cross-sectional data are insufficient to capture the dynamic evolution of restrictions on cross-border data flows over time. Therefore, the mainstream literature in recent years has increasingly turned to the Digital Services Trade Restrictiveness Index (DSTRI) or the Services Trade Restrictiveness Index (STRI) published by the Organisation for Economic Co-operation and Development (OECD) for cross-country panel analysis. The DSTRI database not only covers a long time span and multiple economies, but its sub-indicators also provide a refined reflection of the institutional barriers to cross-border data flows. Accordingly, this paper constructs a cross-border data regulation index (CDR_{it}) based on the OECD-DSTRI so as to accurately capture the temporal evolution of regulatory intensity across countries.

6.2.3. Control Variables

Several control variables are introduced to control for cross-country differences. Internet penetration (NET) is represented by the percentage of population with internet access. Broad internet coverage facilitates information exchange and external connections and is expected to promote economic growth. The quality of intellectual-property systems (IP) is measured by intellectual-property royalty payments as a share of GDP. Sound intellectual-property frameworks stimulate R&D, draw technology-focused investment and facilitate technology transfer, delivering positive economic effects. Services-trade openness (TRADE), defined as total services trade over GDP, improves resource allocation, raises productivity and expands employment to drive GDP increases. We use "the proportion of information and communication technology service exports in total service exports" to measure the level of ICT development in countries. ICT technological progress can not only promote innovation and improve intelligent production efficiency, but also make the service industry more diversified. Foreign direct investment (FDI) looks at the "FDI net inflow" data, which can reflect a country's ability to attract foreign investment to promote industrial upgrading and technology diffusion. Finally, we use the "total domestic R&D expenditure" to measure the level of innovation and development (RDE). Only with sufficient investment in research and development can we stimulate the potential of innovation, enhance the technical strength of local enterprises, and let the scientific research results really land, so as to support the national economic development.

6.3. The Impact of Cross-Border Data Regulation on Economic Development: Empirical Analysis

In order to test the impact of cross-border data supervision on the economy, this paper uses the LSDV estimation method with a robust standard error. The regression results are shown in Table 3. After controlling the fixed effect of the country and year and gradually adding the control variables, we found that the coefficient of the cross-border data regulation restriction index has always been significantly negative, and all have passed the 1% significance test. In the whole sample regression, the coefficient of the core explanatory variable is -1.8753, which is still significant at the level of 1%. Simply put, the stricter the cross-border data management, the more detrimental it is to a country's economic growth, which is completely consistent with the prediction of the previous theoretical analysis.

7. Conclusion and Suggestions

In the digital age, cross-border data has become a key production factor to maintain the operation of the global economy, bringing new opportunities for global growth. But at the same time, the cross-border transmission of data also brings a series of complex challenges in terms of data security, privacy protection and compliance regulation. This article first explores the possible "inverted U-shaped" relationship between cross-border data supervision and industrial chain resilience. Then, based on the panel data of 52 economies from 2014 to 2022, it further examines how the cross-border data regulation policies of various countries affect economic performance. The empirical results show that cross-border data rules that are too restrictive will indeed hinder economic development.

Based on the previous analysis and empirical results, this article puts forward some practical policy suggestions for China's data governance practice. First of all, domestic data cross-border rules must continue to be optimized, and some reasonable fine-tuning of the existing regulatory obstacles should be made.

Table 1. Cross-Border Data Regulation and Economic Development: Baseline Regression Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CDR	-1.5239***	-1.8424***	-1.8884***	-2.3459***	-2.3682***	-1.9739***	-1.8753***
	(-2.5968)	(-2.8045)	(-2.8714)	(-3.7592)	(-3.7976)	(-3.3066)	(-3.1589)
NET		-0.4614	-0.3959	0.1405	0.1394	-1.2099***	-1.4603***
		(-1.0778)	(-0.9183)	(0.3399)	(0.3376)	(-2.7548)	(-3.2807)
IP			-2.5059	7.2872***	7.7599***	8.4923***	11.8827***
			(-1.2214)	(3.1270)	(3.2987)	(3.7843)	(4.6831)
TRADE				-0.0152***	-0.0156***	-0.0143***	-0.0150***
				(-7.5647)	(-7.6955)	(-7.3469)	(-7.6981)
lnFDI						0.4457***	0.5130***
						(6.9153)	(7.5029)
ICT							-1.9018***
							(-2.7911)
Individual FE	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES
_cons	27.1110***	27.5242***	27.5103***	27.4561***	27.4768***	27.6791***	27.9414***
	(223.1197)	(68.4467)	(68.4211)	(72.2924)	(72.3664)	(76.2552)	(75.0333)
N	468	468	468	468	468	468	468
adj.R^2	0.012	0.012	0.014	0.120	0.122	0.203	0.214

Note: The values in parentheses are t-statistics. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Although strict management is necessary to prevent the security risks brought about by transnational data flow; but we can't control too much in order to pursue absolute security, which will kill economic vitality. Therefore, policymakers must find a reasonable balance between guaranteeing security and promoting development. Secondly, it is better to set up a special data regulatory agency. In this way, it can be reviewed and evaluated in different categories according to the level of data risk, which helps to make the mechanism arrangement of data supervision more reasonable and scientific.

In addition, China should also take the initiative to connect with high-standard international data rules, in order to reduce "toll fees", dig out the potential of cross-border investment, and drive economic growth. Now, the developed economies of the United States and Europe are pushing data rules favorable to themselves. Therefore, when we talk about bilateral or regional trade agreements with others, we must speak out China's ideas, put forward reasonable institutional requirements, and safeguard our own interests. At the same time, we can also communicate more with countries with similar ideas. If we work together based on common principles, we can gradually form a "circle of friends" to provide China's own plan for global data governance. Doing so can not only improve China's voice in the formulation of international data rules, but also reduce trade costs and make transnational investment go more smoothly.

Acknowledgments

This work is supported by the Ministry of Education Humanities and Social Sciences Research Project of China "*Research on Cross-border Data Regulation and the Enhancement of China's Industrial and Supply Chain Resilience*" (Grant No. 23YJC790178), the Ministry of Education Humanities and Social Sciences Research Project of China "*Standard Alignment Driving the Upgrading Path of China's Manufacturing Global Value Chain under Institutional Opening-up*", and the Higher Education Science Research Planning Project of the China Association of Higher Education "*Digital Standards Leading China-ASEAN Supply Chain Cooperation Research*" (Grant No. CA261302001).

References

[1] Cao, C. (2026). Cross-border data flow regulations and the structure of the global NEV industrial chain. Journal of International Trade & Economic Development, 35(4), 1001–1028.

[2] Dinopoulos, E., & Unel, B. (2013). A simple model of quality heterogeneity and international trade. Journal of Economic Dynamics and Control, 37(1), 68–83.

[3] Ferracane, M. F., Kren, J., & van der Marel, E. (2020). Do data policy restrictions impact the productivity performance of firms and industries? Review of International Economics, 28(3), 676–722.

[4] Ferracane, M. F., & van der Marel, E. (2021). Do data policy restrictions inhibit trade in services? Review of World Economics, 157(4), 727–776.

[5] Goldfarb, A., & Tucker, C. (2019). Digital economics. Journal of Economic Literature, 57(1), 3–43.

[6] Mattoo, A., & Meltzer, J. P. (2018). International data flows and privacy: The conflict and its resolution. Journal of International Economic Law, 21(4), 769–789.

[7] Meltzer, J. P. (2019). Governing digital trade. World Trade Review, 18(S1), S23–S48.

[8] Mitchell, A. D., & Mishra, N. (2019). Regulating cross-border data flows in a data-driven world: How WTO law can contribute. Journal of International Economic Law, 22(3), 389–416.

[9] Zouari, D., Ruel, S., & Viale, L. (2021). Does digitalising the supply chain contribute to its resilience? International Journal of Physical Distribution & Logistics Management, 51(2), 149–180.