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UK-BASED ECONOMIC & POLICY RESEARCH

Green Trade Barriers and China's New-Energy Exports

The EU Battery Regulation and the Transport-Sector New-Energy Trade

WW Analysis Limited · Research Report

As the European Union tightens the environmental rules governing battery supply chains, this report quantifies how the 2023 EU Battery Regulation reshaped China's exports of electric vehicles and power batteries — how large the shock was, how long it lasted, and which firms proved resilient.

01 · OVERVIEW

Executive Summary

Transport-sector new-energy products — principally electric vehicles (EVs) and the lithium-ion power batteries that drive them — have moved in little more than a decade from a niche category to one of the fastest-growing segments of world trade. China sits at the centre of this shift as the dominant global producer and exporter, and the European Union has become one of its most important destination markets. That mutual dependence is precisely why a change in Europe's regulatory rulebook can move a large volume of cross-border trade.

This report examines the effect of the EU Battery Regulation, which entered into force in 2023, on China's exports of transport-sector new-energy products, and how exporting firms adjusted. The regulation is a mandatory, life-cycle framework: it imposes obligations on carbon-footprint accounting, raw-material due diligence, recycled-content thresholds and a digital 'battery passport', and in doing so raises the fixed cost of accessing the European market. Using firm-level customs export data and an intensity-based (continuous) difference-in-differences design complemented by an event study, we identify how export behaviour changed around the regulation and which firm characteristics buffered the shock.

HEADLINE FINDING

The regulation produced a statistically and economically significant negative shock to power-battery exports in its early implementation phase. The effect was, however, largely short-lived: it attenuated within several months as firms adapted, and we find no evidence of persistent long-term suppression of exports.

Three messages follow for exporters, investors and policymakers:

- **Short-term disruption, medium-term recovery.** Exports of the most exposed firms fell sharply on impact and then recovered as compliance, documentation and routing adjusted. The pattern is one of adjustment, not permanent exclusion from the market.
- **Governance is resilience.** Listed firms with transparent governance and strong information disclosure absorbed the shock far better than private firms and joint ventures, which faced higher adjustment costs.
- **Compliance capability, not size alone, is decisive.** The capacity to produce verified carbon, sourcing and traceability data — the heart of the regulation — predicted who weathered the change.

The remainder of this report sets out the trade and policy context, the conceptual mechanism through which a green regulation transmits to firm-level exports, the data and identification strategy, the empirical results and their dynamics, the heterogeneity across firm types, robustness checks, and the implications for business and policy.

02 · INTRODUCTION

The new-energy trade and a new kind of trade barrier

2.1 Electric vehicles and power batteries as a growth frontier

The global transition toward carbon neutrality has turned transport electrification into a strategic industrial and trade priority. Electric vehicles and the battery cells that power them have become categories in which scale, cost and supply-chain integration translate directly into competitive advantage. China's manufacturers built that advantage early, achieving scale in cell production, cathode and anode materials, and vehicle assembly, and they now account for a leading share of global EV and battery output and exports.

Europe is central to this trade. Climate policy, fleet-electrification targets and consumer demand have made the EU a large and growing market for imported EVs and batteries, and Chinese exporters have increased their exposure to it accordingly. The flip side of that opportunity is regulatory exposure: when a major destination market changes the conditions of entry, firms that depend on it are directly affected.

2.2 From tariffs to standards: the rise of green trade barriers

Traditional trade policy operated mainly through tariffs and quotas. Increasingly, however, the binding constraints on cross-border trade are *standards* — environmental, safety and disclosure requirements that products must satisfy to enter a market. Such measures are not framed as protectionism; they pursue legitimate environmental objectives. But they nonetheless raise the cost of market access, and they do so unevenly across firms, because the ability to comply depends on data systems, supplier relationships and governance that vary widely.

The EU Battery Regulation is a leading example of this shift. It does not levy a duty; it requires verified information and minimum standards across the life cycle of a battery. Understanding how such a measure affects trade therefore requires looking past average tariff-style effects to the firm-level capacity to comply.

2.3 Research questions

- What was the magnitude of the EU Battery Regulation's effect on China's transport-sector new-energy exports?
- What was the *dynamic* path of that effect — an immediate shock, a gradual onset, or a permanent shift?
- Which firm characteristics — ownership, governance, disclosure — explain who absorbed the shock and who did not?

03 · CONTEXT

The trade landscape and Europe's green rulebook

3.1 The global green transition and the EU market

The momentum behind decarbonisation has reorganised global value chains in transport. Battery demand is concentrated where electrification policy is most advanced, and Europe's combination of regulatory ambition and limited domestic cell capacity has made it dependent on imports during its transition. For Chinese exporters, the EU represents both a large revenue opportunity and a concentration of regulatory risk.

The table below summarises the structural features of the trade relationship that make the regulation consequential.

Structural feature	Implication for exposure
China's scale in cells, materials and EV assembly	High export volumes concentrated in a few large producers
EU demand outpacing domestic battery supply	Strong near-term reliance on imported batteries and EVs
Rising Chinese export share to the EU	Greater firm-level exposure to EU regulatory change
Life-cycle, data-intensive EU rules	Advantage shifts to firms able to document supply chains

3.2 The EU Battery Regulation: scope and intent

The EU Battery Regulation establishes a mandatory framework covering the entire life cycle of batteries placed on the EU market, from raw-material sourcing through manufacturing, use and end-of-life. Rather than targeting a single product attribute, it bundles several obligations that together raise the threshold for market entry and shift competitive advantage toward firms that can verify their environmental and supply-chain credentials.

Requirement	What it obligates	Why it raises the access barrier
Carbon-footprint accounting	Declared, verified life-cycle CO ₂ for battery models	Requires upstream emissions data many suppliers cannot yet produce
Raw-material due diligence	Provenance checks and responsible-sourcing policies	Adds audit, traceability and supplier-management cost across tiers
Recycled-content thresholds	Minimum recycled inputs, rising over time	Constrains sourcing and bill-of-materials design and cost
Battery passport	Per-product digital disclosure record	Requires data infrastructure and disclosure capability at scale

The economically important point is that these are *fixed, capability-dependent* costs. A firm that already operates mature carbon-accounting and traceability systems can comply at relatively low marginal cost; a firm without them faces a step change in overhead and, in the interim, the risk of disrupted shipments. This is the channel through which a uniform regulation produces sharply unequal effects across exporters.

04 · FRAMEWORK

How a green regulation transmits to firm exports

To interpret the empirical results, it helps to set out the mechanism linking the regulation to firm-level export behaviour. The regulation acts as a compliance shock concentrated on firms with high exposure to the EU market. On its introduction, exposed firms face three simultaneous pressures: documentation requirements that may delay or block shipments lacking the necessary data; one-off investments in carbon accounting, sourcing due diligence and passport infrastructure; and uncertainty about how strictly requirements will be enforced in the early period.

The predicted response is therefore an initial decline in exports among the most exposed firms, followed by recovery as firms build compliance capacity and clear the documentation backlog. The

speed and depth of that adjustment should depend on a firm's pre-existing governance and disclosure systems — the central hypothesis tested in the heterogeneity analysis. Product structure matters too: power batteries, the most directly regulated product, should bear the sharpest initial impact.

WHY THE DYNAMICS MATTER

A measure that causes a one-off, recoverable disruption has very different welfare and policy implications from one that permanently shuts firms out of a market. Distinguishing the two requires tracing the effect over time — which is why the analysis pairs a difference-in-differences estimate with an event study.

05 • DATA

Firm-level customs evidence

5.1 Source and coverage

The analysis is built on firm-level customs import–export records, which report export values and destination markets at the level of the individual exporting firm. This granularity is essential: the regulation's effect operates through firm-level exposure and capability, and only firm-level data allow that exposure to be measured and exploited for identification.

5.2 Processing and variables

The raw records are cleaned and aggregated to a consistent firm-by-period panel of exports to the EU and to other destinations. The key variables used in the analysis are summarised below.

Variable	Role	Definition
Export value to EU	Outcome	Firm-period export value of new-energy products to the EU
EU export share (pre-policy)	Exposure	Share of a firm's exports going to the EU before the regulation
Post-policy indicator	Timing	Periods on and after the regulation's entry into force
Firm controls	Controls	Ownership type, size, product mix and related characteristics

5.3 Descriptive patterns and limitations

Descriptive statistics show wide dispersion in EU exposure across firms, which is the variation the identification strategy exploits. As with any customs-based study, several limitations apply: customs values capture shipments rather than profitability; firm attributes are observed imperfectly; and the window around the policy, while sufficient to identify the short-to-medium-term dynamics, does not speak to effects over a multi-year horizon. These caveats bound the interpretation but do not undermine the central, well-identified result on the timing and incidence of the shock.

06 • METHOD

Identification strategy

6.1 Continuous difference-in-differences

The empirical strategy exploits cross-firm variation in *exposure* to the policy. Rather than splitting firms crudely into ‘treated’ and ‘control’ groups, we use each firm’s pre-regulation share of exports to the EU as a continuous measure of policy-exposure intensity. Firms with a higher EU share are mechanically more exposed to a regulation that governs the EU market. The continuous difference-in-differences design compares the change in export behaviour of more-exposed versus less-exposed firms, before versus after the regulation took effect.

Formally, the outcome is regressed on the interaction of exposure intensity with the post-policy indicator, alongside firm and time fixed effects and controls. The coefficient on that interaction measures how much more (or less) exposed firms changed their exports relative to less-exposed firms around the policy date.

6.2 Identifying assumptions

Identification rests on a parallel-trends assumption: absent the regulation, more- and less-exposed firms would have followed comparable export trajectories. Firm fixed effects absorb fixed differences across firms, time fixed effects absorb common shocks (such as aggregate demand or exchange-rate movements), and the event study provides a direct test of pre-policy parallelism.

6.3 Event study

The event-study specification replaces the single post-policy term with a set of period-specific coefficients, tracing the effect month by month around the regulation’s entry into force. This serves two purposes: it tests for pre-trends (which would invalidate the design) and it reveals the *dynamic path* of the effect — the onset, depth and duration of any shock — rather than collapsing it into a single average.

07 • RESULTS

What the evidence shows

7.1 Event-study dynamics

The event study shows no meaningful divergence between more- and less-exposed firms in the periods before the regulation, supporting the parallel-trends assumption. Around the entry into force, more-exposed firms experience a clear decline in power-battery exports relative to less-exposed firms — the early-stage negative shock. The estimated effect then narrows over the following periods, consistent with firms adapting their compliance and documentation.

7.2 Regression estimates

The difference-in-differences regression confirms a statistically and economically significant initial effect: greater EU exposure is associated with a larger fall in exports immediately after the regulation. Crucially, the effect is stage-dependent rather than permanent. Within several months the gap closes substantially, and the data show no evidence of a persistent long-term suppression of exports. The overall picture is one of disruption followed by recovery.

INTERPRETATION

The regulation behaved like an adjustment cost concentrated on the most exposed firms, not a permanent market closure. Exporters that could meet the new documentation and standards re-established their EU sales; the cost was borne mainly in the transition.

7.3 Mechanisms

The pattern is consistent with the compliance-shock mechanism set out above: an initial disruption driven by documentation and capability gaps, resolved as firms invest in the systems the regulation requires. Power batteries — the most directly regulated product — show the sharpest initial response, as the mechanism predicts.

08 · HETEROGENEITY**Who absorbed the shock****8.1 Ownership and governance**

The aggregate result conceals substantial variation across firm types. Listed firms — which typically operate more developed governance, internal controls and information-disclosure systems — were markedly more resilient: their exports recovered faster and their losses were smaller. Private firms and joint ventures faced relatively higher adjustment costs, consistent with thinner compliance capacity and less mature traceability and disclosure infrastructure.

8.2 Time dynamics of heterogeneity

The heterogeneity is itself dynamic. The gap between well-governed and less-well-governed firms is widest in the immediate aftermath of the regulation and narrows over time as laggard firms build capability. This reinforces the central interpretation: the binding constraint was the *capacity to comply*, and that capacity could be acquired, albeit at a cost and with a lag.

MANAGEMENT IMPLICATION

Investment in governance, disclosure and supply-chain traceability functions like an insurance policy against tightening environmental market-access rules: it shortens the disruption and lowers its cost. The return on that investment is realised precisely when the regulatory environment changes.

09 · ROBUSTNESS**Confidence in the findings**

The core results are robust to alternative specifications of exposure and to the inclusion of additional controls, and the event-study cross-check reproduces the benchmark difference-in-differences pattern of an early shock that fades over subsequent months. The consistency of the estimated effect across designs increases confidence that it reflects the regulation rather than confounding trade dynamics such as aggregate demand swings or exchange-rate movements, which are absorbed by the time fixed effects.

We also probe the timing of the effect to ensure it aligns with the regulation's entry into force rather than anticipatory behaviour, and we confirm that the absence of pre-trends holds across

specifications. Taken together, the robustness checks support a causal reading of the short-term disruption and medium-term recovery.

10 · IMPLICATIONS

For business, investors and policy

10.1 For exporters

- Treat compliance infrastructure — carbon accounting, sourcing due diligence and battery-passport data — as a strategic investment to be made *ahead of* regulatory deadlines, not after.
- Map exposure by destination market and product, and prioritise readiness where exposure and regulatory intensity are highest.
- Build supplier-level traceability early; much of the adjustment cost in the data fell on firms that lacked verified upstream data.

10.2 For investors and buyers

- Governance quality is a leading indicator of resilience to environmental regulation in supply-chain-intensive sectors; it belongs in due-diligence frameworks.
- Firms with mature disclosure are better positioned to retain access to regulated markets and to command preferential supplier status.

10.3 For policymakers

- Green trade barriers can be absorbed where firms have the capacity to comply; clear data standards, advance notice and transition support reduce avoidable disruption.
- The distributional impact — heavier on smaller and less-governed firms — is a design consideration where broad-based compliance is the goal.

11 · INTERNATIONAL CONTEXT

Beyond Europe: a converging pattern

The EU Battery Regulation is the frontrunner of a broader movement, not an isolated measure. Other major markets are advancing their own carbon-border, content and supply-chain-disclosure rules, and the common direction of travel is toward standards-based, data-intensive regulation of imports. For Chinese exporters this matters in two ways. First, it raises the stakes of building compliance capability, because the capability transfers: the carbon-accounting and traceability systems assembled for the EU are largely reusable for the next market that adopts comparable rules. Second, it changes the calculus of market diversification.

Diversifying sales across destinations has historically been a natural hedge against single-market regulatory risk. As environmental rules converge internationally, however, diversification reduces exposure to any one regulator but does not remove the underlying compliance imperative, since the requirements themselves are becoming similar across markets. The firms best placed are therefore those that treat compliance not as a market-specific cost but as a portable capability that travels with their products.

STRATEGIC READ

As green market-access rules converge across major economies, the right response is not to chase the least-regulated market but to build portable compliance capability. The investment made for Europe is, increasingly, an investment in global market access.

12 · OUTLOOK**Tightening rules and three scenarios**

The EU Battery Regulation is designed to tighten over time: recycled-content thresholds rise, due-diligence enforcement intensifies, and the battery passport moves from phase-in to full operation. The short-term shock documented in this report is therefore the first of a sequence of adjustment moments rather than a one-off. How the trade evolves depends on how quickly firms and supply chains build the required capability. We sketch three medium-term scenarios.

Scenario	Mechanism	Trade outcome
Smooth adaptation	Firms invest ahead of deadlines; supply chains build traceability	Trade normalises at a higher compliance cost; volumes recover
Bifurcation	Well-governed firms consolidate EU share; weaker firms exit or redirect	Concentration of EU-facing exports among compliant, larger firms
Friction escalation	Green barriers proliferate across markets faster than firms adapt	Higher costs and recurring disruption across multiple destinations

The evidence in this report — an early shock followed by recovery, with resilience concentrated among well-governed firms — is most consistent with a path between smooth adaptation and bifurcation. The decisive variable is the speed at which the broad base of exporters, beyond the largest listed firms, builds compliance capability.

13 · CONCLUSION**Short-term shock, medium-term adjustment**

The EU Battery Regulation produced a clear pattern: a significant negative shock to China's power-battery exports in the early implementation phase, followed by recovery within months as firms adapted, with no evidence of persistent long-term suppression. The burden fell unevenly, concentrated on firms with weaker governance and disclosure, and eased as compliance capacity was built.

For an economy in which green trade barriers are becoming the dominant form of market-access regulation, the lesson is constructive: such barriers are navigable, and the firms that invest early in environmental data, traceability and governance convert a source of disruption into a source of competitive advantage.

About WW Analysis Limited. WW Analysis is a UK-based economic and market research consultancy. We turn economic data, market behaviour and policy dynamics into decisions our clients can defend. For the

full methodology, data appendix, or bespoke research on green trade barriers and the new-energy economy, contact ww.analysis.uk@gmail.com. Methodology and data available on request.

APPENDIX A**The wider green-trade-barrier landscape**

The EU Battery Regulation is one instrument in a broader and rapidly expanding system of environmental market-access rules. Read in isolation it looks like a battery-specific measure; read in context it is part of a structural shift in how advanced economies regulate imports, with implications well beyond batteries.

A.1 A system, not a single rule

Alongside the Battery Regulation, the EU has advanced a carbon border adjustment mechanism for emissions-intensive goods, due-diligence and deforestation requirements affecting a range of supply chains, and eco-design and digital-product-passport initiatives that extend the logic of life-cycle disclosure to other product categories. Each rests on the same architecture: verified data, supply-chain traceability, and minimum environmental standards as conditions of market entry. Firms that build the underlying data capability for one rule are better placed for the next.

A.2 Why standards-based barriers behave differently from tariffs

A tariff is a price; a standard is a capability test. A price raises the cost of every unit uniformly and is, in principle, payable by any exporter. A capability test can be binding regardless of price: a firm that cannot produce the required carbon or sourcing data cannot ship at all until it can, no matter how competitive its costs. This is why the effects of standards-based barriers are concentrated and lumpy at the firm level, and why they reward investment in compliance infrastructure rather than simply squeezing margins.

STRATEGIC READ

The direction of travel in major markets is toward more standards-based, data-intensive trade regulation. The capability a firm builds to satisfy the EU Battery Regulation is a down-payment on access to a widening set of regulated markets.

APPENDIX B**Sector deep-dives****B.1 Electric vehicles**

Finished electric vehicles sit at the end of the regulated value chain. Their exposure to the Battery Regulation is indirect but real: the battery pack is the single most regulated and most valuable component, and a vehicle's access to the EU market is therefore tied to its battery's compliance. Vehicle exporters with integrated or closely-managed battery supply chains are better able to assemble the required documentation than those sourcing cells at arm's length.

B.2 Power cells and packs

Power batteries are the direct object of the regulation and, in the data, the product category that bears the sharpest initial impact. Carbon-footprint accounting, recycled-content thresholds and the battery passport apply most concretely here. Cell makers with established environmental-management and disclosure systems experienced the smallest and shortest disruption; those without faced the steepest adjustment.

B.3 Materials and components

Upstream materials and components are drawn into the regulation through due-diligence and recycled-content requirements that flow up the supply chain. Because compliance at the cell and vehicle level depends on data from suppliers, traceability becomes a shared obligation: a well-prepared exporter can still be constrained by an unprepared supplier. This interdependence is part of why firm-level governance and supplier management predicted resilience.

APPENDIX C

Data and variable construction

This appendix documents the construction of the analysis panel in more detail to support replication and to make the identification transparent.

- **Unit of observation.** The firm-by-period panel records, for each exporting firm and time period, export values disaggregated by destination (EU versus rest of world) and by product category.
- **Outcome variable.** Firm-period export value of transport-sector new-energy products to the EU, with power batteries identified separately as the most directly regulated product.
- **Exposure measure.** Each firm's pre-regulation share of exports going to the EU, fixed at its pre-policy value so that exposure is predetermined with respect to the policy.
- **Controls.** Ownership type (listed, private, joint venture), firm size, and product mix, alongside firm and time fixed effects.
- **Sample treatment.** Standard cleaning of customs records, removal of inconsistent entries, and aggregation to a balanced firm-period structure over the policy window.

Because exposure is measured before the policy and the design includes firm and time fixed effects, the estimates are not driven by fixed differences across firms or by economy-wide shocks common to all exporters in a period.

APPENDIX D

Methodology notes

D.1 The continuous difference-in-differences estimator

The estimating equation regresses the export outcome on the interaction between continuous exposure intensity and a post-policy indicator, with firm and time fixed effects and controls. The coefficient on the interaction is the difference-in-differences estimate: the differential change in exports for a marginal increase in EU exposure after the regulation relative to before. Using a continuous exposure measure rather than a binary treatment improves precision and avoids arbitrary group cut-offs.

D.2 Event-study specification

The event study replaces the single post-policy term with period-specific interactions between exposure and time, normalised to the period immediately before the policy. The resulting coefficients trace the dynamic path of the effect. Flat, near-zero coefficients before the policy support parallel trends; a downward step on implementation followed by a return toward zero captures the short-term shock and medium-term recovery.

D.3 Robustness battery

Robustness checks include alternative exposure definitions, additional controls, placebo timing tests, and the event-study cross-check against the benchmark difference-in-differences result. The estimated short-term disruption and subsequent recovery are stable across these variations.

GLOSSARY

Key terms of the EU Battery Regulation

Term	Meaning
Carbon footprint declaration	A verified statement of a battery model's life-cycle greenhouse-gas emissions
Due diligence	Obligations to identify and address environmental and social risks in raw-material sourcing
Recycled-content threshold	Minimum proportion of recycled material required in new batteries, rising over time
Battery passport	A digital record holding a product's compliance and life-cycle data, accessible to regulators and buyers
Life-cycle scope	Coverage spanning sourcing, manufacture, use and end-of-life, rather than a single attribute
Policy-exposure intensity	A firm's pre-policy reliance on the EU market, used to measure how strongly it is affected

APPENDIX E

A compliance-readiness checklist for exporters

Drawing the analysis together, the following practical checklist captures the capabilities that distinguished resilient firms in the data. It is intended as a starting point for exposure assessment rather than an exhaustive compliance guide.

- Carbon accounting.** Establish verified life-cycle carbon-footprint data for each battery model, with the upstream supplier data needed to support it.
- Sourcing due diligence.** Document raw-material provenance and responsible-sourcing policies across supply-chain tiers, not only at the final stage.
- Recycled content.** Track recycled-input shares against current and scheduled thresholds, and design bills of materials with future thresholds in mind.
- Battery passport readiness.** Build the data infrastructure to populate per-product digital disclosure records at scale.
- Governance and disclosure.** Strengthen internal controls and information disclosure — the single strongest predictor of resilience in the analysis.
- Exposure mapping.** Quantify exposure by destination market and product, and prioritise readiness where exposure and regulatory intensity are highest.

FURTHER READING

Sources and context

This report draws on firm-level customs trade data and on the published text and official guidance surrounding the EU Battery Regulation, set against the wider literature on non-tariff measures, environmental regulation and firm export behaviour. A full data appendix and reference list are available to clients on request, along with bespoke extensions — for example, exposure mapping for a specific product portfolio or destination-market readiness assessments.