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Determinants of Electric Vehicle Sales in G20 Countries: A Marketing Management Perspective

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ABSTRACT

This study analyzes the macroeconomic, institutional, and market confidence determinants of electric vehicle (EV) sales across 17 G20 countries during the 2020–2024 period. Drawing on Marketing Environment Theory and the Environmental Kuznets Curve framework, panel data regression using the Random Effects Model (REM)—selected via Chow, Hausman, and Lagrange Multiplier tests—was conducted. The empirical results indicate that Gross Domestic Product (GDP) and the Business Confidence Index (BCI) exert a negative and statistically significant effect on EV sales, whereas the Consumer Confidence Index (CCI) displays a positive and significant effect. Government Effectiveness (GE) does not exhibit a statistically significant impact in the full model. Overall, the model demonstrates high validity with a Prob > F value of 0.000. These findings highlight that EV adoption is driven not only by raw economic expansion but also by market confidence dynamics and ecosystem readiness. Strategic recommendations emphasize charging infrastructure development, targeted B2B/B2C marketing, and consistent policy integration to accelerate sustainable EV transition.

Keywords: Electric Vehicle Sales; Gross Domestic Product; Consumer Confidence Index; Business Confidence Index; G20 Countries

1. INTRODUCTION

Global climate change represents one of the most critical challenges to sustainable development in the 21st century. According to the Intergovernmental Panel on Climate Change (IPCC, 2023), the transportation sector stands out as a primary contributor to greenhouse gas emissions due to its heavy reliance on fossil fuels. To mitigate these impacts and meet net-zero emission targets, governments worldwide are fostering green transportation systems. Electric vehicles (EVs) have emerged as a disruptive innovation capable of driving this low-carbon transition by delivering superior energy efficiency and zero tailpipe emissions. Reports from the International Energy Agency (IEA, 2024) indicate that global EV sales have grown exponentially, transforming from a niche segment into a central pillar of the automotive industry.

Developing the EV market directly aligns with the Sustainable Development Goals (SDGs), particularly Goal 7 (Affordable and Clean Energy), Goal 9 (Industry, Innovation, and Infrastructure), Goal 11 (Sustainable Cities), and Goal 13 (Climate Action). Within this global trajectory, the Group of Twenty (G20) nations play a pivotal role, representing over 85% of global GDP, 75% of international trade, and two-thirds of the world population. However, the adoption rates of EVs across G20 countries exhibit stark disparities. While market leaders such as China, Germany, and the United States demonstrate rapid market penetration, emerging economies within the G20 face structural bottlenecks including infrastructure gaps, higher upfront costs, and macro-financial uncertainties.

From a marketing management perspective, EV sales reflect market performance resulting from the interaction between corporate strategies, consumer behavior, and the macro-marketing environment. Kotler et al. (2022) emphasize that macro-environmental forces—comprising economic, political, technological, and socio-cultural dimensions—shape consumer purchasing power and confidence. High-involvement products like EVs require substantial capital investment, rendering purchase intentions highly sensitive to economic growth (GDP), market sentiment (CCI and BCI), and governance quality (Government Effectiveness).

Despite a growing body of literature on EV adoption, prior empirical studies often analyze economic variables, environmental policies, or individual consumer perceptions in isolation. Few studies systematically integrate macroeconomic indicators with consumer and business confidence metrics across G20 nations using panel econometrics. To fill this research gap, this study investigates how GDP, CCI, BCI, and Government Effectiveness jointly influence EV sales volume across 17 G20 member countries from 2020 to 2024.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Theory of Marketing Environment and Environmental Kuznets Curve

The theoretical foundation of this study integrates Marketing Environment Theory (Kotler et al., 2022) with the Environmental Kuznets Curve (EKC) framework (Panayotou, 1993; Grossman & Krueger, 1995). The marketing environment framework posits that macro-level environmental forces—economic growth, political governance, and technological infrastructure—determine the boundaries of market feasibility and customer delivered value. EVs, as high-involvement eco-innovations, require a supportive macro environment to transition from niche markets into mass adoption.

Complementarily, the EKC hypothesis postulates an inverted U-shaped relationship between economic growth (GDP per capita) and environmental degradation. In early stages of economic development, growth prioritizes low-cost fossil-fuel consumption. However, once a turning point is reached, rising national income shifts public preferences toward environmental quality and sustainable technologies. In marketing terms, post-turning point GDP growth alters customer value propositions, turning green products like EVs from luxury status symbols into mass-market necessities.

2.2. Gross Domestic Product (GDP) and EV Sales

GDP reflects the overall economic activity, purchasing power, and household disposable income within an economy. Under Keynesian consumption theory and Rogers' (2003) Diffusion of Innovations theory, higher income levels accelerate the adoption of technological innovations by enhancing consumer affordability. Empirically, studies such as Sierzchula et al. (2014) and Li et al. (2020) show that per capita income is a critical driver of EV adoption. However, when controlling for market saturation and post-pandemic economic shifts, rapid GDP expansion in certain developing G20 economies may still prioritize traditional infrastructure over premium green technology. Thus:

- **H1:** Gross Domestic Product (GDP) significantly influences Electric Vehicle sales across G20 countries.

2.3. Consumer Confidence Index (CCI) and EV Sales

The Consumer Confidence Index (CCI) serves as a key psychological leading indicator measuring household optimism regarding future financial security and economic stability (OECD, 2024). High CCI reduces perceived financial risk, encouraging high-involvement expenditure on durable high-tech goods like EVs (Dees & Brinca, 2013; Solomon, 2023). Conversely, falling confidence causes buyers to delay major capital expenditures.

- **H2:** Consumer Confidence Index (CCI) has a positive and significant effect on Electric Vehicle sales across G20 countries.

2.4. Business Confidence Index (BCI) and B2B Market Adoption

Commercial fleet adoption, corporate leasing, and B2B logistics form a substantial portion of total EV sales. Business Confidence Index (BCI) reflects supply-side readiness, corporate capital expenditure optimism, and ecosystem investment willingness (Lilien, 2016; OECD, 2024). However, during periods of economic rebalancing or high interest rates, elevated corporate expectations may coincide with conservative fleet replacement cycles or capital reallocation away from high upfront cost EV fleets.

- **H3:** Business Confidence Index (BCI) significantly affects Electric Vehicle sales across G20 countries.

2.5. Government Effectiveness (GE) and Governance

World Bank's Government Effectiveness (GE) metric captures the quality of public service delivery, bureaucratic competence, and policy consistency. Institutional Theory (North, 1990) suggests that effective institutions reduce transaction costs and market uncertainty. High GE facilitates coherent EV charging infrastructure deployment, stable tax subsidies, and clear regulatory frameworks.

- **H4:** Government Effectiveness (GE) has a positive and significant effect on Electric Vehicle sales across G20 countries.

3. RESEARCH METHODOLOGY

3.1. Research Design and Data Sources

This study employs a quantitative panel data regression design combining cross-sectional observations across 17 G20 member nations over a 5-year longitudinal window (2020–2024). The European Union is treated as a regional organization rather than a single country, and certain members were excluded due to data availability. Secondary data were compiled from verified international statistical databases:

Table 3.1: Description of Variables and Data Sources

Variable	Abbreviation	Operational Definition / Measurement	Source
Electric Vehicle Sales	EV	Total annual EV unit sales volume (BEV & PHEV)	IEA Global EV Outlook (2024)
Gross Domestic Product	GDP	Annual GDP growth percentage (%)	World Bank WDI (2024)
Consumer Confidence Index	CCI	Normalized psychological consumer sentiment index	OECD Indicators (2024)
Business Confidence Index	CBI / BCI	Normalized corporate market sentiment index	OECD Indicators (2024)
Government Effectiveness	GE	World Governance Indicator index score (-2.5 to +2.5)	World Bank WGI (2024)

3.2. Econometric Model Specification

To evaluate the empirical relationships, three panel regression specifications were constructed:

Model 1 (Baseline Model):

$$EV_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 GE_{it} + \varepsilon_{it}$$

Model 2 (Extended Sentiment Model):

$$EV_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 CCI_{it} + \beta_3 CBI_{it} + \varepsilon_{it}$$

Model 3 (Full Integrated Model):

$$EV_{it} = \alpha + \beta_1 GDP_{it} + \beta_2 GE_{it} + \beta_3 CCI_{it} + \beta_4 CBI_{it} + \varepsilon_{it}$$

Where i denotes the country ($i = 1, ..., 17$), t denotes the time period ($t = 2020, ..., 2024$), α is the intercept, β_k are parameters to be estimated, and ε_{it} is the idiosyncratic error term.

3.3 Model Selection Diagnostic Procedures

Panel model selection followed standard econometric diagnostic protocols:

1. Chow Test: Compares Common Effect Model (CEM) versus Fixed Effect Model (FEM).
2. Hausman Test: Evaluates systematic correlation between individual effects and regressors to decide between FEM and Random Effect Model (REM).
3. Lagrange Multiplier (LM) Test: Validates REM against CEM.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1 summarizes the descriptive statistics for all sample variables across the 2020–2024 period.

Table 4.1: Summary Descriptive Statistics (2020–2024)

Variable	Unit	Mean	Std. Dev.	Min	Max
EV	Units	1,639,036	4,685,294.41	396	34,000,820
GDP	%	2.15	4.17	-10.30	11.44
GE	Index score	67.48	15.01	45.09	91.94
CCI	Index	96.02	12.13	45.25	104.46
CBI / BCI	Index	97.46	11.56	46.70	105.47

The extreme variance in EV sales (ranging from 396 to 34,000,820 units) demonstrates substantial market concentration, with major market share held by China, the United States, Germany, and the UK. Macroeconomic variables reflect post-pandemic fluctuations, recovering sharply in 2021 before stabilizing through 2024.

4.2 Panel Model Specification Diagnostics

The diagnostic decision rules determined the optimal panel regression structure as summarized in Table 4.2:

Table 4.2: Model Specification Diagnostic Tests

Test Method	Null Hypothesis (H_0)	Prob. Value	Decision
Chow Test	CEM is appropriate	0.0000	Reject H_0 → Select FEM
Hausman Test	Difference in coefficients not systematic	0.3379	Accept H_0 → Select REM
Lagrange Multiplier (LM)	No random effect variance	0.0000	Reject H_0 → Confirm REM

The Hausman test p-value (p = 0.3379) confirms that individual country effects are uncorrelated with explanatory variables, confirming that Random Effect Model (REM) via Generalized Least Squares (GLS) provides the most efficient, unbiased estimators (Baltagi, 2021; Wooldridge, 2020).

4.3 Panel Regression Analysis

Table 4.3: Random Effects Model (REM) Regression Results

Variable	Model 1 (Baseline)	Model 2 (Extended)	Model 3 (Full Model)
GDP	0.448*** (0.003)	0.514*** (0.000)	-0.181*** (0.000)
GE	0.079*** (0.002)	—	0.875 (0.102)
CCI	—	0.091 (0.109)	0.274** (0.019)
CBI / BCI	—	-0.141** (0.022)	-0.088*** (0.003)
Constant	5.151*** (0.007)	—	—
Prob > F	**0.000**	**0.000**	**0.000**

Notes: Parentheses indicate p-values. *** p < 0.01, ** p < 0.05, * p < 0.10.

4.4 Empirical Discussion

Across all three estimated models, the joint probability (Prob > F = 0.000) validates the overall explanatory power of the integrated macro-marketing framework.

In Model 1 and Model 2, GDP exhibits a strong positive relationship with EV sales (β = 0.448 and β = 0.514, p < 0.01). This aligns with classical economic theory and studies by Sierzchula et al. (2014), indicating that income growth expands consumer purchasing power for durable goods. However, in Model 3 (Full Model), when controlling for market sentiment and governance variables, GDP shifts to a negative coefficient (β = -0.181, p < 0.01). This control effect (Wooldridge, 2020) suggests that macro GDP expansion alone does not guarantee EV sales unless matched by favorable market sentiment and infrastructure investments. In fast-growing developing G20 economies, GDP expansion often correlates with mass-market purchases of lower-cost internal combustion engine (ICE) vehicles rather than premium EVs.

The Consumer Confidence Index (CCI) exhibits a positive and statistically significant impact in Model 3 (β = 0.274, p = 0.019). This confirms Hypothesis 2, supporting Rogers' (2003) innovation diffusion model and consumer sentiment theory (Dees & Brinca, 2013). When households are optimistic about future financial security, their willingness to pay for premium, high-involvement eco-innovations increases.

Conversely, the Business Confidence Index (BCI) yields a consistent negative and statistically significant coefficient (β = -0.088, p = 0.003 in Model 3). In a post-pandemic macro environment, high business confidence scores often coincide with central bank monetary tightening and elevated interest rates aimed at controlling inflation. Higher interest rates increase corporate financing costs for fleet electrification capital expenditure (CapEx), causing B2B buyers to delay large fleet transformations despite high strategic optimism.

Finally, Government Effectiveness (GE) shows a significant positive impact in Model 1 (β = 0.079, p = 0.002), but loses statistical significance in the full model (p = 0.102). This indicates that broad institutional efficiency serves as a necessary baseline condition, but specific targeted policy instruments—such as direct financial incentives, localized charging networks, and tax rebates—are required to directly drive consumer conversion.rational-subsistent trap. Because the actors possess low educational backgrounds and no formal business training, they utilize a simple word-of-mouth approach that keeps the money circulating strictly within the village ecosystem. While this social interaction strengthens horizontal communal ties and fosters local economic independence, it creates a stagnant market equilibrium. To transition these micro-enterprises from a passive mechanism of poor family survival into an active vehicle for upward socioeconomic mobility, external institutional interventions in the form of capital injections and structural digital literacy training are fundamentally required

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study investigated the macro-marketing determinants of EV sales across 17 G20 nations from 2020 to 2024 using panel data econometrics. The Random Effects Model demonstrates that EV sales volume is strongly driven by consumer sentiment (CCI) and influenced by corporate business confidence (BCI) and broader economic indicators (GDP). Raw economic expansion alone is insufficient to drive the transition toward sustainable mobility unless supported by positive consumer expectations and well-structured B2B financing frameworks.

5.2 Managerial and Policy Implications

For Automotive Marketers & Manufacturers:

1. Segment-Specific Positioning: Automotive marketers should tailor strategies according to consumer psychological sentiment. During high CCI periods, premium sustainability marketing should be emphasized; during economic uncertainty, pricing transparency, total cost of ownership (TCO) advantages, and long-term battery warranties must be highlighted.

2. Flexible B2B Commercial Schemes: To overcome negative interest-rate/BCI friction in B2B adoption, manufacturers should introduce flexible EV-as-a-Service (EVaaS), structured fleet leasing, and battery swapping models to lower upfront corporate CapEx barriers.

For Policymakers:

1. Targeted Ecosystem Subsidies: Rather than relying solely on general governance capacity, governments must maintain consistent tax incentives, mandate public charging infrastructure standards, and incentivize private-sector charging station installations.

2. Monetary & Fiscal Alignment: Fiscal green transition policies must be coordinated with monetary policy to ensure green vehicle credit lines remain accessible even during inflation-control cycles.

5.3 Limitations and Future Research

This study faces limitations regarding secondary panel data availability over a 5-year post-pandemic period. Future research should extend the observation window, incorporate micro-level parameters (e.g., local charging point density, battery cost variations, fuel price differentials), and perform sub-sample comparative analyses between developed and developing G20 economies.

REFERENCES

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies*, 2(4), 314–324.

Alesina, A., & Summers, L. H. (1993). Central bank independence and macroeconomic performance: Some comparative evidence. *Journal of Money, Credit and Banking*, 25(2), 151–162.

Baltagi, B. H. (2021). *Econometric Analysis of Panel Data* (6th ed.). Springer.

Dees, S., & Brinca, P. (2013). Consumer confidence and consumption growth: A structural investigation. *Journal of Macroeconomics*, 38, 120–131.

Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The Quarterly Journal of Economics*, 110(2), 353–377.

International Energy Agency (IEA). (2024). *Global EV Outlook 2024: Scaling up the transition to electric mobility*. Paris: IEA.

Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2023: Synthesis Report*. Geneva: IPCC.

Kotler, P., Keller, K. L., & Chernev, A. (2022). *Marketing Management* (16th ed.). Pearson.

Li, W., Long, R., Chen, H., & Geng, J. (2020). A review of factors affecting EV adoption capacity. *Renewable and Sustainable Energy Reviews*, 122, 109725.

Lilien, G. L. (2016). The B2B knowledge gap and the B2B marketing agenda. *International Journal of Research in Marketing*, 33(3), 543–556.

OECD. (2024). *Consumer and Business Confidence Indicators*. Paris: OECD Publishing.

Panayotou, T. (1993). *Empirical tests and policy implications of environmental Kuznets curves*. Working Paper, ILO.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Sierzchula, W., Bakker, S., Maat, K., & van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Transportation Research Part D: Transport and Environment*, 32, 183–194.

Solomon, M. R. (2023). *Consumer Behavior: Buying, Having, and Being* (13th ed.). Pearson.

Wooldridge, J. M. (2020). *Introductory Econometrics: A Modern Approach* (7th ed.). Cengage Learning.

World Bank. (2024). *Worldwide Governance Indicators (WGI) & World Development Indicators*. Washington, DC: World Bank.