

Research on the Impact of Elon Musk's Business Empire on Global Macroeconomy

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Abstract: In the context of accelerating technological disruption and global energy transition, Elon Musk's enterprises, including Tesla and SpaceX, have emerged as pivotal forces reshaping industries and macroeconomic dynamics. This paper investigates the impact of Musk's business empire on the global macroeconomy, focusing on its role in driving structural changes in the energy, transportation, and aerospace sectors. The study aims to elucidate how Musk's innovations reconfigure industrial landscapes, alter geopolitical economic power, and generate new growth drivers. The research employs a mixed-methods approach: case studies of Tesla and SpaceX are analyzed to assess their industry-level disruptions and uses some data for analysis. Primary data sources include corporate financial reports, industry datasets (e.g., International Energy Agency), and government publications (e.g., U.S. Bureau of Labor Statistics). Comparative analysis is utilized to contrast Musk's vertically integrated model with traditional industries. The findings reveal four key outcomes: First, Musk's industries reshape traditional industries. Second, geopolitical economic power shifts, raising resource-rich countries' status. Third, they have a huge impact on employment. Last but not least, Tech giants' vertical integration brings problems, urging an international governance framework.

Keywords: Tesla, SpaceX, Energy Transition, Global Macroeconomy

1. Introduction

The business empire of Elon Musk, with Tesla and SpaceX at its core, by virtue of the "vertical integration production paradigm" and "disruptive cost reconstruction", is triggering drastic changes in the global industrial chain and a paradigm shift in macroeconomic indicators. The electric vehicle revolution driven by Tesla not only forces the German automotive industry to passively embrace electrification but also reshapes regional supply chains through "super manufacturing nodes" such as the Shanghai Gigafactory. However, some of Musk's core enterprises have also led to certain problems, which are also the focus of this paper:

First, industrial reshaping- Tesla's electrification disruption forces the traditional automotive industry to undergo a comprehensive transformation and drives dramatic changes in the landscape of the energy and communication industries. Second, the transfer of geo-economic power--the decline of the petroleum economy weakens the influence of oil-producing countries such as the Organization of the Petroleum Exporting countries, while the surging demand for "green metals" such as lithium and rare earths strengthens the strategic position of resource-rich countries.

Third, the polarization effect on investment and employment-Tesla's Gigafactories reshape regional economies through the "geographical anchoring model". This paper simulates the substitution effect of the industrial chain through the "Global Trade Analysis Project (GTAP)" model and combines cases such as the transformation of the German automotive industry and Indonesia's nickel export control to quantify the transmission mechanism of Musk-style innovation on global GDP, trade flows and geopolitical risks. This paper can reveal the impact of technological innovation, clarify the role of some private enterprises led by Musk in the macroeconomy, and provide directions for the healthy development of the industry and policy formulation.

2. The Core Areas and Disruptive Innovations of Elon Musk's Business Empire

2.1. Analysis of Key Industries

2.1.1. Tesla: The Popularization of Electric Vehicles Accelerates the Global Energy Transition

Tesla has continuously launched high-performance, long-range and technologically appealing electric vehicle models, such as Model 3 and Model Y, etc., attracting consumers with its excellent product capabilities. By building infrastructure like the Supercharger network, it addresses users' charging anxiety. It also takes advantage of economies of scale and technological innovation to reduce costs, making electric vehicles more price-competitive. At the same time, Tesla has made continuous breakthroughs in battery technology and autonomous driving technology, leading the development direction of the industry and inspiring other automakers to follow suit. By making joint efforts from both the supply and demand sides, it promotes the widespread application of electric vehicles, thus accelerating the global energy transition from traditional fossil fuels to clean energy [1].

2.1.2. SpaceX: Low-cost Aerospace Technology Drives the Space Economy and Satellite Internet

Founded in 2002, SpaceX has significantly reduced the cost of spaceflight through technological innovation, promoting the commercialization of the space economy. Its Falcon 9 rocket achieved the world's first vertical recovery and reuse of an orbital-class rocket (with a single rocket reused up to 19 times at most), reducing the launch cost from hundreds of millions of dollars in the traditional way to about 60 million dollars. The self-developed Raptor engine and Starship are aimed at Mars colonization and deep space exploration. At the same time, through the Starlink project, it has launched more than 5,000 satellites to build a global satellite internet, generating an annual revenue of over 6 billion dollars. The company also compresses the supply chain cost with a vertical integration model (self-developing engines, rockets, spaceships and launch pads), and spreads the marginal cost through high-frequency launches, causing the average price of global space launches to drop by more than 90% within ten years. This paves the way for the commercialization of industries such as satellite services, space tourism and lunar bases [2].

2.2. Special Innovation Model

2.2.1. Vertical Integration Strategy

In the battery field, Tesla independently develops battery technologies. It enhances the performance by virtue of advanced battery chemistry systems such as Nickel-Cobalt-Aluminum (NCA) and Nickel-Cobalt-Manganese (NCM). Meanwhile, it establishes long-term cooperation with raw material suppliers and explores battery recycling technologies, so as to stabilize the supply, reduce procurement costs and achieve the recycling of materials.

In the production and manufacturing process, Tesla has introduced the integrated die-casting technology. For instance, in the rear body of the Model Y, multiple components are integrated into a large die-cast part, reducing the number of components and production processes. Additionally, it optimizes the factory layout, adopts advanced production processes and logistics management systems, and establishes localized production bases, thereby reducing transportation and logistics costs.

In the energy business, Tesla has launched the Solar Roof and the Powerwall energy storage system. By integrating the industrial chain covering solar power generation, energy storage and energy management, it provides users with one-stop energy solutions, reducing both energy costs and marketing and channel costs.

Overall, through constructing an independent technology chain in multiple aspects ranging from the battery field to the energy business, Tesla has comprehensively and effectively reduced the enterprise costs, and enhanced the competitiveness and market share of its products.

2.2.2. Cooperation with the Government

Since its establishment in 2002, SpaceX has achieved numerous breakthroughs in the private space industry through its close cooperation with the government [3]. The collaboration with NASA has been a significant driving force for its development. Since 2006, SpaceX has received over \$8 billion in project orders from NASA. In 2008, NASA awarded SpaceX a \$1.6 billion contract to deliver cargo to the International Space Station using the Falcon 9 rocket and the Dragon spacecraft. The contract was extended several times, providing SpaceX with stable revenue and opportunities for technical verification. In 2012, the Dragon spacecraft successfully delivered cargo to the International Space Station, inaugurating a new era of private spaceflight. This cooperation model has saved NASA a large amount of money and enabled SpaceX to accumulate experience. In the military field, SpaceX has also reaped rich rewards. In October 2020, the U.S. Department of Defense's Space Development Agency awarded SpaceX a \$149.1 million contract to develop the missile tracking function of Starlink. In March 2021, SpaceX received a nearly \$160 million contract from the Pentagon to carry out two launch missions using the Falcon 9 rocket. In addition, it has won a \$733.5 million launch contract from the U.S. Space Force, including multiple missions for the U.S. Space Development Agency and the National Reconnaissance Office. Through cooperation with the government in various aspects such as space and military, SpaceX has obtained sufficient funds to develop advanced technologies, such as reusable rocket technology. It has achieved multiple rocket recoveries, reducing the launch cost, laying the foundation for the development of space economy industries such as satellite services and space tourism, and continuously promoting breakthroughs in the private space industry.

3. The Core Impact on the Global Macroeconomy

3.1. Industrial Reshaping

Elon Musk's enterprises, such as Tesla, SpaceX, and SolarCity, have profoundly reshaped the global landscape of industries like automotive, energy, and communication through disruptive technological innovations and the reconstruction of business models.

In the automotive field, Tesla has propelled the transformation of the century-old automotive industry with electrification, the concept of software-defined vehicles, and a vertical integration model. Tesla continuously launches new vehicle models to demonstrate that electric vehicles can keep evolving, with better performance and longer range, and they are not merely for short-distance transportation [4]. Older vehicle models can also achieve continuous updates through software installations, which can improve the driving range or add new functions such as voice assistants.

Tesla's vertical integration model reduces its dependence on outsourced supply chains. It manufactures its own 4680 batteries, FSD chips, and electric motors, and conducts green and low-cost vehicle production through various Gigafactories. Some well-known automotive companies, such as Volkswagen, BMW, and Mercedes-Benz, have halted the research and development of fuel-powered vehicles and shifted to comprehensive electrification. The European Union has even legislated and set a timetable for banning the sale of fuel-powered vehicles by 2035 [5].

In the energy field, due to the gradual popularity of electric vehicles, the energy demand has shifted from traditional fossil fuels to electricity. Tesla has not missed the opportunity to change the energy layout and has reshaped the logic of power generation and consumption. Its launched home energy system combines energy storage batteries with solar panels, promoting self-sufficiency in home energy. Tesla has also built a virtual power plant in Australia, covering at least 50,000 households [6].

In the aerospace and communication fields, SpaceX's most famous recyclable rocket technology has reduced the launch cost by 70%. The Starlink satellite internet covers more than 2.5 million users in remote areas around the world. It has also triggered a global low-orbit satellite competition, forcing the European Space Agency to abandon traditional rocket designs and prompting communication operators to accelerate the deployment of satellite networks. Musk's Starship project aims to send ordinary people into space so that they can experience the mysteries of the universe.

Through technological disruption, cost revolution, and ecological reconstruction, Musk's enterprises have compelled traditional industries to make fundamental adjustments in terms of technological paths, business models, and even national policies. This kind of reshaping is not only the result of commercial competition but also an epitome of humanity's transition towards sustainable energy and space exploration [7].

3.2. The Transfer of Geo-economic Power

Most of Elon Musk's enterprises rely on electricity, which has an impact on the status of some enterprises mainly relying on traditional energy sources and weakening the oil hegemony of OPEC. Tesla delivered 1.81 million electric vehicles globally in 2023, which is equivalent to reducing gasoline consumption by approximately 3.6 billion liters per year. If the global penetration rate of electric vehicles reaches 30%, the daily demand for oil will decrease by 10 million barrels, which is equivalent to one-third of OPEC's current production. While this is undoubtedly a good thing for the environment, it reduces the profits of oil-exporting countries and weakens OPEC's ability to influence oil prices through production regulation. The petrodollar system is gradually loosening. Traditional oil-producing countries (such as Saudi Arabia and Russia) are forced to accelerate economic diversification. Saudi Arabia's sovereign wealth fund (PIF) has invested hundreds of billions of dollars in new energy and technology industries, attempting to reduce its dependence on oil revenue.

Resources such as lithium and rare earths are likely to replace oil as the main energy sources for new energy vehicles in the future. A Tesla Model Y requires approximately 60 kg of lithium carbonate. The global demand for lithium has surged from 180,000 tons in 2015 to 1 million tons in 2023, and it is expected to reach 3 million tons by 2030. Tesla's motors use neodymium-iron-boron permanent magnets, and each vehicle requires about 1 kg of rare earths (mainly praseodymium and neodymium produced in China). 90% of the global rare earth refining capacity is concentrated in China, and China can strengthen its control over the technology industry chain through rare earth export controls.

Therefore, the status of these new resource-rich countries will rise rapidly. In the future, the large demand for new energy will increase the import and export of resources, thus promoting international trade, which will have a huge impact on the world economic pattern. Through the triple leverage of technology, industry, and capital, Musk's enterprises are accelerating the transfer of global geo-economic power from the "oil-dollar" system to the "lithium/rare earth-technology" system. This reconstruction is not only an inevitable result of the clean energy transition but also harbors the risks and opportunities of a new round of competition among major powers.

3.3. Investment and Employment

Elon Musk's enterprises (with Tesla at the core) have exerted a remarkable "chain effect" on investment, employment, and regional economy through the Gigafactory model. Taking the Shanghai Gigafactory as an example, its influence can be broken down into the following three aspects:

Firstly, Tesla's initial investment in building the factory in Shanghai was huge, making it the largest foreign investment project in the history of the Shanghai Free Trade Zone. Moreover, over 90% of the equipment in the factory comes from Chinese suppliers, which drives investment in China's manufacturing industry. The Yangtze River Delta region has gathered 360 of Tesla's first-tier suppliers (such as CATL for batteries and Tuopu Group for chassis components). The cumulative investment of supply chain enterprises has exceeded 200 billion yuan.

Secondly, the Gigafactory has expanded the scale of employment. It has hired 23,000 employees with an average monthly salary of 12,000 yuan, which is higher than the average wage in the manufacturing industry of the Yangtze River Delta region, thus driving up the value of the regional labor force. It also promotes indirect employment in sectors such as logistics and catering.

Thirdly, the benefits brought by the Gigafactory are immeasurable. With an annual output value of 280 billion yuan, it accounts for approximately 3.2% of Shanghai's GDP. It drives employee consumption and foreign exchange earnings from exports, increasing the industrial added value in the Yangtze River Delta region. For example, Suzhou Inovance Technology has increased its net profit margin from 8% to 14% by supplying motor controllers [8].

Through capital aggregation, technology diffusion, and industrial chain reshaping, Tesla's Gigafactory has formed a positive cycle of "investment → employment → consumption → upgrading", and its economic multiplier effect can reach 1:8.3. This model not only reconstructs the local economic structure but also becomes a benchmark for the global "new industrialization".

4. Conclusion

This paper explores the impact of Elon Musk's enterprises on the world economic pattern from multiple perspectives. Enterprises such as Tesla and SpaceX have reshaped traditional enterprises, redirecting their goals towards new energy. The frequent utilization of new energy has spurred the transfer of geo-economic power, and in the future, oil will no longer be the most crucial resource. Meanwhile, the emergence of Gigafactories has promoted local investment and employment, thus enhancing GDP growth and driving international trade. This thesis has not yet employed more rigorous and detailed research methods; instead, it merely conducts data comparison and formula application. Future research may focus on international cooperation and conflicts, specifically on whether technological blockades that could lead to monopolies or trade frictions will occur. Additionally, it may explore how private enterprises, while driving economic growth, also increase inequality and risks, and discuss how countries can avoid such situations.

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