Political Levers of Innovation: How Sanctions, Tariffs, and Industrial Policies Shape Technological Development

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Abstract

Tariffs, sanctions, and industrial policies are political actions critical in shaping the trajectory of technological innovation in ways that are not immediately predictable. While some accelerate innovation by reducing barriers to entry or protecting infant industries, others impede innovation by reducing competition, discouraging investment, or limiting international collaboration. This paper examines these dynamics through three case studies. The first examines the Chinese air conditioning industry after tariffs were imposed on Korean imports, showing how protectionist measures can stimulate short-term growth but stifle incentives for sustained innovation over time by eliminating foreign competition. The second considers the electric vehicle sector, where BYD benefited from a protected domestic market while Tesla’s entry under selective tariff exemptions fostered healthy competition. Finally, the effect of U.S. export controls—most notably the placement of companies like Huawei on the Denied Party List—forced affected firms to accelerate independent innovation, like in the development of HarmonyOS, advanced domestic semiconductors, and DeepSeek. Tariffs and related policies are neither inherently beneficial nor harmful. Their effect depends on scope, duration, and the broader geopolitical and industrial context in which they are applied.

**Historical Context: The Trade War Era Before COVID-19**

The U.S.–China trade conflict escalated rapidly after 2018, beginning with U.S. steel and aluminum tariffs under Section 232 of the Trade Expansion Act, justified on the grounds of national security. China and other trade partners retaliated with counter-tariffs on U.S. agricultural products like soybeans, pork, and sorghum (White & Case). Over the next two years, tariffs expanded to cover hundreds of billions of dollars in bilateral trade, eventually affecting nearly every good traded between the two countries (Largest Trading Partners). These measures set the stage for a volatile pre-COVID trade environment, characterized by uncertainty, supply chain disruptions, and reduced global market access.

**Tariffs and Retaliation: Macro Effects and Innovation**

Tariffs imposed during the trade war offer robust evidence of how such measures can inhibit innovation through broader economic contraction. Trade barriers between 2018–2020 reduced real GDP by roughly 0.5%, while increasing consumer prices reduced average household income by $1,277 in 2019 dollars (Rothman). Most economic consequences of tariffs are borne by lower- and middle-income households, as they have less flexibility in their disposable income and cannot easily alter spending patterns to avoid higher prices; this inelasticity made tariffs a regressive form of taxation (LexisNexis).

A Federal Reserve study quantified losses for consumers and firms at $51 billion, with retaliatory tariffs triggering nearly a 10% decline in U.S. exports (Khandelwal). The Budget Lab at Yale projects that all tariffs enacted as of 2025 will shave 0.5 percentage points off GDP annually, eliminate around 505,000 jobs, and cumulatively reduce long-run GDP by about $125 billion per year (“State of U.S. Tariffs: August 7, 2025”). Firms face compressed revenues, heightened uncertainty, and reduced global market engagement. The fixed-cost burden of R&D becomes untenable when demand contracts and profit margins erode.

**How the Trade War Differs from Normal Trade Policy**

Unlike multilateral tariff agreements negotiated under the WTO framework, the trade war tariffs were largely unilateral and targeted, serving as a bargaining tool in diplomatic disputes (Ferragamo and Klobucista). In 2019, the U.S. threatened to impose escalating tariffs on all Mexican imports, explicitly tying these measures to demands for enhanced Mexican efforts in curbing migration and drug trafficking rather than conventional trade objectives (González). This approach amplified retaliation risk and disrupted established supply chains. In “most-favored-nation” tariff regimes, rates are uniform across trading partners. Even without retaliatory measures from trading partners, tariffs still generate contractionary effects through reduced exports due to exchange rate shifts, inflationary pressures that cut into real wages, and rising costs for firms when tariffs are applied to intermediate inputs.

Exchange rate adjustments can significantly offset the intended trade-rebalancing effect of tariffs, thereby undermining their efficacy (Rooney). After U.S. tariff increases during the 2018–2019 trade tensions, the Chinese yuan experienced controlled depreciation, consistent with the People’s Bank of China’s efforts to mitigate export losses (Reuters). This lessened the prohibitive effect of tariffs by making Chinese goods more affordable in dollar terms, diluting the intended protectionist outcome. Concurrently, the U.S. dollar appreciated as tariffs reduced import demand and heightened perceptions of American monetary tightening (Reuters). U.S. exports was more expensive for foreign buyers, eroding the international competitiveness of domestic firms and reducing their export market share. When tariffs are applied to critical intermediate inputs, domestic downstream producers face elevated production costs (Bloom). These increased expenses compress profit margins and reduce the internal funds available for innovation, curtailing investment in R&D and long-term technological upgrading.

**General Tariffs and the Phillips Curve Perspective**

Normally, there is a negative relationship between the unemployment rate and inflation. As the demand for workers increases, wages and prices rise, best illustrated through the Phillips Curve framework (Fig. 1).

Fig. 1 *The Phillips Curve: Trade-offs Between Inflation and Unemployment (Justiz-Vaillant et al.).*



When an external factor, like a tariff, affects this relationship, the curve shifts outwards. Inflation rises, causing real wages to decline, reducing household purchasing power and labor supply incentives (Fajgelbaum et al.). Simultaneously, unemployment increases as industries that rely on revenue from exports contract. Higher inflation with stagnant or declining output directly undermines firms’ willingness to commit resources to long-term R&D projects. Innovation becomes less attractive when demand and profitability are constrained.

Nevertheless, tariffs are temporarily effective in nurturing innovation, particularly in unilateral cases where the imposing country maintains access to international markets while shielding its infant industries from aggressive foreign competition. The U.S. in the early 20th century successfully used temporary tariffs to protect its nascent steel and textile industries (Khandelwal). Short-term protection give domestic firms the time and space to scale up, improve quality, and build internal capacity. If this protection persists too long, it reduces competitive pressure, creating stagnant, inefficient industries.

**Sanctions and Export Controls: Huawei & DeepSeek**

Sanctions and Export controls may play an important role in foreign policy and upholding national security interests; however, their effectiveness as a protectionist measure to hinder international competition for domestic benefit has proven to be limited, if not counterproductive. Huawei was placed on the Entity List in May 2019 for violations of U.S. sanctions on Iran and due to national security concerns. The expected effect of this action was a massive limitation on Huawei’s global competitiveness by cutting it off from U.S. chips and software ecosystems. Yet, Huawei chose self-reliance, accelerating development of HarmonyOS and intensifying R&D in semiconductor design, culminating in the Kirin 9000S chip in 2023 (Tanna et al.). DeepSeek adapted to chip export controls, using restrictions as a catalyst to massively increase efficiency, reducing the need for excessive computing resources, and strengthening China’s domestic AI ecosystem (Sasse).

The theory of constraint-based innovation suggests that external restrictions can force firms to build internal capabilities. This does not prove that artificial constraints are inherently effective for innovation. Such positive outcomes require pre-existing capabilities and government support; smaller or less advanced firms often collapse under similar pressures. From the sanctioning country’s perspective, these measures may backfire, as they encourage innovation in rival economies while imposing higher costs on domestic suppliers who lose access to foreign markets.

**Subsidies: China’s Electric Vehicle Industry**

 China’s electric vehicle (EV) sector demonstrates how proactive domestic subsidies can transform tariff-induced challenges into innovation momentum. Amid rising U.S. and EU tariffs on Chinese-made EVs—some exceeding 100%—China maintained high domestic demand through a comprehensive industrial policy that included subsidies totaling over US$230 billion since 2009 (Kennedy). This support included direct purchase subsidies for consumers, tax exemptions for manufacturers, and massive public investment in nationwide charging infrastructure (Zhang et al. 101424). By drastically reducing the financial barriers to entry for both producers and consumers in a capital-intensive industry, these policies ignited rapid market expansion and attracted a flood of new entrants (Barroso and Laborda).

Companies like BYD thrived, achieving breakthroughs in battery technology and cost efficiency, eventually surpassing Tesla in global sales (AnushkaDixit). However, the very success of these policies led to an oversaturated market containing dozens of startups competing for dominance. As subsidies were gradually scaled back, a necessary market consolidation occurred. Only firms capable of genuine innovation to outpace intense domestic competition survived (Kennedy).

This case shows how state support helps scale innovation in capital-intensive fields, especially when barriers to entry are high and global market access is restricted. But subsidies are most effective when accompanied by large domestic markets, capital availability, and supportive policy frameworks. Without these, protection risks foster inefficiency rather than innovation.

The trade war era demonstrates that protectionist measures can yield sharply divergent innovation outcomes. Unilateral tariffs, especially when met with retaliation, impeded domestic innovation by constraining market size, raising costs, and creating macroeconomic drag. Contrastingly, domestic subsidies—paired with market scale and competition—accelerate technological progress. Sanctions and export controls are not necessarily effective in fostering domestic innovation. Historically, they have spurred innovation in target countries rather than at home.

Ultimately, policymakers should recognize that while targeted interventions—like temporary safeguard tariffs or strategic subsidies—can foster domestic capability, broad-based protectionism undermines the very competitiveness it seeks to protect. The key lies in coupling short-term protection with long-term investment in education, infrastructure, and R&D ecosystems to create conditions for sustainable indigenous innovation.

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