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Economic Impacts of COVID-19 in China, Taiwan, and Japan

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Abstract

This paper compares three countries—China, Taiwan, and Japan—focusing on their disease-control policies and the resulting economic outcomes. China pursued strict elimination in 2020, suppressing infections but generating sharp disruptions, and then shifted abruptly in 2022 with renewed turbulence. Taiwan combined efficient border controls, digital tracing, and targeted restrictions, keeping early outbreaks in check while maintaining stability. Japan relied on request-based and voluntary measures, limiting enforcement but reducing immediate costs. These differing approaches led to distinct economic consequences. China experienced the most pronounced industrial swings, from deep contractions to rapid rebounds, while Taiwan's production stayed steadier and Japan's shifts were more moderate. Service trade collapsed across all three, but goods trade recovered quickly, particularly in China and Taiwan through supply-chain adaptation. Digitalization surged in China and Taiwan, especially in e-commerce and mobile payments, while Japan lagged due to institutional and cultural inertia. The comparison highlights the importance of prior preparedness, effective use of digital technologies, and policy sustainability for future pandemics.

Keywords: COVID-19; pandemic response; East Asia; industrial structure; digitalization; cross-country comparison.

1 Introduction

The COVID-19 pandemic imposed an unprecedented shock on societies and economies across the globe. Governments were compelled to pursue a delicate balance between infection control and the maintenance of economic activity; however, their policy measures, institutional frameworks, and levels of public acceptance diverged significantly. The purpose of this paper is to elucidate the characteristics of infectious disease countermeasures, their socio-economic impacts, and the progress of digitalization in China, Taiwan, and Japan through a comparative analysis, thereby providing insights for preparedness in future pandemics. Although geographically proximate, these three countries adopted distinct approaches, exhibiting clear differences in policy stringency, the utilization of digital technologies, and structural features of their economies and industries. These differences were distinctly reflected in both the magnitude of the pandemic's impact and the trajectory of recovery. China was characterized by a state-enforced zero-COVID policy and its abrupt reversal; Taiwan by proactive preparedness and the extensive application of digital technologies, informed by its experience with SARS; and Japan by a request-based approach, lacking legal coercion and relying heavily on voluntary social cooperation.

China, from the onset of the pandemic, implemented one of the world's most stringent zero-COVID policies, encompassing city-wide lockdowns, large-scale mobility restrictions, and infection control measures supported by artificial intelligence and the Health Kit systems. These measures curtailed the spread of infection in the short term and enabled an early resumption of economic activity. Nevertheless, as the pandemic persisted, the social and economic costs became increasingly apparent, culminating in a sudden policy reversal at the end of 2022. The Shanghai lockdown and the establishment of a nationwide PCR testing regime symbolized both the strength of state control and the robustness of digital infrastructure, while simultaneously revealing the limits of policy sustainability and societal tolerance. On the economic front, growth was driven by manufacturing, e-commerce, and digital finance; yet structural challenges emerged, including rising youth unemployment and a decline in consumer confidence.

Taiwan, drawing upon the lessons of the 2003 SARS outbreak, had already developed a comprehensive legal framework and command structure for infectious disease control. From the earliest stages of the pandemic, Taiwan implemented centralized crisis management under the Central Epi-

demic Command Center (CECC), rigorous border control, digital monitoring through Electronic fence and QR codes, and real-name mask distribution. These advanced and flexible measures enabled Taiwan to contain infections without resorting to harsh lockdowns, while achieving a relatively early recovery of economic activity. Manufacturing, particularly the semiconductor industry, along with the ICT sector, maintained strong growth, while digital services—including e-commerce, mobile payments, and food delivery—expanded rapidly. From 2022 onward, in response to the spread of the Omicron variant, Taiwan gradually transitioned to a coexistence strategy, seeking to balance sustained socio-economic activity with infection control.

Japan, constrained by constitutional limitations and the difficulty of achieving social consensus, adopted predominantly request-based and non-coercive measures, such as the state of emergency and the priority preventative measures. Unlike the coercive lockdowns implemented in Western countries and China, Japan's response relied on voluntary citizen cooperation and behavioral adaptations such as avoiding the so-called *Three Cs* (closed spaces, crowded places, and close-contact settings). Economically, face-to-face service industries—including hospitality, dining, and tourism —suffered significant setbacks, and demand-stimulation policies such as the *Go-To-Campaign* produced only limited effects. Furthermore, structural factors—including delayed digitalization, a cultural preference for cash, and infrastructural constraints in rural regions—impeded the expansion of e-commerce and remote work, rendering Japan's digital transition comparatively slow. Recovery was pursued through vaccination rollouts, the strengthening of medical infrastructure, and the gradual relaxation of restrictions, although the full resumption of service trade and tourism lagged behind other nations.

This paper conducts a comparative analysis of the policy responses of these three countries and their socio-economic impacts, with particular emphasis on infection trends, industrial structures, trade dynamics, and the progress of digitalization. Section 2 provides an overview of infection status and policy measures in each country. Section 3 examines shifts in industrial structures, Section 4 analyzes trade trends, and Section 5 discusses the advancement of digitalization. Through this comparative framework, the study offers insights into future pandemic preparedness and strategies for strengthening socio-economic resilience.

2 Infection and Policy

2.1 China

China's COVID-19 response, shaped by its unique position as the site of the initial outbreak and underpinned by a powerful system of state control, constituted the world's most stringent and prolonged set of containment measures. From the first confirmed cases in Wuhan, Hubei Province in late 2019 until the termination of the zero-COVID policy in 2023, China's approach can be broadly divided into three phases: Phase I was characterized by the emergency containment of the outbreak through the lockdown of Wuhan and nationwide mobility restrictions. Phase II introduced the normalized prevention and control system, which institutionalized routine infection management. Phase III entailed the intensification of the dynamic zero-COVID policy, followed by its abrupt reversal.

`### Figure 1: Stringency Index for COVID-19 Measures in China, Taiwan, and Japan ###`

`### Figure 2: Excess Deaths in China, Taiwan, and Japan ###`

Phase 1(Late 2019 to April 2020) At the end of 2019, when infections emerged in Wuhan, Hubei Province, the Chinese authorities imposed a citywide lockdown on Wuhan. In January 2020, all domestic and international group travel was prohibited, and large-scale population movements during the Lunar New Year were restricted. As shown in Figure 1, exceptionally stringent mobility restrictions were enforced by global standards. According to Zhu et al. (2024), human mobility declined by 70 – 80 % in early February. By late January, the *The Health Kit* system was introduced, enabling the assessment of individual infection risk. From March onward, mobility restrictions were gradually lifted, and by April, the restoration of daily life had progressed substantially.

Phase 2 (May 2020 – July 2022) Following the lifting of the Wuhan lockdown in the spring of 2020, China transitioned to a framework known as the normalized prevention and control. This shift represented a move toward routine operations that combined early detection through fever clinics and sentinel surveillance, localized risk classification, and large-scale PCR testing. During the Delta variant outbreak in the summer of 2021, major urban centers experienced large-scale infections; however, through intensive mass testing and targeted lockdowns, the outbreaks were

contained within several weeks. From that summer onward, Delta continued to spread across various regions. Vaccination efforts also progressed, though delays in coverage among the elderly population emerged as a significant concern. Figure 2 presents estimates of excess mortality from The Economist's tracker for covid-19 excess deaths.[1] Although the accuracy of the statistics is subject to limitations, an upward trend in excess deaths is observable from mid-2021. In early 2022, in response to the Omicron variant, the government officially adopted the slogan of dynamic zero-COVID. Unlike the aim of achieving absolute elimination of infections, this policy sought to suppress localized clusters within a short time frame, thereby preventing chains of transmission from spreading widely across society. Nevertheless, in April 2022, Shanghai entered a de facto citywide lockdown, which resulted in growing social fatigue and mounting public discontent.

Phase 3 (August 2022 –) In the latter half of 2022, public dissatisfaction with the zero-COVID policy became increasingly visible, culminating in protests across multiple regions. In response, the government implemented a substantial relaxation of restrictions through the *20 prevention and control measures* announced in November and the *New 10 epidemic prevention policy* in December, effectively abandoning the practice of city-wide lockdowns. This abrupt easing precipitated a rapid surge in infections, accompanied by a sharp increase in excess mortality, as illustrated in Figure 2. In January 2023, the legal classification of COVID-19 was downgraded to Class B infection, formally bringing an end to the zero-COVID regime. The large-scale population movements associated with the Lunar New Year were once again permitted, revitalizing tourism destinations. However, the infection rate reached approximately 80 percent, resulting in the attainment of herd immunity within a remarkably short period.

Summary The most distinctive feature of China's COVID-19 response lies in its extreme policies and their abrupt reversal. After nearly three years of maintaining the world's most stringent zero-COVID policy, the government abruptly shifted course in December 2022, declaring its sudden termination. Particularly during the Shanghai lockdown in the spring of 2022, China enforced an unprecedented measure by sealing off a metropolis of 25 million people for more than two months —an action inconceivable in most other countries. This approach was fundamentally different from Japan's request-based state of emergency or Taiwan's gradual coexistence strategy, as it prioritized

[1] `https://www.economist.com/graphic-detail/coronavirus-excess-deaths-tracker`

collective safety over individual freedoms through strong social control. However, such extreme containment measures ultimately revealed the limits of policy sustainability. Whereas other nations adjusted their policies gradually, China was compelled by mounting social pressures to undertake a drastic reversal, which led to a sharp surge in infections and excess mortality between late 2022 and early 2023. This experience underscores the trade-off between the short-term effectiveness of stringent state control and its long-term sustainability.

2.2 Taiwan

Taiwan has established a legal system for responding to infectious diseases based on its experience with SARS in 2003, and has taken advance measures to prevent pandemics.

`### Figure 3: New COVID-19 Cases in Taiwan and Japan ###`

`### Figure 4: Mobility index in Taiwan and Japan ###`

Phase 1：Initial response and Lockdown（December 2019 - April 2021） In January 2020, the Taiwanese government established the Central Epidemic Command Center (CECC) and initiated a policy of transparent information disclosure. Emphasizing strict border control (Cheng and Liu, 2024; Lai et al., 2023), authorities implemented symptom screening and a mandatory 14-day quarantine for incoming travelers, introduced an online health declaration system using QR codes, and deployed monitoring technologies known as the Electronic fence. (Chen and Wei, 2023) At the same time, Taiwan adopted a universal mask policy, ensuring stable supply through a real-name distribution system via pharmacies and other outlets.

As a result of these measures, Taiwan maintained a relatively low Stringency Index, as shown in Figure 1, and imposed only minimal restrictions on human mobility, as indicated in Figure 4. Nevertheless, the number of new infections was kept remarkably low (Figure 3), and excess mortality remained limited (Figure 2). Thus, Taiwan succeeded in simultaneously achieving infection control and the continuation of economic activity. (Kuo, 2021; Chen and Huang, 2024)

Phase 2：Infections spread and Enhanced vigilance（May 2021 – March 2022） In May 2021, infections originating at Taoyuan International Airport triggered Taiwan's first substantial wave of community transmission. In response, the government declared a nationwide Level 3 alert,

during which time significant restrictions were imposed on socio-economic activities, as reflected in the sharp increase of the Stringency Index in Figure 1. A pronounced shift from outdoor mobility to stay-at-home behavior can be observed in Figure 4, accompanied by the transition of schools to online instruction and the restriction of restaurants to take-out services only. With the progress of vaccination beginning in the summer of 2021, the outbreak was gradually brought under control.

Phase 3：The Omicron Era and Policy Changes（April 2022 – May 2023） With the emergence of the Omicron variant in 2022, the Taiwanese government shifted to a "Living With Covid" Strategy (Yang et al., 2024). As illustrated by the relatively low Stringency Index in Figure 1, the government refrained from halting overall societal activity and instead prioritized the prevention of severe illness. Nevertheless, between April and August 2022, Taiwan recorded several hundred thousand infections, as shown in Figure 3, with a notable rise in mortality among the elderly population. Despite this challenge, a suspension of social and economic activity was avoided.

Interestingly, as indicated in Figure 4, restrictions in human mobility were still evident, even under relatively loose government-imposed measures, reflecting voluntary behavioral adjustments by the public. Following this period, infections subsided, and in May 2023 Taiwan revised the legal status of COVID-19, thereby bringing an effective end to its pandemic response framework.

Summary Taiwan's COVID-19 response was internationally acclaimed, particularly in the early phase of the pandemic, as the so-called Taiwan model. Its most distinctive features lay in the advance preparedness informed by the 2003 SARS experience and the implementation of a smart containment strategy leveraging digital technologies. Through centralized command and coordination under the CECC, as well as innovative digital solutions such as the *Electronic fence* system and the real-name mask distribution scheme, Taiwan successfully combined stringent border controls with relatively moderate domestic restrictions.

When confronted with its first significant wave of community transmission in April 2021, Taiwan managed to bring the outbreak under control through the imposition of targeted restrictions. In the latter stages of the pandemic, the widespread transmission of the Omicron variant in 2022 prompted a flexible policy shift toward a Living With Covid Strategy, which ultimately facilitated the conclusion of the pandemic response. Nonetheless, delays in vaccine procurement emerged as

a notable challenge, with implications for Taiwan's future diplomacy and public health strategy.

2.3 Japan

Japan's fight against the novel coronavirus (SARS-CoV-2) began in early 2020. Unlike Taiwan, Japan had not experienced large-scale outbreaks of SARS or MERS, and was therefore not well prepared.

Phase 1：2020 Japan's initial response began with its handling of the Diamond Princess cruise ship, which underscored the critical importance of the early detection and containment of clusters of infection. Beginning in February, the government emphasized cluster-focused countermeasures and urged behavioral changes centered on avoiding the so-called Three Cs (closed spaces, crowded places, and close-contact settings). In April, following a surge in infections, the government declared a state of emergency, setting a target of reducing interpersonal contact by 80 percent. Unlike the lockdowns implemented in Western countries, this declaration relied on legally non-binding requests for voluntary restrictions on outings and business operations.

As shown in Figure 1, the Stringency Index remained relatively low; however, with public cooperation, mobility declined substantially, as indicated in Figure 4. This Japanese-style lockdown, though lacking legal coercive force, nevertheless achieved a degree of effectiveness.[2] After the first wave subsided in May, Japan sought to reconcile infection control with the resumption of economic activity. Beginning in July, the government launched the Go-To-Travel campaign, followed by the Go-To-Eat campaign in October, providing subsidies for accommodation and transportation in order to stimulate tourism demand and support the food service industry.

However, toward the winter of 2020, infections rose sharply, accompanied by significant increases in the number of severe cases and deaths. Consequently, the Go-To-programs were suspended nationwide at the end of December, revealing the difficulty of simultaneously implementing economic stimulus measures and effective infection control.

Phase2：2021 In January 2021, the Japanese government reissued a state of emergency centered on the Tokyo metropolitan area, adopting a flexible approach that targeted specific regions and industries. Beginning in February, the national vaccination campaign was launched and progressed

[2]Barari et al. (2021) showed Japan's containment policies are relatively effective among the G7 countries.

rapidly over the summer, with the majority of the population completing two doses by autumn. Although challenges arose—including securing sufficient vaccination venues, confusion surrounding the reservation system, and supply shortages—the campaign played a crucial role in containing the surge of infections driven by the Delta variant.

Between July and August, the postponed Tokyo Olympic Games were held without spectators. Amidst divided public opinion regarding the appropriateness of hosting the Games, the fifth wave of infections, fueled by the Delta variant, spread throughout the capital region, resulting in record-high daily case counts. The medical system came under severe strain, and the number of patients required to isolate at home increased sharply. In response, the government established oxygen supply stations and expanded designated accommodation facilities, thereby reinforcing mechanisms to bridge hospital-based and home-based care. From September onward, as vaccination coverage expanded, infections declined rapidly.

Phase 3：Since 2022 From January 2022 onward, the Omicron variant became the dominant strain, giving rise to the sixth wave of infections. Although the number of new cases reached record highs, the severity rate remained comparatively low, largely due to the effects of vaccination. Subsequent waves of infection also occurred; however, the government refrained from halting socio-economic activities and instead focused its efforts on securing the capacity of the healthcare system.

Beginning in March 2023, mask-wearing was left to individual discretion, and the legal classification of COVID-19 under the Infectious Disease Control Law was revised. As a result, behavioral restrictions and the scope of public financial support were significantly reduced.

Summary The most salient characteristic of Japan's COVID-19 countermeasures lay in its request-based regulations and the voluntary cooperation of society. Unlike China's coercive lockdowns or Taiwan's digitally enabled management systems, Japan relied on legally non-binding states of emergency, under which restrictions such as stay-at-home guidance and business closures were framed as requests or instructions rather than legally enforceable mandates. While this approach was partly shaped by constitutional constraints, it nevertheless succeeded in achieving significant reductions in mobility through high levels of public compliance.

Japan's strategy also emphasized behavioral change through cluster-focused measures, particularly the nationwide call to avoid the Three Cs. Simultaneously, the government pursued economic

support initiatives, most notably the *Go-To* campaigns, reflecting an effort to reconcile infection control with economic activity. Distinctive policy decisions further included the unprecedented choice to hold the Tokyo Olympic Games without spectators and the shift in March 2023 to leaving mask-wearing to individual discretion. These measures illustrate Japan's incremental and flexible approach to policy adjustment.

Although this Japanese-style approach, with its limited coercive force, was not sufficient to fully suppress the spread of infections, it nonetheless constituted a unique case in which moderate effectiveness was achieved while avoiding deep societal divisions.

3 Industry

`### Figure 5: Real Sectoral Growth Rates in China, Taiwan, and Japan ###`

A comparison of sectoral growth trajectories in China, Taiwan, and Japan between 2019 and 2023 reveals a consistent contrast between sectors dependent on face-to-face demand and those more easily substituted through non-contact alternatives, such as online shopping and delivery services. Figure 5 presents the real growth rates of major industries in each country. Considering first the trajectory of real GDP, China maintained a rare positive growth rate of 2.2 percent in 2020 and then rebounded sharply to +8.4 percent in 2021. This outcome was the result of strict lockdowns under the zero-COVID policy that effectively curbed infections, followed by large-scale public investment. Taiwan, underpinned by stringent border controls and strong semiconductor demand, achieved robust growth of +3.3 percent in 2020 and +7.1 percent in 2021. By contrast, Japan experienced a sharp contraction of − 3.9 percent in 2020. Although it recovered to +3.0 percent in 2021, subsequent growth faltered, as repeated self-restraint requests under the state of emergency hindered the sustained recovery of consumption and investment.

The accommodation and food service sector most clearly reflected differences in national policy responses. In China, the sector declined by − 14.1 percent in 2020 but rebounded strongly to +28.6 percent in 2021 following the lifting of lockdowns. However, the citywide lockdown in Shanghai during the spring of 2022 brought growth down to − 1.2 percent, before surging again to +34.1 percent in 2023 after the termination of the zero-COVID policy. Taiwan recorded contractions of − 9.6 percent in 2020 and − 8.1 percent in 2021, largely due to the collapse of inbound tourism

under border closures. In May 2021, the spread of community transmission prompted the issuance of a nationwide Level 3 alert, which severely restricted restaurants and schools. As vaccination coverage increased, however, the sector rebounded to +15.3 percent in 2022 and +18.3 percent in 2023. Japan, by contrast, suffered the steepest decline: − 35.4 percent in 2020 and − 19.1 percent in 2021, as repeated states of emergency imposed legally non-binding requests for self-restraint and shortened business hours. Nevertheless, the easing of entry restrictions and the introduction of tourism stimulus measures facilitated a recovery of more than +20 percent in both 2022 and 2023.

The wholesale and retail sector also exhibited pronounced cross-national variation. In China, strong growth of +10.4 percent in 2020 and +28.2 percent in 2021 reflected the rapid spread of online consumption. Taiwan maintained stable growth of around 2 percent between 2020 and 2022. Japan, in contrast, contracted by − 4.2 percent in 2020, recovered only modestly thereafter, and reverted to − 2.5 percent in 2023. Although demand-stimulation measures such as Go-To-Travel and Go-To-Eat had some temporary effects, their impact was limited. This contrast is also apparent in the postal services sector, which reflects non-contact demand. China sustained high growth at +29.7 percent in 2020. However, the growth rate dropped down to -34.9 percent in 2021 due to relatively mild infection in the year. Taiwan and Japan suffered a severe contraction in 2020 possibly due to relatively mild restriction, and stayed stagnated in 2021.

In the information technology sector, China consistently maintained high growth rates in the range of +15 to +20 percent, and Taiwan experienced notable expansion, with +10.7 percent growth in 2021. Furthermore, China recorded extraordinary growth of +62.3 percent in financial services in 2020, reflecting the accelerated diffusion of digital finance during the pandemic. By contrast, Japan's IT sector registered only modest growth of around 1 − 2 percent annually after 2020, clearly reflecting its lag in digital transformation. As will be discussed later, whereas China and Taiwan achieved growth through the expansion of online consumption and digital services, Japan's delayed digitalization became a significant constraint on growth.

Table 1: The supply-chain and other economic indices in China

Scepticism arose regarding the accuracy of China's economic data upon the release of this figure. Table 1 indicates the supply chain disruptions in China. According to Liu (2021), China's economic performance in 2020 reflected a significant contraction under zero-COVID policy, notably

the worst since the country adopted its economic accounting system in 1992. Liu (2022) shows Chinese economy contracted due to the shock from lockdown measures in 2022, but the impacts were milder than those observed in early 2020. China's official GDP growth for 2022 is reported to be 3 percent, while it is 2.2% in 2020. However, youth unemployment increased, and in 2022, Chinese households and consumers exhibited weaker expectations than in 2020.[3] Based on a county-level daily panel dataset, Gong et al. (2024) discovered that the zero-COVID policy led to a 30% decline in mobility, a 1.17% decrease in PM2.5 levels (an air quality measure), a 7.7% reduction in nighttime lights, and an overall 3.9% GDP loss in 2022.

Table 2: Taiwan's Selective Inner Demand Indexes

Table 2 lists the selected inner demand indices for Taiwan from 2019 to 2023. Taiwan's service industry was hurt the most in the early stages of the pandemic, especially in hotels, restaurants, and transportation. Accomodation and Catering substantially declined nearly 10% in 2020 and 2021 but dramatically rebound by more than 15% in 2022 and 2023. The number of foreign tourists in Taiwan declined dramatically from 11.86 million in 2019 to 1.38 million in 2020 and 0.14 million in 2021; this number slowly recovered to 0.90 in 2022 and 6.48 million in 2023. Facing a sudden drop in demand at the early stage of this pandemic, the two leading airlines, China Airlines, and EVA Airlines, adjusted their business strategy to transporting packages instead of passengers or redirecting international flights to domestic flights. These adjustments can reduce sudden revenue losses. Taiwan's stock market index grew more than 50% and the average trading volume almost doubled from 2019 to 2022. The TAIEX grew from 10,790 in 2019 to 15,623, and the average trading volume increased from 109.4 billion US $ in 2019 to 228 billion US $ in 2022. Taiwan's Stock market continued to prosper during the pandemic.

In summary, while China, Taiwan, and Japan all experienced severe downturns in face-to-face service industries such as accommodation and food services, their paths to recovery diverged significantly. China displayed sharp declines and rebounds corresponding to repeated cycles of lockdowns and reopenings under the zero-COVID policy. Taiwan, by prioritizing border control, experienced a prolonged slump in tourism and dining, yet its manufacturing sector—particularly semiconductors—and the ICT industry drove robust growth. Japan, despite experiencing relatively

[3]Liu (2025) constructed an index showing that China's economic downturn during this period may have been driven by a decline in confidence about the future.

moderate levels of infection, witnessed a prolonged stagnation in accommodation and food services, as repeated states of emergency and requests for voluntary restraint suppressed demand.

By contrast, non-contact industries such as postal services, as well as information technology, remained resilient across all three countries. China stood out with exceptional growth driven by the expansion of e-commerce and digital finance, Taiwan sustained stable growth alongside manufacturing, while Japan registered only modest gains. These dynamics underscore the extent to which national policy choices and industrial structures shaped the economic impact and recovery trajectories of the three countries.

4 Trade

The outbreak of COVID-19 generated substantial fluctuations in global trade. According to the World Trade Organization (WTO), global trade volume contracted sharply by − 5.3 percent in 2020 compared with the previous year. However, rising demand for medical supplies and products related to remote work, combined with the restoration of supply chains and a rebound in demand, led to an unprecedented increase of approximately 10 percent in 2021. Trade in services suffered even more severe disruptions. WTO statistics indicate that global service exports declined by around 20 percent in 2020, while data from the United Nations World Tourism Organization (UNWTO) show that international tourist arrivals plummeted by nearly 72 percent. From the latter half of 2022, as borders reopened in many countries, tourism revenues began to recover, and the UNWTO announced that by 2023 international tourist arrivals had returned to nearly 90 percent of pre-pandemic levels.

Against this global backdrop, it is instructive to examine the trajectory of trade in China, Taiwan, and Japan. Trade statistics from 2019 to 2023 reveal that all three countries experienced significant declines in service trade due to COVID-19, and that differences in policy responses and infection dynamics became particularly pronounced during the subsequent recovery process.

`### Figure 6: Trade Growth Rates in China, Taiwan, and Japan ###`

Figure 6 shows the trade growth rates in China, Taiwan, and Japan from 2019 to 2023. China markedly augmented its global exports and imports of goods during the pandemic. Both were positive even in 2020, and notably, in 2021, spurred by the household stimulus programs implemented

in the US and other economies, goods exports and imports rose by about 30%. By contrast, service exports fell by -6.3% and service imports by -24.5% in 2020, reflecting the severe impact of the zero-COVID strategy.

Taiwan's exports were impeded in the early stages but strongly rebounded during the pandemic. The export growth rate increased to a 4.9 percent in 2020 and rose further to 29.3 percent in 2021. Similarly, the import growth rate increased greatly to 33% in 2021. With international travel suspended, Taiwan's service exports fell by -20.5% in 2020 and imports by -34.3%, heavily affecting tourism, study abroad, and business travel. After restrictions tightened again in 2021, vaccination progress allowed a rebound, with service exports rising to +10.0% in 2022 and service imports surging by +43.5% in 2023 after border reopening.

However, in 2023, both exports and imports substantially declined possibly due to Russia's invasion of Ukraine and rising tension in the Taiwan Strait. Kuo (2024) mentions that the rising rivalry between the US and China in the new Cold War and the Taiwan Strait tension will harm Taiwan's economy since these two superpowers are Taiwan's top two trade partners. China's possible termination of the Cross-Strait Economic Cooperation Framework Agreement would further impede cross-strait trade.

Japan can be regarded as the country most typically affected by the COVID-19 shock among the three. In 2020, exports declined by − 11.2 percent, imports by − 14.7 percent, service exports by − 23.3 percent, and service imports by − 11.5 percent, reflecting a broad-based contraction. Although government policies such as the state of emergency and priority preventative measures relied primarily on legally non-binding requests for self-restraint, public behavior was nevertheless heavily constrained. With tourism and business travel coming to a halt, the impact on service trade was particularly severe. From 2021 onward, supported by the recovery of external demand, trade in goods shifted into positive territory. In 2022, goods exports and imports recorded substantial increases of +20.0 percent and +41.9 percent, respectively. By contrast, the recovery of service exports was delayed, as the full resumption of inbound tourism did not occur until the summer of 2022. Consequently, the rebound in service trade lagged behind that of other countries. Nonetheless, in 2023 service exports surged by +31.1 percent, reflecting the reopening of tourism and the revival of international events.

A comparative perspective reveals both commonalities and divergences across the three coun-

tries. A shared pattern was the sharp decline in service trade in 2020, followed by a strong recovery in goods trade from 2021 onward. Beyond this, however, clear differences emerged. China, which maintained the zero-COVID policy for an extended period, experienced large fluctuations in trade, with sharp rebounds during phases of policy relaxation. Taiwan sustained stable growth in goods exports, while service imports expanded rapidly in 2023 as borders reopened. Japan, by contrast, exhibited a recovery in goods trade but a delayed rebound in services, reflecting the comparatively late resumption of international mobility. In short, infection dynamics and policy choices left distinct imprints on the trade statistics of each country: China with pronounced oscillations of lockdown and reopening, Taiwan with stable ICT-driven exports and a rapid recovery in service imports, and Japan with a broad-based initial contraction followed by a more gradual recovery.

5 Digitalization

The COVID-19 pandemic served as a catalyst for accelerating digitalization worldwide. Beginning in 2020, many countries introduced lockdowns and restrictions on movement, which rapidly expanded the adoption of remote work, online education, and telemedicine. On the consumption side, the share of e-commerce rose substantially; according to UNCTAD estimates, the value of global e-commerce transactions reached USD 26 trillion in 2020. Digital payment systems and telehealth services also expanded in the financial and healthcare sectors, respectively. These developments stimulated corporate investment in digital transformation (DX) and reinforced the momentum for governments to strengthen digital policy frameworks.

Drawing on Figure 7, the evolution of the e-commerce share of retail trade in China, Taiwan, and Japan between 2018 and 2023 can be summarized as follows. In all three countries, the share of e-commerce in total retail sales displayed an upward trend. As of 2018, China's share already exceeded 11 percent, whereas Taiwan and Japan remained at around 6 percent. The subsequent years, however, revealed a widening divergence. In particular, during 2020 – 2021, when the impact of the pandemic was most pronounced, Taiwan experienced a rapid acceleration of e-commerce penetration, reaching 13.5 percent in 2021, thereby surpassing China. This surge

was largely driven by strict border closures and domestic movement restrictions, which pushed consumers abruptly toward online purchasing.

China, in contrast, already possessed a large-scale e-commerce market. With continued policy support and the rapid diffusion of live-streaming commerce, its share continued to expand, rising again to the mid-13 percent range between 2022 and 2023. Japan, for its part, exceeded 8 percent in 2020 due to voluntary restrictions on outings under the state of emergency, yet its subsequent growth was modest, reaching only 9.4 percent in 2023—considerably lower than the other two countries. This slower expansion reflects Japan's entrenched brick-and-mortar business practices and the relatively weak necessity for online substitution, given the absence of compulsory lockdowns.

Overall, the rise in e-commerce shares during this period was shaped by pandemic-induced changes in consumer behavior and the advancement of digital infrastructure. While China's expansion was policy-driven, Taiwan experienced a short-term surge, and Japan's growth remained gradual.

In China, significant discussions have centered on the digital economy, a concept well-explored by Bukht and Heeks (2017). A major aspect of China's digital economy is online shopping, propelled by advancements in smartphones, 3G/4G technology, rapid delivery services, mobile payments, and big-tech credit. Another crucial area of digital transformation involves the digitization of commercial banks, as highlighted by Huang et al. (2021). Several studies have demonstrated further expansion of the digital economy during the pandemic. For instance, Shao and Kostka (2023) noted a significant increase in overall Internet usage in China owing to the pandemic. Additionally, Xu et al. (2022) observed that the digital economy played a prominent role in enhancing economic development, particularly during the initial stages of the COVID-19 pandemic.

For Taiwan, digitalization is another strategy that has emerged to cope with the need for remote work under quarantine and to mitigate the negative impacts for producers during this pandemic. Taiwan's manufacturers have made significant efforts toward digitalization during the pandemic. The 2022 Taiwan Small and Medium Enterprise Transformation and Demand Survey shows that 91.6% of the small and medium enterprises in Taiwan's manufacturing industry adopted digitalization (5% adopted digital optimization and 28.7% adopted digital transformation). The pandemic has made the transformation towards production digitalization in Taiwan quicker and more widespread, especially in manufacturing.

Cashless payments continued to grow during this pandemic as consumers avoided using cash. Taiwan's coverage of mobile payment has grown from 50.3% in 2018 to 70.6% in 2022.[4] Taiwan's consumer willingness to use mobile payments has continued to increase from 5.1 percent in 2020 to 6.8 percent in 2021, and 9.3 percent in 2022.

The restaurant business was severely impacted in the early stages of the COVID-19 outbreak in 2020 owing to people's fear of infection from others while eating at restaurants. An increasing number of consumers prefer to cook by themselves or order food. According to surveys by The Market Intelligence & Consulting Institute (MIC), food delivery had grown by 293.78%, almost tripling, in the first half of 2020 compared with 2019 in Taiwan. In 2021, 53.3% of consumers use food delivery, among which 10.9% are first-time users and 22.1% increased their frequency of food delivery orders. Additionally, mobile payments were also substantially boosted by the pandemic. The types of food delivery payments changed from 31.4% mobile payments and 68.8 % credit cards in 2022 to 46.5% mobile payments and 55.9 % credit cards in 2023.

As of 2023, Japan's e-commerce penetration rate remained at 9.38 percent, considerably lower than that of China and Taiwan. This gap can be attributed to Japan's distinctive consumer culture, which continues to emphasize cash usage and reliance on brick-and-mortar retail stores, as well as infrastructural constraints in logistics and digital networks in rural areas. Overall, Japan's e-commerce market has continued to expand within the global trend, yet its diffusion has not reached the platform-driven level observed in the other two countries.

The question of whether such digitalization will become entrenched in Japan has been the subject of scholarly debate. Watanabe and Omori (2021) argues that the shift was temporary, contending that the expansion of online shopping did not sufficiently penetrate new user groups. By contrast, Nakajima et al. (2022) demonstrates that many consumers who began using online shopping during the pandemic continued to make purchases afterward. Whereas these two studies focus on consumer-side data, Inoue and Todo (2023) analyzes transaction data from e-commerce platforms and reports that sales ultimately reverted to pre-pandemic trends following the lifting of the state of emergency.

A comparison among the three countries reveals clear differences in the trajectory of digitalization during the pandemic. In terms of growth patterns, China positioned digitalization as a

[4]The mobile payment coverage increased to 60.3% in 2020 and 69% in 2021 during the pandemic according to the MIC mobile payments surveys.

national strategy, sustaining expansion through both state policy and market forces. Taiwan, by contrast, experienced a rapid surge in digitalization triggered by the pandemic, accelerating transformation across diverse sectors including retail, dining, and manufacturing. Japan, however, was constrained by the limited coercive force of its policies as well as entrenched business practices and cultural norms, resulting in only gradual growth.

These findings carry important implications for the future. For China, the existing large-scale market provides a foundation for pursuing leadership in emerging domains such as artificial intelligence, data governance, and the digital yuan. For Taiwan, the key challenge is to ensure that the digitalization accelerated during the pandemic does not remain a temporary phenomenon but instead contributes to long-term industrial competitiveness, which will require support for SMEs in digital transformation (DX) and the cultivation of data-related talent. For Japan, a comprehensive digital strategy is necessary, encompassing consumer culture and institutional frameworks alike. Promoting cashless payments, strengthening logistics infrastructure, and reducing regional digital disparities should be prioritized as medium- to long-term challenges.

More broadly, the acceleration of digitalization during the pandemic must not be allowed to remain a transient development. Sustained competitiveness will depend on leveraging new domains such as AI, data governance, and digital currencies, while simultaneously supporting SMEs in DX and advancing workforce development. Furthermore, the expansion of cashless payment systems, the enhancement of logistics infrastructure, and the reduction of digital divides across regions represent indispensable components of long-term growth strategies for many countries.

6 Conclusion

This paper has conducted a comparative analysis of China, Taiwan, and Japan with respect to infection control measures, industrial dynamics, trade, and digitalization under the COVID-19 pandemic. With regard to infection control, China was characterized by stringent state control through its zero-COVID policy and its abrupt reversal; Taiwan by advance preparation and active utilization of digital technologies informed by its SARS experience; and Japan by a request-based approach with limited legal enforcement, relying heavily on voluntary social cooperation. In terms of industrial outcomes, face-to-face service sectors were severely affected, while non-contact indus-

tries such as IT and logistics remained resilient. In trade, service activities contracted sharply in 2020, whereas goods trade subsequently rebounded. With respect to digitalization, China and Taiwan expanded rapidly, while Japan experienced only gradual growth.

From the experiences of these three cases, several lessons can be drawn for future pandemic preparedness. First, as demonstrated by Taiwan, advance institutional preparation, legal frameworks, and the strategic use of digital technologies can effectively reconcile infection control with economic continuity. Mechanisms such as data integration, real-time monitoring, and electronic resource allocation (e.g., real-name mask distribution) enable rapid responses during crises. Second, although China's strong state control proved effective in suppressing infections in the short term, it revealed limitations in terms of long-term sustainability, social acceptance, and economic and psychological costs.(Le and Nguyen, 2021) Public trust, consensus-building, and flexible policy adjustment are therefore indispensable. Third, Japan's request-based approach helped to avoid social fragmentation and achieved moderate effectiveness, yet delays in digitalization and economic recovery became evident challenges. Looking ahead, strengthening digital infrastructure, enhancing public risk communication, and facilitating behavioral adaptation will be crucial.

In addition, several broader priorities emerge for future pandemic response. First, alongside strengthening medical and public health systems, it is essential to enhance the resilience of supply chains and logistics. This requires preparedness for global supply disruptions through stockpiling of essential goods, diversified procurement, and the use of digital technologies for visibility. Second, the promotion of digitalization must extend beyond efficiency improvements to serve as a foundation for societal crisis response. Infrastructure for telemedicine, remote education, cashless payment, and digitalized administrative procedures must be established in normal times. Third, attention must be paid to socially vulnerable groups and digital divides, as well as to building collaborative frameworks with diverse stakeholders. Because pandemics expose societal vulnerabilities, inclusive policy design is imperative.

Finally, effective policy implementation during crises requires evidence-based decision-making, transparent information disclosure, and mechanisms for social consensus-building. The cases of China, Taiwan, and Japan demonstrate that divergent approaches—coercive state control, digital technology-driven management, and voluntary social cooperation—each yielded certain achievements as well as challenges within their respective contexts. Future pandemic preparedness will

therefore require a synthesis of advance planning, flexible policy operation, digital infrastructure enhancement, and inclusive governance, thereby ensuring more sustainable and resilient responses to global health crises.

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Figure 1: Stringency Index for COVID-19 Measures in China, Taiwan, and Japan

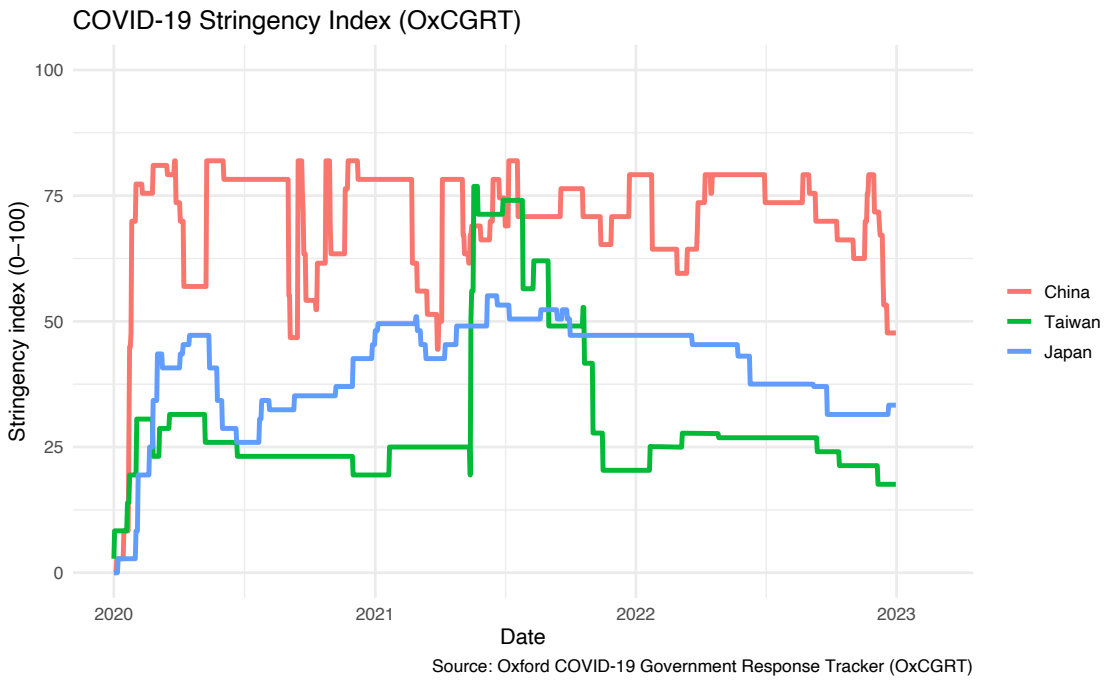
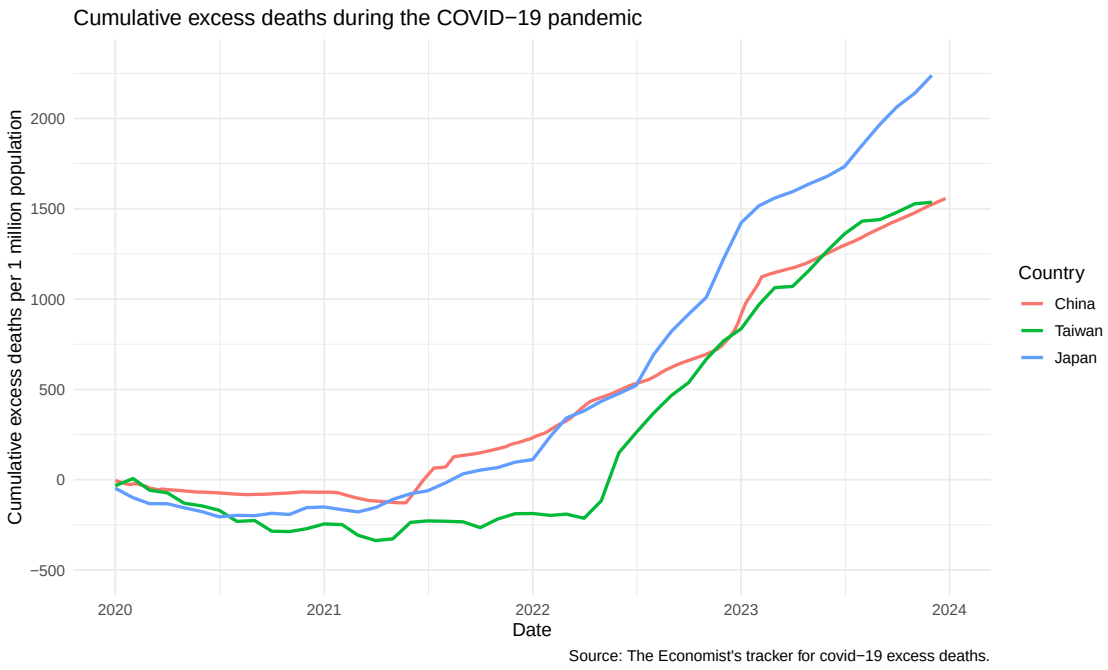
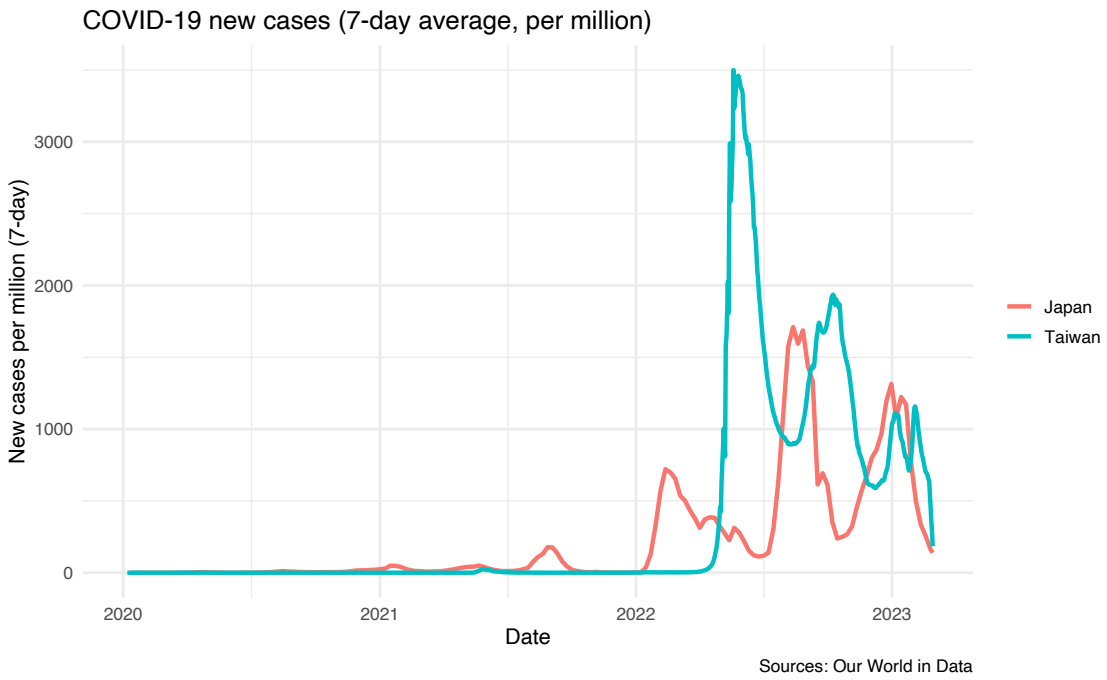


Figure 2: Excess Deaths in China, Taiwan, and Japan



Note: The negative number of excess deaths is thought to be the result of restrictions on behavior such as lockdowns, which have also suppressed the outbreak of infectious diseases other than COVID-19, such as influenza.

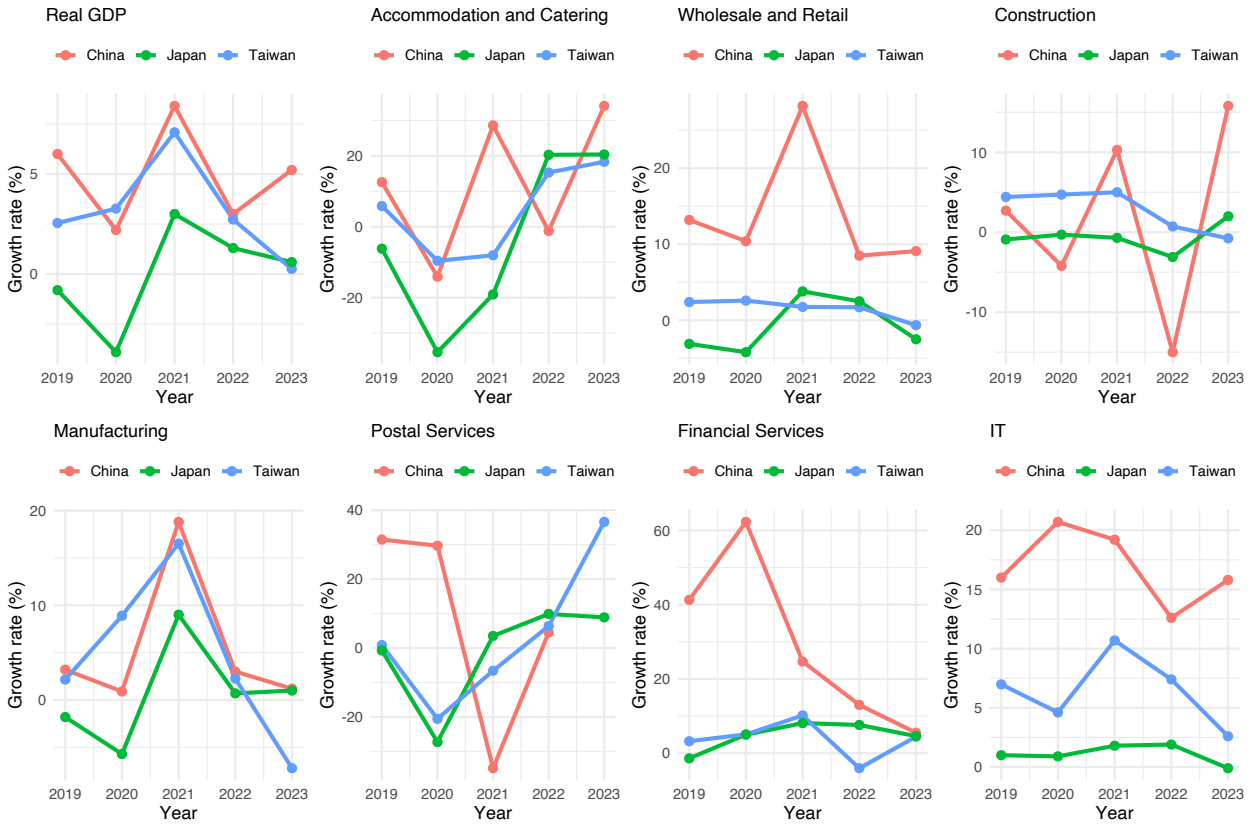
Figure 3: New COVID-19 Cases in Taiwan and Japan



Note: We do not report Chinese data due to limited data availability. See Dyer (2023).

Figure 4: Mobility index in Taiwan and Japan

Figure 5: Real Sectoral Growth Rates in China, Taiwan, and Japan

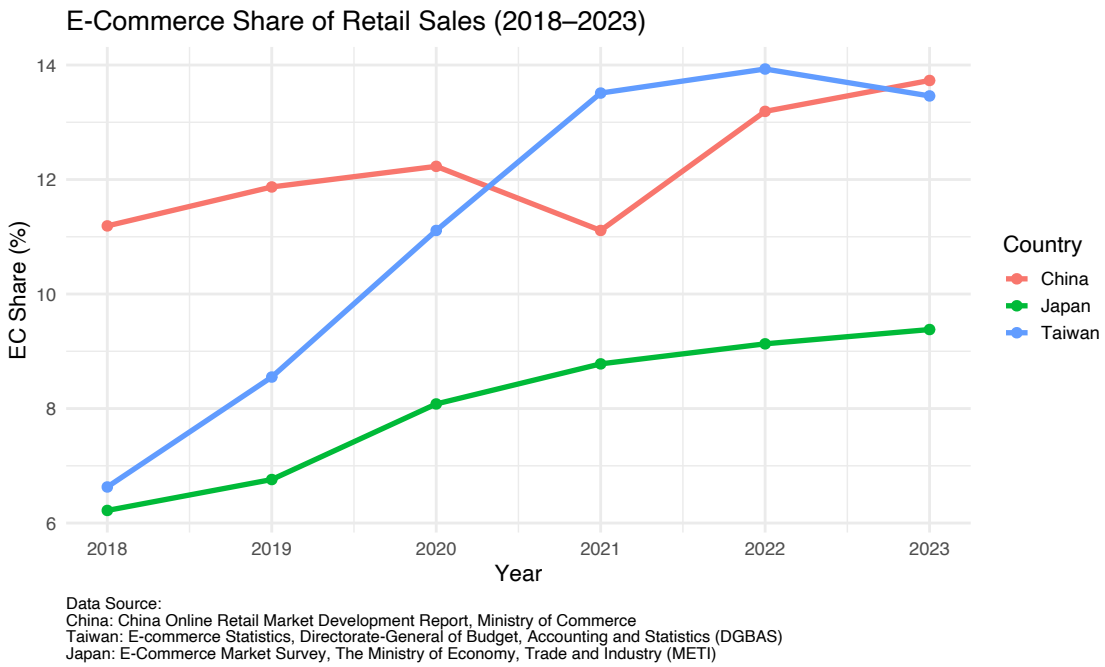


Note. Data are from National Accounts for each country; values represent year-on-year real growth rates.

Figure 6: Trade Growth Rates in China, Taiwan, and Japan

Data Source:
China: General Administration of Customs (GACC) – Customs statistics
Taiwan: Ministry of Finance, R.O.C. — External Trade Statistics
Japan: Ministry of Finance — Trade Statistics

Figure 7: E-commerce Share in China, Taiwan, and Japan



Data Source:
China: China Online Retail Market Development Report, Ministry of Commerce
Taiwan: E-commerce Statistics, Directorate-General of Budget, Accounting and Statistics (DGBAS)
Japan: E-Commerce Market Survey, The Ministry of Economy, Trade and Industry (METI)

Table 1: The supply-chain and other economic indices in China

Category		**Indicators**	**Feb-2020**	**Apr-2022**
Supply Chain	Production	Electricity generation growth	-4.6	-4.3
		Industrial-value added growth	-25.87	-2.9
		PMI: production (manufacturing)	27.8	44.4
	Storage	PMI: finished goods inventory (manufacturing)	46.1	50.3
		PMI: raw materials inventory (manufacturing)	33.9	46.5
	Delivery	Supplier delivery time: manufacturing	32.1	37.2
		Supplier delivery time: non-manufacturing	28.3	42.8
	Trade	3-month average goods export growth	-13.3	11.6
		3-month average goods import growth	-2.8	2.1
Domestic Demand		Aggregated fixed-asset investment growth	-24.5	6.8
		Aggregated real estate development investment	-16.3	-2.7
		Retail sales	-20.5	-11.1
		Commercial housing sales area	-39.9	-20.9
Expectation		Residents' intention to save	53.0	54.7
		Consumer confidence index	118.9	86.7
Other Measures		PMI (manufacturing)	35.0	47.4
		PMI (non-manufacturing)	29.6	41.9
		Urban unemployment rate	6.2	6.1
		Urban unemployment rate, 16-24 years	13.6	18.2

Source: Liu (2021)

Table 2: Taiwan's Selective Inner Demand Indexes

	2019	2020	2021	2022	2023
Foreign tourists (thousands)	11,864	1,378	140	896	6,487
TAIEX Index	10,790	12,074	16,938	15,623	16,386
TAIEX Volume (bn)	109.4	186.3	378.2	228.0	264.3
Hotel Room Revenue (bn)	268	145	134	198	273
Hotel Food Revenue (bn)	264	209	177	212	257

Source: Department of Statistics, Ministry of Finance