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# Responding to the China Challenge in Techno-Nationalism: Divergence Between Germany and the United States

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# **Responding to the China Challenge in Techno-Nationalism: Divergence Between Germany and the United States**

## **ABSTRACT**

President Xi Jinping has made clear that the ‘Great Rejuvenation of the Chinese Nation’ will involve world-leading competitiveness: his ‘Made in China 2025’ plan identifies ten core sectors of advanced technology. This article investigates how American and German elites have responded to this ‘China challenge’, a burgeoning ‘techno-nationalist’ phase of globalization. The first section explores the divergent state responses of Germany and the United States: while both national elites are concerned, the reaction of the US has been far more confrontational. The second section tries to explain this striking contrast in terms of the disparate domestic constituents. The US since Trump has aligned electoral grievances around manufacturing job losses with the interests of the national security establishment. In contrast, German labour has fared better in globalization, and the German state has not been able to override the interests of German capital in the way that the US has. Thus, we offer both an account of *how* Germany and the United States have responded differently to the China challenge, as well as explaining *why* in reference to the divergent structural conditions and class interests. We end by speculating that ‘techno-nationalism’ will only accelerate in the face of the Covid-19 pandemic.

**Key Words:** Made in China 2025; Techno-Nationalism; Globalization; Germany; United States; Industrial Policy; Geo-Economics

## INTRODUCTION

The rise of China is shaking the world. President Xi Jinping has made clear that the ‘Great Rejuvenation of the Chinese Nation’ must involve indigenous technological upgrading. With his ‘Made in China 2025’ (MIC 2025) plan, announced in 2015, this constitutes challenging the world’s current technological champions: the gauntlet has been thrown, the contest has begun. The United States has certainly taken notice and taken a myriad of actions since the Trump administration first designated China as a ‘strategic competitor’ in 2017 — from instigating a trade war to banning US firms from doing business with designated Chinese high-tech firms, most notably Huawei. This robust posture towards China has bipartisan support and is being continued under the Biden administration. In contrast, despite being the technological powerhouse of Europe and even more dependent on manufacturing exports for its GDP than the US, Germany has been slower to respond to the China challenge. While it has begun to more carefully screen Chinese acquisitions of advanced German technology and launched an EU-wide warning system when critical technologies and infrastructure are targeted, its more ambitious ‘National Industrial Strategy 2030’ (NIS 2030) to secure its ‘technological sovereignty’ through greater state involvement has been fiercely opposed by most major stakeholders and faces an uncertain future (BMW, 2019a).

What explains the divergence between the American and German responses to the China challenge? The answer, we argue, lies in (a) the different forms of economic integration between China and the United States on the one hand and between China and Germany on the other; and (b) in the different constellations of social interests that underpin their respective integrations. Driven by Western and primarily US transnational corporations (TNCs) relocating low- and medium-value production to low-wage economies in the 1990s and 2000s, China’s economic boom did not initially give much cause for concern for the governing coalitions in either of the two countries, albeit for different reasons. In the United States, labour was too weak to prevent Corporate America from moving entire production lines to China. Domestic industries and workers in particular regions of the United States lost out from offshoring to, and import competition from, China but could not find political representation until the Trump campaign leveraged these grievances. Concerns over China’s rise were, however, cultivated in the US national security

establishment, which naturally views the China challenge in geopolitical terms and supports a more adversarial US posture. Our argument is that the Trump administration was able to draw upon these two constituencies of labour and national security to drastically change US foreign and economic policy towards China. Seizing upon electoral grievances over the ‘China shock’ and building on institutional support from the military-industrial apparatus has allowed Trump, and now Biden, to formulate an aggressive response to China’s rise and its MIC 2025, going much further than the pressure that US (and other Western) corporate elites would like to see applied on China.

In Germany, by contrast, a comparatively more resilient labour movement has been better able to defend core workers in key export sectors and retain more high-skilled manufacturing jobs. This relative bargaining power, combined with the comparative advantage of German manufacturers in a range of advanced and customized capital goods which are crucial for emerging market economies to industrialize, meant that the effects of the ‘China shock’ on German manufacturing were cushioned and indeed more than offset by deepening trade integration: for the last two decades, China’s economic rise has presented an enormous opportunity for both capital and labour rather than a significant threat to either of them. Although this may be changing in the future, it means that neither of these two social constituencies are likely to support anything approaching the economic aggression directed against China by the United States. German businesses (like their American counterparts), though increasingly concerned about emerging rivalries with Chinese firms in particular sectors, still bank on the massive growth potential of the Chinese market and want to avoid being shut out or caught in the crossfire of the US-China trade war. And German labour, at least until recently, welcomed Chinese investors who generally guaranteed not to cut jobs or move production overseas (Emons, 2019: 202–03). Lastly, there is nothing like the American military-industrial complex in Germany that could compensate for this societal support, as Germany has relied on the United States for its national security since 1945. Short of these institutional capacities, the German state’s more limited response to the China challenge has relied on its corporatist tradition but struggled to enlist both capital and labour in its plans for an ‘NIS 2030’. While labour sees a revived industrial policy as a chance to raise its position as a stakeholder, capital opposes an enhanced role for the state in the economy as too high a price to pay for confronting a challenge from China that has yet to materialize fully.

The approach taken in this contribution departs from realist-inspired interpretations that see the China challenge as yet another instance in a perennial cycle of great power conflict. While such a reading could claim to account for the differential responses of a global US hegemon and a free-riding Germany, we reject it on both empirical and theoretical grounds. First, some of the actions taken by the US significantly expand what should be regarded as matters of ‘national security’ and therefore exceed what can easily be explained in terms of geopolitical competition. Second, the zero-sum view that the Trump administration took of US commerce with China also extended to trade with its military allies, quite unlike the diminution of inter-allied conflict that realist accounts would predict.<sup>1</sup> And third, there is a political economy to the defence interests of the United States that makes it difficult to disentangle whether domestic or international politics are at play and whether security threats are confronted or invoked to pursue other objectives.

Realist-inspired interpretations have difficulties accommodating these empirical complexities because they locate the autonomy of the state in an arena of politico-military competition, supposedly elevated above social struggles and superordinate to the economic sphere (Narizny 2007: 56). By contrast, we advance a class-based approach building on the work of Panitch and Gindin (2012), among others (Offe, 1984; Poulantzas, 1978), which hold that state policy, including national security, depends on and strives to promote the long-term vitality of capitalism. In this view, states derive much of their executive power not from an overriding security dilemma, but from endemic conflict and uncertainty over what the ‘general interest’ of capital is (Hawley, 1987: 145), and how it can best be pursued in an interdependent but politically fragmented global economy (Lacher, 2002). In other words, states retain independent decision-making capacity in so far as they mediate class antagonism and conflicting social interests, and as they manage a *globalizing* capitalism that poses new problems and possibilities rather than a single and easily discernible “imperative” to act upon (Germann, 2021; Panitch and Gindin, 2012: 4, 7, 342).

In the early twenty-first century, by far the most momentous of these challenges and opportunities relate to the unprecedented speed and size of Chinese late industrialization and urbanization — in

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<sup>1</sup> Similarly, the US sanctions against Chinese tech also seem to discriminate against European competitors, with exemptions granted primarily to US firms (Yang 2020).

terms of population, the equivalent of four USAs rising at once and much faster than it took the United States to industrialize (Rosenberg and Boyle, 2019: 36). Our research indicates that, under such circumstances, states are capable not only to ‘intervene’ but also to commandeer fractions of capital to pursue long-range objectives that may contradict the interests of capital in short-/medium-term profit accumulation. While this is clearer in China with the rise of Xi, this is also the case in the US with the state, for example, banning American firms from doing business with the Chinese technological giant Huawei in 2019, as this is against the profit interests of those American firms (especially since no American firm competes with Huawei’s world-leading market-share in 5G telecommunications network equipment).

At the same time, we argue that the current situation of mounting trade tensions and increasing technological rivalries in the global political economy is inadequately captured as ‘the return of the state’ and the concomitant ‘reversal of globalization’. In our view, these are liberal tropes that result from ignoring the central role powerful states — and the US in particular — have played in shaping globalization from the very beginning (Germann 2014; Panitch and Gindin, 2012; Starrs, 2013). Given that the state never left in the first place, what is becoming more pronounced is that states view the national ownership of capital, particularly of advanced technology and its corresponding firms, as vital to not only national security but also the economic prosperity and political stability of their societies. Accordingly, particularly in the context of increasing international competition, the nationality of capital is either something to be protected and promoted or — if it comes from a perceived or potential geopolitical rival — something to guard against.

In other words, we propose that we are witnessing not the end but a new phase of globalization, marked by a resurgence of what Richard Samuels (1994) called ‘techno-nationalism’ in reference to the key organizing principle of the 20<sup>th</sup>-century rise of Japan. As this essay shows, this resurgence is particularly pronounced in China and the United States, but also increasingly present in Germany and perhaps others outside our purview, especially in Northwest Europe and Northeast Asia. While focusing primarily on the divergent responses of the US and Germany to China, this article sets the basis for a class analysis of the varieties of techno-nationalism that we see emerging around the globe. The rest is divided into two sections: 1) to provide the context of the challenge

and responses; and 2) to explain the structural differences driving these divergent responses. We conclude with an analysis of the ramifications of the Covid-19 pandemic for these emerging trends.

## **1. WHAT IS THE ‘CHINA CHALLENGE’? AND HOW HAVE THE US AND GERMANY RESPONDED?**

This section argues that the ‘China challenge’ grows out of a structural dilemma that has faced Chinese policy makers: how to avoid falling into the ‘middle-income trap’ in a global environment in which competition through productivity enhancements or technological innovations rather than low wages is circumscribed by the already advanced capitalist states and their firms (Zenglein and Holzmann, 2019: 8). In order to escape this trap and sustain high-quality economic growth, China needs to shift away from dependence on lower-value, labour-intensive segments of production abandoned or offshored by earlier developers and break into ownership and innovation at the top of the value chains currently dominated (and owned) by American, European, and Northeast Asian companies (Mações, 2018: 77). That is, while China already excels in some high-value production such as in automobiles and electronics, with few exceptions this advanced production is still ultimately owned by foreign transnational corporations, whether directly or indirectly via subcontracting or joint-ventures, as we shall see below.

The key to this attempted transformation has been its ‘Made in China 2025’ strategy. The MIC 2025 is an ambitious industrial policy that aims to reorient the Chinese economy from being an export platform for foreign capital to developing its own advanced technology for export- and domestic consumer-driven growth. It focuses on boosting investment and research and development (R&D), more rigorously transfer technology from the world’s leaders, develop the advanced services sector and upgrade manufacturing in ten core industries: information technology, robotics, aerospace, renewable energy vehicles, raw material extraction, pharmaceuticals and medical equipment, ship building, agriculture, and mobile phones.<sup>2</sup> The plan sets sectoral targets for increasing the prominence of Chinese industry, and it aims to promote technological standards and intellectual property in order to allow Chinese TNCs to control and

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<sup>2</sup> Note that the original list (State Council of the People’s Republic of China, 2015) has evolved over the years.

own the most advanced value-chains. This is crucial since those firms that sit at the top of value chains accrue the most profit, which then allows for further R&D, marketing, and other high-value activities necessary for global competitiveness.

MIC 2025 takes inspiration from other East Asian models, Germany's *Industrie 4.0*, as well as the American system of government-sponsored research in its military-industrial complex, integrated with commercial enterprises (Mazzucato, 2014; Weiss, 2014). Despite contradictions — there is a tension between the type of trade liberalization necessary to source global knowledge, and the state support needed to build domestic capabilities (Ernst, 2018: 62) — the overarching vision is that China should become a technological superpower by 2049 (Zenglein and Holzmann, 2019), the hundredth anniversary of the founding of the People's Republic.

These efforts coalesce around a more interventionist and protectionist role for the Chinese Communist Party and its state-owned enterprises in China's political economy since Xi took power in 2012 (Babic et al., 2019; De Graaff and van Apeldoorn, 2018; Fuller, 2016; Norris, 2016; Starrs, 2017). Taken together, these processes constitute an illiberal challenge to the world's current technological champions. Among the states most directly affected is Germany,<sup>3</sup> given the significance of manufacturing for its gross domestic product and the prominence of high-tech small and medium-sized enterprises (SMEs) in its manufacturing sector (Joshi, 2019: 16; citing Wübbecke et al., 2016: 59). By comparison, the United States is less immediately threatened by China's plans to upgrade its industry, at least in most sectors. It is therefore rather surprising to see that the United States has responded far more aggressively to the China challenge than Germany. We now turn to these two divergent responses.

## **The US Response**

The foreign policy establishment of the United States was largely unconcerned about China's rise for much of the 1990s and early 2000s. The first substantive US response to Chinese investment emerged under Bush in 2005, when the US rejected the attempted acquisition of Unocal by a Chinese state-owned oil firm, CNOOC. Under the Obama administration, rising concerns came to

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<sup>3</sup> Alongside South Korea and Taiwan.

be formalized as a ‘Pivot to Asia’ strategy of ‘balance and contain’ (Tooze, 2018; Watkins, 2019: 12). Nevertheless, Obama still more or less maintained the decades-long US belief that positive engagement with China could further liberalize the latter (beginning with Nixon, but especially since Clinton), whereas the incoming Trump administration soon went on the offensive and explicitly stated that all previous US presidents have failed in their ‘overly’ accommodating stance towards China. Moreover, Trump’s withdrawal from the Transpacific Partnership (TPP) trade and investment negotiations on his first Monday in office more generally signalled a rejection of multilateral ‘free trade’ deals with his ‘America First’ foreign policy. This was fulfilling one of his key campaign promises to the ‘forgotten men and women of America’ whose lives have been upended by decades of trade deals (as discussed in Section 2), especially the Clinton administration signing NAFTA and China’s ‘Most Favoured Nation’ status when joining the WTO in 2001.

After over a year of threats, negotiations, and investigations, in the summer of 2018 Trump finally launched what would become a full-blown trade war between the two largest political economies in the world — the likes of which haven’t been seen in the post-1945 liberal world order. This sharp policy shift encompasses three aspects: 1) an escalating tariff war; 2) much tougher screening of Chinese investment in the United States; and 3) increased export controls on US technology to China. First, in February 2018 Trump imposed tariffs on solar panel and washing machine imports from all countries, not just China. In March these general tariffs were extended to steel and aluminium imports (exempting some countries). In response to the latter, in April China imposed tariffs on specifically 128 US products worth \$3 billion. By July 2018, Trump imposed the first China-specific tariffs on 818 imported goods worth \$34 billion. China immediately retaliated with tariffs on 545 US goods also worth \$34 billion. By the summer of 2019, these tit-for-tat tariffs were extended to virtually all of the China-US goods trade, with evolving exemptions based on negotiations. In January 2020 China and the US declared a trade war truce that soon began to fray as Covid-19 spread, as discussed in the Conclusion.

Second, already robust compared to Europe, Trump implemented even tougher restrictions on inward foreign investment. The Foreign Risk Review Modernization Act of August 2018 expanded the remit and budget of the already powerful Committee on Foreign Investment in the US (CFIUS), established in 1975. Whereas before CFIUS could block investment leading to control of a firm in

certain proscribed sectors relating to national security, it could now scrutinize any investment in technologies deemed to be ‘foundational’ and ‘emerging’, any investment at all from state-owned enterprises (SOEs), as well real estate transactions close to military installations (Zimmerman, 2020). That same year Chinese investment in the United States plummeted by over 80 percent, albeit China also imposed stricter capital controls to prevent capital flight and ‘irrational’ investment overseas (Kirkegaard, 2019: 3). Perhaps a symbol of the new restrictive posture, in April 2019 CFIUS forced Beijing Kunlun Tech to sell its 60 percent acquisition (made in 2016) of the gay dating app Grindr — in previous years hardly seen as a business vital to national security.

Third, the Trump administration implemented ever-widening export bans of US technology to China, starting with the August 2018 passage of the Export Control Reform Act. Most strikingly, the US launched an attack on core Chinese technology firms, outlawing all US business with them. First, in April 2018 the US Department of Commerce banned US firms from doing business with ZTE for seven years (China’s second-largest telecommunications equipment maker, and the world’s sixth largest at that time). With ZTE facing collapse (more broadly revealing China’s dependence on US technology), a deal was reached in June 2018 to suspend the ban for ten years on a probationary basis but with extraordinary conditions breaching Chinese sovereignty. China agreed to allow the US to replace the entire board of directors and senior management of one of its prized technology SOEs and embed a US compliance team during the ten-year probation at its headquarters in Shenzhen, for the first time in US Department of Commerce history.<sup>4</sup> In retrospect, this seems like a practice run for the even more significant ban on US business dealings with Huawei in May 2019, arguably China’s premier technology TNC. This not only effectively banned US firms from doing business with Huawei (with some exceptions) but even affected third-nation firms such as Arm Holdings from the UK and Panasonic from Japan (because of the US content in their exports). Coupled with a diplomatic campaign to ban Huawei in allied countries, it appears that the US state seeks nothing less than the end of Huawei’s global expansion. This constitutes an unprecedented attack on one of the most internationally competitive information technology firms

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<sup>4</sup> As Commerce crowed: ‘These collectively are the most severe penalty ... ever imposed on a company ... setting a new precedent for monitoring to ensure compliance with US law’ (US Department of Commerce, 2018).

of a major political economic power, at least in the post-1945 liberal order. Similarly, the US has since banned American business with over 100 Chinese technology firms.

Rather than simply reflect the idiosyncrasies of Trump and his trade advisor Peter Navarro, this revamped US posture towards China commands significant support from both political parties, as well as the national security apparatus. It harkens back to the US reaction to the increasing competitiveness of Japanese technology in the 1980s and early 1990s, especially in automobiles and semiconductors — largely successful by the turn of the century (Schwartz, 2017).<sup>5</sup> More strikingly, these trends are all continuing under the Biden administration. Within his first 100 days, far from removing US tariffs on Chinese imports (let alone rejoining the Transpacific Partnership) or relaxing controls on US business dealings with certain Chinese tech firms, the new President has expanded the export ban list to Chinese supercomputer firms, tightened restrictions on semiconductors, and is committing hundreds of billions of dollars in R&D investment and ‘Buy American’ plans — suggesting a lasting alignment of a new era of anti-free trade populism with the goals of the national security establishment to contain the China challenge.

### **Germany’s Response**

Compared to the United States, Germany’s response to the Chinese technology challenge has been belated and far less pronounced. It wasn’t until the contested acquisition of the Bavarian robotics manufacturer Kuka by Chinese appliances manufacturer Midea in early 2017 that the German government was called into action. German authorities fought hard to prevent the takeover but, in the end, failed to convince German companies like Siemens or Bosch to match the bid by Midea (Engelen, 2019: 64; Röhr, 2018: 234–235). The complacency of *Germany Inc.* prompted the German state to significantly tighten its screening of foreign direct investment and veto Chinese takeovers, such as in the case of IMTS, a small IT firm (Solomon and Chazan, 2021). In 2018, it lowered the threshold above which it can screen foreign acquisitions from 25 to 10 percent of

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<sup>5</sup> In fact, not only had Trump recycled his view on the Japan-US relationship in the 1980s with the China-US relationship post-2016, he even appointed Robert Lighthizer to reprise his previous role in the Reagan administration as a key official in US trade policy.

voting shares in the area of security and defence and where ‘critical infrastructures’ are concerned (Bierwagen, 2020). And in 2020, the German state prepared to broaden its legal mandate to act in cases that are ‘likely to affect’ public order or security in Germany or another EU member state, as well as where ‘projects and programmes of EU interest’ are concerned. The new legislation, brought forward because of the Covid-19 pandemic, adds health, state communications infrastructure, and raw materials to the list of critical sectors. This requires foreign investors to notify regulators if the ten per cent-threshold is crossed, and freezes such investment until the review is concluded. Moreover, together with France and Italy, Germany also promoted an EU FDI Screening Regulation to take effect from October 2020. Compared to the United States, however, this regulatory framework is considerably weaker (Kirkegaard, 2019: 9). While EU members liaise with the Commission where deals affect critical infrastructure and technologies, they retain ultimate decision-making authority. The new legislation therefore lacks the teeth of CFIUS and the ability to enforce its verdicts citing national/EU security (Bierwagen, 2020; BMWi, 2020; Stratmann, 2020). And while the US has expanded the list of controlled ‘dual-use’ exports to target Chinese high-tech, EU member states have been reluctant to follow this offensive move, the Commission lacks a strong mandate to develop an alternative approach, and the German government is divided (Barkin, 2020). Lastly, the German government has tightened security checks but resisted US pressure to preclude Huawei from 5G tenders. So far, fears of Chinese retaliation against German companies outweigh threats by the US to freeze non-compliant countries out of its intelligence sharing.

In other areas, to be sure, the German state has tried to make up for lost time in the new technological race. Aggravated by the Siemens-Alstom deal that was blocked by the European Commission in 2018/2019, it has pushed the Commission to ease cartel rules so that European companies can merge or cooperate to match the size and reach of state-subsidized competitors (Altmaier et al., 2020; Chee, 2020). It wants to relax EU state aid rules in order to fund strategic value chains ranging from battery cell manufacturing to industrial clouds and platforms (EC, 2020: 15; Hanke, 2020). And lastly, it has sharpened its national competition laws primarily to curb the power of US big tech but with a view also to Chinese digital companies (Neuerer, 2020; Kuhn, 2020). While the new powers of the German Cartel Office and Economics Ministry to regulate digital monopolies and FDI are impressive, progress at the EU level has been slow. The

Commission is weary of having its authority and competition policy checked, and other EU members fear that laxer regulation and more generous state support might benefit German and French companies above all. Most importantly, however, many of Germany's efforts have lacked much needed societal support, as argued in the next section.

The original intention was for these initiatives to coalesce around a 'National Industrial Strategy 2030' — drafted in February 2019 by the Economics Ministry with the express aim of securing Germany's social market economy in a global environment marked by US protectionism and Chinese expansionism (BMW, 2019a). And yet core proposals of the draft — that the state ought to build up European champions, or temporarily invest in key industrial and technology companies to protect them from foreign takeovers — were fiercely opposed by most stakeholders and dropped from the final version published ten months later (BMW, 2019b; Gersemann, 2019). Research institutes have warned that the state is a bad entrepreneur and defended the existing consensus that permits only 'market-conforming' interventions (e.g. Feld et al., 2019). Germany's *Mittelstand* has complained that the ministry's 'size matters' mantra threatens their existence (e.g. Die Familienunternehmer, 2019). And Big Business — though seeking 'reciprocal liberalisation' from China — fears that it will not be able to get rid of the state once it invites itself in, and that a German turn to protectionism could further escalate the US-launched trade wars (e.g. BGA, 2020: 1). Since Germany is so dependent on exports, increasing American and Chinese protectionism would be a disaster. In view of this opposition, it is uncertain whether NIS 2030 will ever become the official position of the German government.

## **2. GLOBALIZATION, LABOUR, AND AMERICAN HEGEMONY**

To understand why the United States has responded more aggressively and comprehensively to the China challenge than Germany, we begin with an analysis of national accounts to identify the broad pattern of economic integration between the United States and China, and contrast it to the German-Chinese relationship. We reinterpret this conventional data in light of the globalization of production and demonstrate that American capital continues to dominate the transnational value chains integrating China, especially in sectors related to MIC 2025, whereas German capital has massively increased its exports to China while retaining more of its manufacturing at home. We

suggest that this is in part due to the differential power of labour in Germany and the United States. The former has negotiated trade-offs with German capital and partially benefitted from deeper integration with China. The latter has been outflanked and decimated by the offshoring (and automation) of production. This destruction has stoked the populist rage that Trump, together with the growing alarm of the US national security apparatus concerning China's rise, could channel into an escalating confrontation. The German state, by contrast, cannot build on such grievances or an independent national security establishment for a comprehensive response to US and Chinese techno-nationalism.

First and foremost is the trade deficit. We can see in Table 1 that the US deficit with China for 2019, which China reported at \$308 billion<sup>6</sup> — even during the height of the trade war — accounts for an astounding 29 per cent of China's total trade surplus with the world. In contrast, Germany runs a small surplus with China of \$23 billion. But what is even more striking is that German exports to China equal the value of US exports to China (\$100 billion), despite the GDP of the United States being roughly quadruple its size. In fact, for the past decade, Germany has accounted for about half of all exports of manufactured goods from the EU-28 to China: an exporting powerhouse relative to its size (Germann, 2021: 176).

*[please insert Table 1 here]*

In addition, while of course the US also exports high-value manufactured goods to China, much of its exports consist of agricultural and other commodities, whereas German exports are weighted more towards advanced manufactured goods. As Table 2 shows, Germany has a trade surplus in six of the seven sectors relevant for MIC 2025, with its largest surplus in Vehicles & Parts at \$19.9 billion.

In contrast, the US only has a surplus in four. With the exception of aerospace, it is notably smaller than Germany's. And, most remarkably, the US also has giant deficits in Electrical Machinery (-

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<sup>6</sup> Note that there are significant differences between the official trade statistics released by China, the United States, and Germany. For an analysis of the sources of the US-China discrepancies, see the annual reports by the Congressional Research Service (e.g. Martin, 2019).

\$69.2 billion) and Electronics (-\$86 billion). This is despite the fact that German and US exports in these two sectors taken together (\$23.4 and \$12.7 billion for Germany, \$17.4 and \$20.2 billion for the US) are almost equal in absolute terms, illustrating how disproportionately more advanced manufacturing has remained in Germany relative to the United States.

*[please insert Table 2 here]*

Contrary to the political rhetoric and public discourse, however, the overall American trade deficit does not mean that Chinese firms are outcompeting American firms — a prominent but flawed explanation for Trump’s tariff and tech war.<sup>7</sup> Especially in advanced technology, these national accounts obscure the transnational value chains that are a core feature of the post-Cold War era of globalization — and how American firms have been their driving force (Sturgeon, 2002). That is, in a wide array of technological sectors, US firms have outsourced their production of various components and final assembly to especially Taiwanese firms which then manufacture in China to export back to the United States.<sup>8</sup> Figure 1 reveals that of the exports relating to China’s insertion into global value chains — what China Customs classifies as ‘process with imported materials’ exports — which account for 29 per cent of China’s total exports (\$735 billion) in 2019, foreign-owned enterprises account for a staggering over 60 per cent since 2006 to the present. If we add joint-ventures, what China Customs classifies as ‘foreign-invested enterprises’ dominate at over 80 per cent of these crucial exports since 2004. Hence the overwhelming majority of China’s advanced technology exports are actually conducted by foreign-invested enterprises, and only 16 per cent of these exports are owned by private Chinese firms by 2020. Halfway through the timeline of MIC 2025, Chinese firms still have a long ladder to climb to compete with foreign manufacturing firms even within China, let alone abroad.

*[please insert Figure 1 here]*

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<sup>7</sup> See Fischer, 2018. For discussion on how we should interpret the American deficit and Chinese surplus more broadly, see Akyüz, 2017; Yu, 2018.

<sup>8</sup> See Starrs, 2018, p. 189, *Table 1. Top Ten Exporting Firms from China by Total Value (US\$), 2015*: Six of the top ten are Taiwanese (including China’s largest exporter, Foxconn), two are South Korean (Samsung and LG), and only two are Chinese (Huawei at fifth largest exporter and Sinopec at ninth). For broader data on ‘foreign-funded enterprises’ exporting from China, see Fischer, 2015: 723–24.

Moreover, the US firms at the head of these transnational supply chains, best exemplified by Apple, appropriate the lion's-share of the profit from these subcontracting relationships spread across multiple continents, with final assembly in China. We can see this in the national profit-shares revealed in Table 3 in the sectors of the *Forbes Global 2000* that roughly align with MIC 2025.<sup>9</sup> The *Forbes Global 2000* ranks the world's top 2,000 corporations using a composite index of assets, market value, profits, and sales — these firms represent the pinnacle of global capitalism. In Table 3 we can see that transnational corporations domiciled in the United States continue to dominate by profit-share most of these relevant advanced industries: from 53 per cent of Electronics to a staggering 79 per cent and 84 per cent in Aerospace and Medical Equipment, respectively, of the profit of the world's top 2,000 corporations.<sup>10</sup> Therefore, even if global production is no longer geographically concentrated in the United States to the extent that it was in the 1950s and 1960s, in the age of globalization American corporations still appropriate the bulk of the profit from this production, at least in the relevant advanced sectors relating to MIC 2025.<sup>11</sup> It would therefore be mistaken to attribute Trump's response to any significant competitive pressure Chinese capital puts on US TNCs.

[please insert Table 3 here]

Given this American corporate dominance coupled with Chinese firms, in aggregate, now surpassing the German profit-share in key technology sectors of the *Forbes Global 2000*, it is all the more a paradox that the US state response to the China challenge has been so much more

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<sup>9</sup> It is impossible to have a precise alignment of sectors between the *Forbes Global 2000* (or any other ranking) and MIC 2025 because of divergent classificatory systems and the fact that many of the largest firms — such as Apple, General Electric, Samsung, Siemens — straddle diverse sectors, among other reasons. Hence these are rough correlations but still illustrative of our general point.

<sup>10</sup> Please see *Table S3* in Supplementary Online Data for a wider look at the years 2015–2020, which corroborate our observations. Notwithstanding short-term fluctuations, American dominance in Pharmaceuticals and Electronics has actually increased from 50 per cent in 2015 to 58 per cent in 2020 and 49 per cent in 2015 to 57 per cent in 2020, respectively. And while China has increased its profit-share in almost all sectors, growth has been uneven with already some declines in Electrical & Industrial Machinery, Electronics, and Vehicles & Parts — which should caution us to linear growth projections. In general, the increasing competitiveness of these Chinese firms is more at the expense of European and Japanese, rather than American, capital.

<sup>11</sup> The primary exception is in Vehicles & Parts (see *Table S3*), the global leaders of which are Japan and Germany, and by 2020 the Chinese profit-share has virtually caught up with the American at 8.3 and 8.4 per cent, respectively — even if this marks a decline of the Chinese profit-share from 11 per cent in 2017.

assertive than Germany's. This is also striking because much of Corporate America was also against Trump's belligerent turn, at least initially and especially in regards to launching a trade war. As argued elsewhere (Gilboy, 2004; Starrs, 2018; Steinfeld, 2010), the nature of China's integration into global capitalism has been highly beneficial to top American corporations with their global value chains leveraging cheap Chinese costs (namely, an obedient and super-exploitable workforce, lax environmental and labour regulations) and relatively excellent infrastructure. Thus, US tariffs on China's exports of advanced technology are more often than not a tax on these American TNCs exporting from China (via their East Asian suppliers). It is no wonder the American Chamber of Commerce, the largest corporate lobby group in the world, was against Trump's trade war — although many eventually began supporting elements of his wider agenda (Cafruny, 2019: 108–09).<sup>12</sup>

On the other hand, despite these benefits to Corporate America, the effects on American labour have been very different. According to some calculations, as many as 2.4 million manufacturing jobs were lost between 1999 and 2011 due to Chinese import competition (Acemoglu et al., 2016). The exact figure is impossible to calculate because much labour has also been lost to increasing automation (as well as import competition from Mexico and others). But whatever the exact figure, perhaps more important is the impression amongst large swathes of the American population, especially in the electorally significant Mid-Western 'Rust Belt', that global trade deals have allowed American jobs to be shipped overseas, most of all to China. These sentiments (whether accurate or not), were certainly widespread enough to have provided fertile ground for both Trump's right-wing and Bernie Sanders' left-wing populism in 2016. That is, massive and growing inequality since the 1980s, decimated communities that relied on a single or a handful of now shuttered manufacturing plants, increasing 'deaths of despair' (drug overdoses and/or suicides), and so on (Case and Deaton, 2020; Hedges, 2018). Much of the populist rage is directed at liberal elites and the political establishment more generally, as they suggest that the 'losers' of globalization should simply get another job, move to a more dynamic community, and/or that American workers should rejoice because prices of many daily goods have stagnated or declined thanks to the super-exploitation of Chinese labour. Of course, Amazon and Wal-Mart themselves

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<sup>12</sup> This is in part because they shared Trump's desire to stop intellectual property theft, forced foreign technology transfers, national subsidies and protectionism, and other aspects of China's industrial policy.

have ravaged family-owned retail stores across Main Street USA, unable to compete with their massive economies of scale of cheaper Made in China goods — further hollowing out entire communities.

Therefore, the pattern of economic integration between China and the United States (as the world's leading importer) has been markedly different than with Germany (arguably the world's leading exporter, if judged by ownership). Since the mid-1990s, the share of Germany's manufacturing sector has remained stable at around 20 per cent of GDP. In the United States, it decreased from 16 per cent in 1997 to 11 per cent in 2017 (World Bank, 2020). Hence as mentioned above, Germany has retained more of its manufacturing at home despite China becoming the workshop of the world, whereas US TNCs have played a large role in driving this rise, shifting production and importing back to the United States. By 2019, Germany posted the world's largest current-account surplus for the fourth year in a row, while its exports in goods have exceeded 38 per cent of its GDP over the past decade (OECD, 2020). In fact, far from a hollowing out, Germany's expanding trade with China — encompassing its supply chains in Central and Eastern Europe — is held to have *added* some 444,000 manufacturing jobs between 1990 and 2010 (Dauth et al., 2017; Südekum, 2018: 49). Moreover, it should be noted that the German welfare state — though significantly scaled back since the early 2000s — still helps to blunt the sort of social decay, despair, and thus populist grievances seen in the United States. And even where it no longer stems downward mobility and precarity, the resulting right-wing populism has taken aim at the EU, Islam, and refugees, rather than China (Balhorn and Nachtwey, 2019).

These divergent patterns of economic integration with China are closely related to the differential strength of organized labour in the United States and Germany. Faced with little organized opposition from a disintegrating labour movement, coupled with accommodating neoliberal policies, US TNCs since the 1980s have been relatively unrestrained in moving entire industries abroad. German firms, though successful in circumventing central union-led bargaining through company-level deals in the 1990s (Kinderman, 2005), still confront labour representation on the shop floor and in the boardroom because of Germany's co-determination laws (Kwon, 2012). These so-called works councils, which elect members of the board of directors and participate in corporate decision-making, have been able to negotiate important concessions at the cost of a more

radical and inclusive perspective (Soltz, 2015). In contrast to their US counterparts, German corporations have tended to relocate only the most low-skilled and labour-intensive segments of a modularized production line, while committing to retaining higher-value segments of production inside Germany (Gräf et al., 2013: 12). Compared to the US, therefore, German capital still shares more of the spoils of the China trade with German labour, albeit on increasingly unequal and exclusive terms (Lehndorff 2016: 189). Whether future Chinese acquisitions of German technology firms will significantly alter this calculus remains to be seen. While the image of Chinese investors has recently been clouded by job cuts in some prominent cases like Kuka, most works councils have found that their new Chinese owners have upgraded or expanded production, maintained existing staff and sites, and left companies operationally independent (Emons, 2019: 202–03). Insofar as organized labour is changing its mind and calling for a German response, it is motivated more by the enhanced influence it hopes to gain from an industrial strategy than the competitive threat of China.

Even more important than the differential strength of American and German labour to arrest the offshoring of manufacturing, the vast ‘national security apparatus’ of the United States — the indispensable, coercive dimension of its global hegemony since 1945, encompassing the Pentagon and intelligence agencies — has provided the infrastructure that sustains US economic aggression towards China. It reaches far into the foreign policy and media establishment, including think tanks and associated academics. Its routine operating procedure since the collapse of the Soviet Union has been to prevent the emergence of any other rival power. While partially distracted by the ‘war on terrorism’ of the 2000s, China’s continued rise through the 2008 Wall Street crash and ensuing global financial crisis began to raise alarm bells in the national security state. These concerns accelerated with the appointment of President Xi Jinping in 2012, with his increasingly assertive foreign and domestic policies, from constructing military installations in the South China Sea to consolidating a more state capitalist model explicitly oriented towards developing world-leading national champions including in military technologies.

Thus, while Trump was politically savvy enough (compared to most pro-free trade presidential candidates on both sides) to ride (and partially stoke) the wave of populist grievances and anti-establishment sentiments to electoral success, he also found common cause — not to mention

capacities — in the growing alarm of the almighty US national security state. This confluence of interests allowed Trump to dramatically escalate tensions with China, as we saw in Section 1. No such national security state exists in Germany, which of course had to give up its hegemonic pretensions in 1945. If American capital has outsourced its production to China, the German state has outsourced the organized violence needed to maintain global capitalism to the United States. While this has allowed Germany to ‘free-ride’ under the US security umbrella, it has also deprived it of sufficient capacities to bring together opposing interests and overcome the short-termism of business in the name of ‘national security’.

To be sure, the German state — partially in response to rising pressures from both China and the United States — has of late sought to blur the distinction between civilian and military spheres. Moving in tandem with the EC president and former German defence minister Ursula von der Leyen, it has declared the security and defence sector to be vital to Europe’s industrial development (Bundesregierung, 2020: 2; EC, 2020: 13). And in turn, it has extended the range of industries it sees as critical to national security and thus deserving special state support (Bundesregierung, 2020). But while these steps are welcomed by some, German capital on the whole is resolutely opposed to ‘an extension of national security to the protection of key technologies’ (BDI, 2019: 13). And most of the German establishment have opposed the NIS 2030 in whole or in part as an impermissible intervention of the state in Germany’s vaunted ‘social market economy’. Without substantial social forces or a national security apparatus to override the profit interests of capital, the German state has to seek consensus through a revived crisis corporatism, epitomised by its multi-stakeholder *Industrie 4.0* platform. Whether a broader class coalition and comprehensive strategy can emerge from this remains to be seen — but we expect any such German technonationalism to depart significantly from either China or the US.

## CONCLUSION

The final question to address is how Covid-19 has changed the global context and the national responses we have identified in this article. Many commentators see the virus as intensifying pressures towards ‘de-globalization’ (e.g. Ortega, 2020) — the definitive reversal of the post-Cold

War era of a nationally deregulated, multilaterally managed, and globally expanding capitalism, already in crisis since the Great Recession of 2008. The worst-case scenario, in this view, is a breakup of the world economy into rival blocs — akin to the 1930s and already apparent in the US economic warfare against China. To be sure, the virus has revealed the remarkable fragility of a world economy of transnational value chains and ‘just-in-time’ production. It has led many states to commandeer capital to procure the resources and technologies to fight the virus. There is no doubt that this situation, unseen in peacetime in the advanced capitalist world and comparable only to the war economies of the two world wars, holds out the possibility for a significant reorganization of global capitalism. In our view, however, invocations of the Great Depression as a guide to the future are based on the false assumption that the *status quo* now receding was truly a ‘flat world’ in which capital, goods and services circulated far and wide across the globe without prejudice or restrictions. By contrast, we see globalization as a force that was always steered by powerful states and TNCs, massively concentrated in specific regions of the world, and regulated to benefit particular states, societies, and classes. Accordingly, we propose to conceptualise the broader shift underway not as a replay of the past but a new phase of capitalist globalization, in which states are expanding their tools to favour (but also to discipline) what they identify as their ‘national’ or ‘allied’ capital.

Going forward, we suggest that this new era can be fruitfully approached through the lens of ‘techno-nationalism’ (Samuels, 1994), with the important proviso that we are seeing divergent, as well as interdependent, state strategies. We have seen that it is primarily in the United States where the China challenge has been registered and countered as a vital issue of national security, fuelled by an anti-globalism that was stoked by Trump. In this way, the pandemic empowered hawks within both administrations to step up US economic warfare against China. Under the pretext of punishing China for its mismanagement of the virus outbreak, the US announced further tariffs and new sanctions on Chinese officials and companies, restricted the flow of essential goods, and tightened export controls on Huawei and its US suppliers (Pamuk and Shalal, 2020; Politi, 2020). It is also considering tax incentives and subsidies to encourage US companies to leave China and repatriate production and supply chains (Small, 2020: 10). And it aims to build an ‘Economic Prosperity Network’ of allied states in Asia and Latin America and ‘trusted partner’ companies that hope to benefit from this coercive decoupling (Pamuk and Shalal, 2020). In the US, then, the

pandemic has primarily altered the timeline rather than the fundamental approach. And while the mounting death toll and economic collapse arguably derailed the re-election of Trump, this article has revealed broad-based momentum within the foreign policy and national security establishment to further expand and deepen these policies under the Biden presidency.

The German state, we have shown, has resisted being pulled into the contest on such geopolitical and geoeconomic terms. And yet its endeavour to formulate an alternative response to the ‘China challenge’ has foundered because its domestic class compromise has so far been sustained rather than undermined by deeper integration with China over the past decade. This owes to the stronger bargaining power of labour in Germany, leaves the German state without an immediately injured party to support a strategic shift, and stands in marked contrast to the grim reality underneath the ‘Death by China’ rhetoric that emanated from the American populist right.

In Germany, therefore, the pandemic has had a different impact. It has enabled the state to push through parts of the NIS 2030 which capital previously opposed and which labour only tacitly supported. Bailed out to the tune of half a trillion dollars, German business has had to accept, for now, a reprise of the controversial idea for a national investment fund that allows the state to take ownership stakes not only to recapitalize distressed companies but also — as the Economics and Finance Ministry have stressed — to protect them from Chinese and US rivals taking advantage of rock bottom prices (Funk, 2020). The pandemic has also added pressure on European regulators to cede to Franco-German demands and prepare proposals that allow national authorities to regulate companies ‘unfairly’ subsidized by the Chinese state (Espinoza, 2020). Most importantly, the crisis has, for the first time, made a ‘business case’ for bringing manufacturing back. Reshoring vital industries, most notably medicine or food — decried only recently as an economic folly (e.g. Zettelmeyer, 2019: 7) — seems to be emerging as a new consensus within Europe, with the French president and German chancellor calling on the EU to identify critical sectors in which Europe ought to build up strategic capabilities after the pandemic (Vela, 2020).

Whether these industries will overlap with those of China’s MIC 2025, and whether the interventionist measures will outlive the emergency situation under which they are being adopted, remains to be seen. We would certainly caution whether the pandemic is yet another crisis where

the state steps in to socialize corporate losses only to let capital return to business as usual once recovered. But insofar as the virus acts as a further catalyst of the developments we have identified above, it will likely propel the United States and Germany along divergent techno-nationalist paths.

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## Responding to the China Challenge in Techno-Nationalism: Divergence Between Germany and the United States

### TABLES AND FIGURES

*Table 1. China's Manufactured Goods Trade with Germany and the United States, 2015 and 2019 (billions)*

|                      | Total Trade |         | Chinese Exports |         | Chinese Imports |         | China Surplus or Deficit? |          |
|----------------------|-------------|---------|-----------------|---------|-----------------|---------|---------------------------|----------|
|                      | 2015        | 2019    | 2015            | 2019    | 2015            | 2019    | 2015                      | 2019     |
| <b>World</b>         | \$3,288     | \$3,641 | \$2,167         | \$2,352 | \$1,121         | \$1,289 | +\$1,046                  | +\$1,063 |
| <b>United States</b> | \$505       | \$508   | \$401           | \$408   | \$104           | \$100   | +\$297                    | +\$308   |
| <b>Germany</b>       | \$151       | \$177   | \$67            | \$77    | \$84            | \$100   | -\$17                     | -\$23    |

**Source:** Authors' calculations from UN Comtrade (2020), as reported by China.

**Note:** To measure trade in 'manufactured goods', we use the Standard International Trade Classification (SITC) of the United Nations, Rev. 3, (5–8).

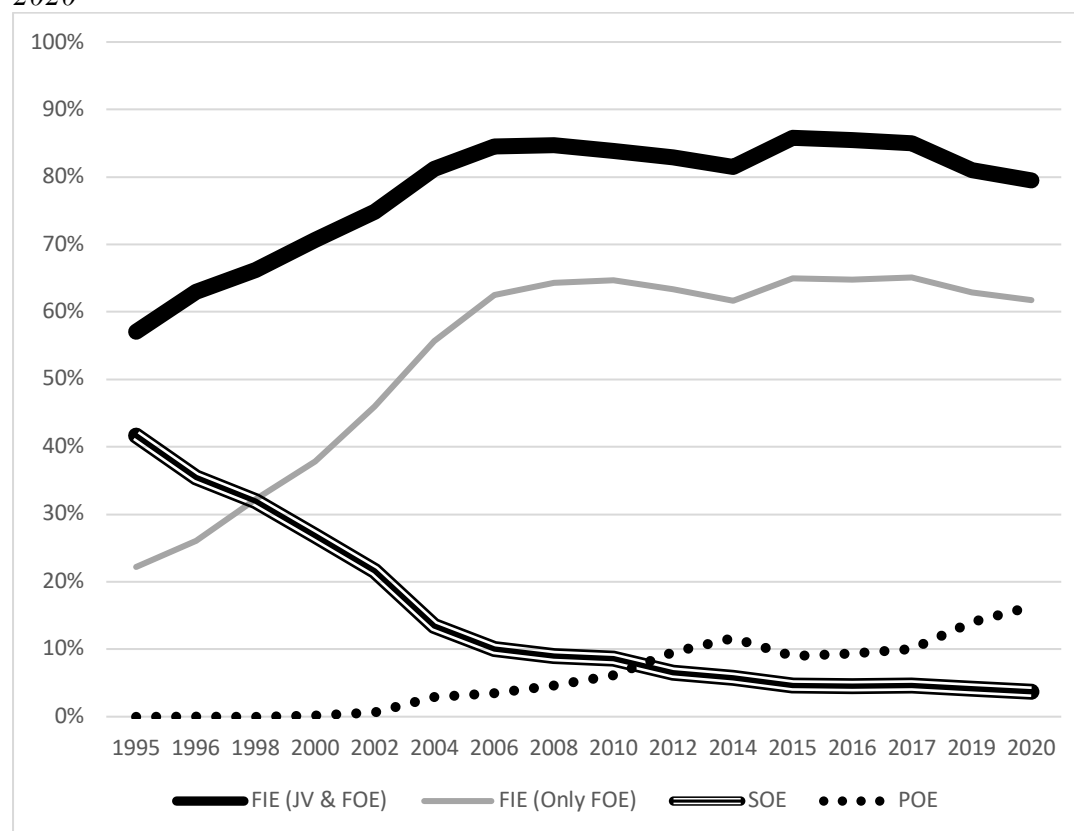
*Table 2. China's Trade with Germany and the United States in Key Sectors, 2019 (billions)*

| <b>World Customs Organization Harmonized System Sectors</b> | <b>Exports to Germany</b> | <b>Imports from Germany</b> | <b>China-German Trade Balance</b> | <b>Exports to US</b> | <b>Imports from US</b> | <b>China-US Trade Balance</b> |
|-------------------------------------------------------------|---------------------------|-----------------------------|-----------------------------------|----------------------|------------------------|-------------------------------|
| <b>VI.28–38 Chemicals</b>                                   | \$3.9                     | \$14.9                      | -\$11                             | \$14                 | \$16                   | -\$2                          |
| <b>VI.30 Of which, Pharmaceuticals</b>                      | \$0.4                     | \$8.9                       | -\$8.5                            | \$1.8                | \$4.9                  | -\$3.1                        |
| <b>XVI.84 Electrical Machinery</b>                          | \$18                      | \$23.4                      | -\$5.4                            | \$86.6               | \$17.4                 | \$69.2                        |
| <b>XVI.85 Electronics</b>                                   | \$18.4                    | \$12.7                      | \$5.7                             | \$106.2              | \$20.2                 | \$86                          |
| <b>XVII.87 Vehicles &amp; Parts</b>                         | \$2.8                     | \$22.7                      | -\$19.9                           | \$14.3               | \$10.7                 | \$3.6                         |
| <b>XVII.88 Aerospace</b>                                    | \$0.2                     | \$3.7                       | -\$3.5                            | \$1.2                | \$7.2                  | -\$6                          |
| <b>XVIII.90 Medical Equipment</b>                           | \$3.6                     | \$10.8                      | -\$7.2                            | \$9.8                | \$12.5                 | -\$2.7                        |

**Source:** Authors' calculations from UN Comtrade (2020), as reported by China.

**Note:** For 2015 data, please see *Table S2*.

Figure 1. Enterprise Type for China's 'Process with Imported Materials Exports', 1995–2020



Source: Authors' calculations from China's Customs Statistics, 1995–2021.

Note: FIE=Foreign-Invested Enterprise; JV=Joint-Venture; FOE=Foreign-Owned Enterprise; SOE= State-Owned Enterprise; POE=Privately-Owned Enterprise.

Table 3. Forbes Global 2000 National Profit-Shares in Key Sectors, 2019

| Table 2 Sectors                                    | US Profit-Share | Germany Profit-Share <sup>1</sup> | China Profit-Share |
|----------------------------------------------------|-----------------|-----------------------------------|--------------------|
| Chemicals                                          | 19%             | 14%                               | 3.8%               |
| Pharmaceuticals                                    | 51%             | 0.4%                              | 2.7%               |
| Electrical & Industrial Machinery, Incl. Computers | 46%             | 4.9%                              | 9.2%               |
| Electronics, Incl. Semiconductors & Smartphones    | 53%             | 0.5%                              | 1.6%               |
| Vehicles & Parts                                   | 11%             | 29%                               | 8.1%               |
| Aerospace                                          | 79%             | 1.3%                              | 0%                 |
| Medical Equipment                                  | 84%             | 5.8%                              | 0.9%               |

<sup>1</sup> Note that most German technology firms are too small to show up in the *Forbes Global 2000*. This includes the approximately 1800 'hidden champions' (mostly machinery and electronics manufacturers) that in 2016 generated some €22 billion in profits (Rammer and Spielkamp, 2019: 8, 12) — important for the German economy but globally insignificant. This is itself an indication that the competitive pressures facing German capitalism today emanate as much, if not more, from the extraordinary lead of US capital than the catch-up efforts of Chinese firms.

**Source:** Authors' Calculations from *Forbes Global 2000* (2019)

**Note:** Please see *Table S3* for methodology.

## Responding to the China Challenge in Techno-Nationalism: Divergence Between Germany and the United States

### Online Supplementary Data

*Table S2. China's Trade with Germany and the United States in Key Sectors, 2015 (billions)*

| <b>World Customs Organization Harmonized System Sectors</b> | <b>Exports to Germany</b> | <b>Imports from Germany</b> | <b>China-German Trade Balance</b> | <b>Exports to US</b> | <b>Imports from US</b> | <b>China-US Trade Balance</b> |
|-------------------------------------------------------------|---------------------------|-----------------------------|-----------------------------------|----------------------|------------------------|-------------------------------|
| <b>VI.28–38 Chemicals</b>                                   | \$3.1                     | \$9.3                       | -\$6.2                            | -\$12.6              | \$13.4                 | -\$0.8                        |
| <b>VI.30 Of which, Pharmaceuticals</b>                      | \$0.2                     | \$4.5                       | -\$4.3                            | \$1.3                | \$3.3                  | -\$2                          |
| <b>XVI.84 Electrical Machinery</b>                          | \$15.3                    | \$20.8                      | -\$5.5                            | \$84.4               | \$15.9                 | \$68.5                        |
| <b>XVI.85 Electronics</b>                                   | \$14.2                    | \$12.4                      | \$1.8                             | \$95.4               | \$19.5                 | \$75.9                        |
| <b>XVII.87 Vehicles &amp; Parts</b>                         | \$1.8                     | \$20.4                      | -\$18.6                           | \$13.3               | \$13.2                 | \$0.1                         |
| <b>XVII.88 Aerospace</b>                                    | \$0.3                     | \$2.8                       | \$2.5                             | \$0.9                | \$16.1                 | -\$15.2                       |
| <b>XVIII.90 Medical Equipment</b>                           | \$2.9                     | \$7.8                       | -\$4.9                            | \$9.9                | \$11.3                 | -\$1.4                        |

Source: Authors' calculations from UN Comtrade (2020), as reported by China.

*Table S3. Forbes Global 2000 National Profit-Shares in Key Sectors, 2015–2020*

| <b>Table 2 Sectors</b>  | <b>Year</b> | <b>Total Profit</b> | <b>US Profit-Share</b> | <b>Germany Profit-Share</b> | <b>China Profit-Share</b> |
|-------------------------|-------------|---------------------|------------------------|-----------------------------|---------------------------|
| <b>Chemicals</b>        | 2015        | \$73.8bn            | 31%                    | 19%                         | 0%                        |
|                         | 2016        | \$69bn              | 31%                    | 16%                         | 0%                        |
|                         | 2017        | \$72.2bn            | 22%                    | 17%                         | 1.5%                      |
|                         | 2018        | \$90.8bn            | 19%                    | 24%                         | 2.1%                      |
|                         | 2019        | \$82.2bn            | 19%                    | 14%                         | 3.8%                      |
|                         | 2020        | \$54.2bn            | 18%                    | 22%                         | 4.6%                      |
| <b>Pharmaceuticals</b>  | 2015        | \$114.7bn           | 50%                    | 1.3%                        | 1.0%                      |
|                         | 2016        | \$134bn             | 48%                    | 0.9%                        | 1.2%                      |
|                         | 2017        | \$126bn             | 48%                    | 1.4%                        | 2.4%                      |
|                         | 2018        | \$111.5bn           | 50%                    | 2.6%                        | 2.6%                      |
|                         | 2019        | \$122.8bn           | 51%                    | 0.4%                        | 2.7%                      |
|                         | 2020        | \$159.7bn           | 58%                    | 3.9%                        | 3.3%                      |
| <b>Electrical &amp;</b> | 2015        | \$124.6bn           | 54%                    | 6.1%                        | 4.5%                      |

|                                                            |      |           |      |       |      |
|------------------------------------------------------------|------|-----------|------|-------|------|
| <b>Industrial Machinery, Incl. Computers</b>               | 2016 | \$97.6bn  | 47%  | 2.7%  | 5.6% |
|                                                            | 2017 | \$89.2bn  | 56%  | 7.9%  | 2.5% |
|                                                            | 2018 | \$114.8bn | 31%  | 6.7%  | 7.8% |
|                                                            | 2019 | \$124.2bn | 46%  | 4.9%  | 9.2% |
|                                                            | 2020 | \$119.1bn | 51%  | 5.4%  | 8.4% |
| <b>Electronics, Incl. Semiconductors &amp; Smartphones</b> | 2015 | \$196.5bn | 49%  | 0.4%  | 1.1% |
|                                                            | 2016 | \$169.7bn | 59%  | 0.4%  | 1.0% |
|                                                            | 2017 | \$152.5bn | 62%  | 0.5%  | 1.3% |
|                                                            | 2018 | \$219.3bn | 47%  | 0.6%  | 2.9% |
|                                                            | 2019 | \$275.1bn | 53%  | 0.5%  | 1.6% |
|                                                            | 2020 | \$226.7bn | 57%  | 0.4%  | 7.6% |
| <b>Vehicles &amp; Parts</b>                                | 2015 | \$123bn   | 12%  | 31%   | 9%   |
|                                                            | 2016 | \$135.5bn | 17%  | 23%   | 8.1% |
|                                                            | 2017 | \$131.9bn | 14%  | 22%   | 11%  |
|                                                            | 2018 | \$157.9bn | 6.9% | 27.8% | 7.4% |
|                                                            | 2019 | \$137.7bn | 11%  | 29%   | 8.1% |
|                                                            | 2020 | \$103.1bn | 8.4% | 23%   | 8.3% |
| <b>Aerospace</b>                                           | 2015 | \$27.1bn  | 74%  | 0%    | 0%   |
|                                                            | 2016 | \$24.4bn  | 75%  | 0%    | 0%   |
|                                                            | 2017 | \$26.6bn  | 75%  | 0%    | 0%   |
|                                                            | 2018 | \$38.9bn  | 58%  | 1.1%  | 0%   |
|                                                            | 2019 | \$39.1bn  | 79%  | 1.3%  | 0%   |
|                                                            | 2020 | \$31.9bn  | 73%  | 1.6%  | 0%   |
| <b>Medical Equipment</b>                                   | 2015 | \$34.8bn  | 89%  | 4%    | 0%   |
|                                                            | 2016 | \$30.7bn  | 87%  | 4.9%  | 0%   |
|                                                            | 2017 | \$39.2bn  | 88%  | 4.6%  | 0%   |
|                                                            | 2018 | \$18.7bn  | 70%  | 11%   | 0%   |
|                                                            | 2019 | \$41.2bn  | 84%  | 5.8%  | 0.9% |
|                                                            | 2020 | \$37.4bn  | 77%  | 6.1%  | 1.9% |

**Source:** Authors' calculations from *Forbes Global 2000* (2015–2020)

**Note:** The above sectors are aggregated from the *Forbes Global 2000* sectors as follows — Chemicals (Diversified Chemicals; Specialized Chemicals); Pharmaceuticals (Biotechs; Pharmaceuticals); Electrical & Industrial Machinery (Computer Hardware (minus Apple); Computer Storage Devices; Conglomerates (minus real estate and trading company firms); Electric Equipment; Heavy Equipment; Other Industrial Equipment); Electronics (Business Products & Supplies; Communications Equipment; Consumer Electronics (plus Apple); Electronics; Semiconductors); Vehicles & Parts (Auto & Truck Manufacturers; Auto & Truck Parts; Recreational Products (only Motorcycles)); Aerospace (Aerospace & Defense); Medical Equipment (Medical Equipment & Supplies; Precision Healthcare Equipment). Around 2016, *Forbes* changed the domicile of Eaton, Medtronic, and Seagate from US to Ireland, but we have maintained their US domicile since this is where they are predominantly based irrespective of their new tax domicile. Also, for those Chinese firms listed by *Forbes* as Hong Kong (such as Lenovo) we have changed to China, because again this is where they are predominantly based. Apple was changed from Computer Hardware to Consumer Electronics because its most profitable product is no longer computers (as in the 1980s and 1990s) but smartphones, appropriately placing Apple in the same sector as its competitor Samsung Electronics. Please note that each *Forbes* year is May–April (e.g. ‘2015’ is May 2014–April 2015).