Re-Innovation Nation: Explaining Technology Transfer Policy in Rising China*

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Abstract

This paper examines China's efforts to accelerate its economic rise using *technology extractors*, defined as policies that condition foreign access to China's market on technology transfers to domestic firms. I argue China pursues technology extraction in strategic industries. However, the Chinese state's enforcement capacity and China's position in global value chains (GVCs) constrain its bargaining power over foreign investors, limiting the use of tech extractors even in highly strategic sectors. China's leverage is weakest when it is intermediate to GVCs, such that most imports are processed locally for re-export abroad. This leaves China reliant on foreign firms as gatekeepers to overseas consumers. Case studies and analysis of a new industry-level dataset from 1995-2015 reveal strategic industries account for 85 percent of tech extractors' increased use after 2002, but China seldom issues these policies when it occupies an intermediate position in GVCs. My findings illuminate how rising powers rise, but also how firms can leverage control over GVCs to constrain even strong states with large internal markets.

Keywords: Rise of China, technology transfer, foreign direct investment, global value chains

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1 Introduction

China's economic and technological rise may be the defining geopolitical event of this century (Mearsheimer, 2021; Weiss, 2019; Christensen, 2015). Technology transfer policies contributed powerfully to this rise, helping transform China into a world leader in sectors like high-speed rail and artificial intelligence (Lin, Qin and Xie, 2021; Hannas and Tatlow, 2020; Jiang et al., 2018).[1] At the same time, they hastened the U.S.-China trade war and the escalation of Sino-American strategic competition.[2] Despite this, we know relatively little about when and how China pursued foreign technology transfers after it joined the World Trade Organization (WTO) in 2001. This gap is surprising given the longstanding importance of foreign technology to China's industrial policy strategy (Tan, 2021; Pearson, 1992). It also suggests a deeper omission in international relations theory. Although scholars have long debated the causes and effects of great power transitions (Edelstein, 2017; Gilpin, 1981), we know much less about *how* rising powers like China rise.

This paper examines the policy foundations of China's technological rise. Concretely, it develops and tests a theoretical framework to explain China's use of *technology extractors*, which I define as policies that condition foreign access to the Chinese market on technology transfers to domestic firms. Using a new industry-level dataset on three policies which underpinned China's push to "introduce, digest, absorb, and re-innovate" (引进消化吸收再创新) foreign technology from 1995-2015, I address two previously unexamined patterns in Chinese tech transfer policy.

First, the use of technology extractors surged in the decade after WTO entry. Despite China's pledge not to condition market access on technology transfers post-accession, the total number of tech extractors in place – including ownership restrictions on inward foreign direct investment (FDI), local content requirements, and preferential public procurement policies – increased more

[1] Regarding joint venture requirements, Jiang et al. (2018) "document benefits from foreign technology in terms of innovation and productivity that go far beyond the joint venture, not only to the Chinese joint venture parent firm but also to entrepreneurs at firms upstream from and in the same industry as the joint venture (backward and horizontal spillovers, respectively)." See Hannas, Mulvenon and Puglisi (2013), Crane et al. (2014), and McGregor (2011) for more on the impact of technology transfer policies on Chinese competitiveness in a wide range of industries.

[2] United States Trade Representative (USTR). 2018. "Report on China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation," Retrieved June 7, 2022 (*Link*). Despite President Trump's emphasis on the trade imbalance, the formal rationale for trade sanctions on China centered on technology transfer.

than six-fold between 2002-2012, from 53 to 339, covering over 100 distinct industries.

Second, within this surge in technology extraction efforts, there is puzzling variation across industries in China's use of these measures. China imposes technology extractors aggressively in a wide range of high value-added industries: From 1995-2015, it introduced 29 distinct FDI ownership restrictions in civilian aircraft manufacturing, 24 in automotive production, and 21 in power generation (including renewable energy). However, it has used technology extractors sparingly in equally vital high-technology industries such as batteries and accumulators (7 ownership restrictions), precision measurement equipment (3), and semiconductor-related products (0).

What explains variation over time and across industries in China's use of technology extractors? I argue that top-down security interests lead China to pursue tech extraction in strategic industries. However, China is constrained in issuing tech extractors, even in highly strategic sectors, by its bargaining power over foreign firms. Consistent with realist theories of foreign policy and research on authoritarian regimes, I suggest the need to improve China's relative power and bolster regime legitimacy provides the core motive behind technology extraction (Gilpin, 1975; Krasner, 1978; Svolik, 2012). That motive, as Chinese Communist Party (CCP) General Secretary Xi Jinping put it, is to "seize the commanding heights of technological competition" in the 21st century.[3]

But whereas security concerns explain why China pursues tech extraction in strategic industries, bargaining power over foreign firms explains when it actually issues tech extractors. I argue that China's bargaining power is greatest when the central state's policy enforcement capacity is high and when China is downstream of global value chains (GVCs) as a final consumer market. By contrast, its bargaining power is weaker when enforcement capacity is low and in sectors in which China is intermediate to value chains – that is, in which its imports consist largely of foreign inputs to be processed locally and re-exported, as more finished goods, to consumers overseas. In these sectors, foreign multinational enterprises (MNEs) rely less on China as a final market than China relies on them as sources of employment and gatekeepers to overseas consumers. This reliance limits China's leverage over foreign MNEs, constraining the use of overt tech extractors.

[3] Xi Jinping. 2018. "Strive to be the World's Leading Science Center and Innovation High Ground," Retrieved July 26, 2022 (*Link*).

I evaluate these arguments using a mixed-method research design that combines statistical analysis of my original dataset with qualitative case studies of technology extraction efforts in wind power and semiconductors. My data, based on manual analysis of over 500 pages of Chinese-language regulations, reveal that strategic industries account for 85 percent of the increase in the use of tech extractors after 2002. However, multiplicative interaction models show that China is more than twice as likely to use these policies in strategic industries in the bottom 10 percent in terms of imports tied to processing trade than in those in the top 10 percent, equivalent to roughly one standard deviation. Industry case studies provide compelling evidence that China's reliance on foreign firms and the value chains they govern constrains its use of tech extractors in strategic industries in which China occupies an intermediate position in global production networks.

Beyond filling an empirical gap in our knowledge of Chinese industrial and technology policy, the paper contributes to theoretical debates in international relations and political economy. First, existing work on trade policy, including in non-democracies, emphasizes the bottom-up sources of policy decisions (Grossman and Helpman, 1994; Lake, 2009; Hankla and Kuthy, 2013; Kim, 2017). This paper shows how strategic interests, not interest group pressures, shape trade-related policies in the world's largest trading nation. As such, it suggests a need to "bring the state back in" to the study of commercial policy, especially in the understudied context of authoritarian regimes.

Second, my findings challenge the received wisdom that market size explains when states wield coercive leverage over firms and other states (Drezner, 2007; Drezner, Farrell and Newman, 2021). Instead, I show that firms can exploit their control over value chains to constrain even strong states with large internal markets. The project thus extends research on how production networks alter bargaining relationships between states and foreign MNEs (Johns and Wellhausen, 2016).

Finally, analysts point to evidence that developing countries emulate Chinese technology transfer behavior to warn of a broader diffusion of mercantilist practices (Atkinson and Ezell, 2012). Though nascent, this process merits close scrutiny by international relations scholars given the embattled state of the existing liberal trade order. Mapping Chinese tech transfer policy can help analysts better monitor "innovation mercantilism" elsewhere (Atkinson, Cory and Ezell, 2017).

The paper proceeds as follows. Section 2 outlines my theory. Section 3 describes my research design and data. Section 4 examines results from statistical analysis. Section 5 presents evidence from my case studies. In section 6, I address prominent alternative explanations. I then conclude.

2 Explaining China's Use of Technology Extractors

This section develops my theory about technology extraction in post-WTO China. It addresses two main questions. First, what explains the rise of tech extractors in the decade after China joined the WTO? Second, why does China impose these measures in some industries but not in others?

The section has four parts. To begin, I elaborate the concept of tech extractor, situate China's use of these policy tools in relation to similar practices by earlier late modernizers and other contemporary developing countries, and discuss assumptions behind my theory. I then make the case that top-down strategic concerns, not interest group pressures, motivate Chinese tech extraction. From there, I describe how sharp gains in central state enforcement capacity following administrative reforms in 1998-2003 bolstered China's bargaining power, facilitating a surge in tech extraction efforts after 2006. Finally, I examine how China's position in GVCs shapes industry-level variation in its bargaining power with foreign firms, and in turn its use of tech extractors.

2.1 Concept, Context, and Assumptions

The outcome of interest for my theory is variation over time and across industries in China's use of technology extractors. I define these as formal, central state policies that "trade" access to the Chinese market for transfers of technology – understood to encompass machinery and software as well as process knowledge and technical expertise – to domestic firms. Although tech extractors resemble conventional market barriers, I argue that as used by China these policies represent a distinct form of trade-related policy tool. Market barriers, whether "at the border" or behind it, serve to deter foreign competition. By contrast, technology extractors allow for and even incentivize foreign inflows; China expressly encourages FDI in 60 percent of industries with joint venture

(JV) requirements. Rather than keep foreign firms out of the Chinese market, these policies aim to "enlist" MNEs, as owners of technology, in strengthening national industrial capabilities.

I argue three policy tools broadly exhaust the concept of tech extractor in post-WTO China. The first is JV mandates and other ownership restrictions on inward FDI. Although China only began publishing explicit, sector-specific JV requirements in 2002, joint ventures have long been the key vehicles for technology transfer in China (Pearson, 1992).[4] The second is local content requirements, which China has used in industries like wind energy and civil aviation not simply to limit foreign competition but to induce foreign MNEs to partner with, train, and transfer technology and know-how to local suppliers (Lewis, 2012; McGregor, 2011). Third, I examine policies that grant preferential treatment in government procurement markets to products made by Chinese-invested firms or which include "Chinese intellectual property." Although many countries use preferential public procurement policies to support domestic producers (Rickard and Kono, 2014), China is distinctive in leveraging "procurement rules tied to product or industry catalogues...to require technology transfer" from foreign firms seeking to enter the market (Sutter, 2020, 65). In particular, China has used preferential procurement policies to encourage foreign MNEs to open local research and development (R&D) centers in high-technology industries (Hannas and Tatlow, 2020).

Several related policies fall outside the scope of my concept of technology extractor. Because I am interested in how China's central party-state uses technology transfer policies to advance national industrial policy goals, I restrict my analysis to policies issued by central state agencies whose overt purpose is to promote industrial upgrading. I thus exclude local-level policies and measures that ostensibly serve goals other than development, such as cybersecurity. In addition, I focus on formal regulations because informal pressures to share technology, however pervasive, cannot be measured systematically and do not reliably reflect the central state's intentions.

China is not alone in using policies like technology extractors. 19th century late modernizers, 20th century import-substitution regimes, and postwar developmental states all sought to move

[4]Prior to 2002, China sometimes issued sector-specific restrictions on wholly foreign-owned investment (不允许外商独资) or required Chinese firms to have a controlling stake in foreign-invested projects (中方控股或占主导地位). But this did not restrict FDI to equity joint venture partnerships.

up the global division of labor through top-down efforts to "construct comparative advantage" in high value-added industries, including by means of foreign technology transfers (Samuels, 1994; Evans, 1995). Such transfers were especially critical to industrial transformation in postwar Japan, South Korea, and Taiwan (Johnson, 1982; Amsden, 1989; Wade, 1990). However, for the most part these regimes relied on strategic market *closures* to nurture infant industries (Irwin, 1996; Krugman, 1986). Even the canonical East Asian developmental states did not meaningfully open their markets to foreign firms; instead, they licensed technology directly from American firms, often with Washington's encouragement (Mason, 1992). American forbearance freed these U.S. Cold War allies from having to "trade the market" for technology.

In addition, although developing economies like Brazil and India maintain policies like local content requirements today, National Trade Estimate (NTE) reports from the United States Trade Representative suggest they do so as simple market barriers, not to encourage technology sharing. Notably, the term "technology transfer" does not appear in any NTE on Brazil from 2007-2020 and appears once in relation to India, and then not in context of a trade complaint. By comparison, the term appears in every NTE on China during the same period, and up to 9 times in a single report. Moreover, NTE reports only use the phrase "forced technology transfer" with respect to China.

Finally, two assumptions underpin my theory. First, I assume compliance with technology extractors is costly for foreign firms and, all else equal, they prefer not to enter partnerships that require them to transfer technology to or invest in training and strengthening Chinese companies (their potential future competitors). Although foreign firms sometimes seek out Chinese partners to help them navigate the local business environment, existing research suggests that the drawbacks of such partnerships, including risks related to technology transfer, outweigh their benefits for foreign investors. As Gallagher (2011) observes, foreign firms in China value the "flexibility and managerial control" afforded by foreign ownership, as well as the protection it provides against "illegal transfer of technology" when compared to joint ventures (Gallagher, 2011, 44).

Second, I assume foreign firms want access to China's market and will pay some price – including, potentially, compliance with technology extractors – to get it. As a result, China enjoys substantial "baseline" bargaining power over foreign firms *ex ante*. This was most true in the period after China joined the WTO, which reduced uncertainty in its investment environment and dramatically increased investor interest in the Chinese market (Davis and Wei, 2020). The huge resources American businesses poured into securing U.S. support for China's WTO entry reflect the depth of this interest.[5] Importantly, investor interest in China was widespread across sectors and perhaps most acute in highly concentrated industries, where competition for marginal global market share is fierce (Milner and Yoffie, 1989).[6] Against this backdrop, the key question becomes not whether China enjoys bargaining power over foreign firms, but rather under what conditions foreign firms can "claw back" sufficient leverage over China to prevent the use of tech extractors.

2.2 From Security Interests to Strategic Industries

I argue top-down national and regime security concerns lead China to pursue technology extraction in "objectively" strategic industries, or industries which most major powers would regard as such. Though straightforward, this argument merits elaboration because it cuts against the grain of both interest group models of trade policy and "fragmented authoritarianism," the dominant heuristic in Chinese politics research (Lake, 2009; Lieberthal and Oksenberg, 1988; Mertha, 2009). These approaches build from a shared skepticism towards the idea of the national state as a coherent actor with interests apart from those of the interest groups which compose it.[7]

[5] As *The New York Times* observed, "[f]rom agricultural processors to Internet businesses, and from automakers to movie studios, corporate America sees profits in China." The same article describes how Boeing leaned on its "10,000 suppliers...spread across 420 of the nation's 435 congressional districts" to lobby on China's behalf. See Bradsher, Keith. 2001. "Rallying Round the China Bill, Hungrily," in *The New York Times*, Retrieved June 7, 2022, *Link*.

[6] This makes China arguably *the* major exception to the "obsolescing bargain" model of FDI (Vernon, 1971), under which investors enjoy greater leverage over host states *ex ante*. As numerous journalistic accounts at the time and since attest, MNEs in virtually every industry were desperate to secure a foothold in post-WTO China, which they (correctly) anticipated would become the world's largest market in many industries (Blustein, 2019).

[7] Regarding interest group models, Grossman and Helpman (1994) posit that the state balances interest group demands against a general concern for voter welfare, but do not attribute specific policy preferences to the state. Subsequent work in the Open Economy Politics research program has largely eschewed the state as an independent actor, instead emphasizing how institutions aggregate the preferences of individuals, firms, industries, and classes (Lake, 2009; Rogowski, 1987; Hiscox, 2002; Kim, 2017). Fragmented authoritarianism is primarily a descriptive framework, and as such does not make particular assumptions about which actors matter and from where their preferences derive. Nonetheless, Chs. 2 and 3 of Lieberthal and Oksenberg (1988) clearly imply fragmentation and parochial competition dominate policy behavior in China's central party-state. More often, "fragmented authority" is used to characterize central-local relations, with a heavy focus on the preferences and activities of localities.

Interest group lobbying and bureaucratic competition undoubtedly explain important variation in Chinese economic policy outcomes. However, neither approach is satisfactory for understanding Chinese industrial policy in general and technology transfer policy, in particular. If interest group pressures explained tech extraction, we would expect China to use these measures in established, politically-connected industries. In fact, it often issues tech extractors in industries, such as renewable energy technology, which effectively did not exist in China prior to the introduction of these policies. Likewise, the surge in Chinese tech extraction efforts began after administrative reforms reduced fragmentation within China's central state. To the extent inter-agency competition for policy influence explains the rise in Chinese tech extraction, it is by virtue of its decline.

I argue that the pressures and constraints associated with being at once a rising great power, a late modernizer, and an authoritarian regime that has long staked its legitimacy partly on economic performance combine to make top-down power and security concerns far more persuasive as motives behind Chinese technology transfer policy. This argument builds on realist accounts of great power politics and research on developmental states, which emphasize how international systemic pressures lead rising powers and late modernizers, respectively, to actively work to enhance the size and sophistication of their industrial bases (Waltz, 1979; Mearsheimer, 2001; Evans, 1995; Doner, Ritchie and Slater, 2005). It is also consistent with the literature on economic performance as a pillar of regime legitimacy in post-Mao China (Nathan, 2003; Tan, 2021). Moreover, as Doshi (2021) shows, CCP leaders publicly and privately discuss foreign technology acquisition in explicitly strategic terms. That strategic imperatives drive tech transfer policy in China is made more plausible by the country's Leninist political structure, which provides an institutional vehicle for translating these motives into action, including in economic policy (Doshi, 2021; Fewsmith, 2021).

I expect top-down security concerns to lead China to pursue tech extraction in sectors expected to provide the highest return in terms of national power and competitiveness. These are strategic industries. Following Ding and Dafoe (2021), I define strategic industries as sectors with great economic or military utility, which generate significant positive spillovers, and the spillovers of which do not easily diffuse across national borders. As they observe, the tendency of markets to underinvest in these industries means that achieving optimal outcomes often requires attention from the highest levels of the state. Examples of these industries include basic infrastructure and utilities as well as various kinds of advanced manufacturing and electronics equipment.

2.3 How Bargaining Power Constrains Technology Extraction

The above discussion explains when China would *like* to impose tech extractors, but it does not specify when China actually *uses* these policy tools – and when it does not. Doing so matters because strategic motives alone cannot account for important variation in Chinese behavior. To begin, to the extent top-down strategic interests vary over time, they do so gradually. Variation in security imperatives thus cannot explain the sudden escalation of tech extraction efforts in the post-WTO period. Likewise, although strategic interests account for much cross-industry variation in China's policy behavior, they do not explain all of it, including the sparing use of technology extractors in strategically important industries like batteries and semiconductors.

This section fills these gaps by examining China's bargaining power over foreign firms. I use the term bargaining power to denote China's ability to induce foreign compliance with technology extraction policies. This rests on whether China can credibly threaten to cut off access to its market if foreign firms refuse to transfer technology to local partners (Hirschman, 1945; Keohane and Nye, 1977; Shambaugh, 1996). China's ability to do so depends on two main pillars.

The first is central state *enforcement capacity*, which I define as the ability to effectively coordinate and implement national priorities on a nationwide basis. I expect increased enforcement capacity to lead to broad gains in tech extraction efforts across strategic industries. The second is China's position in GVCs, which determines the *balance of dependence* between China and foreign investors – that is, whether China depends more on foreign firms as suppliers and employers than foreign firms depend on it as a final market. The less this balance favors China, the weaker its leverage and the less likely it is to impose technology extractors. I expect the balance of dependence to most favor foreign firms when China is intermediate to GVCs in an industry.

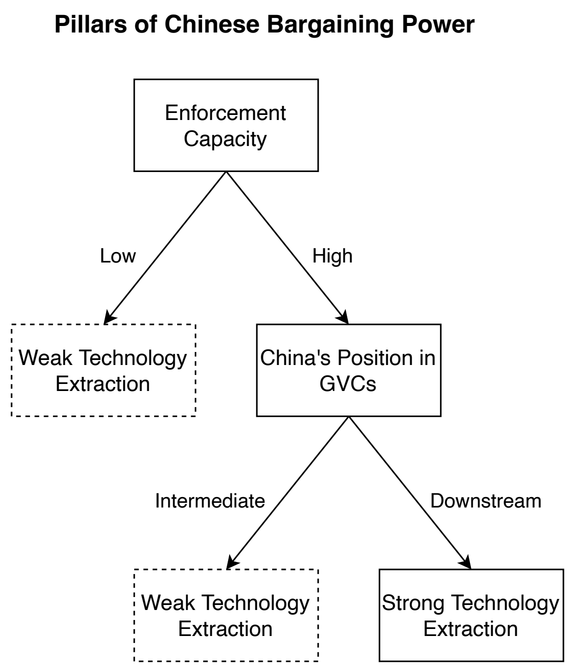


Figure 1: **Pillars of Chinese Bargaining Power**: China's bargaining power will be greatest when enforcement capacity is high and it sits downstream of global value chains (GVCs).

2.3.1 Central Enforcement Capacity and the Rise of Tech Extraction

In the late 1990s, CCP leaders became increasingly concerned that the country's economic policy institutions (including state-owned enterprises) were ill-equipped to capitalize on the opportunities and manage the competitive pressures WTO entry would create (Pearson, 2005; Zheng, 2004). This concern helped catalyze a series of reforms aimed at reducing the bureaucratic fragmentation exposed by China's protracted WTO accession process and, more generally, at building a more effective regulatory and administrative state (Liang, 2007; Pearson, 2005; Hsueh, 2011). One consequence of these reforms was steady improvement in what I call central enforcement capacity.

I identify three watersheds in the growth of central enforcement capacity as it relates to tech extraction. The first was two rounds of administrative restructuring launched in 1998 and 2003, respectively. Carried out in anticipation of and response to WTO entry, these reforms dramatically reduced bureaucratic fragmentation both at the bottom (1998) and top (2003) of China's administrative pyramid (Ngok and Zhu, 2007). In doing so, they yielded a much tighter and more cohesive central economic policy apparatus than had existed in decades prior (Heilmann and Shih, 2013).[8] This process culminated in the 2003 creation of the National Development and Reform Commission (NDRC) as China's sole top macro-economic planning and policy coordination body.[9]

The second watershed was the expansion of the NDRC's policy authority, most importantly following regulatory changes in 2004-2005 which vested it with virtually uncontested power of approval over major infrastructure projects, including large-scale inward FDI (Naughton, 2015; Lardy, 2014). These changes quickly cemented the NDRC's status as China's "Super-Ministry, one half-step above everyone else in the government, the general headquarters of the economy" (Naughton, 2015, 36). They also positioned it to drive hard bargains with foreign investors as the key gatekeeper to China's market. The NDRC made energetic use of this leverage, for example negotiating a deal with Airbus in 2005 to purchase nearly $10 billion in aircraft in exchange for pledges to open training facilities, source a wide range of parts locally, and establish its first final assembly plant outside of Europe (Crane et al., 2014). Likewise, shortly after its formation the NDRC issued far more stringent local content requirements in wind power technology than had either of its predecessors, the State Economic and Trade Commission (SETC) and State Planning Commission (SPC), both of which pursued overlapping wind power industrial policies with limited success in the 1990s. As I discuss in section 5, the NDRC's actions prompted foreign wind turbine makers to significantly expand operations to train local Chinese suppliers after 2005.

The final step in the growth of enforcement capacity was the launch, in early 2006, of the Medium- and Long-Term Program for National Science and Technology Development 2006-2020 (国家中长期科学和技术发展规划纲要2006-2020年), hereafter the MLP. Previous research has shown that the MLP marked a turning point in China's embrace of industrial policy (Naughton, 2021; Tan, 2021). My data suggest it was also an inflection point in Chinese technology transfer

[8]The 1998 round eliminated three-fourths of industrial line ministries in the State Council, China's cabinet. The 2003 reform ended the longstanding practice of having at least two top macroeconomic planning bodies. As Heilmann and Shih (2013) emphasize and I explore in the wind power case study, the presence of multiple "apex" planning agencies before 2003 fostered bureaucratic rivalries that led to policy redundancy and enforcement problems.

[9]A subsequent round of administrative reforms in 2008 created the Ministry of Industry and Information Technology (MIIT), another industrial policy agency focused on information and communications technology (ICT) sectors. I examine the 1998 and 2003 rounds because these were final administrative reforms prior to 2006, which as I show below marked the key inflection point in the rise of technology extractors.

activities. The question is not whether the MLP influenced China's use of tech extractors, but how. It could be argued the MLP signaled a shift in CCP leaders' policy aims. This is not the case: "indigenous innovation," the key phrase associated with the MLP, appeared in 211 distinct policies issued prior to 2006. Alternatively, the MLP may have represented a shift not in leaders' policy aims but in their resolve. However, this is somewhat hard to reconcile with evidence of the Hu Jintao-Wen Jiabao (2002-2012) leadership's relative weakness, and specifically their limited control over central agencies such as the NDRC (Tan, 2021; Fewsmith, 2021).[10]

I argue that the MLP's significance rests primarily in its impact on the central state's capacity to coordinate and implement pre-existing policy priorities. Concretely, the MLP bolstered central enforcement capacity in two ways. First, by providing a clear and authoritative statement of the leadership's priorities, the Program helped align incentives and mobilize coordinated action between the NDRC and other agencies tasked with implementing its key initiatives. Second, by positioning the NDRC as the Program's lead enforcement agency, the Party leadership signaled its confidence in the NDRC, giving it carte blanche to extend technology extraction efforts already underway in core policy domains like energy to a wider array of strategic industries.[11] Importantly, as Naughton (2021) observes, the MLP "was not in itself an industrial policy," but a statement of "principles...intended to guide subsequent action" (Naughton, 2021, 51). As such, it was "not really operational" (Naughton, 2021, 13). Given the Program's non-operational character, translating its broad exhortations into concrete policies depended on the enforcement capacity steadily accrued through institutional reforms in the preceding years.

2.3.2 Global Value Chains and the Balance of Dependence

Gains in central enforcement capacity explain the overall increase in China's use of technology extractors after the launch of the MLP. But within the surge of technology transfer activities, there is substantial variation across industries in China's propensity to impose these tools.

[10] Both explanations also risk deducing "the cause of an outcome from the effect itself, implying whatever type of change the leadership desires can and will happen" (Tan, 2021, 91).

[11] Of the 99 "implementing policies" for the MLP issued in April 2006, 29 (the most of any agency) were assigned to the NDRC, including several directly concerned with technology transfer (Serger and Breidne, 2007).

I argue that China's position in global value chains best explains cross-industry differences in the use of technology extractors within strategic industries. Position in GVCs determines China's propensity to impose tech extractors by shaping the balance of dependence between China and foreign firms. I expect this balance to favor China when it primarily sits downstream of GVCs as a final consumer market. In such industries, China may rely on foreign firms to supply goods and services, but it depends less on them as employers or gatekeepers to overseas markets. As a result, foreign firms in these sectors have fewer resources they can leverage to claim bargaining power over China, leaving China less constrained in the use of tech extractors.

By contrast, when China occupies an intermediate position in GVCs, it relies heavily on the foreign MNEs which govern those value chains both for the direct employment they provide in China and indirectly as chokepoints in China's access to consumer markets overseas. In such sectors, I expect China to depend relatively more on foreign firms and the value chains they anchor than firms do on China as a final demand center. The greater this relative reliance, the less prone China will be to impose overt technology extraction policies.

This argument draws on two key insights from Hirschman (1945). First, the "relative ease of adjustment" after disruptions to trade determines the degree and direction of asymmetries in economic interdependence, and in turn actors' relative bargaining power (Hirschman, 1945, 18). Simply put, the less painful it is for an actor to adjust to a suspension of trade or capital flows, the greater its leverage in a bargaining relationship. Second, all else equal, exporters face higher adjustment costs following trade disruptions than importers. For importers, the salient immediate effect of disruptions to commercial flows is higher prices on goods and services. For exporters, such disruptions manifest primarily in lost employment. While unpleasant, temporary or targeted price increases are seldom politically destabilizing, not least because consumers face high barriers to collective action. Job losses are far more threatening, especially when they are concentrated in urban areas, where density lowers collective action costs (Hirschman, 1945, 27).

As noted earlier, given post-WTO China's substantial "baseline" bargaining power over foreign investors, the central question becomes under what conditions investors might "claw back" sufficient leverage to compel China not to impose tech extractors. I argue that the threat of significant job losses following disruptions to commercial flows is the key factor capable of imposing high enough adjustment costs on China to shift the balance of dependence in investors' favor. Employment shocks can destabilize even the most durable regimes, but this concern is especially acute in China, where employment is a key input in social stability and regime legitimacy (Nathan, 2003).

I expect foreign firms to wield the greatest leverage over China when the costs of trade and investment disruptions for China, in job losses, outweigh the pain of losing access to the Chinese market. I expect this effect to be most pronounced in export-oriented industries in which China is intermediate to GVCs. Because most of what China imports in these industries is not consumed internally but processed and re-exported overseas, China assumes the role of Hirschman's exporter: Disruptions are felt mainly in lost employment, not higher prices on final goods. The concentration of foreign employment and processing trade in China's most politically important coastal cities magnifies the stakes of potential trade disruptions.[12] Thus, although exiting the Chinese market is costly for firms in these sectors, this cost is balanced both by their lower reliance on China as a final market and by China's reliance on them as drivers of growth and employment.

From the above discussion, I derive the following testable hypotheses regarding variation over time and across industries in China's use of technology extractors:

> **Hypothesis 1:** All else equal, China will introduce technology extractors more often in strategic industries than in non-strategic industries.

> **Hypothesis 2:** China's use of technology extractors in strategic industries relative to non-strategic industries should increase following the launch of the MLP in 2006.

> **Hypothesis 3:** China will impose fewer technology extractors in strategic industries with higher import shares tied to processing trade than in strategic industries with lower shares.

The next section details how I test these claims. I first describe steps I took to collect data for and construct measures of my variables of interest. I then discuss my empirical strategy.

[12] In 2007, foreign-invested firms accounted for 5.4 percent of total urban employment in China but 8.8 percent in Beijing, 13.4 percent in Tianjin, 14.1 percent in Shanghai, and 6.9 percent in Guangdong province. That same year, exports as a share of GDP reached 35.4 percent and total urban employment was over 300 million.

3 Research Design

To my knowledge, no previous work has attempted to measure and quantitatively analyze variation in China's use of technology extractors. In part, this reflects significant data collection challenges. Off-the-shelf datasets on trade policies do not include these measures, nor does China record them in an organized way. Measuring tech extractors thus requires combing through hundreds of Chinese-language regulations. Online resources make this task manageable by enabling automated searches. Even so, identifying and coding relevant directives is labor intensive and requires Chinese language facility. Below, I outline steps I took to create my industry-level measure of technology extractors from 1995-2015. I then discuss how I measured other variables of interest.

3.1 Measuring Technology Extractors

I draw data on the three policies that make up technology extractors from Chinese central state agency websites and the Peking University Laws and Regulations Database (LRD), an online repository of laws and regulations issued in China since 1949 (Tan, 2021, 2020).

Data on JV requirements and other FDI ownership restrictions come from the Foreign-Invested Industry Guidance Catalogue (外商投资指导目录), hereafter the FDI Catalogue. These catalogues contain industry-specific ownership restrictions such as JV mandates or requirements that Chinese firms retain a "controlling stake" (中方控股) in projects. For each unique restriction, I recorded its year, Chinese-language description, and relevant industry code(s). I code industries by manually matching Chinese industry descriptions in the FDI Catalogue to industry descriptions in the 2017 revision of the Chinese Standard Industrial Classification (CSIC) system. In many cases, CSIC uses identical industry descriptions to the FDI Catalogues and other regulations. This facilitates reliable matching by reducing coder discretion and uncertainty. CSIC is harmonized with the International Standard Industrial Classification (ISIC), which enables reliable merging with measures of other variables.[13] Altogether, I identified 237 unique restrictions spanning 92 (of 420)

[13]Chinese industry descriptions in the FDI Catalogues vary in granularity, with some more specific than the corresponding CSIC/ISIC 4-digit industry. Although coding restrictions by industry introduces some data loss, this is an

ISIC 4-digit industries across 8 catalogues from 1995-2015, for a total of 1,234 industry-years.

For local content requirements, I compiled a short list of key terms associated with these policies, mostly slight variations on the phrases "national production rate" (国产化率) and "localization rate" (本地化率). I then searched the LRD for all central regulations with at least one of these phrases. These searches yielded 148 policies, which I read to assess their use of the relevant phrases. I identified 30 policies with clear targets in 29 4-digit industries and 186 industry-years.

Although China regularly issues government procurement catalogues, it is difficult to determine, based on the catalogues themselves, when China discriminates against foreign firms. Rather than code every industry in the catalogues as preferential, I take a more conservative approach of using explicitly discriminatory policies. To the best of my knowledge, the only policy that meets this criterion is the Indigenous Innovation Catalogue, which was issued in 2009 and revised once in 2012 before being canceled in 2015. Using this catalogue, I identify 379 unique industry-specific preferential procurement policies spanning 32 ISIC 4-digit industries and 205 industry-years.[14]

3.2 Measuring Strategic Industries

Because I am interested in China's treatment of "objectively" strategic industries, I need a measure of strategic that is exogenous to Chinese policy. I construct a measure of strategic industry adapted from the typology in Ding and Dafoe (2021). Building on their argument about the three "logics" by which a sector may be regarded as strategic, I identify three types of strategic industry: (1) industries with high barriers to entry due to significant R&D requirements, cumulative learning effects, or economies of scale in production, (2) basic infrastructure with significant economy-wide spillover effects, and (3) industrial inputs for which supply is limited or concentrated in a few countries or regions, and thus vulnerable to disruption.

To measure the first type of strategic sector, I use the "Global Innovation 1,000" dataset pub-

acceptable trade-off given that ISIC codes can be corresponded directly to Harmonized System 4-digit codes, which allows me to merge my measure with trade data. It also has the benefit of increasing confidence that (more general) CSIC/ISIC industries at least contain (more specific) industry or product restrictions, even if some granularity is lost.

[14] For a more detailed discussion of my coding procedure, with examples, see Appendix A.

lished by the consultancy `Strategy&`. This dataset contains detailed information on R&D expenditures by firm and industry for the top 1,000 corporate R&D spenders globally between 2012-2017 (detailed industry descriptions correspond closely to those used in ISIC). Although governments and international organizations like the Organization for Economic Cooperation and Development (OECD) sometimes publish data on public R&D expenditures, this data tends to be measured at the national level, and where more detailed information is available it is aggregated far above industry or even sector levels. The "Global Innovation 1,000" index thus provides by far the most granular picture of R&D spending available. Based on this data, I code 115 ISIC 4-digit industries as strategic, about one-quarter of all industries.

For the second type of strategic sector, I hand coded a short list of 13 ISIC 4-digit industries covering traditional basic infrastructure assets like roads and railways, ports, power generation and supply, and other utilities. Finally, I code the the third type of strategic industry using the United States Defense Logistics Agency's Strategic Materials list, which includes 66 raw material inputs considered "critical to national security" by the Department of Defense. All of these materials fall under two ISIC 4-digit industry codes for rare and non-ferrous metal ores.

In total, I identify 129 strategic industries. These industries span 12 2-digit sectors, with the bulk concentrated in manufacturing and transportation. Although what counts as strategic may vary over time, it does so gradually, especially at my measure's level of aggregation. I therefore code industries as strategic across the entire study period. After carefully reading the list of industries, I did not identify any that were clearly not strategic from 1995-2015. A more detailed discussion of my coding procedure and full list of strategic industries is available in Appendix B.

3.3 Measuring Bargaining Power

Building on the discussion in section 2, I use the MLP's launch to proxy for the start of a period of greater central enforcement capacity. I measure China's position in GVCs using the share of Chinese imports tied to processing trade. To calculate this quantity at the industry level, I use the Chinese Customs Data (CCD) dataset. Published by China's General Administration of Customs, the CCD contains information on the universe of import and export transactions across China's borders at the Harmonized System (HS) 8-digit product level, totaling over 160 million observations from 1997-2013. In addition to information on the value of imports and exports by transaction, the CCD also discriminates between types of import transaction. Specifically, it distinguishes between "general trade" (一般贸易), which in the case of imports refers to goods imported into and consumed within China, and several categories of "processing trade" (加工贸易), in which firms import foreign inputs and re-export processed outputs. I focus on two such categories, "imported processing and assembly trade" (来料加工装配贸易) and "outsourced processing trade" (进料加工贸易), which are the most relevant forms of processing trade for my purposes and which together account for over 98 percent of all import transactions that could qualify as processing trade. I use these variables to create a measure of the share of Chinese imports by ISIC 4-digit industry tied to processing trade. I calculate this by creating a variable for the HS 4-digit heading associated with each 8-digit product in the CCD, merging this with the comparable ISIC 4-digit industry code, and summing the value of imports by industry, conditioning on a dummy for processing trade.[15]

3.4 Covariates

I control for two variables which could confound my theory's prediction that top-down strategic interests best explain China's pursuit of foreign technology transfers. First, I control for the geographic concentration of industrial output, a widely used measure of interest group pressures which captures the intuition that collective action costs fall as spatial concentration rises. I measure this with a Herfindahl-Hirschman Index (HHI) of the geographic distribution of industry. Second, I control for state-owned enterprises' (SOEs) share of industrial output by sector. SOEs tend to be politically connected in China and use their connections to secure favorable policies. It could be that "strategic" industries are dominated by SOEs, whose lobbying explains why China uses technology extractors. Appendix D details how I measure these variables.

[15]Foreign firms dominate processing trade in post-WTO China. According to the CCD, in 2005 44 percent of all Chinese imports were tied to processing trade, of which foreign firms and foreign-invested equity JVs accounted for 68 and 17 percent, respectively.

3.5 Dataset

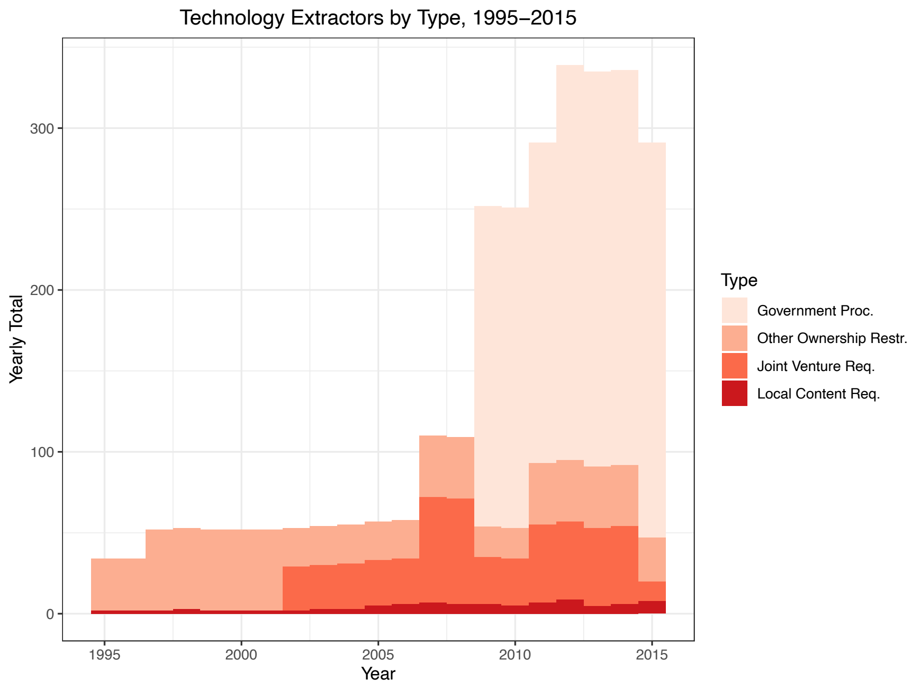
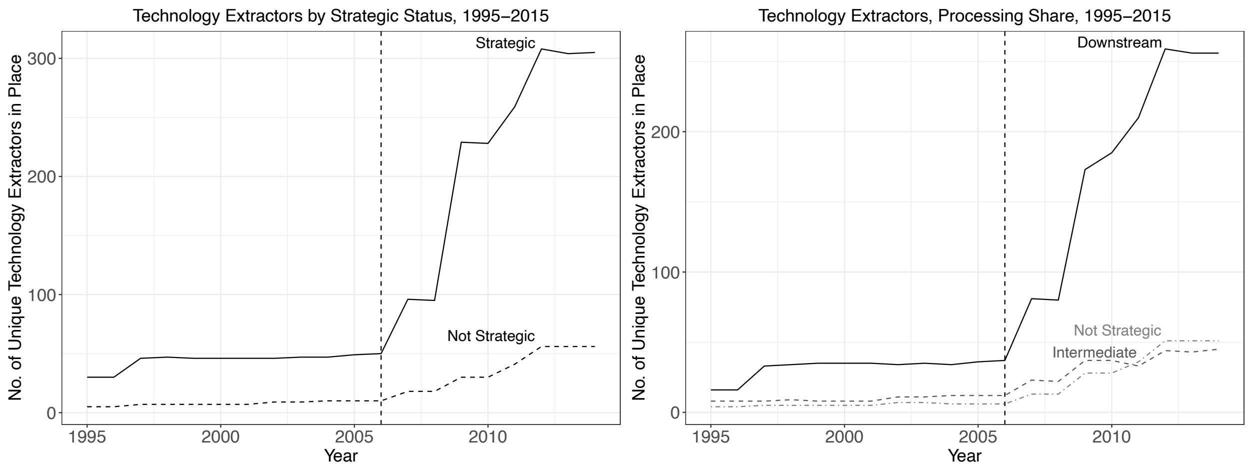


Figure 2: **Technology Extractors by Type, 1995-2015**: The total number of distinct technology extractors in place by year and type of technology extractor. As the figure shows, the total number of technology extractors increases sharply after 2006. Preferential government procurement tied to the Indigenous Innovation Catalogue accounts for much of the increase after 2009, but the period saw sharp gains in the number of each type of tech extractor. Source: Author's Data.

The final dataset spans 420 industries from 1995-2015, for a total of 8,820 observations. As Figure 2 shows, the number of tech extractors in use increased dramatically after 2006. Although preferential government procurement policies account for much of the temporal variation in China's use of these tools, the period also witnessed substantial gains in the number of FDI ownership restrictions, buoyed by sharp increases in the number of JV requirements in place, which rose from 0 before 2002 to 27 between 2002-2006 to 48 in 2007. Though much smaller in absolute terms, the use of content requirements also increased dramatically after WTO accession, with the total rising from 2 in 2002 to 7 in 2007, peaking at 9 in 2012. After controlling for processing trade and controls, the number of observations falls to 3,045. This data loss is unavoidable because trade data is only available for 207 industries and control data only covers secondary sectors.



(a) Strategic vs. Non-Strategic Industries

(b) Downstream vs. Intermediate

Figure 3: **Technology Extractors by Strategic Status and GVC Position, 1995-2015**: The Figures in panels (a) and (b) display the total number of tech extractors in place by year broken down by strategic vs. non-strategic industries (panel a) and by the interaction between strategic status and China's position in GVCs (panel b). The vertical dashed line denotes the launch of the MLP in 2006. The figures show that the surge in tech extraction was concentrated in strategic industries. Specifically, it was focused on strategic industries where most of what China imports it consumes at home ("Downstream"), not those in which China depends heavily on processing trade ("Intermediate"). Sources: Author's data, CCD.

Figure 3 presents the same trend as Figure 2, but broken down by (1) strategic versus non-strategic industries (panel a), and, in panel b, (2) strategic industries in which most of what China imports it consumes internally ("Downstream"), strategic industries in which most imports are processed for re-export overseas ("Intermediate"), and non-strategic industries ("Not Strategic"). After dividing industries into five equally-sized quantiles based on processing share, I assigned those in the 4th and 5th quantiles to "high" and those in the 1st-3rd quantiles to "low" processing share. The figure is based on median processing trade share from 1997-2013.

Figure 3 provides preliminary support for my hypotheses. Notably, the sharp increase in tech extraction efforts began after 2006, well before the global financial crisis materialized in China in late 2008. The use of tech extractors peaked after the Indigenous Innovation Catalogue was issued in 2009, but the catalogue was in development more than three years prior; the directive to create it was among the MLP implementing policies issued in 2006. The crisis may have accelerated but did not cause China's industrial policy revival (Tan, 2021).

To guard against the risk that my results are driven by one type of technology extractor, I re-produced both panels in Figure 3 individually for each policy tool. The results, presented in Appendix C, show a consistent trend across each type of policy tool. China is much more likely to pursue each type of technology extraction in strategic industries than in non-strategic industries and in strategic industries with low processing share than in those with high processing share. As a further robustness check, I re-ran my main model specifications in Section 4 with each type of tool individually set as the outcome variable. Those results, presented in Appendix C, confirm that my findings do not depend on any one type of tech extractor.

3.6 Empirical Strategy

The discussion above provides initial support for my theory's main claims. However, it does not tell us how the strategic status of an industry, the share of imports tied to processing trade, or the interaction between these variables affect China's propensity to use tech extractors in a given industry-year. Nor does it indicate whether this relationship is robust to controlling for potential confounders, such as the risk that bottom-up interest group pressures drive Chinese technology transfer policy.

To more formally test my hypotheses, I model the conditional expectation of the outcome variable, the number of technology extractors in place in industry i in year t, as a function of the interaction between the strategic status of an industry and the share of imports in that industry that are dedicated to processing trade. Because my outcome variable is a non-negative count variable with a relatively small number of a discrete integer values, I estimate this model using Poisson regression, with standard errors clustered by industry and year to account for overdispersion in the outcome (Cameron and Trivedi, 2005). As a robustness check, I also present results from Zero-inflated Poisson regression, which controls for the risk that overdispersion in the outcome variable is caused by a large number of zeros. This is an appropriate control in my case given the large number of industries in which China never uses technology extractors.

I model the conditional expectation of the number of tech extractors in industry i in year t as:

$$\mathbb{E}[Y_{it}|D_i, X_{it}, Z_i] = \exp(\alpha + \lambda_t + \beta D_i + \gamma X_{it} + \eta \cdot (D_i \cdot X_{it}) + \delta^T Z_i)$$

Where D_i is a binary indicator for industry strategic status, $\mathbf{X}_{it}$ is a vector with the share of imports tied to processing trade by industry-year, λ_t denotes year fixed effects, and $\mathbf{Z}_i$ includes controls for the median levels of geographic concentration and SOE share of industrial output by industry, as well as an indicator for the 2-digit sector level corresponding to each 4-digit industry. Note that in my main specifications I examine two measures of processing share. First, consistent with the above equation, I use a time-varying measure of processing share in industry i in year t (model 7 of Table 1). Second, I use a measure of median processing share by industry (models 3, 5-6, 8-9 in Table 1). This measure has the advantage of reducing year-to-year volatility in the share of imports tied to processing trade and thus gives a more reliable picture of the overall effect of processing trade dependence on Chinese behavior.

4 Results

This section presents results from my statistical analysis. The main results from Poisson regression are presented in models 4-7 of Table 1. Models 4-6 present results from regression using median processing share by industry as the moderator. Model 7 presents results using processing share by industry-year as the moderator and includes year fixed effects. As noted above, in addition to Poisson regression with cluster-robust standard errors, I also ran my main model specification (model 6 in Table 1) using Zero-inflated Poisson regression. The results are presented in model 8 in Table 1. As a further check on the robustness of my findings, model 9 presents results from regression of an alternative measure of the outcome variable, the total number of tech extractors by industry throughout the study period. For this, I also used Zero-inflated Poisson to account for overdispersion in the outcome caused by a large number of zeroes. I also ran my main specifications using Negative Binomial regression and find that this does not affect the results. Finally, I ran three OLS

Table 1: Results from Regression with OLS, Poisson, Zero-inflated Poisson

	Dependent variable:								
	TE by Industry-Year, Sq. Rt. (1-3)			TE by Industry-Year					Total TE
		OLS			*Poisson*		*FE Poisson test*	*Zero-inflated count data*	*Zero-inflated count data*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Strategic	**0.431*****	**0.248*****	**1.049*****	**2.838*****	**2.789*****	**2.974*****	**2.977*****	**0.803*****	**1.668*****
	(0.082)	(0.082)	(0.238)	(0.043)	(0.072)	(0.093)	(0.430)	(0.097)	(0.191)
Strategic x Med. Processing Share			**−0.012*****		**−0.019*****	**−0.025*****		**−0.020*****	**−0.034*****
			(0.004)		(0.002)	(0.002)		(0.002)	(0.004)
Strategic x Processing Share							**−0.016***		
							(0.009)		
Strategic x Post-2006		0.384***							
		(0.079)							
Post-2006		0.046***							
		(0.018)							
Median Processing Share			−0.001		0.001	0.002		0.012***	0.022***
			(0.001)		(0.002)	(0.002)		(0.002)	(0.004)
Processing Share							0.009		
							(0.008)		
Constant				−2.313***	−1.622***	−1.612***	−2.023	1.582***	1.648***
				(0.041)	(0.068)	(0.097)	(6.589)	(0.097)	(0.193)
Year FE	Yes	No	Yes				Yes		
Controls	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Observations	8,820	8,820	3,045	8,820	4,347	3,045		3,045	145
Adjusted R^2	0.310	0.320	0.207						

Note: Full Results in Appendix D *p<0.1; **p<0.05; ***p<0.01

models with the square root of the number of tech extractors by industry-year as my outcome. Models 1 and 3 replicate models 4 and 6 using OLS, while model 2 regresses the outcome on an interaction between strategic status and a dummy for the post-2006 period to test whether the pace of tech extraction increases in strategic industries following the launch of the MLP in 2006.

The results in Table 1 provide strong support for my hypotheses. The coefficient on strategic status is positive and significant across all models, suggesting strategic utility is associated with greater use of tech extractors. Likewise, the coefficients on the interaction terms for strategic and processing share are negative and significant in all models. This suggests intermediateness to GVCs exerts downward pressure on the association between strategic status and the use of tech extractors. These results are robust to diverse modeling strategies, alternative measures of variables of interest, and the inclusion of controls. Finally, model 2 indicates the post-2006 period is associated with increased tech extraction efforts in strategic industries. This is consistent with Figure 3 and supports my second hypothesis.

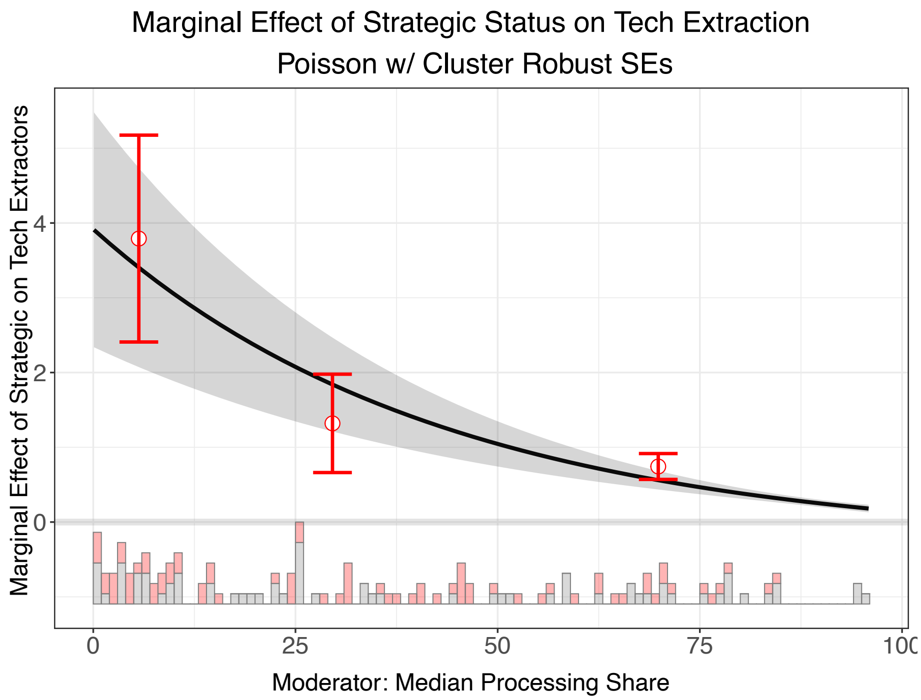


Figure 4: **Marginal Effect of Strategic Status on Tech Extraction**: The marginal effect of being a strategic industry on China's use of technology extractors declines as the share of imports tied to processing trade increases. Estimates are calculated using the flexible binning estimator provided in Hainmueller, Mummolo and Xu (2019), in which effects are separately estimated (using a Poisson link and standard errors clustered by industry and year) in low, medium, and high bins defined by the number of observations at each level of the moderator. Vertical bars along the x-axis indicate the number of strategic (red) and non-strategic (grey) industries at each level of the moderator. Figure based on Model 6 in Table 1. Full results with controls available in Appendix D.

Figure 4 visualizes the relationship between an industry's strategic status and China's use of technology extractors at different levels of the moderator, the median share of imports tied to processing trade. As the figure indicates, China is much more likely to impose technology extractors in strategic industries when median processing share is low. In turn, the marginal effect of strategic status on tech extraction declines sharply as processing share rises. I replicated Figure 4 using linear and Negative Binomial link functions. The results, presented in Appendix D, depict a similar relationship between variables of interest.

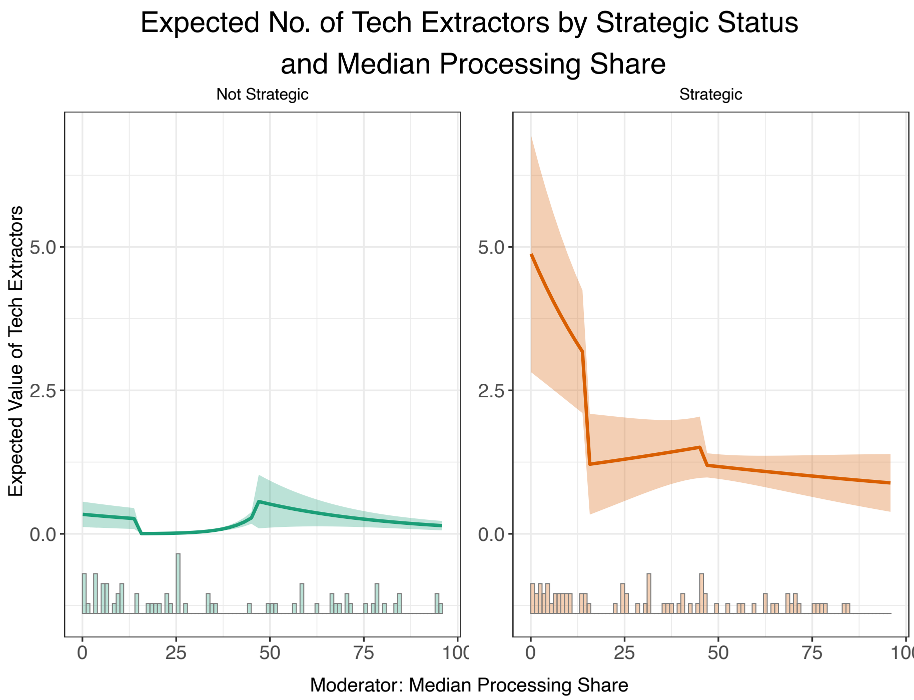


Figure 5: **Expected No. of Tech Extractors by Strategic Status and Median Processing Share**: This figure contrasts the expected number of technology extractors in place at different levels of the moderator in non-strategic industries (left) and strategic industries (right). The relationship between tech extraction and strategic status is essentially flat at all levels of processing trade share in non-strategic industries. By contrast, it declines sharply as processing trade share increases in strategic industries. Figure based on Model 6 in Table 1. Full results with controls are available in Appendix D.

Beyond its statistical significance, the impact of processing trade dependence on the relationship between strategic status and tech extraction is also substantively large. As Figure 5 indicates, as the share of imports tied to processing trade approaches 100 percent, the expected number of technology extractors in place in strategic industries declines from over 4 to almost zero. Concretely, China uses on average about 2.4 fewer tech extractors in strategic industry-years in the 90th percentile of median processing share than in those in the 10th percentile, equivalent to roughly one standard deviation. The near-complete absence of these tools in non-strategic sectors supports Hypothesis 1. A raw plot of the relationship between processing trade and tech extraction in strategic versus non-strategic sectors, presented in Appendix D, reinforces this conclusion.

4.1 Robustness Tests

I conduct four additional tests to probe the robustness of my findings. First, to ensure my findings capture Chinese leaders' beliefs about strategic importance, I created an alternative measure of strategic based on industry lists provided in three authoritative central-level industrial policies. In addition to the MLP, these include the 2010 Strategic Emerging Industries (战略新兴产业) initiative and Made in China 2025 (中国制造2025), which was issued in 2015. Appendix B includes a list of these industries and my coding of them and presents results from re-running my main model specification using this alternative measure. The results show that alternating measures of strategic industry does not substantially affect my findings.

Second, it could be objected be that technology extraction depends less on GVC position than on product-level characteristics. For example, China may not pursue tech transfer in sectors characterized primarily by intermediate goods. In fact, China uses technology extractors heavily in many intermediate goods, including parts and accessories tied to downstream products like industrial machinery, civilian aircraft, and ships. However, to guard against the risk that product-level characteristics confound my findings, I re-run my main model specification with various measures of product type. The results, in Appendix E, show this has no impact on my findings.

Third, because my data covers a 21-year period, policy inertia may explain the persistence of these tools. To account for this, I run my main specification with 2- and 3-year lagged outcome variables, which reflects the intervals between revisions of relevant policies. The results, in Appendix F, show that controlling for temporal dependence does not significantly affect my findings.

Finally, previous work on market power in international relations measures this concept in terms of the size of a country's internal market (Drezner, 2007). I argue market size is insufficient to explain the balance of dependence between China and foreign firms. For example, after subtracting imports tied to processing trade, China took in roughly 3.6 percent of global integrated circuit (IC) imports from 2001-2008.[16] This was comparable to China's share of the world market for rail transport goods, 3.7 percent, and much greater than its 1 percent share of the global auto

[16] I use the terms integrated circuit, semiconductor, and chip interchangeably.

market during that period. If market size explains bargaining power, then China should be at least as likely to impose tech extractors in ICs as in autos and rail. In fact, China introduced on average 5 and 9 tech extractors in autos and rail transport each year from 2001-2008, and none in ICs.

To more formally test my hypothesis, I examine the impact of market size on tech extraction using an approximate measure of China's share of global imports by industry after subtracting processing trade imports. Appendix G explains how I created this measure and presents results from running my main model specification with it. The results show that controlling for market size does not affect my findings.

5 Tech Extraction in Wind Energy and Semiconductors

This section probes the mechanisms behind my theory by comparing technology extraction efforts in the wind power and semiconductor industries. Specifically, I use the wind power case study to explore the relationship between gains in central enforcement capacity following administrative restructuring and variation over time in the use of tech extractors in strategic industries. In the semiconductor case study, I examine how China's position in global value chains constrains the use these policy tools in an otherwise strategically vital industry.

I examine wind power and semiconductors for two main reasons. First, they exhibit wide variation on my outcome of interest and thus help guard against the risk of bias due to selecting on the dependent variable. Whereas China imposed all three technology extractors in wind energy in the decade after WTO entry, it did not issue FDI ownership restrictions or local content requirements in integrated circuits. Although China introduced preferential procurement policies for some IC products in 2009, it did so to a much lesser extent than in other high-tech sectors.

Second, both are strategic industries with high barriers to entry due to scale economies and cumulative learning effects. Holding strategic value constant allows me to better assess the impact of variation in China's bargaining power on its use of tech extractors. In the case of wind energy, in which China sat comfortably downstream of GVCs throughout the study period (on average, 9 percent of wind power-related imports were tied to processing trade between 2001-2008), it helps me isolate the effects of bureaucratic consolidation on the central state's capacity to effectively coordinate and implement policy. In the case of semiconductors, in which China was firmly intermediate to GVCs in the years after WTO entry, it allows me to evaluate how position in GVCs constrains tech extraction despite gains in enforcement capacity.

5.1 Technology Extraction in Wind Energy

To substantiate my argument about the relationship between enforcement capacity and technology extraction behavior in wind power, I provide evidence that (1) bureaucratic fragmentation constrained technology extraction efforts prior to administrative restructuring; (2) China more stringently enforced sector-wide technology extractors after administrative reforms consolidated policy authority under the NDRC; (3) the increased use of tech extractors in wind power preceded the launch of the MLP in 2006; and (4) variation in tech extraction efforts before and after administrative restructuring is not due to a shift in policy priorities.

The earliest major central state policies dedicated to wind power were two documents issued by the Ministry of Electric Power Industry (MEPI) in July and September 1994. The first of these, titled "Provisions for On-Grid Wind Farm Management," required power generators to purchase electricity from wind farms and ordered grid operators to cover the difference in price between electricity from wind and conventional sources. The second, a "Notice on Policy for Electric Power Industry Technology," encouraged the "digestion, absorption, introduction" (消化吸收引进) and "gradual localization" (逐步国产化) of foreign wind turbine units.

Beginning in 1997, the State Planning Commission and State Economic and Trade Commission became involved in wind power industrial policy. This was a significant development for two reasons. First, as China's top economic planning bodies in the 1990s, the SPC and SETC were much more authoritative than MEPI, which was eliminated in 1998. For these agencies to take on wind power policy signaled the importance the CCP leadership afforded the industry. Second, the SPC and SETC were longstanding rivals whose competition reflected not only parochial organizational imperatives but ideological struggles at the highest levels of the CCP leadership over the direction of Reform and Opening in its first two decades (Heilmann and Shih, 2013).

Competition between the SPC and SETC was visible in wind power, where from 1997-2001 they issued a series overlapping policies to increase domestic capacity and promote the localization of foreign technology. The most notable of these were Double Increase (双加) and Ride the Wind (乘风计划), both launched in 1997. Double Increase, the SETC's signature wind power initiative, sought to double China's 79MW of installed wind power capacity and encouraged, but did not mandate, technology transfer (Lewis, 2012; Nahm, 2021). Ride the Wind, the SPC's major wind power policy, established two joint ventures in which the foreign partners agreed to transfer technology necessary to produce 20 percent of finished turbines locally, with a soft goal of increasing the local share to 80 percent as Chinese capabilities improved (Lewis, 2016, 290).

To a striking extent, Double Increase, Ride the Wind, and other policies issued by the SETC and SPC[17] from 1997-2001 overlap in objectives and even language, arguably to the point of redundancy. For example, in a document titled "Interim Measures for the Management of New Energy Capital Projects," the SPC advocated "a combination of independent development and the introduction, digestion, and absorption of innovation" (采用自主开发与引进消化吸收创新) from abroad. In a different policy from the same period, "Notice of Guidance for Accelerating the Localization of Wind Power Technology Equipment," the SETC likewise called for China, "on the basis of the introduction, digestion, absorption of advanced international technology" (在引进、消化、吸收国际先进技术的基础上), to "develop wind power equipment with indigenous intellectual property rights" (开发具有自主知识产权的风力发电设备).

The above discussion shows that the CCP leadership's interest in developing indigenous wind power capabilities through the "introduction, digestion and absorption" of foreign technology predates administrative restructuring and the NDRC's rise. As such, changes in technology extraction behavior cannot be attributed to shifting policy priorities. Likewise, wind power industrial policy before 2003 was characterized by (1) an absence of overt, sector-wide technology transfer require-

[17] Renamed the State Planning and Development Commission in 1998

ments, and (2) overlapping, redundant, and seemingly uncoordinated initiatives by China's two top planning agencies. Though not dispositive, it is notable that these rival initiatives achieved limited results. As late as 2003, China imported virtually all large-scale wind power generator sets from foreign suppliers. Xinjiang Goldwind Science and Technology Co., China's leading wind turbine maker, did not open its first major production facility until 2002 (Lewis, 2012, 129).

This situation changed abruptly after 2003. Less than a year after its formation, the NDRC launched a new Wind Power Concession Project (风电特许权项目), which directed state-owned utilities to sign long-term contracts with wind farm developers (virtually all of which were foreign at this point) but required concession farms to utilize at least 50 percent local content. In September 2004, the NDRC increased the local content requirement for concession projects to 70 percent. In July 2005, it extended the 70 percent content requirement to all wind farms built in China.[18] In 2007, the NDRC issued JV requirements for inward FDI in wind turbine manufacturing. Finally, in 2009, China added wind turbines and associated parts to the Indigenous Innovation Catalogue.

Leading wind power multinationals responded to the NDRC's 2004-2005 local content requirements by announcing plans to build or expand Chinese factories and sending small armies of engineers and managers to train local workers (Blustein, 2019; Lewis, 2012).[19] In the case of Spanish wind turbine maker Gamesa, these engineers not only oversaw "the construction of [an] assembly plant, but fanned to local Chinese companies and began teaching them how to make a multitude of steel forgings and castings, and a range of complex electronic controls."[20] By 2009, Gamesa estimated it had trained more than 500 Chinese machinery companies to manufacture various wind power components (Blustein, 2019). As Keith Bradsher observed in *The New York Times*, the "Chinese government bet correctly" that rather than fight the measure, "Gamesa and the other leading multinational wind turbine makers [would opt] to open factories in China and train

[18] NDRC. 2005. "Notice of Requirements for the Administration of Wind Power Construction," 《国家发展和改革委员会关于风电建设管理有关要求的通知》

[19] As Lewis (2012) observes, "[s]ince there were very few Chinese turbine manufacturers in the market at this time, these local content requirements most directly affected the foreign wind turbine manufacturers, causing most of them to establish manufacturing facilities in China" (Lewis, 2012, 52).

[20] Bradsher, Keith. 2010."To Conquer Wind Power, China Writes the Rules," *The New York Times*. Retrieved June 7, 2022 (*Link*)

local suppliers to meet the 70 percent threshold."

Importantly, these increased tech extraction efforts in wind power directly followed the NDRC's rise but preceded the MLP's launch by at least two years. The divergent trajectories of wind power industrial policy before and after 2003 supports my argument that administrative reforms bolstered China's ability to coordinate and implement technology extraction policies. Notably, before 2003 no fewer than three central agencies issued wind power industrial policies. After 2003, only the NDRC did. Likewise, that gains in tech extraction efforts preceded the MLP by two years suggests the Program itself does not fully account for temporal variation in China's behavior.

5.2 Technology Extraction in Semiconductors

To substantiate my argument about the relationship between GVC position and tech extraction efforts in semiconductors, I provide evidence that (1) Chinese leaders have consistently viewed foreign technology transfers as integral to efforts to develop domestic IC capabilities; (2) China lacked sufficient leverage over foreign chip makers to compel them to form JVs with domestic partners in exchange for market access; and (3) China's relatively low bargaining power over foreign investors in semiconductors was a function of its position in GVCs in the industry.

Acquiring foreign technology has been a core component of semiconductor industrial policy in China since at least 1985, when Chinese authorities began to encourage the use of "foreign technology to advance China's technology, including engaging in joint ventures with foreign firms" in the sector (Simon and Rehn, 1988, 62). In 1989, China launched an effort to create five semiconductor "backbone enterprises," four of which were established as or later formed JVs with foreign chip makers with the express aim of transferring technology (Fuller, 2016). This emphasis on technology transfers continued with Project 908 in 1990 and Project 909 in 1995, which sought to nurture domestic capabilities through technology sharing agreements and joint ventures. Finally, there can be little doubt that securing access to foreign technology has remained central to semiconductor industrial policy in post-WTO China. IC design and fabrication have been identified as priority industries in numerous policies linked to technology extraction, not least the MLP, which calls for "strengthening the absorption, digestion, and re-innovation of introduced technologies" (加强对引进技术的消化、吸收和再创新). Previous research and my own interviews with industry executives, representatives from industry associations, and analysts confirm that informal pressures to transfer technology remain pervasive in the sector today (Mays, 2013; Fuller, 2016).

Despite this, China has never issued explicit, sector-wide FDI ownership restrictions or local content requirements in any segment of the semiconductor industry. Although JVs formed the crux of IC industrial policy throughout the 1980s and 1990s, these "arranged marriage" partnerships were established on a case-by-case basis, often with input from senior CCP officials (Mays, 2013). Even as the 1995 and 1997 FDI Catalogues introduced sector-specific ownership restrictions in industries like automotive and aircraft manufacturing, they did not impose any such limits in ICs. Instead, in June 2000 the State Council issued a policy, known colloquially as Document 18, which explicitly encouraged investment in ICs from firms of all ownership types.

The liberalization of FDI controls in ICs in 2000 is not particularly surprising. It was in line with the Jiang Zemin-Zhu Rongji administration's policy orientation and reflected Chinese officials' disappointment with JV policies from the 1990s (Chen, 2018). More puzzling is that FDI controls in ICs were not reinstated after the NDRC consolidated investment approval authority in 2004-2005 and along with the rise of tech extraction efforts in other high-tech industries.

Why did China refrain from imposing tech extractors in semiconductors? Interviews with former U.S. trade officials, bank analysts, lawyers, and industry group officials indicate that China lacked sufficient leverage to require prospective foreign investors to partner with Chinese companies in the sector. Further, my interviews suggest that China's weak bargaining power arose from relatively low levels of final consumption of IC-related products within China and the country's heavy reliance on processing trade. One interviewee, a senior industry association executive, observed that sectors such as high-speed rail and civilian aircraft manufacturing were "closed loops" in which China's status as a downstream market "gives them incredible leverage" over foreign firms. By contrast, ICs were an "open loop," meaning that most products imported into China were processed for re-export overseas. Another interviewee, a Taiwan-based bank analyst, added that chip makers "were unwilling to do the investment if it required a JV structure," so for China, the "only way to attract [FDI] was offering carrots rather than aggressive requirements on companies to force" technology transfers. A third source, an academic at a Chinese university, added that in the decade after China's WTO entry "much of the market was for re-export processing...so not strong leverage to impose JVs...[Instead,] China had to offer sweetheart deals to lure investment."

These comments underscore that compliance with tech extractors like JV requirements is costly for foreign investors, that imposing such measures requires "leverage" on China's part, and that investors will resist compliance when China's ability to threaten market access controls is weak. They also indicate that as long as China remained an "open loop" in semiconductors, such that most of what it imported consisted of foreign inputs to be processed and re-exported abroad, China's ability to credibly threaten such controls would indeed be weak. Taken together, the comments provide compelling evidence that China's intermediate position in semiconductor supply chains constrained its bargaining power with foreign chip makers, resulting in the non-use of "aggressive [technology transfer] requirements" such as formal FDI ownership restrictions.

6 Alternative Explanations

The discussion in section 3 and findings in sections 4 and 5 cast doubt on a range of alternative explanations for Chinese technology extraction behavior, including changes in the CCP leadership's policy priorities, China's absolute market size and global market share in an industry, competition for policy influence among central state agencies, and lobbying by vested economic interest groups. In this section, I address two alternative explanations for the non-use of technology extractors in strategic industries. The first holds that industry characteristics such as technical complexity or global market structure explain why China refrains from issuing tech extractors in certain industries. The second emphasizes pushback against technology extractors from local governments in export-oriented manufacturing hubs like Shanghai and Shenzhen.

To begin, it could be argued that the sparing use of technology extractors in industries like semiconductors reflects characteristics of the industries themselves, such as extreme technical complexity and rapid innovation or a high degree of international concentration. Under the first scenario, Chinese officials may conclude that the requirements for "catching up" to the world frontier in highly complex industries characterized by rapid innovation are simply too great for policies like joint venture requirements to be of much use in nurturing domestic capabilities. In the face of foreign investor opposition to these measures, Chinese officials may decide the costs of tech extractors outweigh their potential benefits in such industries and opt against them.

Technical complexity and the pace of innovation surely help explain variation in the effectiveness of technology transfer policies, but they do not account for the absence of tech extractors to begin with. China uses technology extractors extensively in many industries characterized by significant technical barriers to entry and high rates of investment in R&D, including civilian aircraft manufacturing, satellite and space technologies, advanced telecommunications equipment, and more. Like semiconductor design and fabrication, producing goods like large civilian aircraft depends not only on mastering a wide array of discrete and highly complex technical processes, but on building and refining the process knowledge needed to seamlessly integrate these steps into a unified production program. It is by no means clear that making semiconductors is fundamentally more difficult than building large aircraft. And while the rate of innovation in ICs is unusually fast, it is not obvious that innovation is faster in other areas in which China seldom uses technology extractors, such as batteries and precision measurement equipment, than in the above industries.

Under the second scenario, China's bargaining power may depend less on where it sits in GVCs than on the number and size of foreign investors in an industry. According to this view, the fewer and larger the firms in an industry, the lower the barriers to collective action and the greater the resources firms can mobilize to oppose technology transfer requirements. This argument cannot explain the aggressive use of tech extractors in globally concentrated industries like wind turbine manufacturing, high-speed rail, and civilian aircraft manufacturing. Moreover, this argument neglects that in oligopolistic industries characterized by large economies of scale, staying profitable means exploiting the largest market possible (Milner and Yoffie, 1989; Krugman, 1986). As a result, foreign firms in these industries have powerful incentives to comply with tech extractors if doing so gives them an asymmetric advantage in the Chinese market.

The second alternative explanation is that pushback from local governments, not China's position in GVCs, explains why China seldom introduces technology extractors in some strategic industries. Tan (2021) suggests divergent policy priorities between central and local governments explain the persistence of liberal FDI policies in semiconductors during the post-WTO period. Specifically, she argues that the liberalization of FDI policy in semiconductors under Document 18 in 2000 led to increased IC-related foreign investment in cities like Shanghai, which in turn lobbied against the imposition of investment controls that might stem future foreign investment. This local opposition "meant that the central government found its ability to advance its priorities on technological upgrading to be substantially weakened" in ICs (Tan, 2021, 135).

Appearances notwithstanding, this argument is broadly consistent with my own, which emphasizes the growth and employment dependencies fostered by China's position in GVCs but is agnostic regarding the precise mechanism(s) by which those dependencies induce central authorities to refrain from issuing tech extractors. As Tan suggests, local officials' opposition to FDI restrictions in semiconductors stemmed from their "rank promotion imperative," which led them to prioritize "short-term output and employment maximization" over technological upgrading (Tan, 2021, 121). Whether opposition from local officials is the sole pathway by which growth and employment concerns reach central policymakers or is one of many pathways (including, for example, direct lobbying of central authorities by foreign MNEs), all that matters for my theory is that the decision not to issue tech extractors be rooted in *growth and employment* concerns, and not some other motive. My argument linking such concerns to GVC position has the added benefit of helping explain the *persistence* of technology extractors in other industries in which foreign firms also provide significant concentrated employment in cities like Shanghai, such as civilian aircraft manufacturing and automotive production. The difference, I argue, is that in these industries almost everything foreign MNEs import into in China is ultimately consumed within China, bolstering its leverage over foreign investors.

7 Conclusion

This paper represents the first systematic effort to document and explain variation over time and across industries China's use of technology transfer policies. It argued that top-down security concerns lead China to pursue tech extraction in strategic industries, but that China is constrained in doing so by its bargaining power over foreign firms. China's bargaining power depends on the enforcement capacity of its central state and its position in GVCs. Statistical analysis of an original industry-level dataset on tech extractors and a qualitative comparison of tech extraction efforts in two strategic industries provided strong support for my hypotheses. Specifically, I found that China primarily uses tech extractors in strategic industries and its use of these tools in strategic industries increases as enforcement capacity improves. At the same time, I found that China is less likely to issue tech extractors in strategic industries in which most imports are tied to processing trade, suggesting intermediateness to GVCs constrains technology transfer policy behavior. I tested my arguments against alternative explanations and found strong evidence in favor of my claim that strategic interests and bargaining power best explain China's use of technology extractors.

The paper provides insight into the concrete policy mechanisms by which China rose during the crucial years of its ascent as an economic and technological great power. But the implications of my arguments and findings extend beyond China. To begin, they indicate a need to take top-down state interests seriously in analyzing trade policies, especially in the context of authoritarian regimes but also, potentially, in democracies like the United States. This need has grown with heightened government interest in industrial policy in the United States and Europe in recent years. The paper also advances our understanding of the domestic determinants of international political outcomes by exploring how institutional reforms which reduce domestic political fragmentation and centralize decision-making improve a state's bargaining power over foreign commercial actors. At the same time, my findings suggest position in global value chains can powerfully constrain how even strong states with large internal markets pursue their policy goals. For MNEs, as owners of much of the world's key technologies, centrality in value chains constitutes an important but understudied source not only of advantage over other firms, but of leverage against states.

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1 Appendix A - Coding Technology Extractors

One of the major challenges in creating an industry-level measure of the number of technology extractors in place is correctly identifying the industry to which a given policy corresponds. Fortunately, this task is made easier by the fact that Chinese-language policies like the FDI Catalogues often use very similar language to industry descriptions in the China Standard Industrial Classification (CSIC) system, which in turn has been harmonized by the General Administration of Quality Supervision, Inspection and Quarantine (国家质量监督检验检疫总局) with the International Standard Industrial Classification (ISIC). In most cases, this makes coding policies by industry simple and straightforward. For example, FDI catalogues and other policies related to high-speed rail invariably use the term 高速铁路, which appears verbatim in the Chinese-language description for CSIC industry "3711 – 高铁车组制造," or in English, "Manufacture of high-speed trains." This in turn corresponds to ISIC industry "3020 – 铁道机车及其拖曳车辆的制造," or in English, "Manufacture of railway locomotives and rolling stock." Although some information is lost in the correspondence from CSIC industry 3711 to ISIC industry 3020, we can at least be confident that 3020 is the correct ISIC industry code for restrictions containing the term 高速铁路.

In some cases, coding industries is more difficult because the policies in question are highly specific or use language that does not directly correspond to the language used in CSIC. For example, the 2006 FDI Catalogue includes a joint venture requirement for 10万千瓦及以上燃气-蒸汽联合循环发电设备, in English "Gas-steam combined cycle power generation equipment with capacity of 100,000 tons and above," under the sector heading 火电, or "thermal power." For restrictions like this, I first search CSIC for terms closely associated with the restriction, in this case 发电机, or power generator. In most cases, this quickly yields a close match. For example, the CSIC industry description for industry "3811 – 发电机及发电机组制造" reads, 指发电机及其辅助装置、发电成套设备的制造, or in English "Refers to the manufacture of generators and their auxiliary devices and complete sets of power generation equipment," which clearly captures the intent of the original JV requirement. Finally, CSIC codes this as corresponding to ISIC industry "2710 – Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus." Although in CSIC, each 4-digit industry is harmonized to only one ISIC 4-digit industry, in some cases I find that a single restriction plausibly corresponds to more than one ISIC 4-digit industry. In this case, I code the policy as also applying to ISIC industry "2513 – Manufacture of steam generators, except central heating hot water boilers." According to the ISIC description, this industry includes "manufacture of steam or other vapour generators," "manufacture of auxiliary plant for use with steam generators," and similar activities that closely correspond to the original JV requirement.

2 Appendix B - Strategic Industries

2.1 B.1 - Main Measure

The table below lists all industries coded as "strategic" in my dataset. As a reminder, I identify three main classes of strategic industry: (1) Industries with high barriers to entry due to significant research and development (R&D) requirements, cumulative learrning effects, or economies of scale in production, (2) basic infrastructure, and (3) critical industrial inputs. Data on the first category of industry is drawn from the "Global Innovation 1,000" index developed by the consultancy Strategy&. This dataset records the 1,000 top corporate spenders on R&D from 2012-2017 and categorizes them by sector and industry. For the second category, I hand coded a short list of 13 ISIC 4-digit industries covering traditional basic infrastructure assets like roads and railways, ports, power generation and supply, and other basic utilities. Finally, I code the the third type of strategic industry using the United States Defense Logistics Agency's Strategic Materials list, which includes 66 raw material inputs considered "critical to national security" by the Department of Defense. All of these materials fall under two ISIC 4-digit industry codes: "0721 – Mining of uranium and thorium ores," and "0729 – Mining of other non-ferrous metal ores."

Although the vast majority of industries on the list below match the conventional wisdom regarding what counts as "strategic," a few may surprise readers. For example, "1200 – Manufacture of tobacco products," "1701 – Manufacture of pulp, paper and paperboard," "1811 – Printing." I would note that firms in these industries ranked among the top 1,000 corporate R&D spenders globaally between 2012-2017. As such, consistently applying my coding scheme requires that I code them as strategic, even though doing so arguably hurts rather than helps my argument given that China seldom introduces technology extractors in these industries. This being said, one could make a principled argument that these industries are, in fact, strategically important. For example, in China as in many countries, tobacco production is a significant source of central state revenue.

ISIC	Industry	Sector
510	Mining of hard coal	Mining and quarrying
520	Mining of lignite	Mining and quarrying
610	Extraction of crude petroleum	Mining and quarrying
620	Extraction of natural gas	Mining and quarrying
710	Mining of iron ores	Mining and quarrying
729	Mining of other non-ferrous metal ores	Mining and quarrying
899	Other mining and quarrying n.e.c.	Mining and quarrying
910	Support activities for petroleum and natural gas extraction	Mining and quarrying
990	Support activities for other mining and quarrying	Mining and quarrying
1061	Manufacture of grain mill products	Manufacturing
1062	Manufacture of starches and starch products	Manufacturing
1079	Manufacture of other food products n.e.c.	Manufacturing
1104	Manufacture of soft drinks; production of mineral waters and other bottled waters	Manufacturing
1200	Manufacture of tobacco products	Manufacturing
1701	Manufacture of pulp, paper and paperboard	Manufacturing
1702	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	Manufacturing
1709	Manufacture of other articles of paper and paperboard	Manufacturing
1811	Printing	Manufacturing
1812	Service activities related to printing	Manufacturing
1910	Manufacture of coke oven products	Manufacturing
1920	Manufacture of refined petroleum products	Manufacturing
2011	Manufacture of basic chemicals	Manufacturing
2012	Manufacture of fertilizers and nitrogen compounds	Manufacturing
2013	Manufacture of plastics and synthetic rubber in primary forms	Manufacturing
2023	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	Manufacturing
2029	Manufacture of other chemical products n.e.c.	Manufacturing
2100	Manufacture of pharmaceuticals, medicinal chemical and botanical products	Manufacturing
2211	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres	Manufacturing
2394	Manufacture of cement, lime and plaster	Manufacturing
2410	Manufacture of basic iron and steel	Manufacturing
2420	Manufacture of basic precious and other non-ferrous metals	Manufacturing
2431	Casting of iron and steel	Manufacturing
2432	Casting of non-ferrous metals	Manufacturing
2512	Manufacture of tanks, reservoirs and containers of metal	Manufacturing
2513	Manufacture of steam generators, except central heating hot water boilers	Manufacturing
2591	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	Manufacturing
2599	Manufacture of other fabricated metal products n.e.c.	Manufacturing
2610	Manufacture of electronic components and boards	Manufacturing
2620	Manufacture of computers and peripheral equipment	Manufacturing
2630	Manufacture of communication equipment	Manufacturing
2640	Manufacture of consumer electronics	Manufacturing
2651	Manufacture of measuring, testing, navigating and control equipment	Manufacturing
2660	Manufacture of irradiation, electromedical and electrotherapeutic equipment	Manufacturing
2670	Manufacture of optical instruments and photographic equipment	Manufacturing
2680	Manufacture of magnetic and optical media	Manufacturing
2710	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus	Manufacturing
2720	Manufacture of batteries and accumulators	Manufacturing
2731	Manufacture of fibre optic cables	Manufacturing
2732	Manufacture of other electronic and electric wires and cables	Manufacturing
2733	Manufacture of wiring devices	Manufacturing
2740	Manufacture of electric lighting equipment	Manufacturing
2750	Manufacture of domestic appliances	Manufacturing
2790	Manufacture of other electrical equipment	Manufacturing
2811	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines	Manufacturing
2812	Manufacture of fluid power equipment	Manufacturing
2813	Manufacture of other pumps, compressors, taps and valves	Manufacturing
2814	Manufacture of bearings, gears, gearing and driving elements	Manufacturing
2815	Manufacture of ovens, furnaces and furnace burners	Manufacturing
2816	Manufacture of lifting and handling equipment	Manufacturing
2818	Manufacture of power-driven hand tools	Manufacturing
2819	Manufacture of other general-purpose machinery	Manufacturing
2821	Manufacture of agricultural and forestry machinery	Manufacturing
2822	Manufacture of metal-forming machinery and machine tools	Manufacturing
2824	Manufacture of machinery for mining, quarrying and construction	Manufacturing
2829	Manufacture of other special-purpose machinery	Manufacturing
2910	Manufacture of motor vehicles	Manufacturing
2930	Manufacture of parts and accessories for motor vehicles	Manufacturing
3011	Building of ships and floating structures	Manufacturing

ISIC	Industry	Sector
3020	Manufacture of railway locomotives and rolling stock	Manufacturing
3030	Manufacture of air and spacecraft and related machinery	Manufacturing
3040	Manufacture of military fighting vehicles	Manufacturing
3091	Manufacture of motorcycles	Manufacturing
3099	Manufacture of other transport equipment n.e.c.	Manufacturing
3250	Manufacture of medical and dental instruments and supplies	Manufacturing
3315	Repair of transport equipment, except motor vehicles	Manufacturing
3510	Electric power generation, transmission and distribution	Electricity, gas, steam supply
3520	Manufacture of gas; distribution of gaseous fuels through mains	Electricity, gas, steam supply
3530	Steam and air conditioning supply	Electricity, gas, steam supply
3600	Water collection, treatment and supply	Water supply, sewerage
3700	Sewerage	Water supply, sewerage
3811	Collection of non-hazardous waste	Water supply, sewerage
3812	Collection of hazardous waste	Water supply, sewerage
3900	Remediation activities and other waste management services	Water supply, sewerage
4100	Construction of buildings	Construction
4210	Construction of roads and railways	Construction
4220	Construction of utility projects	Construction
4290	Construction of other civil engineering projects	Construction
4721	Retail sale of food in specialized stores	Wholesale
4722	Retail sale of beverages in specialized stores	Wholesale
4759	Retail sale of electrical household appliances, furniture, lighting equipment	Wholesale
4911	Passenger rail transport, interurban	Transportation
4912	Freight rail transport	Transportation
4921	Urban and suburban passenger land transport	Transportation
4923	Freight transport by road	Transportation
4930	Transport via pipeline	Transportation
5011	Sea and coastal passenger water transport	Transportation
5012	Sea and coastal freight water transport	Transportation
5021	Inland passenger water transport	Transportation
5022	Inland freight water transport	Transportation
5110	Passenger air transport	Transportation
5120	Freight air transport	Transportation
5221	Service activities incidental to land transportation	Transportation
5222	Service activities incidental to water transportation	Transportation
5223	Service activities incidental to air transportation	Transportation
5310	Postal activities	Transportation
5510	Short term accommodation activities	Accomodation
5820	Software publishing	Publishing
5911	Motion picture, video and television programme production activities	Publishing
5912	Motion picture, video and television programme post-production activities	Publishing
5913	Motion picture, video and television programme distribution activities	Publishing
5914	Motion picture projection activities	Publishing
6110	Wired telecommunications activities	Publishing
6120	Wireless telecommunications activities	Publishing
6130	Satellite telecommunications activities	Publishing
6190	Other telecommunications activities	Publishing
6202	Computer consultancy and computer facilities management activities	Publishing
6311	Data processing, hosting and related activities	Publishing
6312	Web portals	Publishing
6419	Other monetary intermediation	Financial Services
6430	Trusts, funds and similar financial entities	Financial Services
6491	Financial leasing	Financial Services
6492	Other credit granting	Financial Services
6499	Other financial service activities, except insurance and pension funding activities, n.e.c.	Financial Services
6612	Security and commodity contracts brokerage	Financial Services
6619	Other activities auxiliary to financial service activities	Financial Services
7210	Research and experimental development on natural sciences and engineering	Professional, scientific, technical activities
7410	Specialized design activities	Professional, scientific, technical activities
8610	Hospital activities	Human health and social services

2.2 B.2 - Alternative Measure

To ensure my argument captures Chinese leaders' beliefs about what constitutes a strategic industry, I created an alternative measure of strategic using three authoritative central industrial and technology policies: the MLP, the Strategic Emerging Industries initiative, and Made in China 2025. The Figure below shows the marginal effect of strategic status on tech extraction using this alternative measure. As the figure shows, using this measure does not substantially alter the result.

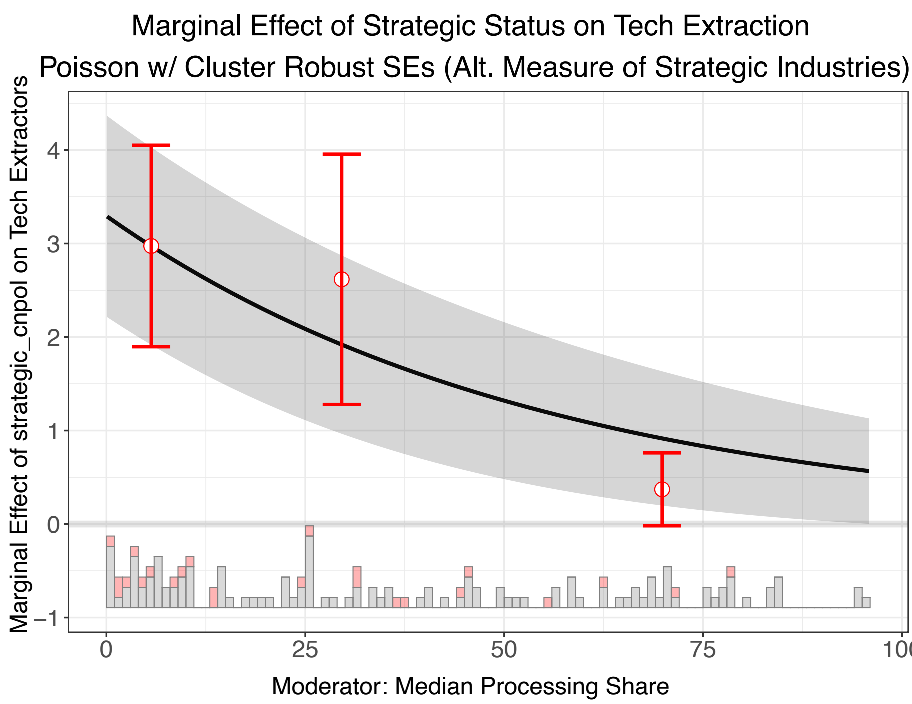


Figure 1: **Marginal Effect of Strategic Status on Tech Extraction**:

Table 1 provides Chinese- and English-language descriptions of the industries included in each of these policies.

Industry (Chinese)	**Industry (English)**	**Policy**
生物技术	Biotechnology	MLP
信息技术	Information Technology	MLP
新材料技术	New Material Technology	MLP
先进制造技术	Advanced Manufacturing Technology	MLP
先进能源技术	Advanced Energy Technology	MLP
海洋技术	Marine Technology	MLP
激光技术	Laser Technology	MLP
空天技术	Aerospace Technology	MLP
节能环保产业	Energy Saving and Environmental Protection Industry	SEI
新一代信息技术产业	New Generation Information Technology Industry	SEI
生物产业	Bio Industry	SEI
高端装备制造产业	High-end Equipment Manufacturing Industry	SEI
新能源产业	New Energy Industry	SEI
新材料产业	New Material Industry	SEI
新能源汽车产业	New Energy Vehicle Industry	SEI
新一代信息技术产业	New Generation Information Technology Industry	MIC 2025
高档数控机床和机器人	High-end CNC Machines and Robots	MIC 2025
航空航天装备	Aerospace Equipment	MIC 2025
海洋工程装备及高技术船舶	Offshore Engineering Equipment and High-Tech Ships	MIC 2025
先进轨道交通装备	Advanced Rail Transit Equipment	MIC 2025
节能与新能源汽车	Energy Saving and New Energy Vehicles	MIC 2025
电力装备	Electrical Equipment	MIC 2025
农机装备	Agricultural Machinery and Equipment	MIC 2025
新材料	New Material	MIC 2025
生物医药及高性能医疗器械	Biomedicine and High-Performance Medical Devices	MIC 2025

Table 1

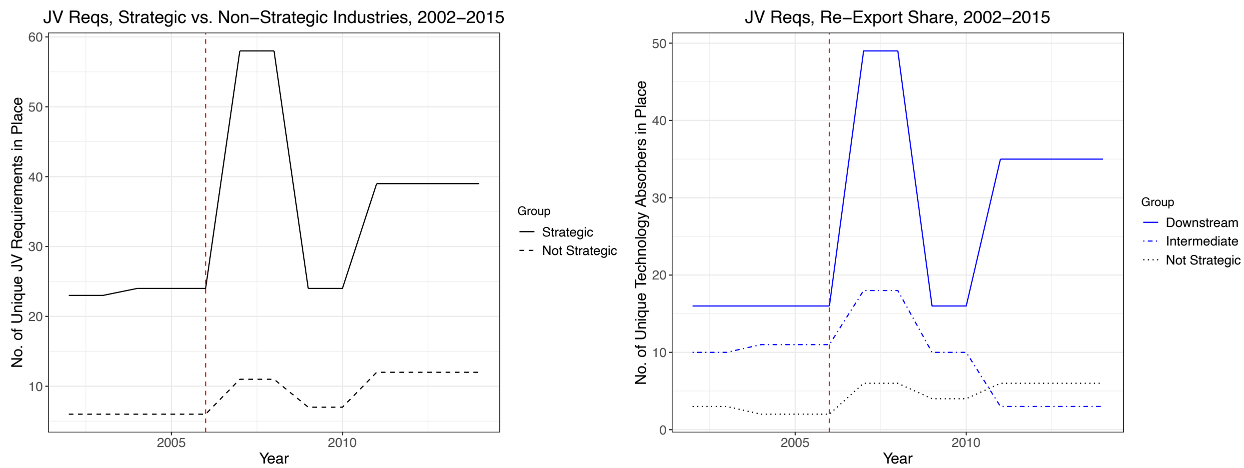
ISIC	Industry Description
2100	Manufacture of pharmaceuticals, medicinal chemical and botanical products
2610	Manufacture of electronic components and boards
2620	Manufacture of computers and peripheral equipment
2630	Manufacture of communication equipment
2660	Manufacture of irradiation, electromedical and electrotherapeutic equipment
2670	Manufacture of optical instruments and photographic equipment
2680	Manufacture of magnetic and optical media
3011	Building of ships and floating structures
3020	Manufacture of railway locomotives and rolling stock
3030	Manufacture of air and spacecraft and related machinery
3040	Manufacture of military fighting vehicles
2811	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
2812	Manufacture of fluid power equipment
2813	Manufacture of other pumps, compressors, taps and valves
2814	Manufacture of bearings, gears, gearing and driving elements
2816	Manufacture of lifting and handling equipment
2818	Manufacture of power-driven hand tools
2819	Manufacture of other general-purpose machinery
2513	Manufacture of steam generators, except central heating hot water boilers
2011	Manufacture of basic chemicals
2012	Manufacture of fertilizers and nitrogen compounds
2013	Manufacture of plastics and synthetic rubber in primary forms
1910	Manufacture of coke oven products
1920	Manufacture of refined petroleum products
2910	Manufacture of motor vehicles

Table 2

Table 2 lists relevant ISIC codes and English-language industry descriptions used to create this alternative measure.

3 Appendix C - Results by Type of Tech Extractor

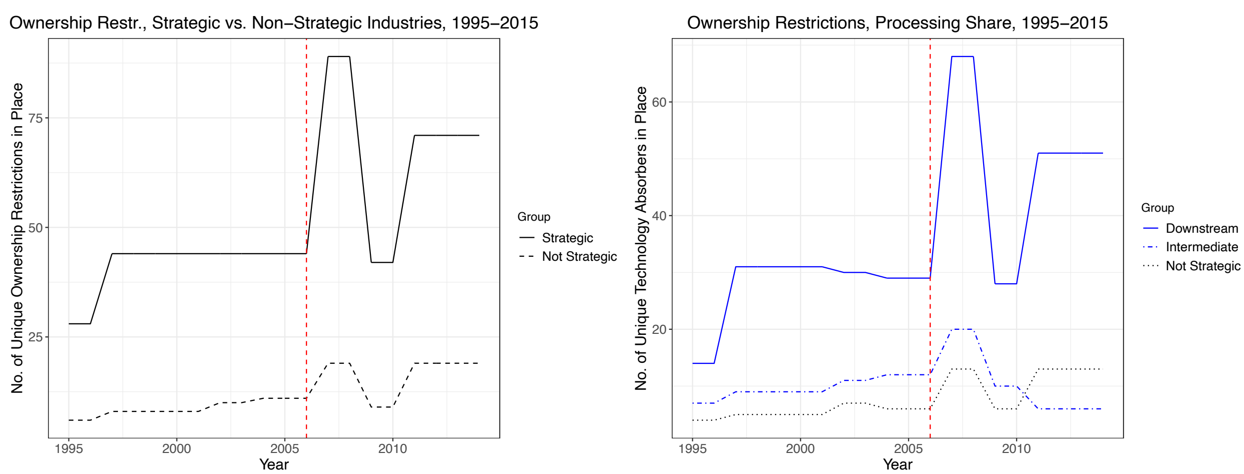
3.1 C.1 - Trends by Type of Tech Extractor



(a) Strategic vs. Non-Strategic Industries

(b) High vs. Low Re-Export Share

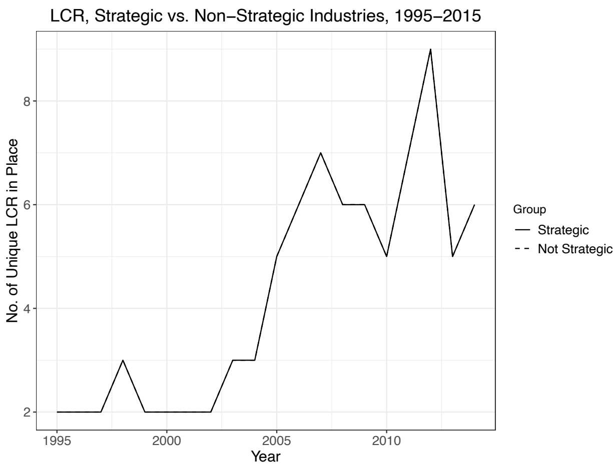
Figure 2: Joint Venture Requirements



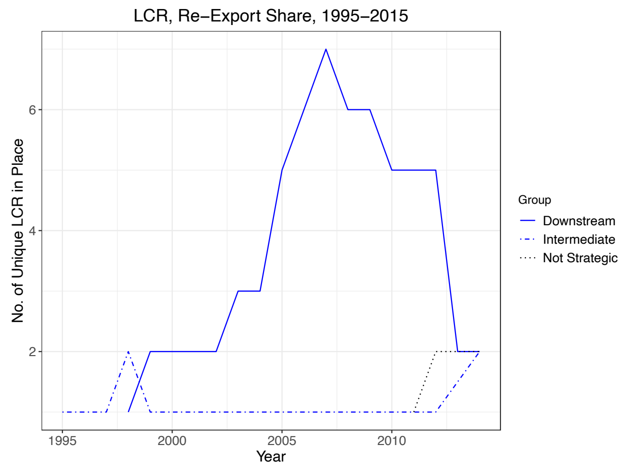
(a) Strategic vs. Non-Strategic Industries

(b) High vs. Low Re-Export Share

Figure 3: All Ownership Restrictions

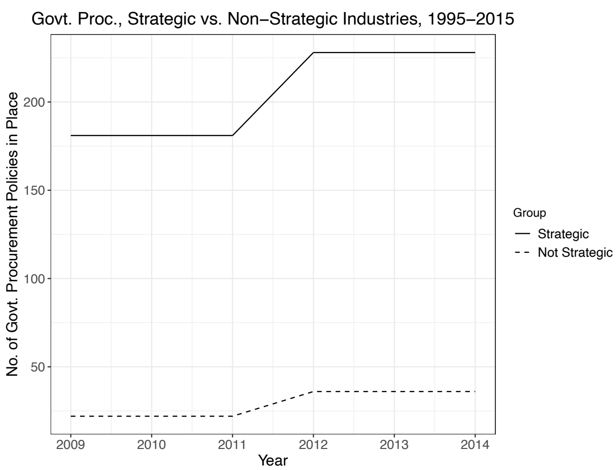


(a) Strategic vs. Non-Strategic Industries

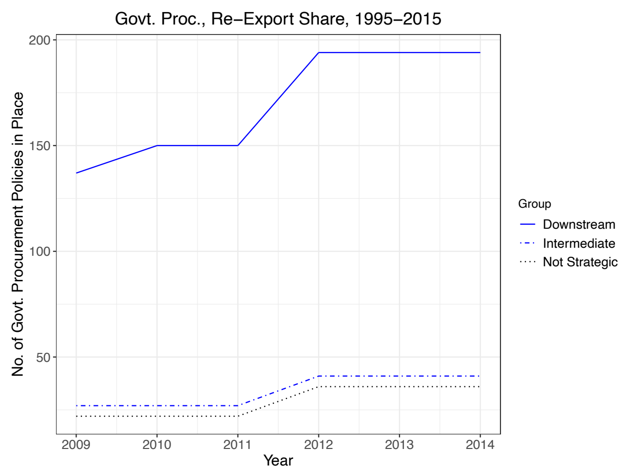


(b) High vs. Low Re-Export Share

Figure 4: Local Content Requirements



(a) Strategic vs. Non-Strategic Industries



(b) High vs. Low Re-Export Share

Figure 5: Preferential Government Procurement

3.2 C.2 - Results by Type of Tech Extractor

Table 3: Ownership Restrictions as Outcome Variable

	Dependent variable:							
	TE by Industry-Year, Sq. Rt. (1-3)			TE by Industry-Year (4-8)				
	OLS			*Poisson*			*Negative Binomial*	*Zero-inflated Poisson*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strategic	0.334*** (0.065)	0.301*** (0.065)	0.650*** (0.143)	2.907*** (0.062)	2.315*** (0.104)	3.849*** (0.275)	3.801*** (0.298)	2.508*** (0.720)
Post-2006		0.014 (0.010)						
Strategic x Post-2006		0.069* (0.041)						
Median Processing Share			−0.0002 (0.001)		−0.025*** (0.004)	−0.007 (0.006)	−0.007 (0.007)	−0.038*** (0.012)
Median HHI			0.0002 (0.0001)			0.0003*** (0.00004)	0.0004*** (0.0001)	0.00003 (0.00003)
Median SOE Share			0.524* (0.268)			0.947*** (0.102)	1.410*** (0.219)	−0.096 (0.157)
Strategic x Median Processing Share			−0.008*** (0.003)		0.004 (0.004)	−0.013** (0.007)	−0.014** (0.007)	0.036*** (0.012)
Constant				−3.051*** (0.059)	−1.915*** (0.098)	−4.199*** (0.278)	−4.507*** (0.313)	−1.541** (0.727)
Year FE	Yes	No	Yes					
Industry FE (ISIC 2-digit)	Yes	Yes	No					
Observations	8,820	8,820	3,045	8,820	4,347	3,045	3,045	3,045
R^2	0.357	0.353	0.241					
Adjusted R^2	0.349	0.346	0.234					
Log Likelihood				−5,809.736	−3,628.558	−2,666.597	−1,978.203	−2,118.898
Residual Std. Error	0.417 (df = 8711)	0.417 (df = 8729)	0.555 (df = 3019)					

Note: *p<0.1; **p<0.05; ***p<0.01

Table 4: Local Content Requirements as Outcome Variable

	Dependent variable:							
	TE by Industry-Year, Sq. Rt. (1-3)			TE by Industry-Year (4-8)				
		OLS			*Poisson*		*Negative Binomial*	*Zero-inflated Poisson*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strategic	0.033**	0.023	0.085**	3.122***	2.549***	2.089***	2.104***	0.471
	(0.015)	(0.015)	(0.037)	(0.247)	(0.389)	(0.385)	(0.439)	(0.730)
Post-2006		0.005						
		(0.003)						
Strategic x Post-2006		0.020						
		(0.015)						
Median Processing Share			−0.0002		−0.002	−0.010	−0.011	0.006
			(0.0002)		(0.009)	(0.008)	(0.009)	(0.014)
Median HHI			0.00001			0.0002	0.001***	0.003***
			(0.00002)			(0.0001)	(0.0002)	(0.0004)
Median SOE Share			−0.036			−0.888*	−1.447**	−2.783**
			(0.047)			(0.500)	(0.698)	(1.110)
Strategic x Median Processing Share			−0.001		−0.021**	−0.021**	−0.019*	−0.054***
			(0.001)		(0.010)	(0.010)	(0.011)	(0.018)
Constant				−5.827***	−4.927***	−4.351***	−4.775***	−5.261***
				(0.236)	(0.364)	(0.412)	(0.480)	(0.960)
Year FE	Yes	No	Yes					
Industry FE (ISIC 2-digit)	Yes	Yes	No					
Observations	8,820	8,820	3,045	8,820	4,347	3,045	3,045	3,045
R^2	0.139	0.139	0.036					
Adjusted R^2	0.129	0.130	0.028					
Log Likelihood				−827.328	−483.846	−455.807	−421.367	−391.856
Residual Std. Error	0.139 (df = 8711)	0.139 (df = 8729)	0.187 (df = 3019)					

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5: Government Procurement as Outcome Variable

	Dependent variable:							
	TE by Industry-Year, Sq. Rt. (1-3)			TE by Industry-Year (4-8)				
	OLS			*Poisson*			*Negative Binomial*	*Zero-inflated Poisson*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strategic	0.120**	−0.066	0.466**	2.745***	3.111***	2.815***	2.957***	1.242***
	(0.046)	(0.046)	(0.192)	(0.062)	(0.105)	(0.104)	(0.458)	(0.110)
Post-2006		0.032**						
		(0.015)						
Strategic x Post-2006		0.391***						
		(0.083)						
Median Processing Share			−0.0003		0.012***	0.002	0.007	0.013***
			(0.001)		(0.002)	(0.002)	(0.007)	(0.002)
Median HHI			−0.00002			−0.00005	0.001**	0.0004**
			(0.0001)			(0.00004)	(0.0003)	(0.0002)
Median SOE Share			−0.384*			−2.585***	−2.298***	−1.849***
			(0.209)			(0.150)	(0.782)	(0.171)
Strategic x Median Processing Share			−0.005*		−0.029***	−0.028***	−0.036***	−0.025***
			(0.003)		(0.002)	(0.002)	(0.010)	(0.003)
Constant				−3.021***	−2.621***	−1.403***	−2.725***	1.265***
				(0.058)	(0.100)	(0.115)	(0.540)	(0.356)
Year FE	Yes	No	Yes					
Industry FE (ISIC 2-digit)	Yes	Yes	No					
Observations	8,820	8,820	3,045	8,820	4,347	3,045	3,045	3,045
R^2	0.169	0.181	0.147					
Adjusted R^2	0.158	0.173	0.140					
Log Likelihood				−8,356.949	−6,760.191	−6,138.346	−1,332.403	−1,476.361
Residual Std. Error	0.469 (df = 8711)	0.465 (df = 8729)	0.763 (df = 3019)					

Note: *p<0.1; **p<0.05; ***p<0.01

4 Appendix D - Covariates, Full Results, and Additional Interflex Figures

4.1 D.1 - Measuring Covariates

In addition to my outcome and explanatory variables of interest, I collected data on two pre-treatment covariates which could confound my theory's prediction that top-down strategic interests and the bargaining power of China's central state vis-a-vis foreign investors explain variation across industries and over time in China's use of technology extractors. Each variable represents a different approach to measuring the underlying concept that bottom-up pressures from vested economic interest groups, not top-down strategic concerns, drive Chinese tech extraction efforts.

The first potential confounder I control for is the geographic concentration of industrial output. This widely used measure of the strength of interest group pressures captures the intuition that as actors become more spatially concentrated the barriers to collective action decline (Pincus 1975). More recently, scholars have used geographic concentration of industry across provinces and administrative regions in China to proxy the salience of local-level economic interests (Li 2013, Tan 2021). Against this backdrop, it could be that the observed relationship between the strategic status of an industry and the use of technology extractors is merely a byproduct of the fact that "strategic" industries tend to be more concentrated geographically and thus better able to secure preferential treatment from the central state, including through the use of technology extraction policies. Following Li (2013), I measure this concept using a Herfindahl-Hirschman Index (HHI) of the geographic distribution of industry by province and year. Formally, I calculate the index for a given industry i in a given year as:

$$H_i = \sum_{j=1}^{n} \big(\frac{X_j}{\Sigma X_j} \cdot 100\big)^2$$

Where X_j is the value of industrial output from industry i in province or administrative region j. To construct this measure, I hired a research assistant (RA) to scrape provincial-level industrial output data from the China Data Online portal maintained by the All China Marketing Company's All China Data Center. All data originally comes from China's National Bureau of Statistics (NBS). China Data Online publishes yearly industrial output data at the CSIC 4-digit level from 1999-2015, which I use to calculate the original industry-year HHI. However, due to data sparsity and quality issues (especially for years after 2011), for my main model specifications I use the mean and median HHI by industry, measured at the CSIC/ISIC 2-digit level. I find that using different versions of the HHI does not appreciably affect my results, but using the mean and median HHIs at the 2-digit level substantially alleviates data missingness problems.

The second potential confounder I control for is state-owned enterprises' (SOEs) share of industrial output. SOEs tend to be better politically connected than their private counterparts in China. It is also is well-known that SOEs regularly use their connections to local and central political leaders to secure various forms of preferential treatment (Leutert 2018, Wang 2015). As with geographic concentration, it could be that so-called "strategic" industries tend to be dominated by SOEs, and that lobbying for beneficial policies by these SOEs, not top-down security concerns, explains when China uses technology extractors. To control for this possibility, I construct a measure of SOE share of output by industry and year using data collected from the NBS.

Table 6: Full Results from Regression with OLS, Poisson, Zero-inflated Poisson (w/ Controls)

	Dependent variable:								
	TE by Industry-Year, Sq. Rt. (1-3)			TE by Industry-Year (4-8)					Total TE (9)
	OLS			*Poisson*			*FE Poisson*	*Zero-inflated Poisson*	*Zero-inflated Poisson*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Strategic	0.431***	0.248***	1.049***	2.838***	2.789***	2.974***	2.977***	0.803***	1.668***
	(0.082)	(0.082)	(0.238)	(0.043)	(0.072)	(0.093)	(0.430)	(0.097)	(0.191)
Post-2006		0.046***							
		(0.018)							
Strategic x Post-2006		0.384***							
		(0.079)							
Median Processing Share			−0.001		0.001	0.002		0.012***	0.022***
			(0.001)		(0.002)	(0.002)		(0.002)	(0.004)
Processing Share							0.009		
							(0.008)		
Median HHI			0.0001			0.0001***	0.00002	0.00001	0.0001
			(0.0002)			(0.00003)	(0.0001)	(0.00002)	(0.00003)
Median SOE Share			0.092			−0.652***	−0.052	−2.055***	−1.101***
			(0.345)			(0.081)	(0.260)	(0.128)	(0.181)
Strategic x Med. Processing Share			−0.012***		−0.019***	−0.025***		−0.020***	−0.034***
			(0.004)		(0.002)	(0.002)		(0.002)	(0.004)
Strategic x Processing Share							−0.016*		
							(0.009)		
sigma							1.687***		
							(0.030)		
Constant				−2.313***	−1.622***	−1.612***	−2.023	1.582***	1.648***
				(0.041)	(0.068)	(0.097)	(6.589)	(0.097)	(0.193)
Year FE	Yes	No	Yes				Yes		
Industry FE (ISIC 2-digit)	Yes	Yes	No				Yes		
Controls	No	No	Yes	No	No	Yes	Yes	Yes	Yes
Observations	8,820	8,820	3,045	8,820	4,347	3,045		3,045	145
Adjusted R^2	0.310	0.320	0.207						

Note: *p<0.1; **p<0.05; ***p<0.01

4.2 D.2 - Additional Interflex Figures

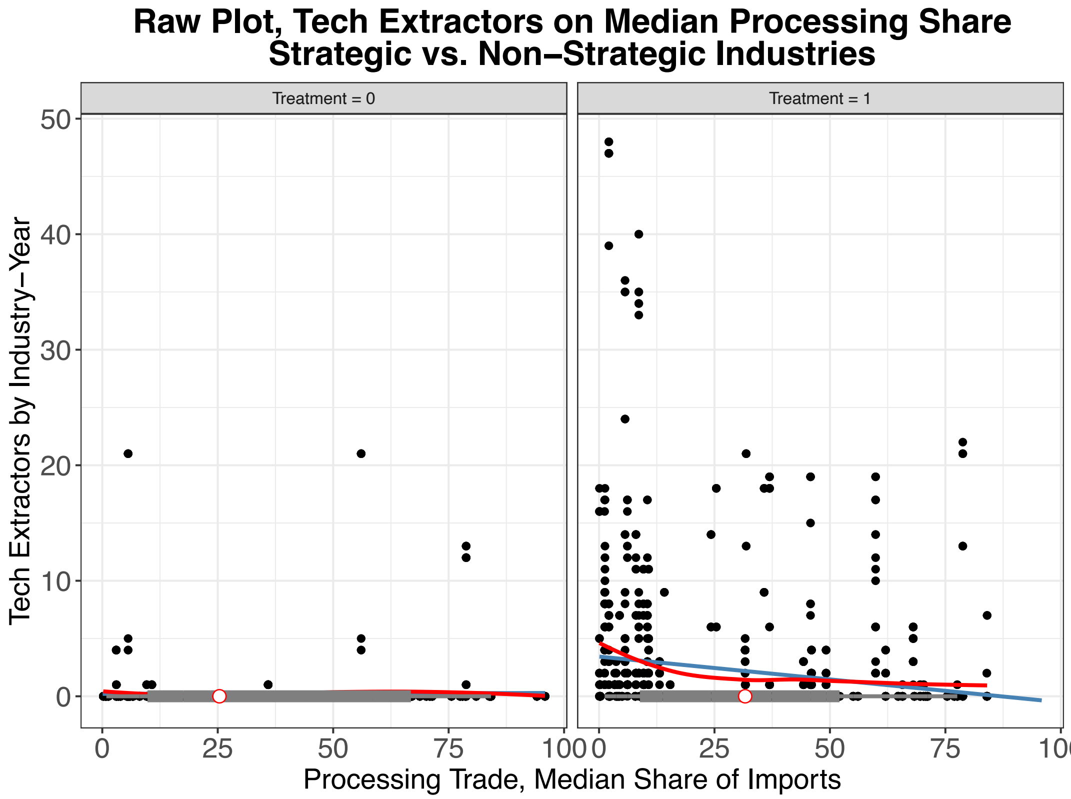


Figure 6

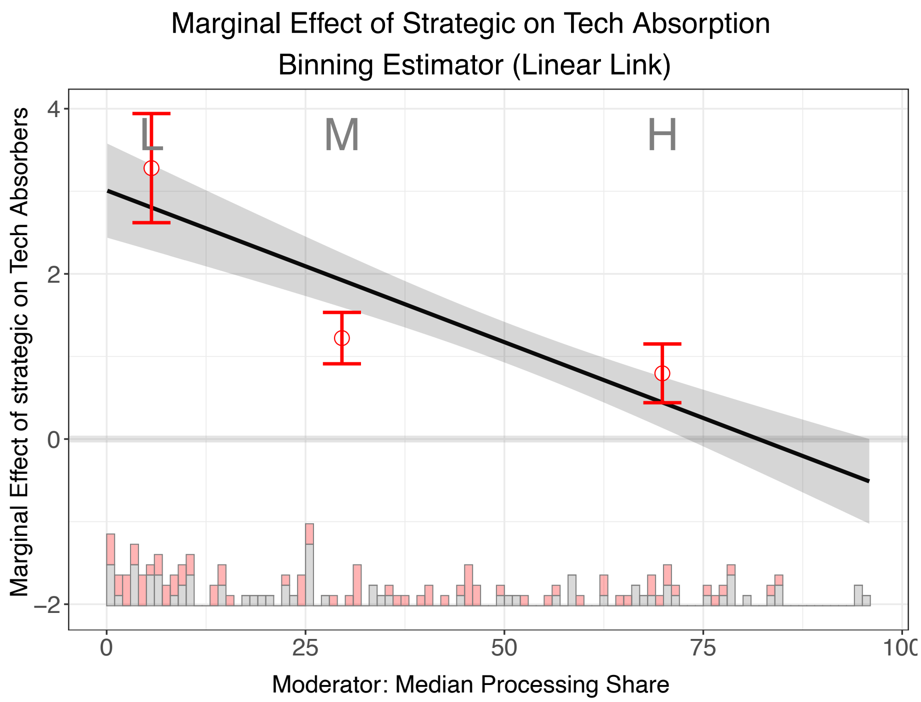


Figure 7

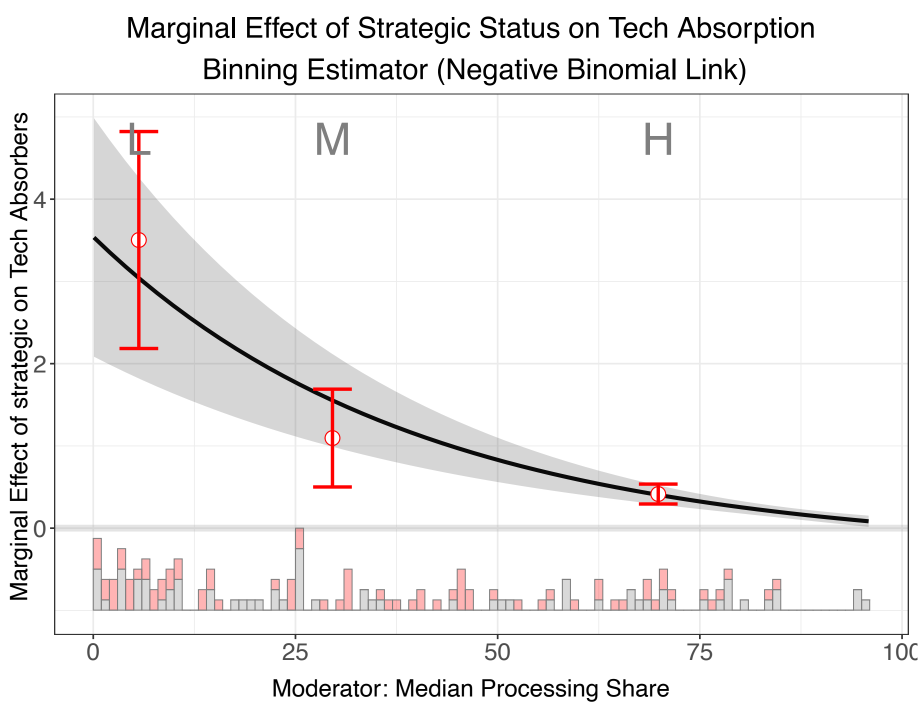


Figure 8

5 Appendix E - Product Characteristics Models

To further probe my argument about the moderating effect of China's intermediate position in GVCs on its use of technology extractors in strategic industries, I ran a battery of tests of the relationship between my variables of interest and various measures of product characteristics. If China's position in GVCs shapes its propensity to impose these policy tools, then we might expect China to use them more often in industries characterized by certain kinds of goods than others.

For example, if China is most prone to introduce tech extractors in industries in which it sits downstream of GVCs, we should observe a positive relationship between the relative "downstreamness" of industries and the number of tech extractors used. By the same token, we might expect China to impose fewer of these policies in industries with a preponderance of upstream goods. In addition, we might anticipate China to pursue tech extraction intensively in finished capital goods, which are downstream of GVCs and for which, because they are primarily consumed by firms, the Chinese state is particularly well-positioned to shape demand levels through policy interventions. By contrast, because it is harder for the state to influence ordinary consumers' consumption preferences, China may use fewer of these tools in industries where household goods predominate.

To examine these possibilities, I constructed several measures of product-level characteristics by industry. First, using the UN's Broad Economic Categories (BEC) table, which sorts HS 6-digit level products into household consumption, intermediate, and capital goods, I calculated the number of products in each category for each ISIC 4-digit industry. This yielded three variables which count the number of household, intermediate, and capital goods, respectively, in each industry. To reduce variance, I log each variable.[1]

Second, I used the `concordance` package from Liao et al. (2020) to calculate levels of upstreamness, downstreamness, and intermediateness by industry. `Concordance` calculates upstreamness and downstreamness at the ISIC 2-digit level for specific countries and years based on measures from Antras (2018). For both measures, I set the country to China and year to 2008. To assess intermediateness, `concordance` calculates the proportion of products containing keywords associated with intermediate goods (e.g. "part(s)", "component(s)") for each input code. I calculate the proportion by HS 4-digit heading and aggregate to the ISIC 4-digit level.

After creating these measures, I re-ran my main model specification (model 6 in Table 1) six times, each time controlling individually for one product-level characteristic. My goal was to assess (1) the sign and significance of the relationship between each product characteric measure and my outcome variable, and (2) whether controlling for product-level characteristics substantially altered the association between my main variables of interest. In addition, I ran simple bivariate regressions of the outcome on each product type measure to ensure the main results hold absent controls. Based on the above discussion, I expected the coefficients on the BEC capital goods and `concordance` downstreamness measures to be positive and significant. In turn, the coefficient on upstreamness should be negative and significant. I did not have strong a prior about the coefficients on either measure of intermediateness because industries in which China is both intermediate in and downstream of GVCs rely heavily on intermediate inputs. Similarly, I did not have strong priors about household consumption goods. Household consumption goods themselves are downstream of GVCs, but my measure may be too aggregated to capture fine distinctions in trade

[1] To be safe, I repeated this process using an original measure of product type by HS 6-digit level product based on analysis of US import transaction data from Panjiva, a trade research database. I developed this measure jointly with collaborators for a separate project. This measure yields similar results to the BEC data.

data between finished consumer goods and inputs into them. In addition, there are not many strategically important industries where household consumption goods predominate.

Although one measure of intermediate goods based on the `Concordance` package shows a negative and significant relationship between the intermediateness of a product and the use of technology extractors (Table 4), the sign and significance of intermediateness varies significantly depending on the measure and modeling strategy. For example, the same measure of intermediateness from `Concordance` is positive and significantly associated with tech extraction in Zero-inflated Poisson regression (Table 6) and not significantly associated with tech extraction in Negativ Binomial regression (Table 5). Meanwhile, an alternative measure of intermediateness based on the United Nations' Broad Economic Categories (BEC) measure is positively but not significantly associated with tech extraction under Poisson regression, positively and significantly associated under Negative Binomial regression, and negatively (but not significantly) associated under Zero-inflated Poisson. Meanwhile, the sign and significance on *Strategic* and on *Strategic x Median Processing Share* are significant and maintain the expected signs in every model.

Table 7: Poisson Regression with Cluster Robust SEs, Product Char. Models

	Dependent variable:					
	TE by Industry-Year					
	(1)	(2)	(3)	(4)	(5)	(6)
Strategic	2.973	2.769***	2.536***	2.795***	3.124***	2.672***
	(2.973)	(0.093)	(0.093)	(0.095)	(0.093)	(0.093)
Median Processing Share	0.002	0.002	0.008***	0.003*	0.002	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Intermediate Good (BEC)	0.009					
	(0.009)					
Consumer Good (BEC)		−0.253***				
		(0.020)				
Capital Good (BEC)			0.392***			
			(0.013)			
Intermediateness (Concordance)				−8.457*		
				(5.093)		
Upstreamness					−0.664***	
					(0.026)	
Downstreamness						1.526***
						(0.060)
Median HHI	0.0001	0.0001***	0.0001***	0.0002***	0.0002***	0.0003***
	(0.0001)	(0.00003)	(0.00003)	(0.00003)	(0.00003)	(0.00003)
Median SOE Share	−0.655	−0.705***	0.351***	−0.550***	0.081	0.130
	(−0.655)	(0.080)	(0.088)	(0.083)	(0.084)	(0.089)
Strategic x Median Processing Share	−0.026	−0.024***	−0.025***	−0.023***	−0.026***	−0.026***
	(−0.026)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	−1.629	−1.252***	−2.120***	−1.677***	0.047	−6.816***
	(−1.629)	(0.099)	(0.103)	(0.099)	(0.121)	(0.233)
Observations	3,045	3,045	3,045	3,045	3,045	3,045
Log Likelihood	−7,295.835	−7,208.945	−6,840.827	−7,217.428	−6,942.607	−6,925.683
Note:						*p<0.1; **p<0.05; ***p<0.01

6 Appendix F - Lagged Outcome Variable Models

To guard against the risk that previous values of the outcome variable explain future use of technology extractors, I re-ran my main model specification including 2- and 3-year lagged outcome variables on the right hand side. The figures below show that including a lagged outcome variable does not meaningful alter the association between the interaction of strategic status and processing share and China's use of technology extractors. I use 2- and 3-year lagged outcome variables because this reflects the intervals between revisions of relevant policies. For example, China issued the Foreign-Invested Industry Guidance Catalogue, which contains industry-specific JV requirements and other ownership restrictions on inward FDI, in 1995, 1997, 2002, 2004, 2007, 2009, 2011, 2015, and 2017.

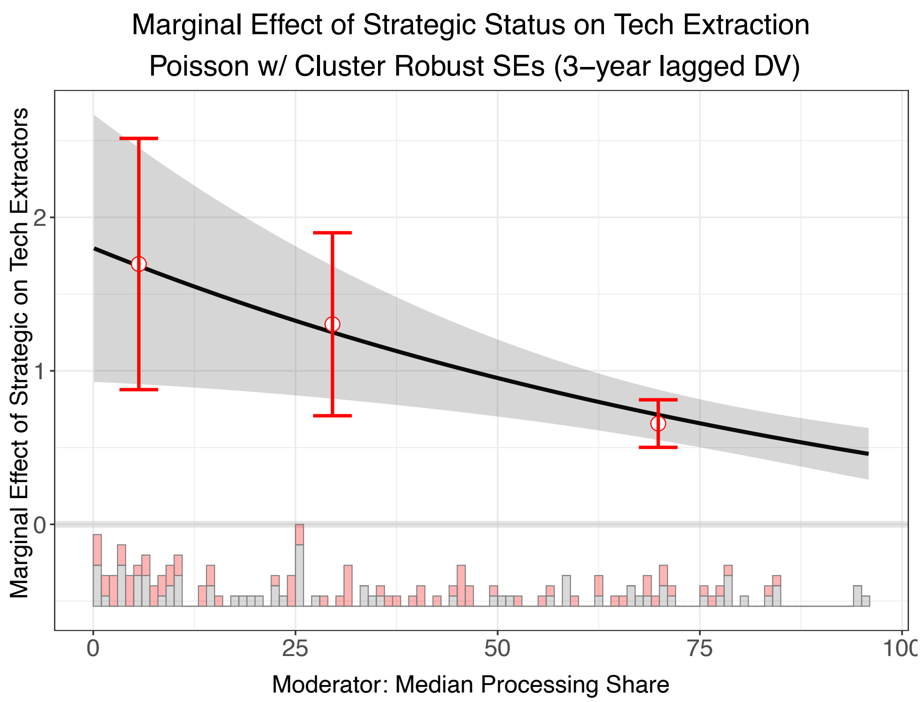


Figure 9: Marginal Effect of Strategic Status on Tech Extraction (2-Year lagged DV)

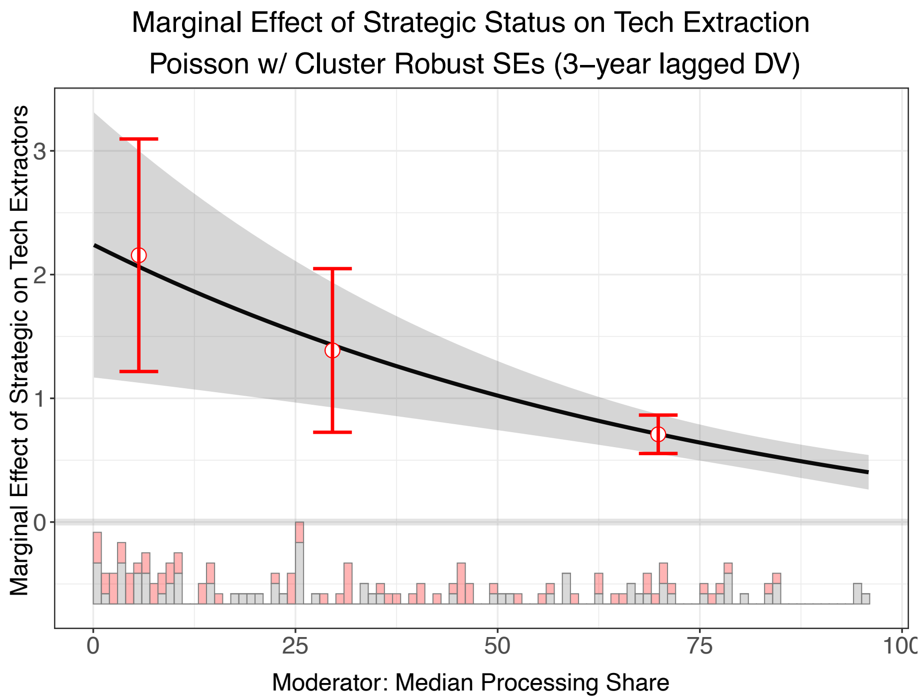


Figure 10: Marginal Effect of Strategic Status on Tech Extraction (3-Year lagged DV)

7 Appendix G - Market Size Models

To formally test my claim that position in GVCs, not market size, explains cross-industry variation in Chinese technology extraciton, I examined the impact of market size on tech extraction using an approximate measure of China's share of global imports by ISIC 4-digit industry after subtracting processing trade-related imports. To calculate this quantity, I multiplied the measure of median industry-level processing share obtained from CCD (in decimal form) by total Chinese imports per industry based on data from UN Comtrade. I then divided this figure by total world imports per industry. I use data on Chinese and world imports from UN Comtrade because CCD calculates import value in RMB, not USD, so directly comparing Chinese import values from CCD to world import values in UN Comtrade is not feasible.[2] I then calculated, for each ISIC 4-digit industry, China's median share (in percent terms) of world imports from 2001-2008, excluding processing trade-related imports. I choose 2001-2008 because this covers the key post-WTO years during which Chinese tech extraction surged. I use both logged and unlogged measures.

Figure 10 replicates model 6 from Table 1 but includes a control for China's logged median global market share by industry, excluding processing trade. Controlling for market size does not meaningfully affect the size or statistical significance of the coefficients on `Strategic` or `Strategic x Median Processing Share` across any of my main model specifications. Moreover, I find that the direct relationship between market size and technology extraction is surprisingly sensitive to modeling choices, the inclusion of controls, and the measure used, with the log of market size positive and significant in most models and the unlogged measure negative and insignificant in several. Nonetheless, although the results suggest the impact of market size is weaker and less consistent than that of my main explanatory variables of interest, market size does appear to be positively associated with tech extraction and to have a positive impact on the marginal effect of strategic importance.

[2] Per Hao Zhang, CCD and UN Comtrade figures for trade volume are highly similar: For 95 percent of HS 6-digit products, there is less than 5 percent difference in reported trade volumes between the two sources.

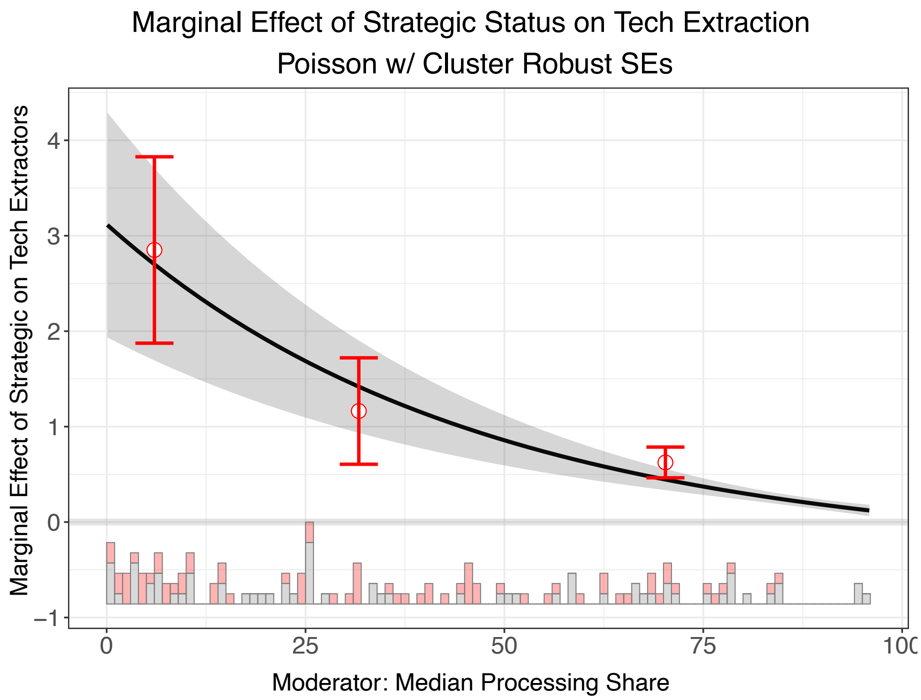


Figure 11: **Marginal Effect of Strategic Status on Tech Extraction (w/ Market Size)**: After controlling for market size, measure as China's share of global imports excluding processing trade (logged), the coefficient on the interaction between strategic status and processing is somewhat smaller, but remains positive and significant across all three bins.

Overall, the results reinforce my argument that existing approaches to bargaining power are insufficient. In focusing on the size of a country's consumer base, previous works ignore important variation *across industries* in bargaining power, as well as the role of expectations about future market growth in China in shaping the balance of dependence between China and foreign investors. More importantly, existing research does not consider transnational production constrains bargaining power's use.

Table 8: Models w/ control for Global Market Share (Logged)

	Dependent variable:							
	TE by Industry-Year, Sq. Rt. (1-3)			TE by Industry-Year (4-8)				
	OLS			*Poisson*			*Negative Binomial*	*Zero-inflated Poisson*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Strategic	0.442***	0.273**	0.818***	3.033***	1.215***	2.797***	2.520***	0.370***
	(0.108)	(0.108)	(0.170)	(0.076)	(0.094)	(0.095)	(0.217)	(0.099)
Post-2006		0.070**						
		(0.029)						
Strategic x Post-2006		0.321***						
		(0.080)						
Median Processing Share			-0.0003	0.002		0.003*	0.0004	0.010***
			(0.001)	(0.002)		(0.002)	(0.003)	(0.002)
Median Global Share (logged)			0.029		-0.274^{***}	0.219***	0.377***	0.470***
			(0.071)		(0.103)	(0.024)	(0.095)	(0.034)
Median HHI			0.0001		-0.0001^{***}	0.00001	0.001***	-0.00001
			(0.0001)		(0.00003)	(0.00003)	(0.0001)	(0.00002)
Median SOE Share			0.181		0.304***	-0.256^{***}	0.343	-1.056^{***}
			(0.297)		(0.086)	(0.088)	(0.350)	(0.123)
Strategic x Median Processing Share			-0.010^{***}	-0.025^{***}		-0.026^{***}	-0.025^{***}	-0.016^{***}
			(0.003)	(0.002)		(0.002)	(0.004)	(0.002)
Strategic x Market Size					0.811***			
					(0.106)			
Constant				-1.595^{***}	-0.938^{***}	-1.588^{***}	-2.644^{***}	1.202***
				(0.072)	(0.096)	(0.099)	(0.252)	(0.100)
Year FE	Yes	No	Yes					
Industry FE (ISIC 2-digit)	Yes	Yes	No					
Observations	3,743	3,743	2,660	3,743	2,660	2,660	2,660	2,660
R^2	0.327	0.330	0.228					
Adjusted R^2	0.316	0.322	0.221					
Log Likelihood				$-7{,}550.141$	$-7{,}061.676$	$-6{,}742.394$	$-2{,}762.028$	$-3{,}801.618$
Residual Std. Error	0.561 (df = 3681)	0.558 (df = 3697)	0.670 (df = 2635)					

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$