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Exporting the Surveillance State via Trade in AI

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Abstract

What are the international ramifications of China's emergent leadership in facial recognition AI? We collect global data on facial recognition AI trade deals and document two facts. First, we show that China has a comparative advantage in this surveillance technology. It is substantially more likely to export facial recognition AI than other countries, and particularly so as compared to other frontier technologies. This comparative advantage may stem in part from the Chinese government's demand for the technology to support its surveillance state — a form of "home-market" effect — as well as Chinese firms' access to large government datasets. Second, we find that autocracies and weak democracies are more likely to import facial recognition AI from China, in particular those lacking domestic AI investment or experiencing political unrest. No such political bias is observed in AI imports from the US or in imports of other frontier technologies from China. To the extent that China may be exporting its surveillance state via trade in AI, this can enhance and beget more autocracies abroad. Regulations of AI trade should thus be framed around regulations on products with global externalities.

Keywords: artificial intelligence, autocracy, innovation, data, China, surveillance, trade, political unrest
JEL Classification: O30, P00, E00, L5, L63, O25, O40, F14

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1 Introduction

Artificial intelligence (AI) technology has been hailed as the basis for a "fourth industrial revolution" (Schwab, 2017) that will drive economic growth in the years to come (Aghion et al., 2017, Brynjolfsson et al., 2021). But the technology has also brought new challenges to the fore. It might undermine democracies (Acemoglu, 2021), enhance autocrats' aims of social control (Guriev and Treisman, 2019, Tirole, 2021), and empower "surveillance capitalists" (Zuboff, 2019). In China, in particular, facial recognition AI supports its surveillance state, and frontier innovation in this technology has benefited from access to large-scale government datasets and government demand (Beraja et al., 2021, 2022).

Given that facial recognition AI can be exported, what are the international ramifications of China's emergent leadership in this surveillance technology? We formulate two hypotheses. First, that China has a comparative advantage in facial recognition AI. This advantage could stem in part from the Chinese government's demand for the technology, industrial policy and access to government data contributing to Chinese firms' exporting capacity. Second, we hypothesize that autocracies and weak democracies are more likely to import facial recognition AI from China. This could reflect higher demand in these countries for surveillance technology, or supply side factors such as China subsidizing exports to autocracies and weak democracies as part of its foreign policy.[1] If these factors are at play, one would expect that the imports of Chinese facial recognition AI are particularly high among autocracies and weak democracies lacking domestic investment in the technology or experiencing political unrest.

To test these hypotheses, we collect global data on facial recognition AI trade spanning 2008-2021 based on the Carnegie Endowment for International Peace's report *The Global Expansion of AI Surveillance* (Feldstein, 2019). The report compiles information from AI companies' announcements of overseas AI deals, either with state or non-state actors.[2] We complement this set of deals with our own search of AI trade deals from all facial recognition AI firms identified in the Capital IQ database. These data are aggregated to the exporter-importer-year level. For comparison, we construct analogous data of trade in other frontier technologies, such as robotic and genomic products, from the UN Comtrade database.

[1] While we will provide evidence that these factors are relevant, it is important to note that other demand side factors in importing countries (e.g., the desire to attract broad package of Chinese development spending) and supply side factors in exporting countries (e.g., the US and European companies sanction their AI exports) could be relevant in this context as well.

[2] Both the state and non-state actors could contribute to the building of a surveillance state. Non-state sectors often act as local intermediaries from which the government procures imported products.

Then, we estimate several linear probability models that predict trade in AI or other frontier technologies between country pairs. Differencing out trade in other frontier technologies allows us to account for other unobserved factors associated with country-pairs trading more in frontier technologies generally. We also control for country dyad characteristics that are known to affect trade (e.g., distance between countries).

We find three primary results. First, China is more likely to export facial recognition AI than other countries, and particularly so as compared to other frontier technologies. For instance, we observe 201 Chinese export deals of facial recognition AI, almost double the deals from the second highest exporting country (the US, with 128 deals). In no other frontier technology does China exhibit such exporting dominance.

Second, autocracies and weak democracies are more likely to import facial recognition AI from China. For example, we observe that 45% of China's export deals are with autocracies and weak democracies, while only 23% of US exports are with those countries. These patterns are particularly striking given the generally higher income and higher trade volumes of (strong) democratic regimes. Such political bias is not seen in US exports of AI or China's exports of other frontier technologies.

Third, we observe variation in autocracies and weak democracies' imports of Chinese facial recognition AI, reflecting their domestic political and economic conditions. Within this set of countries, we find that those with little domestic AI investment are more likely to import AI technology, especially from China. Moreover, autocracies and weak democracies are differentially more likely to import China's AI technology in years of greater political unrest. Importantly, there is no evidence of differential pre-trends of AI imports leading up to domestic political unrest. Again, these patterns are only observed in facial recognition AI, but not other frontier technologies.

Our finding of China's comparative advantage in facial recognition AI suggests a political dimension to the "home-market effect" (Linder, 1961; Krugman, 1980; Costinot et al., 2019). The Chinese government's demand for surveillance and political control translates into more exports of AI. Moreover, our finding that autocrats and would-be autocrats abroad demand surveillance technology from China suggest that political factors may affect the direction of AI innovation (Habakkuk, 1962; Acemoglu, 2007).

The political bias of AI imports from China suggests a novel mechanism through which domestic autocratic institutions may diffuse abroad.[3] Traditional views emphasize how ideology and correlated shocks shape political transition in waves — a so-called *domino* effect in the spread of democracy (Huntington, 1993) and of autocracy (Ninkovich

[3]Magistretti and Tabellini (2022) document the diffusion of *democratic* institutions abroad through increased trade and the resultant spread of democratic capital.

et al., 1994). Moreover, the literature has shown that institutions can affect international trade too (see Nunn and Trefler, 2014 for a review). Our findings highlight that a technology used for domestic surveillance can affect institutions abroad via its export: potentially enhancing autocracies elsewhere, and triggering weak democracies to move towards autocracies.[4] As such, our paper also relates to the literature on the impact of trade with China (Autor et al., 2016), especially on domestic politics (Autor et al., 2020), and to the literature on how governments should respond to automation technologies like AI (Costinot and Werning, 2018; Korinek and Stiglitz, 2020; Beraja and Zorzi, 2022).

2 Data sources

Trade in facial recognition AI technology. We begin constructing our database of AI trade deals with the bibliography of the Carnegie Endowment for International Peace's report *The Global Expansion of AI Surveillance* (Feldstein, 2019). This bibliography focuses on international procurement of AI surveillance technology by governments, containing 1,300 citations spanning 75 importing countries.[5]

For each item in the bibliography, we develop a web scraper to collect the source text.[6] We then use Stanza (Qi et al., 2020), a Python NLP (Natural Language Processing) and NER (Named Entity Recognition) package developed by the Stanford NLP Group, to identify key variables from each source: the exporting country, importing country, year of the deal, exporting company, and whether the deal concerns smart city technology. At least one research assistant then validated whether each source contains an actual AI trade deal, as well as each of the deal characteristics described above.[7] Out of the 1,300 citations, we confirm that 313 of them reference AI trade deals.

Since the Carnegie report was only intended to provide an overview of the industry and is not a comprehensive record of all AI trade deals, we use these trade deals as a starting point to explore the universe of potential trade deals.[8] To do so, we search

[4]Other technologies with political implications include the printing press (Dittmar, 2011), radio (e.g., Olken, 2009; DellaVigna et al., 2014; Yanagizawa-Drott, 2014), and information and communications technologies such as mobile phones (Manacorda and Tesei, 2020) and 3G internet (Guriev et al., 2021).

[5]The original bibliography is accessible at `https://www.zotero.org/groups/2347403/global_ai_surveillance/library`.

[6]Some sources pointed to images and others contained references in non-English languages. For the former, we used Google's Tesseract-OCR engine to obtain the source text, and for the latter, Google Translate.

[7]We follow the guidelines in The OECD Handbook on Measuring Digital Trade (González and Jouanjean, 2017) to resolve potentially ambiguous instances of trade in AI.

[8]As the report notes: "Given limited resources and staffing constraints (one full-time researcher plus volunteer research assistance), the index is only able to offer a snapshot of AI surveillance levels in a given country." All of our results are robust to using only the trade deals identified in the Carnegie report sources.

through the website of every firm that appears in the report, as well as references to them in the news/media, and collect any references to potential AI trade. There are 15,351 such sources. We collect deal-level information from each source following the procedure outlined above: a web-scraper collects the text, Stanza's NER identifies whether this is an AI trade deal and documents important deal characteristics, and then a human verifies each entry and cleans the output as needed. This ensures that we do not flag any trade deals as false positives. We use Google as a test company to ensure that our procedure misses relatively few AI trade deals: we manually check all 206 sources flagged as non-AI trade deals and find only 2 false negatives.[9] At this point, we find 1,377 AI trade deals from 36 exporting countries to 132 importing countries.

Given the focus of the report on raising awareness of "surveillance states", one may be concerned that the Carnegie report contains a biased sample of companies. To address this concern, we collect a list of all facial recognition AI companies from Capital IQ, which is the S&P's financial database covering global public and private firms. There are 2,878 companies in this list. For each new company in this list, we follow the process outlined above and collect data on whether these companies export their technology to other countries. By combining these sets of trade deals, we create a comprehensive database of trade in facial recognition AI.[10]

In all, we find 1,636 AI trade deals from 36 exporting countries to 136 importing countries. China is the largest exporter of AI with 250 trade deals, while the United States is the second largest exporter with 215 deals. For the remainder of our analysis, we restrict our sample of exporters and importers to the top 100 countries by GDP, given the sparsity of trade in AI outside of this sample. In this sample, we find 1,488 AI trade deals from 33 exporting countries to 92 importing countries. China remains the largest exporter of AI with 238 trade deals, while the United States is the second largest exporter with 211 deals. Examples from our dataset include trade deals titled "Safe City Service Brings the Future to Laos: Huawei case studies" (China exporting to Laos in 2015), " Bosch equips Hong Kong-Zhuhai-Macao Bridge with customized security solutions" (Germany exporting to China in 2018), and "Digital Intelligence is Helping Brazil's Federal Police Seize Millions in Assets to Bring Down Drug-Smuggling Kingpins" (Israel exporting to Brazil in 2020). Table 1 shows summary statistics at the importing country level. Bar charts of the top

See Appendix Tables A.8 to A.11.

[9]This procedure extends our dataset from the business-to-government deals identified in the Carnegie report to also include business-to-business (B2B) trade deals. For our analysis, we use the total number of deals between two countries, since many B2B sales are government sub-contracts or could reasonably be associated with government procurement due to local regulations.

[10]Our main results replicate when using just the subsample of companies covered by the Carnegie report. See Appendix Tables A.8 - A.11 for details.

exporters and importers in AI trade are displayed in Appendix Figures A.1 - A.2.

Table 1: Summary statistics

	All	Strong democracies	Weak democracies/ autocracies
	(1)	(2)	(3)
Total AI import deals	14.9	20.9	9.4
	(27.8)	(38.1)	(9.8)
AI import deals from China	2.1	1.9	2.3
	(2.7)	(3.0)	(2.4)
Total smart city import deals	11.0	15.6	6.8
	(21.5)	(29.4)	(7.7)
Smart city import deals from China	1.3	1.1	1.5
	(1.7)	(1.7)	(1.7)
Log(GDP)	25.3	25.9	24.8
	(1.6)	(1.7)	(1.2)
Total unrest events	5951.4	6668.9	5289.1
	(16893.6)	(23487.6)	(6683.2)
Observations	100	48	52

Notes: This table presents sample means and standard deviations of key variables, aggregated at the import country level. Column 1 contains statistics for the top 100 countries by GDP, column 2 restricts the sample to strong democracies, and column 3 restricts the sample to weak democracies and autocracies. A Polity score of 7 is used as the cutoff for a 'full democracy' by the Polity IV project (Marshall et al., 2016), which we use to distinguish mature and weak democracies.

Frontier trade and country characteristics. We collect data on trade in frontier technologies from the UN Comtrade database. Our fields of frontier technology are the 10 technologies identified in the Organization for Economic Co-operation and Development (OECD) Science, Technology, and Innovation Outlook (OECD, 2018): artificial intelligence, the internet of things, virtual reality/augmented reality, drones, robotics, autonomous vehicles, space, genomics, neuroscience, and blockchain technology.[11] We then find 16 SITC codes that are most closely associated with these frontier technologies, and collect information on the volume of trade at the country dyad level from the years 2000-2020. Notably, there is no SITC code associated with artificial intelligence. [12]

[11] In particular, these Standard International Trade Classification (SITC) codes are: 525, 541, 712, 716, 718, 728, 731, 772, 774, 776, 781, 792, 872, 874, 884, and 899. These 10 technologies are commonly associated with frontier technology. For instance, the UN's 2018 report "Frontier technologies for sustainable development" (ESCAP, 2018) identifies and analyzes the same 10 technologies.

[12] One may be concerned about the comparability of data between trade in AI and other frontier trade. We therefore focus our analysis on the extensive margin of trade (whether two countries engage in trade in a sector of frontier trade), which should be more comparable between the data, instead of the intensive margin (number of trade deals). However, our main results all replicate using the number of trade deals as the outcome. See Appendix Tables A.12 to A.15.

We also collect data on country dyad characteristics (distance between countries, whether they share a common border, free trade agreement, colonial history, legal system, language, or religion), sourced from Helpman et al. (2008). Data on country level Gross Domestic Product (GDP) comes from the World Bank, data on AI investment by country from NetBase Quid, and data on regime type from the Polity IV Project.

Political unrest. We collect data on political unrest from the Global Database of Events, Language, and Tone (GDELT) Project. The GDELT project records instances of events based on articles from a global, comprehensive set of news feeds.[13] In sum, we find 18,449,402 events across the world indicating political unrest.[14] Sample headlines indicating unrest include "Laos: Police arrests 8 activists planning to stage protests to condemn land grabs and dam projects, later releases 6 of them," "Two more monks arrested in Ngaba county for calling freedom in Tibet," and "Brazil's President Rousseff Rocked by Anti-Government Protests." Combining the GDELT data with the data above, we obtain panel data at the country-year level on the amount of AI trade, non-AI frontier trade, and political unrest in a country.

3 China's comparative advantage in facial recognition AI

A first indication of China's comparative advantage in facial recognition AI can be seen in the number of countries to which China exports the technology. In Figure 1, we map the export deals from the two largest producers and exporters: China in Panel A and the US in Panel B. Between 2008 and 2021, we observe that China exports to roughly twice as many countries as the US (83 versus 48 links) and has about 10% more trade deals (238 versus 211).

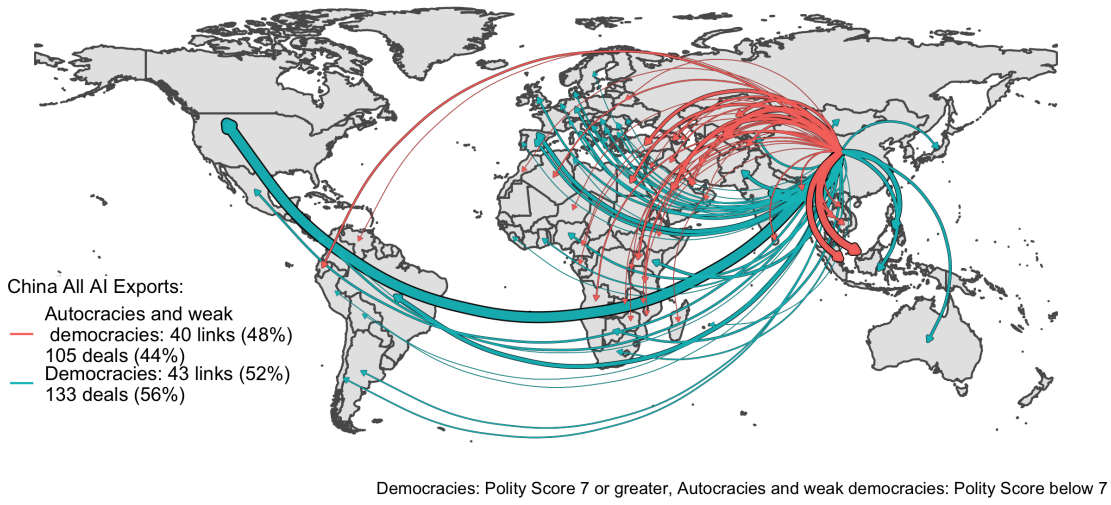
To examine China's comparative advantage more rigorously, we compare China's exports of facial recognition AI to the rest of the world, relative to their exports of other frontier technologies. Specifically, we estimate the following equation:

$$trade_{ijs} = \beta_0 + \beta_1 \mathbf{1}_{i=\text{China}} + \beta_2 \mathbf{1}_{s=\text{AI}} + \beta_3 \mathbf{1}_{i=\text{China},s=\text{AI}} + X_{ij} + u_{ijs}, \quad (1)$$

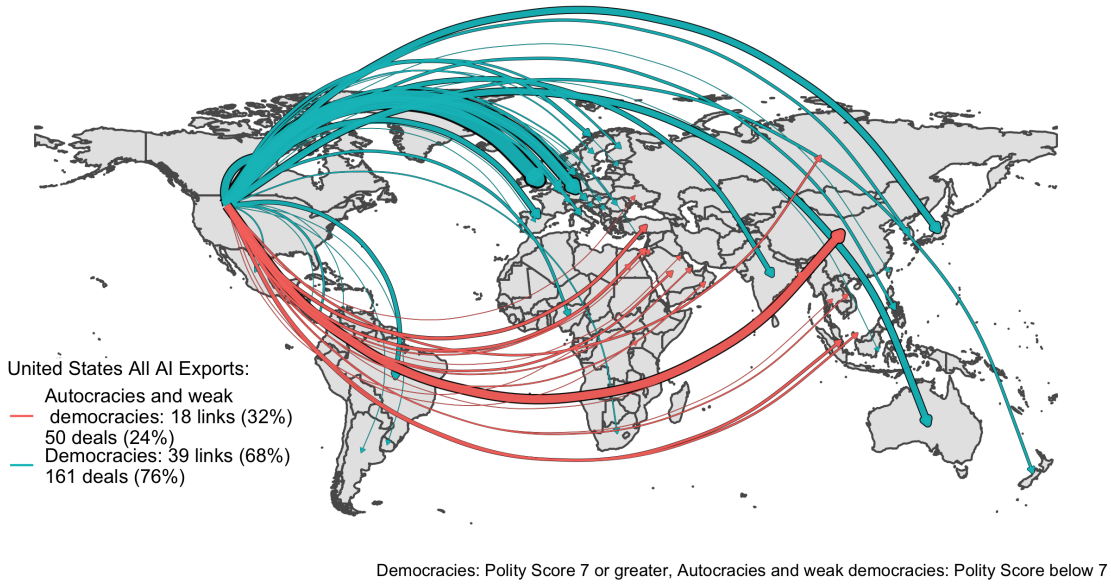
[13] Text analysis and machine learning methods are applied to the contents of these articles to identify salient characteristics, such as event location, date of the event, and the nature of these events. When multiple news sources cover the same event, GDELT records only one event. See `https://www.gdeltproject.org` for a detailed description of the GDELT Project and its methodology.

[14] Each event is classified under the Conflict and Mediation Events Observations (CAMEO) event and actor codebook. Twelve of the twenty top-level "verbs" that an event can be classified under indicate political unrest: protests, sanctions, violence, investigations, demands, disapproval, rejections, threats, coercion, assault, fights, and unconventional mass violence.

Figure 1: Facial recognition AI exports from China and the US



Panel B: United States



Note: These figures display trade links and number of export deals in AI from China (Panel A) and the United States (Panel B) to the rest of the world. A thicker arrow represents more deals. Exports to autocracies and weak democracies (polity score under 7) are displayed in red. Exports to mature democracies (polity score greater than or equal to 7) are in blue.

where $trade_{ijs}$ denotes a trade link in technology sector (s) between exporting country (i) and importing country (j), and X_{ij} are a vector of controls at the country-pair level. The coefficient β_1 indicates the difference in exports of non-AI frontier technologies between China and the rest of the world (which is the omitted category). The coefficient β_2 indicates the difference between the exports from the rest of the world in AI and its exports of other frontier technologies. Finally, the coefficient β_3 indicates the differential export of China's AI, relative to other frontier technologies and the rest of the world.

We present the results in Table 2. China's exports of non-AI frontier technology are very similar to that of the rest of the world — β_1 is approximately zero — once we account for countries' GDP and distance. However, China is more likely to export AI than other frontier technologies relative to the rest of the world — β_3 is significantly greater than zero. The magnitude of the coefficient implies that the propensity for Chinese AI exports is 47.4 percentage points greater (at the country-pair level) than Chinese exports of other frontier technologies. These results hold for specifications that control for a range of other country-pair characteristics that influence trade, including trade agreements, common boarder, institutional characteristics such as common language, common legal system, and common religion. We observe similar patterns focusing only on imports of smart city AI technology, the flagship urban surveillance tools (see Appendix Table A.1). These results also hold restricting the sample to the two largest exporting countries: in Appendix Table A.2, we replicate Table 2, but now comparing China with only the US. We again find that China is differentially more likely to export more AI than other frontier technologies.

In the baseline analysis above, we compare AI technology exports with all non-AI frontier technology trade aggregated together. To illustrate how AI technology differs from other frontier technology, we repeat the baseline analysis but now estimate China's differential exports in technology sector s, one frontier technology sector at a time. We plot the β_3 coefficients for each frontier technology sector s in Figure 2. One observes that China also exhibits moderate comparative advantage in the production of radioactive and associated materials, steam turbines, and laser and other beam processes. However, China's comparative advantage in AI technology stands out.

3.1 What contributes to China's comparative advantage?

Many factors may have contributed to the Chinese comparative advantage in the facial recognition AI industry that we document. We highlight two salient factors below.

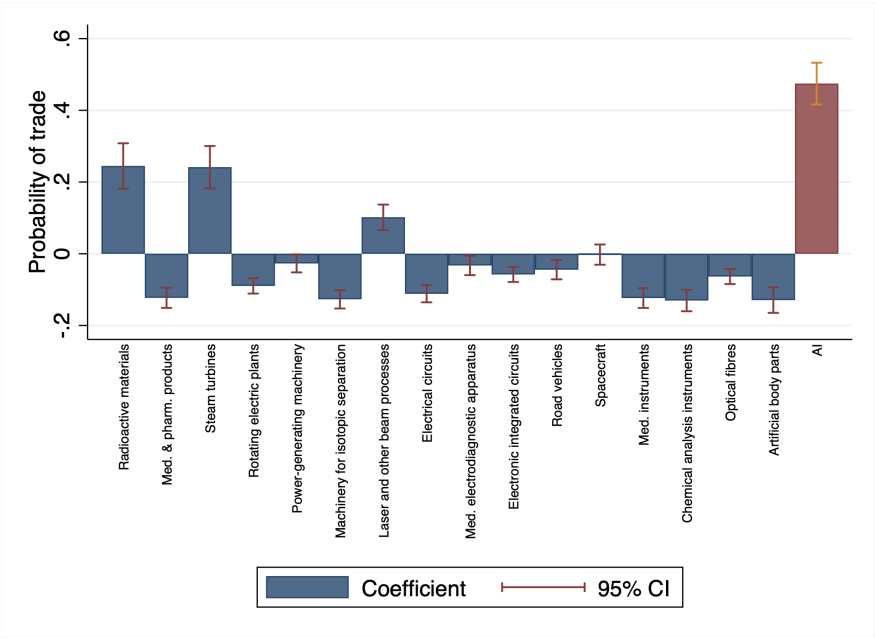
The Chinese regime has explicitly stated that becoming a world leader in AI is one

Table 2: China vs. rest of world, AI vs. frontier technologies

	Engage in trade			
	(1)	(2)	(3)	(4)
Origin China	-0.026	-0.026	-0.012	-0.026
	(0.024)	(0.024)	(0.025)	(0.024)
AI	-0.356***	-0.357***	-0.355***	-0.355***
	(0.010)	(0.010)	(0.010)	(0.010)
Origin China X AI	0.474***	0.475***	0.461***	0.475***
	(0.030)	(0.030)	(0.030)	(0.030)
N	402300	402300	402300	402300
Importer/exporter GDP	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No
Institutional characteristics	No	No	Yes	No
Geographical characteristics	No	No	No	Yes

Notes: Regressions are at the product-import-export country dyad level. Outcome is dummy for trade. Omitted: not China X not AI. All columns control for importer/exporter GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for landlocked and island characteristics. Standard errors are clustered by origin country. * significant at 10% ** significant at 5% *** significant at 1%.

Figure 2: China vs. rest of world, frontier technology exports



Note: The figure follows the specification in Table 2 and presents the coefficient and 95% confidence interval for the interaction term (Origin China X frontier technology) for each of the different frontier technologies.

of their key development and strategic goals.[15] In practice, this has meant that AI firms receive generous government subsidies and are recipients of a variety of AI-related industrial and innovation policies.[16] A range of government incentives to train and recruit AI talent are in place as well.

Moreover, the facial recognition AI industry in particular has also directly benefited from government demand for surveillance technology and firms' access to large-scale government datasets. In Beraja et al. (2021, 2022) we have shown that AI procurement by public security agencies (e.g., municipal police departments) stimulates firm innovation and development of a variety of new products. In part, such procurement has been motivated by the local agencies' desire to suppress political unrest, and the stimulus has come from firms gaining access to valuable government data to train AI algorithms (e.g., surveillance video from street cameras). Indeed, we found that the firms winning such public security contracts become more likely to export.

4 Who imports China's AI technology?

Having established China's comparative advantage in facial recognition AI technology, we next explore the characteristics of the importers of such technology.

4.1 Domestic political institutions

We begin by considering the possibility that autocracies and weak democracies are more likely to import facial recognition AI from China. A first indicator of such a bias can be seen in Figure 1. We categorize autocracies as those with a Polity Score below 0 and weak democracies as those with a score between 0 to 6, in contrast with mature democracies (Polity Score greater than or equal to 7).[17] The US' AI exports in terms of both country links and number of trade deals are considerably concentrated in mature democracies, perhaps reflecting the fact that these countries are in general richer. In contrast, China's AI exports country links and trade deals are nearly equally split between mature democracies or autocracies and weak democracies.

[15]Examples of landmark policies in AI set by China include the "'Internet +' Three-Year Implementation Plan" in 2016, the "New Generation Artificial Intelligence Development Plan' in 2017, and the "National New Generation of AI Standardization Guidance" in 2020.

[16]For a list of tax incentives, see for instance: https://www.china-briefing.com/news/tax-incentives-china-to-encourage-technology-innovation-updated/.

[17]The Polity IV project (Marshall et al., 2016) uses a score of 7 as the cutoff for a "full democracy." We use this same cutoff to distinguish between mature and weak democracies.

To investigate this more formally, we examine whether autocracies and weak democracies differentially import China's AI technology (relative to other frontier technologies). We estimate the following regression model:

$$trade_{i=\text{China},js} = \beta_0 + \beta_1 \mathbf{1}_{j=\text{low Polity Score}} + \beta_2 \mathbf{1}_{s=\text{AI}} + \beta_3 \mathbf{1}_{j=\text{low Polity Score},s=\text{AI}} + X_{ij} + u_{ijs}, \tag{2}$$

where the unit of analysis is the technology (s) by the importing country (j), and X_{ij} are a vector of controls at the country-pair level.[18] In particular, the coefficient on the interaction β_3 indicates the differential export of China's AI to autocracies and weak democracies relative to other frontier technologies.

We present our findings in Table 3. One can see in column 1 that mature democracies and autocracies import most technologies similarly (β_1 is close to zero). Mature democracies are less likely to import AI from China relative to other frontier technologies (β_2 is negative), but autocracies and weak democracies are substantially more likely to import AI from China relative to democracies (β_3 is positive). The estimated β_3 implies a 0.22 standard deviation increase in autocracies' and weak democracies' imports of Chinese AI, relative to their imports of other frontier technologies from China. One can see in columns 2–4 that these results hold controlling for a variety of importing countries' geographic, economic, and political characteristics.

To benchmark this result, we repeat the analysis but now estimate China's differential exports one frontier technology sector s at a time. We plot the β_3 coefficients for each technology in Figure 3. One observes a striking pattern: AI is the *only* frontier technology that autocracies and weak democracies are more likely to import from China.

Another way to benchmark the result is to compare it with technology imports from the US. The results are presented in Table 3, columns 5-8. In contrast with the political bias in AI imports from China, we do not observe a political bias in the imports from the other major AI exporter, the US. The different patterns between imports from China and the US are statistically significant when we pool the two countries into a single regression (see Appendix Table A.3).

[18] We cluster errors by importer in this table, given that that there is only a single exporter.

Table 3: Leading exporters' trade in AI by importers' Polity score

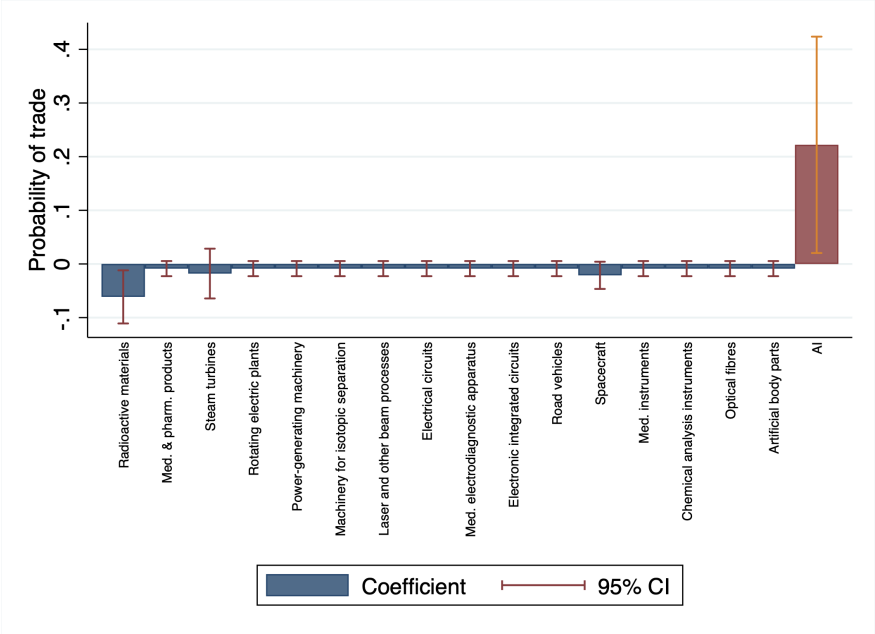
	China exports				*US exports*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination low Polity score	-0.004	-0.003	-0.003	0.000	-0.003	-0.002	0.002	-0.002
	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
AI	-0.600***	-0.597***	-0.560	-0.601***	-0.727***	-0.726***	-0.734***	-0.732***
	(0.097)	(0.101)	(0.794)	(0.096)	(0.062)	(0.062)	(0.065)	(0.060)
Destination low Polity score X AI	0.222**	0.266**	0.223*	0.231**	-0.015	-0.032	0.001	-0.031
	(0.103)	(0.102)	(0.121)	(0.108)	(0.077)	(0.077)	(0.081)	(0.080)
N	2394	2394	2394	2394	2394	2394	2394	2394
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regression at the product-import country level. Outcome is dummy for trade. Omitted: destination democracy with Polity score over 7 X not AI. All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by export country. * significant at 10% ** significant at 5% *** significant at 1%.

These patterns could stem from supply or demand side factors. On the supply side, the Chinese government may be subsidizing AI exports to autocracies and weak democracies as part of its foreign policy. Our data does not allow us to test for this. It is also possible that US companies are self-imposing bans on their AI exports. Among the 23 US companies in our dataset, 3 have released a policy banning such exports (IBM, Microsoft, and Google).[19] The first of these bans was in 2018 (Microsoft), when this issue started being more politically salient. With this in mind, Appendix Table A.4 repeats our analysis using AI deals before 2018. We lose over half of our deals in the sample, but we find that the results for China look similar to our baseline when using the entire sample (although the magnitude of β_3 is smaller) and that, if anything, AI exports from the US were *more* biased towards mature democracies before the self-imposed bans.

On the demand side, facial recognition AI developed in China may be particularly useful in weak democracies and autocracies for purposes of surveillance and political control. We next more closely examine the economic and political factors that drive these countries' demand for AI technology.

Figure 3: Political bias in frontier technology imports from China



Note: The figure follows the specification in Table 3 and presents the coefficient and 95% confidence interval for the interaction term (Destination low Polity score X frontier technology) for each of the different frontier technologies.

[19] In IBM and Microsoft's case, they ban by regime type. In Google's case, they have banned all sales to governments.

4.2 Domestic AI investment

China's facial recognition AI technology may be particularly valuable to weak democracies and autocracies with little domestic AI investment and innovation.

To test this hypothesis, we estimate the following model of trade in AI technology, allowing trade to vary depending on importing countries' (standardized) domestic AI investment:

$$trade_{ij,s=\text{AI}} = \beta_0 + \beta_1 \mathbf{1}_{i=\text{China}} + \beta_2 AI\_investment_j + \beta_3 \mathbf{1}_{i=\text{China}} \times AI\_investment_j + X_{ij} + u_{ij}, \tag{3}$$

where the unit of analysis is at the exporting country (i) by importing country (j) pair level (and X_{ij} are a vector of controls at the country-pair level).

Table 4 presents the results. Columns 1-4 focus on all facial recognition AI technology, and columns 5-8 focus on technology concerning smart city management (which represents China's flagship surveillance AI products). Reflecting China's comparative advantage in AI, countries with mean levels of domestic AI investment import more AI technology from China — β_1 is significantly greater than zero. Moreover, China looms especially large in providing AI technology to countries lacking domestic AI investment. We observe that countries import differentially more from China if they have lower domestic AI investment — β_3 is significantly smaller than zero. All these effects are present among all AI surveillance trade, and among smart city technology deals in particular.

4.3 Domestic political unrest

China's facial recognition AI technology may also be particularly valuable to regimes that have recently experienced political unrest. To explore this possibility, we estimate a model examining how a country's yearly imports of China's facial recognition AI vary in response to the occurrence of domestic political unrest, as well as leads and lags of unrest.

Specifically, we estimate the following model on the import of China's facial recognition AI technology among weak democracies and autocracies:

$$trade_{i=\text{China},s=\text{AI},jt} = \beta_0 + \sum_T \beta_{1T} unrest_{jt} + \alpha_t + \gamma_j + u_{jt}, \tag{4}$$

where T is a set of one lead of domestic unrest in importing country j, contemporaneous unrest at t when AI trade deals are observed, as well as two lags of domestic unrest. We control for calendar time fixed effects (α_t) as well as importing country fixed effects (γ_j).

Table 4: China exports to countries by importers' AI investment

	AI import deals							
	AI				Smart city AI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination — autocracies and weak democracies								
Origin China	0.035***	0.035***	0.035***	0.035***	0.032***	0.032***	0.032***	0.032***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
Destination total AI investment	-0.012*	-0.013**	-0.012*	-0.013**	-0.011*	-0.011*	-0.011*	-0.011*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Origin China X destination AI invest	-0.159***	-0.159***	-0.159***	-0.159***	-0.133***	-0.133***	-0.133***	-0.133***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regressions are at the import country-export country level, only keeping import countries with Polity score below 7. Outcomes are dummy for trade. Origin China and Destination AI investment are standardized. All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by destination country. * significant at 10% ** significant at 5% *** significant at 1%.

Table 5 presents the results. One can see that in columns 1-2 that greater political unrest in weak democracies and autocracies in a given year coincides with significantly higher imports of China's facial recognition AI technology in the corresponding year. There were no higher imports preceding the unrest or during the two years following unrest. Such pattern is observed among countries' imports of China's smart city surveillance AI technology (columns 3-4).

Table 5: Local unrest on AI and frontier trade to autocracies and weak democracies

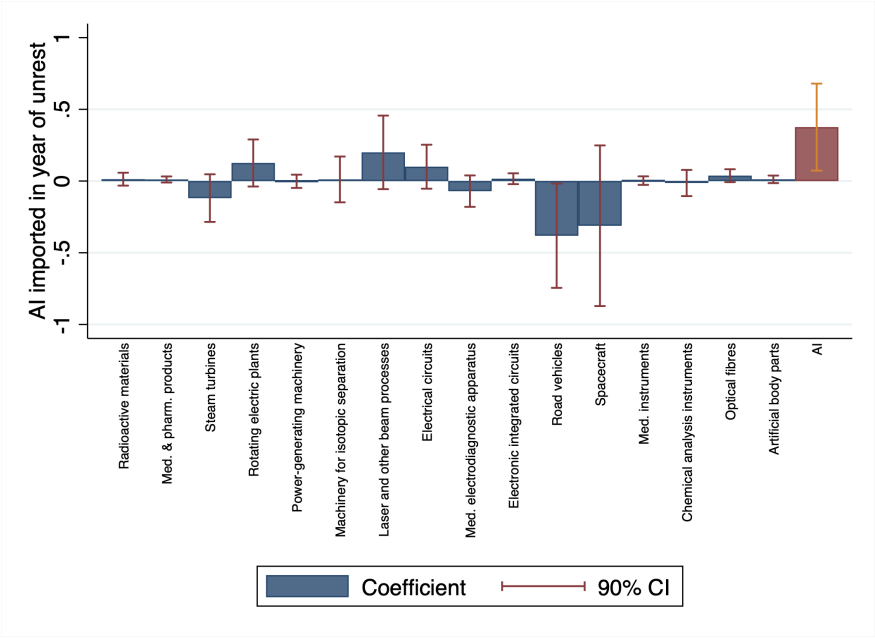
	AI import deal					
	AI				Frontier tech	
	All		Smart city			
	(1)	(2)	(3)	(4)	(5)	(6)
AI 2 years before unrest	-0.020	-0.020	-0.005	-0.005	0.053	0.053
	(0.021)	(0.022)	(0.020)	(0.020)	(0.034)	(0.032)
AI 1 year before unrest	-0.068	-0.314	-0.064	-0.148	0.131	1.134
	(0.153)	(0.326)	(0.116)	(0.280)	(0.443)	(0.767)
AI same year as unrest	0.096**	0.097**	0.055**	0.056**	0.038	0.039
	(0.048)	(0.048)	(0.027)	(0.027)	(0.065)	(0.065)
AI 1 year after unrest	-0.016	-0.016	-0.010	-0.010	-0.007	-0.007
	(0.013)	(0.013)	(0.011)	(0.011)	(0.018)	(0.017)
AI 2 years after unrest	0.022	0.024	0.010	0.010	-0.028	-0.029
	(0.015)	(0.016)	(0.010)	(0.010)	(0.025)	(0.027)
N	1226.000	1200.000	1226.000	1200.000	1226.000	1200.000
log import GDP	No	Yes	No	Yes	No	Yes
country time trend	Yes	Yes	Yes	Yes	Yes	Yes
total trade	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are at the country-year level, stacked so that the independent variable (unrest) vary within an observation. Unrest is standardized. Trade deals is a dummy for any export from China. A Polity score of 7 is used as the cutoff for a 'full democracy' by the Polity IV project (Marshall et al., 2016), which we use to distinguish mature and weak democracies. Residualized number of trade deals relative to year = 0 and controlling for AI 1 year before unrest X year. All columns have fixed effects for import country and year. Standard errors are clustered at the import country level. * significant at 10% ** significant at 5% *** significant at 1%.

Importantly, this is not a generic trend in imports of China's frontier technologies. We observe no relationship between imports and the occurrence of political unrest when we pool non-AI frontier technologies (columns 5-6). Neither do we observe any other frontier technology exhibiting the same pattern as AI technology (Figure 4). In addition, we find that Chinese AI is particularly in demand in countries experiencing unrest: when we examine imports from the US, we do not see observe differential imports from countries experiencing unrest (see Appendix Table A.6). These results suggest that Chinese AI technology is imported to satisfy domestic state surveillance demand.

One may wonder whether we observe similar efforts to enhance surveillance and po-

Figure 4: Local unrest on AI and frontier trade to autocracies and weak democracies



Note: This figure follows the specification in Table 5 and presents the coefficient and 90% confidence interval for trade links in a given frontier technology s in the same year as unrest for each of the different frontier technologies.

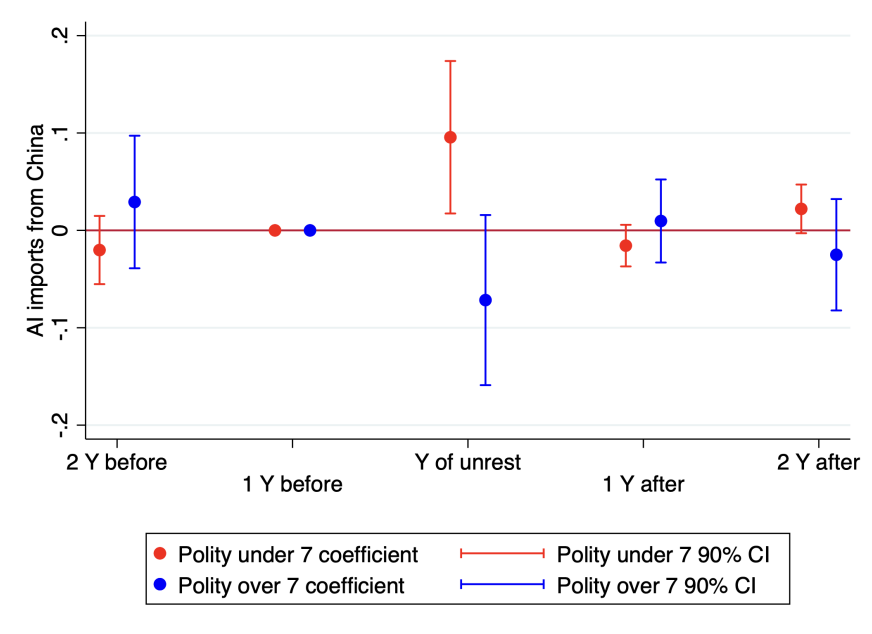
litical control using China's AI technology even in mature democracies. We replicate the above exercise, but now focusing on mature democracies as importing countries. The results are presented in Appendix Table A.7, and Figure 5 plots the β_{1T} coefficients for strong democracies or weak democracies and autocracies. We do *not* find evidence of mature democracies' importing China's AI technology in response to domestic political unrest. This suggests that China's impact on the development of surveillance state abroad may be concentrated (at least for now) in existing autocracies and weak democracies.

5 Conclusion

In this paper, we show that China has a comparative advantage in facial recognition AI, and that autocracies and weak democracies are more likely to import this technology from China, especially those lacking domestic AI investment and those experiencing political unrest. This suggests the possibility that China's exports of a technology used for state surveillance may strengthen autocrats (and would-be autocrats) around the world.

The possibility of negative global externalities (i.e., lost civil liberties and political rights) arising from trade in AI should inform policy discussions on international stan-

Figure 5: Event study, local unrest on AI trade



Note: This figure follows the specification in Tables 5 and A.7 and presents the coefficients and 90% confidence intervals for trade in AI to weak democracies and autocracies (in red) and strong democracies (in blue).

dards for AI development and trade. Regulation of trade in facial recognition AI can be modeled on existing regulations on trade in products with global externalities. Products sharing similar features include dual-use (military-civilian) technologies, which can contribute to global conflict; goods produced using inputs that are unethically sourced, such as child labor; or, goods that generate negative production or consumption externalities, such as pollution. Autocratically biased AI technology can involve externalities that are both upstream (e.g., data collected for the purpose of domestic political repression) and downstream (e.g., technology used for political repression in importing countries). These features suggest that trade regulations need to be carefully devised in order to achieve the desired goal, and to ensure countries' ability to credibly commit to enforcing such regulations.

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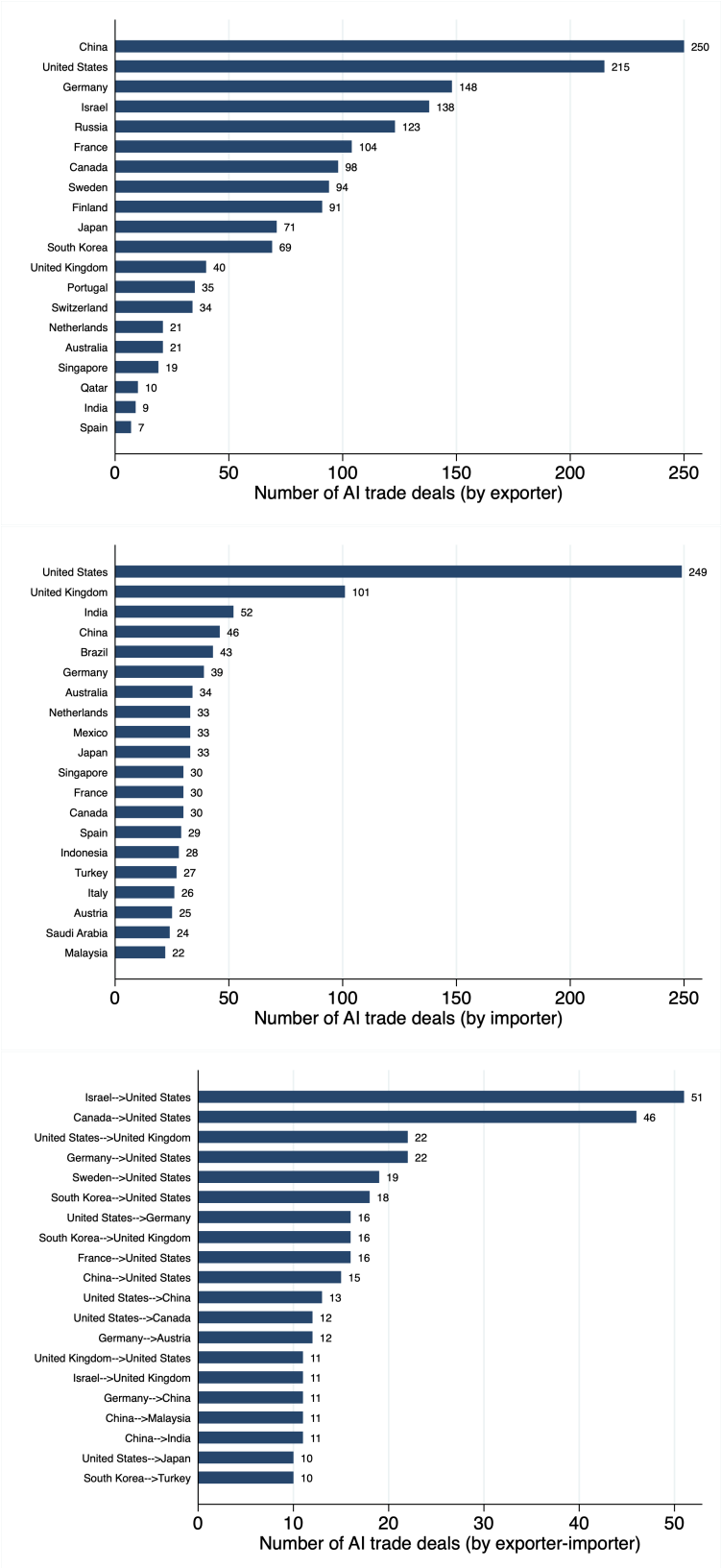
Online Appendix for:
Exporting the Surveillance State via Trade in AI

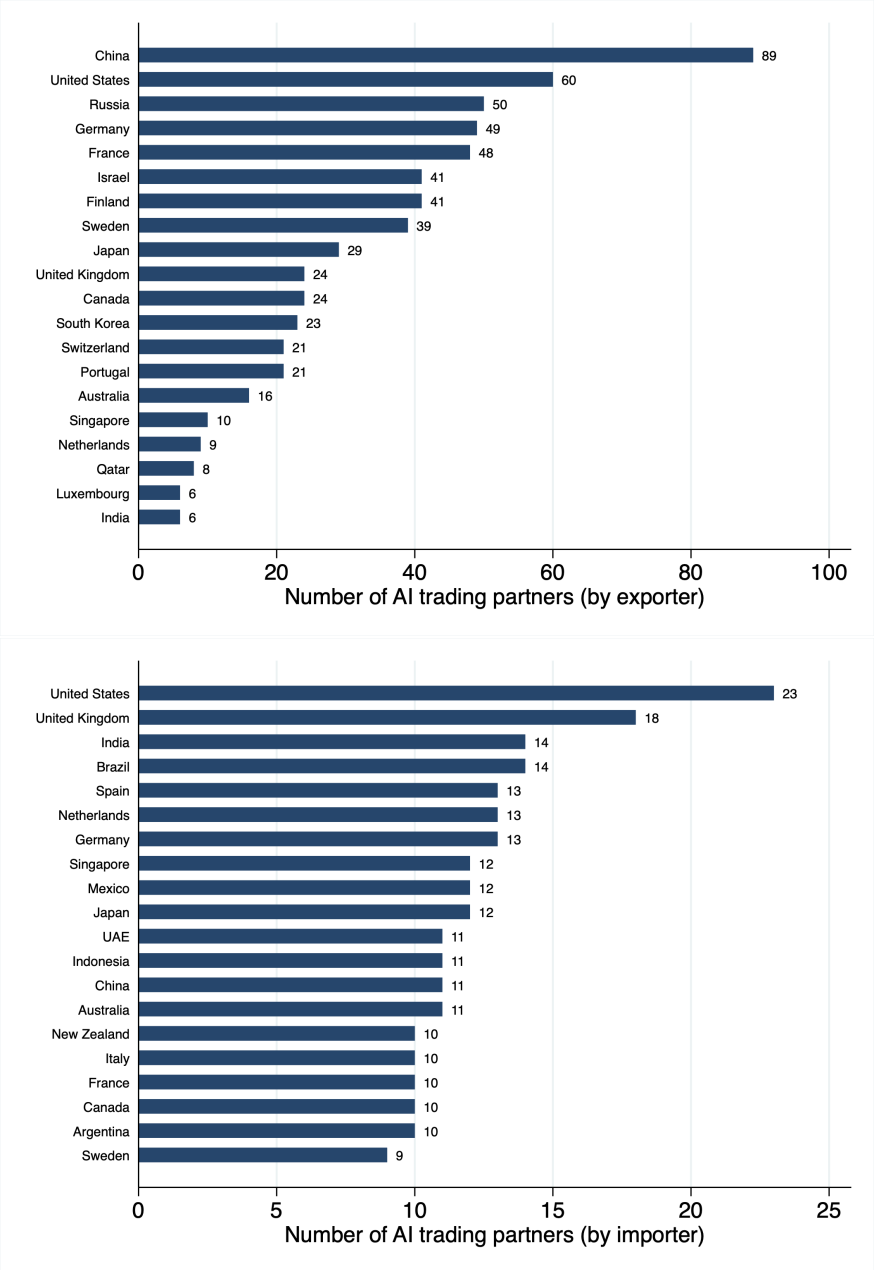
This appendix contains additional figures and tables for the article "Exporting the Surveillance State via Trade in AI."

Figure A.1: Top facial recognition AI importers and exporters (by # of trade deals)



Note: Number of facial recognition AI trade deals by exporter (top), importer (middle), and exporter-importer pairs (bottom).

Figure A.2: Top facial recognition AI importers and exporters (by # of trade partners)



Note: Number of facial recognition AI trading partners by exporter (top) and importer (bottom).

Table A.1: China vs. rest of world, smart city AI vs. frontier technologies

	Engage in trade			
	(1)	(2)	(3)	(4)
Origin China	-0.026	-0.026	-0.012	-0.026
	(0.024)	(0.024)	(0.025)	(0.024)
AI	-0.357***	-0.358***	-0.356***	-0.355***
	(0.010)	(0.010)	(0.010)	(0.010)
Origin China X AI	0.383***	0.381***	0.368***	0.383***
	(0.029)	(0.029)	(0.029)	(0.029)
N	402300	402300	402300	402300
Import/export GDP	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No
Institutional characteristics	No	No	Yes	No
Geographical characteristics	No	No	No	Yes

Notes: Regressions are at the product-import-export country dyad level. Outcome is dummy for trade. Omitted: not China X not smart city AI. All columns control for import/export GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for landlocked and island characteristics. Standard errors are clustered by origin country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.2: US vs. China, AI vs. frontier technologies

	Engage in trade			
	(1)	(2)	(3)	(4)
Origin China	-0.005	-0.005	0.005	-0.005
	(0.004)	(0.004)	(0.007)	(0.004)
AI	-3.361***	-3.331***	-3.514***	-3.333***
	(0.253)	(0.242)	(0.277)	(0.275)
Origin China X AI	0.172***	0.179***	0.241***	0.172***
	(0.043)	(0.042)	(0.060)	(0.043)
N	5364	5364	5364	5364
Import/export GDP	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No
Institutional characteristics	No	No	Yes	No
Geographical characteristics	No	No	No	Yes

Notes: Regressions are at the product-import-export country dyad level. Outcome is dummy for trade. Omitted: US X not AI. All columns control for import/export GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for landlocked and island characteristics. Standard errors are clustered by origin country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.3: Leading exporters' trade in AI by importers' Polity score — pooled regression

	Linear probability of trade			
	(1)	(2)	(3)	(4)
Destination low Polity score	-0.007*	-0.007*	-0.002	-0.006
	(0.004)	(0.004)	(0.005)	(0.004)
Origin China	-0.000	-0.000	0.011*	-0.000
	(0.001)	(0.001)	(0.006)	(0.001)
AI	-0.669***	-0.671***	-0.685***	-0.661***
	(0.061)	(0.061)	(0.073)	(0.061)
Destination low Polity score X AI	-0.022	-0.013	-0.035	-0.016
	(0.072)	(0.074)	(0.078)	(0.075)
Origin China X AI	-0.027	-0.024	0.013	-0.026
	(0.081)	(0.079)	(0.099)	(0.081)
Destination low Polity score X origin China	0.006	0.006	0.002	0.006
	(0.005)	(0.005)	(0.006)	(0.005)
Destination low Polity score X origin China X AI	0.324***	0.333***	0.343***	0.323***
	(0.103)	(0.100)	(0.105)	(0.103)
N	4788	4788	4788	4788
Import/export GDP	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No
Institutional characteristics	No	No	Yes	No
Geographical characteristics	No	No	No	Yes

Notes: Regression at the product-import-export country dyad level. Outcome is dummy for trade. Omitted: origin US X destination democracy with polity score over 7 X not AI X not AI. All columns control for import/export GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for land-locked and island characteristics. Standard errors are clustered by destination country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.4: Leading exporters' trade in AI by importers' Polity score, before 2017

	China exports				*US exports*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination low Polity score	-0.004	-0.003	-0.002	-0.001	-0.003	-0.002	0.002	-0.003
	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.005)	(0.006)	(0.005)
AI	-0.352***	-0.371***	0.096	-0.351***	-0.216**	-0.214**	-0.199**	-0.202**
	(0.083)	(0.094)	(0.750)	(0.082)	(0.088)	(0.087)	(0.090)	(0.085)
Destination low Polity score X AI	0.166*	0.186*	0.118	0.153	-0.230**	-0.246**	-0.245**	-0.218**
	(0.099)	(0.106)	(0.109)	(0.103)	(0.104)	(0.108)	(0.108)	(0.109)
N	2261	2261	2261	2261	2261	2261	2261	2261
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regression at the product-import country level. Outcome is dummy for trade. Omitted: destination democracy with Polity score over 7 X not AI. All trade deals are from the year 2017 or earlier. All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by export country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.5: Leading exporters' trade in smart city AI by importers' Polity score

	China exports				*US exports*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination low Polity score	-0.004	-0.003	-0.003	0.000	-0.003	-0.002	0.002	-0.002
	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
AI	-0.670***	-0.688***	-0.509	-0.664***	-0.626***	-0.626***	-0.656***	-0.643***
	(0.103)	(0.110)	(0.831)	(0.103)	(0.077)	(0.077)	(0.078)	(0.074)
Destination low Polity score X AI	0.180	0.228**	0.177	0.176	-0.256***	-0.258***	-0.214**	-0.282***
	(0.111)	(0.113)	(0.130)	(0.117)	(0.084)	(0.084)	(0.085)	(0.085)
N	2394	2394	2394	2394	2394	2394	2394	2394
Import/export GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regression at the product-import country level. Outcome is dummy for trade in smart city AI. Omitted: destination democracy with Polity score over 7 X not AI. All columns control for import GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by destination country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.6: Local unrest on AI and frontier trade to autocracies and weak democracies — exports from the US

	Standardized trade deals					
	AI				Frontier tech	
	All		Smart city			
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: import countries that are autocracies and weak demcoracies						
AI 1 year before unrest	-0.026	-0.027	0.062	0.062	0.018	0.018
	(0.079)	(0.080)	(0.065)	(0.065)	(0.015)	(0.016)
AI same year as unrest	0.079	0.085	0.103	0.109	-0.060	-0.055
	(0.118)	(0.119)	(0.128)	(0.126)	(0.068)	(0.068)
AI 1 year after unrest	-0.187*	-0.192*	-0.073	-0.078	-0.041	-0.040
	(0.105)	(0.107)	(0.054)	(0.055)	(0.043)	(0.043)
AI 2 years after unrest	-0.004	0.001	-0.074	-0.069	-0.039	-0.036
	(0.072)	(0.075)	(0.080)	(0.083)	(0.034)	(0.034)
N	1226.000	1200.000	1226.000	1200.000	723.000	723.000
log import GDP	No	Yes	No	Yes	No	Yes
country time trend	Yes	Yes	Yes	Yes	Yes	Yes
total trade	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are at the country-year level, stacked so that the independent variable (unrest) vary within an observation. Unrest is standardized. Trade deals are exports from the US. A Polity score of 7 is used as the cutoff for a 'full democracy' by the Polity IV project (Marshall et al., 2016), which we use to distinguish mature and weak democracies. We restrict the analysis to import countries with a polity score below 7. Residualized number of trade deals relative to year = 0 and controlling for AI 1 year before unrest X year. All columns have fixed effects for import country and year. Standard errors are clustered at the import country level. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.7: Local unrest on AI and frontier trade to mature democracies

	Standardized trade deals			
	AI			
	All		Smart city	
	(1)	(2)	(3)	(4)
AI 2 years before unrest	0.114	0.108	0.186	0.180
	(0.160)	(0.161)	(0.265)	(0.268)
AI same year as unrest	-0.276	-0.274	-0.332	-0.330
	(0.205)	(0.206)	(0.309)	(0.310)
AI 1 year after unrest	0.035	0.034	-0.048	-0.048
	(0.100)	(0.100)	(0.084)	(0.085)
AI 2 years after unrest	-0.101	-0.104	-0.117	-0.120
	(0.135)	(0.135)	(0.204)	(0.204)
N	1474.000	1448.000	1474.000	1448.000
log import GDP	No	Yes	No	Yes
country time trend	Yes	Yes	Yes	Yes
total trade	Yes	Yes	Yes	Yes

Notes: Regressions are at the country-year level, stacked so that the independent variable (unrest) vary within an observation. Unrest is standardized. Trade deals are exports from China. A polity score of 7 is used as the cutoff for a 'full democracy' by the Polity IV project (Marshall et al., 2016), which we use to distinguish mature and weak democracies. Residualized number of trade deals relative to year = 0 and controlling for AI 1 year before unrest X year. All columns have fixed effects for import country and year. Standard errors are clustered at the import country level. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.8: China vs. rest of world, AI vs. frontier technologies — Carnegie sample

	Engage in trade			
	(1)	(2)	(3)	(4)
Origin China	-0.026	-0.026	-0.012	-0.026
	(0.024)	(0.024)	(0.025)	(0.024)
AI	-0.354***	-0.355***	-0.353***	-0.352***
	(0.010)	(0.010)	(0.010)	(0.010)
Origin China X AI	0.444***	0.443***	0.427***	0.444***
	(0.033)	(0.033)	(0.033)	(0.033)
N	402300	402300	402300	402300
Importer/exporter GDP	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No
Institutional characteristics	No	No	Yes	No
Geographical characteristics	No	No	No	Yes

Notes: Regressions are at the product-import-export country dyad level. Outcome is dummy for trade. Omitted: not China X not AI. This table only uses trade deals identified in Feldstein (2019). All columns control for importer/exporter GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for landlocked and island characteristics. Standard errors are clustered by origin country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.9: Leading exporters' trade in AI by importers' Polity score — Carnegie sample

	China exports				*US exports*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination low Polity score	-0.004	-0.003	-0.002	-0.001	-0.003	-0.002	0.002	-0.003
	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.005)	(0.006)	(0.005)
AI	-0.352***	-0.371***	0.096	-0.351***	-0.229***	-0.227***	-0.221**	-0.218**
	(0.083)	(0.094)	(0.750)	(0.082)	(0.087)	(0.086)	(0.092)	(0.087)
Destination low Polity score X AI	0.166*	0.186*	0.118	0.153	-0.198*	-0.211*	-0.213*	-0.188*
	(0.099)	(0.106)	(0.109)	(0.103)	(0.105)	(0.108)	(0.110)	(0.109)
N	2261	2261	2261	2261	2261	2261	2261	2261
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regression at the product-import country level. Outcome is dummy for trade. Omitted: destination democracy with Polity score over 7 X not AI. This table only uses trade deals identified in Feldstein (2019). All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by export country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.10: China exports to countries by importers' AI investment — Carnegie sample

	AI import deal (standardized)							
	AI				Smart city AI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination — autocracies and weak democracies								
Origin China	0.161***	0.160***	0.160***	0.161***	0.105***	0.105***	0.105***	0.105***
	(0.009)	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
Destination total AI investment	0.023	0.023	0.021	0.023	0.020	0.020	0.020	0.020
	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)
Origin China X destination AI invest	-0.013	-0.012	-0.014	-0.013	-0.067***	-0.067***	-0.067***	-0.067***
	(0.009)	(0.009)	(0.010)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regressions are at the import country-export country level, only keeping import countries with Polity score below 7. All outcomes are standardized. Origin China and Destination AI investment are standardized. This table only uses trade deals identified in Feldstein (2019). All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by destination country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.11: Local unrest on AI and frontier trade to autocracies and weak democracies — Carnegie sample

	Standardized trade deals					
	AI				Frontier tech	
	All		Smart city			
	(1)	(2)	(3)	(4)	(5)	(6)
AI 2 years before unrest	-0.083	-0.082	-0.035	-0.031	-0.070	-0.070
	(0.079)	(0.080)	(0.102)	(0.103)	(0.085)	(0.084)
AI 1 year before unrest	-0.206	-0.835	-0.264	-0.212	-0.116	-0.118
	(0.556)	(1.186)	(0.576)	(1.391)	(0.128)	(0.129)
AI same year as unrest	0.346**	0.350**	0.269*	0.272*	-0.115	-0.113
	(0.172)	(0.174)	(0.135)	(0.137)	(0.140)	(0.137)
AI 1 year after unrest	-0.053	-0.053	-0.048	-0.047	-0.040	-0.040
	(0.047)	(0.048)	(0.055)	(0.055)	(0.035)	(0.034)
AI 2 years after unrest	0.076	0.078	0.039	0.038	0.058	0.059
	(0.055)	(0.057)	(0.049)	(0.050)	(0.057)	(0.060)
N	1226.000	1200.000	1226.000	1200.000	725.000	725.000
log import GDP	No	Yes	No	Yes	No	Yes
country time trend	Yes	Yes	Yes	Yes	Yes	Yes
total trade	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are at the country-year level, stacked so that the independent variable (unrest) vary within an observation. Unrest is standardized. Trade deals are only the exports from China identified in Feldstein (2019). A Polity score of 7 is used as the cutoff for a 'full democracy' by the Polity IV project (Marshall et al., 2016), which we use to distinguish mature and weak democracies. Residualized number of trade deals relative to year = 0 and controlling for AI 2 years before unrest X year. All columns have fixed effects for import country and year. Standard errors are clustered at the import country level. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.12: China vs. rest of world, AI vs. frontier technologies (standardized outcome)

	Standardized trade			
	(1)	(2)	(3)	(4)
Origin China	0.384***	0.383***	0.411***	0.383***
	(0.078)	(0.077)	(0.080)	(0.076)
AI	-0.671***	-0.673***	-0.669***	-0.663***
	(0.027)	(0.026)	(0.027)	(0.026)
Origin China X AI	1.103***	1.104***	1.077***	1.103***
	(0.079)	(0.078)	(0.081)	(0.079)
N	402300	402300	402300	402300
Importer/exporter GDP	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No
Institutional characteristics	No	No	Yes	No
Geographical characteristics	No	No	No	Yes

Notes: Regressions are at the product-import-export country dyad level. Outcome is the log(trade+1), standardized. Omitted: not China X not AI. All columns control for importer/exporter GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for landlocked and island characteristics. Standard errors are clustered by origin country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.13: Leading exporters' trade in AI by importers' Polity score (standardized outcome)

	China exports				*US exports*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination low Polity score	0.028	0.042*	0.049	0.030	-0.098**	-0.102**	-0.078**	-0.105*
	(0.025)	(0.024)	(0.031)	(0.025)	(0.044)	(0.048)	(0.037)	(0.059)
AI	-1.696***	-1.732***	0.338	-1.701***	-2.391***	-2.390***	-2.395***	-2.407***
	(0.326)	(0.340)	(2.721)	(0.325)	(0.191)	(0.191)	(0.193)	(0.185)
Destination low Polity score X AI	0.805**	0.963***	0.732*	0.801**	0.148	0.143	0.171	0.094
	(0.343)	(0.338)	(0.398)	(0.358)	(0.237)	(0.240)	(0.242)	(0.246)
N	2394	2394	2394	2394	2394	2394	2394	2394
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regression at the product-import country level. Outcome is the log(trade+1), standardized. Omitted: destination democracy with Polity score over 7 X not AI. All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by export country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.14: China exports to countries by importers' AI investment (standardized outcome)

	AI import deal (standardized)							
	AI				Smart city AI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination — autocracies and weak democracies								
Origin China	0.178***	0.178***	0.179***	0.178***	0.082***	0.082***	0.082***	0.082***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)
Destination total AI investment	0.007	0.007	0.007	0.007	-0.013	-0.013	-0.013	-0.013
	(0.034)	(0.034)	(0.035)	(0.034)	(0.031)	(0.031)	(0.031)	(0.031)
Origin China X destination AI invest	-0.329***	-0.329***	-0.329***	-0.329***	-0.458***	-0.458***	-0.458***	-0.458***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Importer GDP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log distance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border/trade characteristics	No	Yes	No	No	No	Yes	No	No
Institutional characteristics	No	No	Yes	No	No	No	Yes	No
Geographical characteristics	No	No	No	Yes	No	No	No	Yes

Notes: Regressions are at the import country-export country level, only keeping import countries with Polity score below 7. All outcomes are standardized. Origin China and Destination AI investment are standardized. All columns control for importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by destination country. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.15: Local unrest on AI and frontier trade to autocracies and weak democracies (standardized outcome)

	Standardized trade deals					
	AI				Frontier tech	
	All		Smart city			
	(1)	(2)	(3)	(4)	(5)	(6)
AI 2 years before unrest	-0.081	-0.081	-0.029	-0.026	-0.070	-0.070
	(0.084)	(0.086)	(0.117)	(0.119)	(0.085)	(0.084)
AI same year as unrest	0.376**	0.381**	0.320**	0.326**	-0.115	-0.113
	(0.185)	(0.187)	(0.157)	(0.159)	(0.140)	(0.137)
AI 1 year after unrest	-0.060	-0.061	-0.060	-0.061	-0.040	-0.040
	(0.051)	(0.052)	(0.064)	(0.064)	(0.035)	(0.034)
AI 2 years after unrest	0.088	0.094	0.056	0.060	0.058	0.059
	(0.059)	(0.063)	(0.058)	(0.060)	(0.057)	(0.060)
N	1226.000	1200.000	1226.000	1200.000	725.000	725.000
log import GDP	No	Yes	No	Yes	No	Yes
country time trend	Yes	Yes	Yes	Yes	Yes	Yes
total trade	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Regressions are at the country-year level, stacked so that the independent variable (unrest) vary within an observation. Unrest is standardized. Trade deals are exports from China. A Polity score of 7 is used as the cutoff for a 'full democracy' by the Polity IV project (Marshall et al., 2016), which we use to distinguish mature and weak democracies. Residualized number of trade deals relative to year = 0 and controlling for AI 1 year before unrest X year. All columns have fixed effects for import country and year. Standard errors are clustered at the import country level. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.16: China vs. rest of world, AI vs. frontier technologies (all coefficients)

	Engage in trade			
	(1)	(2)	(3)	(4)
Origin China	-0.026	-0.026	-0.012	-0.026
	(0.024)	(0.024)	(0.025)	(0.024)
AI	-0.356***	-0.357***	-0.355***	-0.355***
	(0.010)	(0.010)	(0.010)	(0.010)
Origin China X AI	0.474***	0.475***	0.461***	0.475***
	(0.030)	(0.030)	(0.030)	(0.030)
Destination log GDP	0.154***	0.152***	0.155***	0.159***
	(0.005)	(0.005)	(0.005)	(0.006)
Origin log GDP	0.246***	0.245***	0.247***	0.252***
	(0.010)	(0.010)	(0.010)	(0.010)
Log distance	-0.073***	-0.068***	-0.069***	-0.079***
	(0.006)	(0.006)	(0.005)	(0.005)
Destination log GDP X AI	-0.137***	-0.136***	-0.138***	-0.140***
	(0.008)	(0.008)	(0.008)	(0.009)
Origin log GDP X AI	-0.223***	-0.222***	-0.224***	-0.226***
	(0.012)	(0.012)	(0.012)	(0.012)
Log distance X AI	0.071***	0.067***	0.067***	0.075***
	(0.006)	(0.006)	(0.006)	(0.006)
Share border		0.008**		
		(0.003)		
Free trade		0.012**		
		(0.005)		
Colonial ties		0.013***		
		(0.002)		
Share border X AI		-0.007*		
		(0.004)		
Free trade X AI		-0.007		
		(0.006)		
Colonial ties X AI		-0.009***		
		(0.003)		
Common language			0.027***	
			(0.005)	
Common legal			-0.011**	
			(0.004)	
Common religion			0.008**	
			(0.004)	
Common language X AI			-0.025***	
			(0.006)	
Common legal X AI			0.011**	
			(0.005)	
Common religion X AI			-0.009**	
			(0.004)	
Landlocked				-0.002
				(0.006)
Island				0.028***
				(0.007)
Landlocked X AI				0.004
				(0.006)
Island X AI				-0.021***
				(0.007)
N	402300	402300	402300	402300

Notes: Regressions are at the product-import-export country dyad level. Outcome is the dummy for trade. Omitted: not China X not AI. All columns control for log importer/exporter GDP and log distance. Column (2) adds controls for common border, free trade agreements, and shared colonial background. Column (3) adds controls for common language, legal system, and religion. Column (4) adds controls for land-

Table A.17: Leading exporters' trade in AI by importers' Polity score (all coefficients)

	China exports				*US exports*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Destination low Polity score	-0.004	-0.003	-0.003	0.000	-0.003	-0.002	0.002	-0.002
	(0.003)	(0.003)	(0.005)	(0.003)	(0.004)	(0.005)	(0.005)	(0.004)
AI	-0.600***	-0.597***	-0.560	-0.601***	-0.727***	-0.726***	-0.734***	-0.732***
	(0.097)	(0.101)	(0.794)	(0.096)	(0.062)	(0.062)	(0.065)	(0.060)
Destination low Polity score X AI	0.222**	0.266**	0.223*	0.231**	-0.015	-0.032	0.001	-0.031
	(0.103)	(0.102)	(0.121)	(0.108)	(0.077)	(0.077)	(0.081)	(0.080)
Destination log GDP	0.009***	0.009**	0.009**	0.012***	0.016***	0.018***	0.017***	0.017***
	(0.003)	(0.004)	(0.003)	(0.004)	(0.005)	(0.006)	(0.005)	(0.006)
Log distance	-0.001	-0.001	-0.000	0.001	-0.003	-0.004	-0.000	-0.003
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)
Destination log GDP X AI	0.266***	0.276***	0.267***	0.274***	0.356***	0.340***	0.358***	0.335***
	(0.045)	(0.043)	(0.047)	(0.047)	(0.032)	(0.033)	(0.032)	(0.035)
Log distance X AI	-0.064	-0.105*	-0.060	-0.059	0.073**	0.099**	0.078**	0.084**
	(0.054)	(0.058)	(0.056)	(0.057)	(0.036)	(0.038)	(0.038)	(0.038)
Share border		-0.001				-0.003*		
		(0.001)				(0.002)		
Colonial ties		0.002*				-0.002***		
		(0.001)				(0.001)		
Share border X AI		-0.056**				0.051***		
		(0.028)				(0.016)		
Colonial ties X AI		0.098***				0.005		
		(0.023)				(0.006)		
Common legal			0.001				0.001	
			(0.003)				(0.004)	
Common religion			-0.018				0.011	
			(0.095)				(0.007)	
Common legal X AI			0.011				0.025	
			(0.092)				(0.031)	
Common religion X AI			0.054				0.046	
			(1.127)				(0.069)	
Landlocked				0.007**				0.003
				(0.003)				(0.005)
Island				0.008**				-0.001
				(0.003)				(0.008)
Landlocked X AI				0.021				-0.076*
				(0.061)				(0.040)
Island X AI				0.009				0.008
				(0.063)				(0.049)
N	2394	2394	2394	2394	2394	2394	2394	2394

Notes: Regression at the product-import country level. Outcome is dummy for trade. Omitted: destination democracy with Polity score over 7 X not AI. All columns control for log importer GDP and log distance. Columns (2) and (6) add controls for common border and shared colonial background. Columns (3) and (7) add controls for legal system and religion. Columns (4) and (8) add controls for landlocked and island characteristics. Standard errors are clustered by export country. * significant at 10% ** significant at 5% *** significant at 1%.

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