Talent Mobility as an Engine of Frontier Innovation

Talent flows, Chinese high-skill immigrants, Return migration, Frontier innovation

Extended Abstract

How do technology controls reshape frontier innovation when high-skill people and their tacit know-how can still move? Over the past decade, the United States has increasingly treated frontier technologies as a domain of geopolitical competition, deploying export controls and research-security measures that restrict the transfer of advanced chips, models, and other codified inputs [15, 16]. Meanwhile, China has pursued an explicit national strategy that frames artificial intelligence and adjacent sectors—semiconductors, advanced communications, clean energy, and critical materials—as engines of productivity growth and national competitiveness [13, 12]. These policy debates often center on *things* (hardware, code, publications), yet innovation also depends on *bundles* of education, skills, and work experience that accumulate over careers and travel with individuals [11, 2]. A widely discussed "DeepSeek moment" in early 2025, when news about rapid progress in Chinese AI rattled U.S. technology markets, underscored how quickly expectations can shift in frontier competition [4]. The implied question is not only whether technical controls work, but whether they overlook the diffusion channel that remains comparatively weakly regulated: cross-border mobility of high-skill talent.

We introduce a measurement framework for tracing the cross-border flows of Chinese high-skill immigrants trained in the United States and relating those flows to frontier-industry growth in China. Our core contribution is empirical: we link LinkedIn-scale longitudinal career histories to innovation outputs and policy regimes to quantify (i) who moves, (ii) which experience bundles move, (iii) where those bundles are deployed across frontier sectors, and (iv) how flows shift around major policy changes. This approach advances the long-standing "brain circulation" perspective [10] by providing individual-level trajectories at scale and by organizing mobility around frontier industrial domains rather than aggregate migration totals.

Data and linkage. We draw on global talent microdata from Revelio Labs, which aggregates public professional profiles and provides longitudinal education and job histories for hundreds of millions of individuals worldwide. We identify Chinese immigrants using a transparent, high-recall, rule-based screening procedure: names are standardized; candidates are flagged via Han-character detection and curated romanized surname dictionaries; and a complementary location-based signal (e.g., early education/employment in China) improves robustness [14]. We then classify career episodes by country and sector, allowing us to construct event histories of U.S. training (education and/or work) followed by subsequent relocation to China ("departure") or continued residence in the United States ("staying"). To connect talent flows to innovation outcomes and industrial upgrading, we integrate two additional data streams (Figure 1). First, we use patent microdata from the U.S. Patent and Trademark Office via the PatentsView platform [7, 17], which offers research-grade disambiguated records suitable for longitudinal and network-based analyses. Second, we use large-scale Chinese firm and innovation registries (business registrations and patent corpora) that make it possible to track firm entry, sectoral growth, and patenting in frontier domains. We harmonize people, firms, and patents through deterministic entity resolution: we standardize organization names, filter person-like strings, and match via exact cleaned-name agreement, retaining diagnostics for auditing [14]. Sectoral focus follows a frontier taxonomy that separates AI, semiconductors, advanced communications/networking, clean energy, and critical materials.

Measures. We treat human capital as a portable bundle and construct two families of measures. *Mobility measures* include annual counts and rates of departures (U.S. $\rightarrow$ China), return timing, and cohort profiles by education stage, occupation family (SOC), and industry. *Outcome measures* capture frontier capability building in China: firm entry and growth, geographic clustering, and patenting intensity in frontier domains. We also compile policy attention measures from both sides: U.S. export-control shocks [15, 16] and China's national and subnational industrial and talent policies that explicitly target AI and related strategic sectors [13, 12, 18].

Illustrative findings. We report two descriptive results that motivate the next stage of causal analysis. First, Chinese high-skill talent in the United States is not evenly distributed across frontier domains. Figure 2 shows the number of location-based Chinese individuals observed in frontier industries, disaggregated by major occupation families. AI absorbs the largest stock, followed by advanced communications/networking and semiconductors, with smaller observed stocks in clean energy and critical materials. The occupational mix differs sharply by sector: computer and mathematical roles dominate AI, while architecture/engineering and life/physical/social science roles contribute more heavily in semiconductors and clean energy. This heterogeneity supports the interpretation that the relevant unit for policy is not "STEM" in aggregate but specific bundles of technical and organizational capability.

Second, departures from the United States to China are disproportionately concentrated in particular frontier domains. Figure 3 plots the number of Chinese outflows over the years across different industries (identified via names). Semiconductors exhibit the highest normalized departures for most of the series, peaking in the mid-2010s, while advanced communications shows a distinct rise beginning in the late 2000s. By contrast, AI and clean energy show lower and more stable ratios. Two implications follow. (i) Talent reallocation toward China is not uniform across frontier sectors; it is strongest in domains where tacit manufacturing, process, and systems integration knowledge may be especially valuable. (ii) "China shocks" in talent are potentially measurable *within* industries, enabling designs that compare treated vs. less-treated frontier domains around policy shocks (e.g., export-control episodes) and around domestic Chinese policy expansions.

Why this matters for computational social science. Our framework connects three literatures that often proceed separately. Research on skilled immigration shows large effects of high-skill migrants on U.S. innovation [3, 5], but it typically evaluates contributions *within* the host country. Work on return migration emphasizes selection and human-capital accumulation [8, 1], yet it rarely measures sector-specific reallocation at scale, especially in frontier technologies. Finally, studies of Chinese returnees show links between returnee hiring and firm innovation [9, 6, 19], but the evidence base is often limited to listed firms or smaller panels. By combining LinkedIn-scale trajectories with innovation outcomes and policy timelines, we provide the empirical substrate needed to model talent mobility as a diffusion process: individuals carry tacit knowledge across borders, embed in organizations, and reshape the topology of cross-national innovation networks.

Next step. We are building micro-to-macro linkages that move beyond descriptive flows to mechanisms. The next phase identifies which U.S.-trained returnees become founders, technical leaders, or patent-linked inventors in China, and estimates how specific skill/experience bundles predict downstream outcomes such as frontier firm entry, patenting, and regional clustering. This extension will allow counterfactual policy exercises: how would alternative high-skill visa selection rules or retention policies reallocate frontier talent, and what innovation returns would these counterfactual allocations generate?

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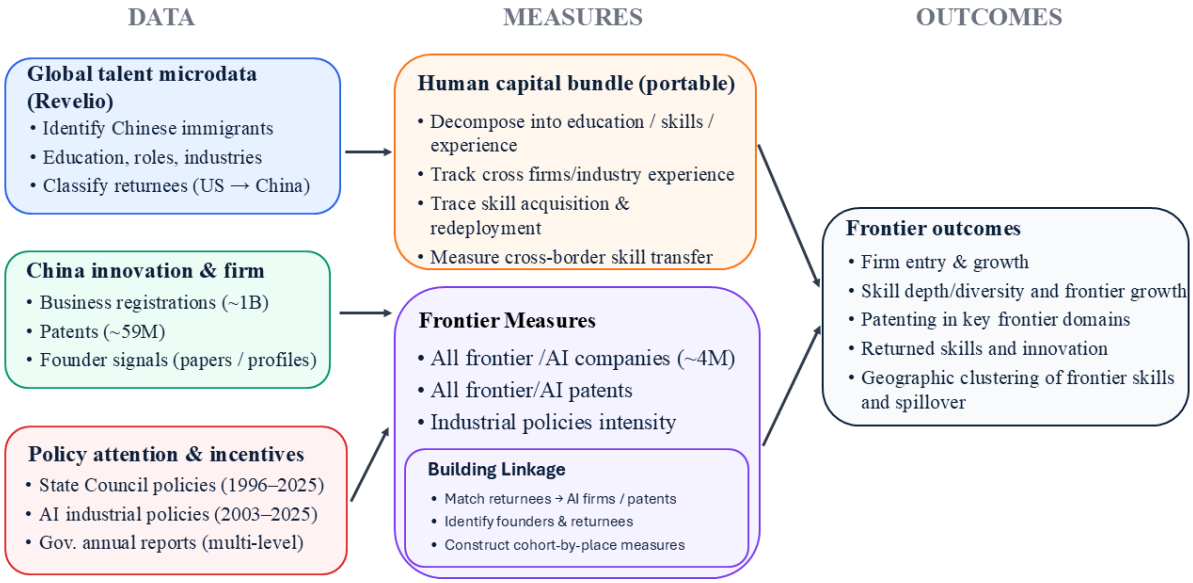


Figure 1: **Data, measures, outcomes, and linkage pipeline.** We combine LinkedIn-scale career histories (Revelio) with patent and firm registries to trace Chinese U.S.-trained talent, classify frontier-industry exposure, and link mobility to innovation outputs and policy regimes.

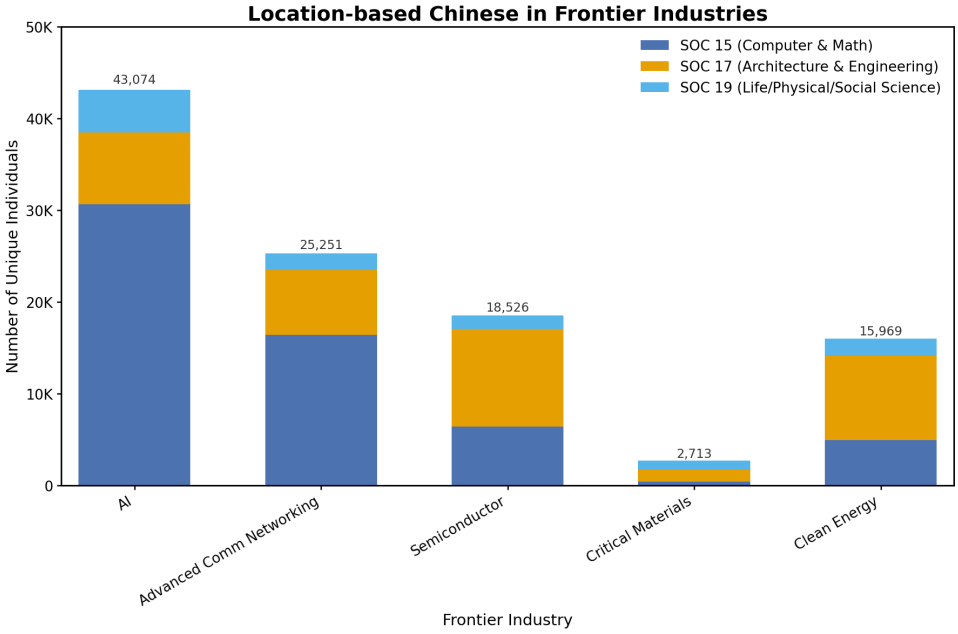


Figure 2: **Stock of location-based Chinese talent in frontier industries.** Stacked bars report unique individuals observed in each frontier domain, disaggregated by major SOC occupation families (Computer & Math; Architecture & Engineering; Life/Physical/Social Science).

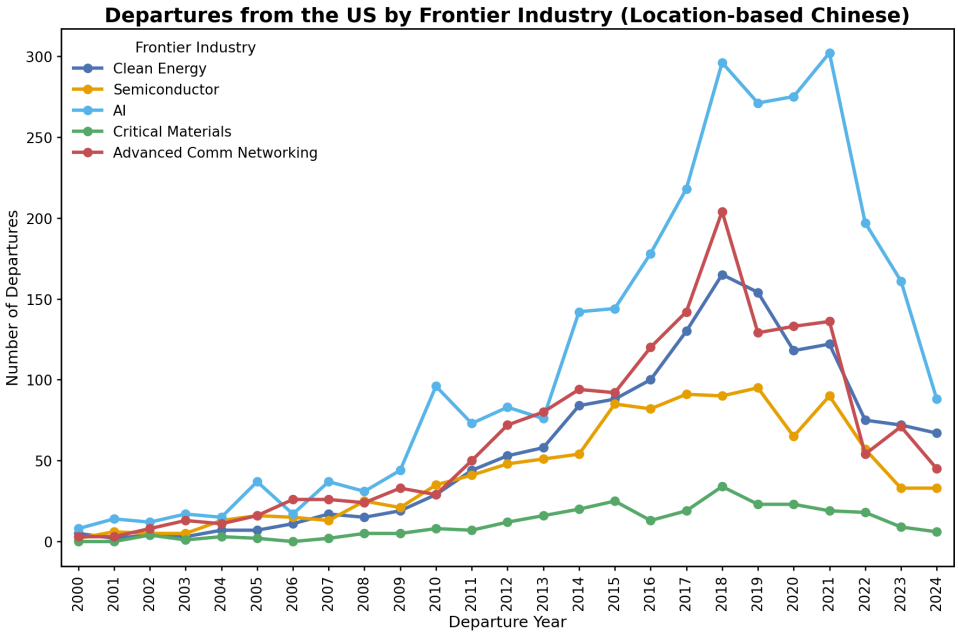


Figure 3: **Chinese Departures from the U.S. Across Frontier Industries.** Annual counts of U.S. $\rightarrow$ China departures among location-based Chinese individuals, disaggregated by frontier industry (AI, semiconductors, advanced communications, clean energy, and critical materials). Departures are near zero before the late 1990s, rise through the 2000s, and accelerate sharply after $\sim$2010. AI exhibits the largest surge in the late 2010s–early 2020s, followed by advanced communications/networking and clean energy; semiconductors grow more steadily and critical materials remains smaller throughout. The decline after $\sim$2021 may reflect a combination of real changes and right-censoring/incomplete observation in the most recent years.