Importing Role Models and Collaborators? Chinese Immigrants and U.S. Women Patenting

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Abstract. Women are starkly underrepresented in U.S. patenting. We examine whether exposure to female inventors can influence patenting outcomes among women in innovation-related careers. Specifically, we study whether short-horizon local inflows of college-educated immigrants from China—a country with high rates of female patenting—affects patenting by non-Chinese U.S.-based women. Using data from the United States Patent and Trademark Office (USPTO) together with U.S. Census and American Community Survey (ACS) data, we find that an influx of 1,000 college-educated Chinese immigrants to a local labor market over a ten-year period increases the number of patents with at least one non-Chinese U.S. female inventor by approximately 1.9 per 100,000 base-year residents, holding constant the number of men-only patents. We also find preliminary evidence that non-Chinese women in inventor occupations earn higher wages in areas experiencing larger Chinese immigrant inflows, a result consistent with productivity gains arising from exposure to Chinese female inventors who may serve as role models or effective collaborators. In addition, we estimate statistically significant decreases in fertility among female inventors, suggesting a potential shift toward greater career investment.

1. Introduction

Although women now earn about half of all science and engineering degrees (NSF report, 2021-2022), they continue to be significantly underrepresented as inventors on U.S. patents. As of 2019, only about 20% of all U.S. patents include *any* woman listed as an inventor, and the share of women among all U.S. patentees remains below 13 percent (Toole et al., 2020). Increasing women's patenting could expand innovation overall (Bell et al., 2019), promote inventions that better address women's needs (Koning et al., 2021), and improve women's career advancement and economic outcomes. This paper examines whether the arrival of college-educated immigrants from China, a country with relatively high rates of female patenting, affects patenting by non-Chinese U.S.-based women, as Chinese female inventors serve as role models or collaborators for American women.

One explanation for women's underrepresentation in patenting is that they are less likely to pursue careers in science and engineering, and when they do, they are concentrated in fields that produce fewer patents (Hunt et al., 2013; Lubczyk and Moser, 2024). The preferences and abilities that shape these career paths may form early in life (Bell et al., 2019) and are often difficult to change in adulthood. However, there are other, potentially more malleable, factors that play a role in shaping patenting outcomes for women who do enter innovation-focused careers (Chien and Grennan, 2024). For instance, in the absence of same-gender role models on-the-job, women may be less likely to make the investments required for successful patenting. Moreover, if being the sole woman on a patenting team is isolating or otherwise unpleasant, women may self-select out of promising opportunities. Boschini and Sjögren (2007) provide evidence of gender sorting in co-authorship team formation, and Li and Liu (2025) of gender homophily in the context of patent citations. In addition, managers and coworkers—most of whom are male--who lack examples of

successful female inventors may be less inclined to include women in high-potential projects. This paper investigates these channels by asking whether greater representation of women in the inventor workforce influences patenting outcomes for women.

Empirically identifying the effect of female representation on women's patenting is difficult because a positive correlation may simply reflect unobserved firm or regional characteristics that both attract women to patenting and enhance their productivity. To address this concern, we begin by presenting evidence that Chinese women are disproportionately likely to patent, and that there is a sizable population of educated Chinese immigrants in the U.S. We then examine whether the plausibly exogenous arrival of college-educated Chinese immigrants to a local labor market in the U.S. increases patenting among non-Chinese U.S. women in that area.

We combine patenting data from the PatentsView database, developed by the U.S. Patent and Trademark Office (USPTO), with data on the inflow of Chinese immigrants from U.S. Census and American Community Surveys (ACS) to examine whether local areas that received more immigrants from China over a ten-year period experienced greater growth in patenting among non-Chinese women during the same period. To address concerns about the endogeneity of immigrant location choices, we use a standard shift-share instrument that leverages the tendency of new immigrants to settle in established ethnic enclaves, conditional on other factors.[1]

Our estimates suggest that an inflow of 1,000 college-educated Chinese immigrants to a local labor market over a ten-year period increases the number of patents with at least one (non-Chinese) U.S. female inventor by approximately 1.9 patents per 100,000 residents during that period, holding constant the level of men-only patenting in the same geographic location. This

[1] The National Academies of Sciences, Engineering, and Medicine (2017) report provides a comprehensive review of the immigration literature, most of which uses this broad identification strategy. For further evidence of the instrument's widespread acceptance, see the rather long list of immigration papers in top general and field journals in economics using some form of this instrument in Appendix Table A.1 of Jaeger, Ruist, and Stuhler (2018).

suggests that an average change in the inflow of college-educated Chinese leads to about a 5% increase in patents with at least one non-Chinese female inventor. Our findings are robust to using different measures of Chinese immigrant inflows (e.g., all Chinese, college-educated female Chinese) and to using the number of women inventors on patents as an alternative measure of women patenting.

For evidence on the mechanisms driving these patenting results, we turn to Census and ACS information on U.S. (non-Chinese) women in *inventor occupations*—like engineers and scientists—living in areas receiving more Chinese immigrants. First, we examine whether American female potential inventors are drawn to areas receiving more Chinese immigrants. We find no evidence of selective migration of this type; Chinese inflows to an area do not yield changes in the number of females with inventor occupations in that area. Next, we examine labor supply decisions of these female potential inventors. We find no evidence of American women in inventor occupations working more weeks of the years, more hours in a typical week, or working long hours (over 50) in a week in response to Chinese immigrant inflows. However, we do find a positive and statistically significant effect on wages pointing to either higher productivity of women (during normal work hours) or more recognition of this productivity by managers.

Women often start investing less in their careers upon arrival of their first child (Kleven, Landais, and Søgaard, 2019). Exposure to more women in the workplace may influence career and family decisions in different ways. It could lead women to postpone marriage and childbearing to focus on their careers. Alternatively, this exposure could provide role models for successfully balancing work and family, encouraging mothers to remain engaged in patenting. To explore these possibilities, we examine the impact of Chinese immigrant inflows on the likelihood that U.S female inventors are married and have recently given birth. Greater exposure to Chinese

immigrants is associated with a decrease in the probability that they have a child under age five at home, a result pointing to a shift in preferences toward career at the expense of starting a family. However, we also identify increases in the likelihood of being married, making this pattern less clear.

The remainder of the paper is organized in the following way. In Section 2, we provide background information on why an inflow of Chinese immigrants to an area may induce American women to patent more. Section 3 describes our data sources and provides descriptive statistics. Our main empirical model is presented in Section 4, and our main results on patenting are discussed in Section 5. Section 6 examines the impacts of Chinese inflows on hours of work, wages, and marriage and fertility patterns of non-Chinese women living in the US and working in inventor occupations. Section 7 concludes.

2. Background and Mechanisms

2.1 Immigration and Innovation

A large and growing literature examines how immigration affects innovation. Immigrants are disproportionately employed in science and engineering and are often positively selected on inventive ability, suggesting they may boost innovation directly—through their own patenting—and indirectly, through spillovers to native-born inventors. Seminal studies consider both channels. Hunt and Gauthier-Loiselle (2010) show that immigrants patent at higher rates than natives, largely due to differences in field of study. Using a shift-share instrument, they provide indirect evidence of positive spillovers: inflows of college-educated immigrants to U.S. states lead to larger increases in total patenting than can be explained by immigrant patenting alone. Kerr and Lincoln (2010),

who use name-based algorithms to classify inventors by ethnicity, find that expansions of the H-1B program—the primary U.S. visa for high-skilled foreign workers—increase patenting by Chinese and Indian inventors, with little change among native inventors, as proxied by inventors with Anglo-Saxon names.

More recent work, leveraging improved data and identification strategies, tends to find stronger spillovers. Instead of using the pre-existing distribution of immigrant origins in constructing the "share" component of the shift-share instrument (as in Card, 2001; Hunt and Gauthier-Loiselle, 2010), Terry et al. (2025) predict immigrant inflows making use of variation from over a century of historical settlement patterns. Using the location of first U.S. patent filing to proxy for nativity, they find that native patenting accounts for 80 percent of the immigrant-induced increase in total patenting. Bernstein et al. (2025) offer a more precise measure of immigrant inventors—based on the age at which they received a Social Security Number—and show that while immigrants represent 16 percent of inventors, they are named as inventors on 23 percent of patents. The authors estimate spillover effects by exploiting variation from premature deaths of inventors, finding that the loss of a foreign-born collaborator leads to larger productivity declines than the loss of a native-born collaborator. Taken together, their results suggest that immigrants account for roughly one-third of U.S. innovation, with half of that contribution coming from spillovers to domestic inventors.

We complement this literature by (1) focusing on spillovers to female inventors—a group underrepresented in innovation—and (2) examining the impact of inflows from a specific country, China, rather than all immigrants. We are not the first to take a group-specific approach. De Rassenfosse and Pellegrino (2024) show that the arrival of ex-Soviet inventors after the collapse of the Soviet Union increased patenting by U.S. inventor teams with no former Soviet members.

Moser et al. (2014) find that German Jewish émigrés to the U.S. during World War II raised U.S. patenting in chemistry by 31 percent in fields where the émigrés were most active.

Like us, Borjas, Doran, and Shen (2016) examine the impacts of Chinese migrants. They show that an inflow of Chinese PhD students in mathematics increases the productivity of Chinese American advisors, both in terms of coauthored and solo-authored publications. The authors attribute this to the tendency of newly arriving Chinese students to match with Chinese advisors. This pattern is consistent with Freeman and Huang (2015), who find that research coauthors are more likely to share an ethnicity than would be expected by chance. In our analysis of patents, we test the hypothesis that, because women are overrepresented among Chinese inventors, some of the spillovers may flow especially to non-Chinese *female* inventors. We use a name-based classification of inventors' ethnicity (Chattergoon and Kerr, 2022), and like Hunt and Gauthier-Loiselle (2010), we construct a shift-share instrument based on the historical distribution of, in our case Chinese, immigrants across U.S. areas.

2.2 Mechanisms

We hypothesize that inflows of college-educated Chinese immigrants to an area increase the number of Chinese female inventors, given the relatively high representation of women among Chinese inventors. An alternative possibility is that Chinese and non-Chinese women function as substitutes in the innovation process—for example, if firms aim to satisfy explicit or implicit gender targets—such that an inflow of Chinese female inventors reduces patenting by non-Chinese women. However, our empirical evidence is most consistent with Chinese female inventors generating positive spillovers that enhance overall female patenting.

One mechanism through which Chinese inflows may increase local female patenting is via peer effects. In innovation, peers can help shape ideas, offer feedback on which ideas are worth pursuing, and share information about navigating the patent process. If women find it easier to exchange tacit knowledge with other women, exposure to female inventors may improve both the quantity and quality of information they receive. For instance, women may be more likely to get feedback on whether an idea is patentable from other women, especially valuable information given the evidence that women tend to shy away from competitive environments (Niederle and Vesterlund, 2007). This could in turn lead to more patenting among women.

Evidence also suggests that female inventors may lack guidance in later stages of the patenting process. Pairolero et al. (2025) find that women benefited more than men from a USPTO assistance program, particularly first-time inventors in male-dominated fields—suggesting that women face information gaps that peer advice may help fill. Relatedly, Aneja, Reshef, and Subramani (2024) show that women are less likely than men to refile after an initial patent rejection, and this accounts for over half of the gender gap in patenting. If peers provide useful information—e.g., that few patents are approved on first submission but most eventually succeed (Aneja et al., 2024) —or help with resubmissions, exposure to female inventors could encourage persistence and increase patenting.

Peers need not operate through direct help or information-sharing. Same-gender peers may also serve as role models, making success in patenting seem more attainable. Observing a female colleague's achievements can raise aspirations, shift career priorities, or demonstrate how to balance work and family demands—factors that may encourage women to pursue and persist in innovation.

Importantly, female engineers can positively influence other women's patenting even if they work at different firms or do not patent themselves. One potential channel is information-sharing about which employers are most supportive of women's careers. Hampole, Truffa, and Wong (2024) show that women randomly assigned to MBA study sections with more female peers are significantly more likely to reach senior management within 15 years, a pattern driven by greater employment in family-friendly firms. This suggests that female contacts may help women identify and sort into more supportive workplaces, improving long-term career outcomes.

While all these mechanisms may play a role regardless of Chinese women's roles within firms, the effects could be stronger if these women occupy managerial positions. In a study of white-collar jobs in Norway, Kunze and Miller (2017) show that female managers reduce gender gaps in promotions. Similar studies find positive impacts of women in other leadership roles—such as bosses in private sector firms (Kunze and Miller, 2017) and academic advisors (Canaan and Mouganie, 2023).[2] In our context, female managers may be more likely to assign women to projects that result in more patenting. However, we view this as unlikely to be the primary mechanism for the positive effect of immigration, since our identification strategy exploits changes in immigrant inflows over only a ten-year window—a relatively short time for new immigrants to rise into management. That said, some female Chinese immigrants may arrive through intra-firm transfers and take on leadership roles immediately.

[2] There is also evidence that having more female evaluators on decision-making committees does not help and may hurt female candidates (Bagues, Sylos-Labini, and Zinovyeva, 2017). Also, having more females promoted to associate and full professor positions (for exogenous reasons) does not increase the number of women hired or promoted in the department within the following ten years and does not increase the share of female PhD students (Bagues et al., 2023). In addition, gender quotas for companies' boards of directors do not increase women's representation among CEOs and other senior executives (Matsa and Miller, 2025). Finally, female principals may increase the share of female teachers in schools but only because male teachers are more likely to leave schools led by female principals and to work at schools lead by male principals (Husain, Matsa, and Miller, 2021).

Finally, an exogenous increase in Chinese female engineers may boost patenting among non-Chinese women by shifting male perceptions of female productivity. If women are less likely to be assigned to high-potential projects or invited to join productive teams due to doubts about their commitment, the presence of highly productive female peers may help change those beliefs. Supporting this idea, Dahl et al. (2021) find that men randomly assigned to mixed-gender teams during Norwegian military bootcamp were significantly more likely to believe mixed-gender teams perform as well or better than same-gender teams.

Taken together, these mechanisms suggest that the inflow of college-educated Chinese immigrants—some of whom become inventors—is likely to increase, rather than decrease, patenting among their non-Chinese female colleagues. We test this hypothesis empirically in the sections that follow.

2.3 Why Immigrants from China?

We examine the impact of immigrants from China for two main reasons. First, women are disproportionately represented among Chinese inventors. Second, the volume of college-educated Chinese immigrants to the U.S. is large enough to allow us to detect impacts, even though only a small share work as inventors. We provide evidence of both in this section.

We start, however, by considering the history of China and how it may have led to more patenting among women to this day—for reasons unrelated to patenting opportunities in particular U.S. cities. Traditional Confucian beliefs, which continue to exert influence today, emphasize a gendered division of labor in which men are expected to serve as providers and women as caregivers. However, starting in 1949, the Communist Party of China promoted a markedly different view, emphasizing gender equality. Mao Zedong's famous slogan—"Women hold up half

the sky"—exemplified the view that women should participate fully in all aspects of society, including the labor market. The state provided support for working women, including public childcare, which enabled high levels of female labor force participation. In 1990, China's labor force participation rate for women between the ages of 15 and 64 was about 79% (International Labor Organization, 2025). Following China's economic liberalization beginning in 1978, state support for childcare and other family services declined, and female labor force participation also fell. In 2024, China's female labor force participation rate was roughly 69%, comparable to that of the U.S. (International Labor Organization, 2025). Despite this convergence, China's legacy of state-driven gender equality may have left a lasting imprint—particularly in women's participation in traditionally male-dominated fields such as science and engineering.

Evidence from other former socialist contexts supports this idea. For example, one study of children who immigrated to Israel from the Former Soviet Union found that they exhibited smaller gender gaps in the likelihood of pursuing STEM degrees than both native Israelis and immigrants from non-socialist countries (Friedman-Sokuler and Senik, 2025). Similarly, women from the former East Germany—another socialist country—are significantly more likely to work, even today, than women from West Germany, even when living in the same labor market (Bauernschuster and Rainer, 2011; Boelmann et al., 2025; Campa and Serafinelli, 2019).

To examine more directly whether Chinese women are especially likely to patent, we begin by examining female representation on patents in the ten countries with the highest number of U.S. patents granted with assignees in these countries between 1976 and 2023. A patent assignee is an entity that owns it. Often these are companies where the inventors work. About 50% of U.S. patents have international assignees. As shown in Table 1, China is among the top ten countries patenting in the US, indicating substantial innovation activity. The cumulative number of patents assigned

to each of the top ten countries is listed in column (1). In column (2) we display for each country the share of inventors that are female on patents with assignees in that country. The share of female inventors for USPTO patents with Chinese assignees is about 26 percent, which is the highest for these top-patenting countries, and substantially larger than the share of female inventors of USPTO patents with US assignees (only about 10 percent).

We supplement these observations using data on immigrant occupations from the 1980, 1990, and 2000 5% census, as well as the 2009-2011 and 2017-2019 American Community Survey (ACS), the data we use to construct our immigrant inflow variables in our analysis. All values are averaged across the sample years. Table 1 columns 3-5 show that there is a large population of immigrants from China in the US. Among the top ten patenting countries, the largest foreign born college-educated population in the US is from China, and this population has been growing in recent decades by on average about a quarter of a million people per decade. Columns 6-7 highlight that women are highly represented among China-born immigrants in the U.S in STEM occupations: 30 percent of all STEM workers born in China are female, and this figure only drops to 26 percent if we focus on STEM occupations that are male dominated. These are the highest shares among the top ten patenting countries. The comparable figures for U.S.-born STEM workers are 21 and 18 percent, respectively.

Of course, patenting behavior in China may not directly reflect the behavior of Chinese immigrants in the U.S. Unfortunately, U.S. patent data do not include information on inventors' country of birth. To better understand patenting patterns among immigrants in the U.S., we restrict our sample to USPTO patents with U.S. assignees and then use predicted ethnicity of inventors based on their names, information obtained from Kerr (2008) and Chattergoon and Kerr (2022). In Table 2, each row lists one of ethnicities from the inventor ethnicity dataset. We restricted the

data to inventors who reside in the US and classified each inventor-patent observations to one of these rows if its probabilistic ethnicity value was equal to 1. We defined an unknown ethnicity category that includes 11% of the inventor-patent observations whose ethnicity is either missing or has positive probabilities on multiple ethnicities. In column 1 we report the share of all U.S. inventors with the row's ethnicity. In column (2) we show the share of all U.S inventors who are female (using USPTO gender attribution data) in each ethnic group. Column (3) of Table 2 shows the share US female inventors with each listed ethnicity among all U.S. inventors. As shown in the table, the share of female inventors is highest among U.S. inventors with Chinese names. Interestingly, this share is lower among inventors with Japanese ethnicity who share Confucian traditions (Japan).[3] In contrast, Korean inventors show relatively high female inventor shares, but the share of female Korean US inventors is low. It is about a tenth of the share of female Chinese US inventors.

While India is not included in the top ten countries with U.S. patents (Table 1), there are large immigrant inflows from India to the U.S. There is a relatively large share of female Indian US inventors (about 15%), and they also account for a similar share of U.S. patents (8%) to Chinese (9%). Based on these statistics, we might expect to find a similar impact of college-educated Indian immigrant inflows on U.S. women patenting.

Additional evidence supports our expectation that many Chinese immigrants to the US are likely to work in STEM occupations that lead to patent inventions. In 2022, China was the third-largest source country for new immigrants to the U.S., with 90,000 arrivals, following Mexico (150,000) and India (145,000) (Moslimani and Passel, 2024). According to a study of doctoral recipients in science and engineering, among the 42,950 foreign students on temporary visas in the

[3] Russia is not among the top ten patenting countries in the USPTO data, although it shares a history of socialism. The share female among inventors with Russian ethnicity is about 10%, similar to the overall share in the US.

U.S. in the year between 2017 and 2019, 15,800 were from China, compared to 5,750 from India. The number of Mexican doctoral recipients in these fields was too small to be reported in the table (National Center for Science and Engineering Statistics (NCSES), 2025).

Taken together, all these patterns motivate our focus on immigrants from China in our empirical analysis.

3. Data and Descriptive Statistics

We merge data on U.S. patents, which includes information on their inventors and assignees, with data on immigration and labor market outcomes. This section summarizes our data sources.

3.1 Patent Data

The primary source of our patent data is the USPTO PatentsView Annualized Data Tables, which provide data on the universe of patents granted each year. About 30,000 patents were granted to US assignees in 1980, and the rate of patenting increased over time reaching more than 160,000 patents granted to U.S. assignees in 2020.[4] For each patent, the dataset includes the assignees (again, companies or other types of organizations that own the patents) and their geographic location, as well as the names and likely gender of the patent's inventors. Inventors do not report their gender in patent applications; hence the USPTO used a gender attribution algorithm to assign gender.[5] The dataset provides gender attribution for the first ten inventors in each patent (99% of the patents have ten or fewer inventors).

[4] See https://patentsview.org/data/annualized
[5] A description of the gender attribution process is available at https://patentsview.org/gender-attribution

We restrict the data to utility patents with U.S. assignees.[6] Most patents only have one assignee, but for the small share of patents that have more than one assignee (about 2%), we keep one assignee prioritizing large corporate assignees with non-missing county data. The dataset includes information on the county where the assignee is located. In cases where county information is missing, we impute the county using information on the assignee's state and city. In the end, only one patent remained missing a county code. We dropped it.

We merge the patent dataset with an inventor ethnicity dataset (Kerr, 2008; Chattergoon and Kerr, 2022) that provides, for each inventor on each patent, an inferred ethnicity (based on ethnic-name matching) and an indicator for whether the inventor is based in the United States. We use the ethnicity dataset to infer which inventors are U.S-based women inventors whose ethnicity is not Chinese. This allows us to measure the effects of inflows of Chinese women immigrants on the patenting of other women inventors, rather than through patenting of the Chinese women immigrants themselves.

We also merge our patent dataset with the USPTO Patent Examination Research Dataset,[7] which gives us the patents' filing dates, and with the Patent Quality Indicators database (OECD, 2023) which includes technology field classifications. Like Terry et al. (2025), we construct per capita patent counts normalized using the 1970 county's population obtained from the 1970 U.S. Census.[8]

[6] Most patents are utility patents. A utility patent grants exclusive rights to a new and useful invention—such as a process, machine, or composition—based on how it works or is used. We exclude plant and design patents. We also drop reissue patents (that correct errors in earlier patents) to avoid double counting.

[7] https://www.uspto.gov/ip-policy/economic-research/research-datasets/patent-examination-research-dataset-public-pair

[8] Downloaded from https://www.census.gov/data/datasets/time-series/demo/popest/1970s-county.html

We aggregate the combined individual-level patent dataset to a county by period dataset. Time periods are denoted $t=\{1980, 1990, 2000, 2010, 2020\}$. Each of the decade year variables are constructed using a 5-year window centered at the decade year. Granted patents with application years in the range 1978-1982 are used to construct 1980 variables, with similar five-year ranges used for each decade year until 2010. We use patents with applications years 2016-2020 (instead of 2018-2022) for 2020 because we only have ethnicity and gender information for granted patents, and many patent applications in 2021 and 2022 had not yet been granted by 2024, the last year for which the ethnicity and gender datasets are available to us.

We generate three county-by-year measures of women patenting as our dependent variables. (i) the number of patents that have at least one non-Chinese U.S. women inventor; (ii) the number of patents with a first inventor who is a non-Chinese U.S. woman; (iii) the total number of non-Chinese U.S. women inventor-patent instances. In each case we count patents that were granted to organizations located in the county, with application dates in the 5-year window of time that we associate with decade t. We then normalize each of these measures by the county's population in 1970 (in 100,000s) to obtain our county-year measures of U.S. women patenting. We construct corresponding measures of male-only patents which we use to control for overall innovation activities. In the empirical models, we use decadal changes in these variables, for example, the 2020 dependent variable of interest would be the change in the number of patents that have at least one non-Chinese US-based woman inventor between 1990 and 2000. In some specifications, we also control for the base-year share of all patents in the county-year that are in each field.

3.2. Immigration and Labor Market Data

The main source of data for immigrant inflows and other labor market characteristics are samples of the U.S. Census and American Community Survey (ACS) obtained from the Integrated Public Use Microdata Series (IPUMS) (Ruggles et al., 2024). We use the 1970, 1980, 1990, and 2000 Censuses. We use ACS data for the last two decades, with 2009-2011 referred to as 2010 and 2017-2019 referred to as 2020 (to avoid the COVID pandemic years).

While our analysis relies on patent counts measured at the county level, our measure of Chinese inflows is constructed at the commuting zone (CZ) level. Commuting zones are clusters of contiguous counties—both urban and rural—defined based on strong commuting ties. An inventor producing a patent for a firm (assignee) located in one county may reside in a different county, but the structure of CZs makes it likely that both the firm and the inventor's residence fall within the same CZ. There are 741 CZs consistently defined based on the 1990 classification.[9] Our final patent estimation dataset contains 695 CZs, as the remaining have no patenting activity in our sample period.

Our main variable of interest is the decadal change in the number of college-educated immigrants from China in each CZ. We also use these data to construct several CZ by decade-level control variables, including the unemployment rate, female labor force participation rate, total population, and the average age of native-born women. In addition, we use data on the total number of college-educated Chinese immigrants in the U.S. each year during our sample period (1980, 1990, 2000, 2010, 2020) in the construction of our instrumental variable, as discussed in

[9] CZ information is not directly available in our Census and ACS data. We assign individuals to CZs following the procedure developed by Autor, Dorn, and Hanson (2013), which maps Public Use Microdata Areas (PUMAs —the smallest geographic units available in these datasets—to CZs using population-weighted crosswalks. This approach reflects the fact that PUMAs do not always align perfectly with CZ boundaries, but individuals residing in PUMAs that span multiple CZs can be probabilistically matched to CZs. To do the matching, we use the crosswalks available on David Dorn's website (http://www.ddorn.net/data.htm), where further details the procedure can be found.

Section 4.2. We use the distribution of Chinese immigrants across different CZs in the 1970 Census (Metro 1 and Metro 2 samples) in the construction of our instrumental variable as well.

While our main outcomes are constructed from patent data, in Section 6 we also examine the impact of Chinese immigrant inflows on a range of labor market and family outcomes for U.S.-born, working-age (ages 25–64) non-Chinese female inventors, using data from the Census and ACS. In this analysis, we define inventors as individuals who report an occupation of engineer or mathematical, computer, or natural scientist. Our primary labor market outcomes include weeks worked in the previous year, usual hours worked per week, an indicator for working long hours (defined as more than 50 hours per week), and log hourly wages. We calculate hourly wages by dividing wage earnings in the previous year by the product of usual weekly hours and weeks worked last year. Family outcomes include an indicator for being married, an indicator for having at least one child under the age of five, and the number of children under age five. All outcomes are constructed as CZ-by-year averages.

3.3. Descriptive Statistics

Merging the county-level patent data with our CZ-level demographic data is straightforward because counties map perfectly onto CZs.[10] We first-differenced the outcome and immigration variables from 1980-2020 data to obtain a dataset for 1990-2020. The difference between 1990 and 1980 is the 1990 change, etc. Our final dataset consists of 10,292 county-by-year observations, for 2,573 counties in 695 commuting zones in the years 1990, 2000, 2010 and 2020.

Figure 1 shows trends (by application year) in the number of granted U.S. patents with at least one women inventor and the number of patents with men-only inventors in our sample. The number of patents with at least one woman inventor has been increasing over time, but even in

[10] Again, we use the cross-walk available on David Dorn's website (http://www.ddorn.net/data.htm).

2020, the number remains quite low—especially when compared to the number of men-only patents shown in the same figure. Figure 1 shows a decline in the number of granted patents for application years 2019–2020. This pattern does not reflect a true decrease in patenting activity but rather censoring in the data: because we observe patents granted through 2023, many applications from recent years are still pending and thus do not appear in our data set of granted patents.

Table 3 presents descriptive statistics for the variables used in our analysis. Columns 1 and 2 report the mean and standard deviation for the full sample. Columns 3 and 4 show these statistics for county-years with high Chinese inflows—defined as having a ten-year change in the number of college-educated Chinese immigrants in the local area larger than the median in the sample—while columns 5 and 6 report the same for county-years with low (less than median) inflows. As shown in the table, non-Chinese U.S. women inventors tend to patent more in areas that receive greater inflows of Chinese immigrants. Figure 2 presents this same basic information in graphical format. Of course, all these correlations may reflect the fact that immigrants are drawn to dynamic regions with higher levels of patenting activity among both women and men of all ethnic backgrounds. We address this concern in several ways in our empirical analysis described in the next section.

4. Empirical Strategy

Our ultimate goal is to explore whether exposure to women inventors increases women's patenting. To this end, we examine the impact of local inflows of college-educated Chinese immigrants (a group where women are especially likely to patent) on the number of patents with non-Chinese women U.S. inventors, using an often used shift-share instrument to identify the causal impact of these Chinese inflows.

4.1. Empirical Model

We estimate the following equation:

$$\Delta y_{c,z,t} = \beta \Delta CB_{z,t} + \delta \Delta MP_{c,t} + \gamma X_{z,t-1} + \alpha_t + u_{c,z,t} \quad (1)$$

where *c* denotes county, *z* the commuting zone, and *t* year.[11] The dependent variable $\Delta y_{c,z,t}$ is a measure of the change in women's participation in patenting in county *c* between years *t-1* and *t,* where *t* refers to decades 1980, 1990, 2000, 2010 and 2020 and *t-1* refers to the decade before. Recall that each *t* variable was constructed using a 5-year window centered at *t*. We use the change in the number of patents with at least one non-Chinese woman U.S. inventor per 100,000 1970 residents as our primary measure of women patenting.

Our variable of interest, $\Delta CB_{z,t}$, captures the change in the number of college-educated Chinese-born immigrants over that same period in the commuting zone *z* (that contains county *c*). To control for overall innovation activities in each county *c* in the same period, we use the change in the number of men-only patents, again normalized to the 1970 population: $\Delta MP_{c,t} = MP_{c,t} - MP_{c,t-1}$. Additional controls include a vector of base year commuting zone level controls, $X_{z,t-1}$, (see list in Table 3 in the data section). We also include year fixed effects, α_t, which, because we are estimating a first difference model, account for unobservable factors that would induce year-specific *changes* by decade in women's patenting.[12] Lastly, $u_{c,t}$ is a mean-zero disturbance term. We cluster standard errors at the commuting zone level.[13]

[11] Note that each county lies in exactly one commuting zone, but commuting zones contain multiple counties.
[12] Our results are robust to the inclusion of state-specific year fixed effects, which would control for any impacts of a change in state parental leave policy, for example.
[13] Results are robust to clustering by state instead of commuting zones.

The immigration inflows variable $\Delta CB_{z,t}$ is potentially endogenous. Areas experiencing growth in patenting opportunities may attract more Chinese immigrants, particularly those who are college-educated. At the same time, firms without enough male inventors to do the work might rely more on their female inventors for patenting. To address this potential endogeneity problem, we take an often-used instrumental variables approach.

4.2. Instrumenting for Immigration Inflows

We construct a shift-share instrument, based on the approach pioneered by Card (2001), which predicts local inflows of Chinese immigrants based on the national growth in high education Chinese immigration to the U.S. (the shifts) together with historical Chinese settlement patterns across U.S. commuting zones (the shares). The intuition behind this approach is that, holding constant patenting and other labor market opportunities, new Chinese immigrants are more likely to settle in areas with larger pre-existing Chinese communities where they can access culturally familiar amenities like traditional festivals, regional cuisine at Chinese restaurants, and established ethnic business or job search networks. This implies that in years when more college-educated immigrants come to the U.S. from China—due, for example, to changes in visa policy or labor market conditions in China—a disproportionate share will settle in commuting zones with larger Chinese networks for historical (rather than contemporaneous) reasons. Capturing this basic intuition, we construct a measure of the predicted number of college-educated Chinese immigrants using the following:

$$\widehat{CI}_{z,t} = S_z^{1970} \times CI_t. \quad (2)$$

where S_z^{1970} is the share of all Chinese immigrants living in the U.S. in 1970 who resided in commuting zone z in that year—that is, the number of Chinese immigrants in CZ z divided by the total number of Chinese immigrants nationwide in 1970. This share acts as a pull factor to different

commuting zones, for reasons independent of patenting opportunities for women. We multiply this share by CI_t the population of college-educated immigrants from China across the entire U.S. in year *t*. Importantly, this term is not likely to be affected by local changes in any particular CZ. This product is predictive of the number of college-educated immigrants from China in CZ *z* in period *t* if new immigrants from China to the US tend to settle in geographic locations where there were China immigrants as far back as 1970, ten to forty years prior to our sample period.

As an instrument for the change in the population of college-educated immigrants from China in commuting zone *z* in time *t* ($\Delta CB_{z,t}$) we use the difference between the value of the shift-share instrument in *t*, and its value in the previous period $IV_{z,t} = \widehat{CI}_{z,t} - \widehat{CI}_{z,t-1}$. We then estimate model (1) using a two-stage least squares.

We consider alternative measures of immigration flows to capture an increase in exposure to women inventors. In one, we use the larger population of all immigrants from China, in another we restrict to flows of *female* college-educated immigrants from China. For each of these, we construct the variable of interest, and the corresponding shift share instrument in a similar way as we did for immigration flows of educated people from China. As we move to more restrictive groups of immigrants that likely better proxy increases in women inventors, regression coefficients of interest increase, but also become noisier. Our main analysis is presented using an intermediate measure – educated Chinese immigrants.

5. Immigration and Women Patenting

We provide evidence of a positive effect of exposure to women-inventors on women's participation in patenting, exploiting exogeneous local changes in Chinese immigration.

5.1. Main Results

In Table 4 panel A, we present results from estimating the empirical model (1). The dependent variable is the change in the number of patents with at least one non-Chinese U.S. women inventor. The variable of interest is the change in the number of college-educated Chinese immigrants to each county. All models in Table 4 include year fixed effects and cluster standard errors by commuting zone. In the first column we show estimates from a baseline ordinary least squares model showing a positive relationship between the dependent variable – counties' change in the number of patents with at least one U.S. women inventor per 100,000 residents, and the variable of interest – flows of immigrants from China to the commuting zone that contains this county. The only control we include in column (1) is the change in the number of men-only patents in the county. In column (2) we add labor market controls. Both columns show a positive relationship between immigration from China and U.S. non-Chinese women inventors' participation in patenting.

In columns (3) and (4) we show estimates of two-stage least squares models where we instrument for the potentially endogenous immigration flow variable with the shift-share instrument. Column (3) only controls for the change in the number of men-only patents, and column (4) adds labor market controls. The coefficient of college-educated Chinese immigration inflows in column (4) is equal to 1.929 (SE = 0.279) which is highly statistically significant. It suggests that an increase of 1,000 immigrants increases the number of patents with at least one U.S. women inventor per 100,000 residents by about 1.9 patents. Panel B of the table shows the first stage regression corresponding to the IV model in column 4. Our instrument is highly significant, with an F test statistic of about 21.

Table 5 show estimates for the same model as in Table 4 column (4) (repeated in column (2) for comparison), only we replace our measure of immigration flows using flows of all Chinese immigrants in column (1), and flows of college-educated Chinese female immigrants in column (3). The models show positive effects of Chinese immigrants on U.S. women patenting. The coefficient is smallest in column (1) (using the broader set of all Chinese immigrants) and largest in column (3) (that restricts to educated female immigrants). As we narrow the immigrant groups to those who more likely lead to more exposure to women inventors, the magnitudes of the coefficients increase, but also the standard errors.[14]

Table 6 demonstrates that our findings are robust to controlling for college-educated immigrant inflows overall (from any country) into commuting zones. In column 2, we include predicted inflows of college-educated immigrants constructed analogously to equation (2), but instead of restricting to Chinese immigrants, we sum across all origin countries within each commuting zone–year. As with our instrumental variable, we then take decadal differences of these predictions. Our coefficient of interest remains positive and statistically significant with a similar magnitude. This suggests that our results are not driven by commuting-zone–level increases in the demand for inventors (resulting, for example, from breakthroughs in science that generate many new patenting opportunities) that could simultaneously attract college-educated immigrants from around the world and increase women's patenting.[15] Rather, the effects appear specific to Chinese immigrant inflows—a group in which women are disproportionately likely to patent. In column 3,

[14] Using OLS models we also obtain positive significant effects using inflows of immigrants in STEM fields or when restricting to STEM field female immigrants. However, the instrument is weak and for the latter, the coefficient of interest in the IV model is statistically insignificant.

[15] Lubczyk and Moser (2024) show that more women entered patenting-intensive STEM fields during WWII, when many male inventors were enlisted in the war. If firms turned to women for patenting activities in the 1940s when male inventors were scarce, we may expect even greater reliance on female labor in more recent years whenever patenting opportunities expand relative to the size of the local labor force.

we add controls for the shares of patents in each of six NBER technology categories: (1) Chemicals, (2) Computers and Communications, (3) Drugs and Medical, (4) Electrical and Electronic, (5) Mechanical, and (6) Other. Results are robust to adding these controls, although the estimated coefficient decreases slightly in magnitude.

In Table 7, we repeat the models from Table 4 for two additional measures of women patenting. The change in the number of non-Chinese U.S. women inventors, and the change in the number of patents with a U.S. non-Chinese female first inventor. An increase in the flow of educated immigrants from China has positive effects on women patenting also according to these measures.

5.2. Heterogeneity

We next explore whether the impact of Chinese immigration on women's participation in patenting varies across different technology fields. We use the NBER six-field categorization (Chemicals, Computers and Communications, Drugs and Medical, Electrical and Electronic, Mechanical, and Other). Each patent in our dataset is assigned to one of these categories (Wang, 2020). Women participation in patenting varies significantly across technology field. The share of patents with at least one women inventor in the Drugs and Medical category is 37.2% while in the Mechanical category it is only 13.3% (authors' calculations).

Figure 3 presents IV estimates from our preferred specification (Table 4, Column 4), run separately for each technology field. We use the change in the number of patents with at least one non-Chinese U.S. woman inventor per 100,000 residents in each field as the outcome variable. All regressions include the same controls and fixed effects as our preferred specification and are clustered at the commuting zone level. The figure illustrates the coefficient of interest for each subsample of patents in one technology field. Appendix Table A1 includes the full estimation table.

The results indicate heterogeneous effects across fields. There is a positive and highly statistically significant impact of educated Chinese immigration in the Computer and Communications and Drugs and Medical categories (Columns 2 and 3), the coefficient on educated Chinese immigration is 1.384 (SE = 0.489) and 0.405 (SE = 0.069) respectively, suggesting that an inflow of 1,000 Chinese immigrants leads to an increase of roughly 1.3 and 0.4 patents with women inventors per 100,000 residents, respectively. The effect is only marginally significant in the Electrical and Electronics category 0.433 (SE = 0.256). The coefficient is positive but insignificant in the remaining categories. This means that most of the total change in women patents due to the inflow of educated Chinese immigration is in Computer and Communications technology category.

These findings suggest that exposure to female inventors via immigration may be particularly influential in certain fields, possibly those where women already have a stronger presence or where team-based innovation is more common.

6. Chinese Inflows and U.S.-Born Female Labor Market Outcomes

To shed light on the mechanisms behind our main results, we next investigate whether Chinese immigrant inflows affect labor market behavior and family choices of U.S.-born women in inventor occupations. If exposure to Chinese female inventors operates through a peer effect or role modeling, we might expect increased effort or persistence in innovation-related work.

Unfortunately, there is no way to link labor and demographic characteristics to the women in our patent data. Instead, we draw inference on these women from the women in our Census and ACS data who report occupations where patenting is more likely: engineers and mathematical,

computer, or natural scientists. Our estimating equation for these analyses is similar to equation (1) except that, without county information in the Census and ACS, we focus on commuting zone-level changes. In particular, we estimate:

$$\Delta FY_{z,t} = \beta \Delta CB_{z,t} + \delta \Delta MY_{z,t} + \gamma X_{z,t-1} + \alpha_t + u_{z,t}$$

where *z* denotes commuting zone and *t* year. $\Delta FY_{z,t}$ denotes the change in *non-Chinese* women's labor and family outcomes in CZ *z,* between decade t-1 and t, $\Delta \mathrm{CB}_{z,t}$ is change in number of college-educated immigrants from China in commuting zone z, and $\Delta \mathrm{MY}_{z,t}$ is change in corresponding male outcomes in CZ z. Our vector of controls is identical to that in equation 1. We also use the same estimate instrumental variable as before, and cluster standard errors at the commuting zone level.

We start by examining whether women in inventor occupations move to areas receiving more Chinese inflows. This would also be suggestive of a change in the composition of non-Chinese female inventors in the area. For example, if the most career-focused, high patenting women move to areas that receive more Chinese immigrants (for exogenous reasons), this might suggest a preference for work in areas with more Chinese immigrants, but it would not be indicative of Chinese female inventors making women more productive via peer effects or role model effects. Column 5 of Table 8 shows that in fact, conditional on the change in the share of males working in inventor occupations, Chinese inflows result in no change in the share of non-Chinese females working in these occupations; the point estimate is not only statistically insignificant, but practically zero in magnitude.

Next, we explore whether Chinese inflows lead non-Chinese women to invest more heavily in their careers by working more hours. This might occur, for example, if working in more female-

friendly offices becomes more enjoyable or if exposure to successful (Chinese) female inventors makes non-Chinese women more ambitious. It is also possible that when the mostly-male managers observe successful Chinese female inventors, they assign non-Chinese women to promising projects potentially requiring especially long hours of work. The remaining columns of Table 8 show no evidence of increased work effort. Specifically, our results show no change in the number of weeks worked, hours worked, or probability of working long hours. We do, however, find a positive and statistically significant increase in wages. This result is consistent with women either exerting more effort on-the-job or being assigned to more productive projects, despite no increase in work hours. It is also consistent with increased compensation for women after the mostly-male managers are provided with more examples of highly productive women.

We can also examine whether inflows of Chinese immigrants to an area make US-based non-Chinese women more career-focused. One possibility is that exposure to female inventors lead non-Chinese to postpone marriage and fertility in order to focus on their careers. Another possibility is that Chinese female inventors provide role models for combining work and family responsibilities. This may result in more female patenting if female inventors who would otherwise leave the labor force to care for children instead remain working despite a recent birth. The results in Table 9 show that the estimated effects on the probability of being married are positive but statistically insignificant. We also find a reduction in the presence of children under the age of five. These results suggest that the increase in labor supply could be driven by a shift in preferences toward career over family.

While overall these findings are inconclusive, they suggest that Chinese immigrant inflows increase exposure to women inventors, which may encourage greater investment in innovation careers among U.S.-born women. The absence of changes in hours or weeks worked suggests that

the key mechanism comes from family structure: women are having fewer children and so might be able to exert more effort on-the-job. This is consistent with peer-based or role model effects as well as the possibility that women are given better opportunities by their managers or peers, as outlined in Section 2.

7. Conclusions

This paper examines whether an increase in the number of women in a local labor market who are likely to patent influences the patenting behavior of other women. Specifically, we exploit a plausibly exogenous inflow of college-educated immigrants from China—a country with high female representation among inventors—to study its impact on patenting by U.S. non-Chinese women. Our findings indicate that such inflows lead to a rise in the number of patents with at least one U.S. non-Chinese female inventor, even after holding constant the overall level of patenting. The effect is mainly concentrated in the Drugs and Medical technology category that has a relatively high share of women inventors. Although our patenting data do not contain information on work hours or wages, supplemental analysis using Census and ACS data reveals that U.S.-born women in inventor occupations respond to Chinese immigrant inflows by having fewer children, and they generally have higher wages.

Taken together, our findings provide compelling evidence that Chinese women inventors do not act as substitutes for non-Chinese U.S. women in patenting, as might be expected if firms were simply filling implicit gender quotas. Unfortunately, without firm-level data on teams and managers, it is difficult to pin down mechanisms driving our results; several mechanisms could explain the patterns we observe. One possibility is that experienced Chinese women inventors serve as mentors or role models, encouraging non-Chinese U.S. women to invest in their careers

as inventors. Alternatively, the presence of more women on inventor teams may improve workplace dynamics. When women feel more supported within their teams, they are likely to invest more in their projects. From the demand side, exposure to high-performing Chinese female inventors may shift perceptions among (predominantly male) managers and colleagues, leading to greater inclusion of non-Chinese U.S. women on high-potential projects. We leave to future research the task of identifying which of these potential mechanisms drive these findings.

Innovation drives economic growth, improves living standards, and helps address pressing global challenges—from climate change to public health. Regardless of the precise mechanisms at play, any barriers that limit women's participation in innovation are likely to reduce the overall volume and diversity of innovations—particularly in fields that disproportionately affect or interest women. Understanding the sources of these barriers is a critical first step toward designing policies that promote more equitable access to innovation-oriented careers, not only for women but for other underrepresented groups as well.

8. References

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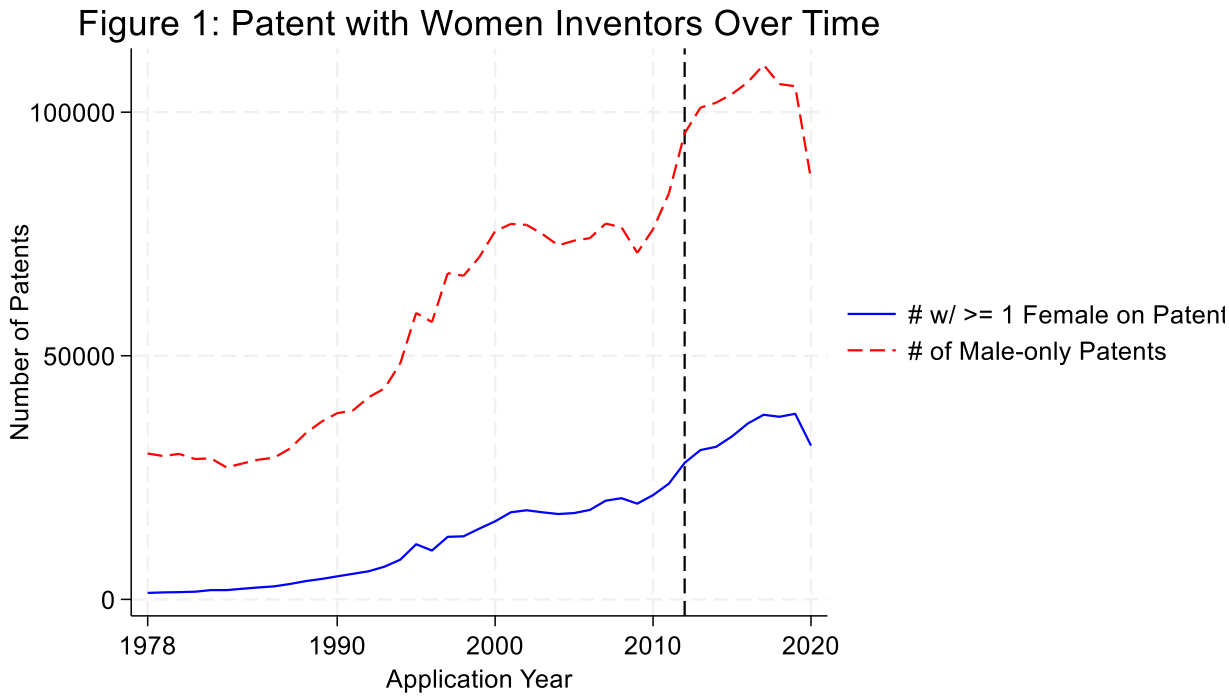
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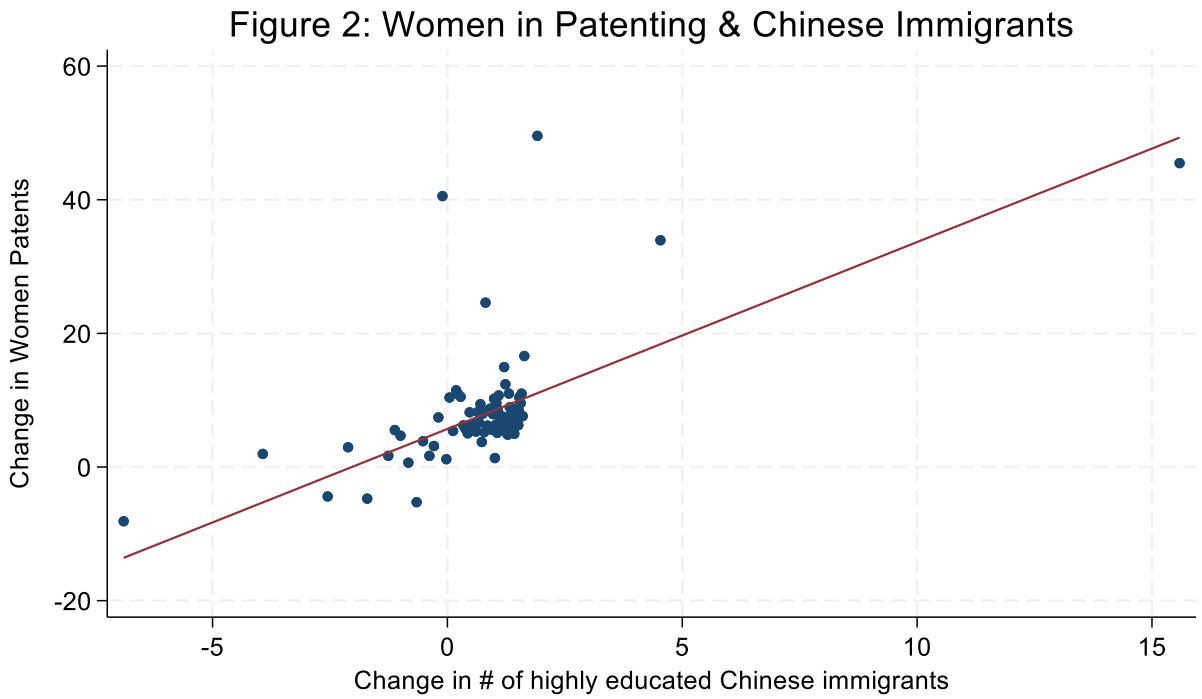
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9. Figures

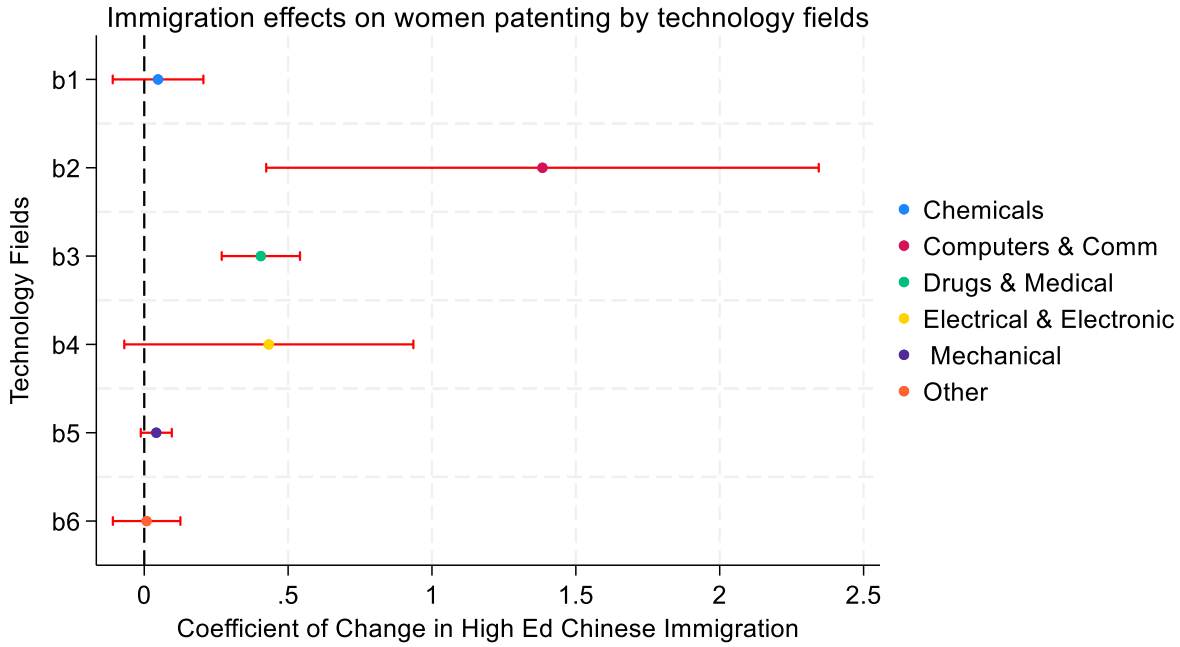


Note: PatentView annualized data of granted USPTO patents between 1976-2023. We restricted the data to patents with US assignees and application years in 1978-2020. Data includes approximately 3.37 million patents.



Notes: Using our estimation datasets with 10,292 county by year observations from 1990-2020. Each year observation captures changes from the previous decade. Binned scatterplot, with baseline controls year, population and change in the number of males-only patents.

Figure 3:



Note: Figure uses our estimation dataset, each bar represents the coefficient of interest – capturing the effect of the change in the number of high educated Chinese immigrants on the change in the number of patents with at least one non-Chinese U.S. inventor. Estimates are from six separate regression stratifying the sample by technology classifications.

10. Tables

Table 1: Descriptive Data for Top Ten Countries Patenting in The USPTO

	1	2	3	4	5	6	7
Country	# Patents with Assignees from Country /1000	Share Female Among Inventors With Assignee From Country	Average Population in US / 1000	Average College-Educated Population in the US /1000	Average Decade Growth in College-Educated /1000	Share Female in STEM Occupation	Share Female in Male-Dominated STEM Occupation
United States	**3953**	**0.10**	**381544**	**57141**	**16967**	**0.21**	**0.18**
China	**208**	**0.26**	**1254**	**487**	**255**	**0.30**	**0.26**
Republic of Korea	346	0.25	869	324	142	0.23	0.20
Taiwan	216	0.22	317	187	68	0.25	0.21
France	173	0.12	234	86	31	0.24	0.19
Canada	115	0.09	1250	340	108	0.21	0.17
Switzerland	104	0.09	57	21	5	0.17	0.13
United Kingdom	129	0.08	612	150	30	0.15	0.13
Germany	442	0.06	1554	369	142	0.24	0.19
Japan	1447	0.06	571	178	57	0.18	0.16

Note: Columns (1) and (2) were generated from PatentView data of USPTO patents with grant years 1976 to 2023. We include top ten patenting countries in the US. In column (1) we count inventors with assignees from the country and in column (2) we show the share of inventors from the country who are female. Column (3). Columns 4-7 use averages from our Census data of 1980-2020.

Table 2: Descriptive Statistics of U.S. Patent-Inventors by "Ethnicity" / Origin

Inferred Ethnicity or Country of Origin	Share US Patent-Inventors with Ethnicity	Share Female by Ethnicity Among US Inventors	Share US Inventors Who Are Female and With Ethnicity
Chinese	0.09	0.25	0.022
Korean	0.01	0.22	0.002
Vietnamese	0.01	0.17	0.001
Indian	0.08	0.15	0.012
Japanese	0.01	0.15	0.001
Hispanic	0.04	0.13	0.005
Russian	0.03	0.12	0.003
Unknown or ambiguous	0.11	0.12	0.014
English	0.52	0.10	0.050
European	0.11	0.10	0.011

Note: Table created using 8,289,852 observations of inventor by patent from the PatentView 1976-2023 data that contains name-based gender attribution, merged with Kerr's (2008, 2024) name-based ethnicity dataset. Inventors were counted repeatedly each time they patent.

Table 3: Summary Statistics of Main Variables

	All		High Imm		Low Imm	
	mean	sd	mean	sd	mean	sd
Δ Patents with Non-Chinese Female /100K	5.94	74.48	8.91	53.64	2.98	90.55
Δ # Female Inventors on Patents /100K	7.71	94.62	11.36	66.40	4.05	116.06
Δ Female First Inventor Patents /100K	2.07	28.57	3.18	21.39	0.95	34.25
Δ College-educated Chinese immigrants	0.87	3.74	1.77	5.13	-0.03	0.09
Δ Chinese immigrants	1.75	7.89	3.49	10.88	0.01	0.18
Δ College-educated female Chinese immigrants	0.48	2.09	0.96	2.87	-0.01	0.07
Δ Male-Only Patents /100K	17	300	27	223	7	361
Population/1000	691	1385	1198	1806	184	251
Unemployment Rate	0.07	0.03	0.07	0.03	0.07	0.03
Female Labor Force Participation	0.54	0.07	0.56	0.06	0.52	0.07
Average Female Age	34.07	3.08	33.70	2.97	34.43	3.15
Observations	10292		5145		5147	

Note: Using our estimation dataset with decade years 1990-2010. The full sample is used for the first two columns, the sample with above median immigration changes for the next two, and the sample for below median immigration changes for the last two columns.

Table 4: College-Educated Chinese Immigration Flows and Women Patenting

Outcome: Δ in number of patents with at least one woman inventor

	(1)	(2)	(3)	(4)
	OLS	OLS + Controls	IV	IV + Controls
Δ in # of College-Educated Chinese Immigrants	1.899***	1.894***	1.930***	1.929***
	(0.511)	(0.514)	(0.270)	(0.279)
Δ in # of Male Patents per 100K	0.191***	0.191***	0.191***	0.191***
	(0.038)	(0.038)	(0.038)	(0.038)
Lag Population	-0.000**	-0.000**	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Lag Unemployment Rate		-23.045		-22.730
		(41.443)		(40.931)
Lag Female Labor Force Participation		12.586		12.741
		(10.999)		(11.346)
Lag Mean Age of U.S.-Born Females		0.314		0.314
		(0.361)		(0.361)
Constant	2.571***	-13.302		
	(0.744)	(8.605)		
Observations	10,292	10,292	10,292	10,292
R-squared	0.602	0.602	0.601	0.601
Mean dependent				5.940
Mean Δ in immigration var				0.871
Panel B (First stage): y= Δ in # of College-Educated Chinese Immigrants				
Instrumental variable for y			0.349***	0.349***
			(0.076)	(0.076)
F statistics for testing the instrument			21.27	21.20

Notes: Using our main estimation sample with decade years 1990-2020. First two columns report estimates of an OLS column, and the next two instrumental variable models. All models include year fixed effects and cluster standard errors by commuting zone in parentheses. Panel B shows results of the first stage corresponding to the models in columns (3) and (4).The instrumental variable is the predicted change in the number of college-educated Chinese immigrants.

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Alternative Immigration Measures and Women Patenting

Outcome: Δ in number of patents with at least one woman inventor

	Change in Chinese immigration		
	(1)	(2)	(3)
VARIABLES	All Chinese	College-Educated Chinese	College-Educated Female Chinese
Δ in # of Chinese Immigrants	0.688***	1.929***	3.315***
	(0.173)	(0.279)	(0.400)
Δ in # of Male Patents per 100K	0.191***	0.191***	0.191***
	(0.038)	(0.038)	(0.038)
Observations	10,292	10,292	10,292
R-squared	0.599	0.601	0.601
mean dependent	5.940	5.940	5.940
mean immigration variable	1.753	0.871	0.475
F-stat	55.73	21.20	35.32

Notes: Same models as in Table 4 column (4), using two more measures of change in immigration. (1) Change in the number of Chinese immigrants; (2) repeat our main model using the change in # of College-Educated Chinese Immigrants; (3) Change in # of College-Educated Female Chinese Immigrants.

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Robustness Test: Controlling for All Immigrant Inflows or Technology

Outcome: Δ in number of patents with at least one woman inventor	(1) Main model	(2) Add Δ in College-Educated Immigrants	(3) Add County's Share of Patents in Technology Fields
Δ in # of College Educated Chinese Immigrants	1.929***	1.939***	1.831***
	(0.279)	(0.401)	(0.392)
Δ in # of Male Patents per 100K	0.191***	0.191***	0.191***
	(0.038)	(0.038)	(0.038)
Δ in College Educated Immigrants (IV)		-0.001	-0.000***
		(0.040)	(0.000)
Lag County's Share "Chemicals"			10.079**
			(4.891)
Lag County's Share "Computers and Communications"			13.614***
			(4.293)
Lag County's Share "Drugs and Medical"			6.834***
			(2.625)
Lag County's Share "Electrical and Electronic"			6.883***
			(2.122)
Lag County's Share "Mechanical"			0.778
			(0.823)
Lag County's Share "Other"			0.759
			(0.850)
Observations	10,292	10,292	10,292
R-squared	0.601	0.601	0.602
F	21.20	103.3	21.07

Notes: In the first column we repeat the model from Table 4 column (4). As robustness tests, in column (2) we add the predicted change in the number of high educated from any country as a control. In column (3) we add the share of patents from each category in the county. Standard errors are clustered at the commuting zone level (in parentheses).
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Other measures of women patenting

	(1)	(2)
	Δ in # of Female-Patent Inventors	Δ in # of Patents With a Female First Inventor
Δ in # of College-Educated Chinese Immigrants	2.821***	0.593***
	(0.365)	(0.101)
Δ in # of Male Patents per 100K	0.228***	0.071***
	(0.046)	(0.015)
Observations	10,292	10,292
R-squared	0.535	0.557
Mean dep	7.706	7.706
F-statistic	21.20	21.20

Notes: Repeat our main model from Table 4 column (4) for two other dependent variables. In column (1) the dependent variable is the number of women-patent inventors. In column (2) the dependent variable is the change in patents with a non-Chinese US women inventor. Models include year fixed effects and controls. Standard errors are clustered by commuting zone (in parentheses).

Table 8: Labor Market Outcomes for US-Women in Inventor Occupations

	(1)	(2)	(3)	(4)	(5)
	Δ in Log Wage of non-Chinese Female "Inventors"	Δ in Average Weeks Worked for non-Chinese Women "Inventors"	Δ in Average Hours for non-Chinese "Inventor" Women	Δ in Probability of Long Hours for non-Chinese "Inventor" Women	Δ in Share of non-Chinese Women in "Inventor" Occupations
Δ in # of College-Educated Chinese Immigrants	0.003**	0.109	0.046	0.001	-0.000
	(0.001)	(0.067)	(0.030)	(0.001)	(0.000)
Δ in Log Wage of non-Chinese Male "Inventors"	0.103***				
	(0.040)				
Δ in Average Weeks Worked for non-Chinese Men "Inventors"		0.105*			
		(0.060)			
Δ in Average Hours for non-Chinese "Inventor" Men			0.277***		
			(0.069)		
Δ in Probability of Long Hours for non-Chinese "Inventor" Men				0.155***	
				(0.045)	
Δ in Share of non-Chinese Men in "Inventor" Occupations					0.130***
					(0.016)
Observations	2,909	2,932	2,917	2,917	2,964
R-squared	0.005	0.007	0.028	0.018	0.111
F	20.31	20.31	20.30	20.30	20.26

Notes: Repeat our main model from Table 4 column (4), but controls for respective male outcomes instead of male-only patents. Includes the same controls as our baseline model. Models include year fixed effects and standard errors are clustered by commuting zone (in parenthesis).

Table 9: Family Outcomes for US-Women in Inventor Occupations

	(1) Δ in the Probability non-Chinese US Women are Married	(2) Δ in the Probability non-Chinese US Have Children Under Age of 5	(3) Δ in the # of Children Under 5 non-Chinese US Women Have
Δ in # of College-Educated Chinese Immigrants	0.001***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
Observations	2,964	2,964	2,964
R-squared	0.080	0.118	0.136
F	20.34	20.34	20.34

Notes: Repeat our main model from Table 4 column (4), but does not control for male-only patents. Includes the same controls as our baseline model. Models include year fixed effects and standard errors are clustered by commuting zone (in parenthesis).

11. Appendix Tables

Table A1: Heterogeneous Immigration Effects by Technology Fields

	(1)	(2)	(3)	(4)	(5)	(6)
	Chemicals	Computers and Comm.	Drugs and Medical	Electrical and Electronic	Mechan.	Other
Δ in # of College-Educated Chinese Immigrants	0.048	1.384***	0.405***	0.433*	0.042	0.008
	(0.080)	(0.489)	(0.069)	(0.256)	(0.027)	(0.060)
Δ in Male-Only Patents in Category	0.402***	0.247***	0.462***	0.193***	0.148***	0.166***
	(0.052)	(0.061)	(0.032)	(0.041)	(0.018)	(0.037)
Lag Population	0.000	-0.000	-0.000*	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lag Unemployment Rate	-10.638	5.645	-4.685	-0.771	-4.404	-9.755
	(15.503)	(9.507)	(9.518)	(4.479)	(8.521)	(10.919)
Lag Female Labor Force Participation	0.561	0.073	6.665**	1.002	1.175	-0.065
	(2.839)	(7.166)	(2.785)	(2.989)	(1.225)	(2.691)
Lag Mean Age of U.S.-Born Females	0.168	-0.202*	0.074	-0.068	0.073	0.019
	(0.106)	(0.110)	(0.098)	(0.059)	(0.046)	(0.060)
Observations	10,292	10,292	10,292	10,292	10,292	10,292
R-squared	0.618	0.552	0.767	0.639	0.421	0.447
Mean of Dep Var	0.886	2.302	1.483	1.057	0.605	0.934
F-statistic	21.14	21.19	21.15	21.17	21.16	21.15

Notes: We estimate similar models to the last column of Table 4 column (4) but use changes in patents in specific technology fields. Standard errors in parentheses are clustered by commuting zones. *** p<0.01, ** p<0.05, * p<0.1