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ABSTRACT

This paper studies the impact that immigrant innovators have on the global activities of U.S. firms by analyzing detailed data on patent applications and on the operations of the foreign affiliates of U.S. multinational firms. The results indicate that increases in the share of a firm's innovation performed by inventors of a particular ethnicity are associated with increases in the share of that firm's affiliate activity in their native countries. Ethnic innovators also appear to facilitate the disintegration of innovative activity across borders and to allow U.S. multinationals to form new affiliates abroad without the support of local joint venture partners. Thus, this paper points out that immigration can enhance the competitiveness of multinational firms.

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1 Introduction

Immigrants to the U.S. play a particularly prominent role in science and engineering communities. In the 2000 Census of Populations, immigrants constituted 25% and 48% of the U.S. workforce employed in science and engineering occupations with bachelor's and doctorate educations, respectively. Moreover, immigrants account for most of the recent growth in U.S. scientists and engineers. This paper analyzes the impact these individuals have had on the global operations of U.S. firms by addressing three main questions. First, to what extent do U.S. based innovators of a particular ethnicity enhance the competitiveness of U.S. multinational firms in countries associated with that ethnicity? Second, how do these immigrants influence the global distribution of the multinational's research and development (R&D) and patenting efforts? Finally, are U.S. multinationals that employ innovators of a particular ethnicity less dependent on joint venture partners when forming new affiliates in countries associated with that ethnicity?

High-skilled immigrants are likely to have several attributes that could help U.S. multinationals capitalize on foreign opportunities. Beyond language skills, well-educated immigrants typically possess specialized knowledge about how to conduct business in their home countries. They are likely to have a strong understanding of customer behavior there and to have insights about what kinds of products would succeed. Furthermore, high-skilled immigrants often also have relationships and are part of networks that can facilitate foreign market access. In order to study these effects of skilled immigrants, it is particularly useful to work with data that links individuals of particular ethnicities to specific firms.

Such data are drawn from a variety of sources. In order to characterize the immigrant science and engineering workforce of firms, the analysis uses a measure based on one type of their output, namely patents. More specifically, the analysis uses detailed filings from the U.S. Patent and Trademark Office for all patents granted from 1975-2008. These filings include the names of the inventors of each patent, their employer, and their location. In order to the measure the degree to which innovative activity is performed by individuals from each of nine ethnic groups, procedures that make use of commercial databases of ethnic names assign probable ethnicities to innovators. For example, innovators with the surnames Ming or Yu are assigned a high probability of being of Chinese ethnicity, while innovators with the surnames Agrawal or Banerjee are assigned a high probability of being of Indian ethnicity.

In order to conduct tests of the relation between ethnic innovation and multinational firm activity, the analysis links data on inventors to data on the activities of U.S. multinational firms captured in the 1982, 1989, 1994, 1999, and 2004 Survey of U.S. Direct Investment Abroad conducted by the Bureau of Economic Analysis (BEA). These data include measures of the activity of each of the foreign subsidiaries of multinationals with a U.S. parent, including measures of assets, sales, employment, and employment compensation. The BEA data also contain information on where multinationals perform R&D and measures of the ownership structure of foreign affiliates.

Tests that analyze panel data of parent-ethnicity observations reveal that increases in the share of innovation performed by individuals of a certain ethnicity are associated with increases in the share of multinational affiliate activity in their native countries. These tests include parent-ethnicity fixed effects so that responses are measured off of time series variation in the role played by innovators of a specific ethnicity at a specific firm, and they include a fixed effect for each ethnicity-year to control for trends in the growth of distinct ethnicities. The results of these tests are particularly pronounced for firms that are likely to place high value on ethnic innovators in the sense that these firms are beginning to perform innovative activity in the home countries of the innovators.

The results also do not seem to merely capture the possibility that decisions to employ innovators of a certain ethnicity and to expand in countries associated with that ethnicity are jointly determined. Measures of the share of ethnic innovation reflect shares in the years preceding the measures of affiliate activity. Furthermore, results hold in specifications that use a measure of the predicted extent of ethnic innovation that is computed based on a firm's initial level of ethnic innovation across U.S. cities and the subsequent growth in ethnic innovation by city. This approach is similar to the supply-push immigration framework of Card (2001). Taken together, the results on the relation between the share of innovation performed by an ethnicity and the share of multinational firm activity in the home countries of that ethnicity indicate that immigration enhances the competitiveness of U.S. multinationals. The knowledge and cultural sensitivities of these innovators thus appear to be valuable in helping multinationals unlock key factors to succeeding in these markets.

The data allow for exploration of where U.S. firms conduct R&D and of the extent to which U.S. based innovators team up with foreign innovators to generate patents. Linear probability specifications that control for parent-ethnicity and ethnicity-year fixed effects illustrate that firms with more patents generated by innovators of a particular ethnicity are more likely to conduct R&D in the countries associated with that ethnicity. Similar specifications also reveal that firms with more patents generated by U.S. based innovators of a particular ethnicity are more likely to collaborate with innovators based in countries associated with that ethnicity when generating patents. Thus, the paper shows that ethnic innovators facilitate the disintegration of innovative activity within multinational firms across countries.

Analysis of new affiliates reveals that U.S. multinationals are able to own larger shares of new entities in countries that are home to firms' ethnic innovators. Linear probability specifications that include parent-year fixed effects indicate that higher levels of patenting activity by inventors of a particular ethnicity are associated with higher propensities to form new affiliates as wholly owned or majority owned entities. Previous work indicates that one motivation for the use of joint ventures is to gain access to a local partner who can provide information about local demand and customs.[1] The findings in this paper suggest that the input of ethnic innovators makes the input of local partners less valuable and lowers entry barriers to foreign countries.

These findings contribute to several literatures by illustrating the role firms play in linking immigration, foreign direct investment (FDI), and knowledge diffusion. A significant body of research documents the effects of immigration on other forms of international economic inter-

[1] See, for example, Balakrishnan and Koza (1993) and Desai, Foley, and Hines (2004).

action.[2] Ethnic networks have been shown to play important roles in promoting international trade, investment, and cross-border financing activity, with recent work particularly emphasizing the role of educated or skilled immigrants.[3] Much of this work uses aggregated data and cross-sectional techniques, so the panel analysis of firm-level data in this paper complements it and identifies key mechanisms in these linkages.

Recent work also considers the possibility that social and ethnic ties facilitate transfers of technology.[4] Individuals who are geographically mobile appear to play a significant role in these kinds of transfers.[5] Because this paper's findings illustrate a mechanism by which knowledge is transferred globally, it also adds to research on the role multinational firms play in the international diffusion of knowledge.[6] Finally, the results inform a growing body of work that analyzes firm decisions about whether to locate innovative activity in a single place or in multiple locations.[7]

The remainder of this paper is organized as follows. Section 2 provides details about the data. Section 3 includes three parts; the first describes the analysis of how U.S. based ethnic innovation shapes the share of a multinational's activity in countries associated with that ethnicity. The second part describes the analysis of the extent to which ethnic innovators facilitate the disintegration of innovative activity across borders. The third part presents the examination of whether firms that employ innovators of a certain ethnicity are less likely to use joint ventures when they form new affiliates in countries associated with that ethnicity. Section 4 concludes.

[2] Rauch (2001) reviews papers on the economic impact of ethnic networks, and Saxenian, Motoyama, and Quan (2002) provide survey evidence on the cross-border linkages of science and engineering immigrants in particular.

[3] Papers in this literature include Saxenian (2002, 2006), Arora and Gambardella (2005), Buch, Kleinert, and Toubal (2006), Kugler and Rapoport (2007, 2011), Bhattacharya and Groznik (2008), Docquier and Lodigiani (2010), Huang, Jin, and Qian (2010), Iriyama, Li, and Madhavan (2010), Hernandez (2011), and Javorcik et al. (2011). Related work on trade includes Gould (1994), Head and Ries (1998), Rauch (1999), Rauch and Trindade (2002), Kerr (2009), and Rangan and Sengul (2009). Clemens (2009) and Docquier and Rapoport (2011) provide broader reviews.

[4] Examples of this work include Agrawal, Cockburn, and McHale (2006), MacGarvie (2006), Oettl and Agrawal (2008), Kerr (2008), Papageorgiou and Spilimbergo (2008), and Agrawal et al. (2011).

[5] For evidence of this point, see Almeida and Kogut (1999), Rosenkopf and Almeida (2003), Nanda and Khanna (2010), Choudhury (2010), and Hovhannisyan and Keller (2010).

[6] Papers on this topic include Keller (2004), Veugelers and Cassiman (2004), Singh (2004, 2005, 2007), MacGarvie (2005), Branstetter (2006), Alcacer and Chung (2007), and Nachum, Zaheer, and Gross (2008).

[7] Recent work on this topic includes Zhao (2006), Singh (2008), Alcacer and Zhao (2011), and Zhao and Islam (2011).

2 Data

This section describes the data employed, starting with the ethnic patenting data developed for U.S. multinational firms. The second part describes the BEA data on the foreign operations of these firms and the merger of the two data sources.

2.1 Data on Ethnic Innovators

Measures of the ethnicity of innovators employed at U.S. multinational firms are created on the basis of data on each patent granted by the United States Patent and Trademark Office between January 1975 and May 2008. Hall, Jaffe, and Trajtenberg (2001) provide extensive details about these data, and Griliches (1990) surveys the use of patents as economic indicators of technological advancement. Each patent lists at least one and often several inventors and includes information on the location and employer of each inventor. These data are extensive, containing over eight million inventors and four million granted patents during the sample period. Much of the analysis below considers the impact of U.S. based innovators, and inventors are classified as being based in the U.S. if they are located in a U.S. city. Although the data are selected using a screen related to the date of patent grants, the date of patent applications is used to identify the timing of innovative activity.

The immigration status of inventors is not listed on patents, but it is possible to determine their probable ethnicity through their names. The matching approach exploits the fact that people with particular first names and surnames are likely to be of a certain ethnicity and makes use of two databases of ethnic names. The first was developed by the Melissa Data Corporation for use in direct-mail advertisements and the second by LSDI, also for marketing purposes. The process affords the distinction of nine ethnicities: Anglo-Saxon, Chinese, European, Hispanic, Indian, Japanese, Korean, Russian, and Vietnamese. When there is more than one inventor associated with a patent, each individual is given an ethnicity assignment and then these are averaged. The name match rate is 99%. Kerr (2007, 2010) provides details on the matching process, lists frequent ethnic names, and provides multiple descriptive statistics and quality assurance exercises.

Table 1 displays the share of U.S. based innovation performed by ethnic innovators working at public companies over the time periods that are analyzed in more detail in Section 3. The Anglo-Saxon ethnic share declines from 81% of U.S. domestic patents for public firms in the 1975-1982 period to 68% in the 2000-2004 period. This declining share is primarily due to the growth in innovation among Chinese and Indian ethnicities, which increase from under 3% to 10% and 7%, respectively. The data also indicate that ethnic inventors are more concentrated in high-tech industries than in other industries and that this gap has widened substantially over the past three decades. Furthermore, while ethnic innovation was particularly prevalent in pharmaceuticals and chemicals industries in the 1970s, ethnic contributions to innovation in computers and electronics industries were particularly prevalent in the 2000s.

The tests below exploit variation within firms in the share of innovation performed by inventors of a certain ethnicity and control for ethnicity-year fixed effects. Therefore, the tests depend on there being variation in evolution of ethnic innovation across firms. Figure 1, which is constructed from the patent database, illustrates that such heterogeneity exists among seven large U.S. firms that report earning foreign income in Compustat.[8] Each line plots the share of U.S. based innovation that is attributed to Chinese and Indian innovators for one of seven large firms. As indicated, there is substantial variation in the levels and changes of the share of innovation performed by Chinese and Indian inventors across firms.

The analysis described below uses data on ethnic innovation aggregated to the firm-ethnicity-year level. The analysis calls for measures of ethnic innovation that precede the measures of the outcomes of interest. Therefore, levels and shares of innovation performed by each ethnicity for each firm are calculated for each time period listed in Table 1. The years associated with each period relate to the timing of patent applications. On average, slightly more than 50 patents per firm and time period are used to calculate these relative ethnic contributions.

[8] In order to protect the confidentiality of the BEA data, to which the patent data are linked, the names of these firms are not identified.

2.2 Data on U.S. Multinational Firm Activity

Data on the activities of U.S. multinational firms are drawn from the Survey of U.S. Direct Investment Abroad conducted by the Bureau of Economic Analysis. U.S. direct investment abroad is defined as the direct or indirect ownership or control by a single U.S. legal entity of at least 10% of the voting securities of an incorporated foreign business enterprise or the equivalent interest in an unincorporated foreign business enterprise. A U.S. multinational firm includes the U.S. legal entity that has made the direct investment, called the U.S. parent, and at least one foreign business enterprise, called a foreign affiliate.[9] The sample includes records drawn from the 1982, 1989, 1994, 1999, and 2004 benchmark surveys. These surveys capture financial and operating data for each foreign affiliate of each U.S. multinational, so it is possible to create a panel of data on the assets, sales, employment, and employment compensation for each firm in each country. The BEA data also include information on the parent's ownership share of each affiliate, as well as the amount affiliates spend on R&D.

A number of steps were taken to link the data on U.S. multinationals with the data on ethnic innovators. Data on the CUSIPs of employers of ethnic innovators were taken from the NBER Patent Citations Data File and have been manually updated to assign patents to subsidiaries of major corporations and to account for major mergers and acquisitions.[10] These CUSIPs were matched with Employment Identification Numbers (EINs) from Compustat. The BEA data include EINs, and an automated merge was performed on the basis of these. Automated matches were manually confirmed and augmented with a visual comparison of firm names. One notable consequence of this process is that the matched sample only includes publicly listed firms because CUSIPs are used as the starting point.

Much of the analysis below also aggregates the data on U.S. multinational firm activity to the firm-ethnicity-year level. This requires relating ethnicities to countries. There is a one-to-one mapping of ethnicity and country for five cases. Chinese, European, and Hispanic ethnicities each

[9] As a result of confidentiality assurances and penalties for noncompliance, BEA believes that survey coverage is close to complete and levels of accuracy are high. Mataloni (1995) and Mataloni and Yorgason (2002) provide further details on these FDI data.

[10] Debbie Strumsky and Bill Lincoln performed portions of this update.

relate to more than one country. Chinese economies include Mainland China, Hong Kong, Macao, Singapore, and Taiwan. European economies include Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Netherlands, Norway, Poland, Sweden, and Switzerland. Hispanic economies include Argentina, Belize, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Philippines, Portugal, Spain, Uruguay, and Venezuela.

The final sample has several limitations, but it offers broad coverage of U.S. multinational activity nonetheless. The firms only include publicly listed entities that have been granted patents during the sample period and have a foreign affiliate. Anglo-Saxon innovators and multinational activity in Anglo-Saxon countries are removed from the sample because such innovators are less likely to be recent immigrants and to have distinctive ties to countries associated with their ethnicity. Although it is not possible to identify ethnic names associated with many countries like Thailand or Saudi Arabia, the aggregated data cover 45 foreign countries. The final sample includes 641 firms which account for more than two-thirds of aggregate foreign affiliate sales in each of the locations associated with non-Anglo Saxon ethnicities in each benchmark year. Furthermore, these shares are higher in industries that intensively employ patenting. Table 2 presents descriptive statistics for the variables used in the analysis below.

3 Empirical Tests and Results

This section describes the empirical tests and presents the results. It contains three subsections. The first presents analyses of the relation between the share of innovation performed by a particular ethnicity and the share of multinational affiliate activity that occurs in countries associated with that ethnicity. The second, which includes two parts, explores the association between ethnic innovation and the amount and location of innovative activity that U.S. multinationals perform outside of the U.S. The third describes tests of whether U.S. multinationals own larger shares of affiliates in countries that are home to firms' ethnic innovators.

3.1 Ethnic Innovation and Shares of Multinational Affiliate Activity

One of the questions this paper seeks to address is whether U.S. based innovators of a particular ethnicity enhance the competitiveness of U.S. multinational firms in countries associated with that ethnicity. Several tests shed light on this question by examining the relationship between the share of innovation performed in the U.S. by a certain ethnicity and the subsequent share of affiliate activity that occurs in the countries of origin of those inventors. The basic estimating equation takes the following form:

$$MNE\%_{fet} = \phi_{fe} + \eta_{et} + \beta \cdot EI\%_{fet} + \epsilon_{fet}. \tag{1}$$

The observations employed in this test relate to a particular firm for a particular ethnicity in a particular year. $MNE\%_{fet}$ is a measure of the share of firm f's foreign activity that occurs in countries associated with ethnicity e in benchmark survey year t. Four measures of this share are calculated using data on foreign affiliate assets, sales, employment, and employment compensation. $EI\%_{fet}$ measures the share of U.S. based innovation performed by individuals of ethnicity e in the period leading up to benchmark survey year t. These periods span seven years for the 1982 and 1989 benchmark years and five years for the 1994, 1999, and 2004 benchmark years. ϕ_{fe} and η_{et} are vectors of firm-ethnicity and ethnicity-year fixed effects. Standard errors are clustered by ethnicity-year.

Several features of this specification are noteworthy. The firm-ethnicity fixed effects remove time invariant differences in the extent to which firms invest in countries associated with a particular ethnicity and employ innovators of a particular ethnicity. The β parameter is therefore identified off of changes in these firm characteristics over the sample period. A potential concern is that there appear to be secular trends in the shares of innovation performed by certain ethnicities, as indicated in Table 1, and these might coincide with secular trends in the growth of affiliate activity. Including ethnicity-year fixed effects addresses this concern. Finally, firm specific changes in the scale of activity could generate coincident changes in the levels of ethnic innovation and multinational affiliate activity. Measuring the extent of ethnic innovation and the location of multinational affiliate activity using shares, as opposed to levels, addresses this concern.

Table 3 presents results of tests using specification (1). The dependent variable in the first column is the share of affiliate assets in countries associated with a particular ethnicity. The 0.1008 coefficient in column 1 is statistically significant and implies that a one standard deviation increase in the share of innovation by individuals of a particular ethnicity is associated with a 2.3 percentage point increase in the share of multinational affiliate activity in the native countries of the innovators. Consistent results are obtained for other measures of the distribution of affiliate activity that are computed using data on sales, employment, and employment compensation, as indicated in columns 2-4. Because the estimates that appear in columns 3 and 4 are of a similar magnitude, the results suggest that changes in the share of ethnic innovation are not associated with changes in the wage structures of foreign operations.

These basic results are robust to a variety of checks. They do not depend on the inclusion of any particular ethnicity; the results hold dropping each of the ethnicities. They also do not appear to be a consequence of activity in particular industries where patenting is especially prevalent. Removing firms that are primarily engaged in the production of pharmaceuticals or other chemicals; audio, video and communication equipment; or computer and office equipment does not overturn the results. The measured relationships also do not seem to be driven by the recent rapid growth in innovative activity by individuals of Chinese or Indian ethnicity; removing observations related to the 2004 benchmark survey does not affect the results.

The findings in Table 3 suggest that innovation by individuals of a particular ethnicity enhances the competitiveness of U.S. multinationals in countries associated with that ethnicity. If this interpretation is correct, one would expect U.S. based ethnic innovation to have particularly large effects when firms are also beginning to engage in innovative activity in countries associated with an ethnicity. U.S. based ethnic innovators could play a valuable role in facilitating cooperation between innovators working in different locations and in identifying products and services that could be developed further abroad to meet local demands. In order to identify such situations, it is possible to use the patent data described above to isolate firm-ethnicities for which: 1) the firms had previously applied for patents for innovations of U.S. based inventors and 2) subsequently applied for patents for innovations involving inventors located in countries of a particular ethnicity. This sample is labeled the sample of new foreign innovators.

Table 4 presents the results of running specification (1) on two subsamples, the sample of new foreign innovators and other observations. The top panel presents results for the new foreign innovator sample and the bottom panel for other observations. The 0.2155 coefficient on the Ethnic Share of U.S. Patents in the top panel is statistically significant and much larger than the 0.0551 insignificant coefficient on this variable in the bottom panel. A similar pattern holds across the panels for the specifications in columns 2-4. The results therefore indicate that the association between U.S. based ethnic innovation and multinational affiliate activity are more pronounced in situations where U.S. based ethnic innovations are arguably more valuable to the firms they work for.

An additional and perhaps more fundamental concern that can be raised about the results in Table 3 is that they may reflect omitted variable bias or reverse causality. In particular, firms might jointly make decisions about the use of ethnic innovators and about where to expand internationally. Alternatively, conducting FDI abroad may lead to identification of promising scientists and engineers that are then brought to the U.S. to work. It is therefore desirable to create an alternative measure of ethnic innovation that is more likely to exhibit exogenous variation.

One such measure can be computed using the patent data and is based on the initial distribution of ethnic innovation across U.S. cities for specific firms and the subsequent local growth of ethnic innovation. This framework is based on the supply-push work of Card (2001), which has also been applied in the immigration and patenting context by Hunt and Gauthier-Loiselle (2010) and Kerr and Lincoln (2010). The identification builds off the fact that immigrants of different ethnicities tend to agglomerate in certain cities and the fact that rates of immigration to the U.S. have differed across ethnicities. For example, many Chinese immigrants settle in

San Francisco, while many Hispanic immigrants settle in Miami. The immigration of Chinese scientists and engineers to the U.S. is therefore more likely to influence firms in San Francisco than firms in Miami.

More specifically, the Predicted Ethnic Share of U.S. Patents is computed by first calculating $ExpEI_{fet}$ as follows:

$$ExpEI_{fet} = \sum_c EI_{f,cet_0} \left(\frac{EI_{-f,cet_0}}{EI_{cet_0}} \cdot \frac{EI_{-f,cet}}{EI_{-f,cet_0}} + \frac{EI_{f,cet_0}}{EI_{cet_0}} \cdot \frac{EI_{-f,et}}{EI_{-f,et_0}} \right). \quad (2)$$

The first term in the expression following the summation captures the initial distribution of ethnic innovation for a firm. It is the count of patents applied for by firm f in which the inventor is based in city c and is of ethnicity e at time t_0, which is the first benchmark year the firm appears in the data. The analysis considers 281 cities defined as Metropolitan Statistical Areas, and Kerr (2010) lists major cities and their inventor shares.

The terms within the parentheses measure growth in patenting activity for firms other than firm f. Taking this approach increases the likelihood that this measure of ethnic innovation is exogenous. For cities in which a single firm is responsible for a large share of patenting activity, growth in local patenting by ethnicity for other firms can exhibit irregular properties. Therefore, the terms in parentheses calculate growth rates using a weighted average of city specific and national growth in ethnic patenting for other firms. The two weights are captured by $\frac{EI_{-f,cet_0}}{EI_{cet_0}}$ and $\frac{EI_{f,cet_0}}{EI_{cet_0}}$. These two weights sum to one, and the first is the share of the initial patent counts attributable to firms other than firm f, while the second is the share attributable to firm f. $\frac{EI_{-f,cet}}{EI_{-f,cet_0}}$ is the local growth in patent applications filed by firms other than firm f for patents in which the inventor is based in city c and is of ethnicity e in period t relative to t_0. $\frac{EI_{-f,et}}{EI_{-f,et_0}}$ is a similar measure of growth, but it is measured across all cities and is not city specific. As such, city specific growth gets more weight when a firm is responsible for a smaller share of total innovative activity in the city.

The Predicted Ethnic Share of U.S. Patents is equal to $ExpEI_{fet}$ scaled by the total number of patents firm f is expected to apply for in year t, and it is thus a predicted share for each ethnicity in each period. The predicted share for an individual ethnicity in firm f increases over the sample period if the initially observed ethnic innovation of the firm occurred in cities that subsequently experienced strong inflows of researchers of that ethnicity. The spatial distribution of each firm is held fixed at its initial level to avoid capturing firms expanding into new cities to take advantage of differential growth in innovation.

Table 5 presents the results of tests that make use of this alternative measure of ethnic innovation. As in the previous two tables, the specifications presented include firm-ethnicity and ethnicity-year fixed effects, and standard errors are clustered by ethnicity-year. It is noteworthy that the fixed effects absorb the impact of differences in the initial distribution of ethnic innovation for a firm as well as the aggregate immigration trends of different ethnicities. The identification therefore comes from differences in the extent to which firms were exposed to different growth in ethnic innovation across U.S. cities. The specification in the first column provides evidence that the Predicted Ethnic Share of U.S. Patents is positively correlated with the Ethnic Share of U.S. Patents. The 0.1917 coefficient on the Predicted Ethnic Share of U.S. Patents indicates that the two measures are closely related, but it is less than one, implying that factors besides growth in ethnic innovation across cities influence how inventor compositions evolve in large firms.

The dependent variables in the next four columns are the same ones considered in Table 3. The coefficients on Predicted Ethnic Share of U.S. Patents are positive in each of these specifications, and in three of the four specifications they have a similar or larger magnitude than the coefficients on the Ethnic Share of U.S. Patents reported in Table 3. The coefficients are statistically significant in columns 3 and 4. The findings indicate that changes in ethnic innovation related to plausibly exogenous changes in the growth of ethnic innovation across U.S. cities are associated with changes in the distribution of U.S. multinational affiliate sales and employment. Therefore, these results alleviate some concerns about the potential endogeneity of the Ethnic Share of U.S. Patents in Table 3. The tests are not perfect, as a forward looking manager might have located the firm's initial inventive facilities to attract innovators of a particular ethnicity in anticipation of foreign expansion, for example. Nevertheless, this approach does show the robustness of Table 3's results to several endogeneity concerns.

3.2 Ethnic Innovation and the Disintegration of Innovative Activity

Two pieces of analysis shed light on the role of ethnic innovators in breaking up innovative activities across borders. The first piece examines affiliate R&D activity, and the second piece considers the patenting of foreign innovations.

3.2.1 Affiliate R&D Activity

Although U.S. multinationals perform a large share of their R&D within the U.S., this share has been shrinking. According to the aggregate published BEA data, majority owned foreign affiliates performed 6.4% of U.S. multinational R&D in 1982, but this ratio was 13.6% in 2004. This globalization of R&D activities has received considerable recent attention in the academic literature.[11] While early foreign R&D efforts focused on refining products so they were suitable for foreign markets and on accessing foreign technologies, recent efforts also attempt to tap into the large supply of foreign scientists and engineers regardless of their knowledge of specific foreign technologies.[12] U.S. based ethnic innovators could be especially valuable in facilitating the disintegration of inventive activity across countries.

Linear probability specifications shed light on this possibility, and these take the following form:

$$R\&D_{fet} = \phi_{fe} + \eta_{et} + \beta \cdot \ln(EI_{fet}) + \epsilon_{fet}. \tag{3}$$

$R\&D_{fet}$ is a dummy variable equal to one if firm f conducts R&D in countries of ethnicity e in benchmark year t. Like specification (1), this specification includes firm-ethnicity and ethnicity-year fixed effects. Because the dependent variable does not measure the share of R&D performed in countries of a particular ethnicity but instead captures the extensive margin of R&D activity, the measure of ethnic innovation is not measured as a share either. $\ln(EI_{fet})$ is the log of the count of the number of patents a firm applies for in the period before the benchmark year for

[11] See, for example, Dalton et al. (1999), Freeman (2006), Zhao (2006), and Puga and Trefler (2010).

[12] Studies of these issues include Niosi (1999), von Zedtwitz and Gassmann (2002), Thursby and Thursby (2006), and National Science Foundation (2010).

which the inventor is of ethnicity e. One concern that could be raised about this approach is that $\ln(EI_{fet})$ might reflect something about the overall scale of parent activity. Growing firms might increase employment of ethnic innovators and be more likely to conduct R&D abroad. To address this possibility, tests include the log of parent R&D expenditures and the log of parent sales.

Table 6 presents the results. The 0.0192 coefficient in column 1 implies that a one standard deviation increase in the log of ethnic U.S. patents is associated with a 4.2 percentage point increase in the likelihood of conducting R&D in countries associated with that ethnicity. This effect is sizeable given that the mean likelihood that a firm conducts R&D in countries associated with a particular ethnicity is 48%, implying a relative increase of 9%. The specification in column 2 adds the log of parent R&D as a control. It attracts a positive and significant coefficient, implying that firms that conduct more R&D in the U.S. are more likely to conduct R&D abroad. The coefficient on the log of ethnic U.S. patents becomes somewhat smaller in this specification, but it remains statistically significant. The specification in column 3 also adds the log of parent sales, and the coefficient on the log of ethnic U.S. patents remains significant in this test as well.

Thus, the results in Table 6 indicate that U.S. based innovation by inventors of a certain ethnicity facilitate R&D activity in countries associated with that ethnicity. Further evidence of the manner in which ethnic innovators support the disintegration of inventive activity across borders comes from the analysis of patent data.

3.2.2 Patenting Foreign Inventions

If ethnic innovators promote meaningful foreign R&D, this activity should result in patents that list inventors located outside of the U.S. Specifications that take the following form consider this possibility:

$$ForeignPatent_{fet} = \phi_{fe} + \eta_{et} + \beta \cdot \ln(EI_{fet}) + \epsilon_{fet}. \tag{4}$$

$ForeignPatent_{fet}$ is a dummy equal to one if firm f applies for at least one patent in which at least one inventor is based in a country associated with ethnicity e in the period that precedes benchmark year t.[13] Other variables are defined as in specification (3). To account for potential scale effects, some tests further control for a firm's total patent applications from the U.S., excluding the focal ethnicity. This latter variable includes Anglo-Saxon contributions that comprise the majority of U.S. multinational innovation. The sample employed in this test differs from the samples used elsewhere. This sample is not restricted to firm-ethnicity observations where a foreign affiliate exists in the BEA data. Thus, the patent sample includes public U.S. firms that never conduct foreign operations, and it includes ethnicities within firms where domestic ethnic invention occurs but where foreign affiliate activity never occurs.

Results of running this specification appear in Table 7. In column 1, the log of ethnic U.S. patents has a positive and significant coefficient, implying that changes in innovation by inventors of a certain ethnicity are correlated with changes in the extent of innovative activity in countries associated with that ethnicity. The coefficient on the log of ethnic U.S. patents is smaller and only marginally significant when the specification conditions on the log of firm patents, as in column 2. A one standard deviation increase in the log of ethnic U.S. patents is associated with a 0.6% increase in the likelihood of a foreign patent in the region, a 14% relative increase from the baseline probability.

The specifications in the next two columns attempt to pinpoint more directly the mechanism by which ethnic inventors facilitate the disintegration of innovative activity across borders by analyzing two distinct types of patenting. The dependent variable used in column 3 is a dummy equal to one if firm f applies for at least one collaborative patent in which at least one inventor is based in a country associated with ethnicity e and another listed inventor is located in the U.S. The dependent variable used in column 4 is defined in a similar way, but it is equal to one only if there are no U.S. based co-inventors for a patent.

[13] One concern that could be raised about this analysis is that firms are not required to patent foreign innovations in the U.S. The inclusion of parent firm-ethnicity and ethnicity-year fixed effects alleviates this concern as the fixed effects control for any systematic differences in patenting propensities on either of these dimensions.

If U.S. based ethnic innovators support innovative activity abroad, one would expect to see a larger coefficient on the log of ethnic U.S. patents in the specification for collaborative patenting presented in column 3 than in the specification for non-collaborative patents presented in column 4. The results indicate that this is the case. A one standard deviation increase in the log of ethnic U.S. patents is associated with a 0.8% increase in the likelihood of a collaborative foreign patent in the region, a 28% relative increase from the baseline probability. This evidence on collaborative patenting highlights one way that U.S. based innovative workers can spur changes in foreign activity. Thus, the results of analysis of foreign patenting are consistent with the findings on affiliate R&D activity. They suggest that ethnic inventors in the U.S. promote innovation activity abroad. Furthermore, they indicate that such foreign innovative activity continues to require support of U.S. personnel.

3.3 Ethnic Innovations and Affiliate Ownership Structure

If innovators of a certain ethnicity facilitate the expansion of U.S. multinationals and innovative activity in countries associated with that ethnicity, they might also be associated with distinct ownership choices for new affiliates in those countries. Prior work on ownership structure highlights the role local partners play in providing U.S. multinationals valuable market information. This benefit of shared ownership is weighed against higher coordination costs when multinational firms make ownership choices. Innovators of a particular ethnicity might make local partners less valuable and allow multinationals to own larger shares of new affiliates in countries associated with that ethnicity. Ethnic innovators can often provide both codified and tacit knowledge that can substitute for the local expertise typically acquired through partnerships with local firms abroad. These informational advantages are often cited as a key advantage that diasporas confer.

Specifications that consider this possibility take the following form:

$$OWN_{ayet} = \eta_{ft} + \beta \cdot \ln(EI_{fet}) + \gamma \cdot RESTRICT_{yet} + \epsilon_{aet}. \qquad (5)$$

The dependent variable measures the extent to which the parent owns the equity of affiliate a

located in country y associated with ethnicity e at time t. The analysis considers two measures of ownership: a whole ownership dummy which is equal to one for affiliates that are wholly owned by their parent and a majority ownership dummy which is equal to one for affiliates that are at least 50% owned by their parent. To isolate new affiliates, the sample only includes affiliates the first time they appear in the BEA benchmark surveys, and affiliates that appeared in the first survey in the sample, which occurred in 1982, are excluded. 80% of new affiliates are wholly owned by their parents, and 92% of new affiliates are majority owned. $\ln(EI_{fet})$ is the log of the count of the number of patents the firm applies for in the period before benchmark year t for which the inventor is of ethnicity e. Several countries limit the ownership stake that can be held by U.S. multinationals during the sample period. Specifications include a measure of these restrictions, $RESTRICT$, to capture the impact of these restrictions and to compare the relationship between restrictions and ownership choices with the relationship between ethnic innovation and ownership choices. $RESTRICT$ is a dummy based on Shatz (2000), and it is equal to one if both the acquisition and sectoral score are at least three in a particular country and year. The specification also includes parent-year fixed effects η_{ft}.[14] The specifications are linear probability models, and standard errors are clustered by parent-year.

The results of these specifications appear in Table 8. The positive and significant coefficient in the first column implies that firms that have more innovation performed in the U.S. by inventors of a certain ethnicity are more likely to wholly, as opposed to partially, own new affiliates in countries associated with that ethnicity. The second column also includes the ownership restriction dummy, and it has a negative coefficient, indicating that ownership restrictions limit the use of whole ownership, as one might expect. The results in column 2 imply that a one standard deviation decrease in ethnic innovation is associated with a decrease in the use of whole ownership that is about one half the size of the decrease associated with ownership restrictions.

The next two columns present a similar analysis where the dependent variable is a dummy

[14] Previous specifications include parent-ethnicity and ethnicity-year fixed effects. There is not sufficient entry within parent-ethnicities to identify effects when parent-ethnicity fixed effects are included. If ethnicity-year fixed effects are included, there is little variation in ownership restriction within ethnicity-years, yielding results that do not allow for a comparison of the relationship between ownership restrictions and ownership structure and the relationship between ethnic innovation and ownership structure.

for the use of majority ownership. The results are similar, but, relative to ownership restrictions, ethnic innovators appear to be more strongly associated with majority ownership decisions than whole ownership decisions. Thus, ethnic innovators appear to allow U.S. multinationals to serve countries without the assistance of a local partner. Using ethnic innovators therefore likely increases the ability of multinationals to enjoy the coordination benefits that come with majority and whole ownership. These results support the view that high-skilled immigrants possess knowledge and connections that aid firms in navigating entry abroad.

4 Conclusion

This paper studies the effects that immigrant scientists and engineers have on the global activities of the firms that employ them. The analysis uses detailed data on the names of inventors that appear in patent applications to infer the ethnicity of U.S. based innovators. This information is used in conjunction with detailed data on affiliates of U.S. multinationals.

Tests reveal that increases in the share of innovation performed by inventors of a certain ethnicity are associated with increases in the share of affiliate activity in countries related to that ethnicity. This result is stronger for firms that are more likely to value ethnic innovators; more specifically, it is stronger when firms are beginning to engage in innovative activity abroad, and ethnic innovators could play a role in facilitating cooperation between innovators working in different locations and in identifying products and services that could be developed further to meet foreign demands. This result also holds in tests that use a measure of ethnic innovation that exhibits plausibly exogenous variation. This result implies that innovators of a particular ethnicity enhance the competitiveness of U.S. multinational firms in countries associated with that ethnicity.

The data also illustrate that firms with more innovative activity performed by inventors of a certain ethnicity are more likely to conduct R&D in countries associated with that ethnicity. Furthermore, they are more likely to collaborate with inventors located in such countries to generate new patents. Recent literature points out that firms are increasingly breaking up innovative activities across countries to perform different steps in settings where they can be performed most efficiently. The findings in this paper suggest that ethnic innovators facilitate this change in the manner in which innovation occurs.

Finally, tests show that U.S. multinational firms rely less on joint venture partners when forming new affiliates in countries that are home to the firms' ethnic innovators. Joint ventures typically entail substantial coordination costs and are subject to conflicts over transfer pricing issues and technology transfers. Ethnic innovators appear to make local partners less valuable by providing insights about foreign markets that allow multinationals to majority or wholly own foreign affiliates.

Taken together, these results have implications for immigration policies. Many debates about immigration focus on the potentially deleterious impact of low wage immigrants on the domestic workforce. However, this paper points out that immigrants who are skilled enough to engage in innovative activity generate benefits for firms that are seeking to do business abroad. Immigrants play a significant role in science and engineering communities in the U.S., so these kinds of effects deserve consideration.

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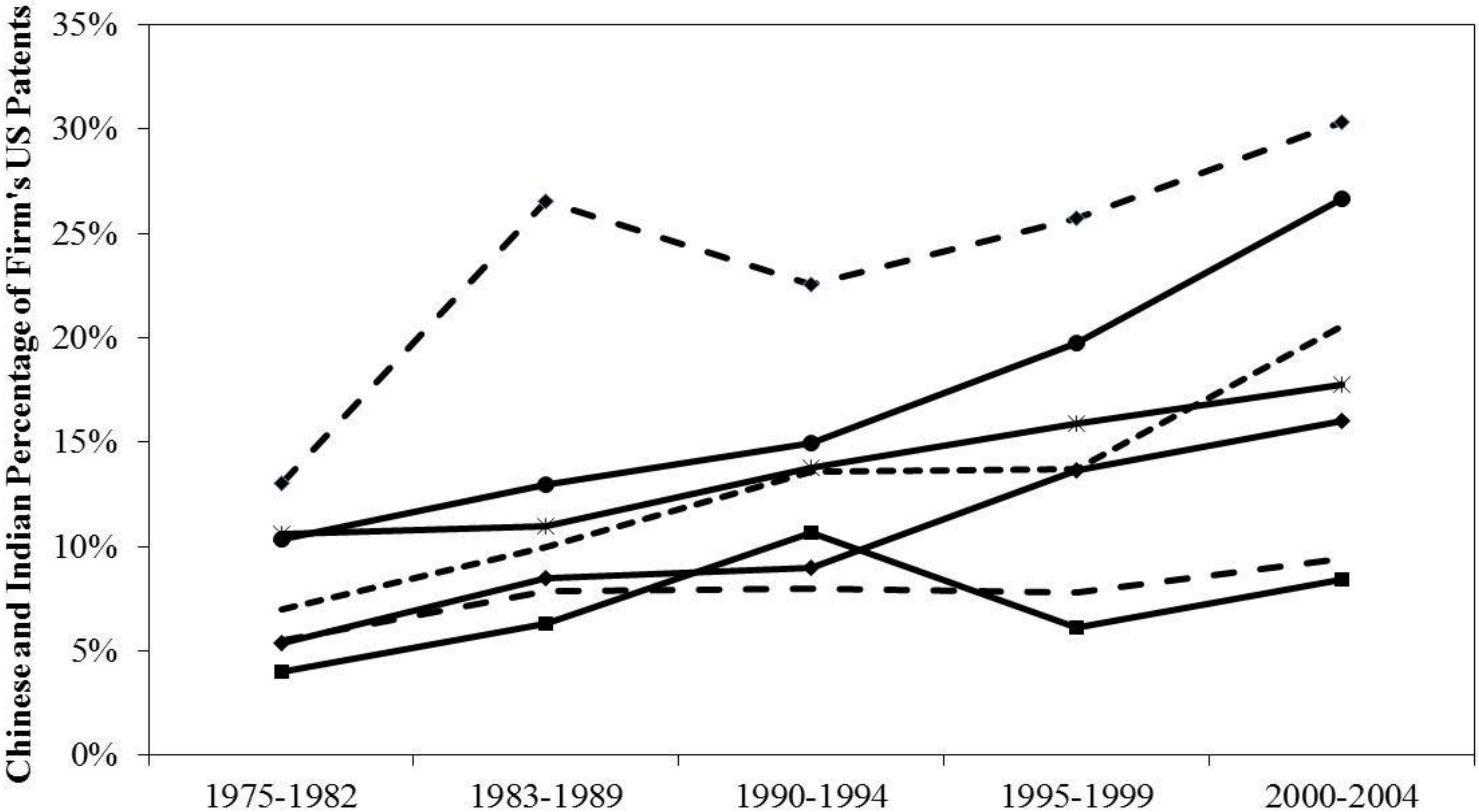
Figure 1: Share of Innovation Attributed to U.S. Chinese & Indian Inventors



Notes: Each line displays a measure of the extent to which innovation at one of seven large firms is performed by inventors of Chinese and Indian ethnicity. This measure is computed using data on patent applications in which inventors are based in the U.S. The Chinese and Indian share is computed by dividing the count of patents in which inventors appear to be of Chinese or Indian ethnicity by the total number of patents. The firm-level information in this figure was constructed from the patent database using data on firms that report earning foreign income in Compustat. In order to protect the confidentiality of the BEA data, to which the patent data are linked, the names of the firms are not identified.

Table 1

Ethnic Shares of Patenting Activity

	Ethnicity of Inventors								
	Anglo-Saxon	Chinese	European	Hispanic	Indian	Japanese	Korean	Russian	Vietnamese
1975-1982	81.3%	2.8%	8.3%	2.8%	2.5%	0.6%	0.5%	1.2%	0.1%
1983-1989	78.5%	4.2%	7.8%	2.9%	3.5%	0.7%	0.6%	1.5%	0.2%
1990-1994	76.4%	5.4%	7.3%	3.4%	4.2%	0.6%	0.6%	1.6%	0.5%
1995-1999	72.8%	7.3%	6.5%	3.7%	5.8%	0.7%	0.7%	1.7%	0.7%
2000-2004	68.0%	9.5%	6.2%	4.0%	7.3%	1.0%	1.1%	2.2%	0.8%
Chemicals	74.1%	6.6%	8.1%	3.5%	4.5%	0.7%	0.8%	1.4%	0.3%
Computers	70.7%	7.7%	6.3%	3.5%	7.3%	0.9%	0.7%	2.1%	0.8%
Pharmaceuticals	74.9%	6.0%	7.5%	4.2%	4.1%	0.7%	0.7%	1.4%	0.3%
Electrical	73.2%	7.2%	7.0%	3.2%	5.0%	0.9%	0.8%	1.9%	0.7%
Mechanical	81.3%	2.8%	7.6%	2.9%	2.8%	0.5%	0.5%	1.4%	0.2%
Miscellaneous	81.3%	3.2%	7.2%	3.1%	2.7%	0.5%	0.4%	1.3%	0.3%

Notes: This table presents the share of patents in which inventors are of particular ethnicities, reside in the U.S. at the time of patent application, and work for a publicly listed corporation. Inventor ethnicities are estimated through inventors' names using techniques described in the text. Patents are grouped by application years and major technology fields.

Table 2

Descriptive Statistics

	Mean	Standard Deviation
Asset Share	0.1902	0.2342
Sales Share	0.1947	0.2255
Employment Share	0.1962	0.2296
Employment Compensation Share	0.1947	0.2366
Ethnic Share of U.S. Patents	0.0404	0.0528
Predicted Ethnic Share of U.S. Patents	0.0474	0.0686
R&D Dummy	0.4844	0.4998
Log of Ethnic U.S. Patents (Table 6)	0.0191	2.2133
Log of Parent R&D	11.4432	1.8534
Log of Parent Sales	14.8101	1.5126
Firm Patenting Dummy--Any Patenting	0.0418	0.2000
Firm Patenting Dummy--Collaborative	0.0284	0.1660
Firm Patenting Dummy--Non-Collaborative	0.0274	0.1633
Log of Ethnic U.S. Patents (Table 7)	-1.6580	2.5981
Log of Firm Patents in U.S. Excluding Focal Ethnicity	0.9503	2.0383
Whole Ownership Dummy	0.7992	0.4006
Majority Ownership Dummy	0.9198	0.2716
Log of Ethnic U.S. Patents (Table 8)	0.8368	2.2064
Restriction Dummy	0.2340	0.4234

Notes: Asset Share, Sales Share, Employment Share, and Employment Compensation Share capture the share of affiliate activity that occurs in countries associated with a particular ethnicity. Ethnic Share of U.S. Patents measures the firm's share of patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. Predicted Ethnic Share of U.S. Patents is calculated by using the spatial distribution of a firm's initial inventor activity across cities and subsequent city-by-city growth of ethnic inventor populations. R&D Dummy is a dummy equal to one for firms that incur R&D expenditures within countries associated with a particular ethnicity. Log of Ethnic U.S. Patents is the log of the number of patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. The Table 6 measure is computed at the parent-ethnicity-year level where both ethnic patenting and affiliate activity exist, the Table 7 measure is computed at the parent-ethnicity-year level where ethnic patenting exists, and the Table 8 measure is computed at the affiliate level and thus implicitly weights by the number of affiliates within a firm-ethnicity. Log of Parent R&D Expenditures and Log of Parent Sales respectively measure the domestic R&D expenditures and sales of a parent firm. Firm Patenting Dummy--Any Patenting is a dummy variable equal to one for firms that apply for at least one patent in which at least one inventor is based in a country associated with a particular ethnicity in the years preceding a benchmark survey year. Firm Patenting Dummy--Collaborative is a dummy variable equal to one for firms that apply for at least one patent in which at least one inventor is based in a country associated with a particular ethnicity in the years preceding a benchmark survey year and if the patent also lists an inventor located in the U.S. Firm Patenting Dummy--Non-Collaborative is defined similarly, but it is only equal to one if there are no listed U.S. co-inventors. Log of Firm Patents in the U.S. Excluding Focal Ethnicity measures the patents of a firm that list only U.S. inventors excluding contributions by the focal ethnic group. Whole Ownership Dummy is a dummy equal to one for new affiliates that are wholly owned by their parent firms and zero for other new affiliates, and Majority Ownership Dummy is a dummy equal to one for new affiliates that are at least 50% owned by their parent firms and zero for other new affiliates. Ownership Restriction Dummy is based on Shatz (2000), and it is equal to one if both the acquisition and sectoral score are at least three in a particular country and year.

Table 3

Foreign Affiliate Activity

Dependent Variable:	Affiliate Activity in Countries Associated with an Ethnicity			
	Share of Assets	Share of Sales	Share of Employment	Share of Employment Compensation
	(1)	(2)	(3)	(4)
Ethnic Share of U.S. Patents	0.1008	0.0772	0.0733	0.0794
	(0.0413)	(0.0324)	(0.0404)	(0.0297)
Parent Firm x Ethnicity FE	Yes	Yes	Yes	Yes
Ethnicity x Year FE	Yes	Yes	Yes	Yes
Observations	5,474	5,475	5,472	5,472

Notes: The dependent variables capture the share of affiliate activity that occurs in countries associated with a particular ethnicity. The four columns respectively measure this share using affiliate assets, sales, employment levels, and employment compensation, and the data used to compute these variables cover the years 1982, 1989, 1994, 1999, and 2004. Ethnic Share of U.S. Patents measures the share of a firm's patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. U.S. ethnic patenting shares are computed using data from the five years prior to the shares of affiliate activity, except in the cases of 1982 and 1989 when seven-year time spans are used. All non-Anglo-Saxon ethnicities are included. The specifications are OLS specifications that include fixed effects for each parent firm-ethnicity and for each ethnicity-year. Heteroskedasticity-consistent standard errors that correct for clustering at the ethnicity-year level appear in parentheses.

Table 4

Foreign Affiliate Activity: New Foreign Innovators

Dependent Variable:	Affiliate Activity in Countries Associated with an Ethnicity			
	Share of Assets	Share of Sales	Share of Employment	Share of Employment Compensation
	(1)	(2)	(3)	(4)
	A. New Foreign Innovators			
Ethnic Share of U.S. Patents	0.2155	0.2547	0.1541	0.2491
	(0.0991)	(0.0852)	(0.0886)	(0.0653)
Parent Firm x Ethnicity FE	Yes	Yes	Yes	Yes
Ethnicity x Year FE	Yes	Yes	Yes	Yes
Observations	2,200	2,201	2,200	2,200
	B. Other Observations			
Ethnic Share of U.S. Patents	0.0551	0.0084	0.0387	-0.0018
	(0.0550)	(0.0458)	(0.0560)	(0.0481)
Parent Firm x Ethnicity FE	Yes	Yes	Yes	Yes
Ethnicity x Year FE	Yes	Yes	Yes	Yes
Observations	3,274	3,274	3,272	3,272

Notes: This table presents specifications like those in Table 3 for two subsamples. The New Foreign Innovators sample isolates firm-ethnicities for which: 1) the firms had previously applied for patents for innovations of U.S. based inventors and 2) subsequently applied for patents for innovations involving inventors located in countries of a particular ethnicity. The Other Observations sample includes other observations.

Table 5

Foreign Affiliate Activity: Predicted Share Estimates

Dependent Variable:	Ethnic Share of U.S. Patents	Affiliate Activity in Countries Associated with an Ethnicity			
		Share of Assets	Share of Sales	Share of Employment	Share of Employment Compensation
	(1)	(2)	(3)	(4)	(5)
Predicted Ethnic Share of U.S. Patents	0.1917	0.0403	0.1540	0.1492	0.0713
	(0.0716)	(0.0628)	(0.0607)	(0.0647)	(0.0577)
Parent Firm x Ethnicity FE	Yes	Yes	Yes	Yes	Yes
Ethnicity x Year FE	Yes	Yes	Yes	Yes	Yes
Observations	5,474	5,474	5,475	5,472	5,472

Notes: The first column presents the relationship between the predicted and actual values of the ethnic share of U.S. patents. The dependent variables in the remaining columns capture the share of affiliate activity that occurs in countries associated with a particular ethnicity. Columns 2-5 respectively measure this share using affiliate assets, sales, employment levels, and employment compensation, and the data used to compute these variables cover the years 1982, 1989, 1994, 1999, and 2004. Predicted Ethnic Share of U.S. Patents measures the expected share of patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. These shares are calculated by combining the spatial distribution of a firm's initial inventor activity across cities with subsequent city-by-city growth of ethnic inventor populations. Own-firm inventors are removed from the city growth through a procedure discussed in the text. All non-Anglo-Saxon ethnicities are included. Heteroskedasticity-consistent standard errors that correct for clustering at the ethnicity-year level appear in parentheses.

Table 6

Foreign Affiliate R&D

Dependent Variable:	R&D Dummy		
	(1)	(2)	(3)
Log of Ethnic U.S. Patents	0.0192	0.0155	0.0141
	(0.0061)	(0.0064)	(0.0066)
Log of Parent R&D Expenditures		0.0336	0.0241
		(0.0119)	(0.0153)
Log of Parent Sales			0.0262
			(0.0209)
Parent Firm x Ethnicity FE	Yes	Yes	Yes
Ethnicity x Year FE	Yes	Yes	Yes
Observations	3,818	3,645	3,645

Notes: The dependent variable is a dummy equal to one for firms that incur R&D expenditures within countries associated with a particular ethnicity, and it is measured in 1982, 1989, 1994, 1999, and 2004. Log of Ethnic U.S. Patents is the log of the parent firm's number of patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. It is computed using data from the five years prior to the R&D measures, except in the cases of 1982 and 1989 when seven-year time spans are used. Log of Parent R&D Expenditures and Log of Parent Sales respectively measure the domestic R&D expenditures and sales of a parent firm. All non-Anglo-Saxon ethnicities are included. The specifications are OLS specifications that include fixed effects for each parent firm-ethnicity and for each ethnicity-year. Heteroskedasticity-consistent standard errors that correct for clustering at the ethnicity-year level appear in parentheses.

Table 7

Patenting Foreign Inventions

Dependent Variable:	Firm Patenting Dummy			
	Any Patenting		Collaborative	Non-Collaborative
	(1)	(2)	(3)	(4)
Log of Ethnic U.S. Patents	0.0115	0.0024	0.0031	0.0005
	(0.0031)	(0.0013)	(0.0012)	(0.0011)
Log of Firm Patents in U.S.		0.0272	0.0204	0.0210
Excluding Focal Ethnicity		(0.0072)	(0.0052)	(0.0061)
Parent Firm x Ethnicity FE	Yes	Yes	Yes	Yes
Ethnicity x Year FE	Yes	Yes	Yes	Yes
Observations	23,860	23,860	23,860	23,860

Notes: The dependent variable in columns 1 and 2 is a dummy variable equal to one for firms that apply for at least one patent in which at least one inventor is based in a country associated with a particular ethnicity in the years preceding a benchmark survey year. The dependent variable in column 3 is a dummy variable equal to one for firms that apply for at least one patent in which at least one inventor is based in a country associated with a particular ethnicity in the years preceding a benchmark survey year and if the patent also lists an inventor located in the U.S. The dependent variable in column 4 is defined similarly, but it is only equal to one if there are no listed U.S. co-inventors. Log of Ethnic U.S. Patents is the log of the parent firm's number of patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. Log of Firm Patents in the U.S. Excluding Focal Ethnicity measures the patents of a firm that list only U.S. inventors excluding contributions by the focal ethnic group (including Anglo-Saxon contributions). All non-Anglo-Saxon ethnicities are included. The specifications are OLS specifications that include fixed effects for each parent firm-ethnicity and for each ethnicity-year. Heteroskedasticity-consistent standard errors that correct for clustering at the ethnicity-year level appear in parentheses.

Table 8

Foreign Affiliate Ownership Structure

Dependent Variable:	Whole Ownership Dummy		Majority Ownership Dummy	
	(1)	(2)	(3)	(4)
Log of Ethnic U.S. Patents	0.0392	0.0344	0.0205	0.0213
	(0.0071)	(0.0086)	(0.0081)	(0.0104)
Ownership Restriction Dummy		-0.1238		-0.0461
		(0.0248)		(0.0192)
Parent Firm x Year FE	Yes	Yes	Yes	Yes
Observations	6,634	4,300	6,634	4,300

Notes: The dependent variable in columns 1 and 2 is a dummy equal to one for new affiliates that are wholly owned by their parent firms and zero for other new affiliates, and the dependent variable in columns 3 and 4 is a dummy equal to one for new affiliates that are at least 50% owned by their parent firms and zero for other new affiliates. New affiliates are identified in the years 1989, 1994, 1999, and 2004 as affiliates that were not present in the previous benchmark survey. Log of Ethnic U.S. Patents is the log of the parent firm's number of patents that cover inventions that occurred in the U.S. and were filed by inventors of a particular ethnicity. It is computed using data from the five years prior to the ownership measures, except in the case of 1989 when a seven-year time span is used. The Ownership Restriction Dummy is based on Shatz (2000), and it is equal to one if both the acquisition and sectoral score are at least three in a particular country and year. All non-Anglo-Saxon ethnicities are included. The specifications are OLS specifications that include fixed effects for each parent firm-year. Heteroskedasticity-consistent standard errors that correct for clustering at the parent firm-year level appear in parentheses.