Running head: NETWORKS AND PROFESSIONAL GROWTH

Network Associations and Professional Growth among Engineers from India and China in Silicon Valley

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Abstract

The economic benefits attributed by the literature to ethnic networks include helping their members cope with social exclusion, mainstreaming, facilitating entrepreneurship, and access to transnational opportunities. In this paper, we explore the benefits provided by participation in ethnic professional associations formed by Indian and Chinese engineers in Silicon Valley. We find that the ethnic professional associations offer several of the above economic benefits. These benefits are complementary to the benefits from other ethnic ties and from non-ethnic ties.

Section 1

Introduction

The arguments for the existence of minority ethnic networks include that they fulfill one or more of the following: (1) They help ethnic minorities combat discrimination, lack of trust and other forms of social exclusion from the mainstream (Fernandez, 1998, Sanders, 2002, Saxenian, 1999, Yeng, 1997), (2) they enable ethnic minorities to enter the mainstream (Portes & Jensen, 1989), and (3) they enable transnational opportunities to be realized (Portes, Guarnizo, & Haller, 2002).

To achieve these outcomes, network members may form more trusted ties than are likely in less exclusive networks. These ties may be used to undertake mutually supportive activities such as investing in fellow members' enterprises, entering into privileged client-vendor relationships or assisting each other in job searches. Most ethnic networks, it should be noted, are informally organized (Bowles & Gintis, 2004, Rauch, J.E. and V Trindade, 2002).

In this paper, we seek to discover the raison d'etre of one type of ethnic network, the ethnic professional associations formed by Chinese and Indian (I-C, for short) engineers in Silicon Valley. Such associations are formally organized networks and typically offer a range of activities built around career development and entrepreneurship.

Most studies of the economic value of ethnic networks look at migrant communities arriving from a poor country into a developed country, and their methods of economic assimilation, starting with relatively low skills.[1] The I-C associations of Silicon Valley are different in that they do not operate out of ethnic enclaves and their members are highly educated. This raises a

paradox: Silicon Valley is often described as a region in which merit counts above other factors (e.g., see Petersen, Saporta and M-D Seidel, 2000). Why would an engineer from China or India who is well-educated and able to access mainstream networks through business colleagues, participation in standard-setting bodies, non-ethnic professional associations, etc., need an ethnic network such as an ethnic professional association? Thus, the sources of value of I-C professional associations in Silicon Valley become an interesting research question.

Using primary data, we first ask whether our sample is representative of Silicon Valley's I-C engineers. We then test whether participation in the ethnic professional associations is related to professional growth. If so, we also consider whether these associations offer intra-network and cross-network diversification (Uzzi, 1999, Ruef, 2002).

The paper is organized as follows. In the next section, the theoretical framework and hypotheses are presented. Section 3 presents the empirical models, methodology and dataset. Section 4 discusses the results and Section 5 summarizes the findings and their implications.

Section 2

Development of Theoretical Framework

Silicon Valley is a region that, within a short period of time – perhaps no more than four decades, became an engine of growth for the US economy. It did this by innovation in selected fields, i.e., by "commercializing a number of the most important electronics and biomedical technologies developed in the second half of the twentieth century." (Kenney, 2000, p.1).

Sturgeon (Kenney, 2000, p. 15-47) showed that the Valley's capacity for leading-edge innovation was established early in the 20th century and maintained since. He has argued that Silicon Valley's success was based on an industrial organization that, even a hundred years ago, was similar to the current system.

Sturgeon has noted the features of Silicon Valley even then as:

A leading role for venture capital; a close relationship between local industry and the major research universities of the area; … an unusually high level of inter-firm cooperation; a tolerance for spin-offs; and a keen awareness of the region as existing largely outside the purview of the large, ponderous, bureaucratic electronics firms and financial institutions of the East Coast.

[End of quote]

What is as remarkable as the date of origin is that these features have "proved to be readily "scalable" as the industry has grown with the region." Note the importance of networks to Silicon Valley's success, such as the "close relationship between local industry and the major research universities of the area" and "an unusually high level of inter-firm cooperation."

This is not to imply that the industrial structure of Silicon Valley, with its emphasis on social networks, is unique. Piore and Sabel (1984) have provided several case studies of regions with governance structures embedded in regional networks rather than firm or even industrial networks. They have argued that these are a logical outcome of the saturation of markets for standardized goods. These networks enable 'flexible specialization', i.e., the production of higher quality, customized goods than is possible with standardization. They emerged in many fields

(Piore and Sabel provided examples of industrial districts in Italy and Germany) in response to the saturation of markets for standardized goods.

These features of networks suggest that networks ought to be well-developed in Silicon Valley. Indeed, echoing a widely asserted statement, Castilla, Hwang, Granovetter and Granovetter (2000) have stated that, "The most crucial aspect of Silicon Valley is its networks" (p.218). The authors have shown that multiple networks play a vital role. They identified "educators, venture capitalists, lawyers, headhunters, engineers and industrial/civic associations and trade groups." (p.218) They have argued that such networks are "linked not only to information technology firms but also to one another in this region" (p.218). They conclude that "variations in these contexts may well explain why myriad attempts to replicate Silicon Valley in utterly different contexts, by copying only the features of its firms, are rarely fruitful" (p.218-9).

The value of ties created by participating in networks has been extensively studied in the literature. The weak-tie approach argues that a large, non redundant network of weak ties is more advantageous than a closed, tightly-knit network of embedded ties (Granovetter, 1973). Uzzi (1999, p.500) has shown that ties of different types (weak/strong, holely/dense, formal/informal) can be complementary rather than cannibalistic when they are combined within the same network. One type of tie can help overcome the limitations of the other type while enlarging information and governance benefits (intra-network diversification). In a study of the usefulness of networks for innovation, Ruef (2002, p.445) showed that multiple networks may also offer complementary benefits (cross-network diversification[2]).

In the view of some scholars, in Silicon Valley, some weak ties are the critical ones and are more important than strong ties that arise from working within a firm. Saxenian (1994), echoing Piore and Sabel (1984), argued that the weak-tie networks that cross firm boundaries are more important to their participants than the firms they work for. She has stated that "the region's engineers develop loyalties to each other and to advancing technology, rather than to individuals, firms or even industries." (p.28). The causes of this may lie in the vast network of ties that enable engineers to move easily from one project or company to another. As Castilla et al., note, networks can incentivize such movement by being an important source of power and influence (p.221). Similarly, as Powell, Kopul and Smith-Doerr (1996), have stated, "The complex reality of rapidly developing fields in which knowledge is both sophisticated and widely dispersed transcends the simple calculation of a make or buy decision" (p. 118).

Does the statement about the importance of weak, regional ties apply to the ethnic networks created by Valley's Indian and Chinese (I-C) engineers? On the one hand, it is claimed that ethnic networks usually arise in response to exclusion from the mainstream (Sanders, 2002, Yeng, 1997). Saxenian (1999), who first brought to public attention the important role[3] that Indian and Chinese (I-C) engineers have played in Silicon Valley, put forward a similar argument (see also Fernandez, 1998).

As Saxenian has stated:

Their (the I-C immigrants') opportunities for advancement to management occupations appear … limited, suggesting the possibility of a "glass ceiling" or invisible barriers to career mobility… The region's Chinese and Indian engineers have responded (to these limits) in typical

Silicon Valley fashion: they left established companies to start their own businesses… Silicon Valley's skilled immigrants also responded collectively to a sense of exclusion from established business and social structures… (They) created a wide range of professional and technical networks and institutions that facilitate professional advancement for recently arrived immigrants... (These) facilitate job search, information exchange and access to capital and managerial know how as well as the sharing of ethnic identities. The region's most successful Chinese and Indian entrepreneurs appear to rely on such ethnic resources while simultaneously integrating into the mainstream technology economy. (p.5-6).

Saxenian has noted that the I-C engineers rely on their ethnic professional networks even more than on mainstream associations such as the Institute of Electrical and Electronic Engineers (IEEE) (p.31).

As evidence, Saxenian provided data showing a lower representation in the managerial workforce and a greater percentage of I-C founded startups relative to the mainstream. However, Saxenian has acknowledged evidence to the contrary as well. She found that "there is no statistically significant difference between the earnings of Chinese and Indians in managerial, professional and technical occupations and their white counterparts" (p.18). This raises the possibility that the lower representation in managerial ranks is explainable by factors other than exclusion. Saxenian has acknowledged this and has noted that this could be due to endowed attributes, i.e., "a bias among these groups towards technical, as opposed to business, education, or to the linguistic and cultural difficulties of many new immigrants" (p.18).

Silicon Valley is asserted to be a region in which merit counts above other factors (Petersen, et al., 2000, p.765). Unlike traditional migrants to the U.S., whose arrival tends to be based on kinship ties, the most common mode of entry for the I-C engineers into the United States is the U.S. educational system (Dossani, 2002, p.11). Hence, such engineers should be able to participate effectively in mainstream networks – both formal associations such as alumni associations and professional associations such as IEEE, and informal networks such as those formed among "educators, venture capitalists, lawyers, headhunters, engineers", as noted above (Castilla, et al., 2000, p. 218).

If so, why might ethnic networks still be useful? We propose the following possibilities: First, they may offer a more efficient pathway to entrepreneurship within a domestic or transnational ethnic economy or in the mainstream. Several researchers have argued that ethnic enterprises, in the sense of enterprises organized by, employing and selling to an ethnic community, are effective vehicles for upward mobility (Portes and Jensen, 1989, p. 930). Portes and Jensen (1989) studied enclave economies among Cuban-born populations in South Florida and found that educational levels and years of work experience positively influenced a disposition towards entrepreneurship among more settled migrants. However, social contexts, notably kinship ties and family composition also mattered. In particular, men typically decided to become entrepreneurs, but were more likely to make this decision if they were married and if the wife also participated in the business. Interestingly, though a knowledge of English was not found to be significant in the decision to become an entrepreneur, anthropological studies found that females' earnings in wage employment were a support for entrepreneurially-inclined husbands

while they learned English and took the first steps toward entrepreneurship. (Portes and Jensen, p.946).

The relevance of these findings to our study of Silicon Valley's I-C networks is that those who wish to become entrepreneurs may benefit similarly from fellow-ethnic support (potentially derived from association membership), even if highly educated. Such support might be valuable when undertaking economic activities within or outside the ethnic group. In other words, social context may count even when educational levels are high; and associations may count by offering benefits such as governance benefits not available through informal networks.

Apart from entrepreneurship within the host economy, a further possibility is that there could be unique transnational economic advantages offered by an ethnic network. Portes, Guarnizo, & Haller (2002), for instance, show that transnational entrepreneurship is a strategy chosen by the elite of newly immigrant communities. Their study of selected migrant communities from South America to the United States finds that "it is the better qualified, more experienced, and more secure immigrants who are overrepresented (in transnational entrepreneurship). Yet the opportunity to engage in them is heavily conditioned by the sociopolitical conditions in the country of origin." (p.291). The stronger the bonds with their country of birth, the more likely are migrants to become long-term transnational entrepreneurs, and such entrepreneurs are usually the elite among the immigrant community. The authors argue that transnational entrepreneurship may help mainstreaming since the superior income from such activities offer first-generation immigrants a more desirable path, including the economic means to support the successful adaptation of their offspring.

Similarly, in Silicon Valley, an ethnic engineer might use the ethnic network to access or otherwise develop transnational opportunities in her country of birth. That such transnational opportunities exist has been documented for high technology opportunities in East Asia (Hobday, 1995) and for international trade among ethnic Chinese (Rauch, 2001). Such opportunities may not be accessible via a mainstream network.

A final possibility we consider is derived from Uzzi (1999) and Ruef (2002) (discussed above), that of the benefits of diversification. Just as mainstream engineers might participate in more than one mainstream association in order to enlarge their sources of information or obtain governance benefits, so might the ethnic engineers. In the case of ethnic engineers, the accessible networks could include both ethnic and non-ethnic networks.

In summary, we hypothesize that participation in I-C ethnic professional associations may be valuable to professional growth because they offer opportunities unavailable otherwise. These could include finding avenues for professional growth despite social inclusion, mainstreaming, facilitating entrepreneurship, and transnational opportunities in their countries of birth. In effect, the I-C professional associations are valuable because they help diversify the sources of information and governance benefits compared both with other ethnic networks and with non-ethnic networks.

The dependent variable in our tests is professional growth. We propose two measures of professional growth, firm creation and position in a firm's hierarchy.

We state our testable propositions as follows:

(1) Intra-network Diversification (ID) Proposition: Ties within ethnic networks that include ethnic professional associations play complementary roles in their relationship to professional growth.

2) Cross-network Diversification (ND) Proposition: Ethnic ties that include ties arising from participation in ethnic professional associations, and non-ethnic ties play complementary roles in their relationship to professional growth.

We now turn to the data, measures, models and tests.

Section 3

Data, Measures and Models

The data for this paper comes from a primary survey of 10,800 members of Silicon Valley's ethnic Chinese and Indian associations. It was conducted by one of the authors in May and June 2001. Separate data were collected for the PRC-born and Taiwan-born respondents under the category of Chinese engineers. The survey was administered over the Internet. It was sent to all the members of 13 ethnic professional associations. These networks comprised the complete set of I-C professional associations at the time.

Each ethnic professional association was provided a link to the survey. This was sent to its members by the association with a request by the association's executive director or equivalent person to take the survey. Each association sent its members at least one reminder while the survey was live. The survey was open for respondents through the months of May and June 2001.

The response rate was 21 percent (2,272 responses). A key question about the sample's representativeness is whether it is representative of I-C engineers in Silicon Valley.

To test for this, we compared our sample with the Public Use Microdata Sample (PUMS) database for the 2000 census, updated with annual American Community Survey data for 2000-2003. Since the PUMS data does not disaggregate below the level of the state, we used data for California. Engineers were identified by NAICS codes. Since the survey provides data on racial origin, we were able to compare certain control variables – age of respondent, year of entry into the United States and years of education, for engineers of Indian, Chinese and Taiwanese origin. The results are shown in Table 1 below. It indicates that our sample data are representative in these respects.

Table 1 Age Distribution of Sample versus ACS Data

	PUMS Mean	Sample Mean	T-Statistic for Equality of Means
Age (years)	36.72	34.74	0.346
Years of education	17.3	18.4	1.59
Year of entry to US	1990	1995	0.45

Source for PUMS data: http://www.census.gov/acs/www/Products/PUMS/pums2002.htm, downloaded December 15, 2009. Relevant NAICS codes: 5112, 5161, 5181, 5182, 5415, 5416, 5417, 5419Z. PUMS sample size: 272, authors' sample size: 1960.

A second key question is whether showing statistical significance in a relation between the dependent variable and the independent variable indicates causality. Given that our data-set is cross-sectional and not temporal, findings of significance always indicate an association rather than a causal relation. However, as we have stated above, our interest is not in determining causality but in determining whether ethnic professional associations play a complementary role to other networks in their relationship to professional growth.

Independent Measures

Our independent variables are ties of different strengths and types. We classify these as strong, weak, transnational, medium and hub ties (see Table 2 for definitions). As in Ruef (2002, p. 439), we assume that strong ties include family, friends and business colleagues. While family ties are ethnic, note that friends and business colleagues may or may not be ethnic ties.

Weaker ties entail more limited investments of time and intimacy. The professional associations, which *prima facie* do not require members to invest in interpersonal relations, will usually lead to some interpersonal connections, which will be weaker than the strong ties listed above. We assume that, due to a common bond of ethnicity, membership of ethnic professional associations leads to the building of stronger ties than membership of non-ethnic professional associations. We also assume that membership of ethnic professional associations leads to the building of stronger ties than membership of an alumni association. The reasons is that although both are

likely to benefit from ethnic bonds, the alumni association usually has non-professional goals and includes members from different professions. Secondly, since a majority of respondents finished their highest degree from American universities (79% of Chinese and Taiwanese-born and 55% of Indian-born), there is likely to be a large non-ethnic component to alumni ties. Hence, we classify membership of ethnic professional associations as offering ties that are stronger than membership of non-ethnic professional associations and alumni associations.

The academic literature also identifies a special sort of tie, the hub. An individual acts as a hub if he has a central position in the business network and thus has access to more information through stronger relationships to key decision makers and informants. Although, by definition, relatively few individuals in a network can be hubs, the position could help professional advancement due to access to superior information. We have collected data on officers and board members of professional associations, those who regularly meet government officials in their country of birth, regularly exchange information with others in their country of birth on jobs or business opportunities in the United States or their country of birth, or exchange information about technology in their country of birth. We classify these as hub ties.

Our final class of ties are transnational weak ties, which we identify as possessed by those who undertake business travel to their country of birth, sometimes meet with government officials in their country of birth, sometimes exchange information with others in their country of birth on jobs or business opportunities in the United States or their country of birth, or exchange information about technology in their country of birth.

Table 2 below defines the ties used in the analysis and Table 3 provides their univariate statistics.

Table 2: Indications of Ties

	Ties	Associated network	Definitions
1	Strong ties	Family, friends and networks of business colleagues	Strong ties entail high investments of time and emotions in a relationship, as well as the reciprocity involved between participating actors.
2	Medium (affiliation) ties	Ethnic professional associations	Medium ties entail considerable investments of time and emotions in a relationship, as well as the reciprocity involved between participating actors.
3	Hub ties	Officer or board member of a professional association, those who regularly meet government officials in their country of birth, regularly exchange information with others in their country of birth on jobs or business opportunities in the United States or their country of birth, or exchange information about technology in their country of birth.	An individual acts as a hub if he has a central position in the business network and thus has access to more information through stronger relationships to key decision makers and informants. A position is locally central if it has a large number of connections with other positions in its immediate environment. A position is globally central if it is strategically significant in the overall structure of the network.
4	Weak (affiliation) ties	Alumni networks and non-ethnic professional associations.	Weak ties entail limited investments of time and intimacy, subsuming an array of social acquaintances. These ties determine the degree to which an actor can access heterogeneous information in a market, even if that information is publicly available through advertising or publicity, because actors use network ties to search for opportunities and investments.
5	Transnational weak ties	Business travel to country of birth, sometimes meet with government officials in their country of birth, sometimes exchange information with others in their country of birth on jobs or business opportunities in the United States or their country of birth, or exchange	Transnational weak ties entail limited investments of time and intimacy, subsuming an array of social acquaintances in the country of birth.

	information about technology in their country of birth.

Sources: Granovetter(1973, p.1361), Ruef (2002, p. 429, 430), Uzzi (1999), Bjorkman and Kock(1995), Skvoretz and Faust (1999)

Control Variables

We incorporate a personal profile of respondents as control variables in the tests. These are: age, years of education, gender, year of immigration to the U.S., visa status and the country of birth. Among these, years of education, years since immigration and permanency of visa status have been shown to be important indicators of income growth (Portes and Jensen, 1989, Borjas 1986; Stevens and Chen 1984).

Of the remaining control variables, country of birth has been shown to be important for social context (Portes, Guarnizo and Haller, 2002). As an example, perhaps Indian engineers may do better in jobs that call for English proficiency (such as executive level jobs vis-à-vis technical jobs), relative to Chinese engineers. Hence, it would be useful to identify a country effect, if one exists.

Dependent Measures

Our dependent variable is professional growth. We use two sets of measures of professional growth. The first is firm creation. The creation of a new firm is measured in two ways: creating the founding team (as founder or co-founder) of a new firm (or startup, in Silicon Valley parlance) and raising capital for the startup.

Obtaining funding for and running a funded startup are signals of professional growth since they indicate verification by at least one commercially motivated outsider, the financier. Risk capital can be from various sources and of various amounts depending on the stage of the firm's growth. The academic literature has shown that the size of risk capital rises with subsequent rounds of funding. Also, later rounds are more likely to include institutional rather than individual or corporate sources (Gompers and Lerner, 1999, pp. 151-155). Hence, our dependent variables include the amount of capital raised and the whether its source was institutional. We also include raising capital from one's country of birth.

The second measure of professional growth is the respondent's position in the firm. We collected this data only for those not involved in a startup.

Table 3 lists the measures of professional growth used in this study. Table 4 lists all dependent and explanatory variables used in this study.

Table 3: Indications of Professional Growth

	Indication of professional growth	
1	Startup-related measures	1.Runs a startup:Probability of involvement in a funded startup 2.Capital raised: Amount of capital raised in $ M 3.Initial capital: Probability of raising the initial rounds of U.S.-based institutional capital 4. Future capital: Probability of raising the subsequent rounds of U.S.-based institutional capital 5. Initial capital (country of birth): Probability of raising the initial rounds of institutional capital from the country of birth

		6. Future capital (country of birth): Probability of raising the subsequent rounds of institutional capital from country of birth
2	Professional Advancement	7. Job type: position in a firm, where 0= technical/non-managerial, 1=managerial, 2=executive

Table 4: Descriptive Statistics of Variables (total sample size: 2272)

Variable	Mean	Std. Dev.	Min	Max	Valid Sample Size (N)
Dependent Variables					
Startup related measures					
Founding or running a startup (0=No; 1=Yes, part time; 2=Yes, full time)	.83		0	2	1337
Capital raised (0=up to $0.5M, 1=$0.5M-$1M, 2=$1M-$5M, 3=$5M-$10M, 4=$10M or more)	2.23		0	4	355
Initial Round of U.S.-based Institutional Capital (1= Yes, 0=No)	.20		0	1	628
Subsequent Round of U.S.-based Institutional Capital (1= Yes, 0=No)	.31		0	1	628
Initial Round of Institutional Capital from country of birth (1= Yes, 0=No)	.05		0	1	628
Subsequent Round of Institutional Capital from country of birth (1= Yes, 0=No)	.11		0	1	628
Professional advancement					
Job status (0= technical/non-managerial, 1=managerial, 2=executive)	.81		0	2	1339
Explanatory Variables					
Strong Ties					
Usage of networks of friends and family for fund raising.	.31		0	1	927
Usage of networks of current or former colleagues for fund raising.	.25		0	1	927
Hub Ties					
Officer or Board Member of ethnic groups	.15		0	1	1745
Frequency of meeting local government officials[2]; Regularly	.03		0	1	1739
Frequency of exchange of information on Jobs or business opportunities in the United States[2]; Regularly	.25		0	1	1734
Frequency of exchange of information on Jobs or business opportunities in the country of birth[2]; Regularly	.14		0	1	1718
Frequency of exchange of Information about technology in the country of birth[2]; Regularly	.29		0	1	1722
Medium Ties					
Participation in ethnic professional association for fund raising.	.08		0	1	927
Frequency of participation in ethnic	4.49	(4.33)	0	12	1762

professional associations[4] (per year)					
Memberships in multiple ethnic professional associations	1.24	(1.25)	0	9	2272

Table 4 (ctd.): Descriptive Statistics of Variables (total sample size 2272)

Variable	Mean	Std. Dev.	Min	Max	Valid Sample Size (N)
Weak Ties					
Participation in alumni networks for fund raising.	.12		0	1	927
Participation in non-ethnic professional association for fund raising.	.07		0	1	927
Transnational Weak Ties					
Frequency of business travel to home country[4] (per year)	1.05	(1.43)	0	5	1746
Frequency of meeting local government officials[2]; Sometimes	.27		0	1	1739
Frequency of exchange of information on Jobs or business opportunities in the United States[2]; Sometimes	.54		0	1	1734
Frequency of exchange of information on Jobs or business opportunities in the country of birth [2]; Sometimes	.52		0	1	1718
Frequency of exchange of Information about technology in the country of birth[2]; Sometimes	.52		0	1	1722
Control Variables					
Age (in years)	34.74	(6.97)	22	50	2193
Education (in years)	18.40	(2.54)	12	24	1964
Male[5]	.19		0	1	2272
Immigration Year[3]	3.46	(.95)	1	5	1802
Country of Birth[1]					
India	.33		-1	1	1746
China	.22		-1	1	1746
Taiwan	<.01		-1	1	1746
Visa Status[1]					
U.S. Citizen	.37		-1	1	1799
U.S. Permanent Resident	.28		-1	1	1799
Foreigner holding H1-B Visa	.22		-1	1	1799
Foreigner holding other type of Visa	.04		-1	1	1799

Source: Survey data

Notes**:**

1. Country of Birth and Visa Status are effect coded. "Born in other Asian countries" and "Other Visa Statuses" are omitted categories.

2. Frequency of meeting local government officials and Frequency of exchange of information on Jobs or business opportunities or technology in US as well as in the country of birth are dummy coded. "Never" is a reference category.

3. Immigration year was transformed to a continuous scale ranging from 1 (before 1970) to 5 (after 1999)

4. Frequency of participation in ethnic professional associations per year and Frequency of business travel to home country per year have been transformed to a continuous scale.

5. 81 per cent of the respondents were male.

6. Multicollinearity among independent variables was not significant pairwise or in groups.

Statistical Models and Methods of Estimation

Logistic regression models were used to analyze the relationships. Some dependent variables were measured on a binary scale and some on an ordinal scale. Accordingly, binary logistic regression or ordinal logistic regression was used. All the models were estimated by the method of maximum likelihood estimates using STATA 8.0. A total of seven staged models were estimated (Models 1 through 7, as described below). The stage-method allows us to add successive sets of ties of similar strengths to an initial regression of control variables only and assess the effect on the dependent variable.

For dependent variables related to the amount of capital raised and sources of funding, six sets of

maximum likelihood estimates were prepared in order to assess the importance of adding successively weaker ties as independent variables. The first (Stage 1) included all the control variables. The second (Stage 2) added strong ties; the third (Stage 3) added hub ties; the fourth (Stage 4) added medium ties; the fifth (Stage 5) added weak ties and the sixth (Stage 6) added transnational weak ties. Likelihood ratio tests were used to analyze if the addition of successively weaker sets of independent variables (i.e., in order, strong ties, hub ties, medium ties, weak ties and transnational weak ties) significantly improved the model. For purposes of interpretation, our analysis used the last stage at which likelihood ratios versus earlier nested models continued to be significant.

The binary/ordinal logistic regression model, applicable to Models 2, 3, 4, 5 and 6, was as follows:

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} + X_{\text{medium ties}}*\beta_{\text{medium ties}} + X_{\text{weak ties}}*\beta_{\text{weak ties}} + X_{\text{transnational weak ties}}*\beta_{\text{transnational weak ties}}$$

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} \quad \text{(Stage 1, Controls)}$$

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} \quad \text{(Stage 2, Add Strong Ties)}$$

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} \quad \text{(Stage 3, Add Hub Ties)}$$

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} + X_{\text{medium ties}}*\beta_{\text{medium ties}} \quad \text{(Stage 4, Add Medium Ties)}$$

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} + X_{\text{medium ties}}*\beta_{\text{medium ties}} + X_{\text{weak ties}}*\beta_{\text{weak ties}} \quad \text{(Stage 5, Add Weak Ties)}$$

$$\text{Logit}\,[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} + X_{\text{medium ties}}*\beta_{\text{medium ties}} + X_{\text{weak ties}}*\beta_{\text{weak ties}} + X_{\text{transnational weak ties}}*\beta_{\text{transnational weak ties}} \quad \text{(Stage 6, Add Transnational Weak Ties)}$$

where Logit is the link function Ln [p(Y)/(1-p(Y))] that relates the probability of response p(X) = $(1+ \exp(-X\beta))^{-1}$, X and β are matrices of independent variables and maximum likelihood estimates respectively. Some independent variables are binary and some continuous as listed in Table 4. Listwise deletion of missing values of independent variables gave valid sample sizes as listed in Table 4.

The binary logistic, six-stage model was used to test for dependent variables that measured whether funds were raised and the sources of funds (Models 3, 4, 5 and 6). The ordinal logistic, six-stage model was used to test the dependent variable measuring the amount of capital raised (Model 2).

For dependent variables related to running a startup and job status, the independent variables were grouped into a series of successively weaker ties. Four sets of maximum likelihood estimates were prepared. The first (Stage 1) included all the control variables. The second (Stage 2) added hub ties; the third (Stage 3) added medium ties and the fourth (Stage 4) added transnational weak ties. Again, for purposes of interpretation, we used the last stage at which likelihood ratios versus earlier nested models continued to be significant. The ordinal logistic regression model, applicable to Models 1 and 7, was as follows

$$\text{Logit}[Y|X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} + X_{\text{medium ties}}*\beta_{\text{medium ties}} + X_{\text{transnational weak ties}}*\beta_{\text{transnational weak ties}}$$

$$\text{Logit}[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} \quad \text{(Stage 1, Controls)}$$

$$\text{Logit}[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} \quad \text{(Stage 2, Add Hub Ties)}$$

$$\text{Logit}[Y \mid X] = X_{\text{controls}}*\beta_{\text{controls}} + X_{\text{strong ties}}*\beta_{\text{strong ties}} + X_{\text{hub ties}}*\beta_{\text{hub ties}} + X_{\text{medium ties}}*\beta_{\text{medium ties}} \quad \text{(Stage 3, Add Medium Ties)}$$

$$\text{Logit}\,[Y \mid X] = X_{controls}*\beta_{controls} + X_{hub\ ties}*\beta_{hub\ ties} + X_{medium\ ties}*\beta_{medium\ ties} + X_{transnational\ weak\ ties}*\beta_{transnational\ weak\ ties}$$ (Stage 4, Add Transnational Weak Ties)

In these statistical tests we measure significance at 1 per cent, 5 per cent and 10 per cent levels. In our discussions below, we shall assume significance only if it is at the 5 per cent level or better.

Section 4

Tests and Results

Table 5 lists the results of Ordinal and Binary Logistic Regressions.

The ties with an ethnic component are family and friends, ethnic professional associations, all the hub ties and transnational weak ties. The ties with a non-ethnic component are current and former business colleagues, membership of alumni associations and membership of non-ethnic professional associations.

Evidence for the intra-ethnic diversification (ID) proposition was sought by checking if adding successively weaker ethnic ties, including ethnic professional association ties, significantly improved the explanatory power of the model.

Evidence for network diversification (ND) was sought by checking the sign and significance of ethnic ties, including ethnic professional association ties, and non-ethnic ties.

Table 5: Binary and Ordinal Logistic Regressions

Dependant Variable[1]	Runs a startup	Capital raised	Initial capital (US)	Future capital (US)	Initial capital (Country of birth)	Future capital (Country of birth)	Job Type
Model #	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Binary or Ordinal Regression	Ordinal	Ordinal	Binary	Binary	Binary	Binary	Ordinal
Sample Size	1337	355	628	628	628	628	1339
Stage # of Total # of stages	St 4 of 4	St 4 of 6	St 2 of 6	St 5 of 6	St 6 of 6	St 6 of 6	St 4 of 4
Ties added for Regression	Transnational Weak	Medium	Strong	Weak	Transnational Weak	Transnational Weak	Transnational Weak
Control Variables							
Age (years)	.01	.04**	.02	.04**	.04	.01	.08***
Male	-.66***	-.72*	-.36	-.96**	.30	-.58	-.16
Country of Birth[2]							
China	-.87***	>-.01	-.04	-.20	-.83*	-.40	-1.16***
Taiwan	-.36**	.23	-.53*	-.37	1.08***	1.04***	-.57***
India	.66***	-.09	.54***	.55***	-.63*	-.40*	1.18***
Immigration Year	-.37***	.09	.12	-.04	-.31	-.11	-.41***
Visa Status[2]							
US Citizen	.32*	-.19	.30	.10	-.44	-.12	.29
US Permanent Resident	.24*	-.05	.26	.08	-.55	-.37	.12
H1B Visa	-.62***	-.35	-.59*	-.25	.80	.13	-.54***
Foreign Visa	-.45*	-.60	-.53	-.77	-.15	-.32	-.15
Education (years)	.05*	.02	.05	.04	.11	.08	-.01
Explanatory Variables							
Strong Ties							
Usage of networks of friends and family for fund raising	--	-.65***	.48**	.60***	.21	.56*	--
Usage of networks of current or former colleagues for fund raising	--	.55**	1.09***	1.22***	.75	.86**	--
Hub Ties							
Officer or Board Member of ethnic groups	-0.07	.08	--	-.31	-0.93	-.81*	-.05
Frequency of meeting local government officials; Regularly[3]	0.58	.54	--	.77*	1.20	>-.01	1.00**
Frequency of exchange of information on Jobs or business opportunities in the United States; Regularly[3]	.02	.23	--	.10	2.29*	.72	-.17
Frequency of exchange of information on Jobs or business opportunities in the country of birth; Regularly[3]	0.17	.07	--	-.04	.19	.38	.07
Frequency of exchange of Information about technology in the country of birth; Regularly[3]	.39*	-.55**	--	-.51*	-.65	-.29	.02

Medium Ties							
Participation in immigrant professional association for fund raising	--	.78**	--	.93***	-1.23	.02	--
Frequency of participation in ethnic professional associations (per year)	.03**	-.02	--	.03	.04	.06	.06***
Memberships in multiple ethnic professional associations	.28***	-.16*	--	-.17*	.03	-.06	.15***

Table 5 (ctd.): Binary and Ordinal Logistic Regressions

Dependant Variable[1]	Runs a startup	Capital raised	Initial capital (US)	Future capital (US)	Initial capital (Country of birth)	Future capital (Country of birth)	Job type
Model # (ctd.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Stage # of Total # of stages (ctd.)	St 4 of 4	St 4 of 6	St 2 of 6	St 5 of 6	St 6 of 6	St 6 of 6	St 4 of 4
Weak Ties							
Participation in alumni networks for fund raising.	--	--	--	.11	-.13	-.07	--
Participation in non-ethnic professional association for fund raising.	--	--	--	1.57***	1.73***	.84*	--
Transnational Weak Ties							
Frequency of business travel to country of birth (per year)	.25***	--	--	--	.16	.35***	.43***
Frequency of meeting local government officials; Sometimes[3]	.45***	--	--	--	.51	.45	.45***
Frequency of exchange of information on Jobs or business opportunities in the United States; Sometimes[3]	-.04	--	--	--	2.64**	.46	.02
Frequency of exchange of information on Jobs or business opportunities in the country of birth ; Sometimes[3]	-.14	--	--	--	-.02	-.18	.08
Frequency of exchange of Information about technology in the country of birth; Sometimes[3]	.20	--	--	--	-.45	-.20	-.17
Intercept	--	--	-4.38***	-3.51***	-7.88***	-5.21***	--
Cut points							
τ_1	1.097	.264	--	--	--	--	2.16
τ_2	2.061	.613	--	--	--	--	3.69
τ_3	--	1.602	--	--	--	--	--
τ_4	--	2.184	--	--	--	--	--
LR χ^2 Current Stage vs null	460.09+++	46.26+++	65.12+++	82.86+++	53.97+++	80.57+++	673.81+++
LR χ^2 Stage 2 vs. nested Stage 1 (df), Models 1 and 7	54.28+++ (5)	--	--	--	--	--	48.18+++ (5)
LR χ^2 Stage 3 vs. nested Stage 2 (df), Models 1 and 7	67.53+++ (2)	--	--	--	--	--	52.04+++ (2)
LR χ^2 Stage 4 vs. nested Stage 3 (df), Models 1 and 7	**42.92+++ (5)**	--	--	--	--	--	**94.69+++ (5)**
LR χ^2 Stage 2 vs. nested Stage 1 (df), Models 2, 3, 4, 5 and 6	--	14.09+++ (2)	**39.00+++ (2)**	76.81+++ (2)	4.64+ (2)	22.10+++ (2)	--
LR χ^2 Stage 3 vs. nested Stage 2 (df), Models 2, 3, 4, 5 and 6	--	5.12 (5)	7.04 (5)	5.67 (5)	4.72 (5)	9.89+ (5)	--
LR χ^2 Stage 4 vs. nested Stage 3 (df), Models 2, 3, 4, 5 and 6	--	**10.91++ (3)**	5.32 (3)	11.20++ (3)	2.98 (3)	3.28 (3)	--
LR χ^2 Stage 5 vs. nested Stage 4 (df), Models 2, 3, 4, 5 and 6	--	2.33 (2)	1.80 (2)	**16.90+++ (2)**	6.27++ (2)	2.83 (2)	--
LR χ^2 Stage 6 vs. nested Stage 5 (df), Models 2, 3, 4, 5 and 6	--	5.78 (5)	3.58 (5)	2.46 (5)	**13.9++ (5)**	**18.02+++ (5)**	--

Notes:

* p <.10 **p<.05 ***p<.01 (two tailed tests) $^{+}$p <.10 $^{++}$ p<.05 $^{+++}$ p<.01 (one tailed tests)

In these statistical tests we measure significance at 1 percent, 5 percent and 10 percent levels. We shall assume significance only if it is at 5 percent level or lower.

[1]In all the cases below, coefficients of variables related to stages not reported can be made available on request.

[1]Runs a Startup: Ordinal Logistic regression predicting if immigrant runs a funded startup (i.e. 0= No, 1= Yes, part time, 2= Yes, full time) (sample size = 1337). Coefficients of variables related to Stage 6 (i.e. Adding Transnational Weak Ties) and likelihood ratio test of all Stages are reported.

[1]Capital Raised: Ordinal Logistic regression predicting amount of capital raised (i.e. 0=up to $0.5M, 1=$0.5M-$1M, 2=$1M-$5M, 3=$5M-$10M, 4=$10M or more) (sample size = 355) Coefficients of variables related to Stage 4 (i.e. Adding Medium Ties) and likelihood ratio test of all Stages are reported.

[1]Initial Capital (US): Binary Logistic regression predicting ability to raise initial rounds of U.S.-based Institutional Capital (i.e. 1= Yes, 0=No) (sample size = 628) Coefficients of variables related to Stage 2 (i.e. Adding Strong Ties) and likelihood ratio test of all stages are reported.

[1]Future Capital (US): Binary Logistic regression predicting ability to raise subsequent round of U.S.-based Institutional Capital (i.e. 1= Yes, 0=No) (sample size = 628) Coefficients of variables related to Stage 5 (i.e. Adding Weak Ties) and likelihood ratio test of all Stages are reported.

[1]Initial Capital (Country of Birth): Binary Logistic regression predicting ability to raise Initial rounds of Institutional Capital from country of birth (i.e. 1= Yes, 0=No) (sample size = 628)

[1]Future Capital (Country of Birth): Binary Logistic regression predicting ability to raise Subsequent rounds of Institutional Capital from country of birth (i.e. 1= Yes, 0=No) (sample size = 628) Coefficients of variables related to Stage 6 (i.e. Adding Transnational Weak Ties) and likelihood ratio test of all Stages are reported.

[1]Job Type: Ordinal Logistic regression predicting immigrant's job type (0= technical/non-managerial, 1=managerial, 2=executive) (sample size = 1339). Coefficients of variables related to Stage 6 (i.e. Adding Transnational Weak Ties) and likelihood ratio test of all stages are reported.

[2]Country of Birth is effect coded; "Born in other Asian countries" is an omitted category

[2]Visa Status is effect coded; "Other Visa Statuses" is an omitted category

[3]Frequency ("Regularly", "Sometimes", "Never") is dummy coded; "Never" is a reference category.

Model 1 is a four-stage test of the relationship of different ethnic ties to running a startup. The dependent variable is the probability of running a startup. We find that adding successively weaker ties significantly improves explanatory power up to Stage 4, while the stronger ties retain their significance. The table above shows the results of Stage 4.

The number of years since immigration (+), the H1B visa (a temporary visa) (-), the country of birth (+ for Indians, - for Chinese and Taiwanese), the frequency of participation in ethnic professional associations (+), membership of multiple ethnic professional associations (+), transnational business travel (+) and occasional connections with government officials in one's country of birth (+) are significant. The signs in parentheses indicate here, and later, whether the coefficient is positive or negative.[4]

The significance of years since immigration and permanency of immigration status are consistent with the literature, as discussed earlier.

Our results support the proposition that ties within ethnic networks that include ethnic professional associations play complementary roles in their relationship to professional growth, i.e., they support the ID hypothesis. An interesting finding is the different signs due to country of birth. It suggests that social contexts are important. For some immigrants (Indians), the country of birth is positively significant, while it is negatively significant for Chinese and Taiwanese. This could be related to the knowledge of English, perhaps. In our sample, 11.8% of Chinese and Taiwanese-born respondents noted that language difficulties were a barrier to

raising capital for a startup, compared with 1.8% of Indian respondents. It could also imply that Chinese and Taiwanese are socially excluded by the mainstream, but not Indians.

The frequency of business travel to one's country of birth (+) and occasional meetings with government officials in one's country of birth (+) were significant, a finding consistent with Portes, Guarnizo, & Haller's (2002) study that transnational entrepreneurship is an important form of economic activity. The other transnational ties, which relate to exchanging information within the United States and one's country of birth are not significant. These are not as relevant to transnational entrepreneurship as the significant variables, hence, this is not surprising.

In summary, Model 1: (1) supports the proposition that the usefulness of ethnic professional associations for starting a firm is due to their complementary role in a wider set of ethnic networks of different strengths (Proposition ID); (2) Supports the proposition that participation in transnational ethnic networks is associated with the development of entrepreneurship. (3) Shows that social context is significant.

Model 2 is a six-stage test of the relationship of ethnic and non-ethnic ties to raising capital to run a startup. The dependent variable is the amount of capital raised. Adding strong ties and medium ties (Stages 2 and 4) improved the test's explanatory power, while adding hub, weak and transnational weak ties did not do so. We discuss the results of Stage 4 below.

Age (+), family and friends (-), ties with current and former business colleagues (+), and participation in ethnic professional associations for the purpose of fund-raising (+) are significant.

The negative sign associated with family and friends means that the strong ethnic ties are associated with raising small amounts of capital, while the positive sign of current and former business colleagues means that strong non-ethnic ties are associated with raising larger amounts of capital.

This finding is consistent with the role of family, friends and business colleagues among mainstream engineers, as found in the literature. Gompers and Lerner (1999, p. 151-155) show that family and friends are usually direct providers of small amounts of finance for a startup. As the amounts needed get larger, the business colleague network helps provide access to those who can provide larger amounts, such as venture capital firms. Our findings show similar behavior by I-C engineers; accessing business colleagues shows their ability to tap mainstream sources, thus questioning whether social exclusion exists.

The positive significance of the ethnic professional associations shows that professional associations are associated with raising larger amounts of capital. Thus, they play a complementary role to both family and friends, and business colleagues.

Model 3 is a six-stage test of the relationship of ethnic and non-ethnic ties to raising initial stages of capital through US financial institutions. The dependent variable is the probability of raising

such capital. Adding weaker ties beyond Stage 2 did not improve explanatory power. Hence, we discuss Stage 2.

Being India-born (+), family and friends (+), business colleagues (+) are significant.

The use of institutional capital is low among mainstream engineers at the initial stages of a startup (Gompers and Lerner, 1999, p. 155). One reason is agency costs, particularly those arising from informational asymmetries. The agency costs fall as the startup becomes older and more information becomes available. (Gompers and Lerner, 1999, p.143). Overcoming agency costs is likely to require the use of trusted networks. Hence, our finding that weaker ties are insignificant is consistent with the literature on mainstream engineers, and shows that I-C engineers are able to tap mainstream sources.

The positive significance of being India-born may be related to the knowledge of English, as discussed for Model 1.

Model 4 is a six-stage test of the association of ethnic and non-ethnic networks with raising subsequent rounds of US-based institutional capital. The dependent variable is the probability of raising such capital. Adding successively weaker ties significantly improves explanatory power up to Stage 5. Hence, we discuss Stage 5.

Age (+), being India-born (+), family and friends (+), business colleagues (+), participation in ethnic professional associations (+) and participation in non-ethnic professional associations (+) are significant.

As noted above, startups are more likely to be able to tap institutional capital in subsequent rounds of funding (Gompers and Lerner, 1999, p. 155). Hence, the significance of weaker ties arises because the information offered by startups in later stages is more trustworthy. The positive significance of strong ethnic ties and ethnic professional associations supports the ID hypothesis.

Among weaker ties, we find that both ethnic and non-ethnic professional associations are significantly positive. The results, therefore, support ND, that the participation in I-C networks that include ethnic professional associations plays a complementary role to participation in non-ethnic networks.

The explanatory power of the tests when transnational weak ties were added (Stage 6) did not improve. Hence, we concluded that transnational opportunities were not significant. This is as expected since the dependent variable is U.S.-focused.

The positive significance of being India-born may be related to the knowledge of English, discussed earlier.

Model 5 is a six-stage test of the association of ethnic and non-ethnic networks with raising initial rounds of institutional capital from one's country of birth. The dependent variable is the probability of raising such capital. Adding successively weaker ties up to transnational weak ties (Stage 6) added explanatory power. Hence, we discuss Stage 6.

Being Taiwan-born (+), participation in non-ethnic professional associations (+) and the occasional exchange of information with transnational contacts on jobs or business opportunities in the U.S. (+) were significant.

We expected that transnational ties would be significant, since the dependent variable is the raising of funds from one's country of birth, and that such ties would be informal given the difficulty of raising formal capital at the initial stage, discussed earlier. That such ties are most associated with Taiwanese-born engineers may be due to the state of Taiwan's venture capital industry which was well-developed by then (Pandey and Jang, 1996), while the Chinese and Indian venture capital industries were underdeveloped (Bruton and Ahlstrom, 2003, Dossani and Kenney, 2001).

Hence, it is surprising that informal ties, particularly family and friends, are not significant. The insignificance of ethnic professional associations is as expected, due to high agency costs at the initial stages, as discussed earlier. The significance of non-ethnic professional associations is, however, surprising.

Model 6 is a six-stage test of the association of networks with raising later stages of capital from overseas institutions in one's country of birth. The dependent variable is the probability of raising such capital. Adding ties up to transnational weak ties adds explanatory power. Hence, we discuss Stage 6.

Being Taiwan-born (+), usage of networks of current and former business colleagues (+) and frequency of business travel to one's place of birth (+) are significant.

As with the test of raising the early stages of capital, the state of the venture capital industry in Taiwan vis-à-vis China and India may explain the significance of being Taiwan born. This may be because Taiwanese engineers are the longest established in the United States. Our sample indicates that 67.5% of Taiwanese engineers arrived by 1989, whereas 28.3% and 42.3% of Chinese and Indian engineers respectively arrived by 1989. As such, the Taiwanese engineers running startups might be the most mainstreamed and have formed enterprises along with non-ethnic colleagues.

Both ethnic ties and non-ethnic ties are significant, providing support for network diversification. However, it is surprising that the informal ties are significant, while the more formal ties, including participation in ethnic professional associations, are not significant.

Model 7 is a four-stage test of the association of ethnic networks to job advancement in established firms. The dependent variable measures job position, with three values: 0= technical/non-managerial, 1=managerial, 2=executive. We test the effects of hub, medium and

transnational weak ties. All the ties tested are ethnic ties, hence this test is only relevant to the ID hypothesis. Adding ties up to transnational weak ties added explanatory power. Hence, we discuss Stage 4.

Age (+), being China-born (-), being Taiwan-born (-), being India-born (+), the number of years since immigration (+), the H1B visa (a temporary visa) (-), a hub tie, regular meetings with government officials (+), frequency of participation in ethnic professional associations (+), membership in multiple ethnic associations (+), frequency of business travel to one's country of birth (+) and occasional meetings with government officials in one's country of birth (+) were significant.

The significance of age, years since immigration and permanency of immigration status are consistent with the literature, as discussed earlier. The difference between being Indian-born and between being Chinese or Taiwanese born may be related to the knowledge of English, discussed earlier.

The significance of several ethnic ties of different strengths, including ties from participation in ethnic professional associations and transnational ties, supports the ID hypothesis. This is of particular interest since it shows that ethnic ties are associated with progress in a job in an established firm, which is likely to be a firm in the mainstream. The causal direction is, of course, not possible to confirm, i.e., it is possible that causality might be in the other direction: a higher position in a firm necessitates participation in the meetings of ethnic professional associations and travel to one's country of birth.

Section 5

Conclusion

This paper uses primary data to explore how participation in the ethnic professional associations created by engineers from China and India (collectively, I-C) in Silicon Valley is associated with their ability to grow professionally. Professional growth was measured by the ability to create firms, raise finance for startups and raise job status within an established firm. The ethnic professional associations were analyzed in the context of the rich networks available to engineers in Silicon Valley. These included networks of weaker and stronger ties, both ethnic and non-ethnic.

Through a comparison with census data, we first established that our sample was representative of I-C engineers in Silicon Valley. Then, logistic regression models were used to estimate the relationships. Likelihood ratio tests were used to analyze if the addition of successively weaker sets of independent variables (in order, strong ties, hub ties, medium ties, weak ties and transnational weak ties) significantly improved the model.

Our results demonstrate the importance of different types of ties associated with professional growth. In particular, participating in ethnic professional associations was found to be related to professional growth within the context of participating in other networks within the ethnic and non-ethnic domains, after controlling for age, settlement status and year of immigration. Our findings were consistent with how mainstream entrepreneurs in Silicon Valley behave, such as

the use of family and friends for raising small amounts of capital at the initial stages of a startup and reliance on business colleagues and professional associations for finding larger amounts of capital and finding capital at later stages of the firm.

The differences between I-C and mainstream engineers were, first, that ethnic associations were available for the former and were used. Second, social contexts also mattered. Being Indian-born was positively related to raising capital in the United States and to one's position in a firm, which is consistent with the Indians' better knowledge of English. Being Chinese or Taiwanese born was negatively related to these factors. Being Taiwanese-born was positively related to raising initial and later-stage capital in one's country of birth while being born in China and India was negatively related. This is consistent with the different stages of development of their home countries' venture capital industries at the time.

We concluded that the I-C engineers use ethnic professional associations as part of a strategy to find complementarities between networks. They access a range of networks that vary in ethnicity, location and strength. The value of the ethnic professional associations thus is driven by the need for both intra-ethnic and cross-network diversification. This is different from the primary role played by ethnic networks in some other contexts, such as managing social exclusion or accessing transnational opportunities.

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Footnotes

[1] The study of ethnic networks operated by more sophisticated migrants operating in developing countries, such as the Chinese savings and loan association of Southeast Asia (Ghate, 1992) represent a different type of ethnic enclave with limited assimilation.

[2] Intra-network and cross-network diversification are the authors' terms for these phenomena.

[3] According to Saxenian (1999, p.12), they were the largest group of foreign-born engineers in the Valley. Between them, they managed a quarter of the Valley's technology firms by 1998, accounting for 14 per cent of the region's technology-related employment. This is a striking achievement considering that they mostly immigrated only in the 1990s (Dossani, 2002), and their share of the workforce, which was 9.7 per cent (Saxenian, 1999, p.12, citing data for 1990).

[4] The signs of coefficients correspond to the signs from the regression tables. However, for the years since immigration, the way that we have defined the control variable is that a lower number indicates earlier immigration. Hence, we have reversed the sign in the text. This also applies to permanency (visa status).